PROCEEDINGS

Edited by Prof.Dr. Hüseyin Gökçekuş

VOLUME 2

International Conference on
Environment: Survival and Sustainability

19-24 February 2007 Nicosia-Turkish Republic of Northern Cyprus
Organized by ***NEAR EAST UNIVERSITY***

Published By: EDUCATIONAL FOUNDATION OF NEAR EAST UNIVERSITY
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Citation: **Gökçekuş, H., 2009 (Editor) Proceedings of the International Conference on Environment: Survival and Sustainability.** Nicosia (Lefkoşa), Turkish Republic of Northern Cyprus: Educational Foundation of Near East University. 10 volumes, LXXVI, 5498, XIV pages.

ISBN: Volume 2: 978-975-8359-54-7

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PREFACE

Creating a sustainable and a healthy environment is one of the most important global issues facing mankind today. Therefore, serious consideration should be given to environmental problems and concerted efforts should be made worldwide in order to respond and prevent present and future environmental risks and challenges.

The International Conference on Environment: Survival and Sustainability (ESS 2007) organized by the Near East University between the dates 19 and 24 February 2007 was held in Lefkosa, Turkish Republic of Northern Cyprus. The main objective of this multidisciplinary conference was to gather scientists from all over the world to discuss the overall issue of the environment, to find out sustainable solutions for environmental problems and to identify areas for future collaboration in this matter. The conference brought together 2,052 participants from 108 different countries. During the conference a total of 1,463 papers were presented under 21 different subtopics, representing various scientific disciplines. The topics included environmental law and ethics, environmental knowledge, technology and information systems, media, environmental awareness, education and lifelong learning, the use of literature for environmental awareness and the effects of the green factor in politics and in international relations.

The Scientific Committee of International Conference ESS2007 evaluated all of the 1,463 papers and selected among them 610 papers to be included in The Proceedings of Environment: Survival and Sustainability. The readers will notice the wide range of topics represented by the papers included in the Conference Proceedings.

It is hoped that this book will serve to contribute to increase in awareness towards various environmental issues as well as drawing more attention to the urgency of international cooperation and collaboration in pursuing sustainable environmental management.

Prof. Dr. Hüseyin Gökçekuş
President of the Conference and the Organizing Committee
Vice Rector of the Near East University
Lefkoşa-TRNC
18 February 2009

ACKNOWLEDGMENTS

The Organizing Committee of the ESS2007 Conference would like to extend its sincere appreciation to Dr. Suat Günsel, the Founding Rector of the Near East University, to Prof. Dr. Ekmeleddin İhsanoğlu, General Secretary of the Organization of Islamic Conference and to Prof. Dr. Walter W. Kofler, President of ICSD/IAS for their significant support and encouragement in the conference.

Appreciation is also extended to the chairpersons, the keynote speakers and the presenters of papers in the conference.

We are deeply grateful for the members of the editorial board who have carefully read and recommended the papers for publishing.

We also wish to express our gratitude to numerous individuals for their valuable contribution to the editing process.

Prof. Dr. Hüseyin Gökçekuş
President of the Conference and the Organizing Committee
Vice Rector of the Near East University
Lefkoşa-TRNC

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Message from the Honorary President of the Conference

The interaction between humans and their environment has entered a critical stage as the delicate balance between them has become more fragile making it difficult for the nature in many areas to renew itself. All this poses a variety of serious challenges for us all. The main challenge before us is no less than redefining our entire relationship with our environment. At this critical juncture, I feel excited and take pride in once again hosting such a distinguished group of scientists, researchers, journalists, and students from all over the world at our university addressing such a critical global concern. I look forward to welcoming you all in Turkish Republic of Northern Cyprus.

Yours truly,
Dr. Suat İ. Günsel
Founding Rector of the Near East University

Message from President of the Conference

It gives me the utmost pleasure in welcoming you all to the International Conference " Environment: Survival and Sustainability" here at the Near East University in Turkish Republic of Northern Cyprus to be held at 19-24 February 2007.
The conference aimed at bringing together more than 2,000 scholars and researchers from over 90 countries around the world to discuss environmental issues from a variety of perspectives; underline the importance of the need for urgency in taking steps by the international organizations, states, local authorities and non-governmental organizations to move to a sustainable environment/development model; and thereby makes its contribution to worldwide debate effort on strengthening the bridge between theory and practice in meeting environmental threats/challenges.
Since our last international conference on environment, "Environmental Problems of the Mediterranean Regions", worldwide environmental disasters as well as local ones have multiplied and environmental degradation and pollution has continued. While major strides have been made in the world in analyzing, understanding and informing the public about the environmental challenges we are facing, we still have a long way to go. Our way of life is still far from a sustainable model and our environment continues to degrade and deteriorate due to human activities. The consequences can be seen in worldwide environmental disasters as well as locally in our daily lives.
This is going to be our third international conference on Environment organized by our young university since it was established in 1988.

Yours sincerely,
Prof. Dr. Hüseyin Gökçekuş
Vice Rector of the Near East University

OPENING SPEECHES

Prof. Dr. Ümit HASSAN
Rector of Near East University, TRNC

His Excellency, the Prime Minister of the Turkish Republic of Northern Cyprus,

His Excellency Secretary General Organization of the Islamic Conference,

Distinguished guests, colleagues, ladies and gentlemen,

On behalf of the Founding Rector and the Near East University, I take this opportunity to wish you all a warm welcome for a fruitful conference. It is a great pleasure for me to be a participant at this international conference.

The International Conference on Environment, Survival and Sustainability is a new and most important sequel to a chain of international conferences organized by the Near East University. I trust the conference will provide participants with an opportunity to discuss, to show and to express the related problems and share their experiences. I believe that we will have a most beneficial scientific medium taking the battles into consideration between theoretical analysis and experimental observations and studies.

It is evident that this balance of methods and techniques will have to create a high level of scientific contribution. In other words, the conference will strengthen the bridge between theory and practice in meeting environmental threats, and emphasize the urgent need for coordination and integration among all bodies towards a more sustainable environment. I would like to take this opportunity to proudly emphasize and announce the accomplishments of the Near East University in fulfilling the requirements in founding the School of Medicine as a subsequent step following the School of Pharmacology and the School of Dentistry which will start to function properly in this coming academic year. Within this context, I would like to inform you that the technological means and the academic staff needed by such schools are at the highest level at the Near East University. Our conception of the Technopark being different from the practices of other universities is solely aimed at using our efforts and resources in developing the necessary infrastructure for establishing a Medical School which will be in the service of the island. From a social-psychological perspective, I believe this will enhance the perception of people regarding the dimensions on the management of health issues of the islanders, and for us this would be a moral boost. Considering the significant intellectual and moral capacity of the participants, I simply think that we all want to declare that each and every soul on this planet has the right for survival and to be included amongst the fittest.

Thank you, thank you all.

Prof. Dr. Hüseyin GÖKÇEKUŞ
President of the Conference & Organizing Committee
Vice Rector of Near East University

Your Excellency, President of the Turkish Republic of Northern Cyprus,
Your Excellencies, Distinguished Scientists and Participants,
Ladies and Gentlemen, Members of the World Press

On behalf of the NEU, I would like to welcome you all to the "Environment: Survival and Sustainability" Conference organized by Near East University in LEFKOŞA.

Today, it has been understood that environmental problems with their cumulative characteristics are closely interrelated with many economic, social, cultural, political and administrative parameters, which are naturally interrelated with academic insight.

Near East University was established in 1988 and has since then grown to become one of the fastest developing universities in the region setting itself the strategic goal of joining the "top 500 universities in the world."

Near East University is a member of the European University Association, the International Association of Universities and the Federation of the Universities of the Islamic World.
The University has over 3,000 staff, of which 900 are academic personnel. 17,000 students from 44 different countries are attending 12 faculties and 50 departments at the university. There are 14 dormitories with a capacity of 4,000; and several new dormitories are under construction. Nearly 50% of the students receive scholarships. This figure includes full scholarships, partial support given to students who are in need of financial help, and to those students with sportive accomplishments.

The University has to date organized 12 international conferences and congresses and many local and regional conferences, seminars and panel discussions on a variety of subjects.

The Near East University is honored to host this world conference which has surpassed in scope and content the conferences it has organized before.

Around 2,000 participants from more than 100 countries in the world are present here to discuss environmental issues from a variety of perspectives.

Turning back to the cumulative characteristic of the environmental problems, it is clear that ecological deterioration is the most important problem resulting from regional conflicts, demographic outburst, consumption of natural resources, starvation, degradation of the environment, dwindling fresh water supplies, natural mega-disasters like typhoons, earthquakes, and landslides. Hunger and malnutrition are a direct result of a lack of access to/or exclusion from productive resources, such as land, the forests, the seas, water and technology. As such, this problem is gradually gaining weight in international and national environmental politics, because all these are threatening the common future of humanity. This has refocused the world's attention on the urgency of researches and practical steps on environmental issues. These issues require global solutions in accordance with their global characteristics.

In the EU programme called "*Environment 2000: Our Future, Our Choice"* 4 major topics have been selected as priority targets.
Climate Change
Biological Diversity
Environment and Health
Management of Natural Resources and Waste
Sustainable development is the solution that leads towards a strategy that will consider the environmental problems for future generations.

Most important guidelines for Sustainable Development are:
-Demographic control.
-Reforestation.
-Protection of agricultural areas.
-Energy saving.
-Development of renewable energy sources.
-Improvement in the implementation of existing legislation.
-Integrating environmental concerns into other policies.
-Working in cooperation with the business.
-Educating people to change their unfriendly behaviors towards the environment.
-Environmental accounting in land-use planning and management decisions.

Global Environmental strategy is a must.

ENVIRONMENT DOES NOT UNDERSTAND POLITICS.
IT HAS NO BOUNDARIES OR BORDERS.

The main message of our Conference will contribute to the worldwide debate and create a multi-disciplinary discussion forum where experts from various disciplines will be able to discuss environmental issues in 21 fields such as culture, biodiversity, health, education, business and economy, environmental technology, climate change and energy among others.

Dear Guests,
Environment: Survival and Sustainability Conference is going to give you all an opportunity to get to know Near East University. The Grand Library collection has reached to more than 500,000 while 52 million articles are accessible through electronic databases. The Grand Library is fully computerized and linked to many major world libraries and research institutions throughout the world. It is open 24 hours a day, serving not only the university but the whole community. In other words the Grand Library functions as a national library.

It is my pleasure to extend our gratitude to the members of the Scientific Committee and the International Advisory Board whose active role raised the scientific level of this conference and also increased the number of participants. Unfortunately, some of the Scientific Committee members withdrew due to non scientific letters they received.

In my opinion, as pointed above

SCIENCE HAS NO BORDERS and NO BOUNDARIES.
IT IS OF THE HUMANS and FOR THE HUMANS.

Coming to our SLOGAN:
RIO 1992
Johannesburg 2002
Nicosia 2007
We do not have much time to lose.

On behalf of the Organizing Committee, I would like to extend our special and sincere thanks to our Founding Rector Dr. Suat Günsel, whose basic aim is to provide generous support for the improvement of continental lifestyle capabilities of the island.

We extend our gratitude to Islamic Development Bank and to the Secretary General of Islamic Conference Organization, Prof. Ekmeleddin İhsanoğlu for their invaluable contributions.

I would like to convey our thanks to the government of Turkish Republic of Northern Cyprus for their support.

Our special thanks go to the Organizing Committee Members and the students who worked day and night for the success of this conference.

Last but not least, we would also like to extend our gratitude to H.E. Mr. Ban KI-MOON Secretary General of the United Nations, for his kind moral support.

I believe this conference will scientifically contribute to the solutions of environmental problems, and hope you will enjoy your stay in our beautiful country.

Thank you.

Rahmi KOÇ
Honorary Chairman & Founding Member of TURMEPA, TURKEY

Mr. President, Mr. Prime Minister, Your Excellencies, distinguished guests, Ladies and Gentlemen

I would like to express my gratitude to Mrs. Sıdıka Atalay for inviting us here for this very important international conference today. As founder of TURMEPA, The Turkish Marine Environmental Protection Association, I would like to share my views with you regarding our activities and accomplishments in Turkey. Why and how did I found TURMEPA? You can call it luck, you can call it coincidence. I was the Chairman of the Turkish-Greek Business Council for six years. During this period, every effort that I made to get the two countries' businessmen to cooperate failed. The Greeks never said no, but they never got their act together either. Again on one occasion in Athens, though I had great enthusiasm to continue to join forces for an interesting project, unfortunately I was very disappointed by their lack of response. At the end of the meeting just before we had lunch, the late shipping Tycoon, George Livanos, who was sitting at the very back of the conference room, called me and said, "Look here, I've been following you and your efforts for sometime and see that you are not getting anywhere and are becoming frustrated. If you really want the Greeks and Turks to cooperate in one area, that will be the environment." He also said, "I founded HELMEPA, Hellenic Marine Environmental Turkish Association, called TURMEPA and let them two cooperate to keep our seas clean. So in 1994, 24 friends believed in the cause and we founded TURMEPA, the first NGO specifically dedicated to keeping the seas clean. At that time, HELMEPA was already eleven years ahead of us and the World Bank had been gathering data on Turkish seas and marine life from HELMEPA. Soon, I found out that this was a long term project and would at least need one generation's commitment. During our efforts, we learned that there are four very important points. Point number one: It's more economical to keep our waters clean than to clean them after polluting them, this was very important. The second important point: the subject is a major undertaking and cannot be done by one association alone and requires a nationwide awareness of the problem. Our third finding was that it needed education; education is most important in achieving our goal. The last important point was international collaboration that is a must as the environment does not have borders, does not have barriers, religion, race or different languages and no politics are involved. With these four points in mind, we first trained teachers in primary schools in coastal areas and then distributed hundreds and thousands of books to these students and pupils. We also held a drawing competition with the subjects of clean seas, we made films for television and cinemas, we used newspaper advertising to get our messages across, and we worked with several universities to test water quality. In the 30 years, from 1960 to 1990 the number of species in the Marmara Sea, believe it or not, came down from 148 to only 14. Now they are coming back. We have started to see dolphins in the Bosphorus and this is good news because when dolphins come, other marine life generates itself. We set up a data room to collect and store information about marine life, our seas, inland waters and currents.

We learned to our surprise again that only 10% of sea pollution comes actually from shipping. The risk comes from domestic and industrial waste; therefore, we set up a system to monitor waste being dumped in our seas. Clean seas are of most importance to tourism which is a major source of revenue for our economy. Therefore to this end, we collaborated with sea side hotels, holiday villages, restaurants and cafes to ensure their compliments with environmental regulations. We then hoisted our TURMEPA flag on their premises. When they did so in the summer months, we put together a team of students to collect garbage from boats and yachts free of charge, we set up garbage containers in coastal areas where garbage can be deposited by banks, businesses, industries and then collected by municipal authorities. Our financing is usually organized on a project basis. With all this said and done, Ladies and Gentlemen, our efforts are still only a drop in the ocean if awareness is not felt by our citizens. Therefore, we are constantly telling the public at large that we have ignited a spark, which we must still help to spread throughout the country.

I am happy to say that the Turkish government and its Ministers, especially the Ministry of Transportation, our Governors, Mayors, academicians and businessmen have realized that clean seas are one of the most important issues we are facing. Clean seas mean life and oxygen. Polluted seas not only kill marine life but also tourism and give third world nation appearance.

I am delighted that I am joined today by our Chairman Eşref Cerrahoğlu, who is himself a ship owner and our Board Member Mr. İbrahim Yazıcı who is himself a sailor, and our General Secretary Levent Ballar who never stops coming up with a new project.

Before I finish, I would like to ask our Chairman, who made contacts yesterday, to give good news to our Cypriot friends.

Thank you for bearing with me.

Eşref CERRAHOĞLU
Chairman of Executive Board of TURMEPA, TURKEY

Mr. President, Mr. Prime Minister, Ladies and Gentlemen,

My Honorary Chairman addressed TURMEPA's activities. I am very pleased and honored to announce our work carried out in North Cyprus. Today, we will be opening a branch of TURMEPA in Girne, and more importantly, we will open a sea and shore observation center in Girne in partnership with the Municipality of Girne and the Near East University, and before the summer of 2009, our training and education program will start.

I would like to thank Mrs. Sıdıka Atalay for accepting the coordination of TURMEPA activities in North Cyprus, and I am confident that we will have all the backing of our President and our Prime Minister, and the people of Northern Cyprus.

Thank you.

Cemal BULUTOĞLULARI
Mayor, Turkish Municipality of Lefkoşa, TRNC

Honorable President, Prime Minister, Secretary General of the Islamic Conference and distinguished guests,

Welcome to Lefkoşa.

The habitat mentioned and diversity of living creatures are shrinking everywhere due to an increase in the fragmentation of landscape. The situation in Cyprus is heading towards a formidable shortcoming in terms of environmental resources. In Cyprus, we have already started to see the danger. There is a great need to improve the diversity and human health on the island. Despite the efforts put forward on these specific issues and existing threats, we still need to stress the fact that deeper collaboration is needed amongst the developing nations.

The conclusion that will be reached at the end of ESS 2007 conference will be a torch light for our municipality and we shall consider balanced use of sources in the future services and activities for Lefkoşa. I wish you all a fruitful conference during your stay in Lefkoşa and North Cyprus.

Thank you.

Asım VEHBI
Minister of Environment and Natural Resources, TRNC

His Excellency, the President of the Turkish Republic of Northern Cyprus,
His Excellency, the Secretary General of the Islamic Conference Organization,
Honored guests,

I would like to welcome you all to our conference on Environment, Survival and Sustainability here in the Near East University in the Turkish Republic of Northern Cyprus. Northern Cyprus is honored to host you with this international conference. I believe that the conference will be an important recognition of the issue of this week's environmental topics which concern not only Cyprus but also the whole world. This conference is bringing together almost 1,500 academicians from more than 100 different countries and there are 21 major topics that reflect all areas of environment such as business and environment, environment and health, global warming and a lot of others.

With the industrial revolution in the late 18th century, human beings started to change the global environment. Prior to industrialization the only unsustainable loses from human economic activities were forest cover topsoil. Most societies were relatively based on small and simple technologies using limited amounts of energy with limited territorial area, but the industrial revolution in Europe has changed this. After the revolution, large scale exploitation of fossil fuels enabled the human societies to consume natural resources, the potential of which seemed limitless. Most of our environmental problems today have a global dimension precisely because of the process of development initiated by the industrial revolution. After the 2nd World War, the world population increased rapidly. With this increase, the world started to use more fossil fuels, but these human activities effected the world adversely and we started to loose biodiversity in the environment. It is stated that every year we are losing at least 50 different species of live hood and every year a vast coverage of agricultural land has been lost due to unplanned development and soil erosion. The forests of the world are declining every year. Waste management of all kinds of waste is another problem including domestic waste and hazardous waste. Societies are producing more waste and waste amounts are increasing every year. The uncontrolled dumping of waste is still continuing specially in developing countries and polluting the soil, air and water resources.

Water shortage is another important problem. The amount of drinkable and usable water is decreasing while we are polluting these resources. Almost two weeks ago, IPCC released the draft project from its fourth assessment report where it puts forward that our climate is changing mainly because of inter human induced efforts. Global atmospheric concentrations of carbon-dioxide, methane and nitrous-oxide have increased as a result of human activities and now far exceed pre industrial values determined from many thousands of years. The global increases in carbon-dioxide concentration are due to primarily fossil use and land use change while those of methane and nitrous-oxide are primarily due to agriculture. The net result of these effects is a global average temperature rise of 6^oC in the last century. When we compare its greenhouse gas emissions within those other developed countries, Cyprus as an island may not have significant effects on the global warming but on the other hand, we may be one of the most effected countries from this problem. According to different United Nations scenarios, the temperature of the island may increase 2 to 4 degrees Celsius in the following century. It is also foreseen that we may have serious water problems and shortages in the near future due to increasing water demand and up to 40% decreases in the precipitation values according to the climate model predictions. Another effect of the climate change expected for Cyprus is an increasing loss of productive land leading to the desertification of the island. We have also been facing serious environmental issues like other developing countries such as problems in waste, waste water management, copper mining related problems such as the CMC and a lot of others. To solve these problems and harmonize with the European Union, the present government of the Turkish Republic of Northern Cyprus has agreed to form a separate ministry for environment: The Ministry of Environment and Natural Resources. The main mission of the ministry is to protect the environment in Northern Cyprus and ensure the sustainable use of its natural resources as well as to preserve its cultural heritage. The role of the ministry is to develop and implement the government's environmental policies in order to achieve its mission in environmental protection, sustainable use of natural resources and preservation of cultural heritage. In particular, our responsibilities include establishing coordination between different ministerial departments internally and with other ministries externally, mainly with Turkey, the European Union and others on issues of sustainability and environmental protection. We have also started to develop necessary policies and legislation. We are reviewing and endorsing different policies and legislation, submitting draft legislations to our Parliament for discussion and approval. We communicate with the media and the public on environmental issues. We provide support for environmental education in all levels of the education system. The environmental policy concerns of the Turkish Republic of Northern Cyprus should be based on economic prosperity and social coherence, taking into consideration the following three key elements.

The first one is sustainable development. Social and economical development will take place in a way that preserves our natural and cultural heritage and resources. The second one is to follow the European Union rules and standards on environmental protection. Our laws will be harmonized with the European Union environmental legislation and policies to protect and preserve our environment and the health and life of our people. The third element will be the establishment of the environmental governments' partnership model among the administration, all sectors of the economy and our people through processes which will both inform about environmental issues and standards and involve people in the associated decision making processes.

Before I finish my words, I would like to express the importance of sustainable development. All of the problems I have mentioned show us that we have to develop in an environmentally sustainable way. We have to protect the environment and preserve our natural and cultural heritage while we are developing.

I would like to thank all of the participants who came from other countries and also I would like to thank the Near East University for this wonderful organization and their great team for their outstanding efforts. I hope that this conference will shed light on most of our regional and global environmental problems.
Thank you.

Tahsin ERTUĞRULOĞLU
Leader of the National Unity Party(UBP), TRNC

Distinguished contributors, participants and honorable guests,

It is indeed an honor for all of us here in the Turkish Republic of Northern Cyprus to welcome you in a country that supposedly does not exist. Your presence here in the name of knowledge and academic freedom, and above all, in the name of service to humanity will hopefully give a valuable lesson to those who tried so desperately to prevent your participation and contributions to this conference.

Dear friends, you shall be subject to further propaganda and will be delivered misinformation about the circumstances here upon your return to your respective countries. The challenging spirit that you have, the spirit of not bothering about those that stand in the way of knowledge, friendship and partnership and service merit will guarantee the success of this most valuable conference.

In closing, I wish to thank the Near East University for working so hard and for so long in making today a reality.

I wish to thank you all for being with us here today. I wish the conference every success.

Thank you.

Assoc. Prof. Dr. Turgay AVCI
Deputy Prime Minister & Minister of Foreign Affairs of TRNC

Your Excellency, Mr President,

Your Excellency, Prime Minister,

Honorable Secretary General of the Organization of the Islamic Conference Prof. Dr. Ekmeleddin İhsanoğlu,

Your Excellencies, distinguished participants, Ladies and Gentlemen,

Today is the day. It is the day of pride and success, the day of international victory. It gives me great pleasure and honor to address a conference of which timing is very important, and welcome you all to the Turkish Republic of Northern Cyprus.

I also would like to thank the Near East University, particularly to its Founder Rector and Honorary President, Dr. Suat İ. Günsel, and the Rector, Prof. Dr. Hüseyin Gökçekuş, and many others who have patiently and continuously carried out efforts to bring this very important conference into life. A thousand papers from over 100 countries are going to be presented today. I, myself being an academician for 15 years before being a politician, know the importance of presenting a paper in such a conference. I know the excitement, the feeling, the success of presenting, asking questions and the feeling of success at the end of such a conference. I have participated in many conferences internationally. I have presented many papers in many countries. It is a great feeling; it is a great pleasure. I know your feelings and I know the success and pleasure that you will get at the end of the conference. Even under normal circumstances, conferences and organizing conferences would have been a drowning task, but in a country like this which is under an inhuman political, economical and cultural isolation and embargoes due to Greek Cypriot's political blackmail and pressure, it is much more difficult to organize such events. It is very much appreciated that you have stood up against these immoral efforts by putting science and survival of global environment first in the line rather than politics. The future of our world and of our children needs courageous scientists, thinkers and writers like you who are able to transit between politics and political pressures wherever they are fighting for the survival of humanity and the global environment. The bounties and rich resources of our planet have given their best to civilizations throughout the past, but we have reached a point in time and technology that our activities have exceeded the life saving abilities of the earth. The global challenges and the level of distraction we have caused are too great now.

The issue of globalization of environment and conservation is the most crucial and urgent issue that the whole of mankind face today. The survival and sustenance of our environment and biodiversity has importance for our future, and just opened our commitment to fight and fight hard for our world. Businessmen, scientists, intellectuals, artists, politicians, indeed the whole of humanity, must stand and strengthen our struggle in this issue. The results of this conference must provide us with the strategies of sustainable environmental management through the development of environment friendly technologies and legislation. We must also show the way for social survival to all global citizens, local governments and non-governmental organizations, and because of this, we have a very challenging but at the same time a noble task. In this context, we also strongly believe that institutions from primary schools to universities throughout the world should make in learning the most important attempts to teach about the environment and to train about the protection of environment. I am pleased to inform you that we have a coalition government in the Turkish Republic of Northern Cyprus and we have a Ministry called the Ministry of Environment and Natural Resources. My friend who spoke a few minutes ago is in charge of this ministry. With these thoughts in mind, I would once more like to take this opportunity to thank Near East University and its Honorary President Dr. Suat İ. Günsel for organizing and hosting the Environment, Survival and Sustainability Conference and wish you success in your deliberations.

I thank you for being here in the Turkish Republic of Northern Cyprus and I am sure you will enjoy your stay here and you will remember us and tell the rest of the world the Turkish Republic of Northern Cyprus is a place to be, a place to visit and a place to enjoy.

Thank you.

Türkekul KURTTEKIN
Turkish Ambassador to Lefkoşa, TRNC

Mr. President, Mr. General Secretary of the Organization of the Islamic Conference, Ministers, Members of the Parliament, Distinguished Party Members, Members of the Organizing Committee, Members of the Media,

Let me first comment on the Near East University for organizing this conference and express my pleasure that I have the opportunity to say a few words about the conference.

From my perspective, the conference is significant for a variety of reasons. Firstly, a very important topic will be addressed throughout the conference. It reminds me the 1972 United Nations Conference on the Human Environment held in Stockholm, the 1992 Earth Summit or the United Nations Conference on Environment and Development held in Rio, and the 2002 World Summit on Sustainable Development held in Johannesburg.

The world constituted combined efforts by the international Community to face a common challenge, that is, the protection and preservation of the environment while achieving developmental objectives in the rapidly changing world. In spite of these efforts, the challenge stays pretty much alive. We, the human beings, have disturbed the balances of nature and the environment. However, we have no luxury for skepticism. A few minutes ago, we heard about the cooperation between TURMEPA and HELMEPA from Mr. Rahmi Koç which proved to us that if there is a will this challenge will be gradually met. You, experts from various disciplines, from academy, various policy makers and executives responsible for the implementation in many countries will be discussing ways to overcome this challenge. Major topics of discussion in the conference show the multi dimensional character and the magnitude of that, and the outcome of your discussions and your deliberations will contribute to the efforts to increase world awareness on this important challenge, and I hope it provides useful material for the decision makers by strengthening the bridge between theory and science.

Secondly, the meaning of this conference in my opinion reflects the severity faced by the Turkish Republic of Northern Cyprus with its people and its institutions. Environment, the problems, economic and industrial development are interrelated issues. The importance of minimizing the environmental damage while achieving sustainable development is widely realized in the Turkish Republic of Northern Cyprus, which is a country going through a remarkable development in the recent year with a growth rate approaching 14% in 2005 and with an increase of 7% in 2006. The increasing public awareness in the Turkish Republic of Northern Cyprus about institutional measures such as the establishment of the Ministry of Environment and Natural Resources constitutes a good, encouraging example. Thirdly, this international conference, which we were told is the 12th of its type organized by Near East University, demonstrates the important role of universities in the Turkish Republic of Northern Cyprus. As many of you have mentioned, education was amongst the fields falling within the problems of the community in the 1960's. The progress achieved by the Turkish Cypriots in this field is commendable and demonstrates the unacceptability of the isolation the Turkish Cypriot people have been subjected to for many years. Even in such circumstances, the Turkish Cypriots have been demonstrating their will and determination to move ahead and to combine forces with the international community to face the common challenges to humanity.

Let me conclude by hoping that this conference will create more awareness around the world and in this respect, the recognition of the Turkish Cypriot People will no more remain unattended. Let me also wish all the distinguished participants of this conference every success and express my sincere hope that your deliberations will contribute to the combined efforts to give a better world to the next generations.

Thank you.

Ferdi Sabit SOYER
Prime Minister of TRNC

His Excellency, Mr. President,
His Excellency, General Secretary of the Organization of the Islamic Conference,
His Excellency, Minister and Members of Parliament and the very important scholars who have came to our country for this conference,

I would like to greet and welcome you all.

Today is the beginning of a meaningful conference where very important environmental issues will be discussed in this conference hall. As you can see, all the flags in this hall symbolize a different color and a different history of all the nations, and as we also know, the colors of nature are reflected by these flags in this beautiful atmosphere. If nature had been just one color, just yellow or just green, the richness and beauty of living would not be seen and people would not have even been able to fall in love. This colorful atmosphere reflects also the dynamism of human beings. Also, this dynamism provides the humans with the ability to find and change everything in nature which they need. It is because of this developing dynamism that human beings take what already exists in nature and turn it to their benefit. Although there are many differences among all nations we should still cooperate together to protect nature. I strongly believe that this conference will bring very important conclusions. I also believe that although the Turkish Republic of Northern Cyprus and Turkish Cypriot society have been isolated both politically and economically, this conference will have very important outcomes. We want to be recognized in the world with our nation, with our national identity. This conference also gives out this message to the world.

I would like to thank the Near East University, the valuable Rectors, and Scholars for participating in such a conference. I would also like to thank and welcome once again the valuable scientists for coming to our country.

Thank you.

Prof. Dr. Ekmeleddin İHSANOĞLU
OIC Secretary General

Your Excellency Mr. President, Mr. Prime Minister, distinguished scholars, Ladies and Gentlemen,

I sincerely greet you all. It gives me great pleasure to be with you here. It is a great pleasure to be at the opening ceremony of this important event: The International Conference on Environment, Survival and Sustainability organized by the Near East University. I am grateful to Near East University for their kind invitation which has enabled me to address such a distinguished gathering. I would also like to thank you all who have worked hard, took part in preparation and realization of this project.

Let me share with you my honest feelings. I am not a newcomer to this island and I have heard a lot about Near East University and I have also heard of its good reputation. Some of my friends' sons and daughters were here as students. I have heard all the facts and data about the universities. I am really impressed.

His Excellencies, Ladies and Gentlemen,
I am not an expert on environment issues but the convening of this important conference is very timely as the subject matter has become a very serious global matter. We read all the reports on a daily basis about the dangers of climate change. Climate change and environmental degradation affect the whole world. Meanwhile we hear the frequent comments of the world leaders about the lack understanding and cooperation on environmental issues which might lead us towards the destruction of our planet and humanity. Global pandemics, deforestation and natural disasters are only a few of the issues that presently affect the globe. All these problems are at the heart of sustainable development that we all need to achieve. We find ourselves helpless today when we see rich nations of the world continuing to load the atmosphere with carbon-dioxide; compromising the well being of human race and pushing our planet to an unknown future. It is obvious that these acts have contributed to a rapid change of climate which has caused global warming, rising sea levels, extreme droughts, erosion of soil, loss of the forests and extinction of the species. Sadly, most of the environment degradation is severely affecting the developing world. Its population is facing severe droughts and dry rivers, while some other areas are facing excess floods, rainfalls, mud slides and loss of properties. I am just back from a long trip to Indonesia and I have seen the negative side of the phenomena there. Ladies and Gentlemen, the catastrophes have also negatively affected ecological imbalance. Hence, they have been posing a serious threat to the genetic pool with ramped out breaks of disasters and leading to more poverty in the undeveloped parts of the world. Recognizing the important role played by the environment in the development and in the progress of its member states, the OIC ten year plan of action, a joined action development for the Muslim world to face the challenges of the 21st century, was developed by the 3rd Extraordinary Summit convened in Mecca in 2005 and attended by all heads of state from 57 OIC countries.

In this context, I would like to bring to your attention the fact that the heads of state present in this Summit in December 2005 made a very strong appeal to all OIC member states and their institutions on the issue and were able to coordinate their environmental policies and positions in the international environmental issues so as to prevent any adverse effects of such policies on their economical development.

Following the adoption of the OIC ten year plan of action, I have organized several meetings with the OIC institutions and stakeholders in the framework of the implementation of the OIC ten year plan of action. The OIC General Secretariat itself is committed to the world capacity and policies to contribute to the global efforts to counter the environmental challenges. The OIC also notes with pleasure that the majority of its many initiatives and activities reflect the facts of important organizations such as UNEP and our parties to various international conventions on environment in particular to the protocol. Joining such conventions reflect the fact that the OIC member states are giving their attention to the international laws and requirements. Such devotion shall certainly provide us with a solid basis for our future efforts suggested by the OIC ten year activity program.

I would like to praise the Near East University for providing the opportunity for the conference participants to address a wide range of crucial issues such as redefining the business of conservation and management of biodiversity, culture heritage and environmental factors, economics, development and sustainability, energy and development, environment and health, the threat of global warming, ecological balance and sustainable environment and social and psychological dimensions of the environmental issues.

Mr. President, Your excellencies, Ladies and Gentlemen,

I am of the view that the environment issue can be viewed from at least two major perspectives: The perspective of science and technology and the perspective of effects and impacts of environment on economic development. The important contributions and inputs from science and technology to ensure sustainable development cannot be denied. However, environmental challenges that we are talking about are mostly trans-boundary ones and cannot be faced with individual efforts of the nations. The very nature of these challenges require that these states should combine their efforts and facilities together. In this context, the OIC member states are called upon by the conclusions of various OIC gatherings and decisions to join hands to collaborate and to synergize their efforts in performing and undertaking research and development to reduce some of the environmental effects and challenges faced by them. Assessing the effects of environmental challenges on economical development also requires regional and global cooperation and coordination. In the domain of sustainable development perspective, one should address the quality and sustainability of our natural resources, the threat of global environmental changes on ecosystems, quality of life in our cities, impact of the use of energy which is essential to our economies and to the way of life. We should be making use of the technologies available with the view of reconciling economical development with environmental sustainability. The achievements of all mentioned goals require coordination, harmonization and synergizing of our entire actions. In other words, we need to follow up very closely all our activities to monitor their progress, to evaluate and assess the impacts and to take recognition of all possible shortcomings.

Naturally, addressing you today in one of the heavenly parts of the world, I cannot emphasize as much as I would like to the importance of environmental studies and undertakings aimed at the protection of the Mediterranean Sea and its ecological diversity.

Ladies and Gentlemen, as I value the timely initiative of organizing this conference on an issue of great relevance for my organization and for our member states considering the excellent academics and research qualities and standards of the Turkish Cypriot Universities, I would also like to mark an appeal from this platform to the universities and scientific institutions around the world particularly those based in the OIC.
Thank you.

Mehmet Ali TALAT
President of TRNC

Distinguished guests, dear participants,

As you may have expected, I will not make many remarks about environment or raise much concern about the environment. My remarks will be mainly political but in the concerns of the environment. Possibly you can claim that environmental concerns should cause an impact to unify humanity because the solutions to environmental problems can only be found by cooperation. So, this unifying factor must be a point of consideration, and we, the Turkish Cypriots know the importance of this fact. We know the importance of being unified with the international community because we are under severe isolation on all aspects of life including environmental issues. My Prime Minister mentioned about the lack of cooperation between the two sides. We are under continuous pressure from our neighbors. Everywhere in the world, we are in a struggle against this isolation issue and try to be unified with the world, and I wish that this conference will give fruitful results to the scientific life and to humanity.

Thank you for your participation and I wish you all success.

FINAL REPORT OF THE INTERNATIONAL CONFERENCE ON ENVIRONMENT: SURVIVAL AND SUSTAINABILITY

Environment is a subject that must be brought to the top of international agendas if the threats to sustainability and survival are to be countered. It cannot continue to be seen as something to be added on to the plans of commercial enterprises or as a minor component of poverty-alleviation programs. Economic development cannot eliminate poverty without conserving natural resources and maintaining ecosystem services. Nor can productive activity ignore the significant effects of resource extraction and waste generation. Environment must be the central focus of national and international programs at all levels.

The International Conference on Environment: Survival and Sustainability, held at the Near East University, Nicosia, Northern Cyprus 19-24 February 2007, dealt with environmental threats and proposed solutions at all scales. The 21 themes addressed by the conference fell into four broad categories:

1.Threats to Survival and Sustainability

Global warming and other climate changes pose a major threat to natural and human systems throughout the world. Major impacts addressed ranged from dieback of tropical forests to altered ecosystem functions in temperate and boreal systems, changes in sea level and in polar and alpine systems, as well as impact on water supply, agriculture and extreme weather events. Pesticides threaten natural ecosystems and human health. Health is also threatened by diseases, pollution and many forms of environmental degradation. Natural and human-made disasters interact to threaten societies in many ways.

2.Technological Advances towards Survival and Sustainability

Environmental science and technology are advancing rapidly, but are not in themselves sufficient to counter the growing threats to environment. Important areas include integrated water management, new and renewable energy sources, and conservation and management of biodiversity.

3.Activities and Tools for Social Change

Activities and tools that can be applied to move society towards greater sustainability were emphasized at the conference. These included environmental law and ethics, environmental knowledge and information systems, media, environmental awareness, education and lifelong learning, the use of literature for environmental awareness, the green factor in politics, international relations and environmental organizations.

4.Defining Goals for Sustainable Societies

The new directions that societies must take include considerations of economics, development and sustainability, redefinition of the interests of business, incorporating cultural heritage, the seas, ecological balance and sustainable environment, and the social and psychological dimensions of environmental issues.

The breadth of the issues addressed at the conference made clear the need for greatly increased interdisciplinary and international collaboration if survival and sustainability are to be achieved. The exchanges at the conference represent a step in this direction.

Cyprus is getting an equal share from these developments and 51 species are under a threat of extinction. Out of 10 regional mini-hotspots within the principal foci in the Mediterranean, and also considering that Cyprus is island number two with a rich plant diversity and narrow endemism, there is a need for protection of its biodiversity.

The matter of global sustainable development actually has a connotation for change of life styles. This calls for

- interactions and understanding of people the world over,
- fair and equitable distribution of benefits derived from resources,
- conservation of biodiversity and protection of our resources,
- the water use efficiency is very important as the availability of water is becoming scarce,
- we need more international collaboration and research for wider and reliable speculation,
- management of plans and their implementation to save the critical aspects of our heritage and environment,
- cooperation of scientific disciplines is necessary to address the situation,
- countries must work together and minimize the impact of borders on science and maximize the benefit for all mankind,
- in order to obtain global sustainability, the curses of over-consumerism should be overcome by an appeal to social and spiritual values,
- for making the world a happy home for everyone, transfer of knowledge has to take place across nations,
- environment and sustainability have to be treated globally, not just locally, before time runs out.

About 2,052 participants from 108 countries from all around the world joined us to make 1,413 presentations and discuss environmental issues from a variety of perspectives.

Global Environmental Strategy is a Must.
As I mentioned on the first day of the conference,
"ENVIRONMENT DOES NOT UNDERSTAND POLITICS".
"IT HAS NO BOUNDARIES OR BORDERS".

This Conference has contributed to the worldwide debate and tried to create a multi-disciplinary discussion forum where experts from various disciplines were able to discuss environmental issues in 21 different fields.

Thanks to the 2,052 participants from all over the world for making this interdisciplinary conference a success. Their active role raised the scientific level of this conference.

I believe this conference has scientifically contributed to the solutions of environmental problems, and hope you have enjoyed your stay in our beautiful country.

Thank you

Prof. Dr. Hüseyin Gökçekuş

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DATA INVENTORY AND MONITORING IN THE COASTAL DUNES OF KAZANLI / TÜRKİYE
A CASE STUDY FOR CONSERVATION PLANNING

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Coastal dune ecosystem, as natural heritage, provides several values for utilisation. Beyond the direct use of these values, an integrated management approach covering conservation and reasonable use of dune areas is being encouraged all round the world. Recently particular interest was focused on the wise use of coastal areas in the Mediterranean basin as well as many coastal countries. Within this context integrated coastal zone management (ICZM) became an important concept and many related disciplines were involved in this issue. Physical planning disciplines as coastal engineering, landscape planning, urban planning and marine transport together with basic science as ecology and biology can be mentioned within this context.

Although they aim same goal that sustainable use of coastal resources, each of them concentrates on specific data sets. While the data on bathymetry, alongshore currents, wave generation and energy, wind patterns and aeolian transport are crucial for modelling coastal dynamics, sand dune succession, wetland ecology, bio-diversity and human influence on the coastal ecosystem are also very important.

A case study, aiming to determine bio-diversity and identify land cover by means of bio-indicators, was conducted as a model for data acquisition and integration in coastal areas. On the other hand, present study aims to create a baseline data for the Kazanlı coast in which diverse ecological features are still maintained. Kazanlı district is a rural settlement, located by the Turkish Mediterranean coast. The research site is a fertile plain, occupied by green houses and partly by industrial infrastructure, which have been deteriorious for the ecological values.

During the field observations 44 bird species and 103 vascular plant taxa were recorded and those were evaluated according to the international criteria for conservation concern. Biological data were integrated to the decision making process for land use planning and contributions of the local authority obtained. Finally a draft of the field guide, which will help to disseminate the project outcomes and enhance public awareness on nature conservation, was proposed.

***Keywords**: Kazanlı, Coastal Dune, Coastal Zone Management, Remote Sensing.*

Background

Almost 60% of the world population resides along the coastal areas all round the world. The Blue plan reports that in 1985 almost 90% of urbanized land in the Mediterranean was located in the coastal zones of Spain, France, Greece, Italy, and former states of Yugoslavia. By 2025, the percentage of the population of these countries living in coastal cities is projected to be more than 85% on average, and as high as 96% in Spain (Grenon and Batisse, 1989). During the course of economic development and industrialization, almost one third of the coastal dunes were severely degraded in Europe. Due to intense agriculture and pastoral activity, coastal dunes were stripped of natural vegetation until the end of the first half of the 20th century in Israel (Tsoar, 2002). Turkey is ranking first among the European countries with 845 km long dune coasts cover more than 10% of the total coastline (8333 km) where rapid conversion was reported for the coastal dunes. Coastal dunes including 110 individual areas, that some of them were designated National Park or Nature Reserve, were transformed to agricultural fields, greenhouses, residential buildings and summer resorts particularly along the Mediterranean coast. The natural vegetation is either completely destroyed or highly damaged in 36 coastal dunes in the country (Uslu, 1989). The area of 16 coastal dunes in the Eastern Mediterranean have decreased from 30 403 ha to 17 905 ha between 1947 and 1993. The number of dune stripes decreased from 33 to 22 in the same period. The total area of sand hills has decreased from 270 ha to 185 ha by the anthropogenic influences. The major destruction in the Eastern Mediterranean coastal dunes is the levelling for creating agricultural fields. From 1990 to 1993 excluding Göksu Delta, 7035.9 ha dunes have been transformed to agricultural fields (Bal and Uslu, 1996).

Study site

The study site is a dune coast in Kazanlı district, which is a rural settlement within the boundary of İçel province. The dune coast is surrounded by a fertile plain, which was occupied by green houses and partly by industrial infrastructure. The population of Kazanlı is about 11 000, and it exceeds 20 000 during cultivation season due to migration of seasonal workers. The distance between Kazanlı and the Mersin city is only 10 km, and the dune area is one of the rare locations, which was not occupied by residential buildings. Therefore, the coastal area still provides nesting ground to endangered marine turtles, and habitats for waders and shore birds as well as unique coastal flora.

Mersin with a shoreline of 321 km and favourable climatic and geographic conditions, industrial and commercial facilities, has attracted the surrounding population. The city has been subjected to heavy immigration, which has resulted in haphazard urbanization and the urban area increased 16 times between 1963 and 1993. The villages between Mersin and Silifke have been affected by this heavy urbanisation. As a result, agricultural land has been transformed to land plots registered for construction by these villages that became municipalities. In addition, the shoreline has been allocated to the construction of multi-storey buildings of up to 10-15 stories (Burak *et al*., 2003).

Dune coast of Kazanlı covers about 3,5 km length and the average width of unspoiled area is 120m. The area has been subjected coastal erosion due to improper activities as sand mining and groin construction by an industrial enterprise (Figure 1). Recently municipal administration has attempted at reclamation for the dune area and removed improper infrastructure including groin, promenade and other facilities, which have been deteriorious for the ecological values. The area represents a strong potential to develop recreational facilities for the inhabitants of Mersin city, which covers a population of 1 million.

Figure 1. General view of Kazanlı coast, which is surrounded by dense agricultural infrastructure.

Methods

The basic approach of this study is to obtain ground data, which is essential for decision making aiming equilibrium between conservation priorities and reasonable use of coastal values. Therefore the topics of the tasks were identified as follows; (i) analysis of principal biological values, (ii) land cover pattern, and (iii) determining conservation priorities.

Remote Sensing and GIS-Based Classification

High ground resolution aerial photographs were interpreted to classify land cover of the study area. For classification of landscape units, digital aerial images acquired by TUBITAK were used. These very high-resolution colour images were taken by the help of a digital camera system mounted on a balloon. Mosaicked image was imported in a GIS environment in order to perform on screen digitization aiming to produce a habitat map. The fact that the aerial images had spatial resolution of few centimetres played a key role in providing high spatial and thematic accuracy in mapping distribution of plant communities. Centimetre-level spatial detail of the images made them highly accurate for habitat mapping compared to the 60-centimeter ground resolution of the most sophisticated commercially available satellite images. Image frames had sometimes an overlap of about 90-95 per cent. For this reason, many images were excluded from the dataset and 27 image frames, with relatively less distortion, were selected to cover the whole study area. These images were the basis of the analyses employed throughout the study. The aerial images were resampled to 30 centimetre ground resolution in UTM (Universal Transverse Mercator) projection system by using nearest neighbour algorithm. Resampling the images into a coarser resolution was done due to the fact that initial ground resolution of the image frames made it very difficult and time consuming to perform operations required in pre-processing (e.g., geo-referencing). This operation resulted with a reasonable image size for further analyses.

Vegetation Analysis

Vegetation analysis was performed to describe biological features of the land cover classes, and reach a consideration on plant bio-diversity. Forty-six plots, (10x10m) approximating the mean minimum area prevailing plant communities were selected in fore dune, semi mobile dune, and reed beds. The plant species within each releve were recorded and collected to identify, following the nomenclature of Davis (1965-1988). During field works, the species richness, (i.e. as the number of species) and relative aboveground cover of each taxon in a unit area were recorded using Braun-Blanquet's (1932) technique. TWINSPAN (Hill,1974) was used to determine the plant communities; further DCA employed to reach an effective ordination of plant communities obtained, and their relation along the natural and land use gradients.

Bird Inventory

A bird census campaign was conducted along line transects, covering the variety of habitats, to describe the avifauna of the area. Line transects are undertaken by observers moving along a fixed route and recording the birds they see on either side of the route. Because the observer needs to be able to move freely through the land transects are more suitable for large areas of continuous, open habitat (Gibbons *et al.*, 1999). During the observations number of individuals of each bird species and the locations were recorded.

Result and Conclusion

Thirteen land cover types were detected along the study site and their boundaries were delineated on the mosaicked image to create the habitat map (Fig.2). Locations of forty-six plots, observed for vegetation analysis, were also overlapped onto the image to identify habitat characteristics.

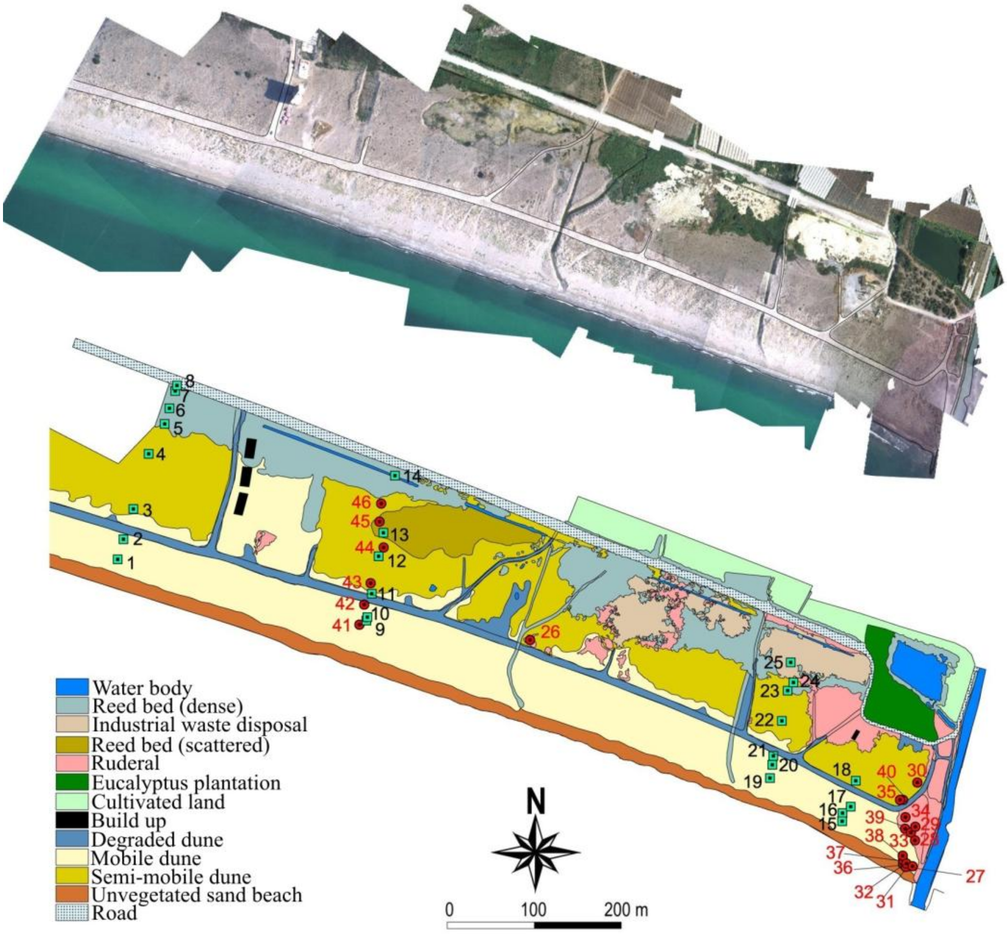

Figure 2. Mosaicked image of the study site and habitat map with locations of 46 observation plots.

The flora of study site comprises 103 vascular plant taxa of which 4 species are endemic. The species diversity derivates from agricultural land uses, as well as successional stages of the dune vegetation occur along the coast. Wetland species can be found around drainage network and adjacent flood areas, while annual weeds are abundant particularly in the semi-mobile dune areas and man made habitats. The largest family is Leguminosae, covering 19 species, which are belonging 10 genera (Fig.3).

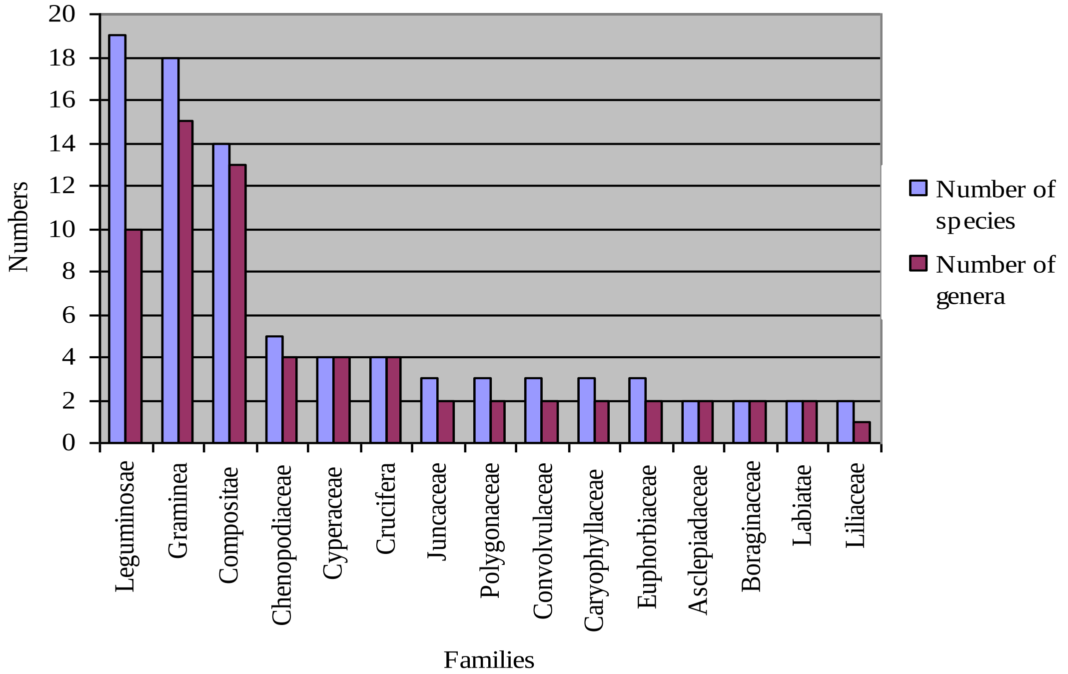

Figure 3. Plant taxonomic distribution of the flora along Kazanlı coast according to principal families (Families with only 1 species were omitted).

Two distinct dune communities are described along a distance gradient from coastline; (i) pioneer psammophytes on mobile fore dunes and (ii) dune scrub on semi-mobile dunes. The species composition of these two communities varies with the distance from coastline, most species of the mobile dunes being able to overcome sand burial and salt spray by the southern winds. The first mentioned community occupies a coastal zone with an extension of 50 meters from the coastline and characterised by *Cakile maritima*, *Salsola kali and Poligonum maritimum*. The associations of this community are; *Zygophyllum album*, *Euphorbia paralias*, *Ipomoea stolonifera*, *Sporobolus virginicus*, *Otanthus maritimus* and *Pseudorlaya pumila*. *Pancratium maritimum* occurs as dominant species on the crest of lower dune ridge, bordering mobile and semi-mobile dunes. Two endemic taxa; *Astragalus suberosos* var. *mersinensis* and *Silene pompeipolitana* are isolated in certain localities while the other endemics *Trigonella halophyla* and *T. cephalotes* have relatively wider distribution along semi-mobile dunes.

Dune scrub community is dominated by *Helianthemum stipulatum* and *Thymelea hirsuta*. This community has a rich herb layer including several graminoids as *Vulpia fasciculata*, *Bromus diandrus*, *B. tectorum*, *Lagurus ovatus* and other common species are *Echium angustifolium*, *Silene kotschyii*, *Crepis aspera*, *Verbascum sinuatum*, *Paronychia argentea*, and *Anchusa agregata*. Wetland community is dominated by *Phragmites australis* and *Thypa domingensis, which* are very common in the area. The associations are *Scirpoides holoschoenus*, *Juncus maritimus*, *Tamarix symirnensis*, *Inula viscosa*, *Xanthium strumarium*, *Pulicaria dysentrica* and *Lycopus europeus*. A pioneer community develops in certain localities on the dunes where solid waste was disposed. This ruderal community, in which species diversity is very low, dominated by *Bassia hyssopifolia*.

A major division into dune sites and wetlands can be seen in the dendrogram and ordination, represented in Figs. 3 and 4. Plot # 25 represents ruderal vegetation, which associates with the extreme growing conditions, due to waste disposal (Fig.4 and 5).

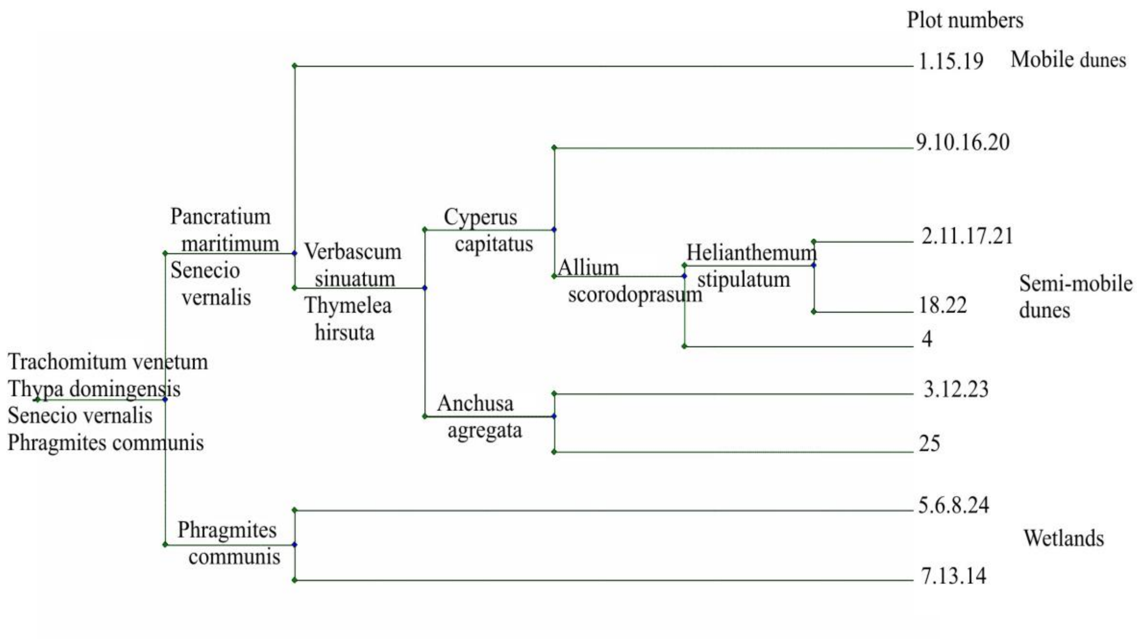

Figure 4. Dendrogram from TWINSPAN analysis of the flora along Kazanlı coast.

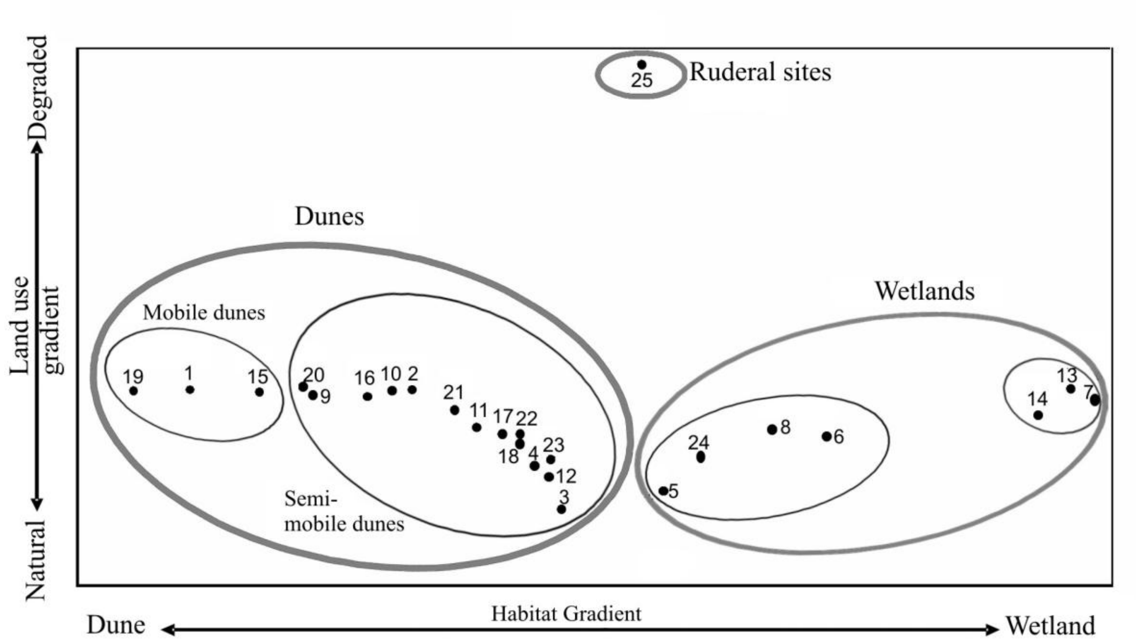

Figure 5. Sampling plots ordination (DCA) of plant communities, and their relation along the habitat and land use gradients.

During the bird census campaign 44 species were recorded. The largest taxonomic group is Passeriformes (55%), while Charadriiformes (11%), Cicciniiformes (10%), Coraciiformes (7%) and Falconiformes (7%) follow it respectively.

Eastern part of the coast including drainage channel, *Eucalyptus* plantation and adjacent reeds beds, was considered the most important habitat complex for bird diversity. The peak value of bird species richness (24 species) was obtained from the census, performed around the pond (Fig.6).

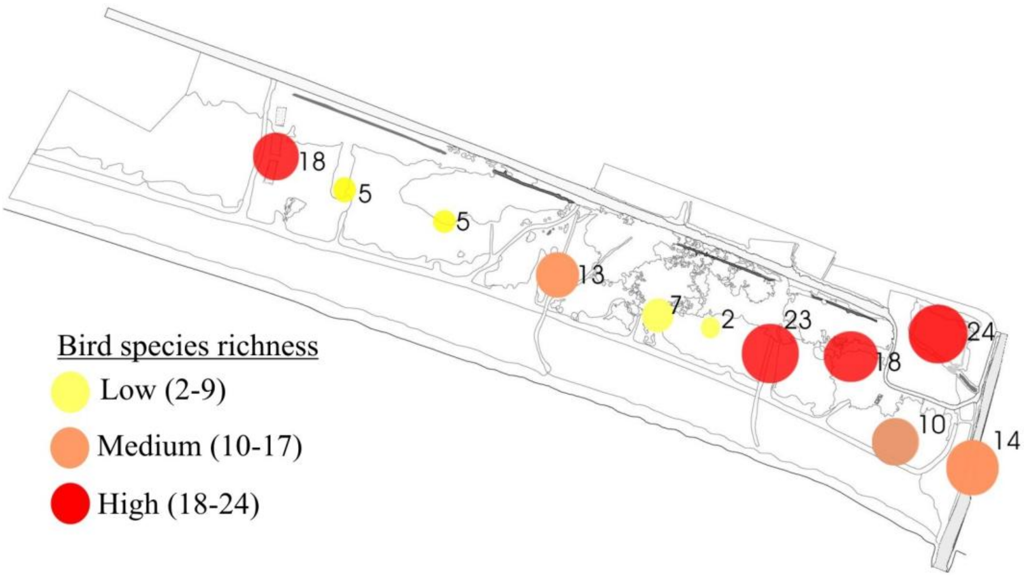

Figure 6. Distribution of bird species richness on the basis of census data and ranking of the localities, important for bird watching.

The artificial pond, surrounded by dense reed beds, located at the eastern end of the study site and provides an invaluable habitat for various heron species (purple heron and grey heron), glossy ibis and moorhen. Kingfishers (Kingfisher and White-breasted kingfisher) can be observed along the main drainage channel and the others, parallel and perpendicular to the coastline. Appearance of white-breasted kingfisher (*Halcyon smyrnensis*), which is rare and one of the target species for birdwatchers in the country, was concluded an advantage that supports the attractivity of the coastal area for this interest group. Sand banks, at the left bank of the main drainage channel, are inhabited by sand martin, which was included in the lists of conservation concern by international authorities (Table1).

To reach a conclusion for conservation needs, threat categories were assessed both for vascular plants and bird species at national and international levels (Table1 and 2). Sixteen bird species out of 44, which were included in at least three threat categories according to the national and international criteria, were taken into account for the evaluation. Actual threats for plant species at local level were evaluated according to the data published by Çakan *et al*. (2005). Study site maintains a habitat complex in which critically endangered, endangered, vulnerable and declining species still survive. The occurrence of those conservation dependent species is a strong evidence for limiting land use activities in the study site. However those species can be the focal point of an eco-tourism scheme, which will attract the urban people and help to increase public awareness on coastal dune conservation.

Table 1. Assessment of threat categories of conservation dependent bird species, according to the national and international criteria.

Bird species	Red Data Book	Bern Convention	Central Hunting Commission	SPECs	European Threat Status
Ardea purpurea	L3	SPFS	Annex 2	3	V
Charadrius alexandrinus	L3	SPFS	Annex 2	3	D
Hirundo rustica	L3	SPFS	Annex 2	3	D
Lanius collurio	L3	SPFS	Annex 2	3	D
Lanius minor	L3	SPFS	Annex 2	2	D
Lanius nubicus	L3	SPFS	Annex 2	2	V
Pelegadis falcinellus	L3	SPFS	Annex 2	3	D
Phonenicurus phoenicurus	L3	SPFS	Annex 2	2	V
Riparia riparia	L3	SPFS	Annex 2	3	D
Saxicola torquata	L3	SPFS	Annex 2	3	D
Sterna albifrons	L3	SPFS	Annex 2	3	D
Alcedo atthis	L3	SPFS	Annex 2	-	D
Anthus campestris	L3	SPFS	Annex 2	3	V
Galerida cristata	L3	-	Annex 2	3	D
Larus minutus	-	SPFS	Annex 2	3	D
Streptopelia turtur	L3	-	-	3	D

RDB (European Vertebrate Red Data Book): List 3 (L3): Non-threatened species with particular interest in Europe. **Bern Convention on the conservation of European Wildlife and Natural Habitats:** SPFS: Strictly Protected Fauna Species. **Central hunting commision:** Annex 2: Protected bird and mammal species in Turkey (Demirsoy, 1999). **Species of European Conservation Concern Categories (SPECs):** Category 2: Species whose global populations are concentrated in Europe, Category 3: Species, whose global populations are not concentrated in Europe, but have an unfavourable conservation status in Europe. **European Threat Status:** D: Declining, V: Vulnerable (Heath *et al.*, 2000).

Table 2. Threat assessment for plant taxa, with conservation priority.

Plant taxa	IUCN Categories	Threats
Alhagi mannifera	VU (Vulnerable)	1,5
Astragalus suberosus var.mersinensis	VU (Vulnerable) (End.)	1,2,3,4,5,6,7
Convolvulus lanatus	LC (Least Concern)	1,2,3,4,5
Helianthemum stipulatum	LC (Least Concern)	1,3,5,8,9
Pancratium maritimum	EN (Endangered)	1,2,3,4,5,6,8
Silene pompeipolitana	VU (Vulnerable) (End.)	1,2,3,4,5,6
Trigonella cephalotes	VU (Vulnerable) (End.)	1,2,3,4,5,6,7
Trigonella halophyla	CR (Critically Endangered) (End.)	1,2,3,4,5,6,7
Zygophyllum album	VU (Vulnerable)	1,2,3,4,5,6

1=agriculture, **2**=limited population or habitat, **3**= recreation, **4**= dune stabilization, **5**= sand mining, **6**= waste disposal, **7**= overgrazing, **8**= chopping and clearing, **9**= fire.

Conclusion

The conservation needs for the study area were determined by the biodiversity itself, threats to biodiversity and the need for its conservation. The results of the study showed that threatened/endangered plant species and bird habitats are evenly distributed throughout the site. Therefore to describe a certain area as “conservation priority zone” is not available. In this case, it may not be compulsory to include this habitat complex, with high biodiversity potential, into a core protection zone. However, the fore dune zone, which is vitally important for endangered marine turtle species as nesting site, is very important. In addition to species-level conservation, regeneration of dune vegetation in this zone is another important point worthy of consideration in terms of stabilizing sand dunes. This may also help reduce coastal erosion.

Planning perspectives of local authority were taken into account for producing resource use proposals in the study area. The local authority’s resource management approach relied on the fact that resource management based on restrictions creates a strong opposition in the community. Thus, the conservation approach in which the local people are involved aimed limited use of resources for economic and recreational activities.

Management approach of this study has been proposed as land use demands of the local authority can be met. However, uncontrolled activation of this potential may lead to new environmental threats such as biodiversity losses. To avoid such environmental threats the planning approach was based on conservation and reasonable use. This approach supported several different recreational uses such as hiking, sports fishing, and bird watching.

Colour aerial photographs have proven to be very useful for vegetation mapping as their spatial resolution is far higher than that of the contemporary high-resolution satellite images. It may be concluded that the land cover information produced on the basis of these images will be very useful for species- and habitat-level environmental conservation and physical planning. Proposed management strategy covering limited recreational activities, may have negative impacts on the natural values of the Kazanlı coast. As a further investigation, change detection study is suggested to monitor possible changes both on the extension of the habitats and their species composition. The inventory represented in this study, can be utilised as baseline data for this purpose.

Acknowledgement

This study was financially supported by the Turkish Scientific and Technical Research Council (TÜBİTAK). Authors wish to thank the Kazanlı Municipality for their assistance, Uğur E. Kaya, Doğan Önal for their invaluable contribution to the bird census campaign, and Kıvılcım Yalçın for her contribution to preparation of the final report.

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International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

SEASONAL GROWTH EFFECT ON HYDRAULIC CHARACTERISTICS OF THE MANGROVE EXCOECARIA AGALLOCHA IN BATTICALOA, SRI LANKA

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Excoecaria agallocha is a semi deciduous true mangrove found in both inland and shoreline areas in Sathurukkondan, Batticaloa, Sri Lanka. Leaf shedding in *E. agallocha* is a common phenomenon that occurs during September – November and leaves rejuvenate in January onwards. Preliminary ecophysiological experiments were conducted using adult plants coppices in an inland of Sathurukkondan mangrove site from December 2005 to March 2006. Above ground hydraulic and growth parameters were investigated at leaf establishment stages of early unfolded (December - January, 2005) and fully unfolded (March, 2006), whether any leaf establishments related to hydraulic and growth parameters or not, was studied. Further, hydraulic and assimilate resistances were increased at the above ground levels by long term manipulations of xylem-phloem notching and phloem girdling in December, 2005 and it responses were investigated in March, 2006.

Leaf establishments and xylem – phloem manipulations of notching and girdling has shown impact on the growth parameters of *E. agallocha* in terms of stem over bark diameter, total leaf area, total leaf dry mass, total stem dry mass and specific leaf area (SLA). Hydraulic parameters of maximum absolute hydraulic conductivity (k_{max}), leaf specific hydraulic conductivity (k_l, k_{max} / leaf area distal) and specific hydraulic conductivity (k_s, k_{max} / sapwood area) were significantly increased concurrently with leaf establishments and xylem - phloem notched *E. agallocha.* Surprisingly, xylem - phloem notched branches shown higher k_s compared with branches measured at fully unfolded stage and this could be suggested as a survival strategy (drought avoider) of *E. agallocha*, while alleviating k_s under stem level stress condition. k_l increased with leaf establishments and in manipulated xylem – phloem notched stems. In accordance, a positive relationship was established between k_l and vessel diameters. Vessel diameters measured at distal ends of stems were progressively and relatively widened and shown significant differences in early unfolded, fully unfolded and notched *E. agallocha*. This suggests that progressive increased hydraulic characteristics were an impact of vessel diameter of stem. Further, *E. agallocha* need not necessarily depend on the leaves for conservative water use like other forms, as this species falls under semi-deciduous with a phenomenon of shedding leaves.

Keywords: *Exoecaria sp., hydraulic characteristics, manipulations, drought resistant, survival.*

Introduction

Water is essential for plant growth and cells contain water as the solvent in which biochemical reactions takes place and cell structures are maintained (Lack and Evans, 2001). Water moves from high water potential to low water potential and water movement occurs by water potential gradient. Transpiration of water from the leaves through stomata generates a low water potential and results in the movement of water from the soil through the root system and in to the xylem (Lack and Evans, 2001). Water stress is a major factor limiting terrestrial plant productivity (Pyrke and Kirkpatrick, 1994). As soil water depleted, water flow through the soil and plant decreases to one - tenth the maximum rate but both the soil resistance and plant resistance increased (Blizzard, 1980).

Mangrove species exhibit a range of water use behaviors related to salinity and their zonation patterns parallel to shore (Sobrado, 1999). At high salinity mangrove species have low stomatal conductances and transpiration rates (Scholander *et al*., 1962; Ball, 1986). However, mangrove stomatal conductances are comparable to those of other tropical forest trees, when thriving habitats are fed by both sea water and fresh water (Becker *et al*., 1997). The catastrophic embolisms in mangrove species may be avoided by stomatal control of water loss (Sperry *et al*., 1988). However development of dynamic water deficit and concomitant xylem embolism are largely determined by water flow rate (Arora and Gupta, 1995). Decreasing water content is accompanied by loss of turgor as wilting, cessation of cell enlargement, closure of stomata, and reduction in photosynthesis and interferes with many other basic metabolic processes in plants (Kramer and Boyer, 1995).

Higher plants respond to water stress with a variety of physiological and molecular mechanism. A common aspect of such response is a decrease of the conductivity to water flow along the soil - plant - atmosphere water pathway so called bulk conductivity (Moreshet *et al*., 1990), which can reduce water loss to the atmosphere. Stomatal resistance is a key component of bulk resistance to water flow (Meinzer *et al*., 1996). However an increase of the resistance to water flow of other segments of the water pathway, such as the roots and the shoot can be part of the plant response to water stress.

Shoot (Lovisolo and Schubert, 1998) and root (Nardini and Tyree, 1999) hydraulic conductivities decreases in response to water stress and hydraulic conductivity can change as a result of interruption of the water column in the vessels (embolism) or modification of the size of the xylem vessels. Further, increased hydraulic resistances by stem and root level manipulations caused reduction in hydraulic conductivity (Sperry and Pockmann, 1993; Brodribb and Hill, 2000; Hubbard *et al*., 2001) and this method effectively used to measure the ability of the plant to stand against a given stress. Several reports have shown that water stress induces embolisms and loss of function of the vessels (Schultz and Matthews, 1988; Sperry and Tyree, 1990; Hargrave *et al*., 1994). The decrease in xylem conductivity due to vessel embolism can directly contribute to reduce water flow across the shoot (Schultz and Matthews, 1988) and at the same time it can induce stomatal closure, which in turn avoids further embolism and limits transpiration (Sperry, 1986; Meinzer and Grantz, 1990; Sperry and Pockman, 1993).

In this present study, *Excoecaria agallocha*, a true and dominance mangrove in Batticaloa district, above ground stem growth characteristics and hydraulic architecture was assessed during the leaf establishment stages. *E. agallocha* is a semidecidious mangrove and sheds their leaves 2 to 3 times annually in Batticaloa, Sri Lanka. A main shedding of leaves occurs immediately after the first break of North – East monsoon in the middle of October and this prolongs up to December. Gradual changes of green into orange / red of leaves and then shedding and sprouting of new leaves often attract the travelers passing the A_{15} highway through the proposed study site of Sathurukkondan, Batticaloa. *E. agallocha* is a dominant mangrove species with other true and associate types cover the vast area in Sathurukkondan.

To our knowledge, no literatures data on hydraulic architecture, particularly during the periods of leaf establishments is available in *E. agallocha*, as well as in other semi deciduous. However, a little work was carried out in *Fraxinus excelsior* concurrently with leaf shedding and establishments, which is a temperate tree (Cochard *et al*., 1997). Hence, it was decided to assess the hydraulic architecture of above grounds in *E. agallocha* (tropical). In this study objectives were three folds, (a) To assess the above ground stem hydraulic architecture during the early stage of leaf establishment (early unfolded stage) and of later stage of leaf establishment (fully unfolded stage), to investigate is there any relationship associated with leaf establishment or not, with measured growth and hydraulic characteristics (b) Hydraulic resistances and assimilate resistances were increased by xylem – phloem notching and phloem girdling manipulations in the stems and morphological responses were observed (c) Further such manipulations (here only notching) whether had an impact on the hydraulic characteristics and it's growth was assessed while compared the data of (a) keeping as a control.

Materials and Methodology

Study site

The plant of semi deciduous true mangrove of *Excoecaria agallocha* (Family: Euphorbiaceae, Tamil: Thilla, Sinhala: Thelakiriya) growing naturally along the shoreline and inland in Sathurukkondan, Batticaloa (DS division: Manmunai North), Eastern province, Sri Lanka were used in this study to investigate the proposed objectives from December 2005 to March 2006. The mangrove site, along the A15 trunk road from Batticaloa to Trincomalee, but opposite (inland) to the Batticaloa lagoon was demarcated for this study. The mangrove plot of 19.8m × 14.2m was located which opposite to third small course from Pillaiyaradi and 17m kept away from road was selected as sampling area and this area dominated with patches of *E. agallocha* with other mangrove species. The numbers of *E. agallocha* patches in the sampling area were counted and randomly selected eight plant patches used as replicates for this study.

Physiological parameters

Hydraulic measurements

Hydraulic conductivity of randomly selected, medium diameter, main branch stem segments of *E. agallocha* was measured using Low Pressure Meter (LPFM) (Sperry *et al*., 1988). The aim of using LPFM in this study was to investigate initial hydraulic conductivity (k_i), maximum hydraulic conductivity (k_{max}) and Percentage loss in hydraulic Conductivity (PLC). The modified and costless LPFM was designed in the Department of Botany, Eastern University, Sri Lanka from the version of Sperry *et al*., (1988). LPFM used in this study was adequate to investigate the put forwarded objectives in this study such as whether any leaf establishments and growth of *E. agallocha* related to growth and hydraulic characteristics.

Hydraulic conductivity apparatus – LPFM

Hydraulic conductivity apparatus was designed to measure hydraulic conductivity of main branch stem illustrates in Fig 1. The apparatus designed to measure the water flow rate of stem segment with pressure gradient of 0.016 MPa (head pressure) and the solution of 0.01M HCl used was distilled, degassed, filtered (0.47 µm, Millipore filter). The solution stored in a supplied tank at 1.6m height from ground floor in order to supply solution into plant stem segment at a pressure different of 0.016 MPa during conductivity measurement. Filtering prevented clogging of dust particles and microbial organisms in the vessels of the stem segment, HCl used to prevent short term microbial growth, degassed water prevent any embolism introduced into xylem vessels due to solution itself (Sperry *et al*., 1988).

The solution was allowed to flow through PVC tubes from reservoir 1 through the stem segment and into drain reservoir *via*. distal PVC connection on an electronic balance (Mettler HF 300, Japan, resolution 0.001g). During flow of water through stem segment weight measurements were taken for every 30 seconds for 7.5 minutes. The second supplying tank (reservoir 2) positioned at 2.41m height to dissolve and flush embolism in the high head pressure of 0.024 MPa immediately after an initial conductivity measurements by flushing the whole stem for overnight. After overnight flushing, maximum hydraulic conductivity was determined in the morning.

Collection of plant materials and measuring hydraulic conductivity

Field measurements

E. agallocha patches in sampling plot used as replicates were used to field measurements from 8th December, 2005 onwards. Stem over - bark diameter of 3 randomly selected branches of each replicate patches were measured 1.5 m from ground level using Vernier caliper.

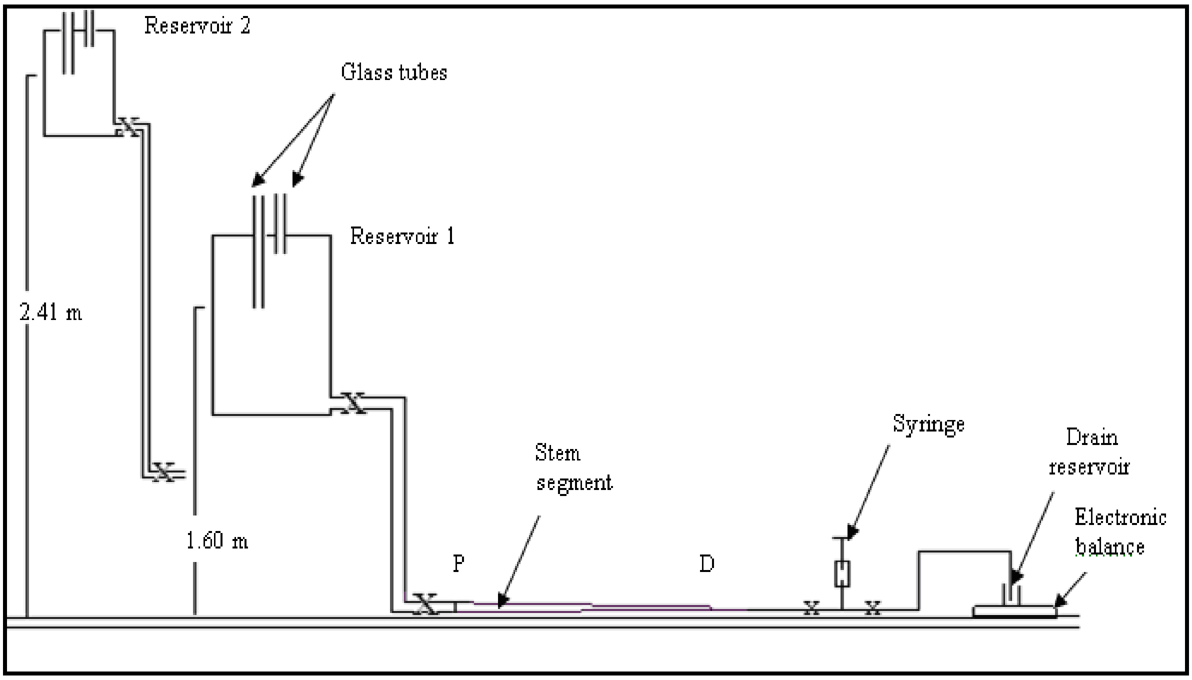

Fig 1 Schematic diagram of modified Low Pressure Flow Meter (LPFM) from the version of Sperry *et al*. (1988). P – Proximal end of the stem segment, D – Distal end of stem segment, X – Taps to control water supply

Vessel length measurements

As a prerequisite for hydraulic parameters measured in this study site, vessel length of *E. agallocha* determined from randomly selected 10 branch segments, length for each greater than 2.5 meter on 6th December 2005 in the laboratory. In a preliminary experiment stem segments greater than 2.5 m in length were sampled to determine maximum vessel length by the air method (Zimmermann and Jegae, 1981). Vessel lengths were taken for 10 branches and averaged.

Hydraulic conductivity measurements

Hydraulic conductivity measurements were carried out from 19th December, 2005 to 22nd March, 2006 using branch stem segments of *E. agallocha* sampled from Sathurukkondan, Batticaloa at three consecutive sets. First measurement was taken from eight randomly collected stem segments at early stage of unfolded (19th December, 2005 – 24th January, 2006), where leaves were an immature stage and second beginning of fully unfolded (7th March, 2006 - 22nd March 2006) where leaves were almost at the flowering. Simultaneous measurements were carried out on the stems subjected to xylem – phloem notching. The branch segments more than the vessel length was cut from randomly selected branch at early unfolded, fully unfolded and xylem-phloem notched stem at mid days. Plants transpire vigorously at midday and maximum embolism expected to occur at the time of 12.00 p.m (Mc Cully *et al*., 1998), and this enables to quantify maximum embolism. Hydraulic measurements were carried out on 2 – 3 samples per day, only during clear days. The cut proximal end of stem was immediately sealed with Para film, whole stem part covered with black polythene bag and carefully brought into laboratory. The immediate sealing of cut end prevent introduction of further artificial embolism into vessels and polythene bags prevented any evaporation and dehydration from the plant parts especially from leaves. The whole plant branch stem was left on the bench top for an hour in order to equilibrate the shoot water potential (Vander Willigen and Pammenter, 1998; Sinniah and Manoharan, 2004).

The proximal end of the equilibrated stem was recut perpendicularly under water to remove any embolized vessels from the initial cut which blocked water flow through stem. The cut end was cleanly shaved with a sharp razor blade and connected to the end PVC tube of reservoir 1 of LPFM. Same way distal end of the stem was cut under water and connected to the drain reservoir of the apparatus. Both ends of PVC tubes and plant stems were sealed using aluminium clamps to prevent leakages and ensured no air bubbles in PVC tubes of LPFM. Shoot was covered with black polythene bag during the measurement period to prevent evaporation.

The flow of solution through stem segment was recorded at every 30 seconds intervals at the head pressure of 0.016 MPa. The initial hydraulic conductivity was determined from the solution flow where flow dripped from distal end *via*. plastic tube on a weighing balance. After measuring initial hydraulic conductivity the same proximal cut end of stem segment was connected to the reservoir 2 for overnight flushing to dissolve embolism at high head pressure of 0.024 MPa. The following morning proximal end of flushed stem was recut under water to remove the wound healing callus or tissue fragments and maximum hydraulic conductivity (k_{max}) was measured same as initial hydraulic conductivity.

Hydraulic architecture parameters
The hydraulic conductivity (k_h) was determined by measuring mass flow (F, kgs^{-1}) of solution through the stem segment of length (l, m) connected to constant pressure of reservoir 1(P, MPa), $k_h = \frac{\text{Flow } (F, kgs^{-1}) \times \text{Twig Length } (l)}{\text{Head pressure } (P, MPa^{-1})}$

Quantification of embolism
The degree of embolism in a main shoot stem was estimated by its initial conductivity, as percentage of maximum obtained after removal of emboli. i.e percentage loss in conductivity (PLC), $PLC = 100\left(\frac{k_{max} - k_{ini}}{k_{max}}\right)$

At the end, maximum absolute hydraulic conductivity (k_{max}) was normalized to the leaf area at the distal end (k_l, leaf specific conductivity), sap wood area (k_s, specific conductivity) and total dry mass of plant shoot ($k_{max} / _{TSDM}$).

$$k_l = \frac{k_{max}}{\text{distal end leaf area } (m^2)}$$

Vessel diameter
The xylem vessel diameter of distal end of stem segment subjected to hydraulic conductivity measurement was measured using ocular meter and stage micrometer. The stained hand transverse section of distal end used for sapwood area measurement used for vessel diameter measurement. Two measurements of vessel diameter per each vessels one diameter perpendicular to another were taken at four fields per section and randomly selected 4 vessels per each fields (altogether 16 vessels per each stem segment) were averaged and taken photographs using photographic microscope (Olympus BH–2 System Microscope, Japan).

Stem xylem - phloem manipulations
Long term manipulations of stem xylem - phloem notching and phloem girdling to increase hydraulic and assimilate resistances at above ground level was assessed in *E. agallocha* to see the nature of susceptibility. Two branches were randomly selected from each replicate patches of *E. agallocha*, where one for xylem - phloem notching and other one for phloem girdling. The stem was notched ("V" shape) for a half diameter of stem (notched area diameter : stem over - bark diameter = 1:2) and girdled separately 1m from the ground level on 8th December 2005 using a sharp razor blade. Xylem-phloem notching removed half of the xylem and phloem tissues and phloem girdling removed phloem tissues without causing damage to xylem. Overall morphological plant responses were observed during the period from 8th December 2005 to 21st March 2006. At the end, stems (8 nos.) subjected to notching were harvested, measured the hydraulic parameters with growth parameters of leaf area, and leaf dry mass. Girdled stems harvested were used to obtain the dry weight parameters only.

Statistical analysis

The statistical analysis of one - way ANOVA and two - way ANOVA was performed using a Statistical Package for Social Sciences (SPSS, 14.0 for windows). One - way ANOVA was performed across early unfolded, fully unfolded, notched and girdled stages and two - way ANOVA performed for notched, girdled stages of early unfolded, fully unfolded *E. agallocha*. The relationship between maximum hydraulic conductivity (k_{max}), xylem specific conductivity (k_s) and vessel diameter were explored by using linear regression analysis of the Graph Pad Prism, Version 3.02.

Results

Growth parameters

Stem over bark diameter (OBD)

Measured OBD values immediately after xylem – phloem manipulations (1st day, initial) and after manipulations (80 days, final) of *E. agallocha* were distributed normally (K-S test, P = 1.02 and P = 0.94 for notching and girdling respectively). Two - way ANOVA revealed that there was no significant differences of OBD in between notched and girdled *E. agallocha* (F = 0.42, P = 0.6). Further, no significant differences were recorded at the initial and final measurements of OBD in between upper and below portions for notching (F = 0.75; P = 0.39) and girdling stems (F = 1.63, P = 0.21). However, the mean values of OBD increased from immediately after xylem – phloem manipulations (initial) to 80 days after manipulations (final) for both notched and girdled *E. agallocha*. This increased values of OBD (could be a one of the growth indicator), concurrently increased with leaf establishments (from initial to final stages).

Total leaf area, total leaf dry mass and total shoot dry mass

Table 1 Above ground growth parameters at early unfolded (EU), fully unfolded (FU), notched (N) and girdled (G) stages in *E. agallocha*. Mean ± SEM (n=7 - 8). Within columns, different letters indicate significant differences at P<0.05 (One -way ANOVA).

Treatments / stages	Total leaf area (m^2)	Total leaf dry mass (kg)	Total stem dry mass (kg)	Specific leaf area (m^2kg^{-1})
EU	0.304 ± 0.042 ^{a}	0.010± 0.001 ^{a}	0.082 ± 0.009 ^{a}	16.7 ± 1.78 ^{a}
FU	0.308 ± 0.09 ^{a}	0.031 ± 0.004 ^{b}	0.140 ± 0.019 ^{b}	9.61 ± 1.8 ^{b}
N	0.394 ± 0.042 ^{a}	0.034 ± 0.004 ^{c}	0.280 ± 0.03 ^{c}	10.88 ± 0.72 ^{c}
G	0.580 ± 0.14 ^{a}	0.046 ± 0.007 ^{d}	0.290 ± 0.16 ^{d}	12.53 ± 0.90 ^{d}

The values of total leaf area, total leaf dry mass and total dry mass of stem segments were normally distributed (K-S test, P = 1.09, P = 0.79 and P = 0.92 respectively). Further, one-way ANOVA revealed that there was no significant differences of total leaf area (F = 2.73, P = 0.06), although, a total leaf area appeared to increase systematically from the stages of EU, FU, N and G (Table 1). Interestingly, significant differences were observed in total leaf dry mass (F = 3.76, P = 0.02) and total stem dry mass (F = 9.39, P = 0.00) at early unfolded, fully unfolded, notched and girdled stages of *E. agallocha*.

Morphological changes in stem xylem-phloem manipulations

The above ground morphological responses were observed in xylem - phloem notched and girdled stems of *E. agallocha.* The new lateral branches [2 ± 1 (SEM) (n=8)] were established below the xylem-phloem notched region. Notched *E. agallocha* stems showed identical growth responses in terms of canopy leaf morphology (leaf size and colour) compared with control (fully unfolded stage) and this suggests notching did not caused comparable effect on canopy leaf morphology of *E. agallocha*.

The new lateral branches [7 ± 1 (SEM) (n=8)] were established below the phloem girdled region, and above canopies appeared with yellow mottled symptoms, this suggests that basipetal transport is important for *E. agallocha*. Further, tissue regeneration was observed in and around the xylem – phloem notched and girdled portions. Among the 8 girdled and notched stems, 7 of notched and 5 girdled stems showed regeneration and this suggests the recovery ability of xylem-phloem tissues in *E. agallocha.*

Specific leaf area (SLA)

Specific leaf area (total leaf area / total leaf dry mass) was used to have a better comparison of growth responses of *E. agallocha* at different measured stages. One-way ANOVA revealed that significant differences of SLA has been appeared at respective growth stages (F = 5.77, P = 0.00). A least SLA reported in FU compared with highest value of SLA noted in EU and suggests the photosynthetic rate adhered with fully established leaves of *E. agallocha*.

Hydraulic parameters

Vessel length measurements

The vessel length was measured in stem segments of *E. agallocha* with the vessel length ranged from 73.1 cm to 106.2 cm and mean was 93.79 cm ± 4.87 (SEM) (n=10). The stem segments above 106 cm (maximum length) were used in this study for hydraulic conductivity measurements to include all anatomical features while measuring the hydraulic conductivity parameters.

Maximum absolute hydraulic conductivity (k_{max})

The k_{max} data of *E. agallocha* obtained at early stage of unfolded (EU), fully unfolded (FU) and xylem - phloem notched (N) were normally distributed (P = 0.87). One - way ANOVA was performed to test, whether to see any differences between maximum hydraulic conductivity measurements of EU, FU and notched stages. ANOVA revealed that k_{max} significantly differed at the stages of leaf establishments from EU to FU and stem xylem-phloem manipulation (F = 7.17, P = 0.00). It has been seen that xylem - phloem notched stem had a higher k_{max} followed by FU and EU (Table 1).

Table 2 Measured maximum absolute hydraulic conductivity at early unfolded (EU), fully unfolded (FU) and notched (N) stages of *E. agallocha.* Mean ± SEM (n=7 - 8). Within columns, different letters indicate significant differences at P<0.05 (One - way ANOVA)

Treatments / stages	k_{max} (kg s^{-1} m MPa^{-1})
Early stage of unfolded (EU)	$9.76 \pm 6.29 \times 10^{-4}$ a
Fully unfolded (FU)	$24.94 \pm 5.72 \times 10^{-4}$ a b
Notched (N)	$43.2 \pm 8.01 \times 10^{-4}$ b

Percentage loss in hydraulic conductivity (PLC)

K- S test showed that PLC data were normally distributed (P = 1.63) and generally high in all three stages studied in *E. agallocha*. PLC was significantly different in all three stages of *E. agallocha* (F = 6.58, P = 0.00). Maximum PLC was recorded in notched with 97.35 ± 1.25, whereas least was recorded in early stage of unfolded with 65.70 ± 12.30. PLC of 95.91 ± 1.90 recorded in fully unfolded stage of *E. agallocha*. In comparative studies, it was revealed that notched one shown significantly highest embolism level compared with EU (F = 7.49, P = 0.02). Further, significant differences was only seen in between EU and FU (F = 5.87, P = 0.03), but not in between FU and N (F = 0.48, P = 0.50), thus suggests no tremendous effect on PLC, as a consequent of long term manipulation of notching in similar growth stages of *E. agallocha.*

Leaf specific hydraulic conductivity (k_l) and specific hydraulic conductivity (k_s)

Identical trend of k_{max} appeared, when k_{max} was normalized to leaf area (k_l, the measure of hydraulic sufficiency of leaves), and sap wood area (k_s, the measure of porosity of the wood) to the distal end of the whole plant shoot.

Leaf specific hydraulic conductivity (k_l)

Results of k_l shown that progressive increment of k_l from the EU to FU and then to N (see a fig.3.3.C). Statistical analysis (One-way ANOVA) revealed that k_l of early unfolded (EU), fully unfolded (FU) and notched (N) aerial portions of *E. agallocha* shown a significant (F = 7.74, P = 0.00) differences at respective stages. However, there was no significant (F = 1.35, P = 0.27) between the early unfolded stage and the fully unfolded stage. It is interesting to note that notched (N) *E. agallocha* had significantly higher k_l value of $27.37 \pm 7.07 \times 10^{-2}$ kg s^{-1} m^{-1} MPa^{-1} compared with EU with the value of $4.97 \pm 0.02 \times 10^{-2}$ kg s^{-1} m^{-1} MPa^{-1} (F = 9.89, P = 0.007) and FU with a value of $8.69 \pm 1.71 \times 10^{-2}$ kg s^{-1} m^{-1} MPa^{-1} (F = 6.63, P = 0.03).

Specific hydraulic conductivity (k_s)

Similar to k_l , k_s also exhibited the similar trend where k_s increased with leaf establishments from early stage of unfolded to notched in *E. agallocha*, as such statistical analysis (One - way ANOVA) revealed a significant effect between the three stages that studied (F = 5.11, P = 0.02). The k_s of early unfolded, fully unfolded and notched in *E. agallocha* were 9.08 ± 5.03 ×10 kg $s^{-1}m^{-1}$ MPa^{-1}, 27.14 ± 8.27 × 10 kg s^{-1} m^{-1} MPa^{-1} and 42.61 ± 10.20 × 10 kg s^{-1} m^{-1} MPa^{-1} respectively. There was no significant effect between EU and FU (F = 4.27, P = 0.06), although the k_s value has increased from EU to FU, perhaps marginally. Data of EU compared with N has revealed a significant effect (F = 9.92, P = 0.00), where N shown tremendous increment in k_s. But this was not appeared when N compared with FU (F = 1.53, P = 0.24). An increased k_s value of N compared with control of FU stage could be a survival strategy of *E. agallocha,* while alleviating k_s under stem level stress condition by xylem phloem notching and classified as drought avoiders.

Maximum hydraulic conductivity normalized by total dry mass of stem segment

Maximum hydraulic conductivity was normalized to total shoot dry mass of stem segment that subjected to hydraulic conductivity measurement to study the carbon investment in the hydraulic pathways (Fig 3.3.F). There was no significant differences at three respective growth stages of early unfolded, fully unfolded and notched *E. agallocha* (F = 0.08, P = 0.92). Though early stage of unfolded had higher value of 1.9 ±1.2 ×10^{-2} kg s^{-1}m MPa^{-1} g^{-1} than fully unfolded and notched stages. Further FU had higher value of 1.87 ± 0.41 ×10^{-2} kg s^{-1} m $MPa^{-1}g^{-1}$ compared with notched one with the value of 0.54 ± 0.23 ×10^{-2} kg s^{-1} m MPa^{-1} g^{-1}. This pattern of hydraulic efficiency showed total reverse pattern from the measured k_l and k_s (Fig. 3.3.C and 3.3.D).

Huber value (HV)

The values of sapwood area per unit leaf area (HV)**,** the measure of investment of stem tissue per unit leaf area were normally distributed (K-S test, P=1.02). There was no significant effect caused by the huber value between the three different stages studied in *E. agallocha* (F = 2.42, P = 0.11). Notched stage showed higher HV of 7.74 ± 1.9 × 10^{-4} than EU and FU. Huber values of EU and FU were 5.79 ± 1.36 × 10^{-4} and 3.52 ± 0.34 × 10^{-4} respectively.

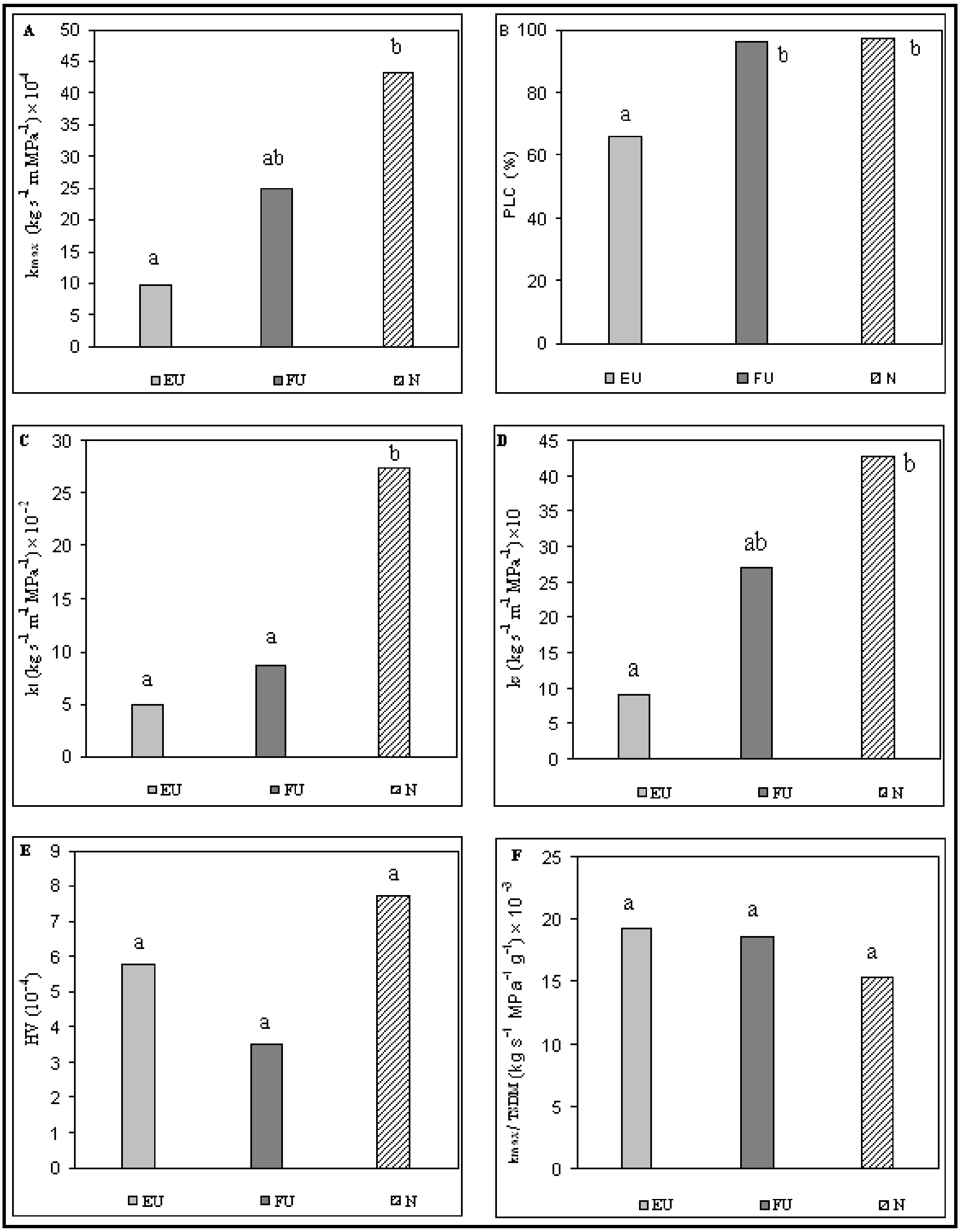

Fig 1 Hydraulic characteristics of *E. agallocha* at early unfolded (EU), fully unfolded (FU) and notched (N) stages. (A) Maximum absolute hydraulic conductivity of stem segments (k_{max}), (B) Percentage loss in hydraulic conductivity after flushing of embolism, (C) Leaf specific hydraulic conductivity (k_l); k_{max} normalized by leaf area at the distal end, (D) Specific hydraulic conductivity (k_s); k_{max} normalized by sap wood area at the distal end, (E) k_{max} normalized by total shoot dry mass ($k_{max}/_{TSDM}$), (F) Huber value (HV). Mean ± SEM (n=7-8). Different letters indicate significant differences at P<0.05 (one - way ANOVA)

Xylem architecture: Vessel diameter

To verify the vessel diameter distribution, whether normally distributed or not, a K-S test was performed and confirmed the normal distribution (P = 2.10). One - way ANOVA revealed that there was significant differences (F = 157.98, P = 0.00) in measured vessel diameter at EU, FU and N stages of *E. agallocha.* The vessel diameter of xylem - phloem notched *E. agallocha* was progressively and relatively widened and significantly wider than early stages of unfolded (F = 279.55, P=0.00) and fully unfolded (F = 55.39, P= 0.00). Likewise, EU significantly different from FU (F = 98.92, P = 0.00).

Table 3 Xylem vessel diameter at the distal end of *E. agallocha* stem segments at early unfolded, fully unfolded and notched stages. Mean ± SEM (n = 7 - 8). Within columns, different letters indicate significant differences at P<0.05 (One - way ANOVA)

Treatments / stages	Vessel diameter (mm) × 10^{-2}
EU	2.94 ± 0.09 [a]
FU	4.19 ± 0.07 [b]
N	4.95 ± 0.07 [c]

Relationship between vessel diameter and maximum hydraulic conductivity (k_{max}) and specific hydraulic conductivity (k_s)

The relationship established between vessel diameter and k_{max} and vessel diameter and k_s was shown in Fig. 3. A & B. k_{max} tend to linearly increased (r^2 = 0.98; linear regression, SPSS 14.0) with increasing xylem vessel diameter (also see a Table 3) from early unfolded to notched stages. Likewise, specific hydraulic conductivity also linearly increased (r^2 = 0.99; linear regression, SPSS 14.0) with increasing vessel diameter. This suggests that responses of specific hydraulic conductivity was an impact on hydraulic architecture (increasing vessel diameter) of stem and need not necessarily depend on the leaves for conservative water use, as this species falls under semi deciduous condition, where partial shedding leaves occurs 2 to 3 times and with a complete shedding of once at annually.

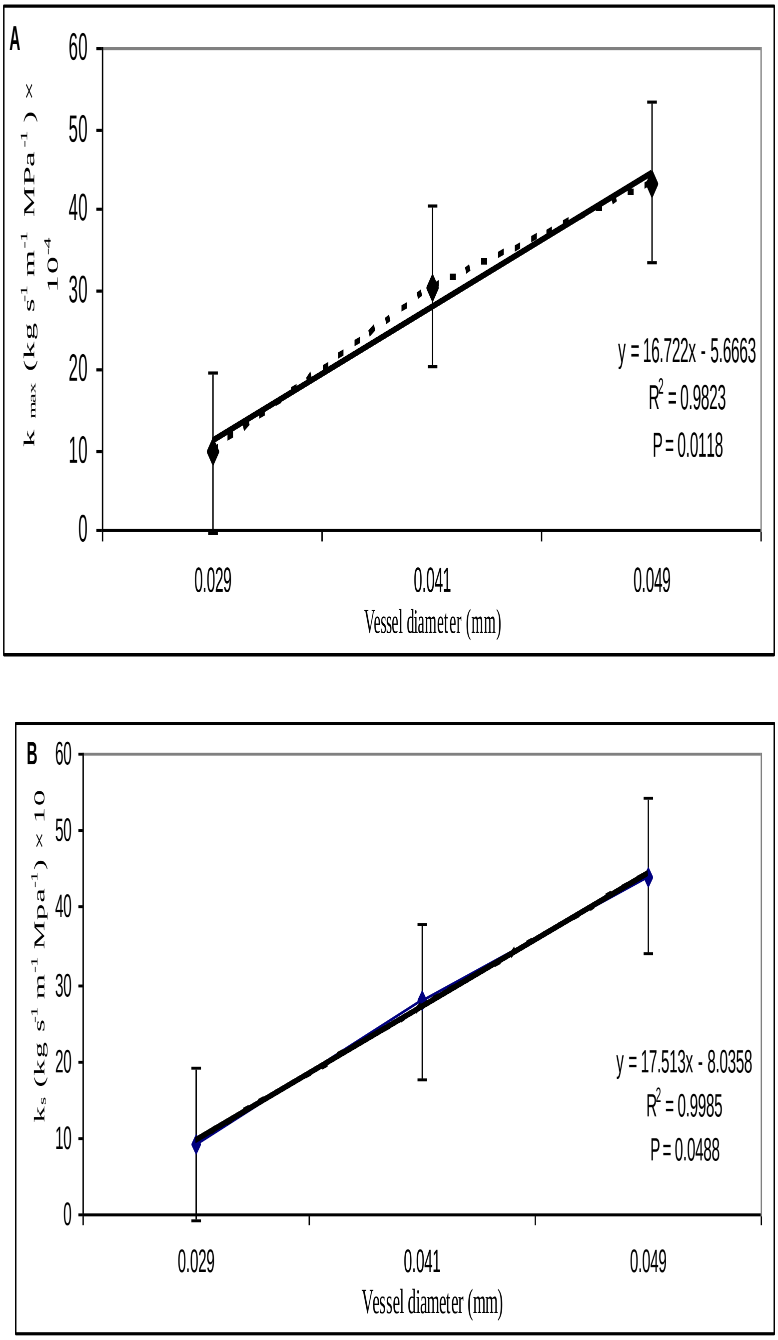

Fig 2 The relationship between k_{max} (A) and k_s (B) and vessel diameter. Each data point represents average measurements of *E. agallocha* at early unfolded (n = 7), fully unfolded (n = 8) and notched stages (n = 8).

Discussion

Plant growth characteristics

In this study, leaf establishments from early unfolded to fully unfolded stages and long term manipulations of xylem – phloem notching and phloem girdling has shown impact on the growth performances in terms of total leaf area, total leaf dry mass, total stem dry mass and specific leaf area (SLA) (see a Table 1). The total leaf area, total leaf dry mass and total stem dry mass increased with increasing hydraulic characteristics of k_{max}, k_l and k_s from early unfolded to fully unfolded stages and further increased to notched *E. agallocha.* Previous reports suggested that species with higher hydraulic conductance are capable of higher biomass production (Kavanagh and Zaerr, 1997; Jaquish and Ewers, 2001). Increases in growth performances associated with increasing hydraulic conductivity reported in mangrove *Leguncularia racemosa* (Ewers *et al*., 2004), lower montane trees in Panama (Zotz *et al*., 1998), *Saccharum* sp (Meinzer and Grantz, 1990) and also reduced growth associated with decrease in k_h reported in grapevines (Schultz and Matthews 1993; Lovisolo and Schuberrt, 1998).

Total stem dry mass and total leaf dry mass concurrently increased with total leaf area from early unfolded to fully unfolded stages and further increased to notched and girdled in *E. agallocha* (Table 1). Greater leaf area intercepts higher amount of light and increases carbon assimilation (Sheriff, 1992) and hence increased growth performance in terms of total leaf dry mass and total stem dry mass. Notched *E. agallocha* showed higher growth performances compared with control of fully unfolded stage, because of high k_{max} of notched stem could have increases transpiration and this increases CO_2 assimilation and thus increases growth. This suggests that imposed stress condition by notching and girdling manipulation did not affect growth performance and this species could be considered as drought avoiders.

Specific leaf area (SLA) is one of the important growth parameter (Van Oosterum and Acevedo, 1993) and higher SLA related to higher photosynthetic capacity and higher growth rate (Lambers and Poorter, 1992; Farrell *et al*., 1996), but in stressful environment low SLA is desirable (Poorter, 1989 *loc cite.* Van Oosrerm and Acevedo, 1993). Significant reduction in SLA was observed in FU compared with EU, however FU produced significantly higher dry mass than EU. Such a situation has been reported in *Eucalyptus microtheca* (Li *et al*., 2000), where the SLA density was lower in the species that had higher photosynthetic capacity. So it is possible that FU would have photosynthesized and invested more carbon than EU.

Plant hydraulic characteristics

In this study, hydraulic characteristics measured at the time of different leaf establishment stages and xylem – phloem notched stems affected the above ground plant hydraulic characteristics in *E. agallocha*. k_{max}, k_l and k_s significantly increased concurrently with leaf establishments from EU to FU and further increased to xylem-phloem notched branches of *E. agallocha*. Xylem hydraulic characteristics have been shown to exert a strong influence over function of plants and transpiration rate (Meinzer *et al*., 1999). The structure of the water transport system of the tree is major determinant of leaf water balance (Zimmermann, 1978 and Tyree and Ewers, 1991 & 1996) and must be considered when interpreting leaf physiological behaviour (Clearwater and Meinzer, 2000). Further, leaf act as an evaporating surface; possibly pulls the water column concurrently with leaf establishments, thus increased the supply of hydraulics in *E. agallocha*.

Tyree and Ewers (1996) reported the range of k_l, k_s and HV for wide range of plants including tropical lianas, hemiphytes, gymnosperms, angiosperms, tropical shrubs and temperate angiosperm trees. The measured k_l, k_s and huber values of *E. agallocha* was within the range of this reported values for angiosperms as well as tropical trees. The measured values of k_{max} and k_l greater than reported values of mangroves *Rhizophora mangle* L. ($k_{max} = 2.67 \times 10^{-7}$ kg s^{-1}m MPa^{-1}, $k_l = 2.28 \times 10^{-5}$ kg s^{1} m^{-1} MPa^{-1}), *Luguncularia racemosa Gaert* ($k_{max} = 1.88 \times 10^{-7}$ kg s^{-1}m MPa^{-1}, $k_l = 1.85 \times 10^{-5}$ kg s^{-1} m^{-1} MPa^{-1}) and *Avicinnia germinana* (L.) L ($k_{max} = 0.75 \times 10^{-7}$ kg s^{1}m MPa^{-1}, $k_l = 0.99 \times 10^{-5}$ kg s^{-1} m^{-1} MPa^{-1}) using high pressure flow meter tool (Sobrado,1999). This perhaps, the high pressure flow meter (HPFM) measured the whole plant shoot where leaf resistances contributed a high proportion compared with LPFM used in this study, where it measured excluding the leaf resistances.

The maximum absolute hydraulic conductivity increased with leaf establishments from EU to FU. Higher hydraulic conductivities are desirable for growth performances of plants (Nardini and Tyree, 1999; Nardini and Salleo, 2000; Tyree, 2002). Because at a particular transpiration higher k_l maintains lower xylem pressure gradient along the soil plant atmosphere pathway (Tyree and Ewers, 1991). This prevents excessive water stress in the xylem (xylem tension), thus prevents xylem dysfunction (Tyree *et al*., 1991) and maintains low water stress at growing meristems, which leads to higher growth (Nardini and Tyree, 1999).

HV is the relative allocation of sap wood to leaves (Tyree and Ewers, 1991) and in branches the relative allocation of wood to leaves measured by HV (Tyree and Sperry, 1989). HV more directly related to mechanical properties than hydraulic properties of stems (Gartner, 1991). High HV recorded in notched stem of *E. agallocha* could be related to mechanical support of stem and for established leaves. The high recorded values of k_{max} and k_l of notched stems showed that stem notching manipulation provides efficient water transport compared with fully unfolded stems, thus suggested as drought avoider's ability in *E. agallocha*.

k_l is a useful parameter, because it is the proportionality constant relating the average transpiration to the stem needed to supply water to the leaves fed by the stems (Tyree *et al.*, 1991). Growth is related to k_l, the drought survival is related to vulnerability of the xylem to cavitation (Tyree and Sperry, 1989). Shoot k_l increases with leaf establishments and manipulated xylem – phloem notched stem concurrently with increased vessel diameter (see Fig 1 & 3). High k_l appeared in notched stem, possibly to prevent excessive water stress to ameliorate the increased hydraulic resistances.

Similar to this study, Sperry *et al.* (1993) and Sperry and Pockman (1993) have demonstrated that experimental reduction of k_l by stem notching could bring about a reduction in stomatal conductance and transpiration without decreasing xylem water potential (Tyree and Sperry, 1989).

k_s is a measure of porosity of xylem conduit (Tyree *et al.*, 1991). At a particular HV higher k_s maintain higher k_l ($k_l = HV \times k_s$) (Tyree and Ewers, 1991 & 1996). The measured k_s of *E. agallocha* agreed with previous reported values of mangrove *Leguncularia racemosa* (Sobrado, 1999) using HPFM tool. Higher k_s being associated with larger vessel diameter already well documented (Zimmermann, 1983) and attributed by the Hagen Poiseuille's equation (Zimmermann, 1983). In this study, increased vessel diameter associated with increased k_s from EU to FU and this was supported by significant differences of vessel diameter at EU and FU stages. Higher k_s associated with wider vessels reported in 5 subtropical trees grown under identical environmental conditions (Vander Willigen *et al.*, 2000). In this study, xylem-phloem notched branches shown higher specific hydraulic conductivity compared with branches measured at fully unfolded stage and this could be a survival strategy of *E. agallocha*, while alleviating k_s under stem level stressful condition and could be classified as drought avoiders.

Plants normally have "native embolism" *i.e* they have considerable amount (10-15%) of embolism during rapid transpiration under well watered condition, causing a 5 - 20% loss of hydraulic conductance. This was reported in field - grown maize (Tyree *et al*., 1986), V*itis vinifera* (Schultz and Matthews, 1988) and in sunflower (Canny, 1997). The PLC reported here was greater than native embolism and this could have increased by xylem tension at early unfolded, fully unfolded and notched stages.

Notched stems had high level of embolism above control level (80 %) reported in *Betula occidentalis* (Sperry *et al*., 1993) and water stress induced embolism was reported in species of *Toona austialis* (Brodribb and Hill, 2000), *Salvia mellifera* (Hargrove *et al*., 1994) and *Acer grandidentatum* (Alder *et al*., 1996). In this study, PLC increased with increasing vessel diameter and this was supported by higher PLC which associated with increasing vessel diameter in *Salvia mellifera* (Hargrave *et al*., 1994) and 90% PLC measured in wider vessels of oaks (Cochard and Tyree, 1990). In this study, PLC did not change the growth performances of *E. agallocha* as expected, that higher PLC would reduce growth by stomatal responses (Tyree and Dixon, 1986). Inversely, higher growth related with increased embolism, as leaf area progressively increased from EU to FU during the leaf establishment stages. Such leaf area possibly increased the photosynthetic assimilates while avoiding the stomatal control. To confirm this, detail studies are required at leaf level.

The leaf shedding in *E. agallocha* has been reported in Andaman Islands, India (Padalia *et al*., 2004) and in Australia (Otterman, 2004). Similar observations reported for other mangroves of *Ceriops decandra* and *Avicennia officinalis* in India during the dry season with increased soil salinity (Mishra *et al*., 2005). *E. agallocha* is a semi deciduous, shed leaves in dry season (Otterman, 2004; Mishra *et al*., 2005), during salt water stress or salt concentration get too in the soil (Kozlowski, 1997) and in later part of summer (Forestry Department, Thailand). The plant hormone abscisic acid also participates in the leaf shedding behaviour of *E. agallocha* (Else *et al*., 2001). In Sathurukkondan, Batticaloa leaf shedding occurs during the monsoons period (April – May and September to November).

This depends on soil water availability in the sites. In dry season, especially in May - June the high salt concentration of water evaporates rapidly from the surface soil and salt becomes progressively concentrated in the root zone, because roots absorb water but very little salt (Kozlowski, 1997). Similar observations were noted along the inland study site in Sathurukkondan. To support this, Schubert (1997) stated that when plant exposed to water stress they show modifications of the transpiration pathway and to reduce the salinity stress and shed their leaves to reducing flow. Lumis *et al*. (1973) and Sucoff *et al*. (1976) reported the complete disappearance of mangroves in India due to salt injury to leaves often followed by leaf shedding and twig die back.

The die - back effect was observed in distal end stems of *E. agallocha* and this symptom considered as vulnerability of stem to embolism. Vulnerability to embolism differs among the plant components (Tyree *et al*., 1991; Cochard *et al*., 1992; Tyree *et al*., 1993a; Sperry and Saliendra, 1994) that distal organs are more vulnerable to xylem embolism (Tyree *et al*., 1993a; Tsuda and Tyree, 1997; Kikuta *et al*., 1997; Salleo *et al*., 2000). This was unique evident in the site immediately after leaf shedding. Frequent leaf shedding has been reported in *Juglans regia* (walnut) (Tyree *et al*., 1993a) in water stress condition and this was revealed with “Vulnerability segmentation”. This hypothesis raised to explain how trees might be designed hydraulically to help them co-op with periods of drought. Hypothesis have generally involved a mechanism of plant segmentation, i.e. a mechanism that permits plants to shed expendable distal components of it͐s shoots while preserving other parts that represent years of carbon investment. Leaf shedding is a potentially cost - effective way for plants to deal with drought stress by a plant segmentation mechanism. As per this, most distal parts of these plants are more vulnerable and often scarified to safe guard the primary plant body under water stress conditions (Tyree *et al*., 1993a).

Vessel diameters are widely recognized as important for models of xylem transport (Zimmermann, 1983) and modification of vessel size are likely to be a common mechanism of response to water stress levels (Lovisolo and Schubert, 1998). There are at least two ways in which a tree may increase transport efficiency. One is by producing more cross sectional xylem per stem area. The other is by changing anatomical features that affect conductivity such as vessel diameter, length and frequency (Ewers, 1985). Of the features, vessel diameter is probably the most important anatomical variables in angiosperm wood because hydraulic conductivity is proportional to the radius raised to the fourth power. As a result, even a small increase in vessel radius should result in a large increase in conductivity (Zimmermann, 1983). In this study, vessel diameter increased with leaf establishments from EU to FU in *E. agallocha.* Further Xylem - phloem notched stem segments significantly developed wider vessels than control of fully unfolded and also the early unfolded stages (see a table 3) and that might have concurrently increased the stem hydraulic conductivity measured in this study. Increased vessel diameter was an impact of hydraulic architecture of stem and thus increases hydraulic characteristics and need not necessarily depend on the leaves for conservative water use. *E. agallocha* is a semidecidious, leaf shedding and establishment is a common phenomenon. Leaf shedding occurs 2 to 3 times per year and main shedding occurs during dry periods as well as at the time of first monsoon breaks. Thus, long standing aerial stems (hydraulic conducting tissue) could act as a main water conducting tissue and need not necessarily to depend on the leaf tissue like other plants.

However, water supplying stem tissue could support the supply of water at the time of leaf establishments and this was evident from the measured hydraulic values, where progressive increase was recorded from EU to FU.

Stem xylem-phloem manipulations

Interestingly, xylem notched stems of *E. agallocha* shown a highest hydraulic conductivity than control of fully unfolded stage which used as a control stems (see a Fig 1 A) instead of expected higher hydraulic resistances by this notched manipulations. Stem notching used to test the ability of the plant species whether to coop with any given stress condition or not. Notching increased hydraulic resistance (Vernieri *et al*., 2001) and water deficit occurs when a plant withstand the imposed stress, and may arise from either tolerance a mechanism that permits avoidance to the situation (Bray, 1997). In *Pinus ponderosa* notching treatments causes two of the replicates to die and the remaining two showed no response to treatment (Hubbard *et al*., 1997) and reduced hydraulic conductance by overlapping transverse cuts reported in the trunk of *Betula occidentalis* (Sperry *et al*., 1993). Several studies have shown that reducing plant hydraulic conductance by notching (Sperry and Pockmann, 1993) and resulted immediate stomatal closure. But in this study, increased in k_s and k_{max} related with increased vessel diameter (Fig 3). Therefore it is also possible to put forward that ameliorated k_s and k_{max} as a consequent of changes in xylem diameter, possibly a mechanism to overcome a stressful condition which caused by notching in the stem. Further newly formed xylem tissues possibly support this phenomenon and suggested that conservative water use possibly regulated by widened xylem structure in the stem.

The increased values of k_{max}, k_l and k_s in notched *E. agallocha* suggested the presence of redundancy pathway in *E. agallocha*. Redundancy (percentage of wall surface in common) is explained by Tyree *et al*. (1994) which provided by the sharing of walls (and pits) in between adjacent conduits and it is highest in conifers, but is still substantial in vessel - bearing trees. As such, redundancy pathways *via.* pit pores, water column routed to the top of canopies to sustain the water supply. Recently, Tyree and Alexander (1992) have addressed redundancy experimentally in *Thuja canadenis* stems. This species has a distinct transition in tracheid diameter between wood formed in spring versus summer. The redundant water transport of *E. agallocha* in this study considered as adaptive mechanism in water stress condition.

E. agallocha appears to be a most adaptability mangrove to grow and establish in a given stress environment; as stress caused by notching in the stems ameliorated the hydraulic conductivity to supply water to leaves. New xylem and phloem tissues formed around xylem phloem notched and girdled portions of stems and considered as survival strategies of *E. agallocha* under assimilate- water stress conditions. Further *E. agallocha* is more often subjected to green pruning by security personals in this sites, which is a major threat.

However it has been shown that rapid emergence of coppices in 2 or 3 months time. These general observations and findings revealed this species as a drought avoider.

Relationship between vessel diameter and maximum hydraulic conductivity (k_{max}) and specific hydraulic conductivity (k_s)

Xylem conductivity is determined by the structure and size of the vessels (Tyree and Ewers, 1991) and by their efficiency, which may be affected by the presence of embolism (Tyree and Sperry, 1989). It is well known that vessel and tracheid diameter can have a profound effect on the conductive efficiency of the xylem (Hargrave *et al*., 1994). Growing conditions that

depress plant growth reduce shoot hydraulic conductivity by inducing the development of xylem vessels of smaller diameter during leaf shedding (Schultz and Matthews, 1993) and water stress (Lovisolo and Schubert, 1998). In this study, k_{max} and k_s linearly increased with increasing vessel diameter (see a Fig 3). This relationship already well documented by Vander Willigen *et al*. (2000) and such condition reported in grapevine (Lovisolo and Schubert, 1998). Shoot k_s is controlled by several anatomical features of the xylem: vessel density, vessel diameter, porosity of pit membranes, vessel lengths and presence of restrictions to water flow (Tyree and Sperry, 1991)

In conclusion, the growth performances in terms of total leaf area, total leaf dry mass and total stem dry mass increased with leaf establishments from early unfolded to fully unfolded stages and further increased to xylem- phloem notched and girdled stems concurrently with increased hydraulic characteristics of k_{max}, k_s and k_l. This suggests that imposed stress condition by xylem – phloem manipulation did not affect the growth performance of *E. agallocha*, thus this species considered as drought avoider. Leaf establishment stages of early unfolded and fully unfolded and xylem – phloem notching affected the above ground hydraulic characteristics of *E. agallocha* in terms of hydraulic conductivity (k_{max}), xylem specific conductivity (k_s), leaf specific hydraulic conductivity (k_l), huber value (HV) and percentage loss in hydraulic conductivity (PLC). *E. agallocha* branches shown progressive increases in k_l from EU, FU and xylem – phloem notched stems. Leaf areas and PLC also increased concurrently with measured k_l parameter. Increased leaf areas were thus balanced against xylem hydraulic transport capacities in the branches of EU and FU.

Further increased k_l (a reverse from the expected) in notched stem of *E. agallocha* could be a strategy to ameliorate the hydraulic efficiency at it's given stress condition. Surprisingly, xylem-phloem notched branches shown higher specific hydraulic conductivity compared with branches measured at fully unfolded stage and this could be a survival strategy of *E. agallocha*, while alleviating k_s under stem level stressful condition. Vessel diameter measured at distal end of stems subjected to hydraulic conductivity measurements were progressively and relatively widened with growth trends of EU and FU and further increased to xylem - phloem notched stems of *E. agallocha*. The increased vessel diameter was an impact of hydraulic architecture of stem and thus increases hydraulic characteristics. As such *E. agallocha* need not necessarily depend on the leaves for conservative water use. New xylem and phloem tissues were formed around xylem phloem notched and girdled sections considered as survival strategies. Lateral branches established below the girdled regions and above canopies exhibited yellow mottled symptoms suggests important of basipetal assimilate transport. There were positive correlation between vessel diameter and k_{max} and k_s that support the hydraulic limitation hypothesis.

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CULTURAL PERSPECTIVE AND BIODIVERSITY CONSERVATION IN UPLAND MOUNTAINS ECOSYSTEMS OF WESTERN GHATS OF INDIA: CHALLENGES & OPPORTUNITIES

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Biodiversity rich areas are fast shrinking and are a cause for concern globally. The conservation of these fragile ecosystems face multifaceted challenges. The establishment of Protected Areas has been found useful to some extent for conservation of biodiversity, but on the other hand it has created new threats resulting in acculturation of indigenous communities by different development activities such as ecotourism, cultural tourism, dams etc. Such propositions have created a series of repercussions, which generate new kinds of management issues. Forests ecosystem is an evolving mosaic of ecosystems that are susceptible to rapid change caused by the interaction of man and technology.

Biodiversity conservation in fragile upland mountain ecosystems of Western Ghats (Sahyadries) of India has been a challenge along with issues of participation and motivation of the communities. Western Ghats mountain system along the western coast of India is one of the twelve biodiversity hotspots of the world. Agasthayamalai range at the southern tip of the mountains harbor about 57% of endemic and endangered species of India. Many parts of these ranges are brought under protected area network of the country. How the changed management pattern from communities to the state has affected the biodiversity is important to understand the issues responsible for forest degradation and forest dependent livelihoods. The processes responsible for deterioration of the upland ecosystem needed to be analyzed before implementing any new management strategy for this ecosystem.

In 2001 Agasthayamalai area was declared as 13th Biosphere Reserve of the country. Kani, an indigenous community has been using these forests for generations and history of their existence in these forests is known for last 150 years. These forests are also rich in water resources with westward flowing rivers. These rivers are dammed in almost every valley. The infrastructure development through such irrigation and hydropower projects, roads and recent tourism development has affected the culture and livelihoods of these indigenous people. Displacement further pushed them away from the rich upland forests. The new regulations of Biosphere Reserve I are trying to involve the communities in protection and management of these forests. Kani culture has many traditions and taboos while protecting and using these forests. Kani consider Agasthayamalai forests as sacred forests and the total landscape has to be treated as their sacred landscape. Kani cultural perspective and its use in better biodiversity conservation have been discussed in the communication. Challenges for conservation include degrading of resources, loss of forest based livelihoods, participation in conservation, awareness and motivation and loss of cultural identity of the people.

Understanding the linkage between cultural and biodiversity; would provide a solid base to involve the traditional communities in conservation and respecting their contribution through generations for protecting the high value biodiversity areas. It is thus necessary to adopt a sustainable landscape-livelihood approach to natural resource management initiatives while designing plans to achieve the synergy between cultural and biological diversity. Such an approach with new participatory framework of conservation of upland ecosystems has been discussed in the paper.

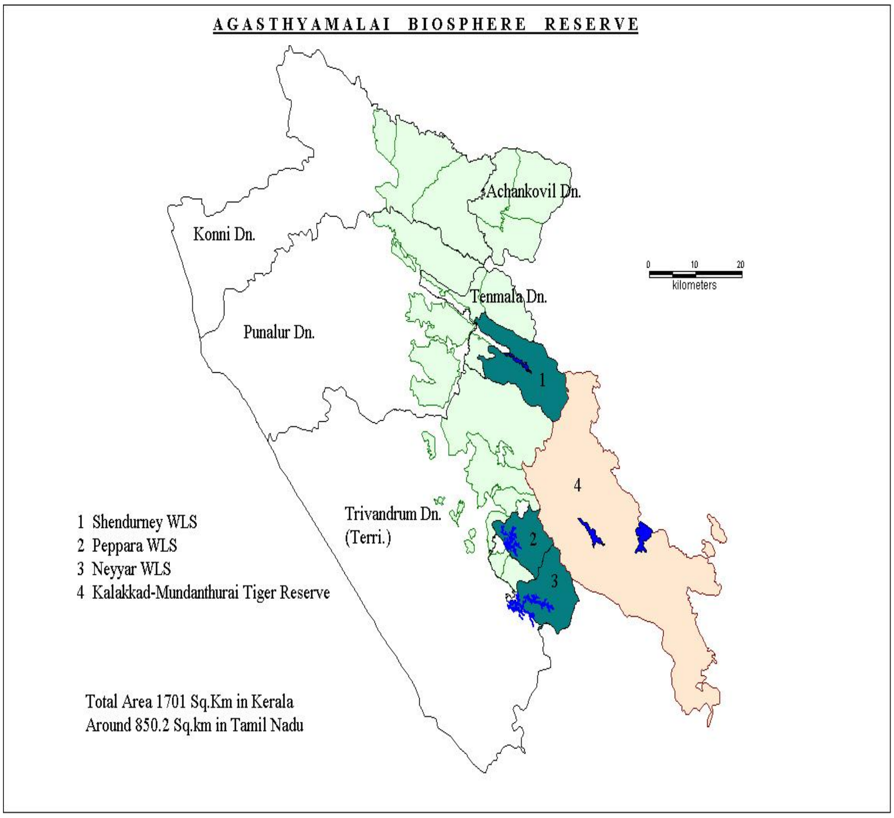
Introduction

The Agasthyamalai Biosphere Reserve (ABR) is a natural unit of mountain system at the southern end of peninsular India . It has the largest tract of wet evergreen forests of Western Ghats. This region also represents a pristine paleotropic region with a very high floral endemism and rich biodiversity. ABR is also one of the important biosphere reserves in the world where the indigenous culture, region and spirituality are associated with the biological diversity. To understand the linkage of cultural and biological diversity at ABR , its role in maintaining the upland fragile mountain ecosystems and its integration for designing conservation programme , UNESCO had assigned a specific study in 2005 . The study conducted in ABR focused on collection of data related to sacred beliefs, legends, myths, and their association with ABR to understand the need of converging cultural & biological diversity for better preservation of the ecosystem embedded in the rich cultural identity of the region. In the present communication an attempt has been made to discuss the challenges and opportunities faced by conservation and interdependence of cultural & biological diversity in ABR.

Agasthyamalai Biosphere Reserve

In 2001 Agasthayamalai area was declared as 13th Biosphere Reserve of the country under UNESCO's MAB programme. The ABR falls exclusively in Kerala covering an area of 1701 sq. km located in South western portion of Western Ghats between 8˚25″ - 13˚0″ N latitude and 76˚ 52″- 77˚34″ E longitude.

The biosphere reserve has adequate area to serve the major functions of conservation, development and logistic support with a core zone of (225 sq. km) a buffer Zone (754 sq. km) and a transition zone (722 sq. km). ABR also has area from Forest divisions, which are non protected areas but are reserve forests area. The ABR falls in three revenue districts of Thiruvananthapuram, Kollam & Pathanmthitta. Three Wild Life Sanctuaries (WLS) i.e. Neyyar, Peppara and Shendurney WLS are also incorporated into the ABR.



ABR as cultural landscape of Kani indigenous group

Kani, an indigenous community is found in the southern-most part of the Western Ghats – the Agasthyamalai range of hills (also known as the Ashambu Hills). They live along the lower valleys and along the forested foothills up to 700 m. elevation. Although originally inhabiting only forested areas, the receding boundaries of the forests have left many Kani settlements stranded far outside the current perimeter of the forests.

Kanis have been using these forests for generations and history of their existence in these forests is known for last 150 years. These forests are also rich in water resources with westward flowing rivers. These rivers are dammed in almost every valley. The infrastructure development through such irrigation and hydropower projects, roads and recent tourism development has affected the culture and livelihoods of these indigenous people. Displacement further pushed them away from the rich upland forests. The new regulations of Biosphere Reserve are trying to involve the communities in protection and management of these forests. Kani culture has many traditions and taboos while protecting and using these forests. Kanis consider Agasthayamalai forests as sacred forests and the total landscape has to be treated as their sacred landscape.

Kanis of ABR have their own traditional system of perceiving nature, forests and minor elements of their environment. They originally belong to Tamilnadu (neighbouring State) . Their original language was Tamil. Later they developed a mixed complicated dialect composed of both Tamil & Malayalam. Only very old Kanis can communicate in this Kani dialect whereas the younger generation has adopted Malayalam as their first language. In Kani dialect there are words for different forest types. This dialect can differentiate between ecosystem types by specific terminology providing the details of the ecosystem structure or function with a lot of precision. ***Adawi*** for example means closed canopy evergreen forests or ***Vennaü*** meaning buttresses, ***Tolavi*** are waterfalls in high mountains and ***Karikam*** means marshy swamps are self-explanatory (**Godbole, Anitha & Chandrasekhara 2005) .**

Biodiversity rich mountain areas have always been homes of the Gods for many of the world's traditional societies. Considering mountains as sacred entities is common all over the developing world especially in the areas dominated by indigenous people. This sacredness is recognized in the sacred landscapes identified by a variety of mountain societies (**Bernbaum 1997**) .

Kanis have been considering Agasthyamalai as their sacred mountain and abode of their supreme God Agasthyamuni. The forests on the higher hill surrounding the higher peaks in the Agasthyamalai range like Koviltherimalai (1313m.), Athirumala (1594m:), Nachiyadikunnu (957m.), Arumukhamkunnu (1457m.) and Kadirumudimalai are part of Kani sacred landscape. Kanis visit the main peak of Agasthyakodam , the highest in the range once in a year in the month of March to light a lamp as part of religious ritual. Earlier there was no shrine or temple but recently a small temple has been built which is the result of growing pilgrimage to Agasthyakodam and can be considered as acculturation. Within this area there are many special areas which are worshipped by Kanis at different occasions and are associated with local deities and clans or ancestors.

Kani Sacred Sites in ABR

Kanis consider Agasthyakodam mountain peak as abode of Agasthyamuni their supreme God but also have many smaller local Gods and separate spaces are allocated to these Gods and protected by all. Specific areas like grasslands, rock shelters, marshy swamps and trees with huge buttresses are considered as abodes of these gods and are fully protected by Kanis.

In Puravimala settlement of Kanis, they have a small sacred grove up to 1 ha in size ; mainly reed dominated areas and is known as Kottamkatiiyakavu. Kavu means sacred grove in Malayalam. It appears that Kanis have forgotten the term for such sacred forest areas in their dialect over the period of time and adopted a Malayalam term. These areas have some huge trees of Ficus sps. Generally the whole area is sacred and people avoid going inside except during festivals. In such smaller groves near the hamlets women are not allowed to enter. In Neyyar WLS Kanis have maintained some **Myristica** swamps as their sacred areas. Cutting trees within the swamp as well as from immediate surroundings is a taboo. Women can go inside and worship as well as offer flowers or coconuts to the Gods. Some Kanis consider the open grasslands as their sacred places, which are considered abodes of ancestors rather than Gods. Such spaces are well known for various Kani clan (Illyams) ancestors. In Chonamapra Kani area, there is a huge **Bombax malabarica** tree with a girth of up to 5 meters and height of about 60 feet. This tree is considered as sacred.

Sacred trees, sacred groves, rock shelters and sacred grasslands are common in Kani surroundings in the ABR forests. It is quite clear that the Kanis had deep understanding of the nature and elements of their environment. The change of Kani's original Tamil culture through their migrations to ABR area over 100 years ago and their blending with Kerala culture and adopting Malayalam language as a channel for communication; is an important cultural transformation which requires detailed study. This cultural transformation has been associated with the dense forest ecosystems of the past to the degraded short cycled shifting cultivation systems of Kanis to finally today's protected area regime with rubber plantations.

Some linkages and parallels between the cultural changes and ecosystem alterations could be easily drawn if we carefully look at Kanis perception of their plants, forests, lands and landscape today. Kanis sacred areas in the form of lakes on the high hills of Agasthyamalai, open rock shelters and some particular huge long-lived trees explain the linkage.

It is quite natural to have open rock shelters as sacred areas for the people who have been residing in the thick forests with close canopy structures for generations. According to Kanis these spaces are pathways to the world outside forests and obviously considered as abodes of Gods and ancestral spirits showing the way. Considering small lakes and water bodies sacred is comparatively easy to understand. Water though not a scare commodity, it needs to be respected as essence of life. Kanis have many such sacred lakes along the high hills of ABR.

Modern tourism development, culture & Conservation

It is interesting to look at the recent developments in the ABR area and what threats these developments are posing to the Kani culture and overall process of conservation in the area.

1. Neyyar WLS

This sanctuary is situated at the southernmost tip of Kerala Western Ghats area and has rich biodiversity in terms of flora , fauna and ecosystems. It is part of catchment area of Neyyar irrigation project and came into existence in the year 1958 and is one of the oldest protected areas from Kerala. The main Agasthyamalai range is in the catchment area of Neyyar irrigation project. The pilgrimage to Agasthyakodam peak also takes place from Neyyar Catchment area. Neyyar dam is visited by tourists frequently mainly for boating and trekking in the forests. Local people from Trivandrum frequent here and this is a most popular day's picnic spot. State Forest Department has developed a tourist information facility. Through this Facility basic information about the WLS and area that could be visited by tourists is provided. However there is no interpretation centre or any information available in English. Most of the foreigner's groups bring translator from Trivandrum or the tour operators provide such help. Forest dept. has kept row boats for boating in the reservoir and which in turn has provided employment to the local youth. Some local people also work with Forest Dept. as guides for trekking routes. Most of them are daily-wage laborers. There is no information about specific species, nearby landscape, importance of Agasthyakodam peak etc available or provided in the information centre. This information centre is managed by chief wildlife warden. Irrigation Dept has also set up an interpretation centre but is non operational. Tourist influx is restricted to the recreational area around the Dam.

In the area surrounding the reservoir there are many non tribal settlements and these people compete for the resources with Kanis residing along the fringes and in the remote interiors.

Within the catchment of Neyyar Irrigation project i.e. part of Neyyar WLS there are many rubber plantations. Obviously this causes lot of disturbance to the forests and vegetation. Since these plantations are within the reach of Agasthyamalai ranges it is important to know about the perception of these plantation owners and laborers.

Neyyar is a very well publicized tourist location in Kerala. Many resorts and hotels are coming up in and around the area. It is important to find out the impact of such increased unorganized tourism on the ABR forests and people associated with the tourism. It is clear that there is very little scope for Kanis to continue their cultural practices in the area. Such cultural change is affecting the positive participation of Kanis in the process of conservation as well as development.

2.Ponmudi

Ponmudi is the nearest hill station to Thiruvananthapuram (65km). It is situated at 915 meters above sea level. It is an idyllic hill resort with narrow, winding path ways and cool, green wooded environs. The natural scenery, salubrious climate and the scope of hiking in high trails make the visit an exhilarating experience. However Ponmudi and surroundings serves as the best example of adverse impacts of Forest and tourism development efforts on ABR. Ponmudi surroundings have high quality untouched wet evergreen forests distributed in about 200 sq. km area and stretched up to Shendurney WLS and Kallad Irrigation Project catchment. Unfortunately these forests have not been included in ABR. But Kanis have many sacred sites and sacred lakes in this area. Surprisingly, Kanis are not involved in any development or conservation work in this area.

At Ponmudi hill station area there are some very old tea gardens owned by a company from Calcutta. In this area old plantations of tropical pine are observed. For these plantations a large tract of wet evergreen forest has been clear felled in the past. Similarly for beautification of the area **Acacia auriculiformis** has been planted as avenue tree. Ponmudi hill station has an acute drinking water problem from March to June. Therefore the only one resort is operated by Kerala Tourism Development Corporation and is closed from March to June. It is clear from the situation that the lush green catchments of the streams originating from Ponmudi have been destroyed for tourist development and other initiatives like commercial plantations of tropical pines.

Forest Dept has developed a deer park in an enclosure and put about 35 Sambar deers. However it was not possible for them to provide fodder and water and this experiment was completely unsuccessful. Now this enclosure is open area devoid of any vegetation.

Challenges of ABR conservation

- Lack of Awareness
- Disintegration of traditional Institutions governing conservation
- Need of continuous facilitation
- Growing populations
- Lack of appropriate policy support
- Various Conflicts

Such efforts by forest dept. have posed many basic questions regarding the ideas of tourism development and use of protected areas for the tourism and its impacts on biodiversity of the area.

Discussion

There is a wide recognition throughout the globe and across the disciplines that regions of ecological prudence exhibit a symbiotic relationship between habitat and cultures (**Arizpe 1996**). Traditionally some of the indigenous societies inherited and maintained very important natural resource management institutions in the form of sacred groves, sacred mountains etc. It was the ultimate expression of these societies to respect the natural forces by considering them sacred and attaching religious importance to it. The rapid development and resultant materialistic culture had considerable negative impact on the traditional societies and indigenous people to a large extent. Such impacts; rapidly modified the indigenous knowledge based resource management patterns and altered the practices of respecting the natural forces expressed in the form of biodiversity conservation. Urbanization and modernization disregarded this value system and traditional institutions maintaining these systems are vanishing fast.

It is apparent that the Agasthyamalai Mountain and surrounding forests have been conserved by local communities and were worshipped for many generations. Traditional understanding and cultural perception are significant in terms of livelihood support and day to day customs of the Kani community. Since the area has been considered sacred since time immemorial, the biodiversity unique to ABR has been preserved.

Now such systems are under enormous pressure as many other non-indigenous people use them. The later inhabitants do not have knowledge of the culture that has preserved the landscape. Growing tourism, pilgrimage, rubber plantations and some forest development activities are helping Kanis earn better livelihood. However this enhanced livelihood is being offered at the cost of their deep routed traditions, culture and age old relationship with their plants, forests and environment.

It is a critical challenge to maintain rich indigenous knowledge of Kanis while achieving biodiversity conservation and development for betterment of Kanis. Before the advent of development the sacred landscapes and ecosystems within them were managed by one or more traditional societies.

It is clear from the few examples from the ABR provided above that hardly any effort has been made to incorporate the cultural understanding and traditional practices of local communities in today's conservation policies, planning and implementation. Such ignorance towards the rich cultural heritage therefore has resulted in conflicts and non participation of the stakeholders. It is also very clear from the case discussed here that development in the form of large infrastructure projects have initially pushed Kanis in the upland biodiversity rich areas increasing pressures on such untouched areas. Later with the notification of protected areas and Biosphere reserves the cultural degradation of this community followed due to the loss of forest based livelihoods. Because of indifferent attitude of planners and policy makers towards the culture of indigenous people, the participation of indigenous community in the conservation is very poor and their bondage with their resources and landscape has drastically changed.

It is evident that the traditional societies like Kanis of ABR perceive the biodiversity based on their indigenous knowledge and they respect the nature and elements of environment around them though they use the same for their well being and livelihood. Whereas, the non traditional societies perceive the nature and forest resources only as useful or useless commodities. Due to such non respecting perception the civilized society is responsible for destruction of forest tracts. The forest being replaced by rubber plantations is a common sight throughout the Peppara and Neyyar areas. There fore it can be said comfortably that non tribal cultures do not provide space for the natural processes responsible for maintaining diversity nor they have certain traditions like sacred groves or sacred landscapes that are contributing to biodiversity conservation.

The knowledge of biodiversity and cultural practices associated with age old conservation practices is vanishing very fast in ABR as in case of all other protected area management and forest /tribal development scenarios. There is need of detailed studies, documentation and in depth research work before implementing any special biodiversity conservation and management programme is such ecologically sensitive areas.

Awareness generation and orientation for all the stakeholders including Kanis should be mandatory before implementation of any new participatory conservation approach. There is need of an integrated approach for establishing balance between environmental protection and development needs to mange and protect the delicate landscapes like ABR.

Conclusion

The Biosphere reserve and natural world heritage site concepts of UNESCO are indeed a rediscovery of the sacred landscape belief system of traditional societies and is an attempt towards an integrated management strategy to conserve natural resources for sustainable use with intergenerational equity concerns (Ramakrishnan 2003). While designing any plan of action to achieve better conservation or providing any special status to a specific area or landscape it is important to understand the linkage of and interdependence of the cultural and biological diversity.

Biodiversity rich areas are fast shrinking and are a cause of concern globally. The conservation of these fragile ecosystems faces various challenges. The establishment of Protected Areas has been found useful to some extent for conservation of biodiversity, but on the other hand it has created new threats resulting in acculturation of indigenous communities by different development intiatives such as eco-tourism, cultural tourism, dams etc. Such propositions have created a series of repercussions, which generate new kinds of management issues. Forest ecosystem is an evolving mosaic of ecosystems that is susceptible to irreversible change due to the intervention of man and technology. The human interface is a critical part of the landscape management and thus social dynamics needs to be accorded a high priority in any natural resource management programme.

Acknowledgements

I am grateful to Prof P.S. Ramakrishnan, Jawaharlal Nehru University , New Delhi for his guidance and encouragement for designing the concept and conducting the research. Thanks are due to Dr. Sudha Mendiratta, UNESCO for assigning this research to AERF and KFRI. Authors are indebted to Dr. S. Santhi & Dr. Satis Chandran Nair for their help , guidance and help for actual field work in ABR . We are thankful to Kerala Forest Department staff for their interest and help in our work. Thanks are due to colleagues in AERF for their interest and help during the research.

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International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

A POPULATION STUDY OF JOHANNESTEIJSMANNIA LANCEOLATA (ARECACEAE) IN MALAYSIA

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A population study on *Johannesteijsmannia lanceolata* (Arecaceae) was carried out in Angsi Forest Reserve, Malaysia. We investigated the growth rate, flowering sequence and spatial distribution for a period of 19 months in 3 study plots. The life stage was divided into 3 stages; adult, juvenile and seedling. The results indicated that in all stages, the spatial distribution of this species was random. The adult produced 2.1 leaves per year, juvenile produced 1.6 leaves per year and seedling 0.8 leaves per year. In adult stage, the plant required 4.5 months interval between 2 successive leaves and 6.9 months in juvenile stage. No data was available for seedling stage. Each leaf in adult stage remained in the crown for 8.8 years and 8.4 years in juvenile stage. No data was available for seedling. The species produced 1.4 inflorescences per year, initially with 1086 – 2150 fruits set and ended up with only 5 – 8 fruits at maturity. The whole flowering sequence lasted about 8.7 – 9.4 months. At the moment, the process of microsatellite development is still on going.

Keywords *Johannesteijsmannia; conservation; population; reproductive; microsatellite*

Introduction

Population study or demography study is based on estimates of numbers, growth rates, age distribution and schedules of birth and death. Although there are many studies on demography or population of palms in most tropical countries such as Brazil and Mexico, there is no extensive research of the same subject being carried out in the Malesian region. A recent study was carried out by Bógh (1996) who studied rattans in Thailand. An 18 month period of study on populations of *Arenga westerhouteii* and *A. obtusifolia* has been carried out by Rozainah *et al* (1999a, 1999b, 2000, 2002) but that is clearly not enough to make a strong conclusion on general demography of palms in Malaysia.

Apart from population ecology, a study of population genetics is also important to establish and enhance critical parameters for conservation purposes. There may be concern about the level of inbreeding within a population and the effective population size. For example, gene flow study or paternity analysis can analyze breeding system and kinship. Maintaining the population of *J. lanceolata* is important as the species is classified as rare and under threat (Johnson, 1996). The genus has also been widely used in landscaping, so stealing plants directly from the forest is inevitable to meet the market demand. The study will help in management, preservation and conservation of the genus and probably help in enlarging the population size. The study of gene flow is crucial in making conservation plans for plant populations. With more and more forest opening and fragmentation process going on, the concern is whether this species can withstand and maintain or possibly expand its population size.

The next plan for this project is to conduct paternity analysis / gene flow study for the population of *J. lanceolata* in Angsi FR via microsatellite markers. Microsatellite is the most common term to describe tandem repeats of short sequence motifs (Hancock, 1999). They can be found in all organisms studied and are useful genetic markers due to their high polymorphism. By using microsatellite markers, the study of paternity within the population is possible. Together with scientists in Japan, we are still developing microsatellite marker for *J. lanceolata* and cross-species amplification for the other three species as an initial stage to conduct paternity analysis.

J. lanceolata belongs to the subfamily Coryphoideae (Uhl & Dransfield, 1987). It is a solitary, pleonanthic, acaulescent and hermaphrodite palm. *J. lanceolata* is one of the four *Johannesteijsmannia* species that are classified as rare and under threat (Johnson, 1996), and Kiew (1989) classified *J. magnifica* as endangered species in Malaysia. This genus is scattered from north Sumatra to the Malay Peninsular and Borneo, and has only been observed in primary forest (Dransfield, 1972). With the exception of *J. perakensis*, they lack a visible stem, so that the leaves appear from the ground. The leaves are large, simple and undivided, and can reach a length of more than 6 metres rising directly from an underground root-stock. The inflorescences conspicuously arise among the leaves. The species studied, *J. lanceolata*, was identified by its long narrow leaves and its inflorescence structure which bears about 10 branches (Figs 1 and 2). The rest of the genus display a huge number of branches i.e. *J. magnifica* can have about 1000 branches and *J. altifrons* can produce up to 100 branches, as has been described by Dransfield (1972), while *J. perakensis* possesses a stem.

Fig 1: A young inflorescense (left) and a mature infructescence (right) of *J.lanceolata*

Fig 2: An adult with 6 metre long leaves of *J. lanceolata*

Materials and Methods

Angsi Forest Reserve is located in Negeri Sembilan and is about 100 km to the south west of the Malaysian capital Kuala Lumpur. It is classified as a dipterocarp forest, with the highest peak is Gunong Angsi at 825 m above sea level, and with Batang Terachi River flowing from it. The temperature during the year is high and uniform, with an annual mean of 28.0^{o}C. Mean annual rainfall is 2376 mm, distributed fairly evenly throughout the year (Manokaran and Kochummen, 1987). Three plots parallel to the river were set up; each of 40 by 40 meters (1600 square metres). In this study, three life stages were differentiated based on the number of living leaves in the crown: seedling, juvenile and adult.

1. Growth rate

All individuals in each plot were monitored closely for its leaf development every two weeks for a total period of 19 months. The t-test was used to check the significance of differences in data obtained from different plots.

2. Spatial distribution

The spatial distribution of each stage in each plot was determined with Coefficient of Dispersion formula and its interpretation.

3. Reproductive study

Twenty four adult plants were observed for their flowering status for the total period of 19 months. Seven stages were used to describe the flowering and/or fruiting status of each plant: Stage 1: Plants with no inflorescence**;** 2: Plants with unexpanded inflorescence**;** 3: Plants with expanded inflorescence in with unopened flowers**;** 4: Plants with expanded inflorescence with mature receptive flower; 5: Plants with immature fruits present**;** 6: Plants with mature fruit as judged from the first fruit to fall**;** 7: Plants with dry inflorescence.

4. Microsatellite development

We collected 46 samples including 6 SSR samples of *J. lanceolata* in Angsi FR, Malaysia for the purpose of microsatellite development. Since not many seeds were encountered during the trip, young leaves were used instead which nevertheless is as good. For the purpose of cross species amplification, we collected 5 samples each of *J. altifrons*, *J. perakensis* and *J. magnifica*. Seventy-six DNA extractions were done based on the Murray & Thompson (1980) method.

The process of microsatellite development was carried out in a lab in one of the leading research institutions in Japan. In order to purify and produce crude DNA and to remove RNA, we used RNase enzyme. Preliminary DNA digestion was conducted by using Nde II enzyme which recognizes to cut GATC nucleotide. DNA digested was ligated by using DNA Ligation Kit Ver 2.1. To check whether the ligation is a success, Nick Translation and DNA precipitation protocols were carried out by using Ethachinmate Kit. This is done with the aid of a PCR machine to amplify the DNA. After amplification with the PCR machine, a process called Hybridization was carried out to catch the microsatellite sequence of CT. Protocols like Magnetic capture and Washing will ensure the hybridization has taken place. A further amplification with PCR machine and gel electrophoresis was carried out to collect DNA between 500 – 1000 base pair. The next process, Precipitation was carried out by using Ethachinmate Kit and followed by Digestion of linker by using Nde II. The sample was then ligated into vector and spread on agar in a Petri dish and leave to incubate for 1 hour before spread again with *E.coli.*

Results and discussions

1. Growth rates

Table 1: Mean values of crown leaves (CL) and number of new leaves (NL) per year for three different stages of J. lanceolata (ns = not significant at 5% level)

Stage	CL	NL (year-1)
Adult	24.3^{ns}	2.1^{ns}
Juvenile	14.8^{ns}	1.6^{ns}
Seedling	4.1^{ns}	0.8^{ns}

The leaf production of each individual is an average of 0.8 leaves per year (seedlings), 1.6 leaves per year (juveniles) and 2.1 leaves per year (adults) (Rozainah & Sinniah, 2005a). Leaf production of J. lanceolata is continuous and slow. In adult and juvenile stages, there can be more than 1 spear leaf occur at the same time. Generally in palms, age determination can be calculated tentatively by using this formula Age = N x P where P is a period between 2 successive leaves and N is a total number of leaves produced throughout its life time. However, in J. lanceolata, it can be problematic due to its saxophone type acaulescent type (Tomlinson, 1990) where the underground part has decayed over the years and age remain unknown.

2. Spatial distribution

Table 2: Coefficient of Dispersion interpretation value of the spatial distribution of J. lanceolata in all stages in three study plots.

Plot	Seedlings	Juveniles	Adults
1	random	random	random
2	random	random	random
3	random	random	random

From the initial survey, the distribution of this species was restricted in a relatively small area on both sides of the river and not evenly distributed in the whole forest. Or the population could be in patches throughout the Angsi FR although no record can be found.
It is discovered that distributions of all stages (seedlings, juveniles and random) are random (Rozainah & Sinniah, 2005b). This can be related to its solitary form and not being caespitose (multi stemmed with stolon underneath the soil). It may also be due to seed dispersal technique, perhaps moved around by vectors. The adult size is huge and may reach up to 3 m across and therefore, they tend to live distant from each other.

3. Flowering behaviour
Results showed that only 71% of plants actively produced new inflorescences within the study period, and only about 1 inflorescence per plant per year. From our calculation, initially, one inflorescence may produce up to 2000 fruit-sets but at maturity, only 5-8 fruits were left while the rest aborted during the development. In term of length of time at every stage, the results were as follow; Stage 2 - 3: 14 - 17 days; Stage 3 - 4: 35 - 45 day; Stage 4 - 5: 7 - 10 days; Stage 5 - 6: 180 days; Stage 6: 25 - 30 days.

From the results above, the whole sequence of reproductive phenology may take 8.7 – 9.4 months (Rozainah & Sinniah, 2006). The low number of seeds at maturity inhibited us from carrying out seed germination tests. We did not carry out a pollination vector 36-hour observation, but many documents record that bees have been proven to be important pollinators in palms in Malaysia (Kiew & Muid, 1989).

4. Microsatellite development
We will finish the development of microsatellite and cross species amplification by adding the processes of sequencing, screening and labeling the primer.

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PHYSIOLOGICAL GENETIC BASIS OF RESISTANCE OF SOME DURUM WHEAT (T.DURUM DESF.) VARIETIES TO DROUGHT

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The study was carried out on 12 durum wheat varieties belonged to T.durum desf. Changes in genome of resistant, middle resistant and susceptible wheat varieties caused by drought and effects of the phytohormones on these changes were studied. It was observed that after stress factors on resistance varieties number of the labile DNA and RNA increase. This shows that on resistance varieties activity degree of genome is high, and intensity of transcription increases that raises the resistance degree on the same varieties.
On susceptible varieties amount on labile DNA and RNA decrease after stress. In addition to these stress factors, it has been determined that both in the hard varieties and soft varieties, the process of repair accelerates when GA_3+KİN hormones combination is added. It is more clearly observed in hard varieties.

Keywords: *Durum wheat, drought stress, RNA, fractions of DNA*

Introduction

The stress factors, especially drought negatively effects plant growth and development and causes a sharp decrease of plants productivity. A great part of arable land of our republic is on the drought areas.
To achieve high output of agricultural crops under stress, stress resistant varieties and the study of resistance of foreign varieties to drought stress in Azerbaijan condition are needed. Resistance of crops to stress factors depend on functional state of genome under stress condition. Genome activity and genetic ordering mechanism is connected with the structural condition of the DNA. The aim of this study is to detail structural and functional changes caused by stress factors in durum wheat genome chromatin, as well as, to gain some knowledge about the mechanism of this effect.
Investigation of increasing ways of resistance to stress factors of plants gains a big scientific and practical significance and is one of the most important problems of agriculture system.

Materials and Methods

This study was carried out in 12 durum wheat (*T.durum desf*) varieties. Their drought resistance was evaluated by the germination ability of their seeds in laboratory conditions at 10 atm.(for durum wheat)(Oleynikova et al , 1976).

For studying genomic structure and activities, a germination susceptible and a resistant variety was chosen each from durum. For the former PEG-3000 was used (Grodingsky and Osipov, 1973). The seeds were kept in distilled water (dH_2O) overnight and germinated in plastic pots (20 cm in diameter) containing air-dried greenhouse soil under natural light at room temperature. Pots containing seedlings were divided in two equal groups after five days. The first was irrigated with 100 ml of distilled H_2O and the second with 100 ml of PEG (60g PEG/I d H_2O: 05 atm.) twice a day at 12 hour intervals.

At the end of 48 hours, 2 g fresh leaves of seedlings were collected from each group in order for genomic nucleic acids to be extracted. The rest of the seedlings irrigated with d H_2O were kept as a control group, and the rest of the seedlings irrigated with PEG were each divided in two groups. The first group was irrigated with 100 ml of d H_2O and the second group with 100 ml of giberellic acid (GA_3) plus Kinetin (50 mg/l + 50mg/l) twice a day at 12-hour intervals over four days. Leaf samples from these groups were randomly collected after 96 hours the onset of stress (72 hours after the relief of stress). To reduce sample variation, all measurements were performed on the second and third leaves of seedlings and samples were collected in four replicates.

Total cell DNA and RNA were isolated by the procedures described below. Nuclear nucleic acids were extracted by the gradual fractionation method. The gradual application of varying ionic power forms the basis of this method, allowing the separation of labile chromatin DNA (free DNA), stable chromatin DNA (DNA bound loosely to histones) and residual chromatin DNA (DNA bound strongly to histones) (Alekseyev 1973; Ovchinnicova and Yocovlev, 1976). Amounts of the nucleic acid were estimated as mg/ml by spectrophotometer with 270 and 290 nm wave-length absorption spectrum (Konaryev and Tyuteryev, 1970).

Results and Discussion

The degree of resistance to drought stress of the wheat varieties studied in the first stage of our investigation are shown in Figure 1.

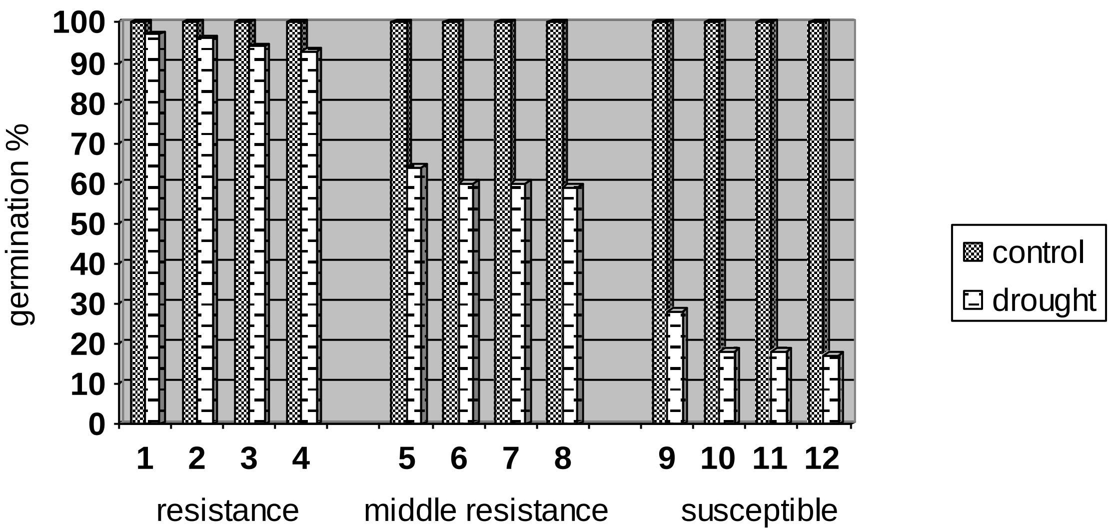

Figure 1. The germination per cent of the durum wheat varieties in 10 atm (durum wheat) in saccharose solution (Drought).

1. Elan	5.Qarabağ	9.Zedan3d-56
2. Cəfəri	6. Şərq	10. Xoranka 46
3. Kalvin	7.Zaparoji 803	11. Persion
4. Febo	8. Kəhrəba	12. Nəsimi

As is seen in Figure 1, amongst durum varieties Elan, Cəfəri, Kalvin, Febo are the most resistant to drought; Qarabağ, Şərq, Zaparoji 803, Kəhrəba middle resistant, and Zedan 3d-56, Xoranka 46, Persion, Nəsimi are susceptible to drought.
In order to detail changes in chromatin structure caused by stress factors, we chose Elan as resistant to drought, Qarabağ as middle resistance and Persion as susceptible. The results obtained are shown in Table 1.

Table 1. Changes in genome structure of wheat varieties caused by drought and effects of phytohormones on these changes

Varieties	RNA	DNT fraksiyaları			Total DNA
		labile	stabile	Resudie	
Elan (resistance)	**48 hours after stress**				
Control	118.0	14.3	29.7	2.85	46.8
PEG	146.9	16.7	29.6	2.10	48.4
72 hours after stress					
PEG+H_2O	108.9	11.6	27.6	2.65	41.8
PEG + Ga+Kin	176.6	19.8	30.8	3.12	53.7
Qarabağ (middle resistance)	**48 hours after stress**				
Control	99.3	10.6	16.4	2.39	29.4
PEG	110.4	13.3	17.1	2.34	32.7
72 hours after stress					
PEG+H_2O	73.1	9.04	12.2	1.85	23.0
PEG + Ga+Kin	125.5	16.2	18.1	3.12	37.4
Persion (susceptible)	**48 hours after stress**				
Control	65.3	12.7	15.6	2.83	31.2
PEG	42.9	8.28	16	2.06	26.3
72 hours after stress					
PEG+H_2O	49.6	10.4	12.9	2.09	25.4
PEG + Ga+Kin	62.5	13.3	16.3	2.74	32.3

From Table 1 it seems that after 48 hours of drought stress in resistance Elan variety, RNA and fractions of DNA are increasing. In particular the increase is seen in the RNA and the labile DNA. In contrast, susceptible Persion variety shows reduced amount of all DNA fractions after 48 hours, at the same time it also reduced RNA and labile DNA. In the middle resistance varieties this increase is less. RNA and labile DNA appear to be correlated. Perhaps, in Elan variety increased transcription velocity associated with greater resistance, in Persion variety the lower transcription velocity is associated with reduced drought resistance.

At 72 hours after stress, there were significant increases of RNA, DNA fractions and total DNA in resistant and susceptible varieties as a result of giving GA+Kinetin hormones. This shows the positive effects of GA+Kinetin hormones on the structural and functional state of genome, as well their effect on increasing the velocity of repair processes.

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CONSERVATION AND MANAGEMENT OF *CROCUS* spp.

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Turkey has the rich in biological diversity including many *Crocus* species except saffron (*Crocus sativus* L.) are growing wild an open, grazed, mountainside in grass and among various shrubs and widespread all over Turkey. They are spring or autumnal flowering geophyte with corms that are covered by tunic, dormant during the summer. The late spring or the beginning of summer the plant shows no above ground organ sor roots. *Crocus* species excep Saffron which is sterile triploid (2n=3x=24) have trilocular capsules containing numerous globule like seeds.

Crocus species are the member of Iridaceae family which embraces about 60 genera and 1500 species. The genus *Crocus* has about 85 species. 36 *Crocus* species and 36 subspecies, a total of 72 taxa are growing naturally in Turkey. Among these, 19 *Crocus* spp. and 21 subsp. as a total of 40 taxa are endemic species.

Industrialization and increasing population are directly affecting this attractive white, yellow, red or violet coloured flowering *Crocus* species future generation as other biological diversities, Accordingly, they becomes one of the endangered species. Thus, Turkey adopted a conservation policy about plant species including *Crocus* spp. that corm collection from their inhabitant and marketing are forbided.

In this presentation; botany, *Crocus* diversity in Turkey, endemism, further conservation and management plan of the *Crocus* species are evaluated.

Key words: *Crocus spp. Botany, Protection measures, Management plan.*

INTRODUCTION

Turkey has a rich in biological diversity because of having four season, different climatic and topografic variations. As other parts of the world, the biological diversity has been under threat or even extinction by certain human activities including urbanization, road construction, grazing, mining, erosion, some agricultural and forestry management practices, and other uses (Vurdu,1993). As a result, approximately 11 percent of described species that equals to 33370 plant species are threatened to some degree according to the 1997 IUCN red list of threatened plants (FAO, 1999). Addition, the environmentalist is strongly believe that some plant species which the number are difficult to ascertain are under imminent risk of total extinction (Küçük at al., 2000).

The most of the threatened plants are wild plants that grow in natural or semi-natural ecosystems in different biomes around the world (Önde and Vurdu, 1988). Because, human impact on these are severe and thus, it is hard to find almost any undisturbed or virgin areas (FAO, 1999). *Crocus* species is one of the floristic composition of Turkey. Except saffron (*Crocus sativus L.*), the species are wild and growing an open, grazed areas, mountainside in grass and among various shrubs and, within the forest (Vurdu and Güney, 2004).

Crocus spp. give delihtful flowers that loved by the people, especially, children. Their flowers signal the end of winter and beginning of spring season or autumn. Because, they are spring or autumnal flowering geophte having corms that are covered by tunic and dormant during summer (Vurdu, at al., 2004). Moreover, it is expected to increase their uses of *Crocus* species in the folk medicine, pharmaceutical, food, cosmatic, textile dyeing and etc. As an example, the well known cultiveted *Crocus* species is saffron (*Crocus sativus L.*) that provides the most expensive spice in the world. Some other *Crocus* species are highly prized for their colorful flowers and used extensively in specialized gardening (Vurdu, at al., 2004).

Crocus species are included into the list of dangered species in Turkey (Vurdu, 1993). As other wild plant species, the habitat of *Crocus spp*. are also affected by people activities along with the increasing population, urbanization industrilization, different land disturbances, recreational

habit, uncontralled gathering, erosion, agricultural and forestry operations. The current trend of impact activation on biodiversity is unprecedented and dramatically increasing (FAO, 1999).

Crocus species are urgently needed a special conservation and management plans to be implemented. Eventhough, Turkey adopted a conservation policy to forbid their gathering from their inhabitant and selling them at localor international market for the endengered plant species list including *Crocus* spp.. However, this conservation policy is considered to be not enough for plant protection measures because of difficulties for monitoring and implementation. Therefore, the further national conservation policy need to support the research and development for the understanding biological dynamics and domestication, to clarify the user rights, to develope effective processing and marketing systems and suitable management and strong monitoring program (Russo, at al., 2000).

This presentation mainly includes botany,species, endemism, further conservation and management plan of the Crocus species for sustainable development.

BOTANY

The genus *Crocus* has about 85 species and belongs to the Iridaceae family which embraces 60 genera and 1500 species (Ciola, 2004; Vurdu, at al.,2004). This family has permanent underground swollen stem bases called corms or bulb. *Crocus* spp. is a monocothyledon geophyte with corms that means bulblike underground swollen stems. The corms covered by a fibrous, membranous tunics, dormant during summer and sprouting in autumn or early spring depending on the species. They may have contractile and fibrous root sytems. Each corm produces one or number of leaves which is located upper part of soil, the grass-like, before or after flowering. Generally, the leaves are deep shiny green, rather broad and have a median white stripe (Vurdu, at al., 2004).

The *Crocus* species classified as either are spring and autumnal flowering *Crocus* species. The flowers have a wide range of intense colors such as white, cream blue, red, yellow, lilac to purple. In addition, there is a stripes or different colors inside and outside the tepals. The well known *Crocus* species is *Crocus sativus L.*(Saffron) that produces the most expensive saffron spice. The saffron plant is an autumnal flowering geophyte.

Saffron plant is a trioploid species which genome shows 2n=3x=24 chromosomes (Ciola, 2004). The other *Crocus* species are generally diploids with 2n=16. However, some *Crocus* species are diploid but having different number of chromosomes such as *C.asumania* has 2n=26, *C. moabiticus* has 2n=14 and *C.pallasii* has 2n=12,14,16 (Jacobsen and Orgaard, 2004). Therefore, saffron is a sterile triploid species having no regular sexual production. The production of saffron is vegetative multiplication year by year by means of corms. Eventhough is sterility, saffron is the cultivated species of *Crocus* because of prime economic importance of its spice. The other cultivated *Crocus* species are highly prized for their colorful flowers used extensively in specialized gardening.

Other than *Crocus sativus L.*, it is known to be the other *Crocus* species are not sterile triploid and having trinocular capsules containing numerous small globule like seeds. They can be propagated by their corms or seeds (Ciola, 2004; Vurdu, at al.,2004).

The species are an inhabitant to an open, grazed, mountainside within grass and among various shrubs and growing wild except saffron (*Crocus sativus L*.). In addition, the leaves are wither during late spring and most of the summer and show no aboveground organs. Thus, Crocus species can be indentified from each other by several futures such as a style, corm tunic, flower characteristics, number of leaves, flower color, and the anther color (Vurdu, at al., 2004).

NATURALLY GROWN CROCUS SPECIES IN TURKEY

Includıng cultivated *Crocus* species saffron plant (*Crocus sativus L*.), Turkey has a natural habitat for many Crocus spp. The genus *Crocus* has about 85 species in the world. Among these, 36 crocus species and 36 subspecies which amount to 72 taxa are growing naturally in Turkey (Table 1). From these, 19 Crocus species and 21 subspecies as a total of 40 taxa are endemic species. There is a widespread distribution of Crocus species all over the country at different elevations from 50 to 2700 meters depending on species (Davis,1984).

Table 1. Species and subspecies of *Crocus* Genus in Turkey

Endemic Species (*)	***Species***	***subspecies***
*	***1. Crocus abantensis***	
*	***2. Crocus adanensis***	
*	***3. Crocus aerius***	
*	***4. Crocus ancyrensis***	
*	***5. Crocus antalyensis***	
*	***6. Crocus asumaniae***	
*	***7. Crocus baytopiorum***	
	8. Crocus biflorus	***- biflorus***
*		***- albocoronatus***
		- adamii
*		***- artvinensis***
		- crewei

Table 1. Cont.

*		***- isauricus***
*		***- nubigena***
*		***- pseudonubigena***
*		***- pulchricolor***
*		***- punctatus***
*		***- fibroannulatus***
		- tauri
*	***9. Crocus boissieri***	
*	***10. Crocus cancellatus***	***- cancellatus***
		- damascenus
*		***- lycius***
		- mazziaricus
*		***- pamphylicus***
*	***11. Crocus candidus***	
	12. Crocus chrsanthus	
*	***13. Crocus danfordiae***	
	14. Crocus flavus	***- flavus***
*		***- dissectus***
*	***15. Crocus fleischeri***	
*	***16. Crocus gargaricus***	***- gargaricus***
*		***- herbertii***
	17. Crocus graveolens	
*	***18. Crocus karduchorum***	
*	***19. Crocus kerndorffiorum***	
	20. Crocus kotschyanus	***- kotschyanus***
*		***- cappadocicus***
*		***- hakkariensis***
		- suworowianus
*	***21. Crocus leichtlinii***	
*	***22. Crocus matthewii***	
	23. Crocus olivieri	***- olivieri***
*		***- balansae***
*		***- istanbulensis***
	24. Crocus pallasii	***- pallasii***
		- dispathaceus
		- turcicus

Table 1. Cont.

*	***25. Crocus paschei***	
*	***26. Crocus pestalozzae***	
	27. Crocus pulchellus	
	28. Crocus reticularus	***- reticulatus***
*		***- hittiticus***
	29. Crocus sativus	
	30. Crocus scharojanii	
*	***31. Crocus sieheanus***	
	32. Crocus speciosus	***- speciosus***
*		***- ilgazensis***
*		***- xantholaimos***
	33. Crocus tournefortii	
	34. Crocus vallicola	
	35. Crocus vitellinus	
*	***36. Crocus wattiorum SYN: (Crocus biflorus subsp. wattiorum)***	

* The endemic taxons of *Crocus* is showing with asterix.

Crocus Species Under Threat

It can be say without any hesitation that it is hard to find any areas which have been not disturbed or modified by human activites. Therefore, the natural ecosystems of *Crocus* species as other wild plants are effected. Because, their grown habitat are getting shrink or may even loss. Consequently, habitat loss is the leading cause of species decline. The causes of habitat degradation are many and the causes are changing from one place to another. In general, the major impacts may be summarized as;

- Increased population needs housing, road construction, foods and almost infinite number of industrial goods,
- Conversion of forest lands to an agricultural lands,
- Heavy grazing and surface mining,
- Increasing recreation desires of people,
- Deforestation, erosion and deposition of windblown dust,
- Reforestation, aforestation, silvicultural forestry implications and logging,
- Uncontrolled gathering,
- Air, soil, water pollutions and others.

In addition, the application of one activites is good for one species in the field, but, it may not be good for the other species. For example, reforestation, aforestation needs soil ploughing for a better tree growth. Contrary, this soil ploughing may degradate *Crocus* habitat.

Conservation and Sustainable Management

Up to now, taxonomists have been doing a great job in order to classifying, naming and spatial locating the *Crocus* species. However, there are more works needed for their conservation and sustainability. Because, the meaning of conservation of the species is more than a given Latin binomial names.

Their population, habitat characteristics, biological and physical requirements should be well understood for each taxon. Similarly, there is a need to know that their morphology, phenology, seed and corm maturation and collection time, germinations, dormancy and growth requirements in order to domesticate any wild species as *Crocus* spp.. In addition, the anount of gathering or harvesting leves require a sound knowledge of reproductive biology, their abundance and the spatial distributions.

Briefly;

A- The pitfalls of *Crocus* species are:

- Decrease or loss of growth habitat continous,
- Difficulties for monitoring or controlling the sustainability,
- Lack of basic knowledge on their biology and growth requirements

B- The strong points of the conservations are:

- Almost completed taxonomical classification and spatial distrubutions of the species,
- continuing some biological researches,
- Having enough qualified scientists to do the required researches,
- Increasing awarness of the people to the environment, medicinal and aromatic plants,
- Existing forbidding regulations for the gathering wild plant species.

C- Sustainable management guidelines of the *Crocus* species are

- Given strong support to the *Crocus* researces by the goverment, universities, and research funding institutions,
- For the base line information required to domesticate the species, biological and developmental researches should be planned as;

- Their population and accessible spatial distributions,
- Current availability, sustainable supply levels dynamics of the species,
- The reproductive biological studies such as domestication of the species,
- Defining works for their natural habitat with having high species population habitat and protection measures,
- Product development such as medicinal, pharmacetual, aromatic, gardening uses,
- Ex- situ conservation policies and protection measures.

CONCLUSION

Conservation of *Crocus* species in Turkey shall be considered in two terms as a short term and long term planning. For the short term protection, the conservation policy must have effective monitoring system organized by the govermental organization in order to decrease or to eliminate gathering, grazing and habitat degradation activities.

For the long term protection, the conservation is needed to be completed the basic researches of the species. Because, there is a need to know the ecological, genetic, scientific, social, economic, recreational and aesthetic values of the *Crocus* species in order to make management plan. Then, the domestication, ex-situ conservation and gathering levels will be planned properly.

As a result, there is a lack of information for its subsistence and domestication, scientific, landscape and commercial uses. Thus, the basic researches for the species shall be encouraged and supported by the founding organizations.

ACKNOWLEDGEMENTS

The *Crocus* studies was supported by the University of Kastamonu-Turkey, through the coordinated project of European Commission DG AGI “ AGRI GEN RES 2005” Project on Genetic Resources of Saffron and Allies (*Crocus spp*.) CROCUSBANK.

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SUSTAINABILITY OF THE LIVE BIRD TRADE IN TANZANIA; QUOTAS AND HARVESTS

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Although Tanzania currently sets annual export quotas for the various bird species, it is not known whether or not the annual quotas are at sustainable level, fully or under utilized. Data was collected form the Wildlife Division, CITES - Arusha, TRAFFIC International Dar es Salaam and CITES website. Data was assessed in terms of annual quota from 1997 – 2003. Findings are that 204 bird species are in trade. Trend in annual quotas was significantly higher than harvests. No bird species are traded above national quota. Despite the current sustainability of bird trade in Tanzania recommendation for further improvement are provided.

1.0 INTRODUCTION

1.1 General introduction

The history of exporting birds from Tanzania dates back to colonial period when live specimens were taken for pet reasons (Steinmetz *et al.* 1998). However commercial export of birds from Tanzania was initiated during the 1960s by a Danish citizen (Steinmetz *et al.* 1998). Since then the trade increased slowly, for by 1970s there were about seven bird exporters operating in the country. During the 1980s the business seemingly grew out of control given that large volumes of bird exports had already reached alarming levels (Leader-Williams & Tibanyenda, 1996). As a result, a quota system was introduced in 1988 in order to control the species and number of birds caught for the international trade (Leader-Williams & Tibanyenda, 1996). This step was taken in recognition of a national and international obligations to safeguard the existence of wild species according to the Convention on International Trade in Endanged Species of Wild Flora and Fauna (CITES), for which Tanzania is a part since 1980.

However, live bird trade is not restricted to Tanzania only; it is an international business involving both exporting and importing countries (Thomsen *et al.* 1992). In Africa, Senegal is the largest exporter of live birds to the international market followed by Tanzania (Thomsen *et al.* 1992; Leader-Williams & Tibanyenda 1996. During the 1980s Tanzania alone was estimated to export 200,000 - 3,000,000 annually (Jensen, 1991). Over years live bird trade in Tanzania has grown in terms of species and companies engaged in the business. For example, there were seven companies during 1970s, 193 companies during 1988, 108 companies in 1989, 125 companies for year 1990 and 90 companies in 1991. Currently there are 113 companies operating bird trade in the country (Thomsen *et al.* 1992; Leader-Williams & Tibanyenda 1996; WD *in litt*.). The current number of companies is about sixteen times from those that operated during 1970s.

Despite the long history of bird trade and the introduction of annual quotas in the country, birds in trade were until the late 1980's listed into broad taxonomic categories such as finches, waxbills, doves etc. Due to this categorization it was difficult to determine the number of individuals for those species that were not indicated in their species names (Thomsen *et al*. 1992; Baker & Boswell 1989). This problem of identification for some species, both CITES and non-CITES species, have increased from 93 taxa in 1990 to over 204 in year 2003 (Thomsen *et al*. 1992; WD *in litt.*). With regards to volume of trade, the total numbers of specimens increased form 72,000 to 323,500 during 1988 to 1990 (Thomsen *et al.* 1992; Leader-Williams & Tibanyenda 1996). This was, however due to high-levels of harvest of the Fischer's Lovebird (WD *in litt.*).

In order to ensure that the international bird trade is well managed in the country, relevant policies have been drawn up by the Government of Tanzania; these policies are "the Management of Tanzania's Avifauna, with Special Reference to the Live Bird Trade" of 1993 (MNRT, 1993) and the Wildlife Policy of Tanzania of 1998 (MNRT 1998). These policies are meant to enhance the concept and practice of sustainable utilization of wildlife resources including wild-caught birds. Accordingly, the two policies put special emphasis on sustainable use of wildlife for the benefit of the people and to generate foreign exchange for the country's social-economic development (MNRT, 1998).

Despite the situation explained above, very little assessment, if any, has been carried out on sustainability of this form of wildlife utilization in Tanzania. It is because of this fact this study was carried out to assess important aspects with regard to the bird trade for the last 15 years in Tanzania.

1.2 Statement of Research Problem

Although Tanzania is involved in the international live bird trade, the sustainability of this business is poorly known in terms of annual quotas compared to harvests. Hence, implications of the trade to conservation of birds are not well known.

1.3 Significance of the study

This work is expected to provide information that will enhance management of the bird trade by the relevant authorities in Tanzania the Wildlife Division in particular. The information will provide opportunities for developing strategies to reduce any impact of the trade in species of conservation concern and to develop strategies to increase sustainable utilization of annual quotas especially where exports are low. Further, the information will provide input towards formulation of relevant policy issues towards sustainable utilization of resources including wildlife in general.

1.4 OBJECTIVES

1.4.1 Main objective

The main objective of this study is to assess sustainability of the live bird trade in Tanzania.

1.4.2 Specific objectives

To assess the trend of annual quotas and harvests for the period 1997 - 2003.

1.5 HYPOTHESIS

The following hypothesis was used to asses the specific objective.
There has been a significant increase in annual quotas and harvests for the period 1997 - 2003.

2.0 MATERIALS AND METHODS

2.1 Data collection

Data for bird trade in Tanzania were mainly secondary and were collected from various sources. Birds trade data including annual quotas and harvests from 1997 to 2003 were collected from the Wildlife Division (WD) annual reports (WD *in litt*), TRAFFIC International, Dar es Salaam (TRAFFIC *in litt*) and CITES website. Other sources of information were from CITES office in Arusha and various literature surveys and extract from published sources such as TRAFFIC bulletin (Mulliken & Rosser 1995) and books (Leader-Williams & Tibanyenda, 1996).

2.2 Data analysis.

Data in terms of annual quotas and actual harvests in each year of trade for all species in trade were analyzed by using Microsoft excel to answer the objective.

2.2.1 Statistical tests

A regression analysis was used to test the objective in order to know if there has been a significant increase in annual quotas and harvests from 1997-2003.

3.0 RESULTS

A total of 204 bird species were included in the trade during 1997 to 2003
(Appendix 1).

3.1 Trends in annual quotas and harvests

3.1.1 Trends in annual quotas

Regression analysis indicated that there has been a very significant increase in annual quotas during 1997-2003, $R^2 = 0.886559$ (Figure 1).

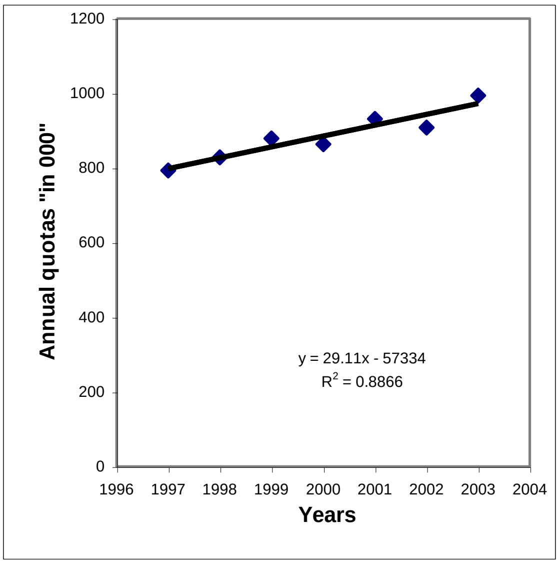

Figure 1: Trend in annual quotas for the period 1997-2003

3.1.2 Trends in annual harvests

With regards to harvests, regression analysis showed that there is no significant increase in annual harvests from 1977 to 2003. R^2 =0.5195, (Figure 2). The number of birds harvested was decreasing since 1997 to 1999; however, it increased in 2000 and started to decrease again in the following years (Figure 2).

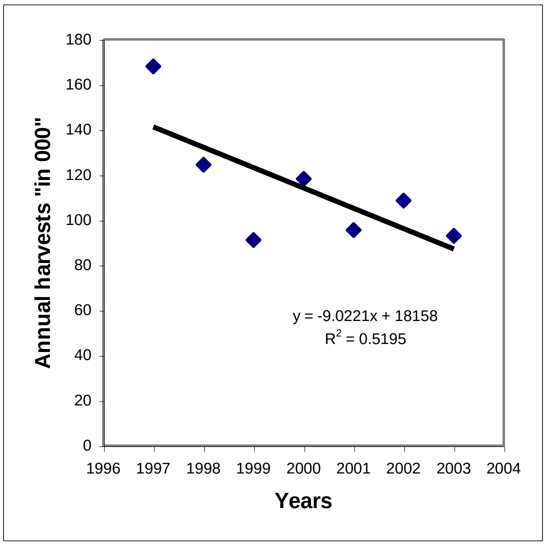

Figure 2: Trend in annual harvests for the period 1997-2003

3.0 DISCUSSION

4.1 Trends in annual quotas and harvests
Trends of bird species in trade from 1997-2003 were examined with reference to the annual quotas and annual harvests. The actual annual quotas were yearly increasing however there were no big variations of increase between years. Unlike annual quotas the general trends of annual harvests of birds in trade were decreasing with fluctuations. Increase in annual quotas might be a strategy for the Management Authority (MA) to avoid problems which may rise incase of big market availability for species which are under the control of the national and CITES quotas, whereby the Management Authority has to notify the CITES. The reason for decrease in annual harvests might be caused by restricts measure towards live bird trade. These measures includes registration with CITES for CITES species indicating also its annual quota harvest in order to monitor over harvest. The national quotas allocation for species in trade has also helped to monitor over harvest of some species, which are in high demand to the external market (Anon, 1993). Allocation of harvest quotas in species level and the distribution of annual thresh hold quotas set among trade dealers provided protection against high harvest of bird species in which case it was easy to determine the level of individual species that was harvested in each year. Market inaccessibility might be another causative for low harvests.

CONCLUSION AND RECOMMENDATION

Conclusion
Annual quotas are far higher than the annual harvests

Recommendation
- A further study is needed in order to understand the underlying causes of underutilization of annual quotas and low harvests of birds since the annual quotas are high when compared to harvests.
- Field studies on the population and breeding biology should be carried out in order to know the conservation status of bird species. This will enable WD to set quotas which are not detrimental to the species.

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BIODIVERSITY CONSERVATION ISUES IN ANTHROPIZED MARSHLANDS A TWO YEAR STUDY OF INSULA MARE A BRĂILEI

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The study was aimed at addressing issues related to the rehabilitation of the Danube flood plain. The research focused on the diversity of three grassland ecosystems, one forest ecosystem and three agricultural ecosystems, all of which are located in the Balta Mare a Brãilei which is situated on the lower course of the Danube.

Soil drainage works performed 45 years ago resulted in a significant anthropic transformation of the marshlands, of which 92% is currently being farmed. Our biocenotic study targeted the vegetal associations and the local fauna, particularly the invertebrates from the herbaceous layer [Insecta: Thysanoptera, Coleoptera (Fam. Chrysomelidae, Curculionidae, Coccinellidae, Elateridae, Mordellidae, Nitidulidae, Oedemeridae, Lagriidae)] and from the soil (Lumbricidae, Acari- Prostigmata, Mesostigmata, Oribatida and Collembola).
The study identified a new vegetal association for the area and one new plant species for Romania. All fauna records are new for the marshlands. Some of the collected species are new records for Romania as well as for science in general.

Also, the modification of the hydrological regime must be monitored in detail, in order to document the evolution of the ecosystems, to save especially those species which are new for science.

THE PURPOSE

The aim of the project was to address questions concerning the restoration of the Danube flood plain. The research focused on the diversity of three grassland ecosystems, one planted forest ecosystem and three agricultural ecosystems, all of which are located on the Insula Mare a Brăilei (The Big Island of Brăila) which is situated on the lower course of the Danube (please see map). Soil drainage works performed 45 years ago resulted in the anthropic transformation of the island. During 2005, the forested part of the island also suffered from high flooding for five months as a result of precipitation.

Literature on the vegetation of the Brăila floodplain prior to human intervention in the ecosystem was consulted for comparison to the present biodiversity. However, there were no historical data available on the local fauna. Instead, we used research from the neighbouring Nature Reserve Insula Mică a Brăilei (The Small Island of Brăila), which is still in its natural flooding regime, has a similar ecosystem, has been affected to some degree by anthropic activities, but whose conditions are still close to the natural state.

MATERIAL AND METHODS

A biocenotic study was conducted on several research sites on the Insula Mare a Brăilei. Data were collected during the maximal vernal and estival periods. A determination of the invertebrate fauna from the herbaceous layer was performed by sweeps with an entomological net (30 cm. in diameter). A total of 10 samples was gathered, each of them consisting of 50 sweeps.

Soil invertebrate fauna were collected directly from soil layers 10 cm deep, in blocks of 10x10x40 cm for Lumbricidae, and for Collembola and Acari with a MacFadyen corer at the depth of 0 – 3 cm, 3 – 6 cm and 6 – 10 cm.

RESULTS AND DISCUSSIONS

The studied sites are the followings:

Site I **- *Hordeetum murini*** Libbert 1932 em. Pass. 1964
Agropyretum pectiniformae (Prodan 1939) Dihoru 1970
GPS Coordinate: N 44.87194º; E 028.05861º

Site II– ***Xeranthemo cylindracei- Brometum arvensis*** Popescu Gh. 1992 [Syn.: *Brometum arvensis* (Şerbănescu 1957 n.n) Kiss 1964]
Typhetum laxmannii Nedelcu 1969
GPS Coordinate: N 44.90371º ; E 028.10885º

Site III–**- *Conietum maculati*** I. Pop 1968
Arctio- Ballotetum nigrae (Felföldy 1942) Morariu 1943- Zăton
GPS Coordinate: N 44.78991º; E 028.00655º

Site IV **- *Triticum aestivum*** L.- Măgura
GPS Coordinate: N 44.81207º; E 027.99986º

Site V **- *Glycine max*** (L.) Merr. – între Măgura, Zăton şi Măraşu
GPS Coordinate : N 44.81846º ; E 027.99433º

Site VI **- *Zea mays*** L.
GPS Coordinate : N 44.81844º; E 027.99419º

Site VII**- *Salicetum albae*** Issler 1924 s.l. plantație – Frecăței

GPS Coordinate: N 44.89690º; E 028.12738º

The floristic diversity in the studied sites:

Lemnetum minoris……………...............15 species
Elodeetum nuttallii……………...............10 species
Scirpo-phragmitetum…………................25 species
Typhetum angustifoliae……….................. 17 species
Typhetum latifoliae……………...............16 species
Typhetum laxmannii…………….................17 species
Sparganietum erecti…………….................19 species
Sclerochloo-Polygonetum avicularis…….36 species
Hordetum murini……………….................23 species
Cynodonto-Atriplicetum tataricae………..43 species
Tanaceto-Artemisietum vulgaris…………..75 species
Ambrosietum artemisiifoliae……………….43 species
Conietum maculati……………….................32 species
Ballotetum nigrae…………………...................35 species
Sambucetum ebuli…………………...................47 species

The invertebrate fauna from the herbaceous layer is dominate by thrips (Insecta: Thysanoptera) sensitive bioindicators of the anthropic impact and characteristic for the meadow zoocoenoses. In the site Hordetum *murini- Agropyretum pectiniforme*, Thysanoptera communities are the richest in the number of species and in the numerical density 228 ind/m^2, revealed a dynamic structure, with a positive evolution.

The Thysanoptera species

No.	Species	Insula Mică a Brăilei (nature reserve)		Insula Mare a Brăilei
		canopy	herbaceous layer	herbaceous layer
1.	*Aeolothrips intermedius*	+	+	
2.	*Frankliniella intonsa*	+	+	+
3.	*Limothrips denticornis*	+		
4.	*Haplothrips setiger*	+		
5.	*Haplothrips aculeatus*	+		+
6.	*Haplothrips niger*	+		+
7.	*Hoplandrothrips bidens*	+		
8.	*Aptinothrips rufus*		+	
9.	*Chirothrips manicatus*		+	+
10.	*Aeolothrips fasciatus*			+
11.	*Melanthrips fuscus*			+
12.	*Frankliniella pallida*			+
13.	*Kakothrips robustus*			+
14.	*Sericothrips staphylinus*			+
15.	*Thrips atratus*			+
16.	*Thrips fuscipennis*			+
17.	*Thrips major*			+
18.	*Thrips minutissimus*			+

The Thysanoptera species Cont.

19.	*Thrips physapus*			+
20.	*Thrips tabaci*			+
21.	*Thrips trehernei*			+
22.	*Thrips trehernei*			+
23.	*Haplothrips leucanthemi*			+
24.	*Haplothrips reuteri*			+
25.	*Haplothrips tritici*			+

The specific diversity of Coleoptera is reduced.

The Coleoptera species

Ord. COLEOPTERA	Insula Mică a Brăilei (nature reserve)	Insula Mare a Brăilei
Fam. **Staphylinidae**		
Stenus sp.	+	
Fam. **Mordellidae**		
Mordellistena micantoides	+	
Fam. **Histeridae**		
Saprinus sp.	+	
Fam. **Apionidae**		
Aspidapion (s.str.) validum		+
Fam. **Curculionidae**		
Ceutorhyncus granulicollis		+
Ceutorhynchus nanus		+
Ceutorhynchus rapae		+
Coniatus splendidulus	+	
Glocianus punctiger		+
Lixus ochraceus		+
Mesagroicus obscurus		+
Mononychus punctumalbum		+
Rhinusa netum		+
Sitona waterhousei		+
Fam. **Nanophyidae**		
Nanophyes marmoratus		+
Nanophyes pallidus	+	
Fam. **Bruchidae**		
Bruchidius sericeus	+	
Fam. **Malachidae**		
Malachius geniculatus	+	
Malachius bipustulatus		+
Fam. **Scarabeidae**		
Aphodius erraticus	+	

The Coleoptera species Cont.

Aphodius prodromus	+	
Aphodius fimetarius	+	
Copris lunaris	+	
Oniticellus fulvus	+	
Caccobius schreberi	+	
Onthophagus amyntas	+	
Onthophagus taurus	+	
Onthophagus nuchichornis	+	
Oryctes nasicornis	+	
Fam. **Coccinellidae**		
Propylaea 14-punctata	+	+
Anisosticta 19-pustulata	+	
Subcoccinella vigintiquattuorpunctata		+
Coccinella septempunctata		+
Thea vigintiduopunctata		+
Fam. **Chrysomelidae**		
Stylosomus tamaricis	+	
Pachnephorus tessellatus	+	
Chrysolina fastuosa		+
Galerucella pusilla		+
Phyllotreta vittula		+
Longitarsus melanocephalus	+	
Longitarsus sp.		+
Altica oleracea		+
Chaetocnema compressa	+	
Chaetocnema aridula	+	
Epitrix pubescens		+
Fam. **Lagriidae**		
Lagria hirta		+
Fam. **Oedemeridae**		
Oedemera femorata		+
Fam. **Nitidulidae**		
Meligethes sp.		+

The invertebrate fauna from the soil from the natural and agro-ecosystems is dominated by Acari, and by Collembola important decomposers.

The specific spectrum of Acari-Oribatida is characteristic.

The Oribatida species

No.	Insula Mică a Brăilei (nature reserve)	Insula Mare a Brăilei
1	*Achypteria coleoptrata*	*Belba limasetosa*
2	*Belba corynopus*	*Belba pseudocorynopus*
3	*Cerachipteria sp.*	*Ceratopia bipilis*
4	*Chamobates spinosus*	*Ceratozetes (Heterozetes) palustris*
5	*Ctenobelba pilosela*	*Ceratozetes fusiger*
6	*Epilohmania cylindrical*	*Chamobates dentatus*
7	*Lauroppia neerlandica*	*Chamobates spinosus* +
8	*Multioppia laniseta*	*Ctenobelba pectinigera*
9	*Oppiella minutissima*	*Epidamaeus bituberculatus*
10	*Poicilochthonius italicus*	*Epidamaeus onustus*
11	*Peloptulus phaenotus*	*Epilohmannia cylindrica* +
12	*Scheloribates laevigatus*	*Eremaeus oblongus*
13	*Tectocepheus velatus*	*Euphthiracarus reticulatus*
14	*Tectoribates proximus*	*Galumna sp*
15	*Zygoribatulla meriehamere*	*Globozetes tricuspidatus*
16	*Zygoribatulla cognate*	*Haplozrtes vindobonensis*
17		*Hydrozetes conferve*
18		*Lauroppia falcate*
19		*Lauroppia neerlandica* +
20		*Lauroppia obsolete*
21		*Melanozetes molisimilis*
22		*Multioppia laniseta* +
23		*Mycobates carly*
24		*Nothrus pratensis*
25		*Ophydiotrichus vindobonensis*
26		*Oribotritia berlesei*
27		*Oribotritia decumana*
28		*Oribotritia grandjani*
29		*Phthiracarus anonnimum*
30		*Pilogalumna altera*
31		*Protoribates badensis*
32		*Protoribates lophothrichus*
33		*Protoribates monodactylus*
34		*Protoribates variabilis*
35		*Ramusela insculpta*
36		*Rhysotritia ardua*
37		*Scheloribates confundatus*
38		*Scheloribates laevigatus* +
39		*Tectocepheus velatus* +
40		*Tropacarus pulcherimus*
41		*Zygoribatulla exilis*

+ commun species

Acari: Mesostigmata, Prostigmata were represented by 29 species: *Pseudocheles sp., Bdellidae, Anystis sp., Glycyphagus sp., Pergamasus laetus, Pergamasus quisquiliarum, Pergamasus barbarus, Parasitus jugulatus, Vulgarogamasus oudemansi, Parasitus sp., Veigaia nemorensis, Epicriopsis horridus, Arctoseius semiscissus, Proctolaelaps pygmaeus, Melichares pomorum, Rhodacarellus kreuzi, Geholaspis longispinosus, Macrocheles decoloratus, Pachylaelaps imitans, Pacylaelaps furcifer, Olopachys vysotskajae, Hypoaspis aculeifer, Pachyseius humeralis, Zercon peltatus, Zercon romagniolus, Trachytes aegrota şi Uropoda sp*.

The study of the collembolan fauna show a low specific diversity, 31 species, two are new records for Romania (*Cryptopygus orientalis* (Stach, 1947), *Isotoma anglicana* Lubbock, 1862 and two new species for science, *Protaphorura* nov.sp and *Lipothrix nov.sp*.

CONCLUSIONS

♦ The natural vegetation of the Insula Mare a Brăilei is highly anthropised as a result of human action on the environment. The phytocoenoses formed by *Elodea nuttallii*, *Ambrosia artemisiifolia* and *Glycyrhiza echinata,* found by the present research, are new species for the territory.

♦ The drainage works that were performed lead to the development of hydrophilous biocoenoses in the irrigation canals and the natural lake Zăton. They also caused an extension on the entire island of the xerophilous grasslands biocoenoses which initially inhabited only a dam area.

♦ The species making up the natural and agricultural ecosystems underwent a dynamic spatial and temporal evolution with respect to the mix of species and their number.

♦ Thysanoptera, an important bioindicator of the herbaceous layer, is an insect characteristic to grassland sites where it forms dynamic coenoses with a positive evolution. All collected species are new records for the Insula Mare a Brăilei.

♦ This is the first time the field literature mentions the species *Sericothrips staphylinus* as having the soybean as a host plant. The research also found *Thrips tabaci* induced galls and brown spots on this plant. The thrips species causes the latter through the TSWV virus which it transmits.

♦ Ord.Coleoptera was represented by species belonging to the following families: Chrysomelidae, Curculionidae, Coccinellidae, Elateridae, Mordellidae, Nitidulidae, Oedemeridae, and Lagriidae.

♦ Among the three Lumbricidae species found, numerous juveniles were present, which points to a positive coenotical evolution of this population with a significant role in the decomposition of the soil.

♦ The presence of the praticolous Oribatidae-Acari species at all sites shows that soil structure on the island is being formed. Also, the species *Epilohmania cylindrica,* which was found during the research, is a typical bioindicator of sandy soil. After the five-month flooding period in 2005, the Oribatid density was higher than previously due to the soil carried in by the flood waters.

♦ The Prostigmata-Acari, represented by common European species, had a richer specific diversity in the soybean ecosystem.

♦ The Collembolan fauna collected revealed the constitutive elements of the biological diversity with three new records for Romania (*Cryptopygus orientalis* Stach,1947, *Isotoma anglicana,* Lubboick 1862 and *Lepidocyrtus arrabonicus*, Traser 2000) and two new species for science in soybean plantations (*Lipothrix* nov. sp. and *Protaphorus* nov. sp.).

Could the rehabilitation, namely reflooding, of the Insula Mare a Brăilei have a positive impact on the island's biodiversity and its conservation?

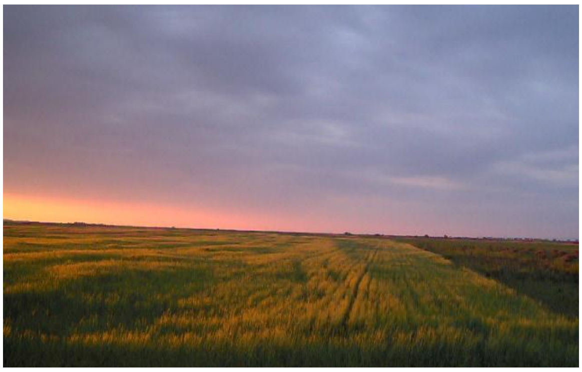
♦ The study identified new plant species for the area. All fauna records are new for the island. Some of the species collected are new records for Romania and new species for science.

♦ During the 2005 flooding the remaining dry areas of the Insula Mare a Brăilei, served as shelter to fauna of the neighbouring Insula Mică a Brăilei, which was entirely affected by flooding.

♦ Reflooding of the Big Island of Brăila (Insula Mare a Brăilei) would certainly mean losing the newly recorded species for science.

♦ The issue of reflooding also calls for an evaluation of the time needed for the Big Island of Brăila (Insula Mare a Brăilei) to return to its initial wet zone before the drainage works. The study of the neighbouring Insula Mică a Brăilei, which is still in its natural state, indicated that this process would take many years.


Picture S.I


Picture S.IV


Picture S.VIII

International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

NATIONAL APPROACH TO THE CONVENTION ON BIOLOGICAL DIVERSITY

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The phrase 'Biological Diversity' conveys the living diversity in the world and their naturallity. Also this shows, the capability of the ecosystems living support period for the welfare of people and the healty environment. Climate change, pollution and unsustainable use of the resources seriously damaged the biodiversity. This situation is threatening peoples' life.

In 1992, the largest evermeeting of world leaders took place at the United Nations Conference on Environment and Development in Rio de Janerio, Brazil. An historic set of agreements was signed at the 'Earth Summit' including two binding agreements, "The Convention on Climate Change", which targets industrial and other emissions of greenhouse gases such as carbon dioxide, and "The Convention on Biological Diversity", the first global agreement on the conservation and sustainable use of biological diversity. The biodiversity treaty gained rapid and widespread acceptance. Over 150 governments signed the document at the Rio conference, and since then more than 187 countries have ratified the agreement.

The convention has three main goals; the conservation of biodiversity (plants, animals and microbiologic lives), sustainable use of the components of biodiversity and sharing the benefits arising from the commercial and other utilization of genetic resources in a fair and equitable way.

In this research, National approach to the subject of Convention on Biological Diversity has been studied. Some answers to the questions, 'After Turkey signed the Convention on Biological Diversity, Which kind of studies has been made?' and also 'What is the 2010 target of European Community?' has been given. Finally, the strategies of Turkey has been discussed and some recommendations has been given for conserving the biodiversity.

1. Biological Diversity

"Biological diversity" means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

Biological diversity is the term given to the variety of life on Earth and the natural patterns it forms. The biodiversity we see today is the fruit of billions of years of evolution, shaped by natural processes and, increasingly, by the influence of humans. It forms the web of life of which we are an integral part and upon which we so fully depend. "Biological resources" includes genetic resources, organisms or parts thereof, populations, or any other biotic component of ecosystems with actual or potential use or value for humanity (1).

This diversity is often understood in terms of the wide variety of plants, animals and microorganisms. So far, about 1.75 million species have been identified, mostly small creatures such as insects. Scientists reckon that there are actually about 13 million species, though estimates range from 3 to 100 million (1).

Yet another aspect of biodiversity is the variety of ecosystems such as those that occur in deserts, forests, wetlands, mountains, lakes, rivers, and agricultural landscapes. In each ecosystem, living creatures, including humans, form a community, interacting with one another and with the air, water, and soil around them.

It is the combination of life forms and their interactions with each other and with the rest of the environment that has made Earth a uniquely habitable place for humans. Biodiversity provides a large number of goods and services that sustain our lives.

At the 1992 Earth Summit in Rio de Janeiro, world leaders agreed on a comprehensive strategy for "sustainable development". One of the key agreements adopted at Rio was the Convention on Biological Diversity. This pact among the vast majority of the world's governments sets out commitments for maintaining the world's ecological underpinnings as we go about the business of economic development. The Convention establishes three main goals: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits from the use of genetic resources.

2. Biological Diversity of Turkey

Biological diversity of the world is increasing from north to south and west to east. Turkey, the transition point of north and south, west and east, contains three biogeographical region, Euro-Siberian, Iran-Turan, Mediterrennean (2).

Turkey has an abundance of biological diversity because of its different climate types (mediterranean, terrestrial, thalassic), geological and geomorphological diversity, generous water resources, altitude differences, habitat types and geographic situation in the temperate climatic region (3, 4).

Comparing with the tropical countries Turkey has a high diversity of species. It holds 75 % of the plant species in Europe and 1/3 of them are endemic plants. Also the fauna of Anatolia is so showy because of the species richness which is more than 80000.

Turkey has a very strong ecosystem diversity and genetic diversity which are important for the nutrient and agriculture. The geographical structure of Turkey provides high endemism and genetic diversity. Forest, steppe, water land, sea and waterside and mountain ecosystems forms the basic types of Turkey’s ecosystems.

In spite of increasing environmental problems, Turkey is the one of the exceptional country that has mainly conserved the natural structure.

Related to the management of biological resources there are public and private institutions, universities and civil society organizations in Turkey. But there is still requirement of educated people related with the various disciplines.

Decrease of biological diversity, is the most serious global environmental threat of humanity. As a result of human activities, ecosystems, species and genetic diversity is being destructed rapidly. The rapid decrease in the biological diversity is still destructing the ecological, economic, moral and cultural profits that is provided from the living resources of the earth.

Turkey, contains a lot of different ecosystems. These ecosystems hold thounsands of mostly endemic plant and animal species, their race and populations. Many and different combinations form different population types and habitat mosaics.

Stability and continuity in Turkey provided by the ecosystem diversity, becoming more critical by the activities of humans. Our natural resources and biological diversities are in a tragic period formed by Breakdown, Decrease and Disappearance stages. Basic reasons of this period is the rapid increase of population and the unconscious use of naturel resources.

3. Convention on Biological Diversity

In 1992, the largest-ever meeting of world leaders took place at the United Nations Conference on Environment and Development in Rio de Janeiro, Brazil. An historic set of agreements was signed at the "Earth Summit", including two binding agreements, the Convention on Climate Change, which targets industrial and other emissions of greenhouse gases such as carbon dioxide, and the Convention on Biological Diversity, the first global agreement on the conservation and sustainable use of biological diversity. The biodiversity treaty gained rapid and widespread acceptance. Over 150 governments signed the document at the Rio conference, and since then more than 187 countries have ratified the agreement (1,5).

The Convention has three main goals;

1. The conservation of biodiversity,
2. Sustainable use of the components of biodiversity, and
3. Sharing the benefits arising from the commercial and other utilization of genetic resources in a fair and equitable way.

The Convention is comprehensive in its goals, and deals with an issue so vital to humanity's future, that it stands as a landmark in international law. It recognizes that the conservation of biological diversity is "a common concern of humankind" and is an integral part of the development process. The agreement covers all ecosystems, species, and genetic resources. It links traditional conservation efforts to the economic goal of using biological resources sustainably. It sets principles for the fair and equitable sharing of the benefits arising from the use of genetic resources, notably those destined for commercial use. It also covers the rapidly expanding field of biotechnology, addressing technology development and transfer, benefit-sharing and biosafety. Importantly, the Convention is legally binding; countries that join it are obliged to implement its provisions.

The Convention reminds decision-makers that natural resources are not infinite and sets out a new philosophy for the 21st century, that of sustainable use. While past conservation efforts were aimed at protecting particular species and habitats, the Convention recognizes that ecosystems, species and genes must be used for the benefit of humans. However, this should be done in a way and at a rate that does not lead to the long-term decline of biological diversity (1).

The Convention also offers decision-makers guidance based on the precautionary principle that where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat. The Convention acknowledges that substantial investments are required to conserve biological diversity. It argues, however, that conservation will bring us significant environmental, economic and social benefits in return (1).

Some of the many issues dealt with under the Convention include:

- Measures and incentives for the conservation and sustainable use of biological diversity.
- Regulated access to genetic resources.
- Access to and transfer of technology, including biotechnology.
- Technical and scientific cooperation.
- Impact assessment.
- Education and public awareness.
- Provision of financial resources.
- National reporting on efforts to implement treaty commitments.

4. National Approach to the Convention on Biological Diversity

The Convention on Biological Diversity, as an international treaty, identifies a common problem, sets overall goals and policies and general obligations, and organizes technical and financial cooperation. However, the responsibility for achieveing its goals rests largely with the countries themselves.

Under the Convention governments assume to conserve and sustainable use of biodiversity. Countries that ratified the convention have to make determination of the situation, definition of the strategies about biological diversity and developing an action plan.

Turkey has ratified the Convention on Biological Diversity and engaged for conserving biological diversity in a global and national scale. The vital and socio economic value and importance of biological diversity, conserving and sustainable use of biological diversity and sharing the benefits arising from the commercial and other utilization of genetic resources in a fair and equitable way, has been accepted. After the Rio Summit Turkey has made serious steps to legal arrangements and political engagements for conserving the biological diversity. Development plans, National Environmental Strategy and Action Plan (NEAP), National Biodiversity Strategy and Action Plan and national and international legal arrangements are the basic important documents about the politics and applications of these subjects. And also some projects are continuing for contributing to the studies of conserving biological diversity (5).

In the convention, Turkey has made the first essential step by preparing the National Biodiversity Action Plan. This Biodiversity Action Plan provides preparing a frame for the convention and also it will help for preparing input for the plan, programme and strategies about biodiversity in Turkey .

Preferred Actions in this Plan;

1. Forming protection areas and preparing management plans for the endemic plants,
2. Forming arboretums for the continuity of wild life and constructing accommodation stations and migration centres,
3. Educating people about conserving concept and principles,
4. To make people conscious of environment,
5. Educating people in the local degree for the rational usage of natural resources (6,7).

Mechanisms for Realizing this Actions;

1. Adapting the preferred actions to the current programmes,
2. Preparing reports about plan, politic and actions for the application of the strategy,
3. Coordinating the national and international factors stated in the strategy,
4. Confirmating the existence of mechanisms about participation for the appliaction of the strategy,
5. Reporting the situation of biodiversity periodically (6,7).

'Ex-situ' conservation has been so long provided in Turkey for conserving biological diversity which conservation uses zoos, botanical gardens and gene banks to conserve species. 'In-situ' conservation- the primary means of conservation, focuses on conserving genes, species and ecosystems in their natural surroundings. For the in-situ conservation, studies has been made by the time of prior Forest Management. National parks, protected natural parks, natural values, wild life reserves, camping areas, botanical gardens and hunting areas has been builded for conserving and developing the wild and natural life (6).

In the development plans, until the fifth five years development plan, subject has not been evaluated in a large perspective in terms of environment sector. In the following plans, there has been politics about conserving and developing the natural environment. But there is still no comprehensible environment politics about the sustainable use of biological diversity (6).

In the action plan it is mentioned that in Turkey there is 35 law, 3 decree law and 23 decision about biodiversity. Some of them are just about biodiversity and others are about environment subject but they have influence on biodiversity. They also include the Environment and Natinal Park Law which has been accepted in 1983.

5. Conclusion

In the Earth Summit about Sustainable Development which took place in Johannesburg in 2002, it was accepted that biological diversity has an important role in sustainable development and abolition of poorness. In this summit also it is accented 40% of our economy is for biological crops. But biological diversity is in a danger and there are so many signals that biological diversity is seriously being changed and declined by the human activities.

Within the framework of Rio Summit, took place in 1992, countries participating in the Johannesburg Summit agreed to take actions to achieve a decrease in the rate of loss of the biological diversity by 2010. Within the European Community and the broader Environment for Europe process, a more demanding target, to halt the loss of biodiversity by 2010, has been adopted. For example, the EU Environment Action Programme specifies the objective to protect and where necessary restore the tructure and functioning of natural systems and halt the loss of biodiversity both in the European Union and on a global scale by 2010 (8).

For the 2010 target there had to be a European monitoring programme. For this programme four lines of action should be followed. These are;

- Coordination of existing international monitoring networks
- Promotion of biodiversity monitoring across Europe
- Coordination of national information networks
- Ensure information available at the European level is policy relevant and useful to everybody involved in halting biodiversity loss (8).

Compared to developed countries, for halting the loss of biodiversity in Turkey, smilar programmes and strategies has been improved. In Turkey many politics, plans and programmes has been developed for conserving biological diversity and sustainable use of biological resources. Governments improved many strategies about conserving watery lands and other watery ecosystems, wild life, forests, agricultural resources and the protected areas. But there is still some requirements about this subject. Here are some recommendations for conserving and sustainable use of biodiversity.

- As much as governments, local populations, work and industrial world agents and individuals should attend the strategy. For achievement, a collaboration between society organizations, private sectors and individuals should be made.

- For an effective collaboration, capacity and possibilities of Ministry of the Environment, Ministry of Forestry, Ministry of Agriculture, Ministry of Culture and Ministry of Private Environment Conserving should be improved.

- Legal arrengements for the implementation of Paris, Bern, Ramsar, CITES, Biological Diversity and Contestation with the Desertification conventions should be immediately completed.

- Inventory of rare and endemic plant and animals of Turkey should be done.

- Protecting areas in forest, mountain, steppe and water land ecosystems should be increased and nurseries, propagation areas, seed gardens, clon parks and gene banks should be constructed and supported by the in-situ and ex-situ conservations.

- Inventory of rare habitats which have national and international value with their wild plant, animal and populations, should be done.

- Conserving programmes should be developed for the areas outside of the protected areas.

- Classifications in the protected areas should be eveluated afresh.

- In the plans for managing the protected areas, in-situ conserving should be basic and there should be possibility for constructing absolute protect areas and ecological affected region.

- Research and educating activities about biological diversity and conserving biological diversity should be improved in the related departments of the universities.

- Forest ecosystem concept should again be defined in the laws.

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SCRUTINIZING THE GEOPHYTES IN TERMS OF BIODIVERSITY

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Geophytes that take place in abundance of Turkey's flora, has been cynosure of scientists for a long time because of their environment values, medical value and their commercial values. First of all these geophytes were picked up for enriching the botanic gardens and in the following years done for the purpose of trading. High percentage of requests and the unconsciously picking up, have caused disappearance of some endemic species and generations. Picking up, production and export of geophytes are disciplinated by the regulations. As if they are compatible to CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) in terms of content and terminology, there is still picking up from nature. In this sense, to know the environmental values of geophytes, their importance, diversity, conserving and propagating, has been necessity. In this research, the importance of geophytes in Turkey in terms of biodiversity, historical improvement and development in the future, has been studied.

1. GEOPHYTES POTENTIAL OF TURKEY

Turkey is one of the richest countries of the world as to its plant diversity since it is situated on a point where different phytogeographical regions (Europe, Mediterranean, Iran-Turan) meet, and includes different ecologies and microclimates. Turkey's flora includes 10754 plant-species in total 3712 of which are endemic, and this constitutes 4.30% of the plant-species over the world. Taking into consideration that area of our country constitutes 0.53% of the world's land area, the richness of our country as to plant-species can be seen more clearly (Arslan 1998, Zencirkıran 2002).

However our biological values are in danger due to corruption of environment and extreme pickings from the nature for commercial purposes. In addition, increase in the population and urbanization, opening new arable fields and over-pasturing, usage of agricultural medicines, increasing tourism activities, forest fires, and works for extending existing roads or opening new ones, mines, toxic gases arising from plants, constructions of dams, lakes and irrigation facilities, and amateur botanists and unauthorized gatherers are some of the factors that threaten biological values of our flora. In this context, the records of The World Conservation Union (IUCN) show that 8 endemic species has died out and 46 endemic species are in danger and 183 endemic species are possible to be harmed in Turkey (Baktır et. al. 1997, Ergun et. al. 1997, Aksu et. al. 2002)

Uprooted from the nature and send abroad for commercial purposes, bulbous, tuberous and rhizomatous (Geophytes) plants have suffered from the greatest harm in our country. Turkey's flora includes more than 600 geophytes species most of which fall under the scope of Liliaceae, Iridaceae, Amaryllidaceae, Orchidaceae and Araceae families (Table 1).

Table 1. Distribution of Geophytes by Families (Zencirkıran 2002).

Families	Genus	Species
Liliaceae	35	449
Iridaceae	6	91
Amaryllidaceae	8	31
Orchidaceae	25	150
Araceae	6	26

2. HISTORY OF EXPORTING GEOPHYTE AND CURRENT STATUS IN TURKEY

The export of wild flower bulbs was first commenced by Frans SLOSER in 1885. This person who settled down in İzmir began with this job by exporting the bulb in *Galanthus elwesii* and *Tulipa humulis* from Toros mauntains, at first and extended as to involve the other flower bulbs in time. His son, George SLOSER continued with his father's job until 1975, by further advancing it. However, he gave up this job after 1975 since the Turkish businessman has began to be interested in subject especially after 1960 and has obtained the prevailance. Some enterprising people from Akseki, and a firm established in Antalya obtained the necessary licence in the years 1964-1965. In recent years, there have been 4 firms dealing with this job (Zencirkıran and Mengüç 1999).

Pulling up the bulbs from nature had became a destruction at the end of 1970s and at the beginning of 1980s, *Galanthus* was the most severaly destroyed species. The subject was first taken under control with the regulation related to production, and export of natural flower bulbs established in 1989; moreover, Association of Natural Flower-Bulb Growers was established, being promoted by Ministry of Agricultural and Rural Affairs and Scientists. The regulation was republished in the years 1991, 1995 and 2004 some changes on it.

The most important innovations introduced through these regulation were the limitations to export, first from nature, and then both from nature and from commercial production, thus the determination of a quota fort he country;moreover, the exportation of numerous natural flower bulbs which were exported formally was banned, the number of species being exported was reduced to 17-18 from 62 species. In view of these regulations, export ban and allowance were catagorized into 3 groups considering the species (Table 2).

Table 2. The Classification of Natural Flower Bulb Species to be Exported (Anonymous 2006).

1. Natural flower bulbs for export from production		
* *Lilium candidum*		
* *Sternbergia lutea*		
2. Natural flower bulb whose export was limited by quota or by other means		
**Anemone blanda*	* *Galanthus woronovi*	* *Lilium martagon*
**Arum italicum*	* *Leucojum aestivum*	* *Lilium cilicatum*
**Cyclamen cilicicum*	* *Scilla bifolia*	
**Cyclamen hederifolium*	* *Urginea maritima*	
**Cyclamen coum*	**Ornithogalum nutans*	
**Dracunculuc vulgaris*	* *Geranium tuberosum*	
**Eranthis hyemalis*	* *Fritillaria persica*	
**Galanthus elwesii*	* *Fritillaria imperialis*	
3. Natural flower bulbs whose export from nature was banned		
* *Allium sp.*	* *Nymphaceae sp.*	
* *Crocus sp.*	* *Orchidaceae sp.*	
* *Fritillaria* (except *F.imperialis and persica)*	* *Arum sp. (expect A. italicum, A. dioscorides)*	
* *Lilium sp. (except L.candidum, L.martagon, L.cilicatum)*	* *Pancratium maritimum*	
* *Muscari sp.*	* *Hyacinthus orientalis*	
* *Sternbergia* (except *S. lutea)*	* *Gentiana lutea*	
* *Tulipa sp.*	* *Iris* (except *I.tuberosum)*	
* *Eminium sp.*		
* *Cyclamen* (except *C.coum, cilicicum, hederifolium)*		
* *Galanthus sp.* (except *G. elwesii and woronovi=*		
* *Biarum sp.*		

These precautions gave results in a short time, thus the export was reduced 66 %, though there were fluctuations according to years. The production studies were commenced to be conducted more seriously, hence a part of the income from export was obtained from production (Arslan 1998).

Our country signed the Washington Agreement in 1997 and became a member of CITES, so the activities carried out based on CITES Agreement before were formalized.

The geophytes collected from the flora of our country are exported to European countries-mainly to Netherlands, Denmark, Switzerland, Germany, Italy, England, Bulgaria and France, also to USA and Japan (Ekim et. al. 1991, Çakırlar et. al. 1994, Zencirkıran 2002). Among geophytes, the emphasis by export (more than 80 %) in on *Galanthus, Erantis, Anemone, Cyclamen and Leucojum* (Table 3).

Table 3. The number of each one of the important geophytes exported between the years 1975 and 2006 (Anonymous 2006)

Year	*Galanthus*	*Eranthis*	*Anemone*	*Leucojum*	*Cyclamen*
1975	7.333.000	5.025.000	1.176.000	1.515.000	324.000
1984	40.000.000	12.060.000	9.675.000	13.165.000	5.000.000
1987	29.220.000	9.870.000	7.080.000	8.460.000	995.000
1990	30.000.000	10.040.000	13.275.000	8.120.000	1.475.000
1994	15.536.820	7.805.000	6.343.200	5.000.000	1.490.325
1995	6.325.700	7.500.000	7.500.000	2.996.000	1.708.985
2005	8.100.000	4.000.000	7.000.000	4.000.000	2.490.000
2006	8.100.000	3.500.000	7.000.000	4.000.000	2.550.000

3. ENVIRONMENTAL VALUE AND USAGE OF GEOPHYTES

Geophytes bear significant environmental value due to many features they bear such as resistance to adverse environmental conditions, excellent genetic features, importance as medical plants and utilizable in landscape applications. Therefore they should be protected and their production should be increased. As geophytes have underground stems, they are resistant to adverse environmental conditions. For example, geophytes are the first plants that grow after forest fires. If the organs under the ground are not burnt, the starch within this organ enables the plant to grow easily. Moreover, geophytes are hardly affected by the drought and lead re-occurrence of vegetation since they include plenty of water.

Geophytes have excellent genetic features since they grow in different environments from sea-level to high altitudes. Also the alkaloids, etc. in the geophytes enables them to be utilized as medical plants and used in food industry. Particularly, the alkaloid called galanthamine which is obtained from the plant *Galanthus* is used in physical therapy applied after infantile paralysis, and the alkaloid called colchicines which is obtained from the plant *Colchicum autumnale* is used in the treatment of gout and plant-improvement studies. Furthermore, geophytes are preferred in landscape works such as house-gardens, parks, arboretums, roadsides, golf courses and especially rock gardens. On the other hand, some geophytes in our country such as *Pseudocrocus* and *Orchis laxiflora*, *Allium* spp., *Arum italicum, Fritillaria meleagris, Leucojum* spp. are suitable for use in pools and ponds, and species such as *Allium moly, Iris reticulata Tulipa* spp., *Erythronium* can be used in dry and well-exposed areas and rock gardens as well as urban areas where open-space areas are in minimum level and these plants can be used as container plants (Baktır et. al.1997, Zencirkıran and Tumsavas 2006).

4. CONCLUSION

Geophytes, which constitute one of our natural assets, are threatened by the fast-developing industry and urbanization, and for many years, they suffer from extreme uprooting from Turkish flora for the purpose of sales. This caused damage in the natural habitats of the plants and prevented seed production, and some species such as *Galanthus* sp., *Eranthis hyemalis, Anemone blanda, Scilla* sp., *Tulipa* sp., *Orchis* sp., *Hyacinthus* sp. are faced with danger of dying out.

Therefore;

* Production, growing and increasing works should be improved and production areas should be established. Such works must be started urgently especially for the species which began to die out.

* The environments where geophytes grow should be well-established, and natural flora should be examined and taken into consideration in the event of urbanization and construction works such as dams, roads, etc.

* Species should be determined once in a few years in order to learn whether uprooting works have adverse effects on diversity of species.

* In the next decades, uprooting from the nature should be prohibited under the scope of a program and exportations should be performed only after these species are cultured.

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International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

VEGETATION AS A BIOTIC INDICATOR OF SOIL AND WATER QUALITY IN AKARCAY BASIN (TURKEY)

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Water quality was estimated based on the soil analyses and plant covers in the region next to river stream. For this reason, correlation analyses between soil which has plant communities in Akarcay basin and water that adjacent to the soil were carried out.

In the study area there are four plant communities called as *Limonium lilacinum, Alhagi pseudalhagi, Peganum harmala* and *Hordeum marinum.* In the correlation analyses, B, Cl, EC, K, Mg, Na, pH, SO_4 parameters of the soil and the water which are belong to the communities were used. At the sample location points there are high correlations between the water and the soil data. This relationship shows the effect of soil chemical parameters on the water quality.
Moreover, the important parameters in the communities of *Limonium lilacinum* are B, Cl, EC, K, Mg, Na, pH, SO_4 and for *Peganum harmala* are Ca, K, pV, and also for the communities of *Alhagi pseudalhagi* the parameters B, Cl, Mg, pH, pV are important. Therefore, these communities may be used as indicator for the parameters mentioned.

Key words: *Akarcay basin (Turkey), Water quality, Vegetation, Soil, Correlation, Salt marsh vegetation.*

INTRODUCTION

The integrated evaluation of the parameters' data of water, soil and living is useful in two aspects in the environmental pollution monitoring and management studies: 1-Integrated evaluation is more reliable than the separated evaluation and 2- One of the parameters can be used as indicator for other parameters.

The integrated approach in environmental pollution and management have been used the for decades: Isidori *et al.* (2004) presented a study on integrated environmental assessment of Volturno River in South Italy. Dinges aimed to public health protection with respect to aquatic vegetation and water pollution control (Dinges, 1978). Lyon and Gross purposed to determine the patterns of plant diversity and plant-environmental relationship across three riparian corridors (Lyon and Gross, 2005). He (2003) aimed a study which integrates geographic information systems and agricultural nonpoint source pollution model to analyze the effect of land use change on nonpoint source pollution in a study watershed. Norton and Fisher (2000) investigated on the effects of forest on stream water quality in two coastal plain watersheds of the Chesapeake Bay using correlation analyses.

Scholz and Trepel (2004) investigated the effect of raised groundwater levels and extensive land use on the water quality of heavily vegetated and groundwater-fed ditches in a riparian peat land located in the River Eider Valley. Another investigation was made using correlation analyses. In the study, the land use and land cover across 28 sub-basins within the Cosumnes Watershed, CA (1989 km^2) were correlated to nitrate-N and total suspended solids (TSS) loading between water years 1999 and 2001 (Ahrearn, *et al.* 2005).

Increased concern over environmental degradation in recent years has led to expanded programs for monitoring ambient water quality. A frequently stated objective of such programs is the detection of present state in water quality. The traditional monitoring activities comprise the laboratory analyses of the samples collected form some determined sampling points in streams then the existing quality of water are determined. There are many handicaps of this process such as: 1- sampling location is determined subjectively, 2- reaching this sampling points sometimes is not possible because of natural conditions, 3- the cost of transportation and laboratory analyses, 4- the results show only present concentration level of the parameter but the parameter is highly affected by environmental conditions.

Main aim of the present study is to determine whether or not the vegetation can be utilized to state the general situation of water quality, and to use it for consideration of nonpoint pollution sources.

Moreover, other aims are: 1- soil-plant salinity relationship was purposed to decide using arid vegetation plants, plants communities, salinity characteristic in the study area, 2- defining ecological properties of halophyts which constitute a group in the plant communities due to the special environment conditions, 3- constituting a base to Turkish vegetation maps which will be realized in the future.

In calculations, the analyses results of 10 chemical parameters belong to water and soil in Akarcay basin (Afyon, Turkey) were used. In addition these chemical parameters, discharge values of the water, and sand, silt and clay rates in soil structure and four plant communities in the sample point were used. Moreover, effects of chemical parameters of soil on the water quality parameters were determined using statistical methods.

MATERIALS AND METHOD

Study area

Akarçay basin is located at inner-west Anatolia (Fig. 1). The primary stream of the basin is Akarcay stream with a length of 130 km. Akarcay basin is a graben kind and has clay density in the ground. Its permeability is very small and the source of the stream is mostly surface water and precipitation. In the basin, there are four thermal springs and the thermal tourism develops rapidly. Thermal spring waters contain N+, K+, Ca++, Mg++, Cl^-, HCO_3^- and SO_4^{--}.

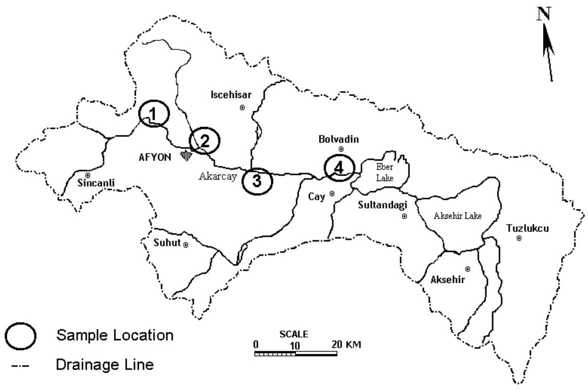

Figure 1. Water and soil sample locations in Akarcay basin.

Sampling

Bimonthly sampling of water quality have been started at different times (Fig. 1) (SIHM, 2005). The calculations comprise discharges and 10 chemical parameters (B^{+++}, Ca^{++}, Cl^{-}, EC, K^{+}, Mg^{++}, Na^{+}, pH, pV and SO_4^{--}) concentration found in the water and the soil samples, and also sand, silt and clay percentage (The quality parameters were written without their electron degrees for easy edition in the following section). In the study area there are halophytic plant communities which are adapted to salty soils.

According to seasonal alterations, there are four plant communities peculiar to both marsh and arid region. These communities are *Limonium lilacinum, Alhagi pseudalhagi, Hordeum marinum* and *Peganum harmala.* Especially, *Limonium lilacinum* plant community is peculiar to this region. Halophytics, as an indicator plant in the soil contains, constitutes a group in the plant communities due to the special environment conditions (Ankara Research Institute of Rural Services, 2000).

The plant samples were collected in 2000-2001. Davis (1965-1988)'s "Flora of Turkey" and also Gazi University's and Ankara University's herbariums were considered in the identification of the plants. The vegetation of the region was classified according to Braun-Blanquet (1932) method. The data on climate was received from General Directorate of Meteorology (DMI), (Meteorological Bulletin 1990; Akarcay Revise Hydrological Research, 1981). 14 soil samples were taken from the 0-30 cms depth of the ground surface, and their physical and chemical analysis were done in RIRS (Ankara Research Institute of Rural Services) laboratories according to the methods determined by Tuzuner (1990).

Calculations

Calculations were carried out in four steps: 1- Means of water quality parameters were calculated. 2- Distribution of the parameter concentration values of four sampling location was presented. 3- Distribution of all parameters in every sampling location (quadrat) was determined. 4- Correlation analyses between the simultaneous monitoring values of water and soil parameters were performed. SPSS 10.0 statistical packaged program was used in correlation analyses.

RESULTS

Means of water quality parameters were presented in Table 1, and physical and chemical properties of soil samples were presented in Table 2. Percent values of a parameter of water and soil at one sampling location were presented in Fig. 3 and Fig. 4. Correlation analysis results between the water and soil parameters were presented in Table 3.

Table 1. Means of water quality data.

P	SL	Mean	P	SL	Mean	P	SL	Mean	P	SL	Mean	P	SL	Mean	P	SL	Mean
B	1	0.23	Cl	1	118.16	K	1	18.83	Na	1	125.73	pV	1	25.91	Q	1	0.46
	2	0.46		2	144.60		2	19.65		2	168.19		2	33.92		2	0.53
	3	0.42		3	143.82		3	21.83		3	164.62		3	31.02		3	1.73
	4	0.16		4	180.86		4	41.26		4	206.50		4	36.89		4	1.34
Ca	1	67.98	EC	1	1.12	Mg	1	22.10	pH	1	7.49	SO_4	1	69.04			
	2	67.20		2	1.27		2	27.21		2	7.57		2	96.24			
	3	91.51		3	1.37		3	26.18		3	7.57		3	105.45			
	4	98.59		4	1.66		4	51.54		4	8.21		4	207.66			

P : Parameters, SL: Sample Location

Table 2. Physical and chemical analysis of soil of four sample location in Akarçay basin (TURKEY).

SL No	Plant community	Physical Analysis %			Chemical Analysis									
					Soluble									
					Cations Me/100 gr				Anions Me/100 gr					
		Sand %	Silt %	Clay %	Na^+	K^+	Ca^{++}	Mg^{++}	Cl^-	SO_4^{--}	pH	EC Me/100 gr	pV %	B ppm
1	*Limonium lilacinum*	22.30	28.44	49.26	34.40	1.20	1.40	0.60	18.60	14.50	8.19	2.550	1.42	6.24
		21.85	30.80	47.35	487.5	15.20	2.10	1.70	75.00	425.8	8.59	20.20	1.60	8.81
		46.93	31.19	21.88	105.5	1.45	0.90	0.10	31.75	57.20	9.53	5.320	1.82	14.46
		21.58	23.62	54.80	13.30	0.68	1.40	0.70	5.60	2.08	8.76	1.400	4.56	10.30
2	*Peganum harmala*	63.42	22.97	13.61	0.25	3.35	2.50	0.40	0.80	1.80	7.99	0.523	3.11	0.24
		56.61	27.49	15.90	0.80	11.90	2.70	0.20	3.35	6.75	8.03	1.262	0.69	0.48
		67.87	22.77	9.36	0.19	3.60	1.60	0.70	0.25	2.14	7.93	0.488	5.49	0.48
		59.21	25.07	15.71	0.12	3.30	1.90	0.60	0.25	1.77	7.96	0.480	6.88	0.64
3	*Hordeum marinum*	28.26	41.57	30.18	6.55	1.10	0.90	0.20	2.00	1.05	7.97	0.694	0.94	2.72
		36.91	37.21	25.88	13.20	0.30	1.20	0.20	6.25	4.05	8.29	1.710	0.34	3.30
4	*Alhagi pseudalhagi*	28.83	29.73	41.45	86.00	1.20	0.70	0.30	40.00	41.90	8.64	4.120	2.63	8.01
		24.54	29.74	45.72	10.20	0.65	0.80	0.60	4.30	1.25	8.62	1.050	4.49	6.73
		46.19	29.52	24.29	1.43	1.48	1.40	1.50	0.55	1.16	8.06	0.466	5.45	1.60
		23.12	31.58	45.30	9.20	0.38	1.40	0.90	4.50	1.18	8.25	1.119	3.17	3.64

SL: Sample Location

Table 3. Pearson correlation coefficients (all the results are significant at 5% significance level).

Sample location no	Pearson correlation coefficient
1	0.99345
2	0.98826
3	0.99055
4	0.97215

Research area located in B3 square in the grid system of Davis, and *Limonium lilacinum* plant community is especially peculiar to this region (Davis, 1965-1988).

***Limonium lilacinum* Community:** The dominant species of the community are *Hordeum geniculatum, Artemisia santonicum, Scorzonera parviflora, Lepidium cartilagineum* subsp. *cartilagineum, Phragmites australis, Spergularia media* and *Plantago crassifolia*. In study field, the community exists in the alluvial soils. The soils have clayey structure. The soil samples taken from the community are very salty, highly calcareous, organic material in the samples varies from low to good and phosphorus in the samples varies from very little to medium with a high level of potassium. The soils are characterized by little alkali and strong alkali with respect to pH (Tuzuner, 1990).

***Alhagi pseudalhagi* Community:** The dominant species of the community are *Limonium lilacinum, Phragmites australis, Hordeum geniculatum, Artemisia santonicum* and *Lepidium cartilagineum* subsp. *cartilagineum*. In the study field, the community exists in the alluvial soils. The soils are in clay and loam structure. The soil samples taken from the community location are very little salty, highly calcareous, organic material in the samples varies from very little to high and phosphorus in the samples varies from very little to medium with a high level of potassium. The soils are characterized by little alkali and strong alkali with respect to pH (Tuzuner, 1990).

***Hordeum marinum* Community:** The dominant species of the community are *Apera intermedia, Descurania sophia* and *Hordeum geniculatum*. In the study field, the community exists in the Brown soils. The soils are in clay and loam structure. The soil samples taken from the community are very little salty, little calcareous, organic material in the samples is very little and phosphorus in the samples vary from very little to little with a high level of potassium. The soils are characterized by little alkali with respect to pH (Tuzuner, 1990).

***Peganum harmala* Community:** The dominant species of the community are *Hordeum marinum, Apera intermedia, Capsella bursa-pastoris* and *Descurania sophia*. The soils structures are in silt and loam structure. The soil samples taken from the community are saltless, medium calcareous, organic material in the samples vary from very little to high and phosphorus and potassium in the samples are high. The soils are characterized by little alkali with respect to pH (Tuzuner, 1990).

DISCUSSION

In the study area, four plant communities were found. Especially, when 4 plant communities were considered for plant-soil relation, it was observed that *Limonium lilacinum* plant communities are well adapted to salty soils.

According to the Figure 2, in the SL4 (Sample Location no 4), the parameters Ca, Cl, EC, K, Mg, Na, pH, SO_4 and Q show very important gradient. In the SL2 (Sample Location no 2), the parameter B, as for in the SL3 (Sample Location no 3), B, Ca, EC, pV, Q have considerable extra value. The discharges in SL3 and SL4 are more than the other two locations. In the SL4 which is downstream of SL3, the low discharge can be explained with the irrigation water which is obtained from Akarcay.

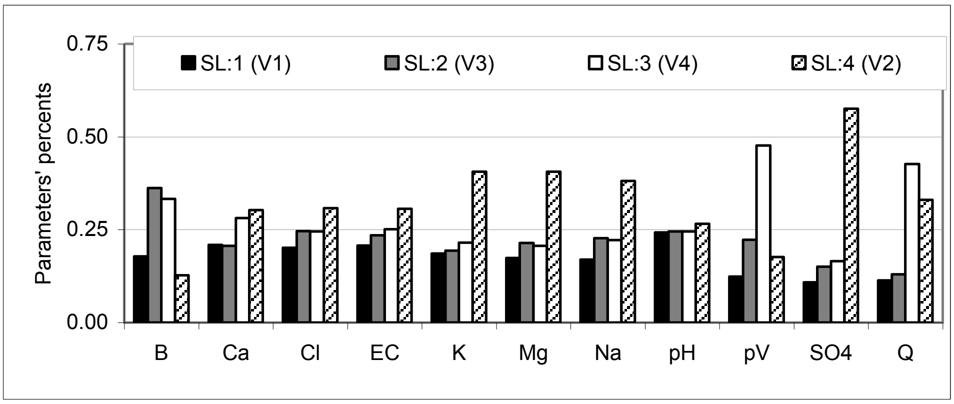

Figure 2. Percent values of water quality parameters (SL: Sample location no, V1: *Limonium lilacinum*,V2: *Alhagi pseudalhagi*, V3:*Peganum harmala*, V4: *Hordeum marinum*).

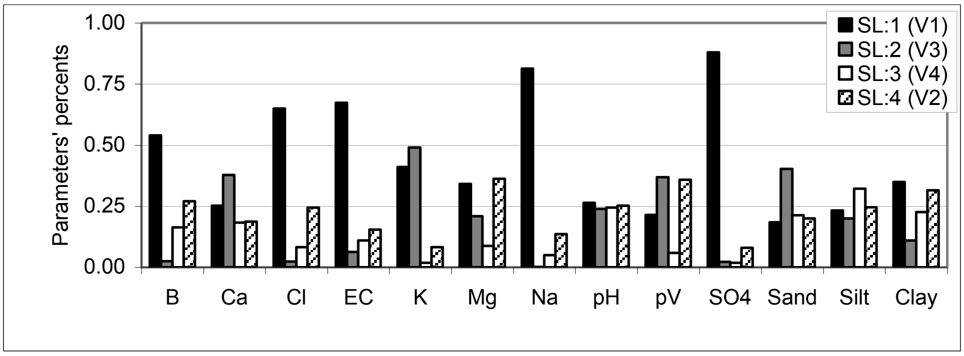

Figure 3. Percent values of chemical and physical parameters of soil (SL: Sample location no, V1: *Limonium lilacinum*, V2: *Alhagi pseudalhagi*, V3:*Peganum harmala*, V4: *Hordeum marinum*).

In Fig. 3, the SL2 has higher sand percent which is bigger than the sand percentages of SL1 (Sample Location no 1) SL3 and SL4. In the SL1, B, Cl, EC, Na and SO_4 have 50% amount more than the other location's parameters. Cumulative values were obtained from 4 location's values so exceeding of the 25% value is important. Therefore, B, Cl, EC, K, Mg, Na, pH and SO_4 in SL1; B, Mg, pH and pV in SL4; Ca, K, pV in SL2 have more than 25%.

Considering, Fig. 2 and Fig. 3 together, according to the sampling locations, the mean percentage for water are SL1: 0.17%, SL2: 0.22%, SL3: 0.28%, SL4: 0.33% and for soil are SL1: 0.45%, SL2: 0.19%, SL3: 0.14% and SL4: 0.22% when calculating means percents of all parameters at one sampling location. Therefore variation ranges (max-min) of percent values in water is 0.16% and for soil is 0.31%. This means that, water quality parameters have less variation then the soil data. This can be explained with upstream downstream relationship, because the concentration of a parameter in upstream is conveyed to the downstream stations. This causes a more stable variation.

The summary of the above evaluations is:

For soil: SL1: *Limonium lilacinum;* Clayey soil; B, Cl, EC, K, Mg, Na, pH, SO_4

SL2: *Peganum harmala;* Sandy soil; Ca, K, pV
SL3: *Hordeum marinum;* Silty soil;

SL4: *Alhagi pseudalhagi;* Clayey soil; B, Cl, Mg, Na, pH, pV, SO_4

For water: SL1: pH;
SL2: B;
SL3: B, Ca, Cl, EC, pV, pH, Q;
SL4: Ca, Cl, EC, K, Mg, Na, pH, SO4, Q

Flow and soil parameters have strong correlation. Firstly, this result shows the stream water quality affected soil parameters in important amount. Secondly, vegetations in arid lands are typical indications of soil and climate. Halophytic vegetation which grows up in these lands is socio ecological groups via media conditions and way of living similarities, however they have not any relatives in systematical side (Yurdakulol and Ercoşkun, 1990). Therefore, the high correlation between water and soil parameters leads to the results as the plants which need these chemical parameters in soil can be used as biotic indicator in ordert to estimate both water and soil quality.

CONCLUSION

Vegetation, soil and water quality relationships were investigated in Akarcay basin. Water and soil samples which belong to four different sample locations were analyzed and discharge is measured and soil structures were determined. At the sample locations, four plant communities called as *Limonium lilacinum*, *Alhagi pseudalhagi*, *Peganum harmala* and *Hordeum marinum* were found and their degree for salinity were determined. Ecological properties of halophyts special environment conditions were defined. Four plant communities and sample locations may lead to the vegetation map which will be constituted in the future.

At the sample locations there are high correlation between the chemical parameters of water and soil samples. These high correlations explain that the water quality parameters affect soil parameters via the rain and irrigation return water. Moreover, at these sampling locations, there are plant communities which need some special properties of the region. Therefore, these plant communities can be used as indicator plants for general situation of water quality and for non-detailed analyses of the quality. Furthermore, it can be stated that, the plant communities as a halophytic plant can also indicate these properties of soils: *Limonium lilacinum;* Clayey soil; B, Cl, EC, K, Mg, Na, pH, SO_4; *Peganum harmala;* Sandy soil; Ca, K, pV; *Hordeum marinum;* Silty soil; *Alhagi pseudalhagi;* Clayey soil; B, Cl, Mg, Na, pH, pV, SO_4.

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International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

SHORT TERM EFFECTS OF ROYAL JELLY ON SPERM QUALITY IN JUVENILE RAINBOW TROUT

(*Oncorhynchus mykiss* W., 1792).

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This research examined the sperm quality responses of dublicate groups of juvenile (299.4 g initial weight) rainbow trout (*Oncorhynchus mykiss* W., 1792) that had each been fed daily to satiation for 2 weeks one of two doses royal jelly added diets. In this investigation, 30 rainbow trout, at the age of 1 year old, were used. Fishes were kept placed into floating cages at a temperature of 14.1 to 14.3 ^{0}C. Fishes were fed with a commercial diet consisted of 45.84 % CP. Food was provided twice a day at a daily feeding rate of about 1% of the fish biomass. Fishes were seperated into two experimental and control groups randomly, 10 each. Two doses of royal jelly applied in feed: 6 mg (0.6 mg per fish, Group II) and 12 mg (1.2 mg per fish, Group I) royal jelly mixed in 30 ml distelled water and added to feed (2.9 g per fish). Control group given only feed (2.9 g per fish). Before and after the administration of royal jelly orally at a dose of 0.6 and 1.2 mg per fish, sperm was collected by abdominal massage during late spawning season. The results showed that the sperm motility and duration of motility were increased significantly ($P<0.05$, 0.001) in the group I when compared with the control and group II. Sperm pH was decreased significantly ($p<0.001$) in the group II. These findings indicated that administration of royal jelly orally at a dose of 0.6 mg per fish increased the sperm motility, duration of motility and sperm pH, but high dose royal jelly decreased the sperm motility, duration of motility and sperm pH in juvenile rainbow trout. Therefore the use of the royal jelly at a dose of 0.6 mg per fish during late spawning season could be suitable.

Key word: *royal jelly, sperm*

Introduction

Royal jelly (RJ) is a nourishment made by nurse bees. It has been reported that RJ has several pharmacological activities, such as antifatigue activity (Kamakura et al., 2001), antioxidative activity (Nagai et al., 2001), antibacterial activity (Yatsunami and Echigo, 1985), and immunostimulator activity (Heidrick et al., 1948). Also, RJ is used to regulate hormones and to promote sexual vitality (Nagai et al., 2001).

Royal jelly contains essential fatty acids, amino acids, minerals, lecithin, vitamins A, D, E, B5, B6, C (Kamakura et a., 2001). With numerous studies on vitamins, essential fatty acids, amino acids, and minerals supplements on the literature, experimental formulas for the effect of specific sperm parameters (motility, duration of motility, concentration and pH) in different animals are based on established research. In sperm and testes there are high amounts of fatty acids. N-arachidonoylethanolamide (anandamide [AEA]) is the main endocannabinoid described to date in the testis.

Cobellis et al. (2006) suggested that physiological role of endocannabinoid had a conserved physiological role system in controlling the inhibition of sperm motility in mouse and rat. The structures of some smaller proteins, such as protamins, have been studied. Protamines are low molecular weight, highly basic proteins that replace histones and testicular basic proteins during the development of mature spermatozoa, spermatogenesis (Lee and Cho, 1999). Research has shown that trace elements, such as Se, Mn, and Zn, can alter reproductive functions. Barber et al. (2005) suggest that trace minerals such as Se, Mn and Zn must act at the reproductive tissue level during spermatogenesis to improve sperm quality. Vitamin A insufficiency cause an increase in abnormal spermatozoa ratio (Coşkun et al., 1997). In rams; vitamin B1, B6 and B12 are found to be important with respect to the libido, sperm quality and continuity of fertility (El-Darawany, 1999). Among primary suspected causes of male infertility is seminal oxidative stress (OS). Antioxidant substances like vitamin C (ascorbic acid) and vitamin E are effective on the damage of sperm motility caused of the active oxygen groups (Jervis and Robaire, 2004). Salem et al., (2001) have established that ascorbic acid has positive effect on rabbit sperm and serum testosterone quantity.

Rainbow trout (*Oncorhynchus mykiss W., 1792*) is one of the commonly used fish models, but very little is known about the effect of RJ on sperm quality in this species. In this study, we have examined the effects of RJ on sperm quality in rainbow trout.

Materials and methods

The mean total length and weight of specimens were 15.03 ± 0.4 cm (Fig. 1), and 242.4 ± 18.6 g respectively. Thirty 1-year-old rainbow trout were used in a study conducted on floating cages (4 x 4 x 4 m dimensions) on the Atatürk Dam Lake (37^{o} 23’29’’03’’’N, 38^{o} 34’38’’05’’’E) in 2005. During the study, males were kept under natural lakewater condition. Fishes were fed with moist pellets. The pellets contained 45.84 % proteins, 82.20 % organic matter, 12.02 % lipit and 91.59 % dry matter. Food was provided twice a day at a daily feeding rate of about 1% of the fish biomass (based on the weight of crude ingredients without water added).

Fishes were randomly allocated into two treatment groups. Two doses of royal jelly (Uludağ Bal Pazarı Co.Ltd) applied in feed: 6 mg (0.6 mg per fish, Group II) and 12 mg (1.2 mg per fish, Group I) royal jelly mixed in 30 ml distelled water and added to feed (2.9 g per fish). Also, control group given only feed (2,9 g per fish).

Collections of sperm were made at approximately 15-day interval from 7 February until 21 February 2005. Sperm samples were taken by applying gentle manual pressure to the abdomen of fish. Anesthetic matter was not used for the collection of milt. After collections, sperm samples were transported to the laboratory under cold conditions (7–10 º C). In collected milts; total volume of sperm (ml), percentage of spermatozoa exhibiting forward motility (sperm motility, %), duration of forward motility of at least 5 % of the spermatozoa in the field of view, spermatozoa concentration (number of spermatozoa x 10^{9}/ml) and sperm pH were determined.

Sperm volume was determined by the measuring pipette and expressed as ml. Sperm motility was assessed by a similar procedure to that of Tekin et al. (2003) and expressed as a percent of motile spermatozoa. One drop milt (0.5 µl), was placed close to another drop (10 µl) of activating (0.03 % NaCl) on a slide placed under a microscope (x 400). Then, the two drops were mixed and the motility of spermatozoa was observed at 7 ºC. The duration of motility was timed by chronometer from the initial contact between the solution and milt until forward motility of at least 5 % of the spermatozoa in the field of view and expressed as seconds. Spermatozoa concentration was determined using haemocytometer and expressed as number of spermatozoa x 10^9/ml. Sperm pH were determined with a pH indicator strips (pH: 0–14; Merck, Germany).

Statistical procedures

One-way analysis of variance (ANOVA) was used to compare the means of sperm parameters at different times during the sampling period. Post-ANOVA multiple comparison of means was carried out using a Tukey Test. Statistical analyses were carried out by Statistical Analysis System (SPSS Inc. 1999). Mean ± SD are given. Differences between mean values were considered significant at $p < 0.05$.

Results

In the study, determined spermatological properties on control group and RJ given experimental groups male fishes are shown in fig 1.

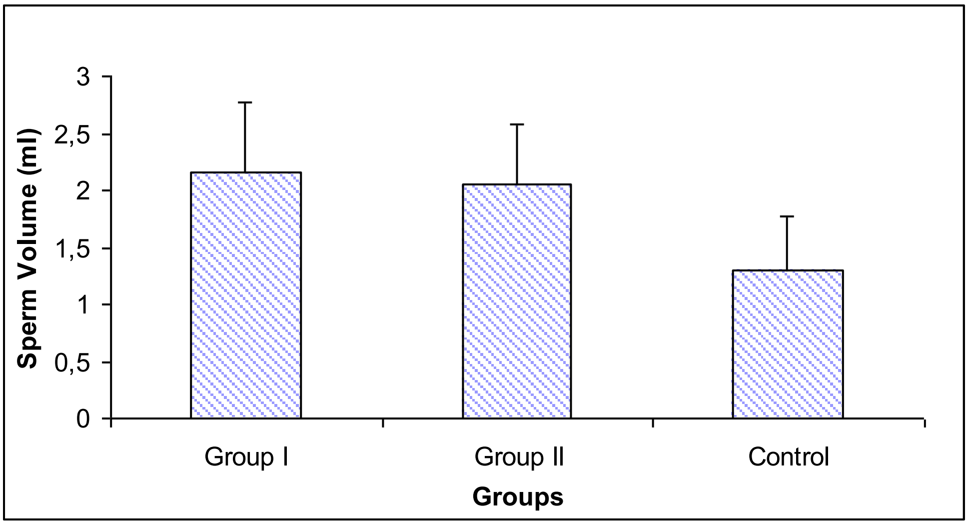

Fig 1. Sperm volume of in juvenile rainbow trout males (n= 10) at different levels of RJ.

Differences among the royal jelly groups with reference to sperm volume (fig 1) and concentration (fig 4) were not significantly influenced by the royall jelly levels. The lowest mean sperm volume was found in the control group. Mean of sperm concentration values of all groups varied from 6.9 to 9.0 x10^9/ml. The highest percentage of forward motility of spermatozoa (fig 2) was shown by group 2 (83.0 %) and differed significantly (P<0.05) from the control group (57.0 %) and group 1 (68.0 %). The duration of motility decreased from 88.5 s of the group1 to 64.0 s of control group (fig 3). The duration of motility of groups 2 differed significantly from the density of other groups (P<0.001. Value of sperm pH of groups 2 were higher than that of the control group and 1 (P<0.001, fig 4).

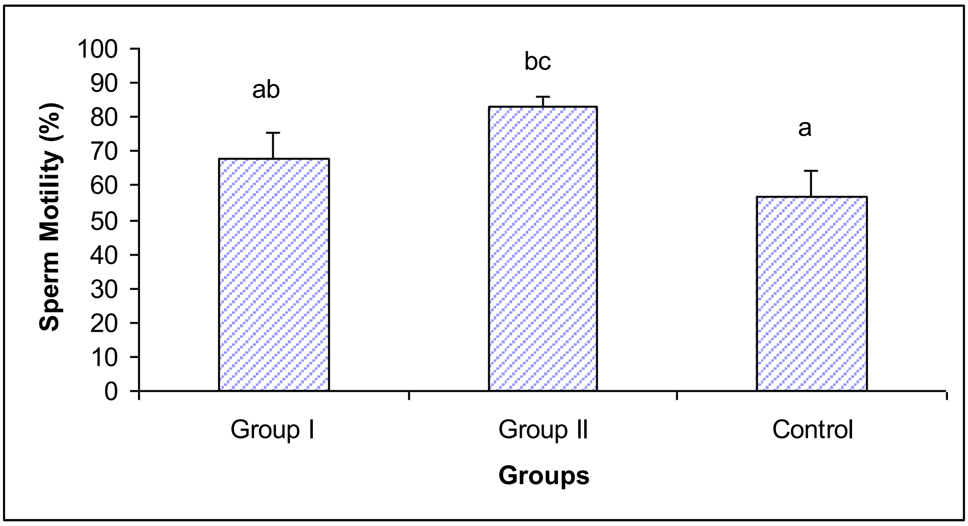

Fig 2. Sperm concentration of in juvenile rainbow trout males (n= 10) at different levels of RJ. Different letter superscripts indicate means that were significantly different (P<0.05).

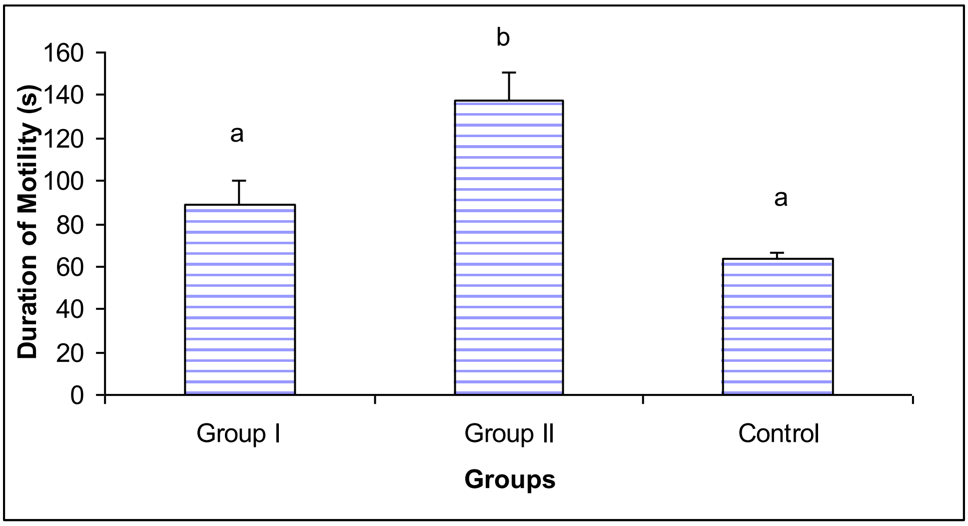

Fig 3. Duration of Motility of in juvenile rainbow trout males (n= 10) at different levels of RJ. Different letter superscripts indicate means that were significantly different (P<0.001).

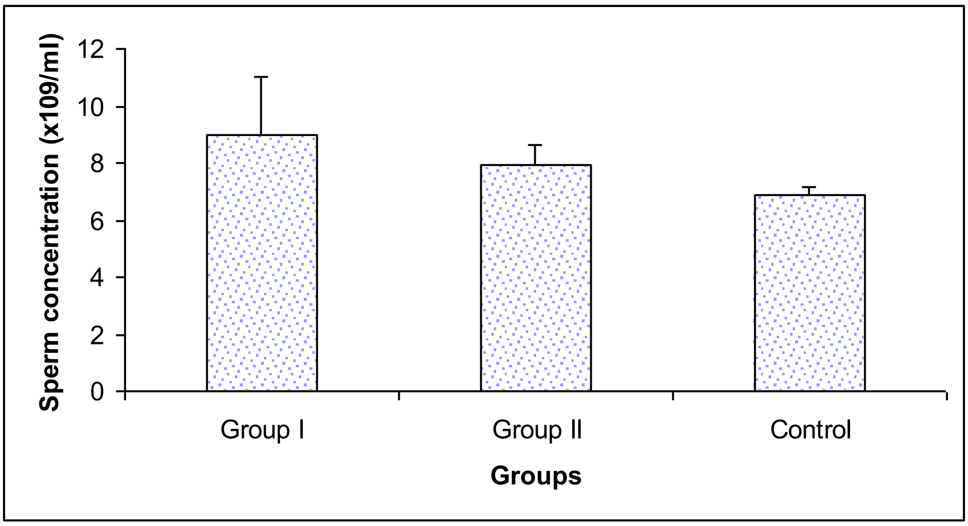

Fig 4. Sperm concentration of in juvenile rainbow trout males (n= 10) at different levels of RJ.

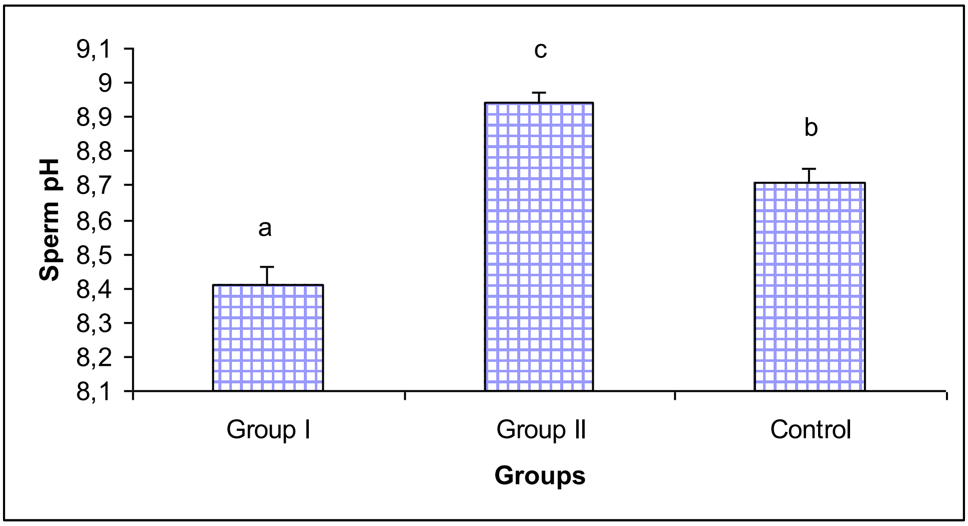

Fig 5. Sperm pH of in juvenile rainbow trout males (n= 10) at different levels of RJ. Different letter superscripts indicate means that were significantly different (P<0.001).

Discussion

Sperm volume and concentration of group I were numerically greater than the other two groups, but this was not significant statistically. Sperm volume and concentration were at physiological levels. Sperm volume (1.83 ml) was similar to the mean of 1.59 ml reported by Aral et al. (2004) in rainbow trout. However, the sperm volume of 7.20 ml in rainbow trouts with 1 to 2 years old, reported by Tekin et al. (2003), was considerably higher than the average obtained in this study. The mean spermatozoa concentration of 7.90 $x10^9$ /ml was slightly lower than the range of 8.97 to 17.9 x 10^9 /ml, reported by other authors (Ciereszko and Dabrowski, 1993; Babiak et al.,1999; Bloom and Ottobre, 2001; Babiak et al., 2002; Tekin et al., 2003). The low sperm concentration could be related to the low ejaculate volumes obtained in males. Furthermore, fish stock, or age, appear to influence sperm concentration (Poole and Dillane, 1998).

The significantly negative influence of high vitamin RJ dosage on the sperm motility and duration of motility is more important, because fertilization varies with the changing motility and duration of motility of sperm. To our knowledge, hitherto there have been no reports on the effects of dietary RJ supplementation on sperm quality of male rainbow trout. The present study is the first report on these relationships. Alterations in sperm motility and duration of motility indicate a disorder in spermatozoa or its enviromental factors such as pH and ions. Energy necessary for fish sperm motility is supplied in the form of ATP synthesized by oxidative phosphorylation in the mitochondria and flagellum (Hayashi et al., 1987). Thus, the deleterious effects of high level RJ on sperm motility parameters could be related to an ATP depletion at a site independent of mitochondrial oxidative phosphorylation or a decrease in ATP utilization. On the other hand, cations such as K+, Na+ and Ca 2+, cAMP, pH and protein phosphorylation triggers the initiation of sperm motility in many fishes (Morisawa 1994, Darszon et al., 1999, Watanabe et al., 2003). The determinate influence that external ions have on sperm motility to light the importance of ion channels in these crucial cell processes. Ion channels are key elements in sperm motility are inhibited by certain ion channel blockers (Morisawa 1994; Florman et al., 1998; Publicover and Barrat, 1999; Darszon et al., 2001; Watanabe et al., 2003). Alteration in ions of sperm could be decreased sperm motility and duration of motility in high level RJ. Finally, it is possible that the low level pH induced by high level RJ, acts as a inhibitor of depolarization of the cell membrane and that the deleterious effects observed on sperm motion are an early functional reflect of an toxic event. Also, a significant decrease of sperm pH in high level RJ diet was observed.

There was a significant ($P < 0.05$) decrease in sperm pH when male juvenile rainbow trout were given feeds supplemented with 1.2 mg RJ (group I). Studies on fishes, concerning the relationship between sperm pH and dietary RJ supplementation have not been published so far and, to our knowledge, the present report is the first one on this subject. However, sperm pH and sperm motility in group I were higher than those control and group I. These results are consistent with a study that reported that the sperm of halibut *Hippoglossus hippoglossus* exhibited the best sperm motility at a pH of 7.5–8.5 (Lim et al., 2004). Morisawa and Suzuki (1980) suggested that fish spermatozoa acquire their motility during transition from the testis to the sperm duct where pH is high. This suggests that 0.6 mg of RJ in feed may induce the secretion of seminal plasma in the sperm duct, where pH was near to alkaline.

The results of this study show that excess of RJ in feed of male fishes led to a negative influence on such semen parameters as sperm motility, duration of motility and sperm pH. In conclusion, it seems clear that supplementing the feed with a moderate level of RJ (0.6 mg per fish) improves male reproductive performance. It is therefore concluded that a moderate level of RJ supplementation is beneficial for sperm motility, duration of motility and sperm pH of male juvenile rainbow trout. However, further work is essential to confirm and extend these findings.

Acknowledgements
We gratefully acknowledge the valuable comments of Prof. Necmettin TEKİN and Prof. Selçuk SEÇER from Ankara University Faculty of Fisheries in Ankara. Also, the authors would like to thank Harran University Bozova High School Department of Fisheries Directorate in Sanliurfa, Turkey for equipment and chemical support.

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International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

EVALUATION OF ALGAL FLORA OF INFRA-LITTORAL ZONE FROM NORTH CYPRUS MARINE ECOSYSTEM*

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In this study, the marine algal flora of North Cyprus (from Yesilirmak to Gazi Magosa Harbour), also distribution and abundance of species at coastal and benthic structure examined. The material was collected with snorkeling and SCUBA and algae were preserved in 4% formaldehyde in sea water and deposited in the Department of Biology (Celal Bayar University, Turkey). Physico-chemical properties of sea water gathered with Water Quality Checker (DKK-TOA). The photographs were taken using Sea&Sea G-8000 under water camera system. Sea water parameters gathered from sampling stations (pH, temperature, salinity, turbidite etc.) of upper-infralittoral zone, compared with the abundance of indicator algae species. Two invasive species that green alga *Caulerpa racemosa* (Forsskål) J. Agardh and brown alga *Stypopodium schimperi* (Buchinger *ex* Kutzing) Verlaque *et* Boudouresque were found abudantly in the Gazi Magosa Harbour. The marine algal flora of North Cyprus was compared with other Mediterranean Countries.
* This study is been supported by TÜBİTAK-TBAG.

INTRODUCTION

The marine algae of the Eastern Mediterranean Sea (Turkish Mediterranean coast and Levant States) have been investigated by Mayhoub (1976), Ozturk and Güner (1986), Ozturk (1988, 1991, 1996a and 1996b), Aysel and Gezerler (1996), Aysel (1997a and 1997b), Ozturk and Taşkın (1999) and Taşkın et al., (2000, 2001, 2004). Several studies including or dealing only with the marine algae of Cyprus have been made by Argyrou et al. (1999), Benli et al. (1999), Verlaque et al. (2000) and Cirik et al. (2000).

Cyprus is the third largest island in the Mediterranean Sea (area 9251 km^2) found at a distance of 390 km north of Egypt, 75 km south of Turkey and 380 km from the Rhodes. Like most parts of the Mediterranean, Cyprus is a tourist island that is visited each year by an increasing number of visitors and tourism is the main industry in Cyprus (Stephanou, 1999). The Island has a total of 772 km of shoreline, of which 404 km are in the occupied northern area (52%).

The aim of the present study is to increase the knowledge of the marine algal flora of North Cyprus (from Yesilirmak to Gazi Magosa Harbour), also distribution and abundance of species at coastal and benthic structure examined. However, sea water parameters gathered from sampling stations (pH, temperature, salinity, turbidite etc.).

MATERIAL AND METHODS

The material was collected with snorkeling and SCUBA and algae were preserved in 4% formaldehyde in sea water and deposited in the Department of Biology (Celal Bayar University, Turkey). Also, herbarium of species deposited in the Near East University (Lefkoşa, North Cyprus). Physico-chemical parameters of sea water gathered with Water Quality Checker (DKK-TOA WQC 24) (Table 1). The photographs were taken using Sea&Sea G-8000 under water camera system. Sampling was made from seven different localities (Fig. 1).

Figure 1. Map of the study area showing sampling sites.

I. Yeşilırmak: Yeşilırmak is in the north coast line of North Cyprus. The general characteristic of the shore is the rocky and bottom is the sandy. (Fig. 2)

Figure 2. General view of Yeşilırmak station.

II. Koruçam: Koruçam is in the north coast line of North Cyprus. The general characteristic of the shore is the volcanic rocky, very rough and bottom is the sandy. (Fig. 3)

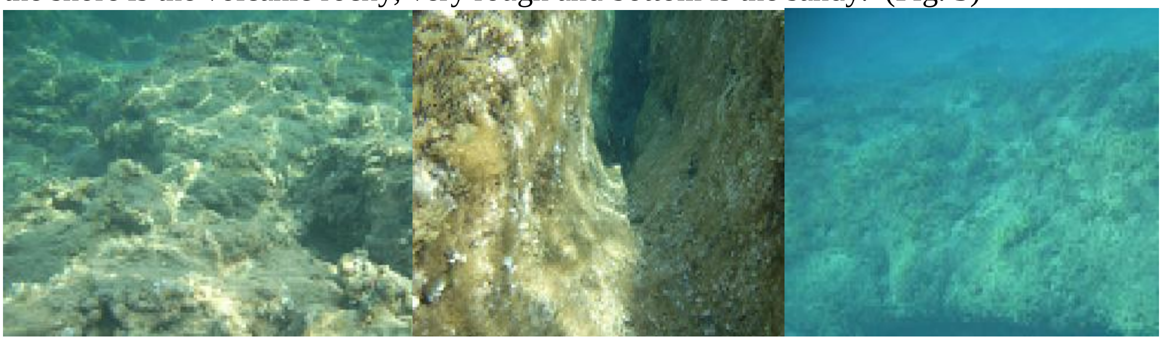

Figure 3. Pictures from Koruçam station.

III. Girne (35° 20′ 44″ N - 33° 19′ 42″ E): Girne is in the north coast line of North Cyprus. Sampling was made from two different localities: Girne Harbour and Kordon Blue. The general characteristic of the shore of Kordon Blue is the volcanic rocky and big stones. The bottom of the Girne Harbour is the sandy. (Fig. 4)

Figure 4. Pictures from the stations; a) Girne Harbour, b) Kordon Blue.,

IV. Dip Karpaz (35° 36′ 22″ N - 34° 26′ 53″ E): The general characteristic of the shore of Dip Karpaz is the rocky, sandy, retaining wall and pools. (Fig. 5)

Figure 5. Pictures from Dip Karpaz station.

V. Kumyalı (35° 24′ 59″ N - 34° 07′ 70″ E): Kumyalı is a fisherman shelter. Sampling was made from shelter's rocky. Bottom is sandy. (Fig. 6)

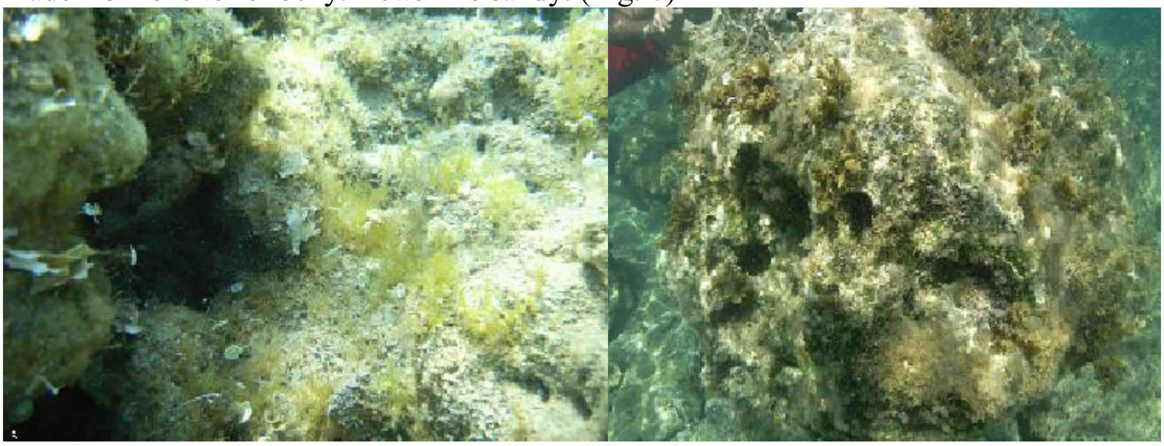

Figure 6. Pictures from Kumyalı station.

VI. Salamis (35° 15′ 49″ N - 33° 54′ 48″ E): Salamis is in the south coastline of North Cyprus. The general characteristic of the shore of Salamis is the sandy and terrace. (Fig. 7)

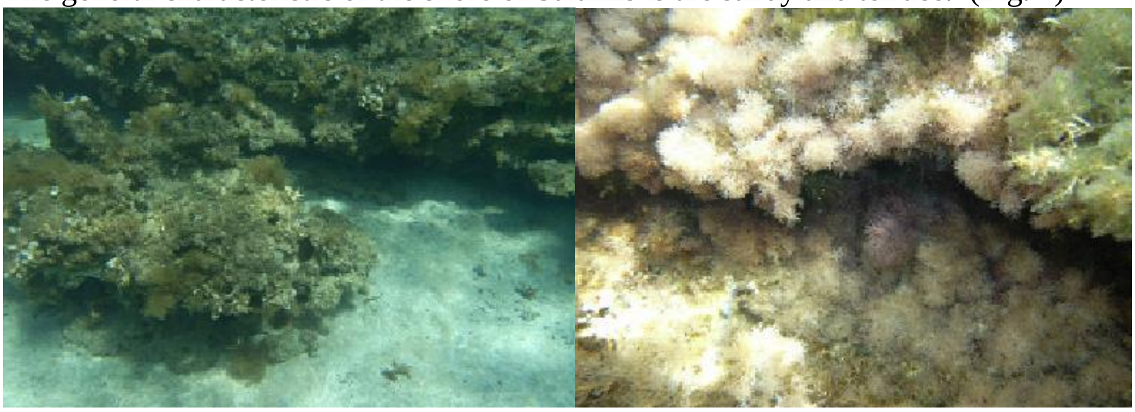

Figure 7. Pictures from Salamis station.

VII. Gazi Mağosa Harbour (35° 07′ 16″ N - 33° 57′ 55″ E): This station is in the south coastline of North Cyprus. The general characteristic of the shore of Gazi Mağosa Harbour is the sandy, rocky, pools and terrace. (Fig. 8)

Figure 8. Pictures from Gazi Mağosa station.

Table 1. Physico-chemical parameters of sea water of North Cyprus.

Seasons	Parameters	Stations						
		Yeşilırmak	Koruçam	Girne	Dip Karpaz	Kumyalı	Salamis	Gazi Magosa
Spring	pH	8.23	8.27	8.53	8.25	8.15	8.28	8.34
	Temperature °C	19	18	19	18.7	18.5	19	19
	Salinity ‰	36.3	35.1	34.9	36.4	35.3	35.3	36.4
	dO_2 mg/lt	5.14	5.41	5.96	5.7	4.75	5.49	5.27
	Turbidity NTU	5	4.1	4.3	4	4.5	3.4	11.8
Summer	pH	8.23	8.26	8.28	8.25	8.24	8.21	8.26
	Temperature °C	28.4	29	28.6	29.5	30.5	31	29.2
	Salinity ‰	33.9	37	36.8	37.8	38.1	37	37.3
	dO_2 mg/lt	-	-	-	-	-	-	-
	Turbidity NTU	2.9	-	2.9	5.4	2	-	-
Autumn	pH	-	8.25	8.27	8.42	8.24	8.33	8.31
	Temperature °C	-	28.6	28.8	26.9	27.6	28.7	29.4
	Salinity ‰	-	37.4	35.5	36.7	37.1	36.3	35.6
	dO_2 mg/lt	-	-	-	-	-	-	-
	Turbidity NTU	-	0	2.3	0	0	0.5	1.9
Winter	pH	8.03	8.53	8.35	8.41	8.34	8.36	8.28
	Temperature °C	16.3	14.7	15.7	16.1	15.1	14.8	16.1
	Salinity ‰	32.6	35.5	36.1	36	34	35.6	36.1
	dO_2 mg/lt	5.22	5.20	6.02	6.20	5.61	5.86	6.42
	Turbidity NTU	10.8	10.8	8.7	8.2	7.7	3.5	4.8

RESULTS

In this study we are reported 41 taxa of marine algae (2 Cyanophyceae, 17 Rhodophyceae, 13 Phaeophyceae and 9 Chlorophyceae) from North Cyprus. These;

Cyanophyceae: *Chroococcus turgidus* (Kützing) Nägeli; *Oscillatoria curviceps* C.Agardh.

Rhodophyceae: *Erythrotrichia carnea* (Dillwyn) J.Agardh; *Acrochaetium daviesii* (Dillwyn) Nägeli; *Ganonema farinosum* (J.V. Lamouroux) Fan *et* Wang; *Corallina elongata* J. Ellis *et* Solander; *Jania rubens* (L.) J.V. Lamouroux var. *rubens*; *Hypnea musciformis* (Wulfen) J.V. Lamouroux; *Callithamnion corymbosum* (Smith) Lyngbye; *Ceramium ciliatum* (J. Ellis) Ducluzeau var. *ciliatum*; *Ceramium ciliatum* var. *robustum* (J.Agardh) Feldmann-Mazoyer; *Spyridia filamentosa* (Wulfen) Harvey; *Wrangelia penicillata* (C.Agardh) C.Agardh; *Dasya rigidula* (Kützing) Ardissone; *Chondrophycus papillosus* (C.Agardh) Garbary *et* J. Harper; *Digenea simplex* (Wulfen) C.Agardh; *Laurencia obtusa* (Hudson) J.V. Lamouroux; *Polysiphonia opaca* (C.Agardh) Moris *et* De Notaris; *Rytiphlaoea tinctoria* (Clemente) C.Agardh.

Phaeophyceae: *Myriotrichia clavaeformis* Harvey; *Colpomenia sinuosa* (Mertens *ex* Roth) Derbes *et* Solier; *Hydroclathrus clathratus* (Bory *ex* C.Agardh) M. Howe; *Halopteris filicina* (Grateloup) Kützing; *Stypocaulon scoparium* (L.) Kützing; *Dictyopteris polypodioides* (A.P. De Candolle) J.V. Lamouroux; *Dictyota dichotoma* (Hudson) J.V. Lamouroux var. *dichotoma*; *Padina pavonica* (L.) Thivy; *Stypopodium schimperi* (Buchinger *ex* Kützing) Verlaque *et* Boudouresque; *Cystoseira compressa* (Esper) Gerloff *et* Nizamuddin; *Cystoseira foeniculacea* (L.) Greville f. *foeniculacea*; *Cystoseira foeniculacea* f. *tenuiramosa* G.Garreta, B. Martí, R. Siguan *et* R. Lluch; *Sargassum vulgare* C.Agardh.

Chlorophyceae: *Phaeophila dendroides* (P.L. Crouan *et* H.M. Crouan) Batters; *Enteromorpha linza* (L.) J.Agardh; *Ulva lactuca* L.; *Anadyomene stellata* (Wulfen) C.Agardh; *Cladophora* spp.; *Caulerpa prolifera* (Forsskål) J.V. Lamouroux; *Caulerpa racemosa* var. *lamourouxii* f. *requienii* (Montagne) Weber-van Bosse; *Flabellia petiolata* (Turra) Nizamuddin; *Dasycladus vermicularis* (Scopoli) Krasser.

Two invasive species that green alga *Caulerpa racemosa* var. *lamourouxii* f. *requienii* and brown alga *Stypopodium schimperi* were found abudantly in the Gazi Magosa Harbour.

Cirik et al. (2000) reported 146 taxa of marine algae from North Cyprus. They give a preliminary list of marine flora from North Cyprus. Argyrou et al. (1999) reported five species from Moni Bay (Limasol, Cyprus): *Caulerpa racemosa*, *Caulerpa prolifera*, *Dasycladus claveiformis*, *Udotea petiolata* and *Dictyota mediterranea* (Schiffner) G. Furnari (as *Dilophus mediterraneus*). However, *Caulerpa racemosa* var. *lamourouxii* f. *requienii* was collected from Gazi Magosa Harbour at 1 and 8 m depth in November 1998 by M. Verlaque (Verlaque et al., 2000). In 1990–1991 massive growth of the green filamentous alga *Cladophora patentiramea*, an indopacific species, occurred in the most touristic areas of Ayia Napa area (Stephanou, 1999).

The some general lists of the marine algae of Mediterranean Sea was made by Ribera et al. (1992, 265 Phaeophyceae), Gallardo et al. (1993, 214 Chlorophyceae) and Gómez Garreta et al. [2001, 271 Ceramiales (Rhodophyceae)]. But this lists do not contain any marine algae from Cyprus because of studies on marine algae from Cyprus have not been done. This project which aims determines marine algae Northern Cyprus is still in progress.

ACKNOWLEDGEMENTS

This research is been supported by TÜBİTAK-TBAG (Ankara). We also gratefully thank to Prof.Dr. Şenol BEKTAŞ (Near East University) for kind help.

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International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

DETERMINATION OF SOME REPRODUCTION CHARACTERISTICS IN *Mastacembelus mastacembelus* (Bank & Solender, 1794) LIVING IN ATATURK DAM LAKE.

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Some population characteristics of *M. mastacembelus* living in Atatürk Dam Lake were investigated in this study. Total 249 samples were gathered between May-October 2005 from the lake, 154 of 217 of total samples (%70,10) were male, whereas 63 of 217 of total samples (%28,9) were female in sexuality determination.

Total lengths of samples changed between 18.9–74.1 cm, total weights of samples varied between 26.4–1001.9 gr and ages of samples altered between 2t and 9t.

The highest gonadosomatic index (GSI) values of females and males were 19.027 and 2.2206, respectively and the highest values were determined in june.

The regression formulas of total weight and gonad weight relationship in females and males were $y=0.1337X–7.731(R^2=0.62)$ and $y=0.0254X–2.7337$ ($R^2=0.56$), respectively. The regression formula in total weight with egg number was determined as $y=30.287X–729.46$ ($R^2=0.81$). The regression formula of total lenght-egg number relationship was found as $y=437.96X–11277$ ($R^2=0.70$).

INTRODUCTION

Mastacembelidae have a long series of well-separated dorsal spines, hence their name ‘spiny eels’. Members of mastacembelidae are widely distributed in the Asia and Europa continents (Vreven, 2005; Suesh et al, 2006).

There are only one species (*M. mastacembelus*; Bank & Solender, 1794) of this family is existent mainly in Turkish freshwaters (Kuru, 1980). Latest distribution area of this species is Tigris-Euphrates River Systems (Geldiay ve Balık, 1996).

Recent years, investigations on the some biological parameters (Kılıç, 2002) and reproduction biology (Eroğlu, 2004) of *M. mastacembelus* have been studied in Turkey. In addition, Pazira et. al. (2005) have been studied on their age estimation and growth. However, no information on this species exist about biology and ecology in Atatürk Dam Lake.

M. mastacembelus is consumed with pleasure in local area and has commercial value. The aim of the present study is to determine some biological characteristics of the current population such as sex ratio, age, growth, reproduction properties from Atatürk Dam Lake for the first time.

MATERIALS AND METHODS

Atatürk Dam Lake, situated on the Euphrates River, is the largest dam lake in Turkey, and is used for irrigation and electrical energy production. Its area and volume are about 81,700 ha and 48.7 km^3, respectively. So, it has large amount fisheries potential.

The study was carried out on *M. mastacembelus* (n=249) specimens, which were obtained with gill nets (15, 17, 20, 28, 30 mm mesh sizes) during the months May to October 2005 from the Atatürk Dam Lake (37°21'45" N, 38°31'36" E).

After being caught, fish samples were fixed in formalin and brought to the laboratory, and the fork lengths (L), and weights (W) were measured to the nearest 1.0 mm and 0.1 g respectively.

The gonads were removed, dried and weighed. Sex was determined by examination of the gonad tissue either by eye for bigger fish or with the aid of a microscope for smaller fish. The monthly gonadosomatic indices (GSI) were calculated using the formula:

$$\%GSI: \text{Gonad weight (g)} / \text{Body weight (g)} \times 100$$

Sexual maturity was determined by observation of the stages of the maturation of gonads according to Avşar (1998). The egg size was measured to 0.1 mm using a micrometer eyepiece. The relationships between total length, body weight, and gonad weight and egg number were calculated by exponential and linear regression.

Age determination of specimens

Samples obtained were moved to the laboratory for age determination; vertebra was examined under a stereomicroscope (Nikon SMZ 2 T stereo, Tokyo, Japan).

RESULTS

Gonad Development and Spawning Period (GSI)

Gonadosomatic index (GSI) values for females (between May and August 2005) and males (between May and October 2005) were found to be 0.965 – 19.027 and 0.606 – 2.220 respectively. In both sexes, the GSI values were found to be the highest in July. Gonadosomatic index (GSI) values of specimens are presented in Figure 1 and 2.

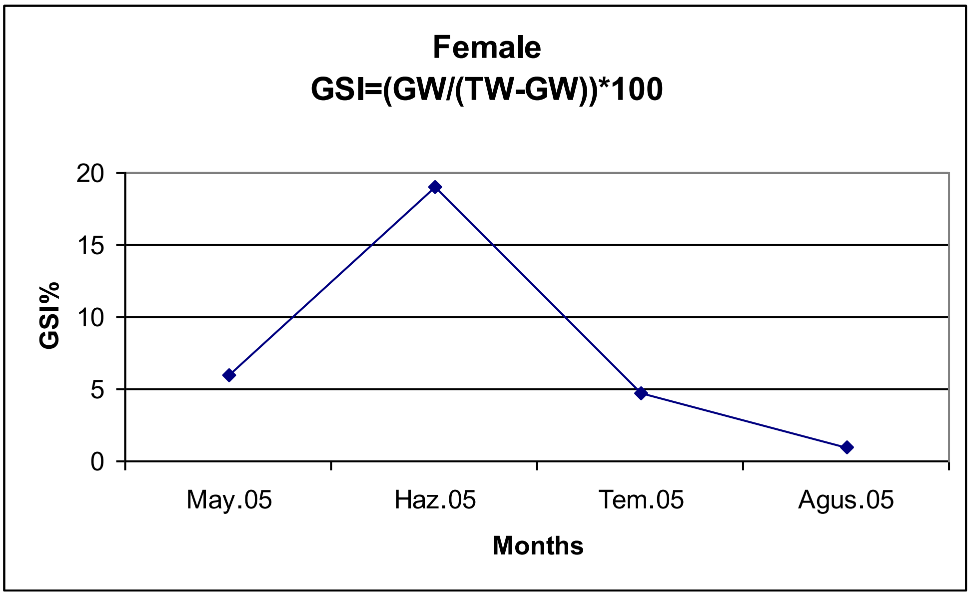

Figure.1 Gonadosomatic index (GSI) values of female *M. mastacembelus*

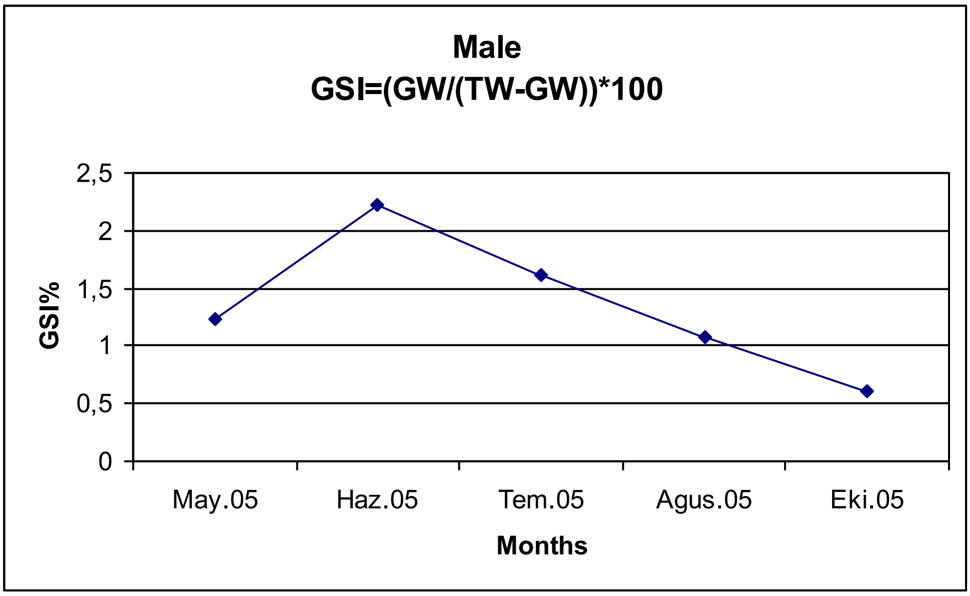

Figure 2 Gonadosomatic index (GSI) values of male *M. mastacembelus*

The regression formulas of total weight and gonad weight relationship in females and males were y=0.1337X–7.731(R^2=0.62) and y=0.0254X–2.7337 (R^2=0.56), respectively. Also, the figures of the total weight and gonad weight relationship in females and males have been given, respectively (Figure 3 and 4).

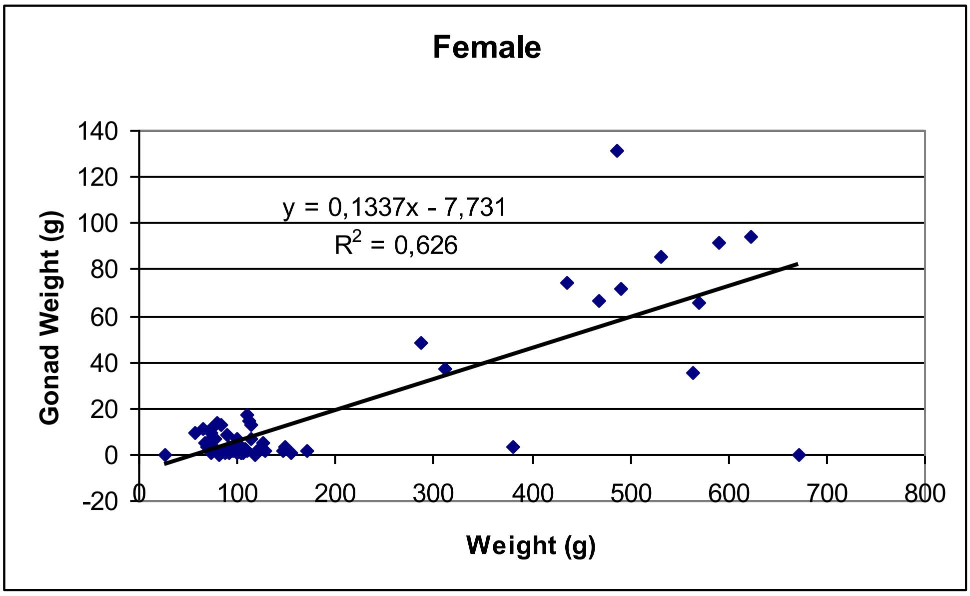

Figure 3. Total weight and gonad weight relationship in females

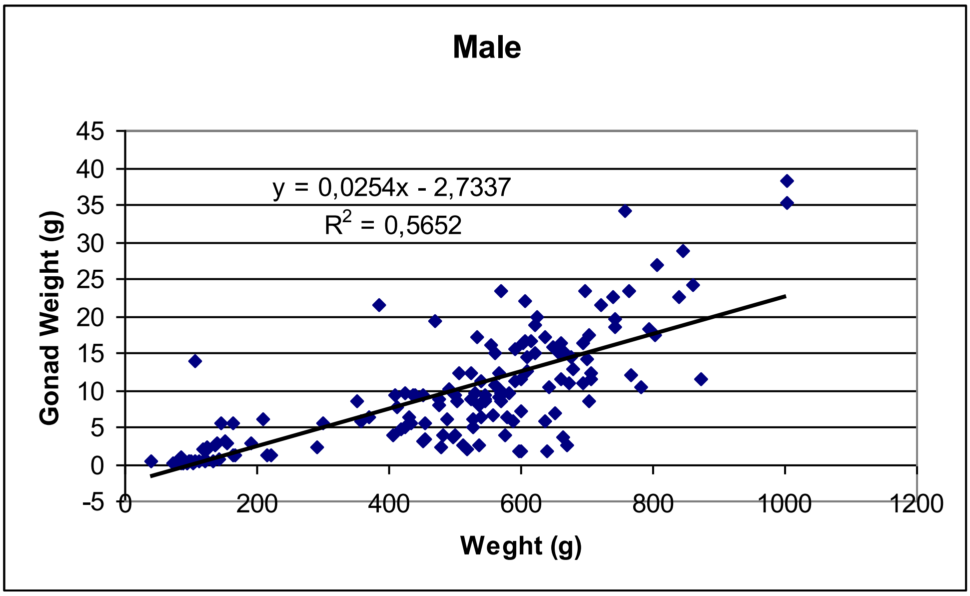

Figure 4. Total weight and gonad weight relationship in males

Total weight with egg number

The regression formula in total weight with egg number was determined as y=30.287X–729.46 (R^2=0.81) and shown in figure 5.

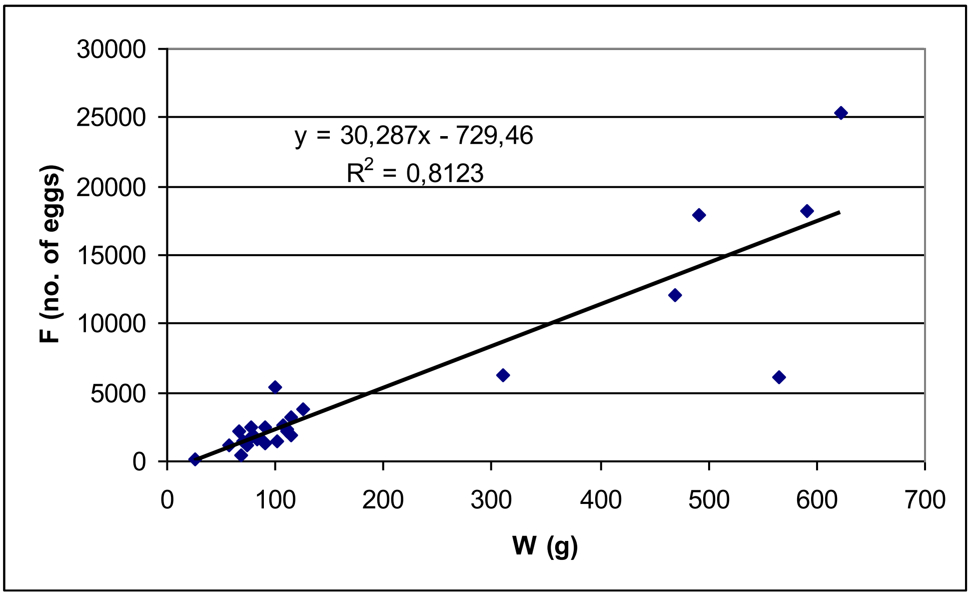

Figure 5. Total weight - egg number relationship

Total length with egg number

The regression formula of total length-egg number relationship was found as y=437.96X–11277 (R^2=0.70) and shown in figure 6.

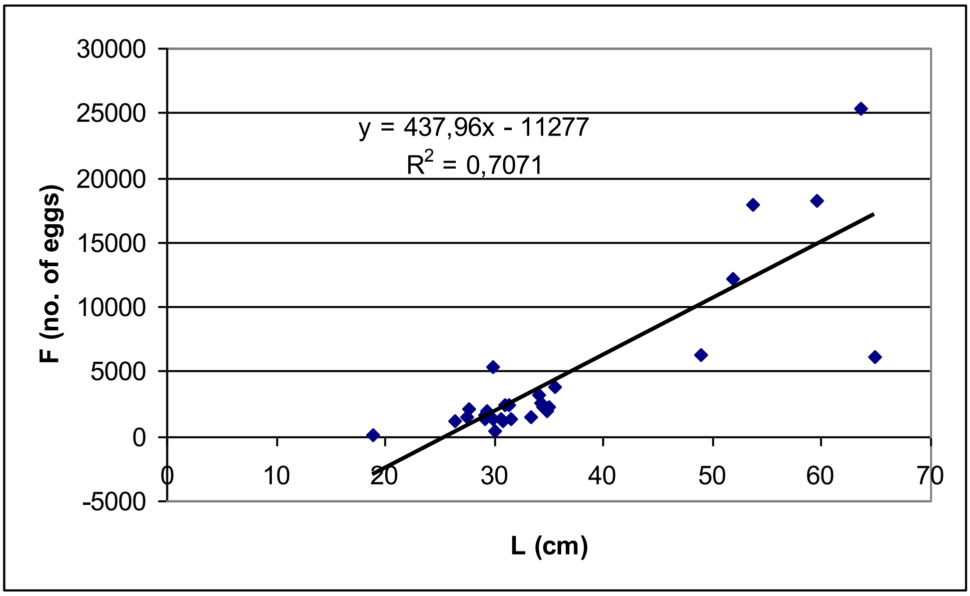

Figure 6. Total length-egg number relationship

Discussion

Total 249 samples were gathered between May-October 2005 from the Atatürk Dam Lake, ranging between 2 and 9 age group, 154 of 217 of total samples (%70.10) were male, whereas 63 of 217 of total samples (%28.9) were female in sexuality determination. Age groups of *M. mastacembelus* living in the Tigris River varied between 1 to 9 ages, and 52.94 % of total samples were male, whereas 47.06 % of total 187 samples were female in sexuality determination (Eroğlu, 2004). In relevant research on *M. mastacembelus* in the Sultansuyu Brook, Beyler Brook and Karakaya Dam Lake consisted of 66 specimens, the age groups ranged from 1 to 5 females, and 1 to 7 in males, In addition, %28.77, and %56.19, and 13.63 % were female, and male, and juvenile of the total specimens, respectively (Kılıç, 2002). Males were dominant in all three mentioned study. This result could be explained that females may be renouncing the spawning areas after the spermiation immediately, and though males have gradual spawning period, they are further along in their fishing areas than the females (Nikalsky, 1969).

Total lengths of total 249 specimens changed between 18.9 to 74.1 cm, and total weights of samples varied between 26.4 to 1001.9 gr. It was reported as 19.5 to 70 cm, and 19.5 to 730 g by Kılıç (2002). This result indicated that population of the Atatürk Dam Lake were greater than the other localities.

In this study, estimated values of gonadosomatic index (GSI) of specimens are given in Figure 2 and 3. In the same species, the GSI values of females and males were 0.06 – 3.65 and 0.01 – 21.4, in Karakaya Dam Lake, respectively (Eroğlu, 2004). The highest values showed that the spawning season of *M. mastacembelus* in both study occurred in June.

The regression formulas of total weight and gonad weight relationship in females and males are given in figure 4 and 5.

The regression formulas for females in Karakaya Dam Lake were estimated as y = 0.0013 X + 1.4182 (r=0.18 (Eroğlu, 2004). These results were lower than the Atatürk Dam Lake population. This situation indicated that they have greater adaptation in Atatürk Dam Lake.

The regression formula in total weight with egg number was presented in figure 6. The same equation in the Karakaya Dam Lake was reported as y=27.048 X + 2079.1 (r=0.78) (Eroğlu, 2004). This result was higher in the Atatürk Dam Lake specimens (R^2=0.8123) again when compared with the Karakaya Dam Lake.

The regression formula of total lenght-egg number relationship was showed in figure 7. The same feature in the Karakaya Dam Lake was found as y=437.96X–11277 (R^2=0.70). Similarly, these findings was higher in the Atatürk Dam Lake specimens (R^2=0.7071) again.

In conclusion, owing to the Karakaya Dam Lake was being constructed nearer to the downstream; the Atatürk Dam Lake has lower altitude. Because of the lower altitude, and existing more southern latitudes, could be bring about to higher temperature and more suitable ecologic condition to the Atatürk Dam Lake. It was reported that variations in fish growth in length and weight can be explained as an adaptive response to different environmental conditions such as temperature, and the quantity and quality of food (Nikolsky, 1963). In the light of our findings, we can say that the Atatürk Dam Lake has suitable habitat to growth and reproduction for *M. mastacembelus*.

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CONSERVATION OF BIODIVERSITY IN AGRICULTURAL LANDSCAPE BY SUSTAINABLE LAND USE IN CONDITIONS OF SW SLOVAKIA

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Man is a significant factor that effects biodiversity. Through his activity a new type of landscape has been created since the Neolithic period which continues to change. Anthropogenic changes are often irreversible, for instance forests changed into xerothermic shrubbery (matorrals etc.) in the Mediterranean region or anthropic enlargement of steppes in the lowland areas of the Carpathian Basin. Biological diversity changes how the environment is used. Man, beginning with the first farmer (at the transition from a hunter-gatherer to a grower), had to cope with spontaneous vegetation of the agricultual landscape – including weeds. Conservation of rare and endangered species and habitats is one of the principles of sustainable land use.

"Wanted" species

There are series of Central European works published addressing the problem of assessment and conservation of spontaneous vegetation in the Central European agricultural landscape (Streďanský, Supuka, Šipošová 1997, Anderlik-Wesinger 2000, Nentwig ed. 2000, Holec, Tyšer, Soukup 2003, Fehér, Košťál, Končeková 2005, Pinke, Pál 2005 etc.) that are focused on

- dispersed wood and grassland patches in agriculrural landscape,
- conservation of rare and endangered arable land and meadow weeds,
- protection and restoration of accompanying vegetation – outfields, balks, etc.,
- endangered and vulnerable weeds „escaped" form farmlands to semi-natural or natural habitats.

The fourth group is the one less known. The non-arable herbaceous habitats in agricultural landscape (and also out of it) are periodically disturbed by human manipulation and therefore can also absorb the R-strategy species from the neighbouring arable lands. Some weed species can be established there as casuals or permanent species. The occurrence of rare weeds has been reported mainly in xerothermic grasslands on sands, loess and limestone or dolomites (Tab. 1).

Tab. 1. Selected rare and endangered weed species observed in semi-natural herbaceous habitats with different levels of ruderalisation in SW Slovakia (Fehér, Košťál, Končeková 2005).

Weed species	Threat and rareness category	Farmland	*Ruderalised grasslands*
Adonis aestivalis L.	LR	cereals	subxerothermic ruderalised roads-side
Adonis flammea Jacq.	CRr	cereals	xerothermic herbaceous habitats
Agrostemma githago L.	CRr	cereals	casual road-side occurrence, herb-boundaries
Bupleurum rotundifolium L.	*Enr*	vineyards, cereals, abandoned fields etc.	ruderalised spots in *Festucion valsiacae* associations
Calcitrapa solstitialis (L.) Lam.	*CRr*	abandoned fields, vineyards	ruderalised grasslands
Carthamnus lanatus L.	*ENr*	vineyards, abandoned fields	ruderalised grasslands
Cyanus segetum Hill	*LR*	cereals etc.	casual road-side species
Linaria arvensis (L.) Desf.	EX	arable land weed	urban area
Nigella arvensis L.	VU	arable land weed	disturbed xerothermic grasslands
Polycnemum arvense L.		arable land weed	uncovered plots in xerothermic grasslands

Abbreviations: EX – extinct, CR – critically endangered, EN – endangered, VU – vulnerable, LR – lower risk, r – rare.

The observed, extensively used semi-ruderal herbaceous habitats can provide convenient conditions for rare weed species suppressed in the arable land. We can propose implementation of non-intensive technologies (e.g. organic farming) as effective conservation method for maintaining rare species in agricultural landscape.

More important could be conservation of rare weeds in arable land conditions (in fields) by using following methods (c.f. Pinke, Pál 2005):

- protected (herbicide-free) field margins (the biodiversity in field periphery is higher because of less effective agrotechnology, more compact soil, root competition of trees, different light intensity, variable temperature and water balance)

- sawing of weed seeds (danger of genetical side-effects!),
- extensive arable land use (lower fertilizer doses, no herbicides, usually lower crop density, casual mechanical weed control etc.),
- segetal flora reserves (shallow animal-powered plough, hand-sawing of traditional grain varieties, no use of agrochemicals, late hand-harvest, grazing of stubbles and fallows, wind-cleaning of grains, use of own saw-seeds),
- organic farming,
- fallowing, set-aside (artificial decrease of high agricultural production and improving of ecological conditions of soils),
- vineyard biodiversity protection (focused mainly on geophytes by no soil tillage during winter).

Red list of rare and threatened weed species of Slovakia is under preparation. From almost 350 plant species which can be classified as arable weeds in the neighbouring Czech Republic, 98 species are endangered or already extinct. The most important factors, which influenced decrease of their abundance during the last decades, were changes in farming systems and crop technologies, together with use of herbicides, intensive fertilization, improved agrotechnics and crop seed cleaning (Holoec, Tyšer, Soukup 2003).

“Unwanted” species

The potential negative effects of weeds (very often aliens introduced from other countries) in agricultural landscape are: competition with crops, the increase of protection costs, reduction in crop and animal quality, decreased crop production, changes in water balance, human health, decreased land value, reduced crop variety and aesthetic value. Invasive species also effect species genetics (e.g. hybridization), population dynamics (e.g. abundance), biocoenoses (e.g. species richness) and ecosystems (e.g. disturbance frequency). However, losses to natural ecosystems are difficult to quantify (Booth, Murphy, Swanton 2003). The list of expansive weeds of the Czech Republic and Slovakia includes 40 species (Jehlík ed. 1998), the Ministry of Agriculture of the Slovak Republic consider as dangerous 12 expansive weed species (*Acroptilon repens, Abutilon theophrasti, Alopecurus myosuroides, Amaranthus spp.* except for *A. retroflexus* and *A. hybridus, Ambrosia artemisiifolia, Ambrosia trifida, Cenchrus incertus, Iva xanthiifolia, Lactuca tatarica, Setaria faberi, Sisymbrium volgense* and *Sorghum halapense*, MASR 1998). The Slovak legislation gives 7 invasive plant species (*Heracleum mantegazzianum, Fallopia japonica, Fallopia x bohemica, Fallopia sachalinensis, Impatiens glandulifera, Solidago canadensis* and *Solidago gigantea* (Country Act Nr. 24/2003) but there must be more of them (c.f. Fehér, Končeková 2005a).
The clustering of functional groups of neophytes (aliens introduced after 1492) may support the development of their control methods. In accordance with the canonical correspondence analysis (Canoco ver. 4,5 and CanoDraw for Windows ver. 4) synanthropic plant communities are formed of aliens *Abutilon theophrasti, Ambrosia artemisiifolia, Amaranthus powelli, Artemisia annua, Cannabis ruderalis, Conyza canadensis, Helianthus annus, Iva xanthiifolia, Panicum capillare, P. dichotomiflorum, P. milaceum, Rumex patientia* and *Sorghum halepense.* The group of invasive plant species of natural and semi-natural plant communities is formed of *Aster lanceolatus, A. novi-belgii, Bidens frondosa, Fallopia japonica, F.* x *bohemica, Impatiens glandulifera, I. parviflora, Solidago canadensis* and *Stenactis annua.* The species *Conyza canadensis* and *Solidago gigantea* are on the boundary between the two groups and can be found both in synanthropic and natural and/or semi-natural communities (c.f. Fehér, Končeková 2005b).

Some neophytes of the Danube and Small Danube floodplain forests (for instance *Impatiens glandulifera, I. parviflora*) practically do not penetrate into the agricultural (productive) landscape. While evaluating the occurrence of non-native plant species along the ecological gradient we have found that the neophyte *Stenactis annua* grows equally successfully in riparian stands as in ruderal sites in agricultural landscape. Similarly the species *Iva xanthiifolia* occurs except field cultures also in riparian tall-herb nitrophilous phytocoenoses. We have also recorded a penetration of populations of species *Solidago gigantea* and less often also of the species *Aster novi-belgii* agg. from the alluvial Danubian meadows to grasslands of agricultural landscape. The alliance *Atriplecion nitentis* (class *Stellarietea mediae*, order *Sisymbrietalia*) includes typical plant communities that are the source of expansive neophytes propagules in agricultural landscape.

To quantify the expansive weeds we selected an „amoeba“ type indicator (ray diagram, cyclogram, radar-diagram). Changes in the irregular amoeba-shape line indicate changes in the agro-ecosystem biodiversity (each x axis = abundance of one species). It helps to evaluate ecological conditions of the environment (ecological gradient) and the effect of man on the agricultural landscape. Their indicative value reveals the following phenomena (Fehér, Končeková 2005b):

a) ecological and environmental:

- expansive weeds tend to reduce biodiversity, unify phytocoenoses and zoocoenoses (create mono-dominat communities)
- reduce ecosystem stability by breaking biota functional structure and relationships,
- draw off nutrients (especially N) and water,
- create sources of diaspores for further expansions and/or invasions.

b) socio-economic:

- reduce the yields of cultural crops (quantitative economic losses),
- by their presence they deteriorate some cultural plants (qualitative economic losses),
- many species are allergenic.

c) other:

- they often indicate the presence of natural and/or artificial corridors of propagation, and/or closeness of foreign species propagules source (water currents, roads and railways, etc.).

It is advisable to use for ecosozological biodiversity evaluation with expansive weeds indicators of the „amoeba“ type that include rare, protected and endangered species of synanthropic plants. Additionally the proportion of the number of invasive and expansive species with biosozologically valuable species should be considered. The weak side of such an indicator is the fact that it takes the abundance of individual species into account only semi-quantitatively (in case the number of sites is shown, the information about the size of a population is missing). They may also be quantified by the rate of infection of the given area.

Regional aspects of biodiversity changes in agricultural landscape (case studies)

1. Alluvial lowland: Žitný ostrov region

The land use in this region is very intensive. Valuable natural and semi-natural habitats and phytocoenoses can be found in the alluvial forests of the Danube and Small Danube rivers (partly protected), in small-size residual wetlands and alkali habitats (so called "slanisko" habitats) and in xerothermic and semi-xerothermic semi-natural grasslands (Fehér 2003a). Several red list species have been observed here, e.g. *Apium repens, Blackstonia acumnata, Nymphoides peltata, Senecio paludosus, Tithymalus lucidus, Trapa natans, Viola elatior* etc. (c.f. Čeřovský et al. 1999). There are some remarkable thermophytic weeds in arable land, e.g. *Heliotropium europeum, Hibiscus trionum* etc. Crops and the "traditional" weed flora are endangered by expansion of alien neophytes, e.g. *Amaranthus powellii, A. blitoides, Ambrosia artemisiifolia, Artemisia annua, Cannabis ruderalis, Chenopodium pumilio, Stenactis annua, Iva xanthiifolia, Kochia scoparia* etc. (c.f. Jehlík ed. 1998). Natural and semi-natural plant communities are invaded by *Aster novi-belgii agg., Fallopia* x *bohemica, Impatins glandulifera, I. parviflora, Lycium barbarum, Solidago spp.* etc. (Fehér 2003a). The diversification of landscape pattern is expected in the future.

2. Hilly region on loess: Žitava river basin

The land use is intensive, the valuable species are very rare, occuring mainly in the xerothermic grasslands (e.g. *Adonis vernalis, Artemisia pontica, Echium russicum, Lathyrus nissolia subsp. pubescens, Nepeta pannonica, Orchis morio, Phlomis tuberosa, Rosa gallica* etc.). These Pannonic loess grasslands are threatened by land use change (ploughing), water regime change, fertilization, natural succession, biological invasions and clay exploitation. A long-term sustainable land use has been proposed including removal of expanding trees and shrubs, mowing, grazing and regulated collecting or local burning of dry hay (Fehér, Končeková, Balážová 2004).

3. Sand dunes: Borská nížina lowland

Part of this region has been planted with pine trees, the rest is used for agriculture. In agricultural landscape many rare plant species can be recorded: *Dianthus serotinus, D. superbus, Gypsophila paniculata, Helichrysum arenarium* etc. (Fehér 2003b). In the past there were many rare segetal and ruderal species, e.g. *Adonis flammea, Agrostemma githago, Apium repens, Bromus secalinus, Linaria arvensis*, but nowdays you can find only few valuable weeds there, e.g. *Polycarpon tertraphyllum* and *Reseda phyteuma* (c.f. Čeřovský ed. 1999). Along ecological corridors and on abandoned fields invasive plants can be observed (mainly from the genera *Aster, Solidago* or *Conyza*), in human-close habitats *Fallopia* x *bohemica* and *Lycium barbarum*, in herb-layer of pine forests or in their clearings *Phytolacca americana*, in wetter habitats *Imptiens parviflora*. *Ambrosia artemisiifolia* expands northwards in the region but also other new-coming weeds can be found (e.g. *Amarnthus albus, Artemisia scoparia* etc.). In the Borská nížina region there is a territorial protection of rare species, but management of invasive species is insufficient (Fehér 2003b). The sand dunes vegetation is threatened by bad agricultural practices, afforestation, sand excavation, recreation, industrial park establishment, fires etc. (Kalivodová et al. 2002).

4. Fragments of alkali habitats: Danubian lowland

In the second half of the 20th century as a result of the changes in management, many field observations already gave only degradation of halophytous associations and the decline of these species on those sites (for instance: ploughing away, fertilization, hydro-amelioration, attemps of intense agricultural utilisation, afforestation, access grazing, straw storage, ruderalisation, waste, earth works, recultivation, trucking out excrements, jubbing out divet for gardening purposes, weed invasion etc.). The alkali habitats of Slovakia had a relatively high biodiversity, which was well preserved in some localities (e.g. Močenok). Some rare halophytic plants penetrate into agricultural stands and poplar plantations, e.g. *Camphorosma annua, Scorzonera parviflora, Artemisia santoncum subsp. patens, Plantago tenuiflora* etc. in Veľké Kosihy (Fehér 2003a) and others infiltrate the village/urban areas, e.g. Tvrdošovce (Fehér, 2000, ined.). Long-time survival of fragmentary, but valuable alkali habitats in Slovakia is questionable. Introduction of grazing by sheep, no water balance changes aand no fertilization are expected in these areas.

Summarized principles of biodiversity management in agricultural landscape

The importance of biodiversity management in agricultural landscape of Central Europe is growing (Sabo, Šubová, Kováč et al. 1999, Ángyán, Tardy, Vajnáné-Madarassy eds. 2003, etc.) and the landscape ecological aspects of sustainable land use in Slovakia have been studied in detail (Izakovičová, Miklós, Drdoš 1997, Hrnčiarová 2001, Demo, Látečka eds. 2004 etc.). It is not a side-activity but a healthy production supporting management practice and a pillar of the agroecosystem stability. The most important headlines of biodiversity management in conditions of intensified or disturbed agricultural landscape of SW Slovakia are:

- high proportion of natural or semi-natural vegetation (forests, grasslands etc.),
- high structural diversity (mosaics, pattern),
- low chemicals in-put (herbicides, pesticides etc.),
- low nutrients content in soils (mainly N and P),
- slow changes in landscape.

A sustainable and diverse agricultural landscape can be supported by many practices:

1. *Extensive and/or traditional land use.*

Traditional landscape structure (pattern) is needed with valuable bio-centres (woods, ponds, managed grasslands etc.) and bio-corridors (tree-raws, hedges, brooks etc.). Small land strips, traditional tillage, ecologically designed crop rotations, cultivation of old crop species and varieties (they have been resulted by a long-term selection, adopting to the local environmental conditions) and fallowing are needed. Vineyard and orchards can be included with mechanical weed regulation and anti-erosion measures (grass under-growth etc.). Priorities in animal breeding are: traditional breeds, nutrients feed-back to plant production (organic materials, N and P, etc.) and extensive breeding.

2. *Maintenance of meadows and pastures.*
- On loess soils: extensive grazing, removal of expanding woods and shrubs, no fertilization;
- on sandy soil: sensitive ecosystem with low production, extensive grazing (with low number of animals), no afforestation;
- on slope (or karst) steppes: grazing by sheep, max. 1 mowing per year, no fertilization, tree seedlings removal;
- in wetlands: water balance control, mowing (grazing is not very effective), management of invasive plants.

3. *Permaculture and organic farming.*

Ecological farming protects the good soil conditions, increases the biodversity (includng spontaneous flora, fauna and microorganisms), does not pollute the environment and produces high-quality bio-products.

4. *Aquaculture (fish etc.), apiculture, reed cultivation, energy plants etc.*

Additional, expected actvities in a sustainable agricultural landscape. Energy plants (*Salix viminalis* etc.) provides biomass for energy production from renewable resources. Energy plants production is under study at the Slovak Agricultural University (experimental plantations).

Planning sustainable agricultural systems under special conditions has been prepared for Slovakia, including systems for the areas endangered by erosion, around water reservoirs, influenced by the ground water table etc. (Demo, Látečka eds. 2004). One of the most important ecosystem-oriented strategies is organic farming. Slovakia has a national regulation for organic farming (Country Act Nr. 421/2004). The organic agriculture is operated and/or supported by several organizations and institutes, e.g. farmers associations Ekotrend and Natural Alimentaria, the Central Control and Testing Institute in Agriculture (CCTIA/UKSUP), the certifying body Naturalis etc. The Institute for Scienetific and Technical Informations for Agriculture (ISTIA/UVTIP) provides advisory services. The crop production produces mainly cereals and forage crops, the organic animal husbandry is focused on cattle and sheep breeding. Unfortunately there is a considerable fluctuation in number of organic farms and there are many problems to be solved in the future: the farms need a more effective system of governmental support, a high level advisory network and a functioning market, as well (Tab. 2).

Tab. 2. Evaluation of organic farming in Slovakia (Fehér, Venglovský 2006).

Strong points	Weak points	Needs for further research and cooperation
	Organic farming in general	
- good legal background (Country Act 421/2004) - no considerable scandals are known	- no effective support and advisory organisations - weak bio-product market - fluctuating number of organic farms	- higher governmental support - create more effective advisory system - improve the bio-product market
	Organic plant protection	
- use of effective biological control agents - international projects	- no complex monitoring and regional/national survey - minimum information in media	- deal with more information - better monitoring system
	Organic seed and propagation material	
- regulations applied - organic seed database	- low level of organic seed production - few organic seed companies - not enough organic seed on the market	- higher seed production - more research projects
	Organic animal husbandry	
- registered local and imported breed - wide-spread organic grasslands	- no effective governmental support - animal breeding not very profitable	- effective governmental support - improve market conditions
	Organic agrotechnology	
- effective crop rotation - locally: good soil tillage practices - projects in process	- no new machinery - no effective support	- more governmental support - implementation of research results into practice

Tab. 2. Cont.

Organic weed management		
- relatively high biodiversity in agricultural landscape including rare weed species - long-term projects	- expanding alien weeds - no effective measures against some perennial weeds	- create central monitoring and weed database system - more information about rare weed species management
Organic soil fertility improvement		
- functioning national soil monitoring system - central database (GIS based)	- soil erosion, acidification, compaction - institutional problems (the research is loosing its independence)	- more research projects with practical out-put - independent research institute

To maintain a high agrobiodiversity in the future, Slovakia will need:

- biodiversity montoring in the agricultural landscape (indicators for biodiversity and substainable agriculture, c.f. Büchs ed. 2003, Fehér, Končeková 2005b, Jørgensen, Costanza, Xu eds. 2005, etc.),
- more local varieties in agricultural production and breeding (pest resistent, low temperature resistent etc.),
- considering the global changes (global warming etc.),
- include alternative plant production (e.g. energy plants),
- no GMO (danger of genetical erosion).

Conclusions

Anthropogenic changes in agricultural landscape are very often irreversible and biological diversity changes how the land is used. The phytodiversity of agricultural landscape is consisted of cultivated plants (field crops, fruit trees etc.) and spontaneous vegetation (field and meadow weeds, abandoned fields, balks, riparian and road-side habitats etc.). The rare and endangered local cultivated species are preserved in field conditions or in gene banks (the Slovak Agricultural University in Nitra maintains in situ and ex situ gene banks of selected traditional species and cultivars of plants). The spontaneous vegetation also contains rare, endangered or vulnerable plant species and/or archeophytocoenoses. These species and their communities are threatened by intensive land use (mechanical regulation, chemical treatments etc.) and expansion of invasive plants. The occurrence of invasive plant species and expansive weeds is not desirable in the agricultural landscape, that is why it is necessary to monitor them systematically and evaluate those findings. For the time being a universal indicator for their evaluation has not been created. We can recommend for this purpose a universal graph of „amoeba“-type, including the flexibility to change species composition, which complies with the basic criteria for development of sustainable landscape indicators.

It is easy to use and cheap. Biological indicators can be combined with economic evaluation. Management strategies and control methods of sustainable land use have been evaluated and proposed for local conditions in SW Slovakia (extensive and/or traditional land use, maintenance of meadows and pastures, permaculture and organic farming, aquaculture, apiculture, alternative plantations).

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SOME ECOLOGICAL CHARACTERISTICS OF *AGROPYRON TRICHOPHORUM* IN SUMMER RANGELANDS IN THE NORTH OF IRAN(MAZANDARAN)

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Agropyron trichophorum is one of the perrennial species of Gramineae family that found in summer rangelands in the north of Iran –Mazandaran. The objective of this research was to study the relationships between some invironmental factors and distribution of *Agropyron trichophorum* in order to find the most effective factors in the separation of the vegetation type in this rangelands.Sampling of soil and vegetation in the plant units were performed with randomized –systematic method. Soil samples were taken in 0-30 and 30-60 centimeters depths in each quadrat. Multivariate techniques CCA (Canonical Correspondence Analysis), were used to analyse the collected data. The results showed that the vegetation distribution of *Agropyron trichophorum* was mainly related to soil texture, elevation, slope and animal grazing.

Key words: *Ecological characteristics, Agropyron trichophorum, CCA*

1. Introduction:

In order to better understand and manage rangeland ecosystems, It is important to study the relationships between environmental factors and plants in these ecosystems. Topography affects soil and climate, in addition to affecting temprature and evapotranspiration, makes deeper soil and higher content of organic matter, that result in luxurian vegetation in the northern aspects in comparison to the southern ones(Jeenny, 1980). Effects of environmental factors on plant cammunities have been the subject of many ecological studies in recent years. Leonard et.al. (1984) found that vegetation cover had strong relationship with temperature and soil moisture . other soil chracteristics, directly or indirectly, influence the two mentioned parameters(Jafari and et.al., 2004). Study of rangelands production in Kavir-e-phino, located in the Hormozgan province, showed that some variables, such as slope, aspect, saturation moisture percentage and soil depth had the most effective role in the yield of plant species (zare, 1998). Makarenkov and legendre (2002), investigated that effects of water content and reflection of soil radiation on the vegetation cover percentage of Calmagrostis epigejos and Corynephrous canscens using multivariate analysis such as CCA, RDA and non-linear regression, they found that Calmagrostis epigejos is the indicator of wet sites while Corynephrous canscens is indicator of dry sites. To determining which factors control the presence, number and relative abundance and plant species remains a central goal in ecology. The main purpose of these research was to study the relationship between topographic, edaphic factors and animal grazing with distribution of *Agropyron trichophorum,* to determine the most strong factors affecting the separation of *Agropyron trichophorum.* Understanding relationships between ecological variables in a given ecosystem helps us to apply these. Findings in management, reclamation of similar regions.

2. Materials and Methods:

2.1. study area

Ghahardangeh Rangelands are located in the northern slopes of the Alborz mountainous regions of the Mazandaran province in North of Iran. The maximum elevation of the region is 4010meter above sea level, in Chaharno mountains and the minimum elevation is 1200m asl in the Allicola. The climate varies from cold to moderate. Average annual precipitation of the study area ranges from 790.8mm. minimumpercipitation is recorded in july and may(Dianati, 1999), meteorological data were calculated for a 10 –year period.

2.2. Data collection

Based on field survey vegetation were identified. For this study were selected four vegetation units with names: *Agropyron trichophorum – poa paratensis*(Ag.-Po.*),* *Agropyron trichophorum- Dactylis glomerata*(Ag.-Da.*), Bromus tectorum- Stachys byzantina-Agropyron trichophorum*(Br.-St.-Ag.)*, Stachys byzantina-Agropyron trichophorum*(St.-Ag.*)*.In each vegetation units, soil and plant attributes were described within quadrats located along three transects. Quadrats size was determined for each vegetation unit using the minimal area method. Sampling method was randomaized systematic. Soil sample were taken between 0-3- and 30-60 cm layers. Measured soil factors included texture (determined by Bouyoucos hydrometer), organic carbon (OC) determined using walkley and black, 1979), PH determined by PH meter, nitrogen(N) determined by using kejeltek analyzer and animal grazing determined by hight-weight method(Mesdaghi, 1994). In quadrat locations, elevation and slope(using GPS) recorded. All sampling sites were located in the northren aspect. Finally, data were analysed by Canonical Correspondance Analysis(CCA).

3. Results

CCA is a kind of technique that shows non-linear relations between species with environmental factors and chooses the best weights for environmental variables. According to table 1 and 2, first axis(eigenvalue = 0.023). correlation between the first axis and species-environmental variables was 1.00 and monte-carlo permutation test for the first axis was highly significant (P=0.01). the second axis (eigenvalue=0.006). Sum of canonical eigenvalues 0.031. correlation between the second axis and species- environmental variables was 1.00. In addition, the monte-carlo test for the second axis was highly significant(P=0.001). Cumulative percentage variance between the first axis and species- environmental relation was 73.9%. Cumulative percentage variance between species- environmental relation and the second axis was 94%.

Table 1. Canonical Correspondence Analysis for environmental data.

	Axis 1	Axis 2	Axis 3
Eigenvalue	0.023	0.006	0.002
Vegetation units- environment correlations	1.000	1.000	1.000
Cumulative percentage variance of vegetation unit data	73.90	94.0	100.0
Cumulative percentage variance of vegetation units- environment relation	73.90	94.0	100.0

Table 2. Monte Carlo test for vegetation units-environmental correlation.

Axis	Vegetation units-environment correlation	Mean	Minimum	Maximum	P
1	0.96	0.895	0.92	0.97	0.01
2	0.98	0.945	0.90	0.99	0.01
3	0.91	0.90	0.85	0.95	0.01

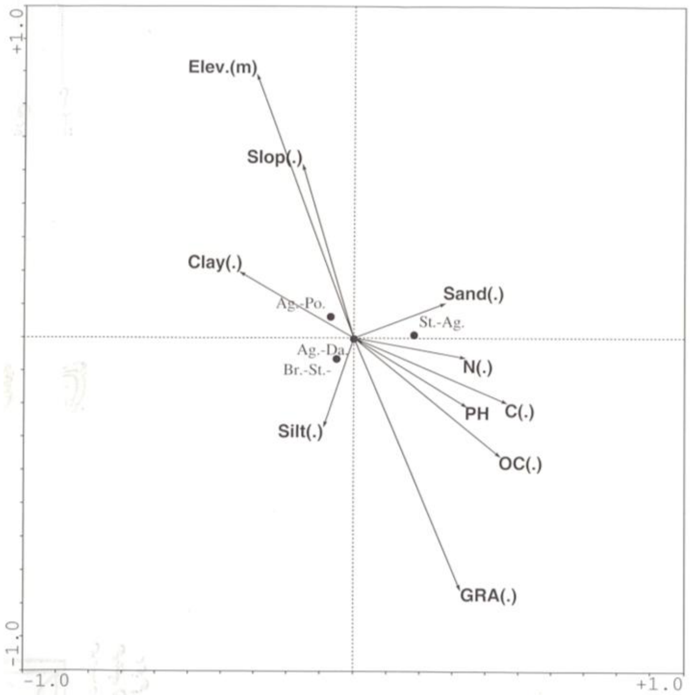

Fig. 1. CCA diagram of the environmental data. for vegetation unites and variables abbrevations, see Appendix A .

Figure 1. shows the relationship between site and environmental factors(edaphical and topography factors). Indicator environpnmental factors of the first and second axes in vegetation unit of *Agropyron trichophorum* has a direct relationship with elevation and slope and an inverse relationship with animal grazing.

4. Conclusion

The results showed that in the study area, among different ecological factors, the distribution of *Agropyron trichophorum* was correlated with topography such as, elevation and slope, soil texture and animal grazing factors. More dense of *Agropyron trichophorum* was in the high elevation, steep terrain and light to moderate animal grazing. Because of carbon , organic mater and nitrogen of soil min the intensity grazing area, *Stachys byzantina* was dominant species an *Agropyron trichophorum* sub-dominant, If intensity grazing to be continue, *Agropyron trichophorum* will be omitted. In the study area *Agropyron trichophorum* was dominant in the light to moderate grazing with the more than 20% slope and clay-sand texture and elevation >2000 m, and *Dactylis glomerata* combinated unit vegetation with *Agropyron trichophorum.* Aghajanlou and et.al., (1999), Dianati, (1999) and Vahedy, (2003) showed strong relationships between vegetation pattern and topography factor., al so land form contorols distribution of rangeland plant species.

Appendix A

Abbrevations of the vegetation unites and environmental factors.

Agropyron trichophorum – poa paratensis	(Ag.-Po.)
Agropyron trichophorum- Dactylis glomerata	(Ag.-Da.)
Bromus tectorum- Stachys byzantina- Agropyron trichophorum	(Br.-St.-Ag.)
Stachys byzantina-Agropyron trichophorum	(St.-Ag.)
Elevation(m)	Elev
Slope	slop
Clay	clay
Silt	silt
Animal Grazing	GRA
Nitrogen	N
Carbon	C
Organic Carbon	OC

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THE PHYLOGENETIC AND BIOGEOGRAPHIC ANALYSIS OF *HERACLEUM* L. (UMBELLIFERAE) OBSERVED FROM ITS DNA SEQUENCE DATA

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ITS sequences of ribosomal DNA may provide a valuable source of intraspecific markers for population-level studies in *Apiaceae*. These regions appear well suited to comparisons among related species and/or closely related genera. We attempt to formulate more precise hypotheses about relationships of *Heracleum* L. species within Apioideae using evidence derived from ITS sequences. Of special ecological and economical interest are those species, which have been introduced by humans and rapidly spread in their new environment. Some invasive species threaten biodiversity in natural habitats by displacement of native biota through competition, hybridization or predation and the effects invasive species have are not only ecological but also economic. These plants could not die in the year that they were created; any mortality within the first year was already considered in the offspring values.

The northern hemispherical genus *Heracleum* has its center of diversity in the mountain regions of Asia (SW, Middle, The Caucasus), Europe (W, Central, SW, S, SE, E), and Africa (N, NW). Our *Heracleum* species share distribution areas approximately from 1000 m to ≥2000 m height levels. Habitat preferences of these species differ from moist valley margins to high mountinous areas.

We obtained phylogenetic trees using ITS DNA sequence datas of *Heracleum* species.

H. pastinacifolium Koch., the most advanced species of all *Heracleum* genus, was collected from North west Anatolia at 2000 m height. This species is perennial and not aromatic with a collar of broad flat fibres. It preferes rockier habitats than the other species, and extremelly variable in indumentum. This species is variable complex and allopatrick and has subspecies from North-east Anatolia up to 3500 m height levels.

These results will provide the resolution necessary that will lead to a through understanding of the historical relationships within this large and taxonomically complex subfamily of Apiaceae. The phylogenies infered using these molecular datas and their shared life history reflect the species phylogeny.

Key Words: *Apiaceae;Cladistic relationships;Heracleum;ITS sequences;Molecular phylogeny;Nuclear ribosomal DNA*

Introduction

Apiacea (Umbelliferae) is one of the best known families of flowering plants, and include many family edible plants (e. g., carrot, parnsnips, parsley, celery, fennel, dill, anise, cumin), because of its characteristic inflorescences and fruits and the distinctive chemistry, reflected in odor, flavors an deven toxicity of many of its members.

This family is very large and taxonomically complex. Fruits of Apioideae exhibit extreme variation in over all form and detail, these structures have been relied up on extensively in various classifications at all taxonomic levels. Characters of the fruit include its general shape, degree of compression, the presence or absence of wings, ridges, hairs or spines, the form and arrangement of spines and ridges. However, dispite this wealth of information, there has been little speculation of phylogenetic relationships within the subfamily.

This genus is perennial or monocarpic, tall or dwarf herbs, variable infacies often aromatic plants. Sepals are minute. Petals are white or sometimes pale greenish (1). Fruits of *Heracleum* L. genus are spiny or small glabrous ones. The fruit compressed laterally at right angels to the comissural plane, Each mericarp commonly bears five primary, longitudional ribs or ridges that contain the vascular bundles: three dorsal and two marginal (or lateral), with the ribs filiform or awinged.

Many members of this genus, including many of the sub-species in this species, contain furanocoumarins. These have carcinogenic, mutagenic and phototoxic properties. Turkey is an acknowledged centre of biodiversity in the middle-sized Umbelliferae genus *Heracleum*, and most probably, the main area of its origin and primary diversification (1). This suggests that the genus is worthy of furter studies in Turkey. We undertook to formulate more precise hypotheses about diverse species comprising *Heracleum* genus. (Umbelliferae). This goal is especially important for Apioideae, which has served as an important system in many evolutionary studies.

Nuclear ribosomal RNA genes provide markers for retrieving phylogeny at a variety of taxonomic levels (2). The nuclear ribosomal RNA genes of higher plants are organized in long, tandem repeating units (3). Each repeat unit consists of a single transcribed region for the 18 S, 5.8 S and 28 S ribosomal RNA' s, two small internal transcribed spacers (ITS1 and ITS2) and a large external nontranscribed intergenic spacer (IGS) (4; 5).

ITS region of nuclear ribosomal DNA (rDNA) contains an evolutionarily highly conserved sequences and suitable variation within sequences. This region was appeared to be useful for phylogenetic analysis of angiosperms. ITS plays a rol in ribosomal maturation and processing of small and large-subunit rRNA's (6; 7; 8). The evolutionary origin of the ITS is considered to be intron-like structure (9).

The entire nrDNA repeat unit is present in up to many thousands of copies arranged in tandem repeats at a chromosomal locus or at multiple loci. This high copy number promotes detection, amplification, cloning and sequencing of nrDNA. The small size of the ITS region and the presence of highly conserved sequences flanking ITS make this region easy to amplify, even from herbarium material. The gene family under goes rapid concerted evolution via unequel cross-over and gene conservation (10; 11; 12).

In this study, We attempted construction of the phylogenetic history of this perennial *Heracleum* genus using ITS sequence datas and their general habitats.

Materials and Methods

Plant Material Collection

Fruits of 7 *Heracleum* species collected from Turkey were indicated below table. These plant materials kept -20 °C until we exemine.

Table 1. Origin of samples and GenBank accession numbers of ITS1 and ITS2 sequence of *Heracleum* species.

Species	Locality and Collector	GenBank Accession No.
H. pastinacifolium Koch.	Karabük-Karaağaç, Keltepe, 1800-1900 m. Rocky areas.	ITS1: AM168434 ITS2: AM167908
H. trachyloma Fisch & Meg.	Kars-Sarıkamış. 1900 m. Moist places, valley margins	ITS1: AM167909 ITS2: AM167910
H. sphondylium L.	Ankara-Kırıkkale, 900 m. Road margins, valley margins.	ITS1: AM167911 ITS2: AM167912
H. antasiaticum Manden.	Erzurum-Aşkale, 38 km. Soğuksu bridge. 1270 m.	ITS1: AM167913 ITS2: AM167914
H. sosnowskyi	Rize-Çamlıhemşin, 400 m. Water side. Moist leafes	ITS1: AM167915 ITS2: AM167916
H. persicum Desf.	Ağrı-Eleşkir 2060 m.	ITS1: AM167917 ITS2: AM167918
H. crenatifolium Boiss.	Konya-Hadim 800 m. Valley margins	ITS1: AM167919 ITS2: AM167920
F. asparagifolia Boiss.	İzmir, Selçuk Efes ruins, E. Akalın, U. Uruşak	ITS1:AJ972387; ITS2: AJ972388

DNA Isolation

Endosperm layers were removed from dried seeds of seven *Heracleum* species (13). Total genomic DNA were isolated from fourteen of endosperm layer from seeds collected for each species.

Amplification of ITS Region

Double stranded DNAs of the complete ITS regions in each genomic DNA were PCR (Polymerase chain reaction)-amplified using ITS5 (direct primer) and ITS4 (reverse primer) primers modified from (14) White et al. (1985) and (4) Downie and Katz Downie (1996). Each PCR reaction cycle proceeded as follows: (1) 1 min. 94 ºC to denature the double stranded template DNA; (2) 1 min. 53 ºC to anneal primers to single stranded template DNA and (3) 1 min. 72 ºC to extend primers. PCR reaction achieved as 35 thermal cycles and followed 10 min. at 72 ºC extension period to complete unfinished DNA strands. Each amplified DNA fragment was electrophoresed in a 1,5 % agarose gel, visualized with ethidium bromid and then excised under low wave lenght UV light.

Sequencing of ITS Region
Sequences were obtained using the ABI 310 DNA sequencer of Middle East Technical University Central Laboratory. ABI trace files were edited and contigs assembled using chromas (version 1.45) software programme.

Phylogenetic Analysis
ITS data matrix was occured with MacClade 4. 03. (15). The resulting data matrix was analyzed by assuming unordered character states using PAUP 4.0b10. (16) with Machintosh performance 6320 computure. All heuristics searches were replicated 500 times with random addition sequence and tree bisection-reconnection (TBR) branch swapping. Initially all searches were performed using equal character weighting. Bootstrap analyse were performed using PAUP 4.0b10. (16) to assess the degree of support for particular branches on the strict consensus tree. Pairwise nucleotide differences of unambiguously aligned positions were determined using the Distance matrix option in PAUP. In the phylogenetic analyses, all gaps were treated as missing data. Transition/transversion ration were calculated using MacClade 4.03. (15). The amount of phylogenetic information in the parsinomy analyses was estimated using the consistency index (17), homoplasy index and retention index (18).

Results
Sequence Analysis
GenBank accession numbers of ITS1 and ITS1 for seven species of *Heracleum* genus are provided in Table 1 and their characteristics summarized in Table 2. On average, ITS1 is 219 bp and ITS2 is 224 bp in size.

Table 2. Sequence characteristics of the two internal transcribed spacer regions, in species of *Heracleum* genus. (Qi-Square:4.73, P: %99).

Sequence characteristics of ITS region	ITS1	ITS2	(Combined ITS) ITS1 and ITS2
Length range (bp)	219	224-225	444-443
Length mean (bp)	219	224	444
G+C content mean (%)	57	50	57
Percent Pairvise sequence divergence	0,3-9	1-8	0,8-8
Transisyon/transversiyon oranı	1	1	0,9
Numbers of informative sites	30	27	57

ITS1 pairwise divergence values are similar on average to those of ITS2 in *Heracleum.* ITS1 gave divergence values ranging from 0,4 to 0,10 % of nucleotides, and from 0,1-0,8 %. in ITS2. Sequences were potentially informative phylogenetically. A greater proportion of ITS2 was excluded from the study because of alignment. ITS2 included more potentially informative characters than ITS1 (Table 2). In direct pairwise comparisions of unambigious positions among all *Heracleum* species, base differenges ranged from 0,11 to 0,92 % of nucleotides in both spacer region. The lowest value was calculated between *H.sosnowskyi* and *H. persicum* Desf. with 0,11%. The highest divergence was determined as 0,85 % between *H. sphondylium* and *H. persicum.* Transition/transversion ratio is 0,9 (Table 2). In this study, the extent of G+C of ITS is rich, and observed as 54 % range for *Heracleum* species (Table 2). Spacer segments with G+C richness may form secondary structures. G+C content may also indicate a bias in substution probabilities. GC richness is supposed to ensure thermal stability at DNA, RNA and protein levels and to be an adaptation to environment (9; 11).

Phylogenetıc Analysis

Strict consensus trees from the combined ITS1 and ITS2 sequence data at Figure 1 placed *H. antasiaticum* Manden. as sister to *H. pastinacifolium* Koch., *H. tachyloma* Fisch &Meg., these combined three species was shown as a monophyletic group. *H. pastinacifolium* Koch. is the most advanced species for these three strict consensus trees. This species is perennial and not aromatic with a collar of broad flat fibres. It preferes rockier habitats than the other species, and extremelly variable in indumentum. It has a widely distribution aeria complising Armeniai Azerbaijan, Southern Estern Anatolia (1).

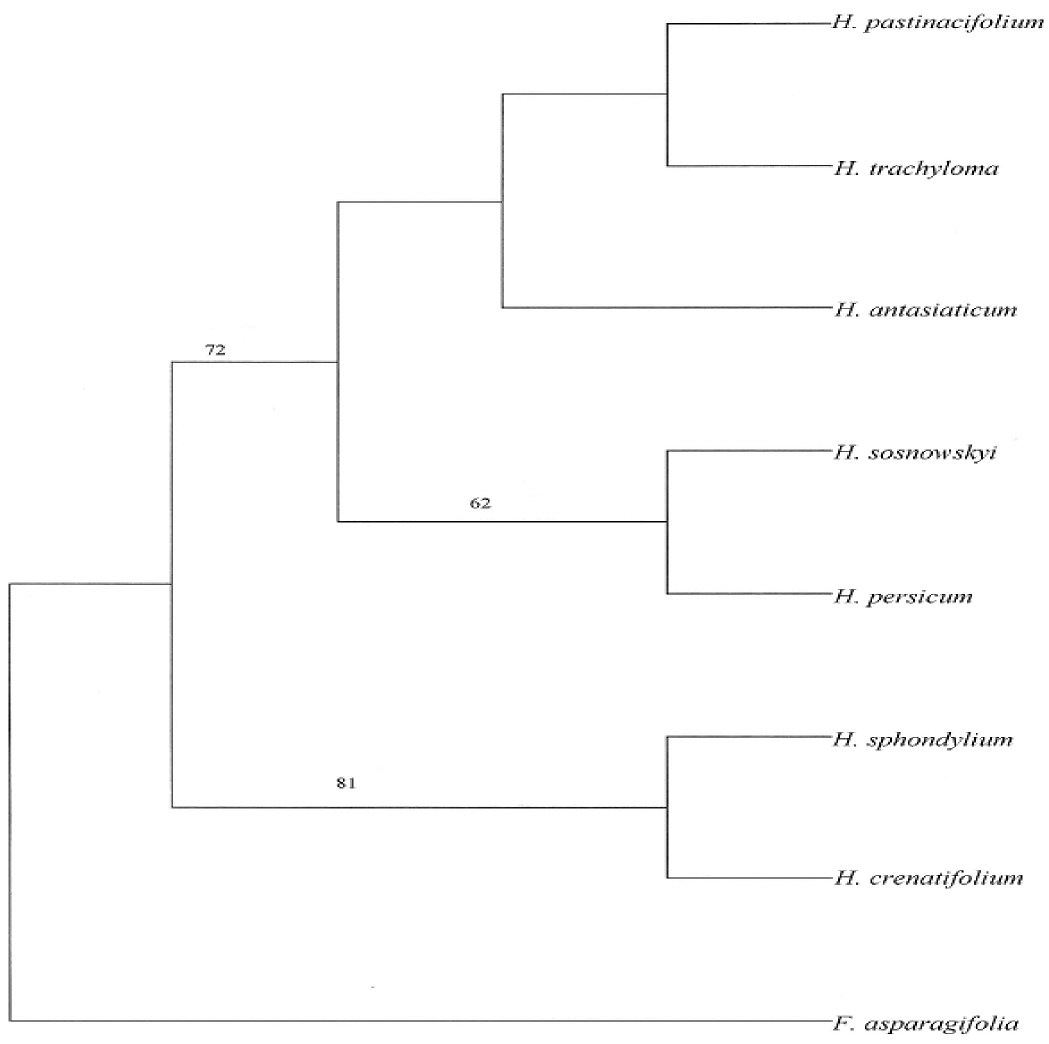

Figure 1. Strict consensus of parsimonious trees derived from equally weighted parsimony analysis of combined ITS1 and ITS2 sequences. Numbers above the branches indicate bootstrap values.

Dıscussion

Like most other angiosperm ITS sequences, these regions have evolved primarily by point mutations, judging from the high levels of ITS sequence divergence between species (11). In all flowering plants reported to date ITS1 and ITS2 are each less than 300 bp (19). On average, ITS2 is longer than ITS1 by ~17 bp (Table 2).

The highly conserved sequence motif, GGCRY- (4 to 7 n)- GYGYCAAGGAA, located in ITS1 and detected in published sequences from 88 species representing ten families and five subclasses of flowering plants (4), is also seen *Ferulago* Koch. species ITS1 sequences between positions 147. and 157. the 5'-GCGAAGGAA-3' motif (20), is predicted not to be part of a base-paired stem region and is thought to serve as a critical recognation element for rRNA processing.

G+C content in ITS1 is roughly similar to that in ITS2. This similarity probably reflects some degree of coevolution of ITS1 and ITS2 sequences as suggested by evidence that both spacers are involved in maturation of large subunit rRNA. Mutations at ITS positions involved in stem formation (via intrastrand nrRNA pairing) may necessitate compensatory mutations at directly opposing sites to maintain structural integrity and proper functioning of the molecule (21; 8). Resolution for phylogenetic problems amongst species is generally well correlated with the extent of variation within spacer suggested from divergence value and numbers of potentially informative bases on data ITS (4;12).

ITS appears to provide valuable molecular markers for phylogenetic analyses of species (2; 22). Highly conserved sequences and suitable variation within ITS sequences among these *Heracleum* species raise corcerns about the utility of this ITS region for phylogenetic hypothesis. In our study, complementarity of ITS1 and ITS2 data sets was indicated by more complete and robust resolution

ITS sequences may not provide a valuable source of intraspecific markers for population-level studies in *Apiaceae* (2). These regions appear well suited to comparisons among related species and/or closely related genera. From this data set one might conclude that the common ancestor of the *H. pastinacifolium*-*H. trachyloma* and *H. antasiaticum* diverged from one ancestral type. *H. sphondylium*-*H. crenatifolium* and *H. sosnowskyi*-*H. persicum* Desf. have the short branch lengths between nods relative to the lengths of terminal branches. *H. sosnowskyi*-*H. persicum* are evolutionarily distant from all other species of the genus. This could merely because of rapid evolution producing a long branch, it might possible reflect an ancient isolation of the lineage. *F. asparagifolia* was selected as outgroup for this analysis. *H. pastinacifolium* was the most advanced species of all *Heracleum* genus (Figure 1.). Sequence divergence values among *Heracleum* species ranged from 0,08 to 0,80. But other groups of Apiaceae were higher or perhaps in the same range. The Pairwise divergence between two species of *Pimpinella* genus from 0,7 % to 0,8 % range, occured from 3 to 7 % between *Ferulago* species (20) and obtained 1,5 % between species of *Lomatium* (2).

A phylogeny of Apioideae derived from parsimony analysis of cpDNA, rpo C1 intron sequences is consistent with, but considerable less resolved than, relationships derived from ITS sequences (4).

Their Ecology and Biogeography

Of special ecological and economical interest are those species, which have been introduced by humans and rapidly spread in their new environment. Some invasive species threaten biodiversity in natural habitats by displacement of native biota through competition, hybridization or predation and the effects invasive species have are not only ecological but also economic. To identify life history stages that make a species vulnerable in terms of the population dynamics and at which the control efforts could be targeted, a detailed knowledge of the plant's demography and ecology is necessary. These plants could not die in the year that they were created; any mortality within the first year was already considered in the offspring values. New plants were placed in the cell of origin (parent plant), or in the neighbourhood. The number of offspring dispersing into neighbouring cells was decreasing with distance.

The northern hemispherical genus *Heracleum* has its center of diversity in the mountain regions of Asia (SW, Middle, The Caucasus), Europe (W, Central, SW, S, SE, E), and Africa (N, NW) (1). *H. pastinacifolium* is distributed southern and southern east Turkey and has widely distribution aerias complising western, east and middle Anatolia, Balkans, and Armenia. *H. crenatifolium* rest in North Anatolia, being narrow endemics. *H. sphondylium* as Europe-Siberia element and *H. crenatifolium* as endemic species are monophyletic species. Habitat preferences of these species are prefers streamsides, field borders, rough cultivation, below 1000 m. *H. antasiaticum* as sister to these two species is Euxine element and prefers height levels of 1250 m. *H. trachyloma* Fesch. and Meg. rest in North east Anatolia at moist valley margines up to 1500 m height. It is interesting that *H. persicum* as Iran-Turan element at mountinous areas in 2000 m height and is distributed southern and southern east Turkey while *H. sosnowskyi* in moist areas at 500 m are monophyletic groups. However, this case results from the widespread habitat preference and biogeographic locations of *H. sosnowskyi*. *H. pastinacifolium*, the most advanced species of all *Heracleum* genus, was collected from North west Anatolia at 2000 m height. This species is variable complex and allopatrick and has subspecies from North-east Anatolia up to 3500 m height levels.

As a result, our *Heracleum* species share distribution areas approximately from 1000 m to ≥2000 m height levels. Habitat preferences of these species differ from moist valley margins to high mountinous areas. Their biogeographic locations change from East and North-East to North and North-West Anatolia. *Ferulago* W. Koch as a out group is a medium sized genus of Umbelliferae comprising about 45 species distributed across part of Europe (W, Central, SW, S, SE,) Asia (SW, Middle, The caucasus) and Africa (N, NW) (23Ozhatay and Akalın, 2000). In Apioideae, several Old and New World genera such as, *Seseli*, *Pimpinella*, *Doucus*, *Angelica*, *Lomatium* and *Torilis*, contain a large number of species and may not represent natural groups (24). Thus inclusion of additional tribl/subtribal representatives in subsequent ITS studies might, perhaps result in phylogenetic conclusions different than the ones presented here. The presented here represent attempt to formulate more precise hypotheses about relationships of *Heracleum* species within Apioideae using evidence derived from nuclear ribosomal DNA ITS sequences. The phylogenies infered using these molecular datas and their shared life history reflect the species phylogeny. ITS sequences appear best suited to comparisons of species and closely related genera, and should be furter explored as a promising source of nuclear phylogenetic markers within Apioideae at these levels. These results will provide the resolution necessary that will lead to a through understanding of the historical relationships within this large and taxonomically complex subfamily of Apiaceae.

Acknowledgements

We acknowledge our thanks to Professor Assistant Ergin Hamzaoğlu at University of Bozok for collecting sample species. We thank Middle East Technical University Central Laboratory in Ankara for help in automating DNA sequencing.

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International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

CITRIC-ACID AND WATER-PRESOAKING ENHANCE SEED GERMINATION OF SCOTS (*Pinus sylvestris* L.) AND ANATOLIAN BLACK PINE (*Pinus nigra* Arnold var. *pallasiana*)

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Globally, forest resources have been reduced both qualitatively and quantitatively. Turkey has taken its share from this: Only 26% of the country's land is forested, of which 38% is productive. Anatolian black pine (*Pinus nigra* Arnold var. *pallasiana*) and Scots pine (*P. sylvestris* L.) are two important conifer species of Turkey, with 2.5 million and almost 760 thousand hectare coverages, respectively. These conifers make up mixed stands in the subalpine and alpine zones between 1,400-1,700 m a.s.l., where plant communities and growth are very limited. Lives of the fauna and flora substantially benefit from these conifers in these difficult terrains. Successful regeneration of these two mountain species is therefore critical to preserve and improve forest cover in these difficult ecosystems.

Seed germination is the key to successful regeneration for trees. Understanding and in turn enhancing the seed germination behaviors of Scots and A. black pine will contribute significantly to the conservation of plant cover and biodiversity in these harsh ecosystems. Citric-acid scarification and water-presoaking improve seed germination for many tree species. Effects of citric-acid and water-soaking for various periods prior to germination on the seed germination of Scots and A. black pine are yet in question. This study has presoaked the seeds of the two species in 0.1% citric acid for 24, 48, and 72 hours along with a 24-h deionized-water presoaking and a control treatment (no acid or water treatment) to test their effects on cumulative seed germination (28th day of test) and germination speed.

Most of seeds germinated within the first week for A. black pine. However, this delayed to the second week for Scots pine. Citric-acid presoaking did not enhance seed germination for Scots pine, yet 24 h water-soaking demonstrated significantly greater seed germination and germination speed. 72-h citric-acid- and also 24-h water-soaking however substantially (>52%) improved seed germination and germination speed for both pine species, when compared to the other treatments. Only a quarter of seeds germinated in the check (no treatment) for both species. These results indicate that endocarp may be a significant germination-inhibiting factor for A. black pine, reducing gas and water intake for embryo although this two species had been thought not to have any seed dormancy. The same conclusion does not apply for Scots pine, for which conventional water-soaking is essential.

Keywords: *Anatolian black pine, citric-acid, Scots pine, seed germination, mountains*

Introduction

Globally, forest resources have been rapidly reduced both qualitatively and quantitatively (Kimmins, 1987). Turkey has taken its share from this: only 26% of the country's land is forested, of which 38% is productive (Anonymous, 2006). Anatolian black pine (*Pinus nigra* Arnold var. *pallasiana*) and Scots pine (*P. sylvestris* L.) are two important conifer species of Turkey, with 2.5 million and almost 760.000 hectare coverage, respectively (Anonymous, 2006). These conifers make up mixed stands in the subalpine and alpine zones between 1,400-1,700 m a.s.l., where site plant communities and growth are very limited (Genç, 2004). Lives of the fauna and flora substantially benefit from these conifers in these difficult terrains. Successful regeneration of these two mountain species is therefore critical to preserve and improve forest cover in these difficult ecosystems.

Seed germination is the key to successful regeneration for trees (Ürgenç, 1998). Understanding and in turn enhancing seed germination behavior of Scots and A. black pine will contribute significantly to the conservation of plant cover and biodiversity in the harsh subalpine and alpine ecosystems.

Water-presoaking improve seed germination for many tree species (Grisez, 1974). Citric acid presoaking variably affects seed germination, depending on tree species and exposure time (Jones, 1963; Grisez, 1974, Eşen *et al.,* 2006). In a recent study in wild cherry (*Prunus avium* L.), 0.1% citric acid presoaking for 48 hours prior to a three-month cold stratification significantly improved the mean germination rate of wild cherry seed, when compared to the only cold stratification treatment. Exposures longer than 48 hours yet were detrimental to seed germination (Eşen *et al.,* 2006). Effects of citric-acid and water-presoaking for various periods prior to germination on Scots and A. black pine are yet in question.

This study has presoaked the seeds of the two species in 0.1% citric acid and deionized water for 24, 48, and 72 hours along with a control treatment (no acid or water treatment) to test their effects on cumulative seed germination (28^{th} day of test) and germination speed during germination period.

Methods and Materials

For the study, seeds were obtained from the Forest Tree Seeds and Tree Breeding Research Directorate of the Ministry of Environment and Forest of Turkey, Ankara, Turkey. The A. black pine seeds were collected from different seed stands: Muğla-Yılanlı (collection year: 2004), Muğla-Boyalı (2005), Bolu-Mudurnu-Sapuncuk (1996). The Scots pine seeds were similarly originated from Erzurum (2004), Daday (2002), Sarıkamış-Karakurt (2003). Each origin was represented in a homogenized mixture with equal quantities for each species. 4,000 seed were in total used for each pine species. Since the pine species do not require any stratification prior germination (Ürgenç, 1998), no stratification was employed for the study.

The study began in the silviculture laboratuary of the Duzce University Forestry Faculty at the beginning of April 2004. The mean seed moisture content and the weight of one-thousand seed before the beginning of the study were calculated for each pine species using International Seed Testing Association rules for seed testing (ISTA, 1999). Five different pre-soaking and the check (no treatment at all) were used for the study. Seeds were pre-soaked in 0.1% citric-acid solution for 24, 48, and 72 hours (CA-24H CA-48H, and CA-72H treatments, respectively). Pre-soaking in deionised-water for 24 hours was the last treatment (DW-24H).

Following the treatments, for each pine species, the seeds of each pre-soaking treatments and the check (four replicates of 100 seed each) were placed in 18-cm glass petri dishes with a standard filter paper. The dishes were placed into an environment-controlled growth chamber (Nüve ID 501®, Nüve, Inc., Ankara, TURKEY) at 20±1^{o}C (ISTA, 1999) for germination and kept moist during the germination test. All of the dishes were monitored for germination on days 4, 7, 10, 21, and finally day 28. The seeds with 5 mm long radicles were considered germinated (ISTA, 1999). Cumulative germination percentage was calculated as the proportion of germinants on day 28 to the total number of sound seeds used, multiplied by 100.

The experimental design for the experiment was a completely randomized design with four replications. One-way analysis of variance (ANOVA) was used to test for main effect. The means were separated using the Scheffe's Mean Comparison Test. P-values ≤ 0.05 were considered significant throughout the experiment.

Results

The mean weight of one-thousand seed and seed moisture content were 11 g and 8% for black pine, respectively whereas these parameters were 23 g and 8% for Scots pine seeds. Different treatments had a significantly different effect on the mean cumulative seed germination for both pine species (Tables 1, 2). The CA-72H and the DW-24H treatments had significantly greater (>52%) mean cumulative seed germination rates than those of the rest of treatments. The differences among the remaining three treatments were non-significant (Table 1).

Generally, Scots pine seed had lower germination rates than black pine seeds (Table 2). Similar to black pine, pre-soaking Scots pine seeds in the DW-24H and CA-72H treatments resulted in the best mean cumulative seed germination rates among all treatments without significant difference the former two treatments (Table 2). Seeds in the check, the CA-48H and CA-24H treatments had significantly lower germination rates (>53%) than the DW-24H treatment for this pine species (Table 2).

Seeds presoaked in deionized-water for 24 hours and 0.1% citric-acid for 72 hours demonstrated more rapid germination behavior when compared to those in other treatments (Figure 1). Majority of A. black pine and Scots pine seeds germinated by day 7 and 10, respectively, during germination test for the CA-72H and DW-24 treatments (Figure 1).

Table 1. Effects of 0.1 % citric-acid-presoaking and dionized-water presoaking for various periods on cumulative germination rate of Anatolian black pine seed.

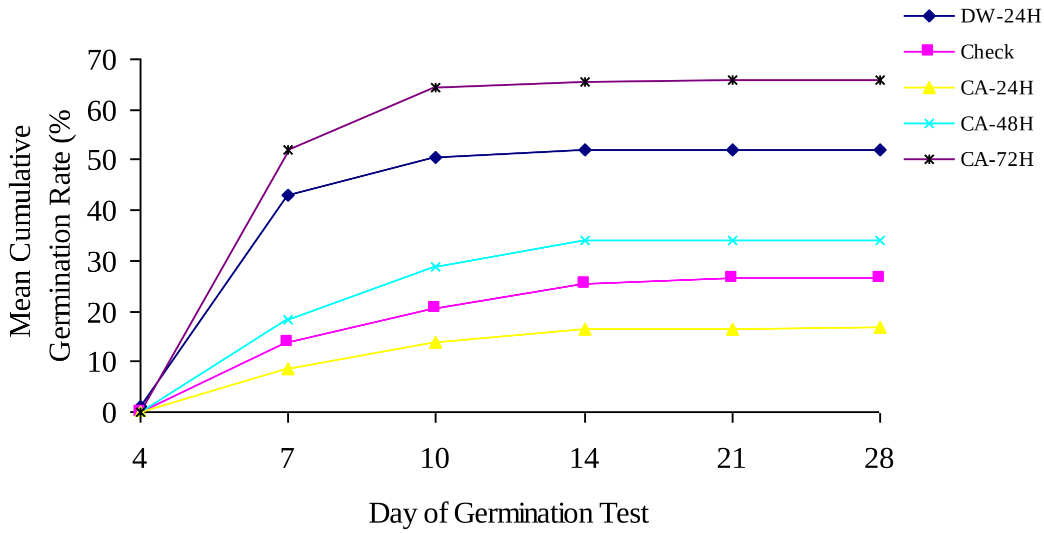
Presoaking Treatment[1,2]	Mean Germination Percentages (%) and Standard Errors (±)
CA-72 hr	66.0 a[2] (±8.6)
DW-24 hr	52.0 ab (±5.4)
CA-48 hr	34.0 bc (±2.9)
the check	26.5 c (±1.7)
CA-24 hr	17.0 c (±3.3)

[1] CA: 0.1% citric-acid presoaking; DW: Deionized-water; hr: hours,
[2] The presoaking treatment was statistically significant according to one-way ANOVA ($p \leq 0.05$)
[3] Means with different letters in the same column are significantly different ($p \leq 0.05$).

Table 2. Effects of 0.1 % citric-acid-presoaking and dionized-water presoaking for various periods on cumulative germination rate of Scots pine seed.

Presoaking Treatment[1,2]	Mean Germination Percentages (%) and Standard Errors (±)
DW-24 hr	43.5 a[2] (±1.9)
CA-72 hr	31.0 ab (±6.2)
the check	21.5 bc (±2.9)
CA-48 hr	12.0 bc (±1.4)
CA-24 hr	10.0 c (±5.2)

[1] CA: 0.1% citric-acid presoaking; DW: Deionized-water; hr: hours,
[2] The presoaking treatment was statistically significant according to one-way ANOVA ($p \leq 0.05$)
3 Means with different letters in the same column are significantly different ($p \leq 0.05$).



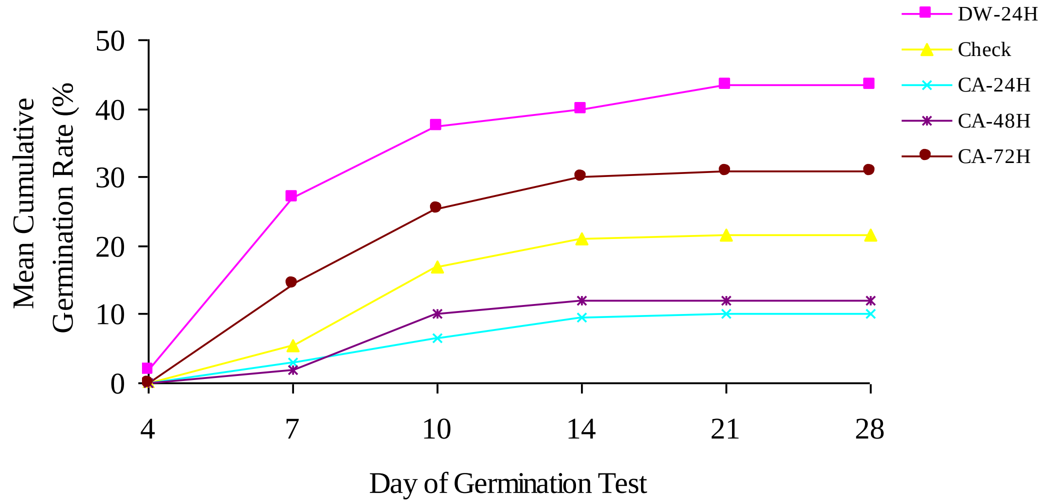


Figure 1. Mean percent germination rates over time of the seeds of Anatolian black pine (*Pinus nigra* Arnold var. *pallasiana*, above) and Scots pine (*P. sylvestris* L., below) from Turkey in different presoaking treatments. Note the different scales of the Y-axes.

Discussion

Generally reduced germination rates with Scots pine seeds than A. black pine ones in the present study might be contributed to the harsher nature of the higher (elevational) distribution of the former conifer species than that of the later one. Lower winter temperatures in higher elevations inflict deeper seed dormancy (Grisez, 1974; Close and Wilson, 2002; Swanton, 2003), which improves species' chances to survive in various site conditions (Radosevich et al., 1997; Swanton 2003) and different years (Isik, 1986). This type of behaviour has been previously reported for black cherry (*Prunus serotina*, Eşen *et al.*, 2007).

Presoaking seeds in water from one to two weeks mostly improve seed germination for conifer tree species (Bonner *et al.*, 1974). Pre-soaking Anatolian black and Scots pine seeds from Turkey for one day yet sufficed in the present treatment. Water-soaking might wash seeds out of chemicals inhibiting germination, alleviate hard seedcoat, or "complete imbibition" process in seed (Bonner *et al.*, 1974). Equally successful germination rates with 72 h citric-acid pre-soaking reinforce the premise that hard endocarp might be a significant germination-inhibiting factor for A. black pine, reducing gas and water intake for embryo (Bonner *et al.*, 1974). The same conclusion cannot be made for Scots pine, for which conventional water-soaking is essential. Faster germination improves the competitive success of the young seedlings of a plant species over its competitors to rapidly take up resources and in turn its survival rate (Radosevich *et al.*, 1997; Swanton, 2003). Rapid germination rates with the 72-h citric-acid and 24-h water-soaking treatments therefore confer a greater chance to the emerged seedling of both pine species in their competitive environment. In conclusion, 72-h citric-acid presoaking and conventional water-soaking for one day suffice for improved germination of both pine species.

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International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

ANALYSIS OF POLYMORPHISM AT THREE MILK PROTEIN GENES IN NATIVE CATTLE BREEDS OF TURKEY AND THEIR USE FOR MANAGEMENT

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The objective of the present study was to determine the allele frequencies of three milk protein (beta-casein, kappa-casein and beta-lactoglobulin) genes in native Turkish cattle breeds and make use of this information to contribute their conservation and management strategies. Each milk protein has two or more genetic variants creating a genetic polymorphism. A1 allele of beta-casein gene has been widely studied and shown to be associated with type-I diabetes, cardiovascular and neurological disorders in humans. Some alleles of kappa-casein and beta-lactoglobulin are known to be related with ratio of fat and protein in milk and milk yield.

To this point, genotypes for beta-casein gene have been determined as A1-like and A2-like. In addition to genetic analysis with DNA, biochemical analysis directly by using cow's milk was performed in order to detect the A1 and A2 alleles of beta-casein gene. There are four native Turkish cattle breeds and thus far, three of them were screened for the most common alleles A and B for kappa-casein and beta-lactoglobulin genes. The results of the present study will be used to conserve and manage the cattle breeds in Turkey, to enhance the quality of milk products, milk yield and to decrease the human health risk associated with milk.

Introduction:

For more than 100 years, studies on the milk protein systems have been in progress and milk protein knowledge had great benefits with the improvement of the experimental procedures and the contributions of molecular biology, genetics and biochemistry. Milk is composed of proteins, fat, carbohydrates, lactose and minerals. Milk proteins are divided into two main groups; caseins (80%) and whey proteins (20%). "Casein" is the insoluble fraction and is composed of four different caseins (Cn); αs1-casein (CSN1S1), αs2-casein (CSN1S2), β-casein (CSN2) and κ-casein (CSN3). "Whey proteins" make the soluble fraction which are composed of several different proteins and the most important ones are α-lactalbumin (α-LA) and β-lactoglobulin (β-LG) (Formaggioni *et al.*, 1999). Each milk protein has two or more forms, which are called genetic variants and therefore milk is polymorphic with respect to its proteins (Farrell *et al.*, 2004). There are numerous studies performed on determining milk protein polymorphism of different cattle breeds (Daniela and Vintila 2005; Ceriotti *et al.*, 2004; Jann *et al.*, 2004; Strzalkowska *et al.*, 2002; Malik *et al.*, 2000; Lien *et al.*, 1999).

One important objective of these studies, in the selection of dairy cows, is to understand the biological significance of the genetic variants, because each of the polymorphic form has a different effect on the composition and manufacturing characteristics of the milk. Genetic variants or alleles creating different genotypes listed in Table 1 are the concern of the present study.

Table 1. Description of the genetic variants of the milk protein genes determined in the present study.

Milk Protein Gene	Genetic Variant/Allele	Amino Acid Position	Amino Acid Change	Reference
β-casein	A2→A1	67	Pro→His	Lien *et al.*, 1992
	A2→A3	106	His→Gln	
	A2→B	67 122	Pro→His Ser→Arg	
κ-casein	A→B	136 148	Thr→Ile Asp→Ala	Malik *et al.*, 2000
β-LG	A→B	64 118	Asp→Gly Val→Ala	Medrano and Aguilar-Cordova, 1990

The main reasons of choosing such milk proteins and genetic variants listed in Table 1 are that they have important effects on milk and cheese yield of cattle breeds and that they are dominantly found in almost all breeds (Fitzgerald *et al.*, 1999). Kappa-casein B allele have a favorable and significant effect on both milk and milk protein yield and BB genotype of □-casein gene seemed to increase the cheese yield approximately by 10%. In β-lactoglobulin system, there are significant differences in milk yield with respect to AB and AA genotypes (AB>AA), in fat yield (BB and AB > AA), in fat content (BB > AA and AB) and in lactose yield (AB > AA). With the milk produced by cows having BB genotype for β-lactoglobulin locus significantly more cheese than that by AA cows can be produced. Polymorphism in the β-lactoglobulin locus was also shown to affect the cows' resistance to mastitis, which causes a major health problem in cows, while occurrence of allele B and genotypes BB and AB is an indicator of their good health status (Strzalkowska *et al.*, 2002; Kaminski 2004; Tsiaras *et al.*, 2005).

Additionally, milk protein polymorphisms may have effects on human health besides their effects on milk and cheese yield. Certain variants have relationships with the occurrence of bioactive peptides affecting human health. For instance; consumption of A1 variant of □-casein has been shown to be a risk factor for type-I (insulin-dependent) diabetes mellitus (Elliot *et al.*, 1999), ischaemic heart disease (McLachlan 2001) and neurological disorders in humans. Moreover, relation of β-casomorphin to sudden infant death syndrome (SIDS) is suggested by Sun *et al.* (2003). It is thought that as a result of proteolytic digestion, β-casein variants A1 and B, two together are known as A1-like, breakdown to form a bioactive peptide β-casomorphin-7 (BCM-7) which may play a role with an unclear mechanism in disease development (Jinsmaa *et al.*, 1999).

This does not occur with the β-casein variants A2 and A3 (A2+A3: A2-like). There is not enough research on frequency of beta-casein variants in native Turkish cattle breeds (Turkish Grey, Eastern Anatolian Red, Anatolian Black and South Anatolian Red). In the study of Jann *et al.* (2004), it was estimated that A1 frequency is 0.04 (lowest frequency in the study) in Anatolian Black (n=50) and 0.24 in Turkish Grey (n=50). Artificial insemination especially with Holstein cattles from Europe is performed in Turkey and Holstein cattle breeds have high A1 frequency (~0.5; Kaminski *et al.*, 2006). Therefore, in order to avoid the allele admixture of A1 allele through artificial insemination, monitoring of A1 allele status of reproductive bulls is needed. Furthemore, for the public health, A1 like individuals must be pruned out from the herds of diary cattle and the tests from the milk must be developed to detect the presence A1 like milk.

The objective of the present study was to detect the genetic variants of β-casein, κ-casein and β-lactoglobulin in native Turkish cattle breeds by using DNA based molecular techniques and also to detect A1-like alleles directly from milk by using biochemical techniques. Therefore, the results of this study will help to decrease the health risk associated with milk and milk products, to enhance the health of milk cows and to increase the milk yield and cheese production. Accordingly, these results will help to develop conservation and management strategies for the native cattle breeds in Turkey.

Materials and Methods:
DNA samples from three native Turkish cattle breeds (Turkish Grey, Eastern Anatolian Red and Anatolian Black) were screened for β-casein, β-lactoglobulin and κ-casein milk protein genes by using the molecular methods.

Polymorphism of β-casein gene was determined by amplification created restriction sites (ACRS) method by using primers and the restriction enzyme (*TaqI*) in Lien *et al.* (1992). Results were observed by agarose gel electrophoresis.

For biochemical analysis, milk samples from cows with different genotypes (A1A1, A2A1 and A1A1) were collected after determination of the presence of A1 and A2 alleles for β-casein gene from DNA samples. Total casein fraction from milk was obtained by acetic acid and ether-alcohol application and then fast performance liquid chromatography (FPLC) method was employed to separate casein fractions (alpha, beta and kappa) (Kauf and Kensinger, 2002). Sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) was performed to diagnose each casein fraction depending on their molecular weights given in Table 2.

Table 2. Molecular weights of casein fractions.
http://www.foodsci.uoguelph.ca/dairyedu/chem.html#protein1 (Dairy Chemistry and Physics, University of Guelph)

Caseins	Molecular Weights
Kappa-casein	19,000 daltons
Beta-casein	24,000 daltons
Alpha-casein	s1: 23,000 daltons s2: 25,000 daltons

Beta-casein fractions were digested with enzymes pepsin, porcine pancreatin elastase and leucine amino peptidase according to Jinsmaa and Yoshikawa (1999) and then high performance liquid chromatography (HPLC) was performed in order to detect BCM-7 from different genotypes (A2A2, A2A1 and A1A1) of beta-casein gene. Therefore, A1 and A2 alleles of beta-casein gene were detected depending on the presence of BCM-7.

Polymorphism of κ-casein and β-lactoglobulin genes were determined by restriction fragment length polymorphisms (RFLP) method with primers and the restriction enzymes (*HaeIII*, *HindIII*) in Soria *et al.*, (2003) and Medrano and Aguilar-Cordova (1990), respectively. Genotypes were observed by agarose gel electrophoresis.

Results and Discussion:
To this point, genotypes for beta-casein gene have been determined as A1-like and A2-like for a limited number of Turkish Grey individuals by ACRS method. Additionally, to determine the genotypes of beta-casein directly from cow milk, casein fractions were obtained by FPLC and these fractions (alpha, beta and kappa) were observed by SDS-PAGE as shown in Figure 1. After SDS-PAGE analysis, proteolytic digestion was performed and the presence of BCM-7 was compared in different genotypes of beta-casein gene by HPLC. BCM-7 was not observed in A2A2 genotypes as expected and it was observed in A2A1 and A1A1 genotypes. Therefore, this biochemical procedure is applicable for the determination of beta-casein genotypes directly from cow milk. The complete result of beta-casein genotyping will inform us about the spread of beta-casein A1 allele and indicate the frequency of undesirable A1 allele in native Turkish cattle breeds. With the help of the methods presented, decreasing the frequency of A1 allele by screening of young bulls and avoidance of introduction or spread of A1 allele through artificial insemination will be possible. In New Zealand, Australia and United States beta-casein genotyping is carried out in breeding programs and herd management. A commercial company "A2 Corporation" (www.a2corporation.com) offers A2 milk, which is obtained exclusively from cows carrying the A2A2 genotype. Although, the clinical implications of A1 milk on human health is still under discussion, it may be necessary to monitor reproductive bulls and decrease the frequency A1 allele.

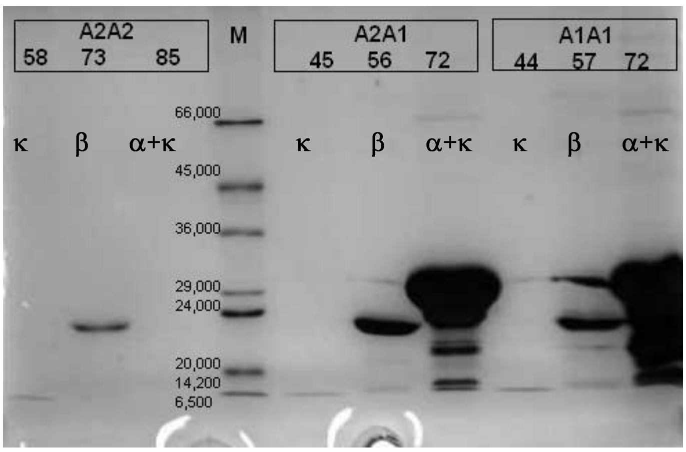

Figure 1. SDS-PAGE of casein fractions from three different genotypes of beta-casein obtained by FPLC. M: Low Molecular Weight Range Marker (6,500 daltons - 66,000 daltons) [Sigma], κ: kappa-casein, β: beta-casein and α+κ: alpha + kappa caseins.

In Figure 2, a typical result of β-lactoglobulin genotyping is presented and the same kind of genotyping result is present for κ-casein (data not shown). Three genotypes (AA, AB and BB) were identified for both genes in native Turkish cattle breeds.

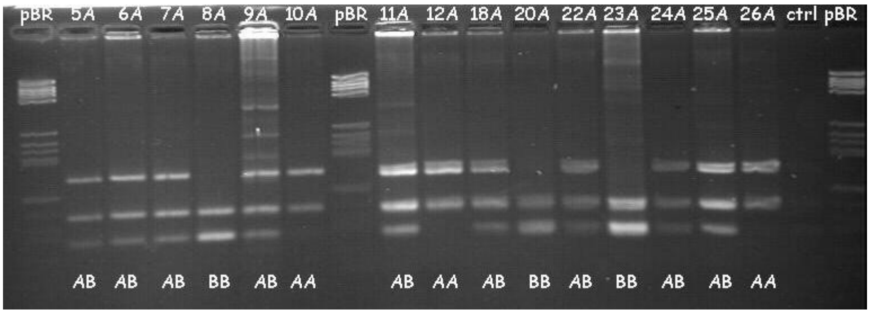

Figure 2. Agarose gel electrophoresis of β-lactoglobulin genotypes.

Thus far, three native Turkish cattle breeds (Turkish Grey, Eastern Anatolian Red and Anatolian Black) were screened for β-lactoglobulin and κ-casein genes and the genotype and allele frequencies with the sample sizes are presented in Table 3.

Table 3. Polymorphism at β-lactoglobulin and κ-casein loci in the studied native Turkish cattle breeds

	β-lactoglobulin					**κ-casein**				
	AA	**AB**	**BB**	**A**	**B**	**AA**	**AB**	**BB**	**A**	**B**
Turkish Grey (40)	0.27	0.50	0.23	0.53	0.47	0.47	0.42	0.11	0.68	0.32
Eastern Anatolian Red (30)	0	0.42	0.58	0.21	0.79	0.53	0.28	0.19	0.67	0.33
Anatolian Black (25)	0.18	0.29	0.53	0.32	0.68	0.44	0.41	0.15	0.64	0.36

Tsiaras *et al.* (2005) stated that cattle with AB β-lactoglobulin genotype have more milk yield compared to AA genotype, therefore, in three of the cattle breeds, the frequency of AB is larger than AA.

For milk yield improvement, strategies should be made to conserve and increase the AB genotype in these populations. With the help of molecular techniques it is possible to genotype all of the candidates for the next generation of cows. By including the cows having AB genotype only a herd with higher milk and cheese yield can be developed. In addition, in order to increase the quality of cheese, high fat content is needed in the milk. B allele of β-lactoglobulin leads to higher fat yield and content in milk, so, milk from Eastern Anatolian Red and Anatolian Black are better for cheese production. Furthermore, the frequency of B allele is high in Eastern Anatolian Red and Anatolian Black meaning that their health status is good, since B allele increases resistance of cattle to mastitis. Therefore, frequency of B allele of β-lactoglobulin should be increased and conserved for better health status in cattle breeds.

Among κ-casein genotypes, AB genotypes have higher protein yield and content compared to AA genotypes, therefore, from Table 3 it can be concluded that these three breeds do not have milk with high protein content. AB genotypes should be conserved and increased to improve protein content of the native Turkish cattle breeds.

Consequently, these results will guide the conservation and management strategies for the native cattle breeds in Turkey in order to decrease the human health risk associated with milk and milk products, to enhance the health of milk cows and to increase the quality of milk products and milk yield.

Acknowledgements:
This research has been funded by The Scientific & Technical Research Council of Turkey (Project No: 104V137).

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THE USE OF CAMERA TRAPS FOR DETERMINING THE PRESENCE OF MEDIUM AND LARGE SIZED MAMMALS IN MARMARIS, TURKEY

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The camera trap is one of the most appropriate methods for conducting mammal inventories in all environmental conditions. Camera trapping is increasingly being used in the recent years in studies involving medium and large sized mammals. The use of camera traps provides detailed information on the abundance, ecology and habits of these animals (such as sex, location, activity time and age) with minimal disturbance. In the present study, 12 remote infrared-triggered camera traps were used to determine the presence of medium and large sized mammal species in the region of Marmaris, south-western Turkey. As a result of the surveys, medium and large sized mammal species including wild boar (*Sus scrofa*), Eurasian badger (*Meles meles*), red fox (*Vulpes vulpes*), stone marten (*Martes foina*) and eastern European hedgehog (*Erinaceus concolor*) as well as some small mammals like Caucasian squirrel (*Sciurus anomalus*), black rat (*Rattus rattus*), yellow-necked mouse (*Apodemus flavicollis*) and rock mouse (*Apodemus mystacinus*) were detected by camera traps. Our study shows that medium and large sized mammal species can be effectively detected by the use of camera traps in Marmaris. Mammals are very important part of ecosystems and most of the conservation efforts focus on mammals. Therefore, camera trapping is an important method that can be used for conservation related research.

Keywords: *large mammals, camera traps, wildlife, sampling techniques, conservation biology, stone marten, wild boar, red fox, Eurasian badger, Turkey*

Introduction

Since the development of the use of camera traps in the early 1980s, they are increasingly being used for monitoring elusive mammal species world wide. Due to the efficient results, this method has become an important tool for wildlife studies (Karanth & Nichols, 1998; Noss *et. al*., 2003; Silveira *et al*., 2003; Sequin *et al*., 2003; Karanth *et al*., 2004; Grassman *et al*., 2005b; Cuellar *et al*., 2006). It is widely used in mammal inventory studies since it is possible to take photographs that give sufficient information for identification of the species with minimal disturbance by the use of camera traps. Besides the inventory surveys, camera traps are widely applied in mammal research such as determining the relative abundance and distribution, estimating the activity patterns, monitoring the nest predation and estimating the population size (Buler & Hamilton, 2000; Carbone *et al*., 2001; Trolle, 2003; Trolle & Kery, 2003; Karanth *et al*., 2004; González-Esteban *et al*., 2004; Jackson *et al*., 2005; Cuellar *et al*., 2006; Varma *et al*., 2006).

Turkey is rich in mammals, as Anatolia has the highest number of mammal species compared to the other five regions of the Mediterranean Basin (North Africa: 84; Iberia: 77; Italy: 72; Balkans: 80; Near East: 62). The total number of mammal species in the Basin is 197, 106 of which are present in Anatolia (Blondel & Aronson, 1999). In spite of the high biodiversity of mammal species in Turkey, scientific studies on large mammals were very limited until the recent decades.

A few studies that had been performed before are helpful to show the general situation in the country (Kurtonur *et al.*, 1996; Demirsoy, 1997) and according to these reference books, the total number of mammal species in Turkey is 132 (Kurtonur *et al*., 1996). However extensive ecological research on wildlife have started in the last decade (Oğurlu, 1997; Başkaya & Terzioğlu, 1998; Birand, 1999; Pamukoğlu, 2000; Can, 2000; Macar, 2004; Soyumert, 2004; Can *et al*., 2005; Soyumert & Gürkan, 2005; Can & Lise, 2006; Giannatos *et al.*, 2006).
Studying with medium and large sized mammal species is very difficult due to their secretive, nocturnal behaviours and low population densities. Being aware of the importance of having detailed ecological information, it is certain that we need to learn more on the mammal species which are the keystones of ecosystems. Due to the threats on mammals, a conservation plan must be evaluated countrywide. Since the mammal species have an important role in ecosystems, this kind of studies are necessary for the conservation of wildlife.
In this perspective, this study has a key value as being a preliminary study on the mammal species in the area. It is also very important to contribute to mammal researches and support the usage of camera trapping widely around the country.
The main purposes of this paper are to present information on the fauna of medium and large sized mammal species found in the study area, and to contribute to the implementation of the camera trap technique for wildlife research in Turkey.

Method
Study area
This study was carried out in Marmaris, Muğla (36º51' N - 28º15' E; Figure 1) located in the south-west of Turkey. The climate is typically Mediterranean with frequent drought during summer and cool, wet winters. The dominant vegetative cover of the study area was *Pinus brutia* Ten. (Turkish Pine) forests and several sites at the different stages of post-fire succession were also present. The post-fire sites consisted of macquis and phrygana vegetation. Dominant plant species of the area included *P. brutia*, *Cistus salviifolius* L., *C. creticus* L., *Quercus infectoria* Olivier, *Phillyrea latifolia* L., and *Smilax aspera* L.

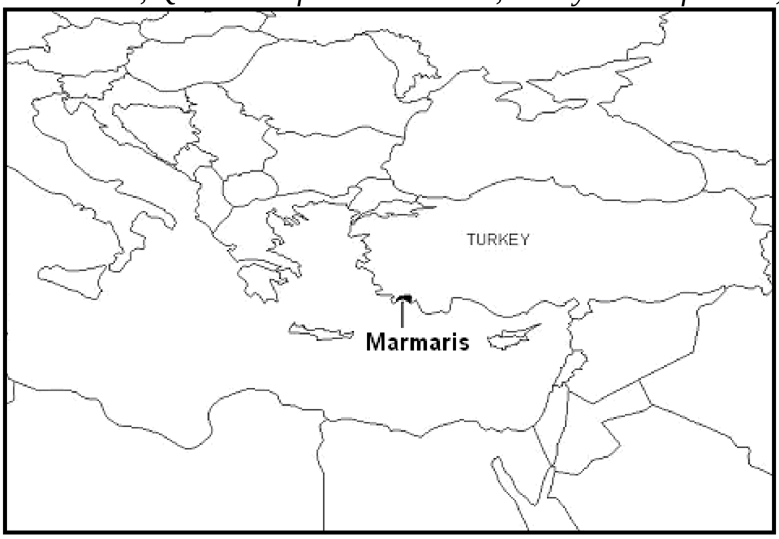

Figure 1. The location of the study area in the Eastern Mediterranean Basin.
Camera trapping

Camera traps were used to determine the medium and large sized mammal species present in the area and to obtain detailed information (such as sex, location, activation time and age) about target animals. The field surveys with camera traps were conducted from August 2005 to August 2006, for a total of 447 camera trapping nights. The overall success of the camera trapping was calculated as the percentage of the ratio of total active camera trapping nights and the number of the captured images of the targeted species (Trolle, 2003).
Twelve Cam Trakker^{TM} Digital (CamTrak South, Watkinsville, GA, USA) camera traps with passive infrared detection systems were used. Built-in sensors detect the presence of an animal in front of the device and activate the camera to take a photograph at the moment. The cameras automatically recorded the date and hour on each photograph and they were set to work 24 hours a day. Camera traps were placed in the field with at least one km intervals. The coordinates of the camera stations were recorded by GPS (Magellan, SporTrakCOLOR). All traps were baited with canned tuna fish. In order to re-bait the sites and get photographs, camera traps were checked every other day. In addition to photographs; the condition of the baits, footprints and other traces of animals around the camera trap stations were also recorded at each visit. All photographs were in digital form, and they were stored in computers. The time information recorded on all images of mammals were used to describe activity patterns of the mammals.

Results

In this study the overall success of camera trapping for medium and large sized mammals was about 13.6%. A total of 61 photographs of wild boar (*Sus scrofa*), Eurasian badger (*Meles meles*), red fox (*Vulpes vulpes*), stone marten (*Martes foina*) and eastern European hedgehog (*Erinaceus concolor*) were obtained by camera traps. Besides these species, rodents such as Caucasian squirrel (*Sciurus anomalus*), black rat (*Rattus rattus*), yellow-necked mouse (*Apodemus flavicollis*) and rock mouse (*Apodemus mystacinus*) were also detected. The activity patterns of the target species according to the information recorded on the camera trap photographs are given in Table 1.

Table 1. The activity patterns of the target species as recorded by camera trapping. Time intervals were determined according to the crepuscular and nocturnal behaviour of the given species. Each "I" represents one record of a species that was photographed by the camera traps in the given time period.

Species	Time interval (hours)						
	06 – 18	18 – 20	20 – 22	22 – 00	00 – 02	02 – 04	**04 – 06**
Vulpes vulpes		IIII	I	I			**II**
Meles meles		I	II		III		
Martes foina				IIIIIIIII I		I	
Sus scrofa	IIIIII			IIII	I	IIIIIIII	**III**
Erinaceus concolor			**I**	**IIIIII**	**I**	**IIIII**	**I**

Discussion

Camera trapping is an efficient technique that is widely used in different ecosystems and climate types for a variety of researches on mammals (e.g.; Africa; Goldman & Winther-Hansen, 2003; Asia; Lynam, 1999; Carbone *et al*., 2001; Grassman *et al*., 2005a; N. America; Buler & Hamilton, 2000; Sequin *et al*., 2003; S. America; Novack, 2003; Trolle, 2003; Europe; Gonzales-Esteban, 2004; Hegglin *et al*., 2004). The present study was also successful in detecting most of the target mammals in the climate and ecosystem studied, as the "trapped" mammals are the common species of Mediterranean ecosystems (Mitchell-Jones *et al*., 1999). However the overall success could be higher than 13.6% by placing the camera traps according to the signs and pathways of the mammals, instead of placing them at random points with 1 km intervals. In surveys which the camera traps are placed along trails the overall success can reach up to 50% (Trolle, 2003).

Despite the detection of the wild goat (*Capra aegagrus*) by direct observation in the study area, no photographs of the species could be taken by the camera traps. As the time and equipment in this study was limited, it was not possible to place the camera traps in steep and mountainous sites, which are the habitat preferences of wild goats (Mitchell-Jones *et al*., 1999). Therefore, longer study periods and intense surveys are very important in order to increase the success of camera trapping.

Even though the detected mammals in this study are not endangered, some of the mammal species are very rare and they have low population density in the country. To prevent the threat on these species, effective conservation plans are needed and the required ecological data for such conservation plans can be obtained by camera trapping (Lynam, 1999; Goldman & Winther-Hansen, 2003; Trolle, 2003; Noss *et al*., 2003). A recent study, which was the first published scientific research conducted by camera trapping in the country, achieved to take photographs of caracal (*Caracal caracal*), a small population sized Felidae species, in South West of Turkey (Giannatos *et al*., 2006). The effectiveness of the method on mammals that have low population density (Copeland, 1993) shows that camera trapping can be a major tool for obtaining the required data for the conservation of endangered large sized mammal species in Turkey.

Consequently most of the targeted large mammal species and even the non-target small mammals in the region were detected by camera trapping. Therefore this result supports the previous conclusion of similar studies claiming that the camera trapping method for determining the mammal species in a region is successful. This preliminary study has opened up the way for an extensive project (Gürkan, 2006) which focuses on large mammals in Northern Turkey.

Acknowledgements

We thank Çağatay Tavşanoğlu and Burçin Kaynaş for their assistance in the field, Ö. Emre Can for his helpful comments on the manuscript and Banu Akkaş for editing. This study was a part of a project supported by Hacettepe University Scientific Research Unit (Project no: 02.02.601.004).

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THE EFFECTS OF LAND USE ON BIOMASS AND CATABOLIC DIVERSITY OF SOIL MICROBIAL COMMUNITIES

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An understanding of the main factors influencing microbial diversity in soils is necessary to predict the effects of current land use trends on diversity. In this study the effects of soil management (high and low input systems and pasture) on microbial biomass and diversity was investigated. Respiration responses to specific substrate were used to measure soil microbial diversity. Catabolic evenness and richness of micro organisms as a measure of soil microbial diversity was measured. In comparison with agricultural systems, native pasture resulted in an increase in organic matter and microbial biomass. However in this three soil managements, in high input systems basal respiration was higher than under other soil managements, suggesting the presence of a small but highly metabolically active micro floral community. Analysis of catabolic response profiles demonstrated that there were large differences in the catabolic capability of the soil microbial communities under different soil management type. Values for Shannon's and Simpson's diversity indices indicated that greatest catabolic existed under native grassland and least diversity under high input systems. This was attributed to broad range of organic pool in pasture. It was concluded that soil management has a substantial effects on the size, activity and diversity of the soil microbial community and that these changes could be broadly related to changes in soil organic matter content. Although the implications of losses of microbial diversity are unknown, but diversity may results more resilient to stresses or disturbances.

Keywords: *microbial diversity, land use, microbial biomass, catabolic response profiles methodology.*

Introduction

Over the last few decades, attention has focused on the impacts that agricultural land uses have on biological and biochemical properties of soils. Indeed, soil is a dynamic, living resource and biologically mediated processes are central to its ecological function. Key soil microbial processes indeed decomposition of organic residues, transformation of soil organic matter, mineralization and immobilization of nutrients and formation and stabilization of soil aggregates [13, 14]. Understanding of soil biological function is necessary predicted structure and function of soil microbial communities. The microbial biomass is living component of soil organic matter and it typically comprises 1-5 % of total organic matter content. Because of its high turnover rate, microbial biomass C can respond rapidly to change in soil management practice [13]. Indeed, the ratio of microbial biomass C to total organic C has been used as an indicator of future changes in organic matter status that will occur in response to alteration in land use, cropping system, tillage practice and soil pollution [26]. Genetic composition of soil bacterial community has been shown to change with conversion from forest to pasture in Hawaii [24]. Also Bradley et al. [5] reported decreases in soil microbial biomass and microbial biomass to total organic matter ratio by intensification of cropping systems.

However it has not been possible to interpret the soil microbial activity from soil microbial biomass [23]. This limitation exist largely because soil microbial can be present in soil but not necessarily functionally active [21]. Direct measurements of functional diversity in soil microbial communities are likely to provide information more relevant to the functioning of soils than species diversity [35]. This component of diversity is different from that obtained by measuring species diversity [10, 12].

Our understanding of soil microbial diversity is very poor [1]. One of the major reasons for the absence of information on microbial diversity is the lack of suitable methods for assessing this diversity [33]. Until recently, investigation of functional diversity in soil microbial communities have largely been based on extracting organisms from soil and determining their pattern of potential substrate utilization under culture conditions [3, 17, 18, 29]. However this approach only provides information about a few culturable organisms in soil, which may not be indicative of the greater soil microbial community. It is not clear whether this approach provide a reliable measure of diversity that is representative of the whole soil microbial community because this method probably only assesses the culturable organisms in soils. This function can be less diverse than the total microbial community in soil [31]. However catabolic response profiles method (CRP_S) of Degens and Harris [8] avoided the problem of the culturablity of soil microbial population under artificial conditions by adding the individual substrate directly to soil and measuring the resulting respiration response. Heterotrophic evenness (a component of diversity) was calculated from the variation in these respiration responses. Since respiration was measured within 4h of substrate addition, there was insufficient time for microbial community adaptation to the substrate [25]. The CRP_S methodology does not measure species or genetic diversity, but rather evenness of different catabolic functions performed by the heterotrophic microbial community. This method is conservative because it measures immediate catabolic substrate induced responses (SIR) on limited range of substrates [8]. Changes in pattern of respiration profiles may not reflected changes in the composition and microbial communities in soils [8].

Greater relative catabolic response to substrate in one soil as compared with the other would indicate the microbial community is more functionally adapted to use that resource [9]. Campbell et al. [6] and Myers et al. [22] have noted that substrate normally founded in the rhizosphere tend to be better discriminators of microbial communities than a general substance. Using the CRP_S approach the microbial community diversity has been shown to respond to changed land use [7], cropping intensity [26], soil organic carbon status [11], successional sequences [35], and stress or disturbance to the soil [5].

The aim of this study was to investigate the effects of land use on activity and metabolic diversity of soil microbial communities. Also whether soil heterotrophic characteristic were related to soil properties, the number of soil biochemical factor including soil organic matter, total nitrogen, total phosphorous, Ca, pH and EC were measured.

Material and Methods

2.1 Site description and sampling

Soil samples were collected from Cheshmegilas district (30° 38´N and 59° 7´E), Chenaran, Iran. Soil samples (20kg) of moist topsoil (0-20 cm) were collected from adjacent site under contrasting management. The land use was classified as either high and low input systems or native pasture. For these purpose 5 low input fields, 3 high input fields, and indigenous vegetation were chosen. Undisturbed area was under long-term pasture (>10 yr.), whereas the others had been under long-term cropping (wheat-fallow). Mean annual rainfall on Chenaran station was 282 mm, and with a mean annual temperature of 12.7$°^{C}$ (mean minimum: –0.3$°^{C}$ in January; mean maximum in June: 24.6$°^{C}$). Twenty samples were collected within each land use. Four sub samples (1kg) from each site after sieving (4-mm mesh) were taken. samples were stored at 5$°^{C}$ until the analysis.

2.2 Soil chemical analysis

Organic C was analyzed by walkley and black dichromate oxidation method and total N by kjeldhal digestion [19]. Soil pH was measured in soil: water slurry using a glass electrode. Exchangeable cations were extracted with 1 M ammonium acetate and available P was extracted with 0.5 M $NaHCO_3$ by Olsen method [19].

2.3 Soil microbial biomass

Soil microbial biomass was estimated using the methods described by Sparling [20]. Briefly, 2 ml of 75-mM glucose solution was added to soil equivalent 1g oven dry weigh in 25-ml bottle and incubated at 25$°^{C}$ for 4h. Microbial biomass C was calculated from the glucose induced respiration rate (corrected for CO_2 evolved in bottle with only deionized water added) as:

MBC (μgC g^{-1}soil) =50.4× respiration rate (μl CO_2 g^{-1}soil h^{-1})

2.4 Measurement of microbial diversity

All samples conditioned in field capacity at 25$°^{C\ in}$ darkness for 7 days before conducting biological measurements to remove the effects of sampling. Microbial functional of soil microbial communities was determined by CRP_S methodology, where measurements are made of the short-term substrate induced responses described by Degens and Harris [8] and Degens [9]. Briefly, the substrate was added as 2-ml solution to 1g equivalent dry weight of soil in 25-ml bottle. A no-substrate control treatment, were only deionized water was added to the soils, was included to determine whether each substrate caused a respiration response above basal respiration. CO_2 efflux from each sample was measured using Infra red gas analyzer (Model LISC 2003) after incubation of the bottle for 4h at 25$°^{C}$ [8]. Substrate included in the assay were: one amine (glutamine), 5 amino acids (argenine, glutamic acid, histamine, lysine, and serine), 5 carbohydrates (glucose, mannose, arabinose, sorbitol, and fructose), and 6 carboxylic acids (citric acid, ascorbic acid, fumaric acid, malic acid, uric acid, and tartaric acid). Concentrations of amino acid and amine solutions were 15 mM, carboxylic acid solutions were 100 mM and carbohydrate solutions were 75 mM. These rates gave maximum respiration response across soil types [7]. All solution was adjusted between 5.8-6.2 to avoid any substrate-ph effects on microbial communities (8).

Diversity is multi-dimensional [26] but the most frequent components calculated are species richness and species evenness. In the case of CRP_S, richness is the number of substrate used by the heterotrophic community [11, 35], whereas heterotrophic evenness (E) was calculated using the Simpson-Yule index [25]: $E=1/\ \Sigma P_i^2$, where P_i is the respiration response summed across all substrate for a soil [20]. Using the formula, the maximum achievable heterotrophic evenness (where all substrate respond equal 1) was 17, which can be re-scaled to range between 0 and 1 by dividing by 17, the number of substrate.

Basal respiration rates were determined from the CO_2 response to water addition in the CRP_S methodology. Also the microbial quotient was measured [34].

2.5 Statistical analysis
The effects of land use on functional richness and evenness were examined by analysis of variation (ANOVA). All statistical analysis was performed on MSTATC and Jump software. Least significant difference was used to compare between land uses.

Results
3.1 Soil microbial properties
Some chemical properties of the experimental soils are shown in table 1. Soil pH was lowest under pasture and highest under high input systems. As expected, p content in fertilized high input systems was higher rather than low input systems and unfertilized pasture. Levels of N and Ca were also higher under native pasture.

3.2 Organic matter and soil microbial properties
Organic C content followed the order: high input systems< low input systems< pasture (fig. 1). Microbial biomass C showed a similar trend with organic C to land use (fig. 1). Differences in microbial biomass C with land use were more pronounced than those for organic C and as a result, there were substantial differences in microbial biomass when expressed as a percent of organic C (fig. 1). Also the effects of land uses on microbial quotient were similar (fig. 1). In contrast basal respiration was significantly greater in high input systems than pasture (fig. 2), however no significant difference was seen between pasture and low input systems (fig. 2).

3.3 Functional diversity of soil microbial communities
Substrate richness, evenness and diversity under the various land uses are shown in table 2. Values for richness were greater in pasture than for the other treatment (low and high input systems). Evenness was lowest under high input systems and greatest under pasture (table 2). Values for the Shannon’s and Simpson’s diversity indices follow the order: high input systems< low input systems< pasture.
Pasture soil had significantly greater response to amino acid and carbohydrate groups (fig. 3). In contrast, high input system soils had relatively greater responses to carboxylic acid groups (fig. 3). In individual substrates level, CO_2 evolved from pasture soil for argenine, lysine, serine, mannose, arabinose, and tartaric acid from high input systems soils for citric acid, ascorbic acid, histidine, and uric acid and from low input system soils for glucose was greatest. Carboxylic acids used in this assay provided the greatest discrimination between soils (fig 3, 4).

4 Discussion

In comparison with undisturbed pasture, soil under low and high input systems has lost organic matter. Microbial biomass C and microbial quotient, showed broadly similar trends to that of organic C.

The higher values for basal respiration under high input systems than under undisturbed pasture could be interpreted as an indication of greater microbial stress under arable agriculture [34]. Major stress are likely to be a low supply of substrate C, that is, unfavorable conditions result in a decrease in the size of the microbial biomass and in the efficiency with which it uses C substrates. As a result there is an increase in respiration rate per unit of microbial biomass [2]. Thus, under an arable system which had the lowest organic matter content, there was a small microbial community that had a proportionally greater metabolic activity (i.e. respiratory rate, ability to hydrolysis substrate) than that under the other land use types. The soil pasture apparently had a larger microbial biomass with a greater proportion of the community present in resting and other non-metabolically active forms. There may well also have been a decrease in the fungal/bacterial ratio under arable land use because of the much reduced inputs of above and below ground plant litter (the substrate for saprophytic fungi) (17, 18, 32). Also annual tillage causing fragmentation and mixing of residues and fungal hyphae. A lower fungal/bacterial ratio would favor a greater metabolic rate and a higher metabolic quotient (4, 16).

Table 1. Some selected chemical properties of soil (0-20 cm) under various long-term land uses.

Land use	pH	EC (ds/m)	N (mg/kgsoil)	Ca (%)	P (mg/kgsoil)
High input systems	7.89	4	1.3	12.8	28
Low input systems	7.73	2.1	1.1	12.6	12
Pasture	7.63	2.7	1.9	12.6	5

Table 2. Effect of long-term land use on substrate richness, evenness and diversity indices.

Land use	Catabolic richness	Catabolic evenness	Shannon's index	Simpson's index
High input systems	14.7 a	0.79 a	1.39 a	0.92 a
Low input systems	13.7 b	0.73 b	1.27 ab	0.86 b
Pasture	13.4 b	0.71 b	1.25 b	0.83 b

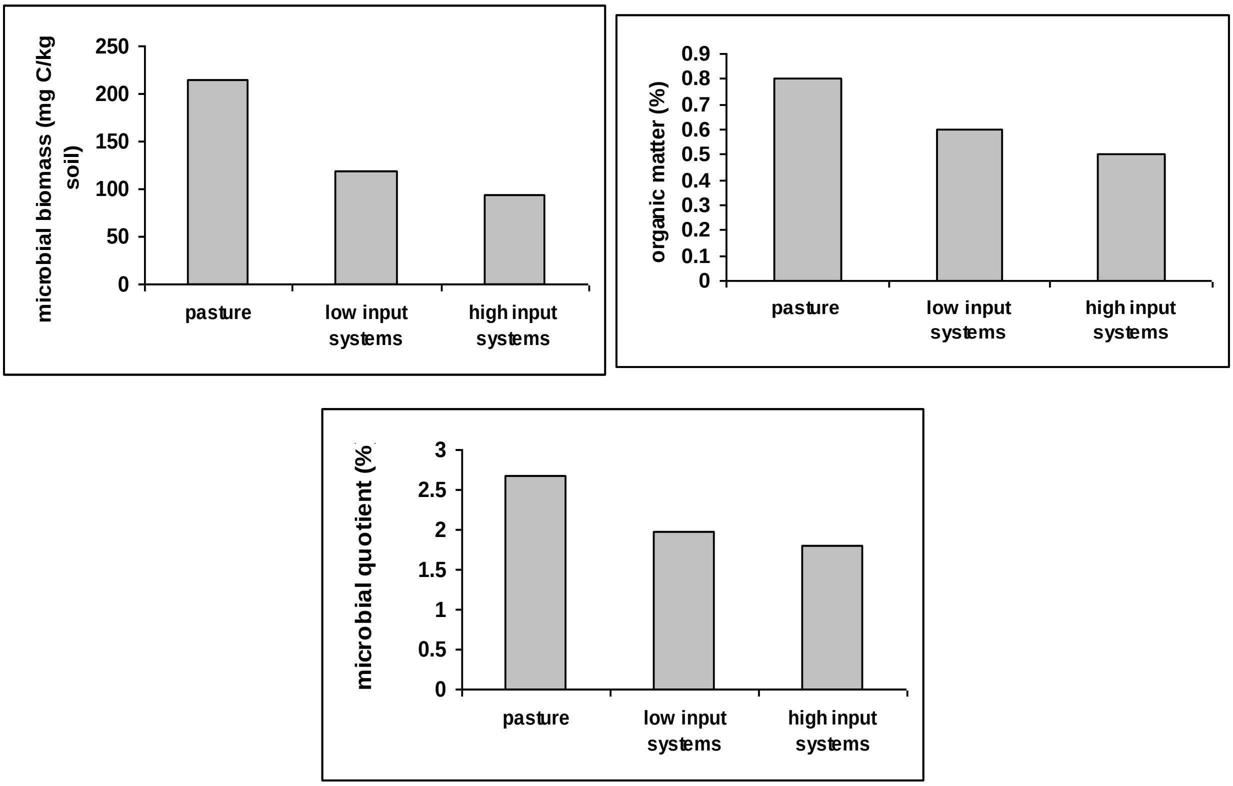

Figure 1. Effect of long-term land use on organic C, microbial biomass C, and microbial quotient.

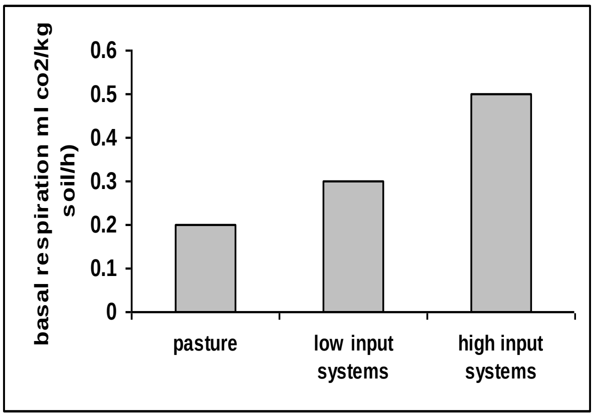

Figure 2. Effect of long-term land use on basal respiration.

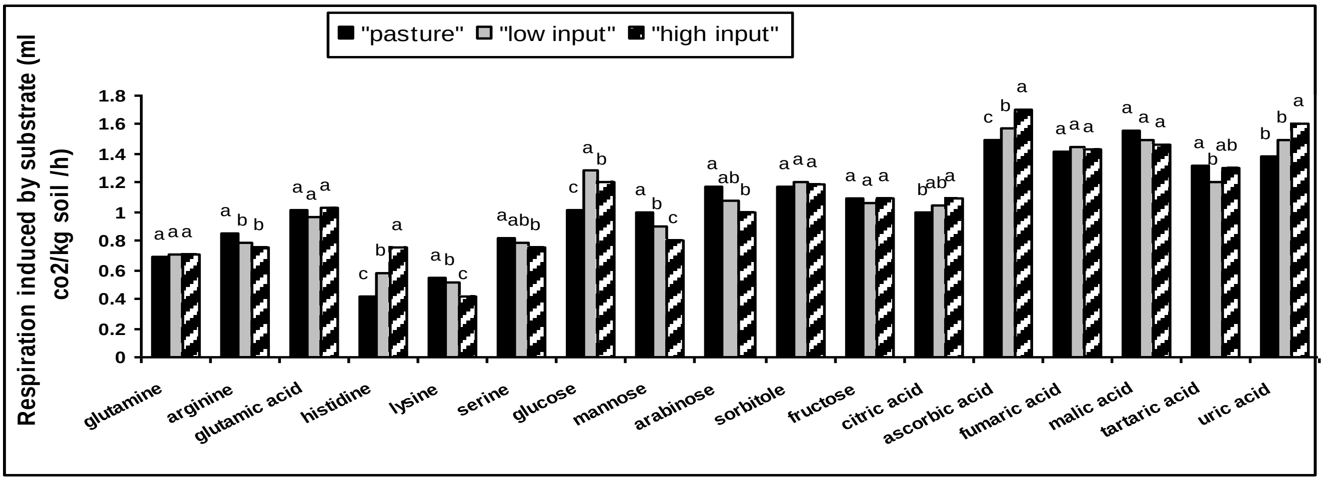

Figure 3. Respiration response profiles induced by substrate groups.

Diversity of soil microbial communities is likely to provide information more relevant to the functional of soils than measurements of species diversity [12]. The diversity of decomposition functions performed by heterotrophic micro organisms presents one important component in catabolic diversity suggests the presence of microbial community with a less resilient decomposition function particularly in response to environmental stresses(e.g. fluctuations in temperature or moisture) [11].

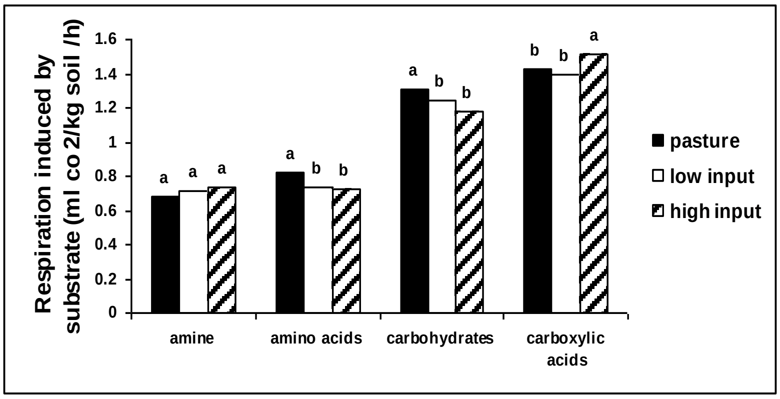

Figure 4. Respiration response profiles induced by substrate groups.

Catabolic diversity of microbial communities in soil depends partly on heterogeneity of food resources then it would be expected that habitats with large and varied production of litter would result in high diversity. In agreement with this, catabolic diversity was greatest under the native pasture. All the other land use types were monocultures of crop species. Nsabimana et al. (23) using CRP_S methodology and showed that catabolic diversity of microbial community can vary under different land uses and this diversity is higher under undisturbed pasture.The implications of decreases in microbial diversity are not known, but may affect soil ecosystem functions. Treatment of soil to reduce microbial catabolic diversity can reduce the capacity for the soil to decompose organic matter, although not always [9]. Studies of community diversity have found that process performed by communities with reduced species diversity can be less resilient to environmental stress (30). Reductions in heterotrophic catabolic evenness may also result in resilient or more unstable microbial decomposition function particularly in response to normal environmental stresses such as seasonal temperature or moisture extremes. If the land uses resulting in losses of organic C from soils that may generate soils that are less resilient to stresses or disturbances. Catabolic diversity (richness and evenness) of soil microbial heterotrophic show potential to be an indicator of soil properties for soils with an unknown history of land use. Although a single index inherently capture only a few characteristics of a catabolic response profiles, such an index can be particularly useful for rapid evaluation of at least a component of microbial diversity.

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CONSERVATION AND MANAGEMENT OF BIODIVERSITY: AN INDIAN PERSPECTIVE

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The term biodiversity may be defined as "variation of life at all level of biological organisation". It is measure of the relative diversity among organisms present in different ecosystems.India is one of the twelve "megadiversity" countries of the world.. This paper seeks to highlight the Indian efforts on conservation and management of biodiversity and the problems faced thereby. The reasons for protecting the biodiversity inter alia include maintenance of environmental balance and preservation of flora and fauna constituting the complex web of food chain. In response to the global calls, India has enacted various legislations and introduced administrative policies for preventing pollution, protecting wildlife and the forests of the country. The Indian judiciary has interpreted right to healthy environment as a fundamental right and relaxed the locus standi principle. However, obstacles remain at various levels of environmental governance on different accounts and this paper seeks to analyse those problems and suggests certain solutions which will help the native State to contribute significantly in the global efforts of biodiversity conservation.

Keywords: *Biodiversity, Environmental Balance, Net Present Value, Carbon Sequestration, In- Situ Conservation*

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DEFINITION OF BIO- DIVERSITY

The term biodiversity may be defined as "variation of life at all level of biological organisation"[1]. It is measure of the relative diversity among organisms present in different ecosystems. "Diversity" in this definition includes diversity within a species and among species, and comparative diversity among ecosystems. In a genetic parlance, it may be defined as "totality of genes, species, and ecosystems of a region". An advantage of this definition is that it seems to describe most circumstances and present a unified view of the traditional three levels at which biodiversity has been identified[2]. Biodiversity is basically of two kinds- one that naturally exists and has evolved with the passage of time and the other one is domesticated biodiversity that has been created by human efforts such as agricultural practices and domestication of animals. The domesticated biodiversity is however not an independent entity and it derives its existence from the various elements of natural biodiversity.

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WHY CONSERVE BIO- DIVERSITY?

India is one of the 12 "megadiversity" countries of the world. It is also at the meeting zone of three major zones of three major biogeographic realms viz. Indo- Malayan (the richest in the world), the Eurasian and the Afro- tropical. India also has the two richest biodiversity areas- the North Eastern region of India and the Western Ghats.[3] This geographical blessing is the most primary reason for conservation of our biodiversity.

Besides, The whole mankind has been ever since dependent upon the biodiversity for all of its needs. It should not be forgotten that the entire bio-system runs on a balance. The environmental balance may be defined as the existence of such conditions that are conducive for the mutual long term survival of plants and animals in any given ecosystem. Various human activities have created imbalance in the nature and have caused the depletion of the natural biodiversity. The inter and intra generational equity has been foregone in order to meet the growing human demands. Development that meets the needs of current generations without compromising the ability of future generations to meet their needs and aspirations[4] is in true terms sustainable development. In the present scenario, anything deviating drastically from the aforesaid phenomenon would be unsustainable. The concept of sustainable development takes within its ambit, the maintenance of a proper environmental balance. Thus, there is a need to maintain the environmental balance in order to conserve the biodiversity. This balance ensures a control over calamities such as floods, unnatural climatic shifts as well as adequate oxygen production and carbon dioxide absorption. Speaking on a Utopian note, we need to ensure an environmental balance that perhaps existed in the pre- industrialization era. However, since it is impossible to dispense with industrialization, we have to take collective measures at local, national and global levels to bring back a certain balance. Speaking in terms of equity, what man has misappropriated from the nature, he has to revive it on two accounts- to replenish and make up for the imbalance created and for the survival of his own self and his succeeding generations.

Another argument in favour of conserving our biodiversity is the species conservation and wildlife protection. All the animals that exist in an ecosystem have a role to play, whether active or inactive, direct or indirect, in the complex web of the food chain. If any step(s) of the food chain is missing, it will create immediate and long term ill effects to the food chain by creating a gap at different levels. A simple illustration may be taken of the several species of insects that have evolved over long periods of time in such a manner that they help in pollination of specific types of flowers. The vast use of insecticides would exterminate these insects which will stop the propagation of the plant varieties also that depend on such insects for pollination.

Since we have derived the domesticated biodiversity from the naturally existing gene- banks, it gives all the more reason to conserve this natural bounty. It cannot be denied that for the long term survival of the domesticated biodiversity, the existence of natural biodiversity is absolutely essential.

[3] T.N. GODAVARMAN v/s UNION OF INDIA; (2006) 1 SCC 1
[4] [WCED, 1987]

Even the plants have a significant role to play in the food chain as they form the basic food source for humans as well as herbivores. There are certain species of plants consumed by only certain species of animals. Similarly, certain other plant species are used by man for medicinal characteristics that they possess. These medicinal qualities of plants have been exploited for thousands of years and are not easily available anymore.

GLOBAL CALL AND INDIAN RESPONSE

The world community responded to the urgencies of conservation of biodiversity early in the 1972 through the Stockholm Conference[5] and in 1992 again through the Rio Conference[6]. These conferences urged the Nation countries to make laws in accordance with the international call to revive the environment. The idea of these conferences centered at the point that today man's activities should not hamper the existence of the future generations. The recent convention on Biological Diversity and Kyoto Protocol has tried to address the international community's grievances about the losses accrued to various ecosystems and concern over the rising global temperatures. They expressed their sincere feelings to protect the flora and fauna in order to bring back the balance. This act of the international community gives a ray of hope that we are trying to achieve and revive our own mother nature.

THE INDIAN RESPONSE

India is a land of diverse cultures where the environment and its various elements are considered to be sacred. A divine and spiritual sanctity is attached to the nature across various communities of India. However, the advent of industrialization and globalization has made this sanctity sub- servient to the growing demands of the people. The forest cover is reduced to less than the needed 33%, there have been short rainfalls, frequent floods in India. These were the results of the so called expansionist attitude of the capitalists and the government which blindly accepted the rapid inroads made by the industries. After the two most important international conferences at Stockholm and Rio the Indian government tried to respond to the international calls timely by formulating the so called environmental legislations and policies, like: The Biological-Diversity act, 2002,The National Environment Policy, 2004, National Forest Policy,1988, The Environment Protection act 1986, the Wildlife Protection Act, 1972, the Air Act 1981, the Water Act 1974, the Wild Life Action Plan 1983, The Forest Conservation Act, 1980.

The Biological -Diversity Act 2002 provides for the establishment of the Central, State and Local boards for conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of utilization of genetic resources. The Act also provides for the establishment of certain fund to be utilized to achieve the objectives of the Act.

[5] The conference called upon the governments and people to exert common efforts for the preservation and improvement of the human environment, for the benefit of all the people and for their prosperity.

[6] This conference reaffirmed the Stockholm declaration with the goal of establishing a new and equitable global partnership through the creation of new levels of cooperation among States, key sectors of societies and people and working towards international agreements which respect the interest of all and protect the integrity of the global environmental and developmental system.

The *National Environment Policy* (NEP, 2004) is a response to our national commitment to a clean environment, mandated in the Constitution in Articles 48 A and 51 A (g), strengthened by judicial interpretation of Article 21. It is recognised that maintaining a healthy environment is not the state's responsibility alone, but also that of every citizen. A spirit of partnership should thus be realized throughout the spectrum of environmental management in the country. While the state must galvanize its efforts, there should also be recognition by each individual – natural or institutional, of its responsibility towards maintaining and enhancing the quality of the environment. The NEP, 2004 is also intended to be a statement of India's commitment to making a positive contribution to international efforts. The NEP, 2004 is intended to be a guide to action: in regulatory reform, programmes and projects for environmental conservation; and review and enactment of legislation, by agencies of the Central, State, and Local Governments. It also seeks to stimulate partnerships of different stakeholders, i.e. public agencies, local communities, the investment community, and international development partners, in harnessing their respective resources and strengths for environmental management.

The first National Forest Policy in 1988 visualized and realized that the forests in the country had suffered serious depletion. This is attributable to relentless pressures arising from ever-increasing demand for fuel-wood, fodder and timber; inadequacy of protection measures; diversion of forest lands to non-forest uses without ensuring compensatory afforestation and essential environmental safeguards; and the tendency to look upon forests as revenue earning resource. The NFP of 1998 strategises to increase the forest cover and the tree cover to 1/3rd of the total land area of the country and 2/3rd of the total area in the mountainous regions. This is sought to be done by various activities under forest research, forest education and forest extension. Its principal aim is to ensure environmental stability and maintenance of ecological balance including atmospheric equilibrium, which are vital for all life forms.The Environment Protection Act 1986 was formulated as a result of the International Convention at Stockholm to take appropriate steps for the protection and improvement of human environment. It is considered necessary further to implement the decisions of the aforesaid international conventions in so far as they relate to the protection and improvement of environment and the prevention of hazards to human beings, other living creatures, plants and property. The Act empowers the central government to establish certain Environmental Laboratories which is a unique taken by the government in order to actually attain the objective of testing the effects of differential use of environment[7].

The Wildlife Protection Act, 1972 is an Act to provide for the protection of wild animals, birds and plants. The Act imposes a prohibition on hunting of wild animals and provides for the setting up of sanctuaries, natural parks etc. It also imposes a prohibition on trading in animal articles and other animal derivatives, such as hyde, ivory, claws, etc. The significant feature of this Act is the schedule which classifies the endangered animals and plants according to the level of threat that they are faced with. However, being an old legislation some drastic amendments have been sought by introducing a latest bill relating to the same in 2006. The new Bill envisages setting up of the National Tiger Conservation Authority (NTCA) and the National Wildlife Crime Bureau. The legislation is also sought to be made tribal friendly. The NTCA will provide oversight by the Parliament and will also ensure support in the form of scientific expertise, IT and legal expertise.

[7] Section: 10 Environment Protection Act, 1986.(No:29 of 1986)

The first National Wildlife Action Plan (NWAP) was adopted in 1983. The plan had outlined the strategies and action points for wildlife conservation which are still relevant. In the meanwhile, however, some problems have become more acute and new concerns have become apparent, requiring a change in priorities. Increased commercial use of natural resources, continued growth of human and livestock populations and changes in consumption patterns are causing greater demographic impacts. Biodiversity conservation has thus become a focus of interest. The National Forest Policy was also formulated in 1988, giving primacy to conservation. Hence a new National Wildlife Action Plan was introduced, giving priority to factors like ecological security, priority to conservation, national land use policy and primacy for water and sustenance. The Action Plan encompasses a state wise review of the Protected Area Network to identify the gaps with reference to the parameters mentioned above and to rectify the inadequacies and to create a series of inviolate areas in representative biogeographic zones and provide linkages between all Protected Areas within biogeographic sub-divisions. The plan envisages to accord primacy to *in situ* conservation, the sheet anchor of wildlife conservation. *Ex situ* measures in zoological parks and gene banks may supplement this objective, without depleting scarce wild resources.

There are several other legislations such as the Forest Conservation Act, 1980, The Water (Prevention and Control of Pollution) Act 1974, The Air (Prevention and Control of Pollution) Act, 1981

THE JUDICIAL CONTRIBUTION

The inadequate enforcement of environmental laws and non-compliance with statutory norms by polluters resulted in an accelerated degradation of the biodiversity of India. Several terrestrial and aquatic ecosystems got polluted, and large-scale deforestation was carried out with impunity. There was also a rapid increase in casualties due to respiratory disorders caused by widespread air pollution[8]. For example, in any country the forest cover should be at 33 per cent of the land mass. In 1996, India had only about 15 per cent forest cover. The Yamuna, a prominent north Indian river flowing through the capital of India, is worshipped here. But when it leaves Delhi, the oxygen content of the water comes down next to nil. Such large-scale environmental degradation and adverse effects on public health prompted environmentalists and residents of polluted areas, as well as non-governmental organizations, to approach the courts, particularly the higher judiciary, for suitable remedies.[9] The higher judiciary of India, specially the Supreme Court acknowledged that in order to comprehend environmental problems, one has to have a know-how of socio-economic, political, legal and other such processes and thus ensure and establish environmentally sustainable development.

[8] thousands of people died and are still dying slow deaths due to the leakage of MIC gas in Bhopal (India) in 1984- **www.hu.mtu.edu/**

[9] Justice B.N. Kirpal- (2002) 7 SCC (Jour) 1

The Supreme Court of India, in recent years, has been adopting a holistic approach towards environmental matters. This is usually done through detailed orders that are issued from time to time, while committees appointed by the Court monitor the ground situation. The origin of this tendency may be seen in cases such as ***Municipal Council, Ratlam* v. *Vardichand***[10] and ***Olga Tellis* v. *Bombay Municipal Corporation***[11] that such an approach has been beneficial is evident from two instances. Since passing the first order in 1996, not only has the decline in forest cover been prevented but the forest cover has actually registered a modest increase. The cleaning of air in Delhi is the other example.[12] The concept of public interest litigation has been extensively developed by the Indian Courts and it has relaxed the principle of locus standi to a large extent. Any public spirited person can approach the Court under the writ jurisdiction[13] and bring to the notice of the Courts, any acts of degradation of the environment. The Courts have also taken suo motu action by treating letters of the aggrieved and newspaper reports as petitions. This has led to the growth of awareness amongst the masses and led to landmark judgments that have formulated new principles of law specifically addressing the need to protect the depleting biodiversity. In the case of ***M.C. Mehta v/s Union of India***[14], the principle of absolute liability was evolved wherein the polluter was deprived of any immunity in case of his acts and omissions leading to mass environmental degradation. The case of ***M.C. Mehta v/s Kamal Nath***[15] laid emphasis on the doctrine of Public Trust. In order to secure sustainable development, the doctrine of Public Trust plays a key role. This is a doctrine of environmental law, under which the natural resources such as air, water, forests, lakes etc are considered to be public properties "entrusted" to the Government for their proper use and protection. Public Trust Law recognises that some types of natural resources are held in trust by the Government for the benefit of the public. The Doctrine of Public Trust has been evolved so as to prevent unfair dealing with or dissipation of all natural resources.[16] In the case of ***M.C.Mehta v/s Kamal Nath and Others***[17] the Hon'ble Supreme Court observed that "If there is a law made by Parliament or State Legislatures the Courts can serve as an instrument of determining the legislative intent in the exercise of its powers of judicial review under the Constitution. But in the absence of any legislation, the executive acting under the Doctrine of Public Trust cannot abdicate the natural resources and convert them into private ownership, or for commercial use." This view was again followed by the Hon'ble Court in a recent case ***T.N. Godavarman v/s Union of India and others*** [18].

The judiciary has made sincere efforts to interpret the Directive Principles and the Fundamental Duties vis-à-vis the right to life and healthy environment as enshrined in the Article 21 of the Constitution through a gamut of judgments.

[10] (1980) 4 SCC 162
[11] (1985) 3 SCC 545
[12] (2002) 7 SCC (Jour) 1
[13] The Supreme Court can be approached under Article 32 of the Constitution and The High Courts of the States can be approached under Article 226 of the Constitution of India.
[14] AIR 1987 SC 1086
[15] (1997) 1 SCC 388
[16] Common Cause, A Registered Society v/s Union Of India And Others (1999) 6 SCC 667 Para 160
[17] *ibid*
[18] (2005) 5 JT 561

In a recent judgment of the Supreme Court, the order that was passed was probably one of the most significant decisions given by the Court having a far-reaching impact on the conservation of forests in India. It emphasized on charging on net present value upon using forest land for non forest purposes. The Court defined NPV as *the present value (PV) of net cash flow from a project, discounted by the cost of capital*. It is the method by which future expenditures (costs) and benefits are levelised in order to account for the time value of money.

The Court held that any threat to ecology can lead to violation of right to healthy life guaranteed under Article 21. It was also held that any nation's development is necessary but it has to be consistent with the protection of the environment and not at the cost of degradation of the environment.[19]

HURDLES IN ENVIRONMENTAL GOVERNANCE AND MANAGEMENT

When we talk about environmental governance at local, national and global levels, each of these levels faces certain impediments in efficient governance and management. In India, there is a lack of local awareness about the need to conserve biodiversity. Consequently there is a lack of individual responsibility especially amongst the illiterate and poor, which make up a significant percentage of the Indian population. Owing to large size of poor families who are illiterate and unemployed, their dependence on the natural resources for basic survival increases manifold. It would however, be unjust to hold them and only them accountable for the depleting environment. The rich people are also contributories to the degrading biodiversity on account of their constant and rising demands of luxurious life. The liberalization of economy and higher availability of disposable income also worsens this situation.

Secondly, at the National level, the lack of political will and administrative incapacity to understand the need of conserving biodiversity in the present scenario, keeping in mind the compulsion of development has rendered the biodiversity paralyzed. Several instances can be cited to establish this situation. The Narmada river case is a prominent example in this regard. This river is considered as the one of the largest agricultural basins in western India meeting the needs of the agricultural sector. The construction of a dam on this river and latest developments on raising the height of the dam has caused submersion of several villages in the State of Madhya Pradesh and irreparable damage to the nearby ecosystem of this State. It has not only taken away the livelihood of several farmers but also rendered them homeless. The domesticated biodiversity of the affected areas has taken a tragic toll. Rampant and unchecked poaching activities have caused the extinction of tigers (*Panthera tigris*) in the Sariska National Park in the State of Rajasthan. Poaching activities remain unnoticed and even if they are noticed, the Forest Officers are not able to do much due to absence of full cooperation from higher political spheres. Certain courts have tried to gain publicity by bringing celebrities to trial for poaching but these cases have also dragged on for years. Other cases involving hardcore poachers go absolutely unnoticed by the authorities and the media.

[19] T.N. GODAVARMAN v/s UNION OF INDIA (2006) 1 SCC 1

The media only indulges in negative publicity in the rare cases where celebrities are involved. Neither the authorities nor the media have attempted to play a constructive role in the prevention of the poaching activity. It is indeed very surprising and disturbing to know that less than hundred Asiatic wild buffaloes remain in the wilds, which are the natural source and gene- bank of the domesticated buffaloes used for meeting the dairy needs.

Thirdly at the global level, the priorities of development cause the countries to overlook the degrading biodiversity. The international economic competition in the present era of globalization and rapid industrialization has become a serious concern for the depletion of our natural resources. We should not be taking any such steps that give rise to such a situation as has arisen in China. China has in the last few decades shown remarkable economic growth that now competes with the best in the world. However, this has come at a cost which is evident in dangerous situations such as the loss of habitat of the Giant Panda, who are also struggling to survive with limited availability of their staple diet, which are bamboo plants.

Briefly said, the compulsion of development in respect of big projects undertaken by Government, industrialization and liberalization and the biotic disturbances caused by rising human demands are the major obstacles in managing our biodiversity and the need of the hour is to create individual awareness about the ill effects of all these obstacles.

SOLUTIONS

In view of the problems discussed hereinabove, certain solutions may be suggested. Since the global warming is adversely affecting the biodiversity, it is necessary to control the rising CO_2 levels. The Kyoto Protocol is an agreement made under the United Nations Framework Convention on Climate Change (UNFCCC). Countries that ratify this protocol commit to reduce their emissions of carbon dioxide and five other greenhouse gases: methane, nitrous oxide, sulfur hexafluoride, HFCs, and PFCs, or engage in emissions trading if they maintain or increase emissions of these gases.

The Kyoto Protocol now covers more than 160 countries globally (not including the United States and Australia) and over 55% of global greenhouse gas (GHG) emissions. Kyoto is a ‘cap and trade’ system that imposes national caps on the emissions of CO_2 in different countries. On average, this cap requires countries to reduce their emissions 5.2% below their 1990 baseline over the 2008 to 2012 period.

The innovative step sought at Kyoto protocol is the introduction of a system called carbon sequestration. **Carbon sequestration** is the term describing processes that remove carbon from the atmosphere. A variety of means of artificially capturing and storing carbon, as well as of enhancing natural sequestration processes, are being explored. This is intended to help mitigate global warming. The protocols hold that, since growing vegetation absorbs carbon dioxide, countries that have large areas of forest (or other vegetation) can deduct a certain amount from their emissions, thus making it easier for them to achieve the desired emission levels. Some countries want to be able to trade in emission rights in carbon emission markets, to make it possible for one country to buy the benefit of carbon dioxide sinks in another country. It is said that such a market mechanism will help find cost-effective ways to reduce greenhouse emissions.

The concept of emission trading means that the ultimate buyers of Credits are often individual companies that expect their emissions to exceed their quota (their Assigned Amount Units, Allowances for short). Typically, they will purchase Credits directly from another party with excess allowances, from a broker, from a JI/CDM developer, or on an exchange.[20]

National governments, some of whom may not have devolved responsibility for meeting Kyoto targets to industry, and that have a net deficit of Allowances, will buy credits for their own account, mainly from Joint Implementation (JI)/Clean Development Mechanism (CDM) developers. These deals are occasionally done directly through a national fund or agency, as in the case of the Dutch government's ERUPT programme, or via collective funds such as the World Bank's Prototype Carbon Fund (PCF). The PCF, for example, represents a consortium of six governments and 17 major utility and energy companies on whose behalf it purchases Credits. There is as yet no carbon audit regime for all such markets globally, and none is specified in the Kyoto Protocol. Each nation is on its own to verify actual carbon emission reductions, and to account for carbon sequestration using some less formal method.

Therefore, the developed and developing countries need to enter into a cooperative stance where they come on an equal platform and enter into treaties which will enable them to buy portions of carbon sinks in the other countries and thereby contribute in reducing the global warming.

IN-SITU AND EX-SITU CONSERVATION

In-situ conservation means "on-site conservation". It is the process of protecting an endangered plant or animal species in its natural habitat, either by protecting or cleaning up the habitat itself, or by defending the species from predators. The benefit to *in-situ* conservation is that it maintains recovering populations in the surrounding where they s to have developed their distinctive properties. As a last resort, ex-situ conservation may be used on some or all of the population, when *in-situ* conservation is too difficult, or impossible.

Wildlife conservation is mostly based on *in situ* conservation. This involves the protection of wildlife habitats. Also, sufficiently large reserves are maintained to enable the target species to exist in large numbers. The population size must be sufficient to enable the necessary genetic diversity to survive within the population, so that it has a good chance of continuing to adapt and evolve over time. This reserve size can be calculated for target species by examining the population density in naturally-occurring situations. The reserves must then be protected from intrusion, or destruction by man, and against other catastrophes.

[20] http://en.wikipedia.org/wiki/Kyoto_Protocol

OTHER SOLUTIONS

The corporate bodies can play a significant role in conservation. The government should provide Tax benefits such as amnesties to capitalists in respect of international emission trading and incentives to multi national companies in respect of foreign direct investment in India if they directly contribute to the bio-diversity conservation.

Another important solution that is must for India is to bring in awareness among the masses about the advantages of preserving and conserving bio-diversity. The government ought to introduce the concepts relating to bio diversity in the primary school curriculum itself and take on drives like planting tress and initiate different methods of afforestation.

The media will prove to be highly instrumental in playing a positive role for conserving biodiversity. It may collaborate with prominent international organizations to spread mass awareness, especially in rural areas. The advantage in rural India is that the traditional values and cultures which are attributed to the nature will give easy access to the widespread natural resources and help us in bringing the villages together to develop the people's consciousness on bio-diversity.

CONCLUSION

Having comprehended the importance of biodiversity, the time is ripe for us to take measures at the local, national and global levels. The call of the hour is to work both harder and smarter and to make substantial investments in research and technology which will pave the way for revival of all that we have lost in so many years. In order to secure the survival of our succeeding generations, an international cooperation and assistance would be required by India to achieve its objectives in respect of all the three levels of environmental governance. When the conscience of every citizen is aroused to take individual responsibility for protecting the rich flora and fauna, only then can we proceed further towards this imperative and noble cause.

International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

EFFECT OF CONSERVATION ON PLANT DIVERSITY IN SEMIARID REGION OF IRAN

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Plant utilization in arid and semi arid region is the main factor of environment degradation and shortage in plant diversity. Conservation in some case shows, plant diversity can be improve under arid and semiarid condition. In order to clear the positive role of conservation in semi arid region of Iran two neighbor site in Qazvin plate were selected, one of these site have been protected for 40 years as a park and another site beside this park didn't have any planning for conservation. Diversity in different plant type from plant richness and vegetation parameters (density, litter and live coverage) point of view in protected area and its neighbor were determined by using of random systematic sampling. Statistical analysis shows these parameters in protected area are higher than its neighbor site. Planting of Saxaul (*Haloxylon aphyllom*) and some xerophytes plant in park have been caused, plant richness became more noticeably. In addition to protection, good management can conserve plant diversity in good condition but after 40 years management in park doesn't have any plan for old plants. This plant must be superseded by new seedling of same species or more durable species.

Key words: *Conservation, plant richness, vegetation and management.*

INTRODUCTION

The area of Iran is 165 millions hectares and nearby half of this vast country has arid and semiarid condition. At recent decades, human's activities destroyed natural resources of Iran and reclamation of these areas need more research. One of the best research in this filed is comparing between protected area and unprotected area in order to find a good solution for this problem. Protection is an old method for management and conservation of plant diversity (Moghaddam, 1999). Management of plant diversity is based on ecological principles that involve those kinds of operations that attempt to modify rather than control natural resources forces operating on the land. Management must consider immediate productivity, as well as long- term management for maintaining the resources (Mesdaghi, 1993).
Wilcox *et al* (1994) noted the aim of management is maintenance of plants resources in productive and sustainable condition. West (1993) states the aims of management program are:
1- Plant conservation and make improvement in trend from quantities and quality point of view.
2- Soil and water conservation.
3- Plant usage without any damaging to plant, soil and water complex during long period.

STUDY AREA

1- Geographical location

Study area located at the east of Buen Zahra city at Qazvin province. This area (Milad Park and contiguous land) is located between 35°46′ to 36° 1′ N and 50° ′6 to 50° 22′E.the road of Buen Zahra to Eshtehard is at the north of study area. Study area is 34440 hectares and 390 hectares from this area was protected as a park for 38 years (form 1964 to 2002) without any livestock grazing.

2- Management program

At park, two plant species have been planted (*Haloxylon aphyllom* and *Colligonum commosum*) in order to stabilize soil and sand hills. Two main local livestock (*camel & sheep*) grazed unprotected area beside the park.

3-*Geology and geomorphology*

Study area is a vast flat land and quaternary alluvial sediment covered this area. Main slope caused, rivers pass this area from northwest to southeast.

4-soil resources

Solon chalk soil covered the most of study area. This kind of soil has fine texture and relatively high depth. At some part of southern of study area there is sandy sirozem soil but depth in this kind of soil is shallow to moderate.

5-Climate

There are three climatologic stations at study area and climatic data was available. Table (1) shows average of temperature and precipitation condition for a 20 years period. This data shows study area has semi arid weather condition. Precipitations occur in winter during plant dormancy.

Table (1): Annual Weather parameter at study area

Station name / Weather parameter	Fath Abad	Allah Abad	Danesfahan
Annual means of precipitation(mm)	171.69	222	208.8
Annual Mean of temperature(C°)	13.29	12.84	13.29
Annual Mean of maximum temperature (C°)	21.86	21.64	19.49
Annual Mean of minimum temperature (C°)	4.25	4.21	8.01

MATERIAL AND METHOD

At first topographic map (1/250000) and aerial photo (1/50000) of study area were prepared. Plant types were separated by photo contrast. Boundaries of plant types were transferred form photo to topographic map and one code was selected for each polygon. At filed, these polygons were controlled by GPS. Uncorrected polygons were corrected by GPS data. At each plant type, sampling was done by using of Random-Systematic method (Random transect and 10 Systematic1×1 plots). In each plot floristic list and life form (Grass, Grass like, Forbs, Shrub and Tree) and coverage of each plant, litter, surface stoniness and bare soil were recorded.

Plant type was determined by main coverage of two dominant plants. Range condition was determined by modified four-factor method (Arzani, 1997). Also by using of balance method Condition trend at each plant, type was determined. Finally the means of main parameters at plant type (live coverage, litter, sand and bare soil) were compare by SPSS ver 9.00 and plant types were grouped by Duncan method from coverage point of view.

RESULTS AND DISCUTION

Results show, there are 61 species at park and these species belong to 23 of tribe but at unprotected area there are only 24 species that belonged to 8 of tribe. Percentage of plant tribe in plant composition at two these areas are showed in figure (1).

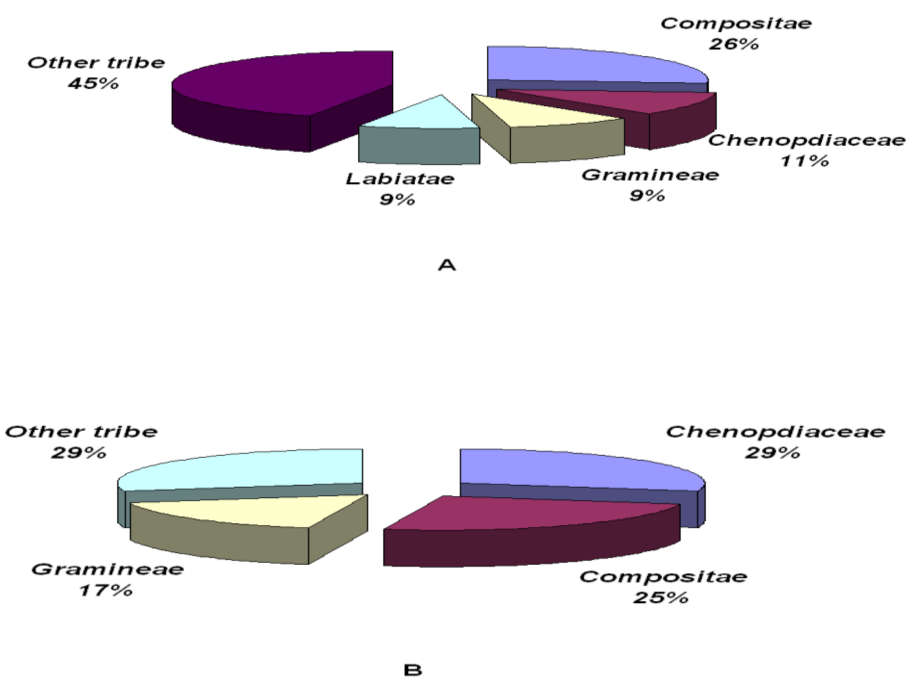

Figure (1): Percentage of plant tribe in plant composition at study area.
A (Milad Park) & B (unprotected area)

There are seven-plant type at unprotected area and only one type at park but plat diversity at park is richer than unprotected area. In five-plant type at unprotected area, *Halocnemum stabilaceum* is dominant specie. Plant type condition and trend were shown at table (4).

Range condition at two areas, show majority of study area doesn't have good condition.

Analysis of variance of measured factor shows, there is significant different in 5% level between plant type table (2).comparison between means of measured factor was done by Duncan test table (3).

Table (2): ANOVA of measured factor in different plan types

		Sum of Squares	df	Mean Square	F
Live cover	Between Groups	4913.788	7	701.970	29.596**
	Within Groups	1707.700	72	23.718	
Total		6621.488	79		
Litter	Between Groups	752.447	7	107.492	19.474**
	Within Groups	397.425	72	5.520	
Total		1149.872	79		
Bare soil	Between Groups	11880.872	7	1697.267	22.845**
	Within Groups	5349.225	72	74.295	
Total		17230.097	79		
Stoniness	Between Groups	823.150	7	117.593	2.937**
	Within Groups	2882.400	72	40.033	
Total		3705.550	79		

**: Significant difference at 1% level

Table (3): Comparison between means of measured factor in different plant type

Code	Plant type	Live cover	Litter	Surface stoniness	Bare soil
1	Ha.ap - Ca.co	30 a	10 a	15.6 a	47 c
2	Li.ir - Ar.si	6.1 de	1.05 c	15.5 a	73.85 b
3	Ha.st - Li.ir	9.6 bcd	0.3 c	8.5 c	85.1 a
4	Ha.st - Sa.sp	6.4 cde	0.5 c	7.5 c	85.6 a
5	Ha.st - Ar.si	10.9 bc	1 c	12.6 ab	75.5 b
6	Ha.st - Se.ro	3.9 d	1.7 c	8 c	85.8 a
7	Ha.st - Ce.ar	5.7 de	0.6 c	8.5 c	85.25 a
8	Ar.si - Sc.ca	13 b	3.88 b	13.2 ab	70.3 b
9	Cultivated land	....	....	....	....

Based on results rangeland condition at Milad park is only good condition and trend is positive at its plant type. This result prove that protection caused condition and trend become better after along time and other plant type don't have favorite condition and trend. Ecosystem in semiarid region like this study area can't tolerate heavy grazing and this ecosystem will lose its production and quality. Livestock grazing without any programs (unclosed grazing) is the main factor for decreasing of plant diversity and live coverage. Wind and water erosion in on soil surface have been increased due to plant converting and this condition is a proper condition for desertification and sand hill formation meanwhile at Milad Park vegetation cover and litter are adequate for soil and water conservation and level of these two factor are located at higher class. Protection at park caused, development of favorite plant like, *Stipa barbata* and *Artemisia sieberi* have been accelerated. This development depends on planted species (*Haloxlon aphyllom* and *Colligonom comosum).* Sexual as a tree have been provide favorite condition for sub storey plant like *stipa barbata and* soil moisture. Stoddart (1975) discusses that the most important factor limiting plant productivity is deficiency of soil moisture, therefore, each practice, which reduces surface runoff and increases soil moisture content, will increase plant productivity and this event was occurred at Milad Park. Plant composition at unprotected area doesn't have good quality not only for grazing nor for soil conservation. Plant composition shows Graminae has higher presence in plant composition at unprotected area but these species are commonly annual grass without any palatability and durability for soil conservation. These Gramineae are known as invader plants at this condition. Based on these results preparation and execution range management plans (R.M.P) strongly recommended solving problems about plant diversity degradation in this region.

Conclusion

Plant richness and diversity are depends on ecological parameters like precipitation, soil condition and other physical condition but management can play main role in these cases. Other researchers have been proved plant conservation can improve biodiversity and production noticeably. Danckworts & Madams (1991) stated that any changing in ecosystem can change plant composition and its structure thus protection or conservation in most cases can improve plant condition and in other hand plant usage without program can reduce diversity and production. This condition for arid and semiarid region is very important because their ecosystem is more fragile. le Houeron (1991) showed plant diversity and plant density had became less and less during continues over grazing at some part of North of Africa but other research which has done by Mirch (1991) show protection can improve plant diversity and production in Saudi Arabia. This research and other research show under good management condition we can prevent degradation process and avouch plant production for along time without any damaging to soil and plant complex.

Table (4): Name of plant type, condition and trend

code	Name of plant type	Area(Hectare)	Condition	trend
1	*Haloxylon aphyllum- calligonum comosum* (Milad Park)	390	Good	Positive
2	*Limunium iranicum- Artemisia sieberi*	2000	Poor	Negative
3	*Halocnemum stabilaceum- limunium iranicum*	2300	very Poor	Constant
4	*Halocnemum stabilaceum- salsola sp*	3600	very Poor	Constant
5	*Halocnemum stabilaceum- Artemisia sieberi*	650	Poor	Negative
6	*Halocnemum stabilaceum- Seidlitzia rosmarinus*	7150	very Poor	Constant
7	*Halocnemum stabilaceum- Ceratocarpus arenarius*	18100	very Poor	Constant
8	*Artemisia sieberi – Scabiosa calocerhala*	250	moderate	Constant
9	Cultivated land	6100	....	....

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THE RECOGNITION OF PLANT ASSOCIATIONS AND COMPOSITION ELEMENTS OF SANGCHAL FORESTS OF MAZANDARAN, IRAN

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The study of phytoscenose and it's relation with land production capability is a must for planning in natural resources. Any biotope has a limited potential that It's recognize helps to better management. Plant associations are the result of ecological conditions. Some ecological factors such as parent material, climate, soil and physiographic cause diversity in vegetation. Iran with huge surface and divers ecological has various plant associations that our knowledge is very limited about them and the role of per species in the vegetation composition of various regions are unknown.

This research was performed in a part of Hyrcanian forest with an area of 2500 ha in elevation range including 800-1900 m above sea level Sangchal forests of Mazandaran province. The forest area had not any forest plan before. The Brawn-Blanquet method was used for floristic consideration. 65 Releves were selected selective-systematic based on exist vegetation structures and main geographical aspects (north and south). The physiognomic study of vegetation was performed with Kuchler method and crown strata and vertical and horizontal profile was prepared. The results showed the study are has 130 plant species belong to 119 genus and 65 family. The results of analysis with Brown-Blanquet tables showed six associations and two sub-associations and one variant including:
1- Fageto-Carpinetum association with Oplismenusetosum sub-association and Paeonia wittmanniana variant. 2- Fagetum orientalis association with Lathyretosum sub-association. 3- Ilicio-Carpinetum association. 4- Queco-Carpinetum association. 5- Buxo-Carpinetum association. 6- Alno – Carpinetum association.

Key words: *Plant phytosociology, Brawn-Blanquet, Plant association, Releve, Vegetation, Iran.*

1- Introduction:

The phytosociology is a branch of ecology that pay attention to recognition, explanations, definition, analysis and combination of plant communities as well as the causes of establishing of conditions (Asri, 1995). The study of phytocenose and it's relation to land production capability is a must for planning in natural resources. Any biotope has a limited potential that it's recognize helps to better management. Plant associations are the result of ecological conditions. Some ecological factors such as bedrock, climate, soil and physiographic cause diversity in vegetation.

The Iranian plateau is a contact point of five phytogeographical regions: the Touranian, European, Indian, Mediterranean and African (Sabeti, 1976). Mesophilic (subhumid) forest vegetation, originally of the Tertiary, called the Hyrcanian zone, characterizes the Alborz Mountains on the Caspian coast (Mobayen and Tregubov, 1970). The Hyrcanian forests are one of the last remnants of natural deciduous forests in the world (Sagheb-Talebi, 2000). The natural forest vegetation is temperate deciduous forests containing broadleaved species. The main feature of the region is the lack of conifers; only relics of coniferous forests are present, which include *Taxus baccata* L., *Juniperus* spp., *Cupressus simpervirens* var. *horizontalis* L., and *Thuja orientalis* L. (Sagheb-Talebi, 2005).

There is a few investigations about combination of plant elements in Iran regard to various ecosystems and the role of each species in vegetations composition of different regions is unknown (Hamze, 1994). The study area is located in the central of hycanian forests and has not been enforced any forest management designs yet and there is not any information from the view point of vegetation cover. Therefore, the results of this study can be advantageous in management and rehabilitation of this forests by native plant elements.

1-1- The geographical situation of the survey area:
Sangchal region located in southern part of Amol city in Mazandaran province that include 8264.5 ha of the hyrcanian forests of Iran. The survey area included a part of forest that conserve it's natural landscape. It's surface area is 2500 ha.

1-2- The geological and edaphical characteristics:
The geological formation of region related to first to third geological times. These are alluviumed from Permian to Quaternary. In generally, the mother stone in this forests include lime and dolomite lime and in some area sand stone-silton-coal argilit, silty marn and sandy lime. The soil pH is acidic on the northern slopes and neutral or alkalic on the southern slopes.

1-3- Weather and climate of region:
By using of the data from meteorological stations of adjacent regions, annual precipitation is 645 mm and average annual temperature is 8.6 ^{oc} . On the base of ambrotermic curve, this region has dry season on June and moisture climate on the basis of Domartan climogram.

2- Methods:

In this study the explanation and classification of plant types are performed by using the Zurrich-Montpliar school and Brawn-blanquet (1964) method. The analysis of plant type is started with selection of vegetation units on the basis on elementary observation. At inside of each of this units, one releve has been selected. In each unit, minimal area was calculated on the bases of species area curve. In attention to elementary observation and primarily distinguish of plant formation and main slopes of region, 65 releve were selected. Then, phytosociologic data was obtained.

The analysis of data was perfomanced by using of brown-blanquet tabulation technique. So that, the whole of releves at columns and the whole of species at rows were settled (raw table). Then, species were arranged in presence table based on them presence from maximum to minimum and the part of species rows that were presented 10 to 60%, were selected for differential species (partial table). On this table the similar releves and species that had similar distribution on releves, were gathered side by side. Therefore, ecological species group or character and differential species were recognized (differential table). Then, any one of these groups were settled at one association (synthesis table) and any one of these associations and upper and lower units were named. The analysis of vegetation on the basis of physiognomic was performanced based on Kuchler method (Kuchler, 1967).

3- Results:

On the base of obtained data from plots, species-area curve was drawn for each releve (the area of releves were calculated 200 to 800 m^2) . In attention to synthesis table of this region, followed associations was recognized:

1-Fageto-Carpinetum association with character species including *Fagus orientalis* Lipsky., *Carpinis betulus* L., *Pteridium aquilinum* (L.) Kuhn, *Astrantia maxima* Pall., *Asplenium adianthum var. nigrum* L., *Tamus communities* L. and *Scutellaria tournefortii* Benth. This association has one variant with *Paeonia wittmanniana* L. and Oplismenusetosum sub-association with differential species including *Oplismenus undulatifolius* (Ard.) P., *Salvia officinalis* L. and *Coronila varia* L..

2- Fagetum orientalis association with character species including *Fagus orientalis* Lipsky, *Euphorbia helioscopia* L., *Polystichum aculeatum* (L.) Roth. and *Hypericum androsaemum* L.. Lathyretosum sub-association with differential species including *Lathyrus volundiplia* L., *Epipactis helleborine* (L.) Crantz and *Polystichum braunii* (Spenner) Fee. present in this association.

3- Illicio-Carpinetum association with *Ilex spinigera* (Loes) Loes, *Carpinis betulus* L., *Carpinus schuschaensis* H. Winki., *Crataegus melanocarpa* M. B. and *Mespilus germanica* L. as character species.

4- Querco-Carpinetum association with character species including *Quercus castaneifolia* C. A. Mey., *Carpinis betulus* L., *Acer cappadocicum* Gled. and *Sorbus torminalis* (L.) Crantz.

5- Buxo-Carpinetum association with character species including *Buxus hyrcana* Pojark , *Carpinis betulus* L., *Mentha longifolia* (L.) Hudson, *Ruscus hyrcanus* Woron, *Phyllitis scolopondrium* (L.) Newm, *Primula heterochroma* Stapf, *Fragaria vesca* L. and *Asplenium septentrionale* (L.) Hoffm.

6- Alno-Carpinetum association with character species including *Alnus subcordata* C. A. Mey, *Acer velutinum* Bioss., *Mercurialis perennis* L., *Lamium album* L., *Fraxinus exelsior* L. Subsp., *Convolvulus arvensis* L..

4- Discussion:

In this study, 130 plant species belong to 99 genus and 65 family were recognized:

Existing flore in study forests

Classification	Trees	Woody plants and Shrubs	Herbs
Species	27	11	92
Genus	24	11	84
Family	14	10	42

Among these associations , Querco-Carpinetum and Alno-Carpinetum associations are semi-heterogeneous. *Epimedium pinnatum* Fisch. and *Paeonia wittmanniana* L. are character species of Fagetum associations. But in this study, these species belong to several associations. In other words, *E. pinnatum* not only was was observed in Fagetum, but also in Fageto-Carpinetum and Querco-Carpinetum associations and *P.wittmanniana* is a variant of Fageto-Carpinetum association.

In Hyrcanian forests, upper 700m above sea level beech is the dominant tree species and forms the *Fagetum hyrcanum* in pure and mixed stands with other noble hardwoods over a vast area in this cloudy zone. From its floristic composition, these beech forests are linked with European forests and with affinities to the beech forests of the Balkans. However, local conditions of aspect and edaphic factors, such as soil moisture and depth, are all of importance in determining the composition of the vegetation, which leads to the establishment of different beech subcommunities (Sagheb-Talebi, 2005). In our study area, this species form two associations.

Fageto-Carpinetum association exhibit as D7cG2rH2r based on Kuchler method. The elevation rang is 1250 meter a.s.l. at the southern slop to 1700 m a.s.l. at the north slope. From the view point of slope direction, this association allocate to northwestern and southeastern.

Fagetum orientalis association has elevation range from 1700 m a.s.l. to 1870 m a.s.l. at northern slope and 1350 m a.s.l. to 1440 m a.s.l. at southern slope. This association exhibit as D7cX1aG2rH2b based on Kuchler method. The evergreen trees such as Yew and Laurocerasus roem rarely present in some stands. Beech at this association with 5 cover class and natural vitality present as pure species. The component tree species in this association are *Acer velutinum* , *Fraxinus exelsior* , *Taxus baccata* L., *Acer cappadocicum* and *Carpinus betulus* . Degree of forest covery is 85-95 percent.

Iliocio-Carpinetum association is exhibited as S6cC3aX1aG2bH2b based on Kuchler method and flourished in 1130-1250 m a.s.l. on western and southeastern slope. The upper strata of this association has low height about 14 meter and have some trees with 80 cm diameter at breast height. From the view point of vitality, *Carpinus schuschaensis* has higher degree than *Carpinus betulus* and it’s trunk cover with more epiphyts.

Querco-Carpinetum association is situated in 1160 to 1600 m a.s.l. at southern slopes. This association is introduced as D7cG2rH2b. Here, Oak trees are young old.

Buxo-Carpinetum association is exhibited S1cC3aG1bH2b and allocate 850 to 1100 m a.s.l. at north slope mostly. Buxus is a relict species of Mediterranean elements in Hyrcanian Forests. This species form associations in lower strata on lowland and sea coast to 200-400 m a.s.l., but at this region it is condensely situated up to 1350 m a.s.l. and with Hornbeam has formed the homogenous forest to 1100 m a.s.l.

Alno-Carpinetum association is introduced D7cG2rH2p and situated in 1100 – 1600 m a.s.l. and distributed mostly in the north and northeastern slopes. Here, the height of *Alnus subcordata* is 30-45 m.

The phyto-sociological studies in the forest ecosystems can help managers in the better planning and management practices, in particular the indicator species are very important for the identification of soil, climate, physiography and other site conditions. The results of this study also can be advantageous in management and rehabilitation of this forests by native plant elements.

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THE LANDSCAPE IMPLEMENTATIONS THREATENING BIODIVERSITY IN URBAN AREAS: SOME SAMPLES OF EASTERN BLACK SEA REGION

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The term "biodiversity" is often used to explain a variety of genomes, species, and ecosystems occurring in a geographically defined area. The term encompasses not only the variety and abundance of elements but also the roles that these elements play within the ecosystem. Although biodiversity is already a "richness" and this is enough to be protected, it is more important to people, because we strongly depend on other species and the ecosystems they create.

As with another thing which is also important to people living in big cities and unnatural environments, landscape architecture has been promoted all over the world for many decades. There is no doubt that many landscape architects have made very important contributions to many cities' environments by creating green areas though, especially in recent years, it is possible to talk about a "genetic pollution" threatening biodiversity in urban areas, due to the use of many exotic and invasive species.

In this study, one of the most natural regions in Turkey, Eastern Black Sea Cost has been chosen as the research area. In spite of the fact that many species, which might –even should- naturally be used in landscape architecture, are native in the region, several species belonging to other geographies have become major elements in the streets, parks and other outdoor places. While many native species, some of which are endemic, are already degraded in their natural environment across the region, using exotic species which prey on native ones might be defined as an important mistake. Hence, some important samples of the landscape implementations threatening biodiversity in urban areas in the region have been represented in this study. Afterwards, important recent and potential results of this situation have been pointed out and some effective solution proposals have been identified to prevent these degradations in biodiversity structure.

Keywords: *Biodiversity, Genetic Pollution, Exotic Species, Black Sea Region*

INTRODUCTION

Biodiversity and Its Importance

The term biodiversity is generally employed to explain a variety of genomes, species, and ecosystems and its meaning encompasses a variety and abundance of elements including their roles within the ecosystem in scientific platforms. Biodiversity is already "richness" and this is enough to be protected. What is more, it is often more important to many people, because we strongly depend on other species and the ecosystems they create. However, human activities might have major impacts on natural environments at small or big scales, producing changes to the number, identity and relative density of species [1,2].

There is no doubt that biodiversity is a fuzzy concept, which is one of the main reasons that many different disciplines work on it and several definitions belonging to the term have been broken out so far. As for one of the most interesting and large scaled definitions, biodiversity means the full range of variety and variability within and among living organisms and the ecological complexes in which they occur, and encompasses ecosystem diversity, species diversity, and genetic diversity [3, 4].

Genetic diversity is the combination of different genes found within a population of a single species, and the pattern of variation found within different populations of the same species [3]. For instance, two different populations of *Picea orientalis,* a native spruce tree of Turkey, might have different genetic adaptations because of the climate or aspect differences of their locations.

Species diversity is the variety and abundance of different types of organisms which inhabit an area [3]. This means two different areas, of which the size is same, might contain different species depending on where they are on the earth.

The third and the last one is ecosystem diversity. It encompasses the variety of habitats that occur within a region, or the mosaic of patches found within a landscape [3]. A highland in the Black Sea Region might contain alpine zones, wet lands, forest areas, pasture lands and more at the same time, which is a rich ecosystem diversity sample.

The Pressures on Biodiversity in Urban Areas

When one talks about biodiversity in anyway, it is common people think of pastoral landscapes, rural areas or at least small villages that only a few hundreds of people live in. In spite of the fact that the term is often attributed to rural areas, all ecological characteristics including biodiversity are considerable important even in urban areas.

Due to the increase in number of people living in cities and improving industrial activities all over the world, urban areas have significant lack of ecologic balance and biologic diversity in general. Their settlers often have difficulties in experiencing natural environments and this situation had seldom been considered as an important problem until they recognized that the environment in which they live was getting urbanized rapidly and it would not be that easy for them to get this naturalism back in the future. Because of this apprehension, settlers, politicians, and municipalities have started to pay attention to establishing of the natural habitats and using more *green* fields in urban areas. However, due to strong pressures and stresses on landscapes from urbanization, many places have several environmental problems including changes in the landscape and loss of several natural resources, which threaten biodiversity. While many natural resources are effected by these activities directly, it is still and often possible to see some indirect effects such as inappropriate plant species use in urban areas on biodiversity.

MATERIAL AND METHODS

Eastern Black Sea Region of Turkey has been chosen as the research area. Several cities in the region were visited in order to identify inappropriate plant species which had been used in the urban areas. In spite of the fact that many species are native in the region, several species belonging to other geographies have become major elements in the streets, parks and other outdoor places. While many native species, some of which are endemic, are already degraded in their natural environment across the region, using exotic species preying on native ones might be defined as an important mistake. Hence, some important samples of the landscape implementations threatening biodiversity in urban areas in the region have been represented in this study. These landscape implementations were categorized so that possible and current problems regarding biodiversity in the urban areas should be pointed out and some solution proposals could be broken out.

MAIN WAYS IN WHICH LANDSCAPE IMPLEMENTATIONS THREATEN BIODIVERSITY IN THE RESEARCH AREA

- **Threats Regarding Genetic Diversity**

The using of same plant species in an area cannot guarantee that genetic diversity is saved without any doubt. In many urban parts belonging to the research area, plant species to be used through landscape architecture were taken wherever they had been found without paying attention to their origin, which might cause a genetic pollution or at least a genetic mess. During a landscape implementation, the defending of genetic diversity might be ignored in two major ways in the research area:

1- For Native Species;

a- The plants which will be used for a landscape implementation might have been taken from a far place having different ecologic characteristics from the implementation area. Those who are responsible for the landscape project are often interested in economic conditions and they can buy the same plant species from a "*strange*" nursery through a better rate. In this case, the plants are supposed to have different genetic characteristics from what the same species, which is or should have been in or near the implementation area, has in the genetic structure.

b- Even if it is sometimes possible to find a plant species having same genetic quality and characteristics with the native one of the implementation area, number of plants might not be enough because of marketing or supply and demand problems. When the situation is so, rest of the plants has to be taken from another place, which means a genetic mess is created in the area again.

2- For Exotic Species;
Exotic plant species are often intentionally imported into regions outside of their normal range as ornamental plants, thereby generating benefits for consumers and producers [5]. Although most of people living in a part of the research area think many native plant species are beautiful and interesting enough to be used in parks and other places of urban areas [6], many exotic species such as *Robinia pseudoacacia, Nerium oleander, Phonix caneriensis, Pittosporum tobira, Acer negundo, Picea pungens* var. Glauca *and Cedrus deodora* are used very often through the research area, while it is nearly impossible to see native ones in any public area. Some of these exotic plant species are called as "*invasive*", therefore they might be prone to expanding in an area, which might be a serious problem for the region in the near future. In some part of the world, invasive exotics now dominate the grasslands, and some native species in the system appear to suffer poor regeneration over much of their range [7, 8, 9]. Nowadays, it is possible to see some exotic invasive species such as *Robinia pseudoacaia* in rural and natural environment in the region and the situation in which genetic structure might be worse in the near future because of this expansion. Apart from this important and dangerous competition between native and exotic species, there are also economical and cultural problems regarding inappropriate plant species use. Native plants can be used in urban areas in order to make a contribution to cities' identification for the visitors [4]. Furthermore, many exotic plant species are imported, which means it will be possible to save an economic value for the country when landscape architects give up using them that often.

- **Threats Regarding Species Diversity**

Species diversity basically means the amount of inhabitants in an area and one of the most effective criteria on this amount is land use types in the region. There is no doubt that urbanization gives a rise to reductions in natural areas. On the other hand, people living in big cities often get bored with *standard* city life and they naturally want to live in healthier and natural environments. Landscape architecture and its implementations have an important role at this point. Landscape implementations can meet urban areas' species diversity needs or it can fail by having no enough ecologic characters.

As for the research area, Eastern Black Sea Region has a mountainous geography. Although this mountainous region is known as one of the *greenest* areas all over the country, major degradations in natural structure have been very common recently. Because of rapid expansion of the cities, many natural environments were demaged so that those who have difficulties in finding new appropriate fields for industrialization and urbanization could establish settlement places.

Landscape architecture is thought to solve these problems by creating ecologic and natural fields in the urban areas. However, sometimes landscape architects or anyone else who is responsible for the landscape projects can also give a rise to same problems. The roads, avenues and squers in the research area are often too larger and less natural than how they were a few decades ago and many parks and roads contain less plant species when compering with past.

Consequently, landscape architecture is defined as a discipline that creats natural and ecologic environments though, sometimes it is hard for even landscape architects to do this owing to public needs, population density, politic reasons or bad planning etc.

- **Threats Regarding Ecosystem Diversity**

Because ecosystems are not homogenous units, it is not that easy to define borders belonging to them [4]. However, many different ecosystems such as streams, forests, pasture and range areas can relatively be identified.

As for cities, there are not many different ecosystems though; creating water surfaces, small forests and other different ecosystems are desired within landscape architecture depending on some criterions. However, some landscape implementations require more “urbanized” belongings, which mean landscape architects cannot create large spaces in which an ecosystem can be established, or sometimes some ecosystmes such as small forests in city parks might be demaged due to road or path contructions, more space needs or any other landscape implementations. In the research area, it is possible to see some samples of this situation. The coast and some parks are the most common samples for this degradation across the research area.

CONCLUSION

- Some landscape implementations threaten biodiversity in different ways in the research area. Genetic, species and ecosystem diversities have been effected directly or indirectly by some landscape implementations.
- Urban areas in the research field are losing their natural habitats quite fast and people living in the areas do not seem to like this though, there is no influential pressure from settlers or municipalities to bring the floral richness that the region has in rural areas to the city centers using landscape architecture.
- Most ornamental plants having been used in the research area are exotics. Apart from the region might face a danger of exotics’ invasion in the future; the urban areas in the research field are too far away to have identification within their landscape.
- Although Turkey has a very rich flora, nearly no native species are used as ornamental plants in the urban areas. Furthermore, some exotics are imported by paying large amounts of money, which means the situation in which the research areas’ landscapes have been for years has not only ecologic but also an economic problems.

SOME SOLUTION PROPOSALS

- Many exotics are likely to cover larger areas than some native species do and this is considered as a serious genetic pollution danger. To avoid this potential risk, invasive species should be identified and listed. What is more, they should not be used in huge areas. Nobody knows what genes will be important for us in the future to use in any way. Therefore, it is essential humanity be kept them pure.
- A special attention should be paid in the early steps when treating a landscape implementation in the urban areas. Because urban areas already have limited natural environments having rich biodiversity in general and damaging these restricted areas might cost more than what one expects at the beginning.
- Although ecologic attempts improving biodiversity have been appreciated, especially owing to recent environmental *trends* all over the world, this kind of actions needs to be supported by several institutions including NGOs.

- Native species should mainly be used in landscape implementations. All the native species in the region should not be supposed to be beautiful and interesting enough, of course. However, when thinking Turkey has been importing many *Rhododendron* species while the region has native ones, horticultural studies should be emphasized so that many native plants could be used in urban areas. In addition, the using of native species helps the urban areas have identification and special characteristics especially in visitors' eyes.

- Because exotic species are often imported and this costs the country a serious amounts of money, to save these amounts by using native species might create a fund for conservation studies.

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THE EFFECTS OF PLANTATION ON BIODIVERSITY AND REGENERATION OF WOODY SPECİES

(in Mazandaran Wood and Paper Industries Forests)

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This study aims to assign woody species biodiversity in three fields of 15 years Maple, Alder and Italian cypress reforestation in mazandaran low forests range of Mazandaran wood and paper industries. In each piece of plantation three 20*20 m plots and one plot also implemented as the witness in natural forests around. Species and number of woody plants has been counted in each plot, and diameter and height of generated species was measured up to 1.3 meters height. Species diversity was examined using Shannon Wiener function and eveness and richness indexes respectively using simpson and menhinic indexes.
Result of this study illustrates that about 22 tree and shrub species were observed in mentioned fields and there is no significant difference about biodiversity indexes (diversity, evenness and richness) among planted areas and natural forest.in this plantations have regenerated valuable species naturally in view of point wood production and echological aspects and the presence of the 22 tree and shrub species is accompany with better future in order to regenerate for this species for foresters.

Key words :*Biodiversity,Regenerate, Plantation,Maple , Alder , Italian cypress,Sari, Mazandaran, Iran.*

Introduction:

Plantation and the recolonization of native woody species in plantation forests has a great effect on the flora i.e. plantation can change the type and composition of fauna and flora of an area. Fast growing tree plantations species on degraded sites have been shown to expedite native woody species recolonization by acting as nurse crops for recolonization of native woody species (Parrotta, 1995). As Parrotta et al., 1997 said plantations accelerate native woody species recolonization by influencing understory microclimate and soil fertility, suppressing competitive grasses and by attracting seed dispersers through the provision of habitat . Intuitively, we understand biodiversity, or species diversity, as the number of species in a given area, habitat, or community. However, the formal treatment of the concept and its measurement is complex (Williamson 1973).The plantation effects on the woody or non-woody plants related to several factors such as direction, slope, altitude, soil type, species, planting distance and the age reforestation (Akbarinia and Hosseini.,2003, Hosseini and Momenipour,2002). Although the role of plantation forests for the recolonization of native woody species is well documented, studies on regeneration processes under the canopies of different plantation species are scanty.

Plantation and replacing it with natural stands has a greet effect on the flor of the related areas. For example, plantations can change the type and composition of the animals and natural floor , increase the competition between plants to receive nutrients, change and disturb growth area conditions , create preventive effects (Allelopathy) , cause some changes in the soils and ultimately can alter the composition of plant species and growth or extinction of some native species (Evants, 1994). Veinotte and others (1998) performed some research about biodiversity in reforestations and natural mixed forests in the vicinity of Fondi natural park in the U.K and concluded that some series of aggressive species compete with the main species in using the light , moisture and nutrients and some leader and aggressive species have appeared during reforestations which are less apparent in natural and old forests. Humphery and others (2000) studied the biodiversity in planted forests in U.K . the results of their research showed that the planted forests stands with the non-native softwood species , prepare the habitat conditions for presence of native plants and animals. The plantation effects on the woody or non-woody plants, depends on several factors such as direction, slope, sea altitude , soil type, species type, planting distances and the age of reforestations (Hoseini,2001 and momeni pour , 2002) .

Roohi moghaddam (2001) has done a research regarding the effects of distruction factors (herd s grazing and forests) on alteration of planetary communities of Chelove forests. The results show that a great deal of changes have been occurred in the natural communities of the area and the presence of aggressive species and also the leader species have been increased , such that the main mixture of the community is completely out of natural condition and has changed to demolished types. Because of the presence of light absorbent and aggressive species and also because of more uniform distribution of people among these species , virgin growth areas have more woody diversity compared to the main communities. Some believe that afforestations reduse biodiversity and some do not accept this idea. The main objectives of this study is to obvious differences of the diversity of woody species in neighboring natural forests with plantation site after 15 years with fast growing species such Maple, Alder and Italian cypress.

Materials and Methods:

Study area is located in Pahnekola, Talukola and Noudeh forest series within the forestry plan site of Mazandaran wood and paper industries in Sari at the north of Iran which has been planted in relatively degraded area with the species of Maple, Alder and Italian cypress. Altitude of this area ranges from 200 to 400 meter above sea level. In each of the above planted forest as well as in adjacent natural forest three plots (20m x 20m) were selected. In each selected plot all generated woody species were counted and diameters and height of the species which had a height of more than 1.3 meters were measured.

Biodiversity indices:

- Shannon-Wiener Index

the related formula is

$$H = -\sum_{i=1}^{s} p_i \log_e p_i$$

in this formula , H The most widely used index of species diversity is the Shannon-Weaver Index. s is the number of species and p_i is the proportion of individuals, respectively . ni is the abundance of im species and N is the abundance of all species . shanon function has more sensitivity to the rare species in the communities or samples (Hoseini, 2001).

- Eveness index :

the quantity of eveness for sympson index is obtained from V´ = D/ Dmax formula. In this formula , V´ is the eveness amount of D and D max is the maximum sympson index variety , which is equal to 1/S (s is equal to the number of species).

- Species Richness :

Richness index used for this research is : menhinic index. Its formula is R2= s/√ N. R2 is menhinic richness index and N and S quantities are the number of species and the total number of observed people (Hoseini, 2001)**.** The simplest measurement of species diversity is a species count. Simple species counts remain the most popular approach to evaluate species diversity and to compare habitats or species assemblages (Humphries et al. 1996). While species counts are often an early step in many ecological and community studies, the number of species *per se* provides little insight into the underlying ecological mechanisms that define **biodiversity**, nor does it encompass evenness.

After grouping and arranging the inputs, we computed the diversity, richness and eveness indices of all inputs, of each sample , using ecological methodology software and biodiversity indices of each planted fragments with the witness forest (natural area) was analyzed by one sample T- test , considering meaningfulness of differences.

Results :

The research results showed that a total number of 22 woody species have appeared in afforestations and natural forest showed that there is no significant difference between natural forests and reforestated areas.

Table 1 : woody species are regenerated in plantation by maple, alder and Italian cypress .

Pahnekola		Talukola		Nodeh		Scientific name
natural forest	reforestation	natural forest	reforestation	natural forest	reforestation	
	*			*		**Acer cappadocicum**
	*		*		*	Acer velutinum
*			*			Albizia julibrissin
	*	*		*		Alnus glutionsa
*	*	*	*	*	*	Carpinus betulus
			*			Celtis australis
*	*	*	*	*	*	Crataegus sp.
			*		*	Cupressus sempervirens . var. horizontalis
*	*	*	*	*	*	Diospyros lotus
			*		*	Ficus carica
				*	*	Gleditsia caspica
*	*	*	*	*	*	Mespilus germanica
			*			Morus alba
*	*	*	*	*	*	Parrotia persica
	*		*	*	*	Prunus caspica
			*			Pterocarya fraxinifolia
	*		*		*	Punica Qranatum
*	*		*			Pyrus ,,,,,,,,,
*	*	*	*	*	*	Quercus castaneifolia
	*		*			Robinia pseudacacia
			*			salix alba
	*		*	*	*	Zelkova carpinifolia

Table 2 : Quantities of biodiversity indexes in reforestation with alder and natural forest within variety sites

pahnekola		talukola		nodeh		index name
reforestation	natural forest	reforestation	natural forest	reforestation	natural forest	
0.591	0.291	–	1.410	–	2.039	Shannon Wiener diversity
0.733	0.329	0.719	0.630	–	1.007	richness
0.428	0.588	0.566	0.424	–	0.423	evenness

Table 3 : Quantities of biodiversity indexes in reforestation with maple and natural forest within variety sites

pahnekola		talukola		nodeh		index name reforestation
reforestation	natural forest	reforestation	natural forest	reforestation	natural forest	
1.270	0.291	0.562	1.410	0.703	2.039	Shannon Wiener diversity
0.662	0.329	0.198	0.630	0.560	1.007	richness
0.607	0.588	0.176	0.424	0.420	0.423	evenness

Table 4 : Quantities of biodiversity indexes in reforestation with Italian cypress and natural forest within variety sites

pahnekola		talukola		nodeh		index name reforestation reforestation
reforestation	natural forest	reforestation	natural forest	reforestation	natural forest	
1.124	0.291	0.674	1.410	0.801	2.039	Shannon Wiener diversity
0.682	0.329	0.600	0.630	0.361	1.007	richness
0.509	0.588	0.651	0.424	0.696	0.423	evenness

1- comparing the rate of biodiversity indexes in the reforested area and natural forest.
1-1 : comparing the eveness index in the reforestated area and natural forest.

Nodeh site : the research results in this site shows that there is no significant difference between the reforestated areas which are planted with three species of Maple, Alder and Italian cypress and natural forest of the area (figure1).

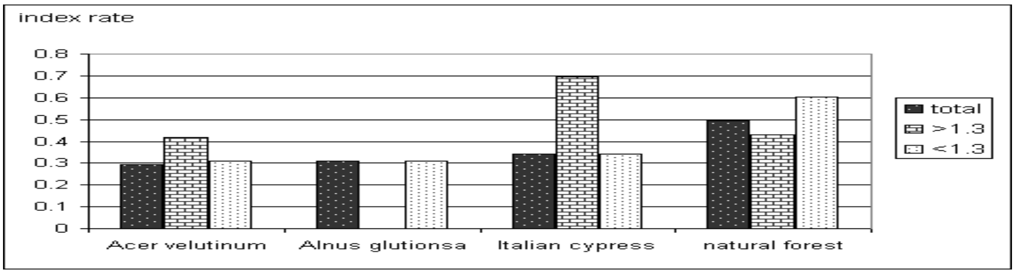

figure 1 : comparing the eveness index in the reforestated area and natural forest.

Talukola site : the research results in this site shows that there is no significant difference between the reforestated areas which are planted with above mentioned three species and natural forest (figure 2).

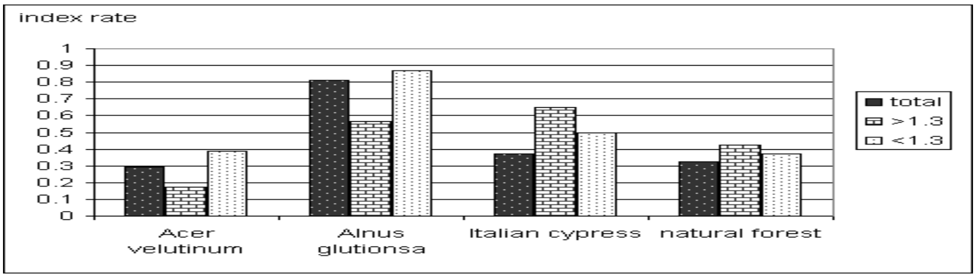

figure 2 : comparing the eveness index in the reforestated area and natural forest.

Pahnekola site : the research results in this site shows that there is no significant difference between the reforestated areas which are planted with above mentioned three species and natural forest (figure 3).

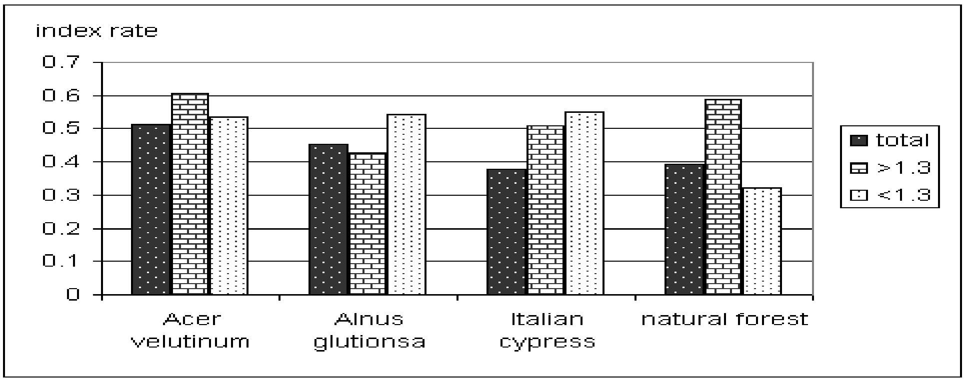

figure 3 : comparing the eveness index in the reforestated area and natural forest.

1-2 : comparing the richness index in the reforestated area and natural forest.

Nodeh site : the research results in this site shows that there is no significant difference between the reforestated areas which are planted with three species of Maple, Alder and Italian cypress and natural forest of the area (figure 4).

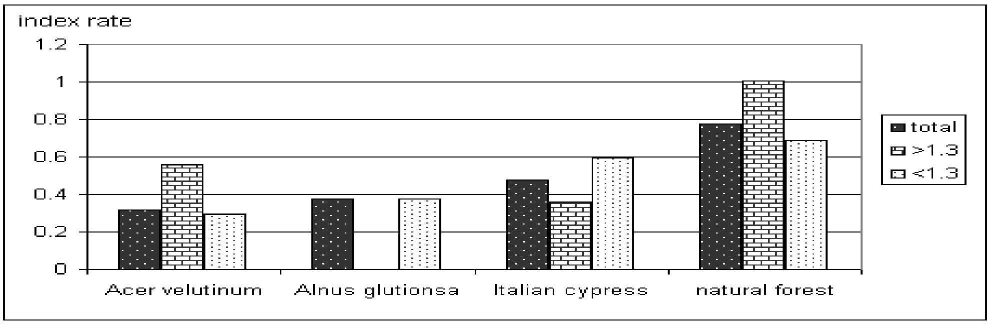

figure 4 : comparing the richness index in the reforestated area and natural forest.

Talukola site : the research results in this site shows that there is no significant difference between the reforestated areas which are planted with above mentioned three species and natural forest (figure 5).

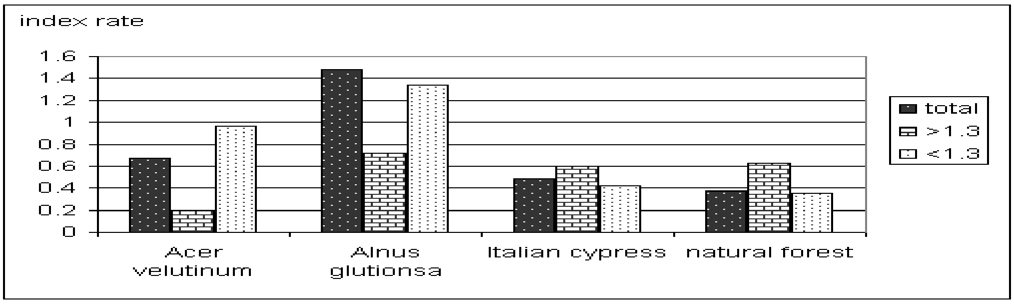

figure 5 : comparing the richness index in the reforestated area and natural forest.

Pahnekola site : the research results in this site shows that there is no significant difference between the reforestated areas which are planted with above mentioned three species and natural forest (figure 6).

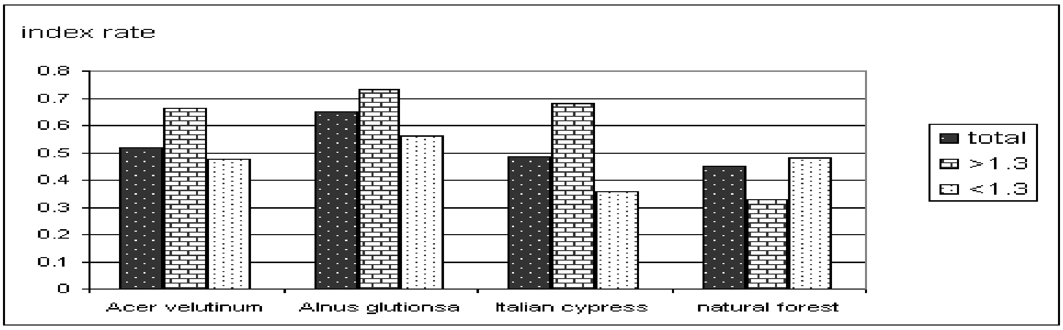

figure 6 : comparing the richness index in the reforestated area and natural forest.

1-3 : comparing the diversity index in the reforestated area and natural forest.

Nodeh site : the research results in this site shows that there is no significant difference between the reforestated areas which are planted with three species of Maple, Alder and Italian cypress and natural forest of the area (figure 7).

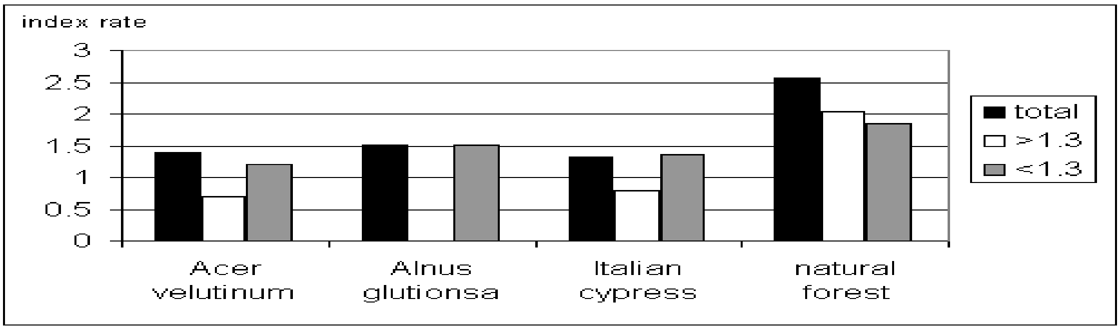

figure 7 : comparing the diversity index in the reforestated area and natural forest

Talukola site : the research results in this site shows that there is no significant difference between the reforestated areas which are planted with above mentioned three species and natural forest (figure 8).

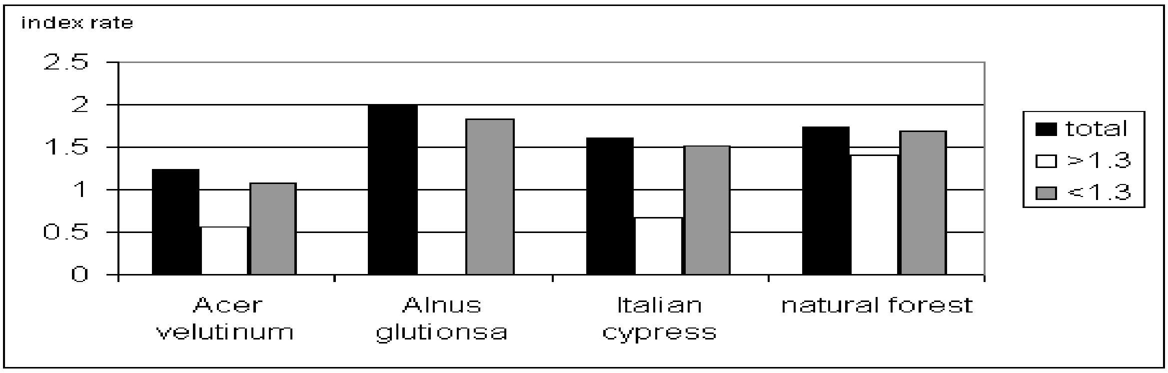

figure 8:comparing the diversity index in the refforestated area and natural forest

Pahnekola site : the research results in this site shows that there is significant difference between the reforestated areas which are planted with Maple and natural forest of the area , but the quantity of these indexes in the reforestated areas planted with Alder and Italian cypress species and the natural forest , dose not show any significant differences (figure 9).

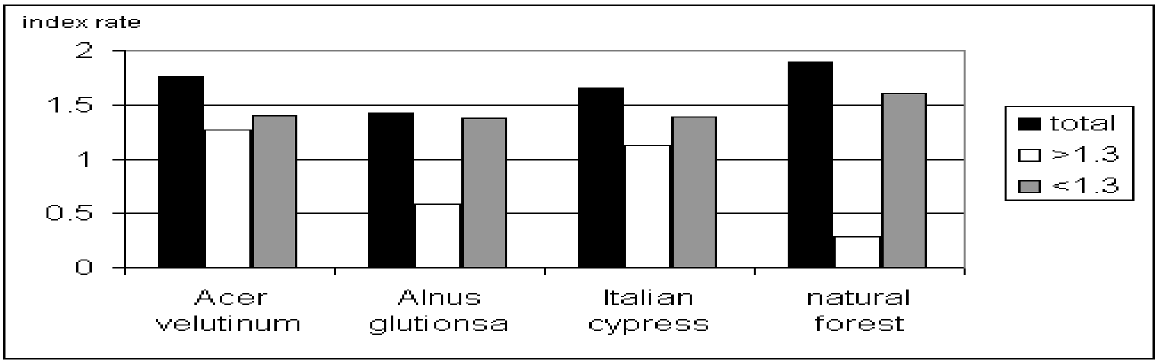

figure 9 : comparing the diversity index in the refforestated area and natural forest

Discussion :

Comparing different indices of biodiversity showed that in most areas there are not any significant differences between afforested areas and natural forests, this means that afforestation has been effective in alteration of woody species diversity alike natural forests.
Soft wood trees in some areas can appear in places where it is difficult for native hardwood presence and thus they prepare the condition for appearance of hardwoods. In this study sites considerable hardwood species have appeared in Italian cypress reforestation, because this species is softwood and the shape of its crown allow more light penetration to the forest floor. As protection and maintenance of biodiversity have been noted a management goal in forestry during past decades (Barton et al., 1998, Carlson, 1999, Dover and Handmer, 1995, Franklin, 1993, Franklin and Swanson, 1992, Ghelichnia, 1997), the result showed in both areas of natural forest and reforestation areas species diversity is considerable at the beginning of spring, such that in some areas dense natural growth of seedlings has been observed but many of them have diminished during summer. The result also showed where crown coverage was with high percentage biodiversity was lower and as time passes with closure of crown coverage of plantation species diversity had a descending trend (Kuksina and Ulanova, 2000). In the initial stage after years of illegal cutting because of intense light penetration the diversity of herb has been increased rapidly and in some cases the invasive species had dominated the area (Veinotte et al., 1998, Humphrey et al., 1998). Here some 22 naturally regenerating plant species were recorded in the plantation stands, its main trees including *Acer velutinum, Zelkova carpinifolia, Gleditsia caspica, Albizia julibrissin, Quercus castaneifolia, Pterocaria fraxinifolia* . the presence of extinting seedlings such as *Zelkova carpinifolia* had a very desirable reforestation effect on the revival of extincted species in this area. Our results revealed that both indigenous and exotic species could be equally used to foster the colonization of native woody species as long as the plantation species provides a reasonably open canopy that allows enoughradiation to penetrate through the canopy. The presence of extincting twigs such as Zelkova carpinifolia has had a very desirable reforestation effect on the revival of the extincting species , such as Albizia julibrissin after reforestation , protective and fostering operations will be perfored. During these operations in the forests covered by Mazandaran wood and paper industries , protective measures will be carried out for naturally appeared species during reforestations. That is during weedings , natural species will remain in the forests. These species might remain in the future , too and the future of forests maybelong to them, in fact , reforested species , as the leader species might have provided the conditions for presence of other natural species. In some cases , other seed - lives will enter reforestation arenas and they will grow a few years after reforestation. In this regard , the presence of reforested species are important as leaders. During reforestation of the studied areas of this research , valuable species such as Acer velutinum, Zelkova carpinifolia, Gleditsia caspica, Albizia julibrissin, Quercus castaneifolia, Pterocarya fraxinifolia and have appeared in different ages after reforestation. In the initial stage , reforestation caused the presence of rare woody industrial twig species such as Acer velutinum, Zelkova carpinifolia, Gleditsia caspica, Quercus castaneifolia, Pterocarya fraxinifolia ,… in the next stage, foresters must direct them toward mixed stands (considering their species) by managing these reforestations. Naturally , the final stability of these reforestations depends on the combination of their ages and species.

Consequently , now we can direct these reforestations toward mixed stands of reforestation species and imported species by gadual changes in their coverage crown (after reforestation). So it is suggested that in order to maintain biodiversity species , we must consider the importance of the presence of imported natural species in the area and keep the imported natural species and perform suitable growth methods in the natural and reforested forests.

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MAPPING THE BIODIVERSITY OF LAND SNAILS İN TURKEY: A PRELIMINARY STUDY

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According to the literature and our studies, 586 species of land snails represented with many subspecies occur in Turkey. Although incomplete, malacofauna of Turkey has been studied since 1700s and the current data can be used for generalizations on the fauna. In the present study, current data on the distributions of land snails in Turkey were evaluated in the taxon level; the endemism, species richness and vulnerability. Also, the factors affecting the richness were also discussed.

Key words: *Land snails, Turkey, biodiversity, biogeography*

The Turkish land snail fauna has been extensively studied by European researchers in terms of taxonomy for the last two centuries, the journeys and surveys should be noted to be regional or superficial, rather than being detailed and comprehensive. Due to recent demographical and industrial developments the determination and protection of faunas under threat of extinction has gained importance. Snails, although physiologically adaptable to unavailable conditions for long periods, are bound to some microclimatic environment they live in, and as in the case of *Graecoanatolica macedonica* (Ryan & Griffiths. 2001) they may vanish suddenly. Cryptic habits and small size of many can cause extinctions unnoticed. The present study aims to provide a general perspective on the current status of land snails and land snail study in Turkey.

Methods
Coordinate data of the localities (n=5971, see Fig. 2) recorded by GPS, directly read from map (Microsoft Autoroute 1998 software) or gazetteer (from Geonet) were recorded in decimal system. To evaluate the biodiversity data GIS software (Diva GIS 5.3) was used. As the diversity index Shannon's index was chosen.

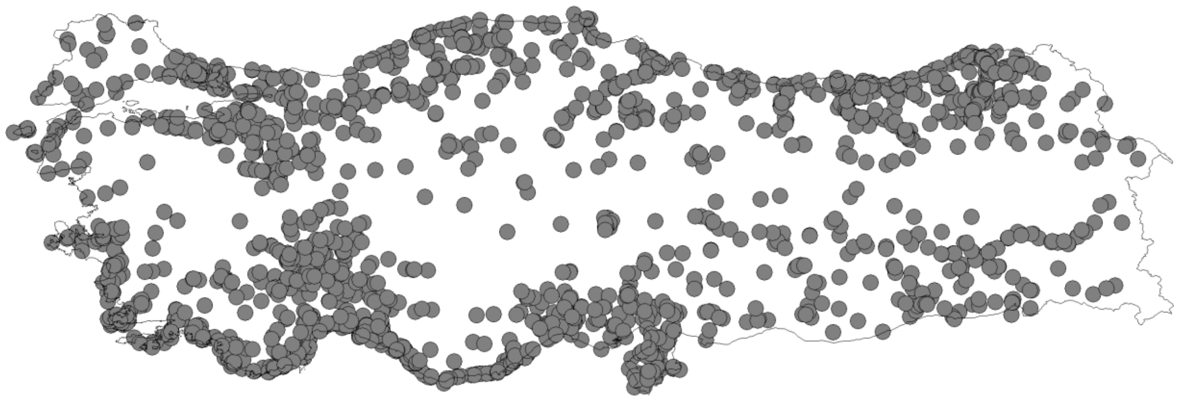


Fig.1. Locality data of the Turkish land snails used in this study (points as filled grey circles).

RESULTS

According to the literature and available material to us, 705 land snail taxa belonging to 591 species occur in Turkey. In the distribution and diversity analyses taxa are used as units as most subspecies are separate in distribution and other aspects, possibly representing different lineages. The richness is quite remarkable, but moreover endemism level is also high, as 56 % (n=393) of total taxa are endemic to the country.

Calcareous rocks and snail diversity

Generally snails are calciphilic and demand sufficient amount of calcium in the substratum. Through the geological and climatic history of Turkey, presence of large areas of calcareous outcrops played an important role in the radiation and species richness (see Fig. 1.), secondarily climate is the factor in the formations of today's fauna.

Fig.2. Main calcareous areas (filled with grey) of Turkey.

Biogeography and richness

According to estimated refugia or original ranges of the species, a grouping of the biogeographical patterns for non-endemics was practiced. In the classification, current known occurrence data resulted by possible transportation is excluded, although this certainty is not possible especially for small snails, which can passively be transported by several ways (Kirchner et al 1997). In the case of family Zonitidae s.l. and slugs also figuring the original homelands is difficult as species such as *Oxychilus translucidus* has a tendency to spread with human activities.

The exact analysis of the data for endemics requires more time and study, due to obscene relictary situation of many endemic genera and active dispersal history.

Generally Turkish land snail taxa can roughly be grouped into 5 major groups as Aegean, Caucasian, Mediterranean, Black Sea, and Northern. Mediterranean term should be understood with the broad sense, eg from Spain to Afghanistan or further. This group can be separated into Cypro-Anatolian (CYP), Syro-Anatolian (SYR), southeastern Anatolian (GDA), Levantine (LEV), eastern and western Mediterranean (EMED, WMED), circummediterranean (MED), Atlantic-Mediterranean (ATLMED), and northern African (NAFR) subunits. MED and ATLMED taxa are relatively widespread, either being old faunal elements or xerophilic taxa, like WMED and NAFR found as common introduced species in the region. Southern Anatolian group are include elements left from the period when Paratethys extended eastwards through the Syrian plateau and Mesopotamia. Most of the taxa are found W Iran, N Iraq and Armenia outside Turkey.

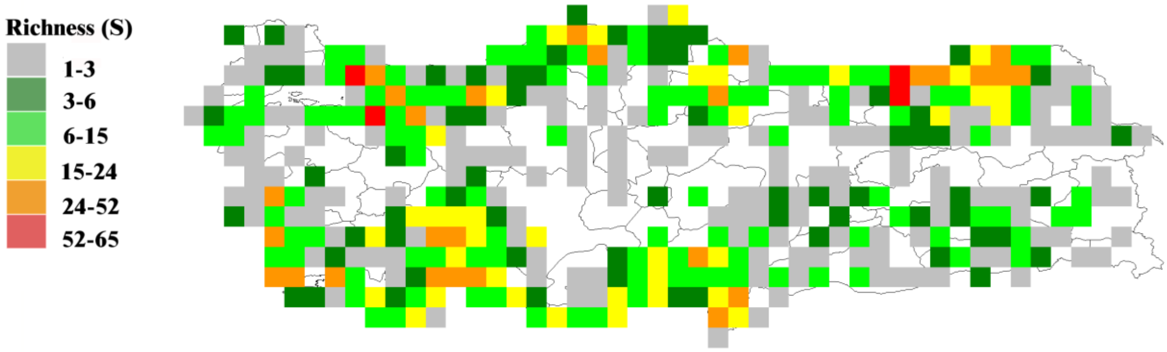
In Caucasian group, there are West Caucasian (WCAU) and Caucasian (CAU) subunits. The latter group is represented with a broader range in Caucasus ranges (eg. Greater and Little Caucasus ranges), while former includes western parts bordering to Turkey like coastal Georgia, Adzharia, Aras and Çoruh valleys.
In Black Sea group includes taxa originally indigenous to Black Sea basin. Southeast European (SEE) subunit is especially interesting as the fauna remained isolated before the sea was closed. Crimea subgroup (CRM) includes a small number of taxa shared with Anatolia. Bulgaria/Northern Balkan (BUL) subgroup is recognizable with high number of species due to high faunal exchange rate. Black Sea (BLA) taxa are generally more widespread and dispersalists, these have a tendency to invasiveness.
Aegean group divided into subgroups as Holo-Aegean (AEG), eastern Aegean (EAG), and Cycladian (CYC). Holo-Aegean group is a relict of the times before the split of the Aegopotamus, eastern Aegean group being mostly related to Anatolian fauna and also relicts; last group belongs to Cyclades endemism center with two species represented in Gökçeada off Çanakkale.
Northern group involves Holarctic (HOL), Palearctic (PAL), and continental/boreal European (EUR) elements. Turkey is the southernmost limit for most of the taxa here and therefore they are found in alpine conditions or with a scattered or isolated distribution. It is notable that the group represented with a small number.

Particularly most CYP, SYR, CRM, WCAU, EAG, BUL, GDA taxa can also be accepted as endemics or regional endemics as most of the ranges of taxa is found in Turkey. For instance, *Chondrus tournefortianus* Fér. is widespread in Turkey in NW and N part, but it is represented outside only in a small portion of Bulgaria. On the other hand, some shared elements Greek islands as Chios or Lésvos which remained connected with the continental Anatolia repeatedly and during the glacial ages are not politically, but biogeographically Anatolian endemics. Addition of the taxa to the endemics sorted, as a reflection of the conservative significance, gives the number 509 (ca 72%). Indeed, if all species with more than half the population in Turkey are counted, the rate would be higher.

Table1. Distribution of Turkish land snail taxa into different geographical units (excl. endemics, for abbreviations see text above)

<table>
<tr><th colspan="2">MEDITERRANEAN</th><th colspan="2">CAUCASIAN</th><th colspan="2">AEGEAN</th><th colspan="2">NORTHERN</th><th colspan="2">BLACK SEA</th></tr>
<tr><td>MED</td><td>25</td><td rowspan="5">CAU</td><td rowspan="5">35</td><td rowspan="3">AEG</td><td rowspan="3">18</td><td rowspan="3">HOL</td><td rowspan="3">14</td><td rowspan="2">BLA</td><td rowspan="2">18</td></tr>
<tr><td>LEV</td><td>12</td></tr>
<tr><td>GDA</td><td>12</td><td rowspan="2">SEE</td><td rowspan="2">22</td></tr>
<tr><td>ATLMED</td><td>10</td><td rowspan="4">EAG</td><td rowspan="4">27</td><td rowspan="4">PAL</td><td rowspan="4">10</td></tr>
<tr><td>WMED</td><td>9</td><td rowspan="3">CRM</td><td rowspan="3">3</td></tr>
<tr><td>AS</td><td>3</td><td rowspan="4">WCAU</td><td rowspan="4">37</td></tr>
<tr><td>NAFR</td><td>2</td></tr>
<tr><td>SYR</td><td>14</td><td rowspan="2">CYC</td><td rowspan="2">2</td><td rowspan="2">EUR</td><td rowspan="2">9</td><td rowspan="2">BUL</td><td rowspan="2">21</td></tr>
<tr><td>CYP</td><td>2</td></tr>
<tr><td>TOTAL</td><td>96</td><td>TOTAL</td><td>72</td><td>TOTAL</td><td>47</td><td>TOTAL</td><td>33</td><td>TOTAL</td><td>64</td></tr>
</table>

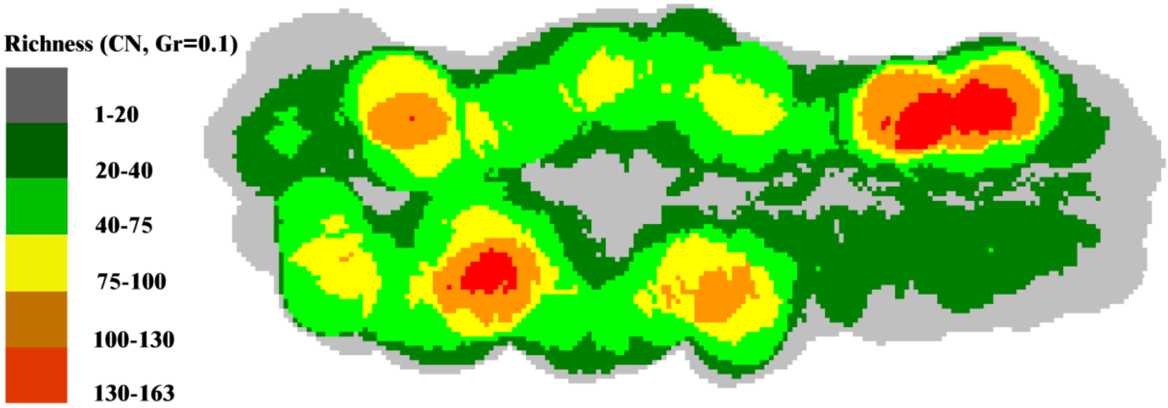
Figure 3. Graphic demonstration of biogeographic elements of Turkish land snail taxa: clockwise; endemics (red, 56%), Black sea (yellow), Caucasian (blue), northern (black), Aegean (turquoise), Meiterrranean (white).



Mapping the diversity

There is a strong parallelism between number of points (Fig. 2) and calcareous land cover (Fig. 1.). The reason behind this partly is the sampling frequency in the 'promising' stations, but as understood by the diversity plots (Fig. 7) such areas hold the highest endemism level.

Fig.4. Turkish land snail species richness: a) simple method, b) circular neighborhood method.



Interior parts like Uşak province, and remote places like Bingol, Hakkari and Tunceli are seem to be least studied regions. But presently there is no province unseen by malacologists. Undercollected sites probably possess much higher overall richness.

According to total number of species (richness) there are eight spots discernible, Bursa-Istanbul line, Abant and environs, Kastamonu, Samsun, Eastern Black Sea region, Muğla, Antalya and Hatay (Figs 4a and b). These areas hold more than 24 species (up to 86) each. In Fig4b., distinction is more clear; Hatay, Istanbul, Antalya and Eastern Black Sea region are recognizable with richness.

Endemism: richness and diversity

Fig.5. Point data of the endemic land snail distribution in Turkey

Applying the same procedure as in richness, only to Anatolian endemics (Fig. 5, 6), it is seen that well searched sites like Thrace, Aegean region except south end, Kars, and Urfa provinces are relatively poor in endemics. On the other hand, Artvin-Erzurum, Trabzon-Gümüşhane regions, Bursa, Kastamonu-Bartın area and Antalya have most endemic species in Turkey (Fig. 6). Each of these has more than 25 endemic taxa.

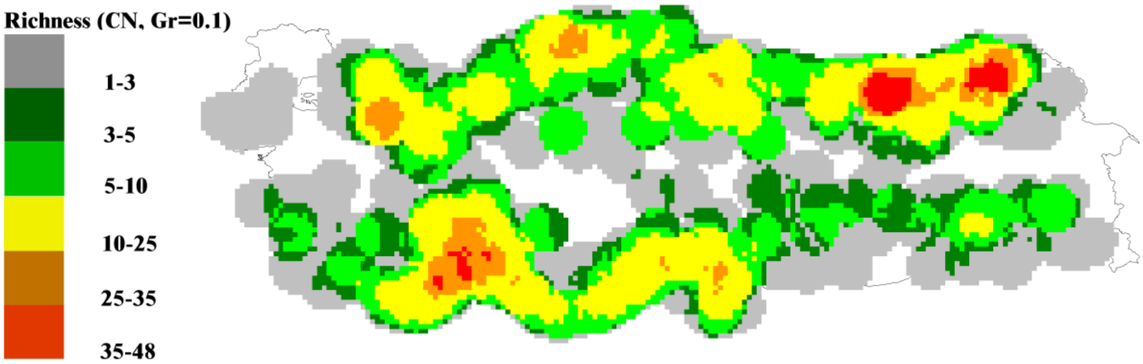


Fig.6. Endemic land snail species richness in Turkey

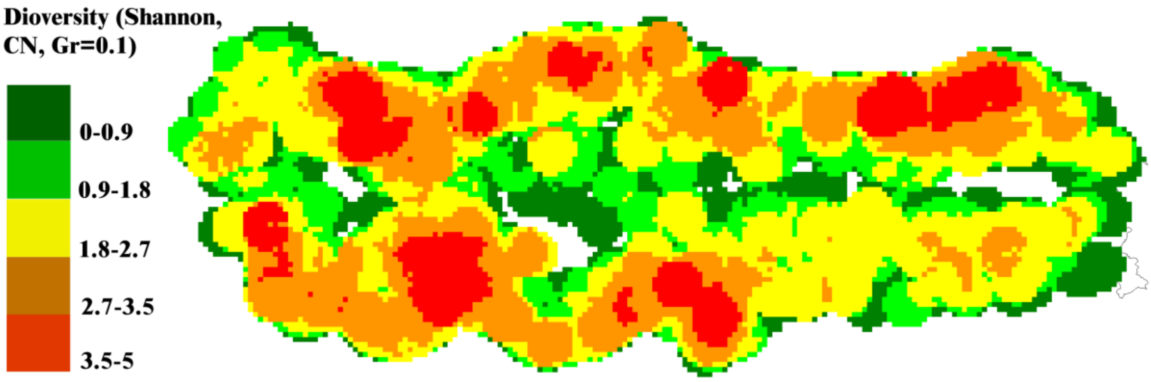


Fig. 7. Land snail species diversity in Turkey: a) general diversity b) endemics diversity

Diversity indexes for whole taxa and for endemics yield similar results. But especially in endemic diversity Adıyaman, Siirt, Erzurum-Gümüşhane-Bayburt-Kars area, Çorum (and environs) provinces clearly show distinct pattern. These areas are rich in endemic species, although not in overall number of taxa.
The indexes are more efficient ways of understanding species diversity than richness data.

Discussion
During the preparation of karstic environment usage schemes, eg. for opening of caves or citadelles to public visits, local gastropod fauna must also be taken into consideration. Because especially in the populated coastal cities like Antalya, a very important center for gastropod endemism and richness (as shown in the plots), the local fauna seems to be retreated to such restricted habitats. Except for fragmentation, direct impact to the habitats such as marble queries, introduction of alien predators, deforestation, exploitation for export are the major threats in turkey. Aquatic and semi-aquatic snails are the most affected group from manipulation of aquatic systems. *Vertigo moulinsiana*, a minute snail associated with reed beds and recorded only once from Turkey, is now listed in the IUCN indexes.
Totally 117 endemic taxa of Turkey are known from single finds. Most of these records are very old and the locality data are somewhat obscure (like “Anatolie” or “Constantinopole”). Thus recovery of the records is quite difficult but urgent considering the high number and inevitable effects of development. Most of the other endemic species are stenoendemics having very limited distributions. These must be checked for the IUCN criteria and list of the taxa requiring protection must be prepared.

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International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

A DISCUSSION PAPER ON PROBLEMS, ROOT CAUSES AND SUSTAINABLE USE OF PAKISTAN WETLAND'S BIODIVERSITY

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Wetlands are the earth's most important freshwater resource and are also the most threatened. They perform manifold functions in the maintenance of the ecological balance of a region. Being dynamic ecosystems, they are continually undergoing natural changes due to infilling with sediments and nutrients, subsidence and droughts etc. They sustain all life and perform some useful functions in the maintenance of overall balance of nature. Unsustainable uses of underground water and in the catchment areas have contributed to the decline of quality and quantity of wetlands. Hence, it is imperative to focus on the preservation of these endangered habitats to achieve ecological sustainability.
Wetland biodiversity and human impact on this biodiversity, is a subject currently generating great scientific interest in Pakistan. To meet the challenges of progressing and governance, baseline interdisciplinary research on biodiversity of wetlands is required. Present understanding of the pressures exerted by human on wetland biodiversity is difficult to apply. In developing countries like Pakistan direst and indirect exploitation of natural resources, most often is going in a very devastating way. Some interactions between human/biodiversity and problems are highlighted in the paper, by studying major wetlands complexes found in Pakistan. Sustainable management of wetlands has been added both in descriptive and experimental point of view.

Key Words: *Pakistan's Wetland Biodiversity, Sustainable use.*

INTRODUCTION

Wetlands support highly valuable pools of biodiversity and genetic resources, but unsustainable development is threatening the biowealth, and even causing species extinction (Khan, 2000). These are fragile ecosystems that are susceptible to changes even with little change to the composition of their biotic and abiotic factors. In recent years, there has been increasing concern over the continuing degradation of world's wetlands, particularly rivers and lakes. Wetlands sustain all life and perform useful functions in the maintenance of ecological balance. Interfacing between land and water systems, they are highly productive and biologically rich ecosystems, and are also the most endangered.
The Earth, two-third of which is surrounded by water bodies looks like a blue planet, the planet of water from space. The world's lakes and rivers are probably the planet's most important freshwater resources, which constitute 2.53 % of the earth's water. At the earth surface, fresh water forms the habitat of large number of species. These aquatic organisms and the ecosystem in which they live represent a substantial sector of the Earth's biological diversity (UNEP, 1994).

As the wetlands occupy only a small part of the landscape. Nonetheless, they are important to birds. This estimation was compared with estimates in the 19th century and it was found that approximately 50% of the world's wetlands have been lost in the past century alone. The major activities responsible for wetlands loss are urbanization, drainage for agriculture, and water system regulation (Shine & de Klemm, 1999). Wetland loss due to draining, filling, or altering of surface-water and ground water flow is a concern to many people. Wetland degradation also has a substantial effect on birds. Although wetland degradation is a serious problem, it is one that is more subtle and less understood than wetland losses. Degradation can take many forms:

- Amounts and periodicity of water supplies
- The quality of water flowing into a wetland
- The flows of sediments or freshwater to marshes
- Water-table fluctuations

The geographic situation of Pakistan, its climatic gradient and its geo-morphological variety has combined to create a series of unique ecosystems. Although predominately arid and semi-arid, Pakistan possesses a great variety of wetlands distributed throughout the country from coastal mangroves and mudflats on the Indus Delta Complex to the glacial lakes of the Himalayas. The 883,000 km^2 portion of the South Asian Sub-continent that falls under the jurisdiction of the *Islamic Republic of Pakistan* consists of an irregular, elongated, polygon that extends through 13.4° of latitude from 23.6°N to 37.0°N. The heterogeneous substrate, substantial latitudinal span, major change in altitude and complex array of slopes and aspects presented by the mountain ranges has generated a wide range of ecological conditions (Pakistan Wetlands Project, 2003).

By virtue of Pakistan's general position in South Asia, the vegetation types that have evolved to occupy these environmental niches include elements of several of the world's major ecological regions. Udvardy's (1975) classification incorporated components of the *Indo-Malayan* and *Palaearctic* realms and Roberts (1991), based on his work in Baluchistan, included a third, the *Ethiopian* or *African Realm*.

Despite the generally arid nature of Pakistan's climate, the region supports an estimated 7,800,000 ha of wetlands and in excess of 225 significant wetland resources are on record (Fig. 1). By 2004, nineteen of these have been internationally recognised by the *Ramsar Convention Bureau* as being of global importance.

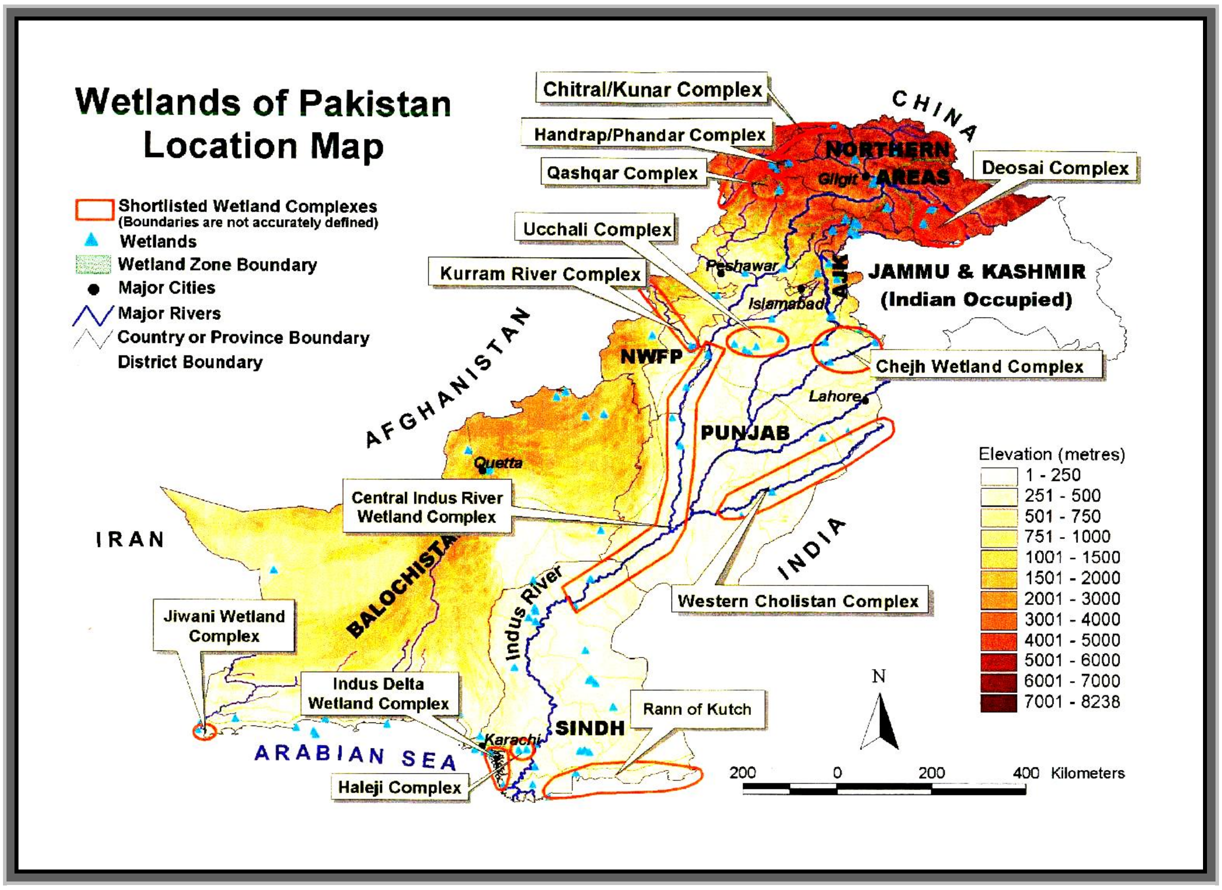

Figure: 1 Wetlands in Pakistan.

Inland Wetland Areas	7,800,000 ha
Rivers and major tributaries	3,100,000 ha
Irrigation Canals	56,000 ha
Natural Lakes	110,000 ha
Water Storage Reservoirs	92,000 ha
Ponds and Fish Farms	108,000 ha
Delta Marshes (Indus)	300,000 ha
Coastal Mangrove Swamps, Saline Wastes	4,000,000 ha

UNDP, PDF-B 2000

As a total more than half (43) out of 75 animals that are designated as endangered or threatened are wetland dependent. Of these, 9 are bird species or subspecies. These birds are categorized as endangered or threatened because their populations are so low that the risk of their extinction is real and immediate. The circumstances that cause each species or subspecies to be endangered differ greatly.

Table 1: Species in major plant and animal *taxa* in Pakistan:

Category	Species recorded in Pakistan		
	Total	Threatened	
		Total	Wetlands dependent
Mammals	174	20	5
Birds	729	25	9
Reptiles	177	6	6
Amphibians	22	1	-
Fish	-	-	-
Freshwater	198	1	1
Marine	788	5	5
Invertebrates	-	-	-
Echinoderms	25	2	2
Marine Molluscs	769	8	8
Marine Crustaceans	287	6	6
Marine Annelids	101	1	1
Insects	c.5, 000	-	-
Plants	-	-	-
Angiosperms	c.5,700	-	-
Gymnosperms	21	-	-
Pteridophytes	189	-	-
Fungi	>4,500	-	-
Algae	775	-	-

Sources: *Biodiversity Action Plan* for Pakistan (2000), Khurshid (2000) and BirdsLife 2004.

A review of the individual status of the range of vertebrate species that are either wetlands dependent or associated with wetlands in Pakistan revealed that 20 threatened species of mammals, 25 of birds, 6 of reptiles 1 of frogs and 198 freshwater fishes are of substantial economic importance and believed to need urgent attention (Table 1).

Pakistan's permanent and ephemeral wetlands are globally significant in two ways: first, in terms of the intrinsic value of their indigenous biodiversity and secondly, as an acute example of the *poverty/subsistence use nexus* that constitutes the most fundamental threat to biodiversity worldwide.

Pakistan has demonstrated its commitment to the conservation of biodiversity by supporting international policies and initiating the development of its indigenous conservation related policies at both national and provincial levels. Of principal relevance to wetlands conservation is the *Ramsar Convention* to which Pakistan became a party in 1975. Under the Ramsar Convention, Pakistan is required to promote the 'wise use' of wetlands and waterfowl and to take measures for their conservation. The country is also expected to establish nature reserves on wetlands particularly those that are designated by Ramsar as Wetlands of International Importance.

Pakistan is also a signatory to the *Bonn Convention on Migratory Species* since 1987 and to the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES) *since* 1976. Under the Bonn Convention, Pakistan's obligations are to protect certain endangered species and to support the protection of those migratory species whose conservation status is unfavourable. As a signatory to CITES, Pakistan is, *inter alia*, obliged to restrict the import and export of species listed under the Convention.

At the national level, Pakistan has provided impetus to environmental protection including biodiversity conservation through the formulation of a *National Conservation Strategy* (NCS) in 1992. Additionally, a Biodiversity Action Plan (BAP) was prepared in 2000 to provide a policy framework for biodiversity conservation. The BAP calls for integration of national policies, development of appropriate legislation, and measures for *in-situ* and *ex-situ* conservation of species, research and raising public awareness for sustainable management of Pakistan's biodiversity.

It emphasises the value of wetlands as important repositories of biodiversity. The country has also launched a *National Environment Action Plan* (2000), as a follow-up to the recommendations of the mid-term review of NCS. The plan includes ecosystem management that is one of the four core areas (Clean Air, Clean Water, Ecosystems Management and Solid Waste Management) of NEAP and wetlands management and protection is a component of the ecosystems management core area.

Pakistan has also formulated a draft *Wetlands Action Plan* that was formally adopted by Government of Pakistan in 2000. In providing an overview of the scope and condition of Pakistan's wetlands, this document highlighted poverty and ignorance as the prime factors contributing to the abuse of wetland resources. The plan presented a list of recommendations and required action to be taken by the key stakeholders including a range of government agencies.Pakistan's conservation laws provide for the formation of a range of Protected Areas (PA) categories. These include Wildlife Sanctuaries, National Parks, Games Reserves and Unclassified PAs. Wildlife Sanctuaries provide the highest level of protection to biodiversity by banning any hunting and providing for absolute habitat protection. National Parks permit limited human activities for research and recreation. Game Reserves allow limited hunting or other forms of resource utilisation.

In Pakistan wetlands related threatened species of birds that required priority action for conservation are, Siberian crane *Grus leucogeranus,* Sarus crane *Grus antigone,* Dalmatian pelican *Pelicanus crispus,* Ferruginous duck *Aythya nyroca,* White-headed Duck *Oxyura leucocephala,* Marbled teal *Marmoronetta angustriostris,* Sociable plover *Vanellus gregarious,* Jerdon's moupinia or Sindh babbler *Moupinia altirostris,* Lesser white fronted goose *Anser erythropus,* Long tailed grass warbler *Prinia burnesii, and* Pallas fish eagle *Haliaeetus leucoryphus* (Khurshid, 2000). The wetlands of the region are, therefore, generally degrading under a broad spectrum of anthropogenic threats most of which are a direct product of poverty, but many of which are exacerbated by human ignorance and mismanagement.

Wetlands Management in Pakistan

Some twenty years after Pakistan's independence, an exploration sponsored by WWF–UK revealed that wildlife and wetlands resources in Pakistan were severely threatened and, in most areas, declining in condition. The expedition report prepared by Mountfort (1967) recommended that a range of wetland sites be declared PAs. Other early efforts included extensive surveys made by Savage (1967 - 1970) and Koning (1970, 1976, 1987 and 1989). Koning's field work was supported by the International Wetlands Research Bureau (IWRB) and he made the first ever effort to train provincial conservation staff in waterfowl identification. Pakistan ratified the Ramsar Convention in 1975 and, simultaneously, nine wetland sites were somewhat hastily recognised by the Ramsar Bureau as being of international importance. Early inventory work tended to be confined to readily accessible wetland sites. In 1980, IUCN compiled A Directory of Wetlands of International Importance in the Western Palaearctic. This was followed by the International Council for Bird Preservation's preliminary Inventory of Wetlands in East Asia. The Directory of Asian Wetlands prepared by Scott (1989) listed 52 sites in Pakistan, based on the work of the NCCW and other agencies. Scott and Poole (1989) subsequently compiled an overview of important wetlands in Asia that featured some of the resources in Pakistan. In 1987 Wetlands International (WI) initiated a mid-winter waterfowl census in the region and government staff from a range of institutions have participated in this survey series annually since that time. The Pakistan NCS (1992) included the protection of watersheds and water bodies as two of fourteen major programme areas for priority implementation. A report based on joint surveys by the NCCW and Ramsar Bureau in 1990 identified priorities for action including surveys, conservation measures, awareness raising, management and applied research. The report recommended rationalising the existing list of Ramsar sites. As a consequence, several were amalgamated into a complex, three existing sites were withdrawn from the list and two others added, bringing the total number of Ramsar sites in March 1996, to eight.

By 2003, the national and site level investment in wetlands was generally inadequate to meet the challenge of conserving globally important biodiversity. At the national level, the key significant drawback was the absence of an effective enabling environment that could encourage and sustain initiatives for biodiversity conservation. Key barriers to creating an enabling environment remained the lack of effective and integrated policies, the absence of decision-making tools and reliable information for wetlands conservation planning, technical deficiencies related to skills and equipment and the lack of general public awareness or political pressure that would favour wetlands conservation. Few comprehensive decision support systems or management tools were available for regional resource planning. The scope of the GIS facilities in the PFI and Forest Management Centre in Peshawar, was limited to forestry only and not organised to accept data on other forms of biodiversity or socio-economic conditions in wetlands and their buffer zones. Technical capacity in almost every aspect of wetlands management tended to be inadequate due to a lack of resources for scientific and specialised wetlands management training, appropriate equipment and exposure to international approaches to wetlands management. While Pakistan had produced a Wetlands Action Plan in 2000, the lack of a comprehensive Wetlands Management Strategy hindered policy formation, co-ordination and management of wetlands at a national scale. Additionally, options for financial sustainability had not been fully explored to enable the proliferation of long-term initiatives in biodiversity conservation. As a result, such initiatives tended to be donor-driven and short-lived.

At the site level, several of the above-mentioned inadequacies were also evident. Although all four of the designated Demonstration Sites fell within the jurisdiction of the provincial forestry and wildlife management agencies, actual activity was limited to partial enforcement of resource use regulations. Some community-based biodiversity management initiatives had been supported elsewhere by the appropriate agencies in NWFP and Sindh. These approaches had, however, not been applied in the four selected wetland sites. Biodiversity monitoring in these sites had also been inconsistent although the ZSD and WWF-P had undertaken some initiatives, particularly during the PDF (B) phase of the Project. Some short-term conservation initiatives had been implemented in recent years in MCWC, CIWC, and SRWC with the active involvement of WWF-P. Significant activities comprised of a programme for the rescue of Indus Dolphins (Platanista minor) stranded in irrigation canals during the dry season in CIWC and support for eco-tourism initiatives on the Indus River. In MCWC, initiatives had included the conservation of endangered Olive Ridley Turtles (Lepidochelys olivacea) and Green Turtles (Chelonia mydas) and the rehabilitation of mangroves near Jiwani. Monitoring of waterfowl, Punjab Urial (Ovis vignei punjabiensis) and Chinkara OR Indian Gazelle (Gazelle bennetti) had been the key focus of conservation activities in SRWC, although some limited community-based ventures, mainly related to environmental awareness, had also been implemented.

DISCUSSION

Wetlands have been famously described as “biological supermarkets” because of the exclusive food webs and rich biodiversity they support as “kidneys of the landscapes” because of the functions they perform in the hydrological and chemical cycles (Mitsch and Gosselink, 1993).

Wetlands dependent species are often rare, threatened or found only in a very restricted geographical area. Freshwater lakes and rivers contain just 0.008 per cent of the world’s water but are of great importance for biodiversity as they contain twelve percent of all animal species (Shine and de Klemm, 1999).

Wetlands are dynamic ecosystems that are in continual change through ongoing processes of subsidence, drought, erosion and siltation. Whilst certain pressures on wetlands arise from natural causes, it is human activities that have significantly altered the rate and nature of wetlands change particularly in recent decades.

The continent of Asia, the largest on the planet earth, has all the major ecosystems from arctic tundra to deserts, temperate to tropical rain forest and coral reefs. These extremely variable climatic conditions in Asia play the fundamental role in determining the suitability of waterbird habitat and their annual to and fro movements from their breeding grounds.

There is a growing realization that genuinely sustainable development depends on conserving the Earth’s biodiversity. Biodiversity underpins our lives, providing many vital goods and services to people. There are also strong ethical and aesthetic arguments why we should care for it well (BirdLife International 2004). Birds help to create positive change, through a public that understands and values biodiversity conservation. They also play a vital part in bringing about the social and political solutions that we need for a more sustainable world.

In many parts of the world, the familiar species around us are in decline, some of these declines are very rapid and severe. Although most of these species are still relatively common, their declines highlight wider environmental problems. Current extinction rate are exceptionally high. Without concerted actions these rates will continue to rise. In total, 1211 birds species (12% of the total) are globally threatened. Nine are recorded from wetlands of Pakistan facing imminent extinction globally.

The immediate threats to species, sites and habitats are nearly always caused by people. Very often, these threats are interconnected and reinforce each other. Habitat destruction is by far the biggest immediate problem, impacting 86% of globally threatened birds. Many other factors are also significant, including our over-spreading infrastructure. When poorly planned and managed, this destroys natural habitat and brings with it damaging human activities.
Bird adaptation to and use of wetland environments differs greatly from species to species. Birds' use of wetlands during life cycles ranges widely. Some birds depend on wetlands almost totally for wintering, breeding, nesting, feeding, or shelter. Other birds use wetlands only for some of their needs, or they might use both wetland and upland habitats. Of the more than 729 bird species that found in Pakistan, about 192 species are exclusively wetland dependent.

Pakistan's wetland systems are of great significance for breeding, migrating and wintering waterfowls. As earlier mentioned during the migration season, over one million waterfowl of 192 species have been recorded as utilising these wetlands (Roberts 1991). Pakistan's wetlands constitute an even more valuable resource of significant economic value, on which people; domestic livestock and wildlife depend for their livelihood and survival. It is a well-established fact that development of water resources is the backbone of any economic activity. Historically, wetlands have served as the life-blood to societies that depend on them for their livelihood in providing resources that sustain them and in also promoting various economic activities. The results of wetland loss lead to environmental and ecological destruction, and depreciation of socio-economic benefits that have largely gone unnoticed where communities depend on wetland resources for survival. Over the recent past, the commercially sensitive, economically exploitative attitudes of the society has subjected these ecosystems to stresses, in some cases leading to destruction and alteration hampering their functioning.

Wetlands in Pakistan are threatened owing to the pressures of unplanned agriculture and land use pattern and industrial development. In order to accommodate the burgeoning populace many of the country's wetlands have paved way to agriculture fields. This has also contributed to the deteriorating water quality.
Morphometry of the lakes is a determining factor in the distribution of the waterfowl. Since 1992 at 16 wetlands studied in Pakistan, migratory birds were much attracted when water was maximum in the lakes. Deeper wetlands with a growth of aquatic plants attract more waterbirds, where they could dabble to acquire their feed (Weller, 1975).

Threats Affecting Sustainable Management of Wetlands
Although it has been known ever since the beginning of mankind that we depend upon available natural resources for existence, the contribution of biodiversity to our sustainable development was formally acknowledged recently. In spite of the recognition of the fact that biological resources are essential for human subsistence and welfare, they are under constant threat. Biodiversity is threatened both at local levels in the form of poaching, encroachment of the protected areas, habitat destruction and pollution, as well as at global level in the form of ozone depletion, deforestation and global warming. More and more species are threatened to extinction, with hundreds of species disappearing from the face of the earth each year.

During the millions of years that preceded the appearance of human life, extinction of organisms was linked to large-scale geologic and climatic changes, the effects of which were translated into major alteration of the environment. Environmental change is still the primary cause of the extinction of animals, plants and other living beings, but now the changes are greatly accelerated by human activity. Clearing land for farms and towns, lumbering, mining, building dams, and draining wetlands all alter the environment so extensively that ecosystems may be completely destroyed. With a burgeoning human population requiring food, shelter, and clothing and constantly demanding more energy-using devices, the temptation to exploit land for human use, more space for living and working without regard for consequences is great (Rondall, 1991).

Increasing population and aspirations for higher standards of people living in developing countries coupled with the exponentially-increasing demands for natural resources by industrialized nations threatens the prospect of achieving ecological sustainability (Osborne, 1995). The maintenance of biological diversity is regarded as a pre-condition for sustainable development- a development which can be sustained within the earth's pool of genetic resources without endangering their natural processes. Similarly such sustainable development can preserve our biological diversity. There are, however, innumerable development patterns and practices which are responsible for endangering this diversity. This is, indeed, very tragic and we must think in terms of converting such vulnerable areas into national parks and gene banks (Desai, 1992).

Lakes are one of the most affected ecosystems in the world through various ways and means. They are more fragile ecosystems than the rivers and this is because they are to a lesser or greater extent closed ecosystems, and their natural cycles take a long time to flush out contaminants. Because of their vulnerability to degradation, lakes need more careful and complex management than rivers and streams (McCalla, 1995).

Wetlands in Pakistan are under great pressure on account of many threats which have led to shrinking of lakes and their biological resource potential. A breief discussion of the major threats confronting the lakes may be broadly categorized as followings:

Drought

The drought in the Central Asian region between 1998 and 2002 greatly reduced wetland habitat for migratory birds and other wildlife (Li & Mundkur 2003). Many important sites for the Waterbirds totally dried out, or their area and water level were greatly reduced. In 2001, the International Research Institute for Climate Prediction reported "a persistent multi-year drought in central and south-west Asia has affected close to 60 million people as of November 2001". The principal conclusions of this report were: central and south-west Asia represent the largest region of persistent drought over the past three years anywhere in the world; from a regional perspective, the ongoing drought has been the most severe in recent decades; significant shortfalls in precipitation have led to widespread social and economic impact, particularly in Iran, Afghanistan, Pakistan, Tajikistan, Uzbekistan and Turkmenistan. Agriculture, animal husbandry, water resources, and public health have been particularly under stress throughout the region. Preliminary analysis suggests that the drought is related to large-scale variations in the climate across the Indian and Pacific Oceans, including the recent "La Niña" in the eastern Pacific. The long-term effects of drought on the viability of waterbird's populations are unknown although potentially critical.

The lack of water has resulted in degradation and desiccation of important breeding sites in Kazakhstan, Mongolia, Russia and Uzbekistan; And wintering sites in Pakistan, Iran and Turkmenistan; and also on staging sites in Afghanistan, Kazakhstan, Uzbekistan, Iran, Turkmenistan and possibly Tajikistan (Li & Mundkur 2003).

Climate Change

Climate change is thought to be causing more frequent droughts resulting in reduced water levels and the drying out of many lakes in central Asia. This phenomenon may be a great threat to the survival of the migratory birds.

Land Encroachment

Pakistan"s essentially agrarian economy places persistent pressure on the need for more agricultural land. In the context of wetland conservation, this tension materialises in the form of encroachment of agricultural practices into wetland sites. The scope of the encroachment ranges from relatively passive practices such as the use of land that is exposed seasonally or during extended periods of drought to practical interventions such as drainage and permanent land reclamation.

Encroachment on wetlands resulting from the extension of agricultural land has substantially reduced the permanent and seasonal extent of wetlands. Exposed areas of lakebed have traditionally been claimed by individuals to the extent that the ownership of the entire surface of some of the lakes is currently in dispute.

Agricultural Farming

Habitat loss and degradation due to human developments is the most significant factor in the past decline of the migratory birds. Agricultural practices in and around lakes have a negative impact by increasing run off and sedimentation rates in wetlands that affect productivity and food availability for the migratory birds.

Groundwater Extraction

Overuse/unsustainable use of water resources for irrigation and man-made modifications to wetlands are critical threats to the migratory birds. Similarly, Uchalli Wetlands Complex is under threat of drying out completely due to a combination of the change in the water-regime in the catchments and the extended drought in Central Asia between 1998 and 2002. This over-abstraction of groundwater, both for drinking and for agricultural purposes, has caused a lowering of the water table and a subsequent reduction in the extent of lakes/wetlands.

Hunting

Though these lakes have been declared protected as wildlife sanctuaries, under the Punjab Wildlife (Protection, Preservation, Conservation and management) Act, 1974 and no hunting was allowed but there was observed incidences of illegal hunting on all the three lakes. The wildlife department with present situation of improper staffing is unable to check illegal hunting.

Subsistence hunting by rural communities and sport hunting by elite or otherwise privileged members of society are well-established traditions in the region. The scope of both forms of hunting has increased over time with the advent of new and more effective weapons. Migratory waterfowl are the most effected component of the *avifauna*.

The migratory birds are an incredibly easy bird to shoot given its lack of an escape response when facing hunters at small valley endorreic lakes. Over-hunting, therefore, undoubtedly played an important role in their decline.

The numbers of hunting incidences were less in summer but it increased from September to March and then was a decline afterwards. A maximum number of hunting incidences were observed in December, which is definitely because of maximum number of waterfowl species appearing in the area.

In Pakistan, fisheries departments without the consent of wildlife departments auctions the rights of fishing in lakes. Many wetlands sanctuaries are also auctioned, which leads to a heavy mortality of waterfowl during the migratory season (Khurshid, 1991).

As stated by Lampio (1982), waterfowl have been hunted in many countries for thousands of years, and the customs and traditions that have grown up during this period differ greatly, sometimes because of varying circumstances but sometimes for no obvious reason. Traditions are essential part of hunting and often deeply affect the character of the whole activity. It has been often said that catch is not as important as the hunting itself. The philosophy is illustrated by the following saying from Finland. “The fox is so valuable, that he is worth hunting even if there is no chance of catching him.”

In recent decades, in many countries, the number of people seeking recreational activity in the country-side has increased sharply. So has their personal mobility, placing hitherto remote areas at risk. Of course, when more than one type of activity takes place on water, the disturbance is greater, although the increase is not necessarily simply additive. The intensity of the activity must also be considered, though again there are complicating factors, one boat may be as disturbing as ten if the water is small, or narrow for its size. The duration of the activity is also important. If short, the birds fly up and then return to the same area; if prolonged, they will seek other areas and not return for some long time. If the disturbance to birds continues day after day, the area will be abandoned by the birds permanently. If most activity is concentrated at the weekends, then the area will continue to be used during the week, provided alternative waters, available nearby (Matthews, 1982). Tuite (1982) was able to demonstrate a wide range of susceptibility to disturbance, ranking the species of wintering wildfowl in increasing order: Pochard *Aythya ferina,* Tufted duck *Aythya fuligula,* Mallard *Anas platyrhynchos,* Wigeon *Anas penelope* and Shovelor *Anas clypeata.*

Lampio (1982) also quotes that, it has often been said that the disturbance caused by hunting is more harmful than direct killing. If waterfowl are prevented from using their favourite feeding grounds because of continuous shooting, they very soon leave the area. Movement along the shore of a wetland drives birds away, even if no shooting takes place, and single shot are enough to scare birds into flight over a large area especially in the later part of the open season. Ardly (1980), quotes his experience about birds and says that life of birds is full of danger and it is unlikely that many will live out there full life span and die of old age. A bird consumes great amount of energy in flying and needs to eat often and well. Diseases usually do not effect birds very much, and other causes are likely to kill them before disease can get a grip. Individual wild birds with exception of waterfowl and game birds, are likely to live in a particular country or continent. While our influence may some times be beneficial and help a species to increase in numbers and spread its range, often we do the opposite. Several kinds of birds come into conflict with us, and suffer at our hands.

Inefficient Wildlife Protection Laws

Prevailing laws are ineffective as far as the protection or conservation of aquatic ecosystems and are concerned as most of them indirectly touch wetland protection (fragmented approach). Pakistan, in spite of being a signatory to the Ramsar Convention on Wetlands and the Convention of Biological Diversity, there is no significant development towards sustaining these ecosystems, either due to lack of coordination among agencies involved or lack of awareness of the values of wetlands among the policy makers and implementation agencies. The effective management of these wetlands requires a thorough appraisal of the existing laws, institutions and practices.

The involvement of various people from different sectors is essential in the sustainable management of these wetlands. Apart from government regulation, better monitoring mechanisms are needed to increase the knowledge of the physical, chemical and biological characteristics of wetland resources, their values and a better understanding of wetland dynamics. Management based on accurate knowledge and increased awareness of wetland issues involving all stakeholders and all components of ecosystem help in long-term sustenance involving restoration and conservation. This would enhance the function and value of the system in terms of natural and socioeconomic factors to satisfy critical resource needs of the human population.

Reduction of Wetlands Vegetation

Reduction of peripheral and emergent wetland vegetation like has reduced the habitat for a wide range of bird.

Deforestation

Timber extraction, primarily for fuel and local construction but also for commercial purpose, poses an indirect threat to wetlands. Reduction in forest cover in the watersheds increases soil erosion and leads to siltation of wetlands.

Use of Agrochemicals

Chemicals and sediments that move from agricultural areas into wetlands are two of the most pervasive sources of degradation. The introduction of off-season vegetables has caused problems in Uchalli Wetlands Complex through overloaded of pesticides. Agrochemical and solid waste pollution indirectly threaten wetlands by leading to eutrophication and other forms of habitat degradation. Agrochemical pollution through increased use of pesticides and insecticides is increasing steadily. Field surveys revealed that many farmers have recently switched to cash crops with concomitant increases in the application of agrochemicals. In the Uchalli Wetlands Complex there has been a clear trend towards crop substitution with farmers switching to vegetables. The fact that lakes are endorreic makes them particularly vulnerable to hyper-eutrophication and pollution. Leaching and run-off of fertilizers and pesticides from agricultural fields that surround the wetlands is known to pollute the water, although their impact has not been determined.

Grazing Grounds and Livestock

Livestock grazing is a common practice along the water line of all three lakes as well as in the catchment areas resulting in the degradation of vegetation cover. As a result the erosion of soil from the watershed goes on silting the lakes with the passage of time. Damage to emergent vegetation in wetlands, by cattle grazing results in the loss of nesting habitat of wetlands birds especially waders.

Livestock grazing pressure is high, to the point of being excessive, in several parts of Uchalli Wetlands Complex. Although communal grazing lands have been most affected, Government forests also suffer from grazing pressure where access is uncontrolled. Statistics reveal that in Uchalli Wetlands Complex, stocking rates are significantly higher than in other areas of the provinces concerned (Salma, 2002). Increased grazing pressure has led to soil erosion and watershed degradation causing siltation of wetlands.

Root Causes

In Pakistan Wetlands Project (2003) the root cause analyses for threats to wetlands in Pakistan has been illustrated by Richard Garstang; some particular causes may be broadly grouped into:

(a) Lack of awareness;
(b) Poverty;
(c) Institutional deficiencies;
(d) Lack of Interdepartmental co-ordination and
(e) Policy deficiencies.

Lack of Awareness

A pervasive lack of awareness is evident in policy making and public attitudes to almost all forms of natural resource management including wetlands conservation. At a site-specific level, lack of awareness lies at the heart of unsustainable uses of wetland biodiversity such as hunting. Hunters were found to be generally unaware of the threatened and endangered status of some species of waterfowl that use wetlands as wintering and staging grounds. *Custodian Communities* also lack awareness of the importance of wetlands and their associated biodiversity and continue to degrade these resources through harmful practices.

Poverty

Poverty related issues emerged as a major root cause of unsustainable use of wetlands. As resources, that are actually or perceived to be common property, wetlands are excessively used for fishing, subsistence hunting, and the extraction of shoreline vegetation and as water sources. The general low level of development, poor access to markets, lack of investment in local processing or value adding activities and over exploitation by intermediaries result in poor communities living a downward spiral of poverty. In these circumstances, they have few alternatives to excessive extraction of wetland products in order to survive. This has led directly to depletion of wetland shoreline vegetation and reduction of habitat for key species.

Institutional Deficiencies

Lack of enforcement of conservation related legislation due to an acute shortages of equipment and physical resources, is a core issue leading to degradation of wetlands. This results in the continuation of harmful activities such as hunting of endangered species within Protected Areas. Similarly, extraction of timber and fuel wood from government forests remains unchecked due to lack of staff and other physical resources. A shortage of training, skills and physical resources also hinders the provincial Wildlife Departments in formulating management plans, monitoring biodiversity and implementing *in-situ* conservation measures. Additionally, these departments lack the experience in integrating custodian communities in wetlands and Protected Areas management.

Lack of Interdepartmental Co-ordination

This leads to a piecemeal approach to natural resource conservation. An example is the introduction of exotic species of plants in areas of water shortage e.g. eucalyptus in the Uchalli Wetlands Complex. Effects on wetlands are rarely taken into account by various agencies when introducing agrochemicals and promoting farming techniques or crops.

Policy Deficiencies

Policy formation at the national level awards scant attention to effects on wetlands. Water sector, agriculture and land policies are key examples of this situation. Lack of an effective system to record and delineate seasonal and perennial area of wetlands leads to land encroachment. The lack of a comprehensive *National Wetlands Management Strategy* exacerbates the situation as no guidelines are present to direct the policy process in integrating wetlands related concerns.

Conservation and Management

Wetlands are one of the Earth's most valuable ecosystems that provide a variety of functions in nature. These functions may be biological, physical or chemical. Wetlands are also a great source of wildlife habitat. One-third of all endangered species make their home in wetland areas. Through groundwater recharge, small amount of water trickle into the ground providing drinking water and irrigation. Wetlands act as "mother nature's kidneys" by increasing water quality.

Wetlands are rich in nutrients and teem with more life than most people suspect. Billions of microscopic algae and larger plants grow and flourish in wetlands, using the sun's energy to produce and reproduce their substance. They serve as food for countless forms of animal life, and these in turn are often consumed by birds and other animals.

During the recent times, invasive human activities have devastated these natural resources. Substantial areas being reclaimed for agriculture development, now the biodiversity of wetlands is under serious threats due to deforestation, drought and forest fires. Problems are increasing due to degradation of the watersheds and lowering of the underground water table. Wetlands are also under grave threats to the life they support due to siltation, degradation of watersheds and long dry spell and an increased pumping of the underground water.

The immediate threats to birds and other biodiversity are rooted in some of humanity's most serious problems. These include continuing strong growth in human population and material consumption, widespread poverty, inequitable access to resources. So long as our accounting is inadequate, we will continue to destroy the resources on which we depend, and short-term gain will be massively outweighed by long term losses.

Awareness of biodiversity, its value to humanity and need for its conservation has been growing steadily, supported by better data than ever before. Commitments made under existing international agreements have enormous potential to achieve biodiversity conservation. However, they need to be activated in national legislation and made effective in practice, most importantly; political will must be manifested in a dramatic scaling up of the resources available for conservation. This is required both nationally and internationally, drawing from a much wider range of sources than at present including the private sector.

As these responses are put in place, birds can provide a key part of a global system to monitor progress. Birds are a gateway to understanding and caring for the environment. Effective biodiversity conservation is unlikely to happen unless demanded by an informed and concerned public. Birds can help to create this constituency for positive change and this brings about eventually, a genuinely sustainable world.

Wetlands are shrinking fast and at the same time the remaining areas are being degraded to an unsustainable level. Pressure from increasing population and demand to bring more land under cultivation might aggravate the situation unless steps to reverse the trend are taken.

Besides their significance for the food, livelihood and security for the human populations living near them, these lakes are rich stores of biodiversity; especially they provide excellent habitat for waterbirds. If managed with appropriate conservation measures, coupled with generation of sufficient public awareness, the wetlands can become very productive and useful ecosystems both economically and ecologically, especially for waterbirds.

Conservation of migratory birds populations, distribution and habitats is very important to check depletion in their numbers. However, these ecologically vital systems are under constant threats due to ever-increasing anthropogenic pressure such as agriculture, land reclamation, as well as uncontrolled silting and weed infestations, making wetlands the most threatened habitats all over the world. Wetlands in Pakistan which provide a winter home to many globally important species of birds are lost at an alarming rate due to neglect and lack of management.

Management of the wetlands by manipulating the water flow system may be quite simple and straight forward to retain its character, but providing appropriate shelter and food to a variety of species arriving and departing at different parts of the year is rather complex. Thus, the ground realities as well as base line information of the components of the system determine the management of the habitat. In a wetland it depend on the water regime and flow system, therefore the knowledge of hydrology and related vegetation, succession system along with the population ecology of the species of the waterfowl help in understanding the processes.

Brewick and Saharia (1995) have stressed on the need for a Waterfowl Management Plan for accomplishing waterfowl conservation, which should define the policies for the same. As the Pakistan is signatory of many international conservation bodies; with their help a national waterfowl/wetlands management plan can be prepared.

The loss or impairment of wetland ecosystem is usually accompanied by irreversible loss in both the valuable environmental functions and amenities important to the society (Zentner, 1988). Appropriate management and restoration mechanisms need to be implemented in order to regain and protect the physical, chemical and biological integrity of wetland ecosystems.

Protecting these wetland’s existing functions proves to be incredibly complex as it involves building a partnership among the various agencies, working in a co-ordinated effort in addressing the common goal of minimizing the human-induced changes that affect the hydrology, biogeochemical fluxes and the quality of wetlands.

The wetland management program generally involves activities to protect, restore, manipulate, and provide for the functions and values emphasizing both quality and acreage by advocating sustainable usage of them (Walters, 1986). Management of wetland ecosystems requires an intense monitoring, increased interaction and co-operation among the various agencies (state departments concerned with environment, soil, natural resource management, public interest groups, citizen groups, agriculture, forestry, urban planning and development, research institutions, government, policy makers, etc). Such management goals should not only involve buffering wetlands from any direct human pressures that could affect the wetlands normal functions, but also in maintaining important natural processes that operate on them that may be altered by human activities. Wetland management has to be an integrated approach in terms of planning, execution and monitoring requiring effective knowledge on a range of subjects from ecology, economics, watershed management, and planners and decision makers, etc. All this would help in understanding wetlands better and evolving a more comprehensive solution for long-term conservation and management strategies.

Management Options for Sustainable Use of Wetlands

There have been notable changes in the state of the habitat even the areas were given protection as wildlife sanctuaries. As the human population is constantly increasing, it is likely that in future anthropogenic pressure will increase. So there is clear need for a new approach to conserve wildlife and lakes. While mitigating people’s demands several studies have approved that the needs and participation of local people should not be neglected. In fact, in case where their needs were well addressed, this helped secure a better future for protected areas. (Nepal and Weber, 1995).

Regarding Wetlands in Pakistan, water is vital for local people living in the periphery of the lakes. They depend on water and for agricultural and household needs. Water was the most important reason given by local people for the local economy. The local tradition can be continued with optimal exploitation and careful management of resources.

To continue natural development processes and minimize the damaging effects of man induced factors.

- Maintain the size of all three wetlands at least at 75% of their original size.
- Prevent the deterioration of water quality and habitat characteristics
- Improve the naturalness of all three lakes
- Maintain and enhance the viable population of endangered species of waterfowl and other birds
- Promote awareness of site importance amongst local communities
- Monitor the public use of the site
- Ensure that public use does not impair the quality of the site.

To improve and develop the socio-economic conditions of neighboring villages through devising conservation activities.

- Plant trees in the vicinity of lakes and on all conceivable sites
- Provide substantial amount of fodder both shrubs and full grasses through range management
- Develop ecotourism in the area
- Improve the existing hygienic conditions in the neighboring villages.
- Provide social facilities at concerned public areas.
- Increase the literacy rate in the adjacent villages.
- Help increase earnings of local populations

To safeguard whenever possible, all notable wildlife species and to control pest species.

- Monitor all important species.
- Evaluate and maintain conditions suitable for migratory and breeding waterfowl and other species.
- Measure human and other disturbances.
- Control pest species.
- Manage visitor use regarding wildlife.

To provide strict protection and evaluate the flyway for conservation of endangered species at other points of migration and to start captive breeding of threatened species.

- Provide strict protection to endangered bird fauna.
- Monitor the population of endangered bird fauna.
- Conduct research on the biology and ecology of endangered birds and all migratory birds.
- Improve upon the management of endangered birds.
- Liaise with national and international organization in order to promote further research to enhance the existing population of endangered birds.
- Start captive breeding programmes for endangered birds and other waterfowl species.

To promote study and research

- Establish wildlife information/education centre
- Promote research activities in relation to safeguarding the habitat and bird fauna.
- Promote cooperation with government and non-government organizations to share their research experiences.
- Gather and record the scientific data.
- Monitor changes in the habitat and species status.

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International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

MANAGEMENT OF THE MARINE BIODIVERSITY IN GALLIPOLI PENINSULA NATIONAL HISTORICAL PARK, CANAKKALE-TURKEY

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In this study, we aimed to specify the biodiversity and endangered species in the coastal protected areas of Gallipoli Peninsula National Historical Park. In order to characterize the species diversity of the Gallipoli Peninsula National Park 11 stations were assigned for seasonal samplings on 2004-2006. Environmental parameters such as temperature, salinity, pH, dissolved oxygen were measured on site at the time of sampling. Samples were collected from each station for the identification and enumeration of phytoplankton, zooplankton, macroalgae, benthic macro invertebrates and demersal fish. Total number of species observed for phytoplankton, macroalgae, zooplankton, benthic macro invertebrates and fish were 124, 72, 41, 341 and 76, respectively. This is so far the first study that includes all of these different aspects of the region. Additionally, management strategies and sustainable protection of the biodiversity of Gallipoli Peninsula will be evaluated.

Key Words: *Gallipoli Peninsula National Historical Park, biodiverstiy, phytoplankton, macroalgae, zoopankton, benthic macroinvertebrate, demersal fish, environmental parameters.*

Introduction

Biological diversity can be briefly defined as the variety of living organisms and the living systems in a particular environment. These definitions include ecosystems and habitat diversity, species diversity and genetic diversity due to genetic variations between species individuals. Turkey is one of the richest areas of the world in terms of its biological diversity. One of the most effective ways of carrying over future generations of our country's biological diversity is implementations as National Protected Parks.

Gallipoli Peninsula National Park which is located at the west part of the Dardanelles Strait is unique with its rich history and biodiversity. This area has been determined as special Protected Areas within the framework of International Protocol by the Turkish Environmental Ministry since 1986.

Gallipoli Peninsula has an area of 35.581,5 ha. National Historical Park lies between 40°02'32" – 40°22'45" N and 26°12'57" – 26°25'43" E. Having a distinctly different two-layer flow regime the study area (Dardanelles and Saros Bay) has high biological diversity due to large salinity differences

There are few studies on Galllipoli Peninsula’s living marine resources in Turkey. Mostly samples were taken from parts of Gallipoli Peninsula during studies to determine macroinvertebrates of Aegean Sea. The studies on mollusca belong to Önen et al. (2003), Öztürk et al. (2000), Öztürk and Çevik (2000), Öztürk and Ergen (1999a, 1999b, 2000); Salman et al. (2003), Ürkmez et al.(2003). Çınar, (1999), Kurt et al. (2003), on Polychaeta; Erkan (2004), Katağan et al.(2001), Kırkım (1998), Kocataş and Katağan (1978), Koçak et. al. (2001), Kubanç and Kılıçaslan (2001), Kubanç (2002) on Crustaceae; Ünsal (1975) on Broyozoa; Türkoğlu et al.(2002, 2003, 2004) on plankton and biomass; Aysel (2000) on macroalgae.

In this study we conducted seasonal samplings in 2004-2006 for phytoplankton, zooplankton, macroalgae, benthic macro invertebrates, demersal fish and environmental parameters such as temperature, salinity, pH, and dissolved oxygen. This study was carried out to characterize the marine species diversity of the Gallipoli Peninsula National Park and protect, utilize and manage our living natural resources as well as biological diversity at this area.

Materials and Methods

11 stations were selected to identify the actual situation of the marine environment of the Gallipoli Peninsula. Stations at the study area were as follows, 1. Akbaş Bay, 2. Kilya Bay, 3. Çamburnu, Soğan Stream, 4. Kilitbahir, 5. Soğan Stream, 6. Memorial, 7. Alçı Hill, 8. Kaba Hill, 9. Arıburnu, Anzac Bay, 10. Küçük Kemikli, 11. Büyük Kemikli.

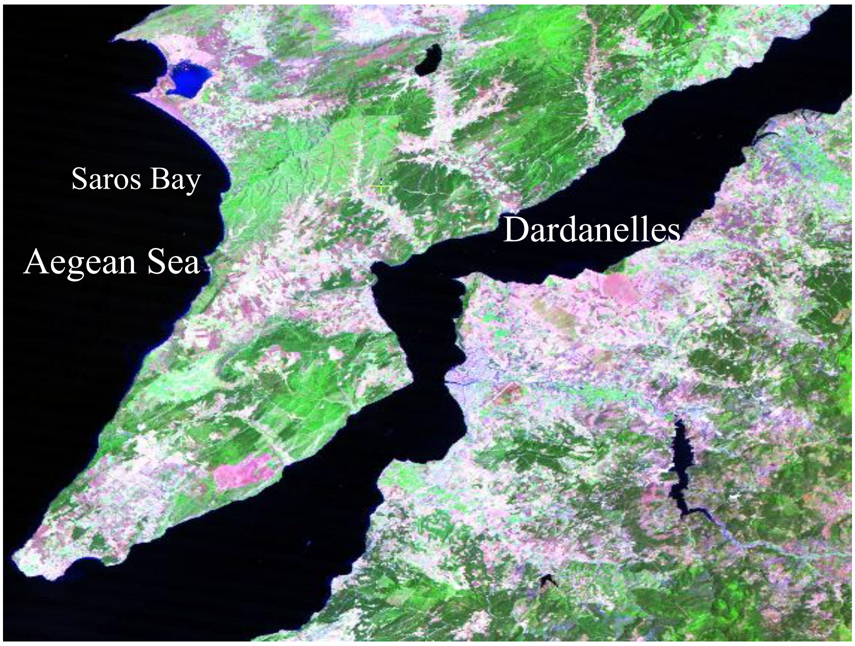

Figure 1. The Satellite view of Dardanelles and Gallipoli Peninsula (From SeaWifs Satellite).

Water quality parameters such as temperature, salinity, pH, dissolved oxygen (DO) were measured from the surface on site at the time of sampling using an YSI 556 MPS. Phytoplankton samples were collected using 40 µm mesh size plankton net. For quantitative analysis of phytoplankton, samples were preserved with 2 % buffered formalin (v/v). Utermöhl sedimentation chambers, Neubauer and Sedgwick-Rafter counting slides were used in combination for identification and enumeration of the phytoplankton species depending on the dimensions and concentrations of the organisms (Guillard, 1978; Hasle, 1978; Venrick, 1978). Zooplankton samples were collected using 180 µm mesh size zooplankton net and identification was done according to (Tregouboff and Rose, 1957). Zooplankton samples were preserved with 4 % buffered formalin (v/v). Vertical and horizontal tows were conducted during phyto-zooplankton samplings. Macroalgae were sampled by scuba or free diving between 0.5 - 30 m depths. Hand nets, 20 x 20 cm quadrat, dredge and 0.1 m^2 van Veen Grabe was used to collect benthic macro invertebrates between 0.5 - 30 m depths. The Samples were then sieved through 0.5 mm mesh and preserved with 4 % formalin in 3-5 litre plastic cases. Demersal fishes were sampled by trawling in the North Aegean Sea from 50-100 m depths (Mater et al., 2003; Whitehead et al., 1986). All samplings were carried with R/V Bilim-1 belonging to COMU, Fisheries Faculty.

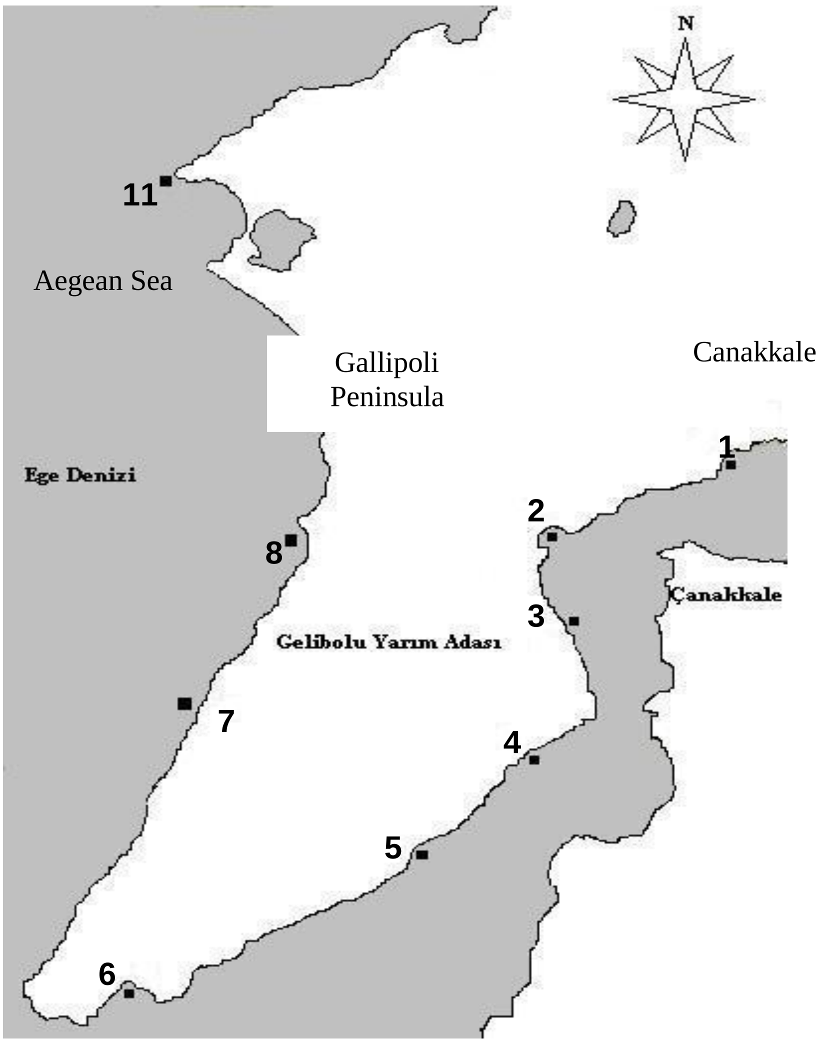

Figure 2. Sampling stations at the Gallipoli Peninsula

Results

Water quality parameters varied among sampling periods. Temperature ranged between 8 and 24 ºC while salinity changed between 25-39 ppt. pH was less variable changing between 8 and 8.6 while DO ranged between 5.8 and 9.1 mg L^{-1} (Table 1). Diatoms such as *Chaetoceros danicuss* Cleve, *Coscinodiscus perforatus* Ehrenberg, *Navicula pennata* A. Smith and *Rhizosolenia fragilissima* Bergon dominated the phytoplankton by 57% then it is followed by dinoflagellates such as *Ceratium furca* (Ehrenberg), *C. fusus* (Ehrenberg) and *Prorocentrum micans* Ehrenberg and *P. minimum* Schiller by 37% in the area (Fig. 1a). Species of Rhodophycea and species of Fukophyceae dominated the macroalgae community by 55% and 22%, respectively. Crustaceans consisted the majority of all zooplankton species by 62%. Few species such as *Acartia clausi* **(Giesbrecht, 1889)**, *Oithona nana* **(Giesbrecht, 1889)** and *Centropages typicus* **(Kroyer, 1849)** were dominant in the Dardanelles (Fig. 1b). Considering benthic macro invertebrates, *Patella caerulea* Linnaeus, 1758 from the Gastropods was found to be continuous in the region. Common species were *Columbella rustica* (Linnaeus, 1758), *Nassarius incrassatus* (Stroem, 1768), *Osilinus turbinata (Von Born, 1778), Gibbula divaricata* (Linnaeus, 1758) from the Gastropods, *Melita palmata* (Montagu, 1804), *Elasmopus brasiliensis* (Dana, 1855), *Hyale schmidtii* (Heler, 1866), from the Amphipods and *Paracentrotus lividus* (Lamarck, 1816) from the Echinoderms (Fig. 2). Abundant species of teleost fishes from North Aegean Sea included *Mullus barbatus barbatus* Linnaeus, 1758, *Merluccius merluccius* (Linnaeus, 1758), *Pagellus bogaraveo* (Brünnich, 1768), *Trisopterus minutus capelanus* (Lacepède, 1800), *Arnoglossus laterna* (Walbaum, 1792). Elasmobranches such as, *Squalus blainvillei* (Risso, 1826), *Dipturus oxyrinchus* (Linnaeus, 1758), *Raja clavata* Linnaeus, 1758 and *Scyliorhinus canicula* (Linnaeus, 1758) were abundant in the region. According to the results of this study total number of species observed for phytoplankton, macroalgae, sea grass beds, sponges, Cnidaria, Crustacea, hydrozoa, polycheata worms, sirripeds, zooplankton, decapod crustaceans, amphipoda, isopoda, fish, sea horses were 124, 363, 4, 3, 4, 164, 34, 50, 1, 65, 19, 23, 22, 52 and 1, respectively.

Table 1. Surface water pH, temperature, salinity and dissolved oxygen measured from each station.

Station Number	Period	pH	Temperature (°C)	Salinity (‰)	Dissolved oxygen (mg/l)
1	Fall-2004	8,1	8,2	26,5	8,5
	Winter-2004	8,1	8,4	27-28	8,8
	Spring-2005	8,5	12	27	9,1
	Summer-2005	-	24	25	8,8
	Fall- 2005	-	13	-	6,7
	Winter-2005	8,2	8,27	26,25	-
	Spring 2006	8,2	15,59	23,89	7,97
	Summer 2006	8,4	21,37	22,39	6,68
2	Fall-2004	8,4	10	27	8,7
	Winter-2004	8,5	9	26	9
	Spring-2005	8,6	12,6	27	7,3
	Summer-2005	-	23	26	8,5
	Fall- 2005	-	13	-	7,5
	Winter-2005	8,2	7,92	26,33	-
	Spring 2006	8,4	15,3	22,53	6,81
	Summer 2006	8,4	21,66	23,98	6,61
3	Fall-2004	8,5	9,1	26	9,1
	Winter-2004	8,5	9,3	26	9
	Spring-2005	8,5	12,2	29	6,1
	Summer-2005	-	23	25	6,8
	Fall- 2005	-	13	-	7,5
	Winter-2005	8,2	8,03	26,43	-
	Spring 2006	8,3	15,41	23,99	6,80
	Summer 2006	8,4	21,50	22,44	6,61

Table 1. Cont.

4	Fall-2004	8,5	10,2	30	7,5
	Winter-2004	8,4	8,4	27	8,9
	Spring-2005	8,5	13,1	31	6,9
	Summer-2005	-	21	28	8,4
	Fall- 2005	-	13	-	6,61
	Winter-2005	8,2	8,96	26,33	
	Spring 2006	8,3	20,34	24,61	5,73
	Summer 2006	8,4	20,97	24,91	6,24
5	Fall-2004	8,5	10,3	32	7,4
	Winter-2004	8,6	13	32,5	7,1
	Spring-2005	-	22	27	8,3
	Summer-2005	8,4	22	28	6,20
	Fall- 2005	8,4	13,0	27	6,24
	Winter-2005	8,2	9,37	28,56	5,62
	Spring 2006	8,4	14,80	26,63	6,72
	Summer 2006	8,4	20,44	25,67	6,12
6	Fall-2004	8,4	12	26	-
	Winter-2004	8,1	9,7	26	-
	Spring-2005	-	21	27	6,1
	Winter-2005	8,3	8,68	28,24	6,2
	Spring 2006	8,3	15,60	27,98	6,81
	Summer 2006	8,2	20,30	32,85	6,36
7	Spring-2005	8,4	11,2	34	-
	Summer-2005	-	24	32	5,8
	Winter-2005	8,2	10,47	30,74	5,20
	Spring 2006	6,3	16,86	34,12	6,65
	Summer 2006	8,3	19,59	30,21	6,42

Table 1. Cont.

8	Fall-2004	8,1	8,7	37	-
	Winter-2004	8,2	12,6	38	-
	Spring-2005	-	24	35	6,7
	Winter-2005	8,2	10,44	34,34	5,62
	Spring 2006	8,3	16,86	34,12	6,30
	Summer 2006	8,2	20,30	32,73	6,18
9	Fall-2004	8,1	8,0	38	-
	Winter-2004	8,3	10,3	37	-
	Spring-2005	-	24	35	7,2
	Winter-2005	8,1	10,64	31,98	7,11
	Spring 2006	8,12	16,39	34,56	7,90
	Summer 2006	8,3	20,18	32,37	6,08
10	Fall-2004	8,1	8,2	37	-
	Winter-2004	-	23	32	7,6
	Winter-2005	8,13	10,37	32,12	7,02
	Spring-2006	7,8	16,41	34,32	6,69
	Summer 2006	8,42	21,02	32,85	6,36
11	Fall-2004	8,1	8,3	37	-
	Winter-2004	8,4	9,9	39	-
	Spring-2005	-	23	34	7,7
	Winter-2005	8,16	10,01	31,54	8,24
	Spring 2006	7,95	16,10	34,58	7,14
	Summer-2006	8,4	21,12	33,89	5,98

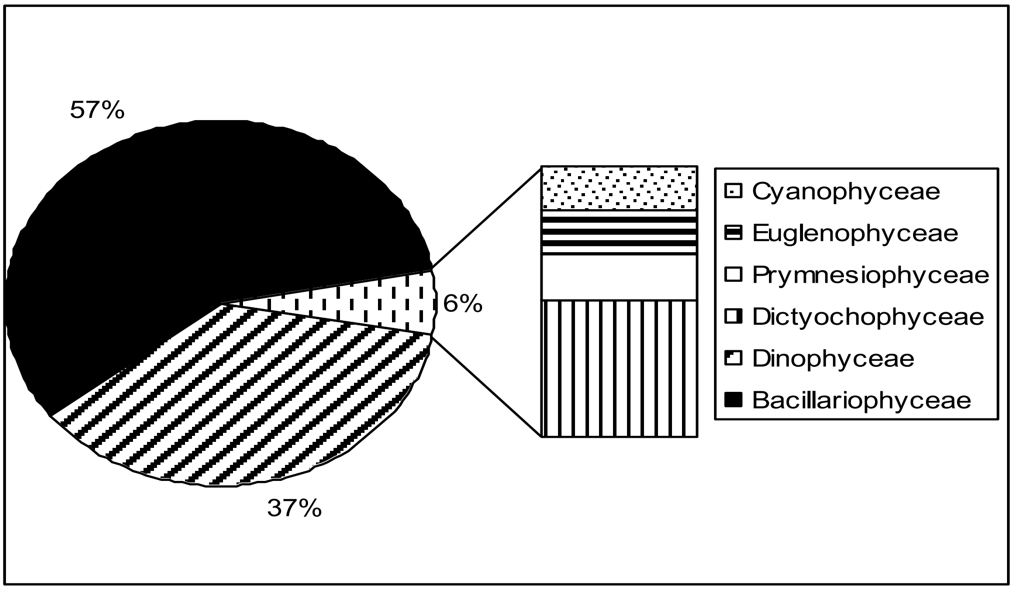

Figure 3. Percent distribution of phytoplankton species composition placed into generic

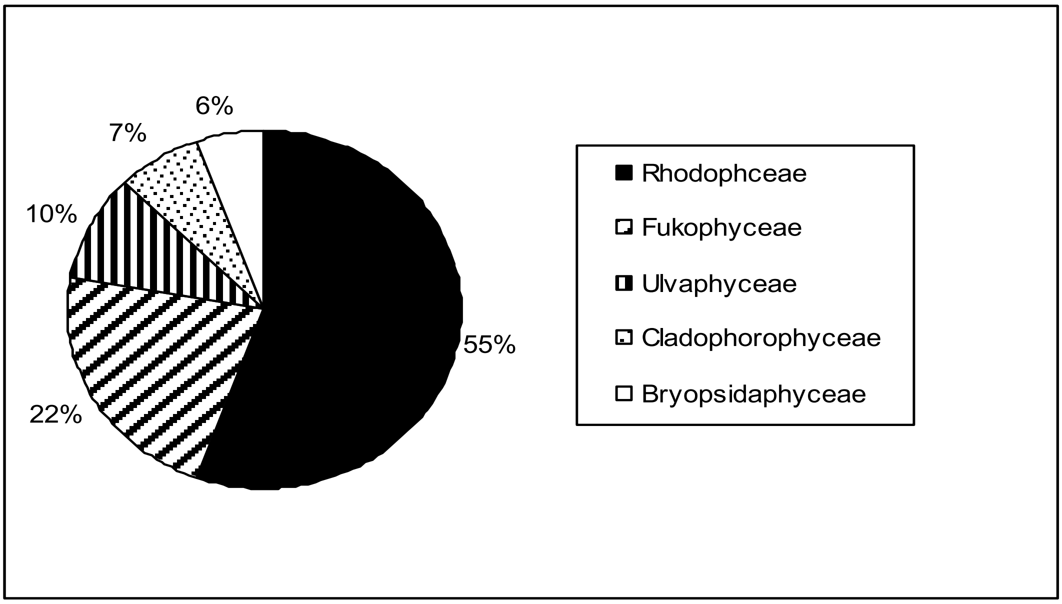

Figure 4. Percent distribution of macroalgae species placed into generic taxonomic groups.

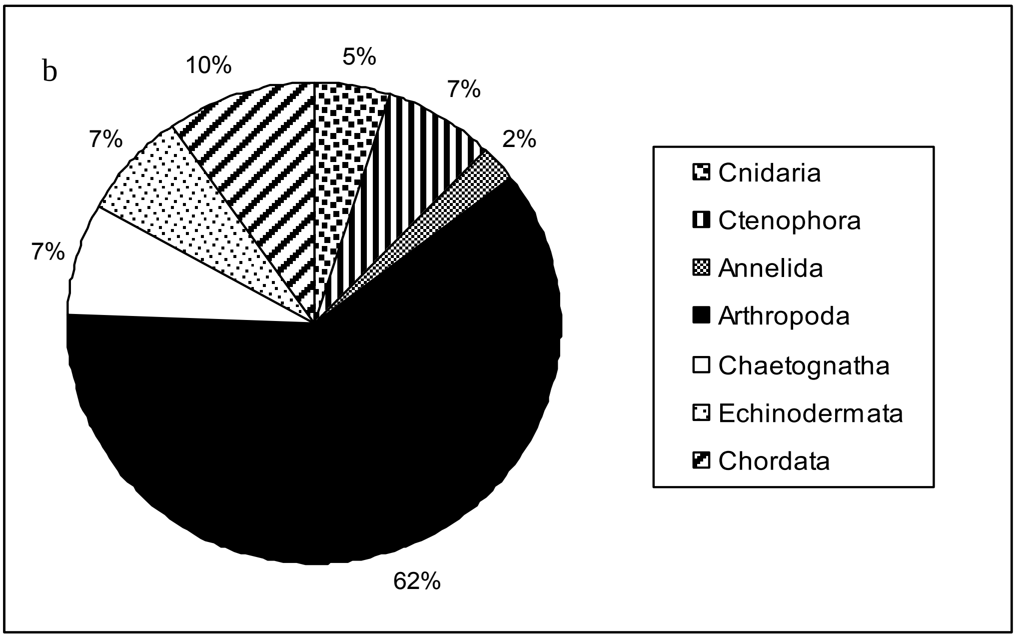

Figure 5. Percent distribution of zooplankton species placed into generic taxonomic groups.

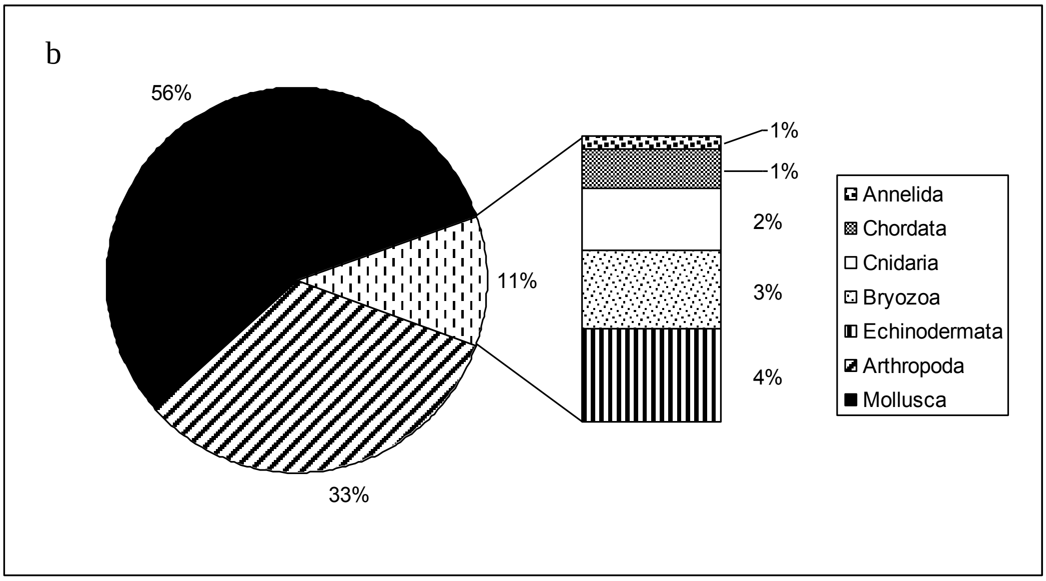

Figure 6. Percent distribution of macroinvertebrate species placed into generic taxonomic groups.

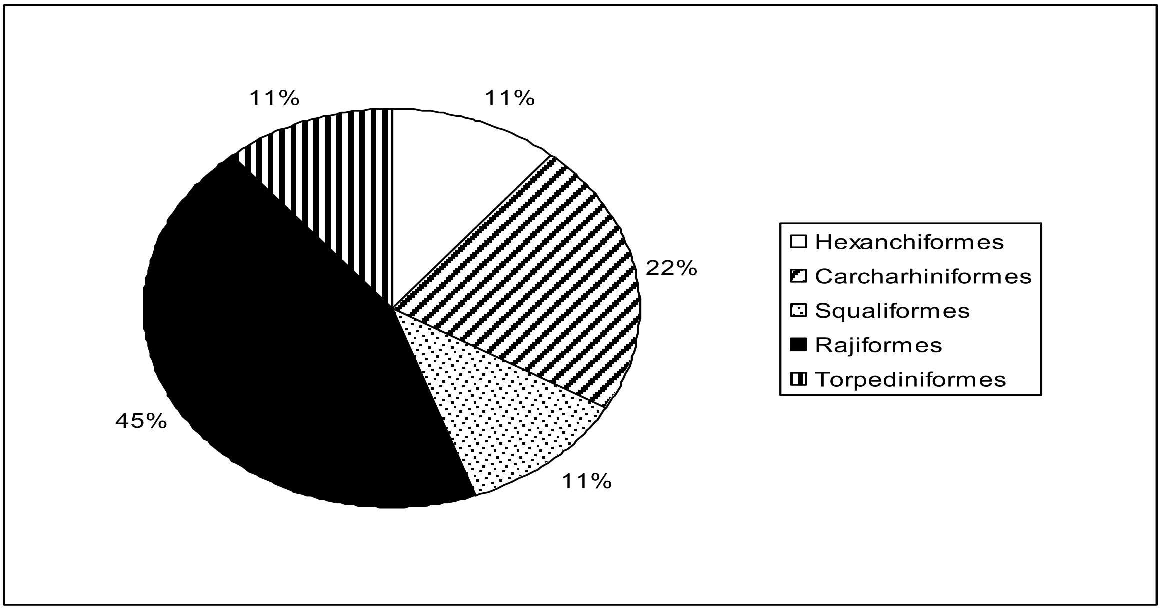

Figure 7. Percent distribution of Elasmobranches placed into generic taxonomic groups.

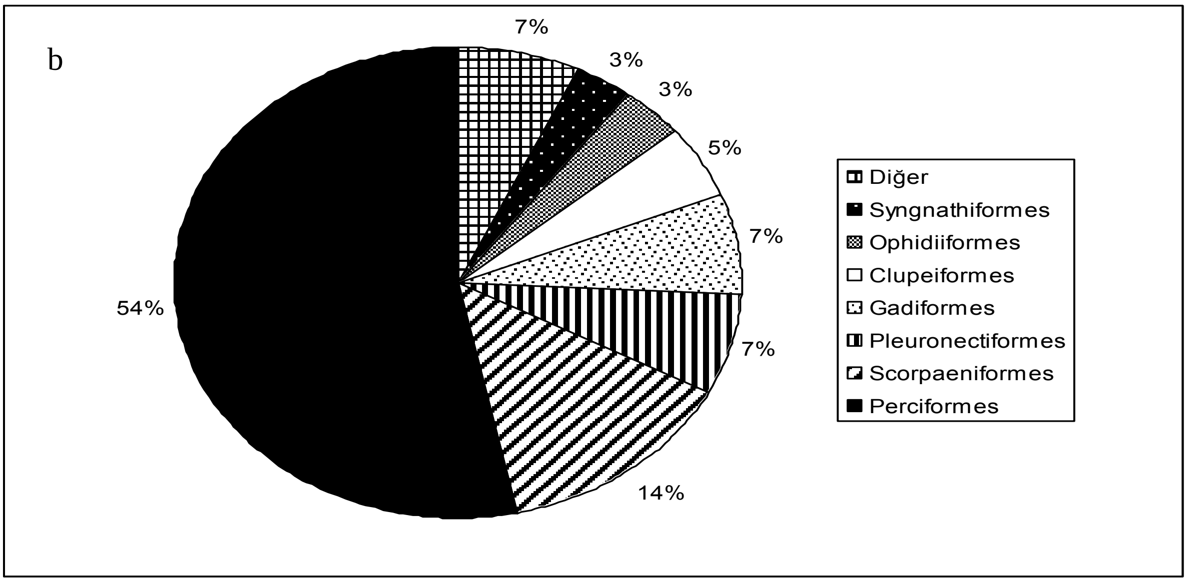

Figure 8. Percent distribution of teleost species placed into generic taxonomic groups.

Discussion

Temperature and salinity measurements showed that there was generally an increase with depth in the sampling period forming two different water masses. Therefore the upper layer consisted of organisms characteristic of Black Sea and the Sea of Marmara while the lower layer composed of Aegean Sea originated biota. Additionally, due to high phytoplanktonic activity DO values were considerably high, especially in the upper layer.

Biota showed a mixture of organisms characteristic to the Black Sea and the Mediterranean. During two years seasonal samplings in the Dardanelles, 124 phytoplankton species were identified from different communities. In these species 9 of them were common, 58 were abundant and 57 were continuous. Macroalgae diversity was observed to be very low since most of the stations had muddy substrates or were mussel beds. Considering zooplankton, species diversity was higher in the stations from the Saros Bay region when compared to the Dardanelles. Regarding benthic macro invertebrates, Annelida and Crustaceans dominated the area being abundant in the seas grass beds. Perciformes consisted the majority of the teleost fish species while Elasmobranches were mostly composed of stingrays and rays which are in the group of Rajiformes.

This study and the similar ones are to be conducted according to the international conventions such as “Biological Diversity”, “Protection of the Mediterranean Sea Against Pollution”, “Protection of Wetlands ”, that Turkish Government has signed.

Turkey signed the Convention on Biological Diversity at the Rio Conference in 1992. This convention aims the conservation of biological resources regionally and internationally. Management strategies for threats against biological resources, taking steps against non-permitted utilization of biological and genetic resources and providing developing countries with new and additional financial resources and tecnology transfer for these purposes are the main subjects of this Convention. One of the most important protection areas in Turkey is Gallipoli Peninsula. Gallipoli Peninsula and Dardanelles are not only a waterway connecting Black Sea, Marmara and Aegean Sea but also have historical importance. Thus, for the maintenance of biological diversity in this area, biotope, species and ecosystem diversity in this region are being studied as part of a project. As an extension of this project we are planning to determine and map the endangered species and abundant species in the area.

Throughout this study, we observed and determined some important problems of this area which can cause significant threats to biological diversity. This region is exposed to anthropogenic pollution such as domestic and agricultural pollution as well as oil spills. Marine transportation is very important in Dardanelles. Therefore, ship accidents may become very problematic causing deleterious impacts on the marine environment like the one that has happened in 2005 in Gallipoli. This accident has affected a very large area of Dardanelles.

Touristic activities that are carried out in these protected areas can be handled within ecotourism and soft tourism. Consequently, familiarity with the fauna and flora of these regions with basic biology knowledge is important. In order to increase the public awareness and provide university-public collaboration Canakkale Onsekiz Mart University, Fisheries Faculty has conducted two symposiums, published 1 book titled “Knowing the Marine

Environment" which its second edition has been prepared. Additionally the Faculty has created a museum of seas and a related gallery which aptly takes its name from our famous seaman Admiral Piri Reis. The goal of this museum is to inform the public about the cultural and natural values related to the seas and the preservation of life within them. Specific collections of the museum include one part of the magnificent piece of Piri Reis "Bahriyye-on Navigation" and various Navigation Maps.

The museum displays more than 200 different species of fin-fish, cartilaginous fish and marine invertebrates such as cephalopods, crustaceans and mollusks which have been captured in all of the seas surrounding Turkey. Additionally, fishing gear which has made an impact on fishing is displayed in the gallery. Furthermore, the herbarium collection of macro-algae that has both scientific and economic applications are also present in the museum. In addition to these collections, the museum includes endangered species such as the sea turtle (Caretta caretta) and the Mediterranean monk seal (Monachus monachus). The last but not least, two marine aquariums were built inwhich different kinds of finfish, sharks and mollusks as well as sea anemonies are being displayed.

Acknowledgements
This research is funded by DPT "Denizel Biyolojik Çeşitlilik ve Nesli Tükenmekte Olan Türler" Project # 2002K120170-1. Thanks are extended to Mülayim Güre for providing the satellite view.

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International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

SALINITY EFFECTS ON GROWTH AND STOMATAL BEHAVIOUR IN STRAWBERRY PLANTS

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A greenhouse experiment was conducted to assess the effect of salt stress on growth and stomatal behaviour in strawberry plants (*Fragaria* x *ananassa* cvs. Camarosa and Tioga). The plants were watered with modified 2/3 Hoagland nutrient solution containing 0 (control), 8.5, 17.0 and 34.0 mM sodium chloride (NaCl) for 10 weeks following 20 days acclimation. High NaCl concentrations caused serious reductions in growth parameters such as fresh weight (FW) of leaves and stems, leaf area and the number of leaf. It was determined that leaf temperature (T_l) was increased with salt treatments in both cultivars. The Gs of strawberry plants in recent work either remained almost unchanged, slightly decreased or increased in all the NaCl treatments in Camarosa and Tioga, which is similar to transpiration rates. We suggest that this may be correlated with the ability of osmotic regulation. Considering the cultivars, the data were indicated that Camarosa and Tioga cultivars had almost the same salt stress tolerance degree under saline conditions, although both cultivars were negatively affected from salt treatments.

Key Words: *Strawberry (Fragaria x ananassa), salt stress, plant growth, stomatal behaviour.*

INTRODUCTION

Salinity is one of the most limiting abiotic stress factors to plant growth and development (Bohnert et al. 1995). In arid and semiarid regions of the world, limited rainfall, high evapotranspiration, high temperature and inadequate water management each contribute to increase in soil salinity (Meloni et al., 2003). Therefore, research on the mechanism of salt stress in species and varieties has a great importance for future advances.

Salt stress with osmotic, nutritional and toxic effects prevents growth in a lot of plant species (Hasegawa et al., 1986; Cheeseman, 1988). Therefore, the reduction in growth was explained by lower osmotic potential in the soil which leads to decrease water uptake, reduction of transpiration, closure of stomata which is associated with the reduced growth (Levitt, 1980; Ben-Asher et al., 2006). Plant species adjust to high salt concentrations by lowering tissue osmotic potential with the accumulation of inorganic ions (such as Na, K and Ca) as well as organic solutes (such as sugars, organic acids, free amino acids and proline) depends on species (Levitt, 1980; Hasegawa et al., 1986).

In strawberry, as well as in some other crops, response of the cultivars to salt stress was well documented using agronomic and physiological characteristics Dobren'Kova and Goncharova, 1986; Barroso and Alvarez, 1997; Turhan, 2002; Turhan and Eris, 2004; Turhan and Eris, 2005; Gulen et al, 2006). According to morphologic properties and ionic composition of the cultivars, Camarosa and Tioga are known to be more salt-tolerant than Chandler (Turhan 2002).

Salt induced injuries can occur due to oxidative effects of salinity. Indeed, Gulen et al. (2006) have reported that strawberry plant must have a good antioxidative system or osmotic regulation in order to tolerate salt stress. It has been shown in our previous work that 8.5, 17.0 and 34.0 mM NaCl treatments for 10 weeks caused osmotic effects in Camarosa strawberry cultivar and Camarosa has the ability to osmotic regulation under salt stress (Turhan and Eris, 2004). Therefore, the aim of the present study was to investigate the morphologic and physiological changes in two strawberry cultivars induced by osmotic stress originated from 10 weeks salt treatments and their role in salt tolerance.

MATERIALS AND METHODS

Seedlings of the Camarosa and Tioga strawberry cultivars were grown in perlite medium, for 10 weeks. When the plants had developed four-five true leaves (20 days after transplanting), plants were started watering with modified 2/3 Hoagland nutrient solution containing 0 (control), 8.5, 17.0 and 34.0 mM NaCl, using a drip irrigation system. The composition of the basic solution was described previously (Turhan and Eris, 2004, 2005). It was attempted to keep the quantity of drainage water at 30% of the amount of nutrient solution applied. The electrical conductivity in the medium was 2.4±0.4 (control), 3.4±0.6, 4.2±0.7 and 6.0±0.8 dSm^{-1}, respectively. The salt level was gradually increased over one week to avoid osmotic shock. Plants were grown in a greenhouse with day/night mean temperature of 38/16°C, average relative humidity of 70%, average photoperiod of 16 h.

At the end of the experiment, plants were separated into leaf, stem and root parts and their fresh weights (FW) were directly determined. Number of leaves was also recorded. Total leaf area was measured using a planymeter (Placom KP-90N). During the experiment, leaf temperature (T_l), stomatal conductance (Gs) and transpiration ratio (E) of leaves were determined using a portable steady state porometer (LI-1600 M, LI-COR). Measurements were made biweekly in the same leaves, during the middle of the photoperiod (between 12:00 and 14:00). Statistical evaluation took into consideration the average of the all measurements.
The experiment was set up using a Randomized Block Design and replicated three times. There was 1 plant in each pot [14 cm diameter], with 10 pots in each replicate. The data were subjected to ANOVA and the means were compared by the least significant difference [LSD] at 0.05 confidence level using the BARNES and MSTAT-C computer programs, respectively.

RESULTS AND DISCUSSION

Strawberry has been described by various authors as sensitive to salinity (Levitt, 1980, Schwarz, 1995). Growth responses of strawberry plants to different salinity concentration in the medium are shown in Fig. 1. NaCl caused a significant suppression in vegetative growth of both strawberry cultivars (Fig.1). The reduction was greater at higher NaCl concentrations. FW gradually decreased with an increase in NaCl concentration for leaves. The reductions were more pronounced at 34.0 mM NaCl in both cultivars, in which it attained 54 % and 72 % of the control for Camarosa and Tioga, respectively. Salt stress also results in a considerable decrease in the FW of leaves in sugar beet (Ghoulam et al., 2002), as parallel to our results. When compared to control treatment, it was determined that high NaCl treatments reduced the stem FW in both cultivars. This result was similar to the outcome of previous investigations (Navarro et al., 2000; Ashraf and Bashir, 2003). For the Root FW it appeared that there was an increase but the anova analyses showed that salinity effect on this parameter was not significant.

The leaf number was also affected by NaCl treatment. The reduction was the highest in 34.0 mM NaCl treatment and reached 46 % and 44 % of the control in cv. Camarosa and cv. Tioga, respectively. Meanwhile, the percentage reduction in leaf area was greater at 17.0 and 34.0 mM NaCl and the highest reduction was obtained for the cultivars Tioga where it reached around 71 % at 34.0 mM NaCl, followed by Camarosa with 57 %. These findings are compatible with those of Dobren'Kova and Goncharova (1986), working with strawberry. Similar results were reported for other species such as sugar beet (Ghoulam et al., 2002) and legumes (Ashraf and Bashir, 2003). The decline in leaf growth is the earliest response of glycophytes exposed to salt stress. Growth inhibition in the long term is related to lower photosynthetic area (Munns and Termeat, 1986). However, decreases in leaf number were not only connected with the growth inhibiting effects of salt, but also related to injurious effects of salt due to defoliation of the damaged leaves.

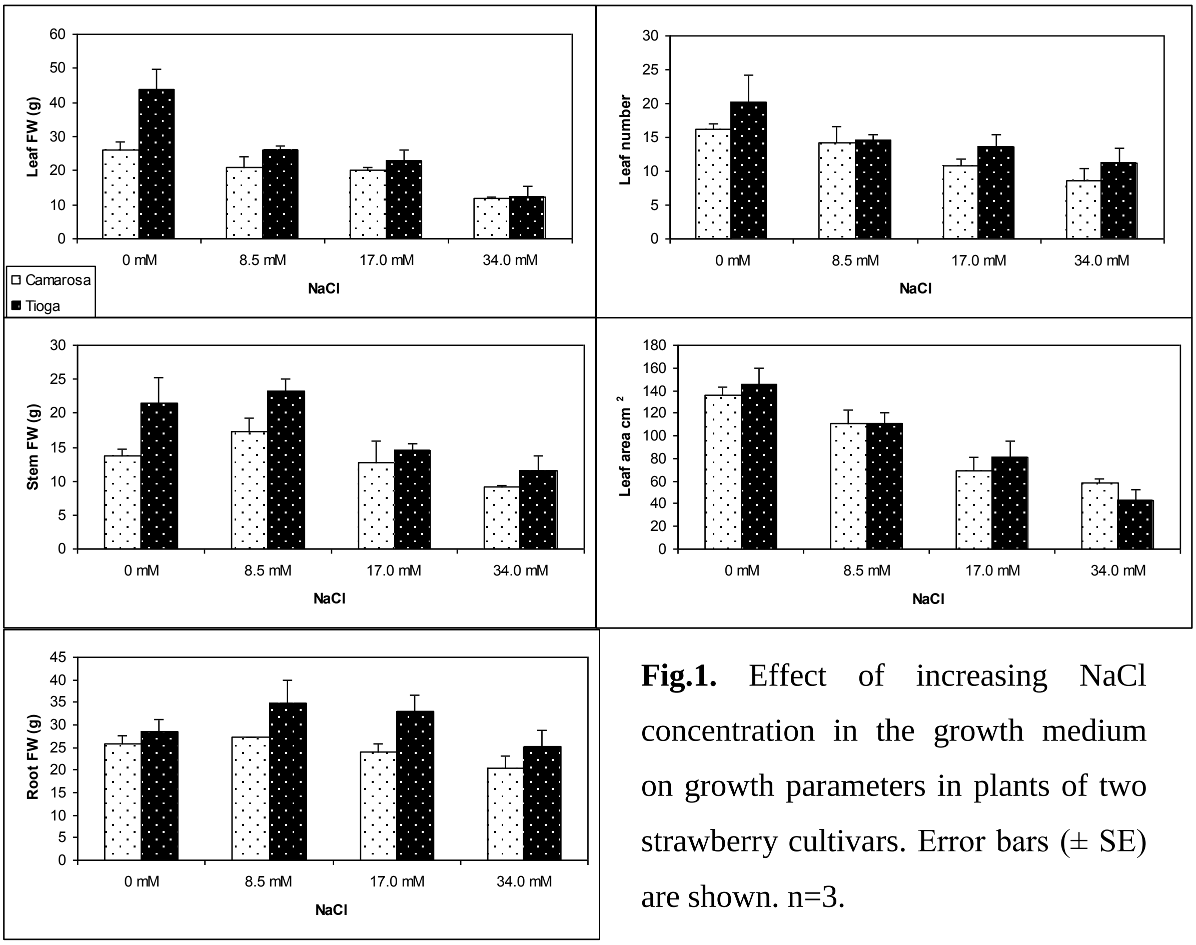

Fig.1. Effect of increasing NaCl concentration in the growth medium on growth parameters in plants of two strawberry cultivars. Error bars (± SE) are shown. n=3.

Salt-induced osmotic stress causes osmotic dehydration. This osmotic dehydration leads rapidly to a decrease in osmotic and water potential of cells and in cell volume (Levitt, 1980). From the present study, it can be detected that the growth reduction due to higher NaCl concentration can be attributed to the osmotic effect of salts. In fact, it was determined that salt treatments decrease leaf water potential and osmotic potential (Awang et al., 1993) and it cause osmotic stress in strawberry (Turhan, 2002; Turhan and Eris, 2004). The growth reduction induced by salinity has also been explained by a suppression of nutrient absorption

due to uptake of NaCl in competition with nutrient ions (Levitt, 1980; Salisbury and Ross, 1994). As a matter of fact, Turhan (2002) and Turhan and Eris (2004) have concluded that with the effect of salt treatments, the amount of Na and Cl increased; while the amount of K decreased. Specific toxic effects of salt also reduce plant growth. It was determined that NaCl treatments increased Cl content in strawberry plant (Barroso and Alvarez, 1997; Turhan, 2002; Turhan and Eris, 2004). According to declaration of Levitt (1980), NaCl treatments increase Na and Cl accumulation and, toxic effects related to the accumulation of these ions cause necroses and moulding in leaves.

The effects of salinity on T_l, Gs and E of leaves are shown in Table 1. T_l increased gradually with the increase of NaCl concentration in cv. Camarosa (from 37.2 ^{0}C to 38.9 ^{0}C) and in cv. Tioga (from 36.8 ^{0}C to 39.6 ^{0}C). Addition of salt to the growth medium caused a controlled reduction in Gs and E of cv. Camarosa. Gs was reduced from 278.1 mmol $m^{-2}s^{-1}$ to 232.3 mmol $m^{-2}s^{-1}$ with the increase of NaCl concentration in cv. Camarosa. E showed a similar trend (10.625 mmol $m^{-2}s^{-1}$ at control treatment, 9.956 mmol $m^{-2}s^{-1}$ at 34 mM NaCl). On the contrary, the increase of NaCl concentration caused a controlled increase in Gs (226.7 mmol $m^{-2}s^{-1}$ at control treatment, 249.3 mmol $m^{-2}s^{-1}$ at 34.0 mM NaCl treatment) and E (8.473 mmol $m^{-2}s^{-1}$ at control treatment, 11.000 mmol $m^{-2}s^{-1}$ at 34.0 mM NaCl treatment) in cv. Tioga. However, no statistically significant differences in Gs and E were found between controls and salt treated plants in both cultivars. A decrease in Gs under saline condition was reported in many plants such as mulberry (Agastian et al., 2006), legumes (Ashraf and Bashir, 2003), pepper (Martinez Ballesta et al., 2004; Lycoskoufis et al., 2005). A decrease in Gs was observed for the NaCl treatments, probably caused by closure of the stomata or a decrease of water uptake through the roots. The decrease in water flow due to salt stress may cause lowering in leaf water content that would result in stomatal closure in order to maintain their water status (Robinson et al., 1997). It has been proposed that the reduction of leaf gas exchange in response to salinity is due to an increase in leaf Na concentration (Garcia-Legaz et al., 1993). However, other authors associated with reductions in photosynthetic capacity and stomatal conductance with high concentrations of Cl (Banuls et al., 1997). Turhan (2002), working with the same strawberry cultivars has concluded that, 10 weeks salinity treatments increased Na and Cl content in strawberry plants. Therefore, in strawberry plants, an effect of both Na and Cl may have occurred.

Table 1. Effect of increasing NaCl concentration in the growth medium on leaf temperature (Tı), stomatal conductance (Gs) and transpiration rate (E) of leaves of strawberry plants.

NaCl (mM)	Cultivar	Tı (^{0}C)	Gs (mmolm^{-2}s^{-1})	E (mmolm^{-2}s^{-1})
0 (Control)	Camarosa	37.2	278.1	10.625
	Tioga	36.8	226.7	8.473
8.5	Camarosa	38.1	234.0	8.507
	Tioga	38.2	220.8	8.337
17.0	Camarosa	38.5	256.4	10.113
	Tioga	39.1	260.7	10.490
34.0	Camarosa	38.9	232.3	9.956
	Tioga	39.6	249.3	11.000
ANOVA				
Cultivar (A)		ns	ns	ns
NaCl (B)		*	ns	ns
A*B		ns	ns	ns

ns and * denote not significant and significant, respectively. Values not associated with the same letter are significantly different (P<0.05).

Transpiration rates generally tend to decline with increasing salinity in almost all plants. This might be due to lowered water potentials in the roots, and the transfer of abscisic acid from root the shoot as a signal, but at higher concentrations it could also be the result of inhibition of photosynthesis caused by salt accumulation in the mesophyll, and increasing intercellular CO_2 concentrations which reduce stomatal apertures (Robinson et al., 1997). Contrast to these evidences, the Gs of strawberry plants in the present study either remained almost unchanged, slightly decreased or increased in all the NaCl treatments in Camarosa and Tioga, which is similar to transpiration rates. This may be correlated with the ability of osmotic regulation of both cultivars. This is well documented in the study of Turhan and Eris (2004) that NaCl treatments caused osmotic effects in Camarosa and possess the ability to bring about osmotic regulation to tolerate the salinity. The response of plants to salinity is direct related to their stage of growth, duration of exposure and cultivars (Schwarz, 1995). In conclusion, the assessment of the effect of salinity on the growth parameters in two strawberry cultivars allow us to conclude that all of the considered growth parameters were affected by salinity with the same degree in both cultivars. Indeed, Camarosa and Tioga cultivars had almost the same salt stress tolerance degree. Considering the physiological parameters, we suggest that control of stomatal conductance and transpiration rate represent adaptive mechanisms to cope with excessive salt.

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ANTIOXIDATIVE ENZYME ACTIVITIES IN ONION (*ALLIUM CEPA* L.) GENOTYPES

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Antioxidative enzyme activities were investigated in seven local and introduced onion (*Allium cepa* L.) genotypes; Aki, Alex, Banko, Kes Valencia, Kapidag, Kantartopu, Yalova 12 in order to predict oxidative properties of these genotypes. In this respect, soluble peroxidase (SPRX), cell wall peroxidase (CWPRX), catalase (CAT) and ascorbate peroxidase (APRX) activities were investigated in onion bulbs. Yalova 12 had the highest SPRX activity whereas Alex had the highest CWPRX activity among these genotypes. APRX activity was the highest in Kapidag, while CAT activity was high in Banko, Kes Valencia and Kapidag. On the other hand, Aki had poor activities in almost all the investigated enzymes. An UPGMA grouping of these genotypes was done based on the activities of these enzymes. In addition, the results related to the genotypic differences and responses of the genotypes to oxidative stress were discussed.

Key Words: *Onion (Allium cepa L.), genetic variability, antioxidative enzymes, oxidative stress.*

INTRODUCTION

All plants are subjected to various biotic and abiotic stresses in natural environments during their lifes. One of the biochemical changes occurring when plants are subjected to biotic or abiotic stresses is the production of reactive oxygen species (ROS), such as superoxide (O_2^-), hydrogen peroxide (H_2O_2) and hydroxyl radicals (OH) (Foyer et.al. 1994, Mittler, 2002; Neill et.al, 2002). These ROS are highly reactive and in the absence of any protective mechanism they can seriously disrupt normal metabolism through oxidative damage to lipids, protein and nucleic acids (McKersie and Leshem, 1994; Allen, 1995).

Antioxidative enzymes like superoxyde dismutase (SOD), catalase (CAT), peroxidase (PRX), ascorbate peroxidase (APRX) and glutathione reductase (GR) are the most important components in the scavenging system of ROS (McKersie and Leshem, 1994; Noctor and Foyer, 1998). SOD is a major scavenger of superoxide (O_2^-), and its enzymatic action results in the formation of H_2O_2 and O_2. The H_2O_2 produced is then scavenged by CAT several classes of peroxidases. CAT which is found in peroximoses, cytosol and mitochondria, dismutases H_2O_2 into H_2O and O_2 (McKersie and Leshem, 1994). Peroxidases are a family of isozymes found in all plants; they are heme-containing monomeric glycoproteins that utilize either H_2O_2 or O_2 to oxidaze a wide variety of molecules (Yoshida et al., 2002). Many physiological functions for peroxidases in plants have been reported, such as removal of H_2O_2, oxidation of toxic reductants, biosynthesis and degradation of lignin in cell walls, auxin catabolism, defensive responses to wounding, defense against pathogen or insect attack, and some respiratory processes (Gaspar et al., 1982).

APRX is the most important peroxidase in H_2O_2 detoxification, catalyzing the reduction of H_2O_2 to water using the reducing power of ascorbate (Noctor and Foyer, 1998).

Onion (*Allium cepa* L.) is botanically included in the *Liliaceae* and species are found across a wide range of latitudes and altitudes in Europe, Asia, N. America and Africa (Griffiths et al. 2002). In 2005 World onion production was around 57 400 277 tonnes making onion the second most important horticultural crops after tomatoes (Anonymous, 2006). An efficient use of the genetic resources requires an understanding of the structure of variation in the available onion germplasm collections.

Morphological and physical markers can be used for determining of genetic variability in *Allium cepa* L. (Singh et al., 1995; Turhan et al., 2006). Isozymes, biochemical and molecular markers are also the ways chosen to investigate *allium* diversity (Haisima and Ikehasi, 1992; Haisima et al., 1993; Klaas, 1998). On the other hand, the importance of antioxidative enzyme metabolism to distinguish genotypes was also reported by earlier studies in different A*llium* species. In addition, it was shown that different *Allium* species posses well-defined antioxidant activity (Stajner et al. 1998; Stajner and Varga, 2003; Stajner et al., 2006). Therefore, the purpose of this study was to screen different genotypes of *Allium cepa* based on the antioxidative enzyme activities such as soluble peroxidase (SPRX), cell wall peroxidase (CWPRX), catalase (CAT) and ascorbate peroxidase (APRX) in order to understand the relationship between the genotypes.

Material and Methods

Antioxidative enzyme activities were investigated in the bulbs of seven local and introduced onion (*Allium cepa* L.) genotypes; Aki, Alex, Banko, Kes Valencia, Kapidag, Kantartopu, Yalova 12 onion (*Allium cepa* L.) The bulbs of genotypes were obtained from a private company in Karacabey/Bursa Region. Characteristic of genotypes are shown in Table 1. Triplicate samples of bulb tissues were frozen immediately and ground in liquid N_2 and stored at -80^{o}C until used

Enzymes were extracted at 0-4 ^{0}C from 1 g of onion bulbs, by grinding with mortar and pestle in 1.0 % PVP-40 and 2 ml of the following optimal media (Moran et.al. 1994); for Catalase (CAT)(EC 1.11.1.6): 100 mM K-PO_4 buffer, pH 7.0, 0.1 mM EDTA, 0.1 % Triton; for Ascorbate Peroxidase (APX) (EC 1.11.1.11): 50 mM K-PO_4 buffer, pH 7.8, 50 mM Ascorbate.

The homogenate was centrifuged at 15,000 g for 20 minute at 4 ^{0}C. The supernatants were used for the enzymatic assays. CAT was assayed by monitoring the consumption of H_2O_2 at 240 nm (Rao et.al. 1996). The activity was calculated using the extinction coefficient of 39.4 $mM^{-1}cm^{-1}$ for H_2O_2. APX activity was determined by measuring decrease in absorbance of the oxidised ascorbate at 290 nm, according to Nakano and Asada (1980). The concentration of oxidized ascorbate was calculated using extinction coefficient (£ = 2.8 $mM^{-1}cm^{-1}$), one unit of APRX was defined as 1 mmol mL^{-1} ascorbate oxidized per minute.

Peroxidase extraction was done according to Andrews et al. (2000). Sample was suspended in ice-cold 10 mM Na-acetate/citric acid, pH 6.0, using 100 µL of buffer per mg of original fresh weight of tissue. This suspension was mixed and centrifuged at 3000 g for 15 min at 4 ^{0}C. The pellet was resuspended in the same buffer and again centrifuged. This process was repeated up to eight times to ensure that all the soluble peroxidase had been washed out. Supernatant from the final wash was assayed to confirm that soluble peroxidase had been reduced to a negligible level. The washed pellet was resuspended in 100 µL mgL^{-1} original fresh weight of 100 mM Na-acetate/citric acid buffer, pH 6.0, containing 1 M NaCl. The suspension was mixed thoroughly and incubated on ice for 60 min with periodic shaking. The sample was then centrifuged at 4 ^{0}C for 15 min at 3000 g. The resulting supernatant contains the salt-extractable cell wall peroxidase; this is assumed to represents that fraction of peroxidase that is ionically bound to cell wall in vivo. Aliquot of 100 µL were added to 2 mL reaction mixtures containing 100 mM Na-acetate-citrate buffer pH 6.0 and 10 µg TMB, solubilised initially in dimethyl sulphoxide (DMSO). The reaction was initiated by adding 10 µL 6 % H_2O_2 and incubation was carried out for 30 min at 25 ^{0}C. To stop the reaction, 0.5 mM 0.6 M H_2SO_4 was added and the optical density of the yellow color was determined at 450 nm. Enzyme activity was expressed by reference to a standard curve made with horseradish peroxidase (Sigma Chemical Co.Ltd.) (Andrews et al. 2000).

Total soluble protein contents of the crude enzyme extracts were determined according to Bradford (1976) using bovine serum albumin (BSA) as the standard. All analyzes were replicated three times. Data were tested by SPSS 13.0 for Windows program and mean separation was accomplished by Duncan multiple ranged test at $P < 0.05$. The data in distance matrix were used to perform a cluster analysis using the un-weighted pair-group method arithmetic average (UPGMA) (Sokal and Michener 1958) with the software NTSYS-pc (Numerical Taxonomy and Multivariate Analysis System version 1.80) (Rohlf 1993). A dendrogram indicating the relatedness calculated among the onion genotypes was constructed with the TREE program of NTSYS-pc.

Results and Discussion

In the present study, all investigated bulbs exhibited antioxidant enzyme activities. The results obtained from the study of antioxidative enzymes are presented in Table 2. The highest SPRX activity was obtained from genotype Yalova 12 with the value of 205.06 u/mg protein. This was followed by genotypes Kapidag and Kes-Valencia with the values of 148.13 u/mg protein and 134.29 u/mg protein, respectively. The lowest SPRX activity was observed in bulbs of genotype Aki (13.47 u/mg protein). Whereas, regarding the CWPRX activity, genotype Yalova 12 had the lowest activity (1.44 u/mg protein) the highest CWPRX activity was determined in genotype Alex (4.67 u/mg protein). This was followed by genotype Kes-Valencia (3,82 u/mg protein), genotypes Banko (3,58 u/mg protein) and Kantartopu (3.20 u/mg protein). CAT activity was high in genotype Banko (203.62 nmol/mg protein), genotypes Kes Valencia (192.43 nmol/mg protein) and Kapidag (173.90 nmol/mg protein). However, genotypes Aki (66.19 nmol/mg protein), Alex (54.63 nmol/mg protein) and Yalova 12 (67.93 nmol/mg protein) had poor activity of CAT. The highest activity of APRX was observed in bulbs of genotype Kapidag (3.05 µmol/mg protein). Activity of APRX ranged from 1.13 µmol/mg protein (Alex) to 1.83 µmol/mg protein (Kes-Valencia) in the bulbs of the rest of genotypes.

Allium cepa L. is common onion and is widely used in all parts of the world as a flavoring vegetable in various types of food. Our results showed that the examined *Allium cepa* genotypes had different susceptibility to the action of toxic oxygen species. Aki exhibited poor activities of all investigated antioxidative enzymes. Alex exhibited high CWPRX activity in bulbs whereas activities of other antioxidant enzymes were low. The highest CAT activity was observed in bulbs of Banko, although SPRX activity was low. However, the low PRX activity could be compensated by the “peroxidase-like” action of catalase (Stajner et al., 1998). Kes-Valencia exhibited high antioxidative enzyme activities except APRX. Kapidag had high CAT as well as high APRX activity although activity of CWPRX was low. It was determined high CWPRX and low SPRX and APRX activities in bulbs of Kantartopu. The highest SPRX activity was observed in bulbs of Yalova 12, although activities of other antioxidative enzymes were low.

We suggest that *Allium cepa* genotypes had high activities of antioxidant enzymes which could prevent membrane damage due to O_2^- and H_2O_2 elimination and degradation. Similar results were obtained in leaves of different *Allium* species (Stajner et al. 1998; Stajner and Varga, 2003; Stajner et al., 2006).

Relationship among the genotypes according to the antioxidative enzyme activities was shown as a dendrogram in Figure 1. The UPGMA dendrogram based on distance data of the activities of these enzymes grouped the genotypes into 4 putative clusters. Separation of the genotype, Yalova 12 as a group indicated that this genotype has a unique antioxidative enzyme activity compare to other genotypes. Similarly, genotype Banko separated in a different group probably due to its high CAT and low SPRX activities (Table 2). While Kantartopu, Aki and Alex were clustered together in a group, Kapidag and Kes-Valencia were clustered in another group.

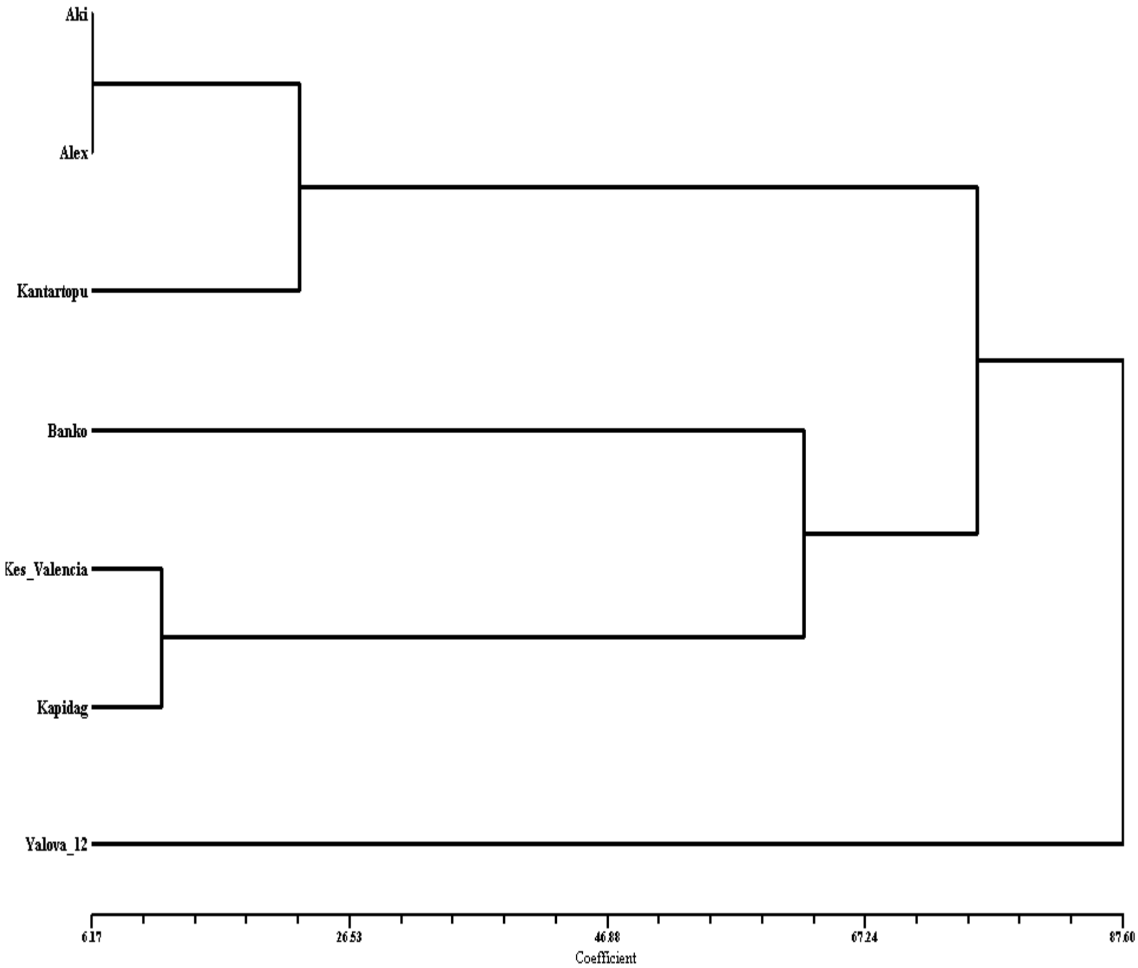

Figure 1. Unweighted pair-group method with arithmetic clustering (UPGMA) dendrogram based on data from antioxidative enzyme analysis of *Allium cepa* genotypes.

Table 1. Characteristics of *Allium cepa* genotypes and its cultivated area in Turkey.

Genotypes	**Origin**	**Cultivated Area**
Aki	Japan	Marmara, Aegean, Mediterrean
Alex	Dutch	Marmara, Aegean, Mediterrean
Banko	Dutch	Thrace, Marmara, Central Anatolia
Kes Valencia	Spain	Thrace, Marmara, Central Anatolia
Kapidag	Turkey	Kapidag
Kantartopu	Turkey	Karacabey, Thrace
Yalova 12	Turkey	Karacabey

Table 2. Antioxidant enzyme activities in bulbs of *Allium cepa* genotypes.

Genotypes	SPRX (u/mg protein)	CWPRX (u/mg protein)	CAT (nmol/mg protein)	APRX (µmol/mg protein)
Aki	13.47 c	1.73 ab	66.19 b	1.59 ab
Alex	16.62 c	4.67 a	54.63 b	1.13 ab
Banko	18.41 c	3.58 ab	203.62 a	1.87 ab
Kes-Valencia	134.29 b	3.82 ab	192.43 a	1.83 ab
Kapidag	148.13 b	1.83 ab	173.90 a	3.05 a
Kantartopu	32.06 c	3.20 ab	101.90 b	1.55 ab
Yalova 12	205.06 a	1.44 b	67.93 b	1.67 ab

Values not associated with the same letter are significantly different $P < 0.05$.

Isozymes have been used in first studies of interspecific relations. In this respect esterase isozyme patterns have been investigated in several *Allium* species (Klaas, 1998). While couples of species did group according to their respective sections, the affiliation to the subgenera could not be sustained by the data from this enzyme (Klaas, 1998). Similarly, we determined that while phenotypic markers are effective in differenciation of genotypes (Turhan et al., 2006). In the present study, the relationship among the onion genotypes according to the activities of antioxidative enzymes was determined. However, further researches related to other enzymes and molecular markers are needed to approve the results.

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International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

CLUSTERING OF SOME LOCAL COMMON BEAN (*PHASEOLUS VULGARIS* L.) GENOTYPES BASED ON CARBOHYDRATE METABOLISM

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Twenty local common bean (*Phaseolus vulgaris* L.) genotypes that are widely cultivated in Turkey were analyzed in this study. Nineteen of these genotypes were obtained from Aegean Agricultural Research Institute whereas one of them was obtained from Cukurova region in Turkey. The phenotypic characteristics of these genotypes were previously identified but their carbohydrate metabolism was evaluated in this study. In this respect, reducing sugar and sucrose analyses were done in the leaf samples of these genotypes. In addition, sucrose synthase, alkaline invertase and acid invertase activities related to the carbohydrate metabolism were determined to clarify the mechanism. Data indicated the significant differences among the genotypes in both soluble sugars and enzyme activities. In addition, the clustering analyzes suggested that "Kokez" is a unique genotype according to its carbohydrate metabolism.

Key Words: *Common bean, Phaseolus vulgaris, carbohydrate, sucrose synthase, acid invertase*

Introduction

Common bean (*Phaseolus vulgaris* L.) is an important economic food legume widely grown in many countries in the world. Due to the wide geographic diffusion of this crop, it is distributed in very different climatic environments all over the world. Suitable climatically conditions in Turkey have resulted in the rapid production of common bean almost all the region of Turkey. However, marketing problem from standard common bean cultivars is waiting to be solved. The traditional way of common bean cultivation in Turkey is based on small properties and a diversity of cultivars or genotypes allowed an efficient yield (Balkaya and Yanmaz, 1999). Thus some studies on the identification of the traditional genotypes are needed to be done.

Studies on the germplasm collection of common bean have been conducted in Turkey as well as many other countries (Maras et al. 2006) due to its economic importance. However, an efficient use of these genetic resources requires an understanding of the structure of variation in the available bean gemplasm collections. Different ways chosen to investigate common bean diversity such as isozyme and morphological (Rodiño et al 2001; Koksal et al 2005), biochemical and molecular (Alvarez et al 1998) and protein (Svetleva et al 2006) analyzes. On the other hand, the importance of carbohydrate metabolism to distinguish genotypes was also reported by early studies in maize (Creech 1965; Gonzales et al 1976).

In this respect, the objective of this study was to group some local common bean genotypes based on their reducing sugar content and some enzyme activities related to carbohydrates, in order to understand the relationship between carbohydrate metabolism and genotypic differences.

Material and Methods

Twenty common bean genotypes cultivated commonly in different regions were used in this study. Only one genotype was obtained from Cukurova Region whereas the rest of them were obtained from Aegean Agricultural Research Institute. Mature leaf samples of genotypes were collected from seedlings for soluble sugar and enzyme analyzes.

Determinations of Soluble Sugars

Sugars were extracted by suspending 100 mg of leaves in 5 ml 80 % (v/v) ethanol at 80 ^{0}C for 30 min, then collecting the ethanolic liquid. This procedure was repeated three times. The ethanolic solutions were combined and evaporated to dryness at 40^{0}C with the aid of continuous ventilation. The dried sugars were dissolved in 1 ml distilled water and kept frozen at -20 ^{0}C until determination. Sucrose concentrations were determined by the anthrone reagent method, as modified for the determination of non-reducing sugars (Van Handel, 1968). Reducing sugar concentrations were determined colorimetrically with dinitro-salicylic acid (Miller, 1959).

Enzyme Assays

Soluble (cytosolic) acid invertase activity in leaf tissue was determined according to Aloni et al. (1991). In short, tissue samples of approximately 300 mg were ground in 5 ml ice-cold grinding medium containing 25 mM HEPES buffer (N2-2-ethanesulphonic acid) pH 7.2, 5 mM $MgCl_2$, 2 mM DDT (DL-Dithiothreitol) and 3 mM DIDCA (diethyldithiocarbamic acid) as antioxidant. This mixture was centrifuged at 20 000 g for 20 min at 4 ^{0}C. Aliquots of 100 µl of the supernatant were incubated in 10 ml 0.1 N phosphate citrate buffer pH 5.0 and 20 mM sucrose. The incubation was carried out for 30 min at 37 ^{0}C and was terminated by addition of 1 ml dinitrosalicylic acid reagent. After boiling for 5 min. the resulting sugars were determined colorimetrically. Sucrose synthase and alkaline invertase activities was determined by the method developed for melon fruits by Schaffer et al. (1987) and optimised for pepper tissue by Aloni et al. (1996). Following extraction as described for acid invertase the mixture was dialysed overnight in order to remove the internal sugars. The enzymatic activity was determined as sucrose breakdown on aliquots of 200 µl incubated in incubation medium containing 0.1 M phosphate-citrate buffer pH 7.0, 200 mM sucrose and 5 mM UDP. After incubation at 37 ^{0}C for 30 min. the resulting fructose was determined by the dinitrosalicylic acid reaction. The data were expressed on fresh mass basis. Total soluble protein contents of the crude extracts were determined using Bradford (1976) assay.

Data analysis

The experiment was arranged with three replications. Data were tested by SPSS 13.0 for Windows program The data in distance matrix were used to perform a cluster analysis using the un-weighted pair-group method arithmetic average (UPGMA) (Sokal and Michener 1958) with the software NTSYS-pc (Numerical Taxonomy and Multivariate Analysis System version 1.80) (Rohlf 1993). A dendrogram indicating the relatedness calculated among the common bean genotypes was constructed with the TREE program of NTSYS-pc.

Results and Discussion

Sucrose contents of 20 common bean genotypes are shown in Figure 1. In general sucrose contents of the genotypes were between 10 and 15 mg/gFW with some exceptions. The highest sucrose contents were determined in genotypes TR 68795 (~25 mg/gFW) and Kokez (~18 mg/gFW), while genotypes TR64813 (~7 mg/gFW), TR 64950 (~8 mg/gFW) and TR 65066 (~9 mg/gFW) had the lowest sucrose contents.

Considering glucose contents of the genotypes (Fig. 2) it was generally between 1 and 2 mg/gFW with the highest and lowest exceptions. Genotypes TR 69024 (~2.8 mg/gFW), Kokez (~2.7 mg/gFW) and TR68795 (~2.5 mg/gFW) had the highest glucose contents, whereas genotypes TR 31540 and TR 64950 (~0.7 mg/gFW) had the lowest glucose contents.

The activities of sucrose synthase, alkaline invertase and acid invertase in the leaves of 20 common bean genotypes were shown in Figure 3. Regarding sucrose synthase activities of the genotypes (Fig. 3a), the highest activities were detected in genotypes TR 61598 and TR 37146 with the activities of 0.85 and 0.56 mg/g prot/min, respectively. The lowest sucrose synthase activities were determined in genotypes TR 64903, Kokez, TR 64813 and TR 68795 with the activity of around 0.15 mg/g prot./min. The rest of the genotypes had the activities of sucrose synthase between 0.20 and 0.40 mg/g prot/min.

Alkaline invertase activities of the genotypes shown in Figure 3b were generally between 0.50 and 1.0 mg/g prot/min. with the highest and the lowest exceptions. The highest alkaline invertase activity was determined in genotype TR 61598 (2.30 mg/g prot/min), whereas the lowest activities were detected in the genotypes, Kokez and TR 62021. Regarding acid invertase activities of the genotypes (Fig. 3c), Kokez showed the highest activity (~5 mg/g prot/h) as a contrast to the activities of sucrose synthase and alkaline invertase. The lowest activities were determined in genotypes TR 32952 and TR 64834 with the values of around 0.50 mg/g prot/h. The rest of the genotypes had the activities of acid invertase between 1.0 and 3.0 mg/g prot/h.

Regarding the dendrogram created using the data of soluble sugar contents (Figure 4), 5 putative groups were identified in the dendrogram. Since genotypes Kokez and TR 68795 had the highest soluble sugar contents (Figure 1 and 2), these genotypes separated from the other groups. On the other hand, there were not sharp differences among the soluble sugar contents of the other genotypes, some connections were seen among other groups of genotypes in the dendrogram. In addition, genotypes TR 32952 and TR 61598 showed the closest relationship having the similar contents of soluble sugar.

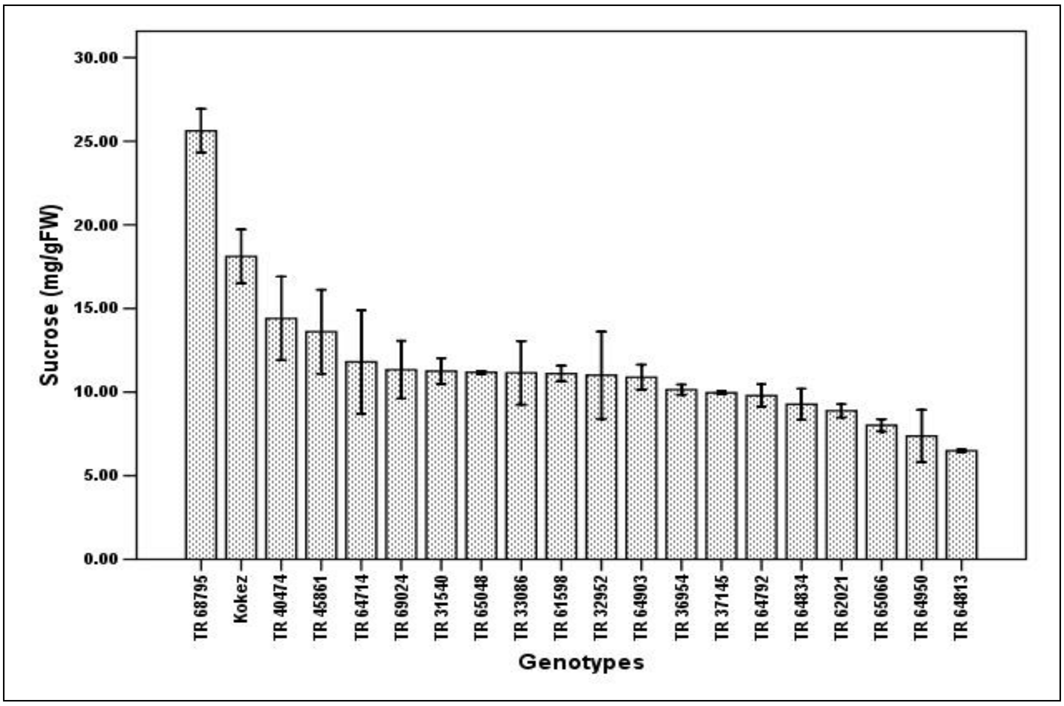

Figure 1. Sucrose contents of 20 common bean genotypes. Values indicate average ± SE of three replications.

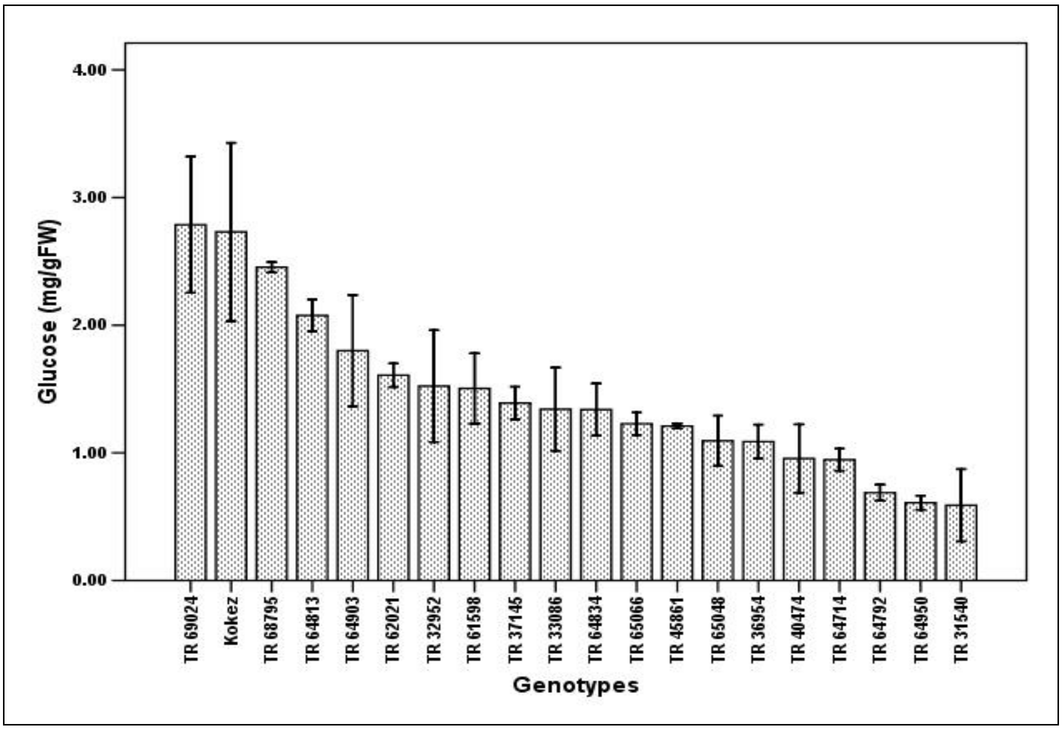

Figure 2. Glucose contents of 20 common bean genotypes. Values indicate average ± SE of three replications.

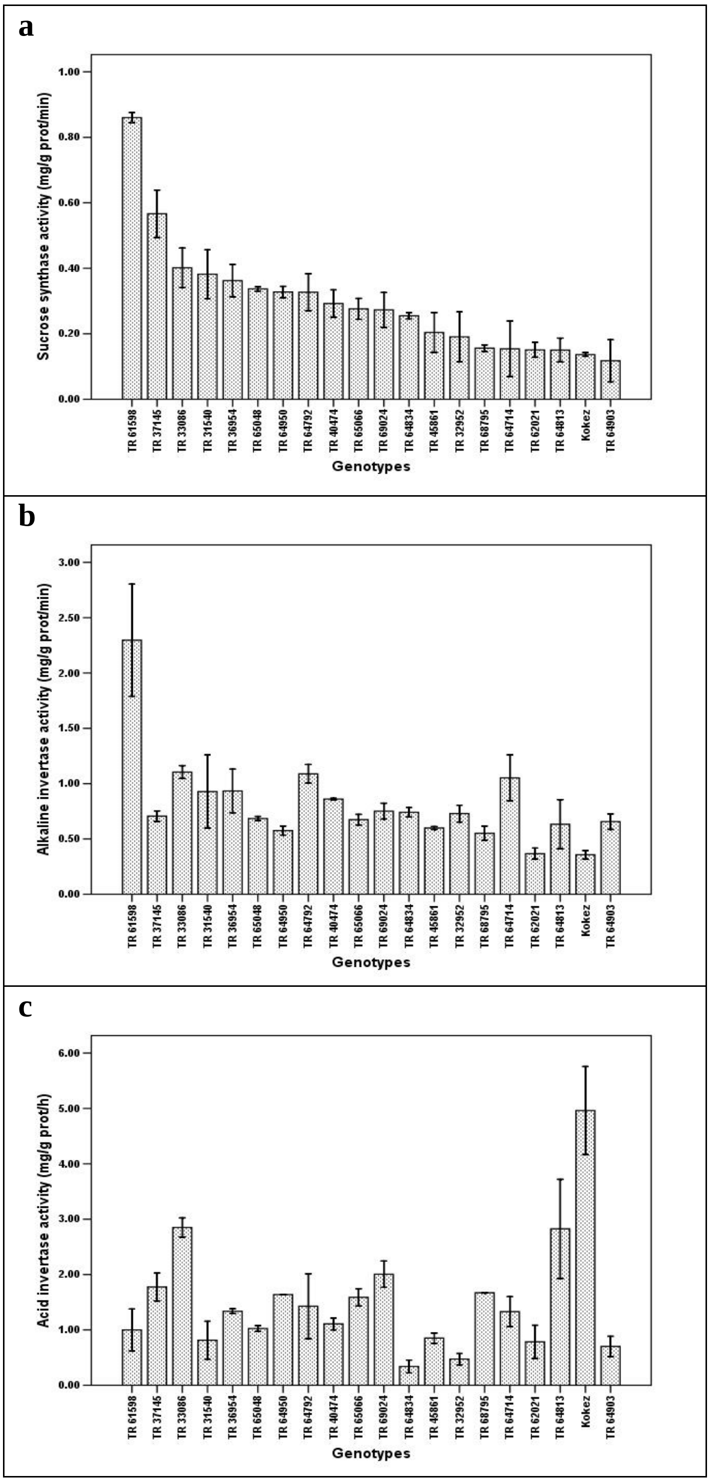

Figure 3. Enzyme activitiy of 20 common bean genotypes. a. Sucose synthase activity b. Alkaline invertase activity c. Acid invertase activity. Values indicate average ± SE of three replications.

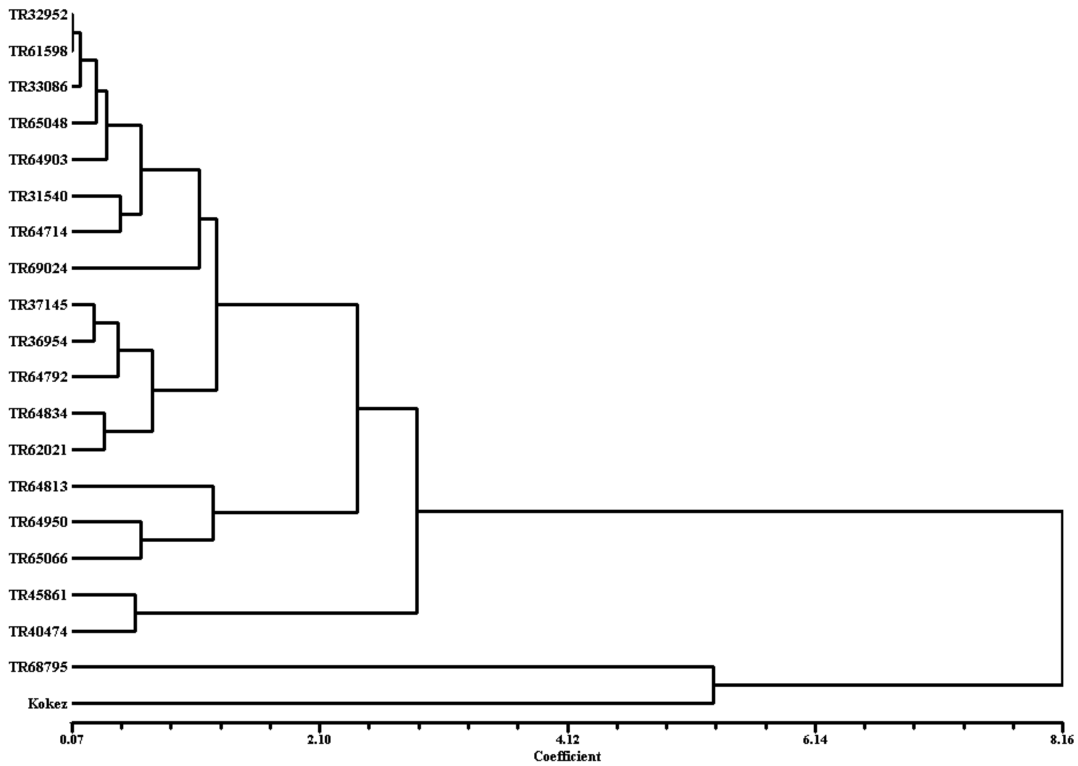

Figure 4. UPGMA dendrogram of common bean genotypes based on reducing sugars.

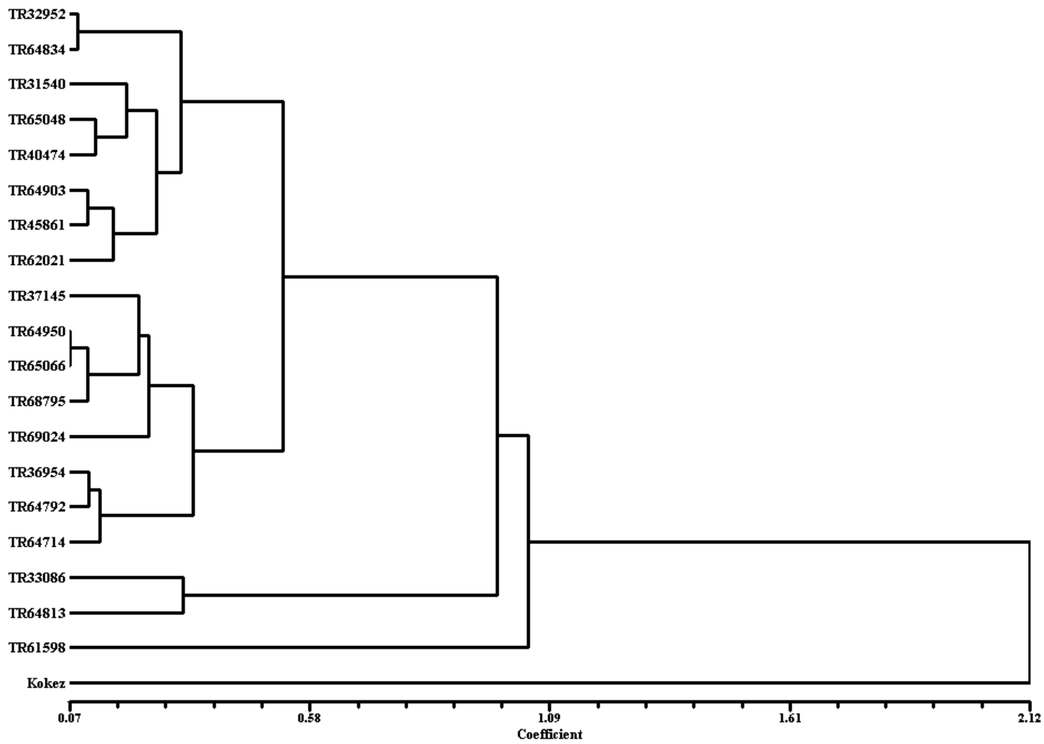

Figure 5. UPGMA dendrogram of common bean genotypes based on enzyme activities.

Relationship among the genotypes according to the total enzyme activities was shown as a dendrogram in Figure 5. The distance data of the total enzyme activity grouped the genotypes in 5 putative clusters. Separation of genotype Kokez as a group indicated that its total enzyme activity is different from other genotypes (Figure 3). Unlike other genotypes only Kokez is traditionally cultivated in Cukurova area. Similarly, genotype TR 61598 separated in a different group having the high enzyme activities (Figure 3). The rest of the genotypes showed relatively similar relationships, even though they separated into different putative groups. Only genotypes, TR 64950 and TR 65066 were seen to have almost same total enzyme activity.

According to Zimmerman (1960) the main transport material in higher plants is sucrose, the first free sugar after photosynthesis. There is evidence that sucrose is the main glucose donor in the formation of polysaccharides. The effects of specific mutations on qualitative and quantitative changes in carbohydrates in maize endosperm were investigated to understand the mechanism of genetic control of polysaccharide and starch synthesis (Creech, 1965). It was reported the significant differences in all carbohydrates between maize genotypes. In addition it was indicated that the significant increase in sugars and sugar retention of certain genotypes suggests possible use in sweet corn quality improvement. Similarly reserve carbohydrates were determined on developing endosperm of new lines of sugary maize by Gonzales et al (1976). Authors reported some genotypic differences based on the content of soluble sugars and some enzyme activities, which is parallel to our results. As a conclusion our results support the conclusion of earlier authors that sucrose synthase and acid invertase are responsible for sucrose biosynthesis in common bean genotypes related to their origin. In addition, the carbohydrate analysis reveals that among all the genotypes tested Kokez is a typical genotype in its carbohydrate metabolizim. It is mostly related to either effects of other enzymes or origin of the Kokez. Further researches related to other enzymes are needed to approve the results.

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THE NEED FOR CONSERVATION OF AFROMONTANE RAINFORESTS WITH THE OCCURRENCE OF WILD *COFFEA ARABICA* POPULATIONS IN ETHIOPIA

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Ethiopian Afromontane rainforests support a high biological diversity. In particular the Afromontane rainforests with the occurrence of wild coffee populations support over 650 plant species (about 11 % of total flora of the country) and many animal species. It is also the only forest ecosystem with wild *Coffea arabica* populations globally. This forest is also part of the "Eastern Afromontane Hotspot," which is one of the globally important regions for biodiversity conservation. Despite all these importance, the Afromontane rainforests of Ethiopia is highly threatened due to the expansion of agriculture and commercial plantations, uncontrolled exploitation of forest resources and new settlements. The diversity and gene pools of wild coffee populations are also endangered by the introduction of improved coffee cultivators and habitat loss. Conservation of Afromontane rainforests and the associated biodiversity apparently need urgent action. Conservation of Afromontane rainforests with the occurrence of wild Arabica coffee populations should therefore be seen as a complementary strategy for economic growth and development. Establishing management schemes that support sustainable use of non-timber forest products such as honey, spices and coffee should be supported in the region.

Key words: *biodiversity, genetic diversity, habitat loss, threats, wild coffee*

Introduction

Ethiopia, located in the Horn of Africa, is a country with greatly varying landscape ranging from high and rugged mountains, flat topped plateaus, deep gorges and incised rivers to valleys and rolling plains. The Great Rift Valley runs from northeast to southwest and divides the country into the western and southeastern highlands. The highlands give way to extensive semi-arid lowlands to the east, south and west of the country. These wide variations in topography and climatic conditions have contributed to a high biological diversity and/or variety of life forms. This has made Ethiopia one of the 12 Vavilov centres of crop diversity in the world. The country has served as source of propagules for different crops cultivated in many parts of the world (Teketay et al. 1998). *Coffea arabica* is among, with its notably high genetic diversity within the wild populations.

Coffea arabica is native to the Afromontane rainforests of Ethiopia and geographically isolated from all other coffee species. Several studies have indicated a high genetic diversity of wild Arabica coffee in these rainforests (Meyer 1965, 1968; Gebreegziabher 1990; Teketay et al. 1998; Teketay 1999; Woldemariam 2003). The existence of such a high genetic diversity is of great national and global economic importance, as it can provide a wide genetic pool on which sustained development of high yielding and stable varieties of coffee can be maintained. However, this great wealth of genetic resources and the associated habitats are disappearing owing to the continuous degradation and loss of the Afromontane rainforests. The causes of depletion are many and varied, but the main reasons are over-exploitation of forest products, conversion of forests to agricultural and grazing lands, expansion of commercial plantations (e.g., tea and coffee) in the previously forested lands (EFAP 1994; McCann 1995; Reusing 1998; Senbeta 2006; Senbeta and Denich 2006).

The ever-increasing demands for forest products and forestland together with the increase in the human population is putting intolerable pressure on the remnant forest fragments. There is a great concern that the current widespread exploitation of the rainforests may lead to the complete loss of these forests together with the unique and valuable genetic resources of wild Arabica coffee. This paper addresses the causes of Afromontane rainforest loss and the implications for the genetic resources of wild coffee. Finally, recommendations for conservation measures to save the remnant Afromontane rainforests, with particular emphasis on the wild populations of *C. arabica*, are forwarded.

Ecology of Afromontane rainforests

Volcanic activities from the Miocene to the present are responsible for the diverse relief in Eastern Africa. These activities have created many mountains ranges across Africa, stretching from Sierra Leone eastwards to the Red Sea Hills of Sudan and the Ahl Mescat Hills of Somalia and southwards in Eastern Africa to the Table Mountain in the Cape Peninsula in South Africa. From this montane belt causes the name “Afromontane Region” which is based on floristic relationships (White 1978, 1983). In addition to the large number of species common to most of these mountains, the Afromontane vegetation also varies in floristic composition, physiognomy and ecology and shows varying relationships with other phytogeographic regions (Coetzee 1978). This region has been recently recognized as the “Eastern Afromontane Hotspot,” which is one of the 34 regions globally important for biodiversity conservation (CI 2005).

The Eastern Afromontane hotspot encompasses several widely scattered, but biogeographically similar mountain ranges in eastern Africa. According to the CI (2005), the primary threat to the biodiversity of this region is habitat loss due to conversion of land for agriculture, plantations and commercial estates, as well as logging.

The Ethiopian highlands form the largest mountain complex in Africa and comprise over 50% of the African land area covered by Afromontane vegetation (Bekele 1994). Afromontane forests are the major natural vegetation in these highlands (von Beritenbach 1963) and occur between 1200 (1500) and 3300 m a.s.l. Afromontane rainforests is one of the Afromontane forest types. It occurs in the southwest of the Northwestern Highlands and in the southwest of the Southeastern Highlands of Ethiopia, at altitudes between 1000 and 2600 m a.s.l. Annual temperatures range from 15-20^{0}C and annual rainfall from 1000 to 2500 mm. Soils are generally well developed and mature and, in the higher-rainfall regions, may be leached.

A segment of Afromontane rainforest has long been recognized as the center of origin and diversity of wild *Coffea arabica.* This portion of Afromontane rainforests with the occurrence of wild coffee populations supports over 650 vascular plant species (which is about 11% of the total flora of the country). The tree canopies of this forest characteristically are made up of a mixture of *Podocarpus* and broad-leaved species. Noteworthy is that *Podocarpus* is predominant in the southeast and gradually becomes rare towards the southwest, while *Pouteria adolfi-friedericii* becomes more prominent there. Trees can be up to 30 m or more tall and distinct strata of emergent trees, canopy trees and shrub and herb layers are present. The characteristic canopy species include *Croton macrostachyus*, *Ilex mitis*, *Olea welwitschii*, *Podocarpus falcatus*, *Pouteria adolfi-friederici* and *Schefflera abyssinica*. Natural coffee is one of the characteristic species in the understorey. Shrubs and lianas are very common and include *Landolphia buchananii, Jasminium abyssinicum, Hippocratea goetzei, Oxyanthus speciosus, Oncinotis tenuiloba, Tiliacora troupinii* and *Hippocratea africana.* Epiphytes are very common and include *Peperomia tetraphylla*, *Asplenium sandersonii*, *Loxogramme lanceolata*, *Aerangis luteoalba*, *Arthropteris monocarpa* and *Asplenium aethiopicum*.

Distribution and ecology of wild coffee

Arabica coffee is the only coffee species that occurs naturally in Ethiopia. Outside Ethiopia, small populations of wild *C. arabica* were reported to occur in southeast Sudan and northern Kenya (Monaco 1968; Friis 1992; Woldu 1999). Coffee follows one of the typical patterns of distribution of polyploids, i.e. peripheral expansion outside the range of distribution of the other diploid species of the genus (Monaco 1968). Self-compatibility could provide the opportunity for quick occupation of new regions away from the original range of distribution. Although the distribution of wild coffee in the rainforest region is complicated by the long history of settlements and agricultural practices, there are still vast forest areas with a high abundance of wild coffee populations. The majority of these forests are located in the southwest highlands, and only one forest patch with wild coffee population is situated in the southeast highlands of Ethiopia (Figure 1).

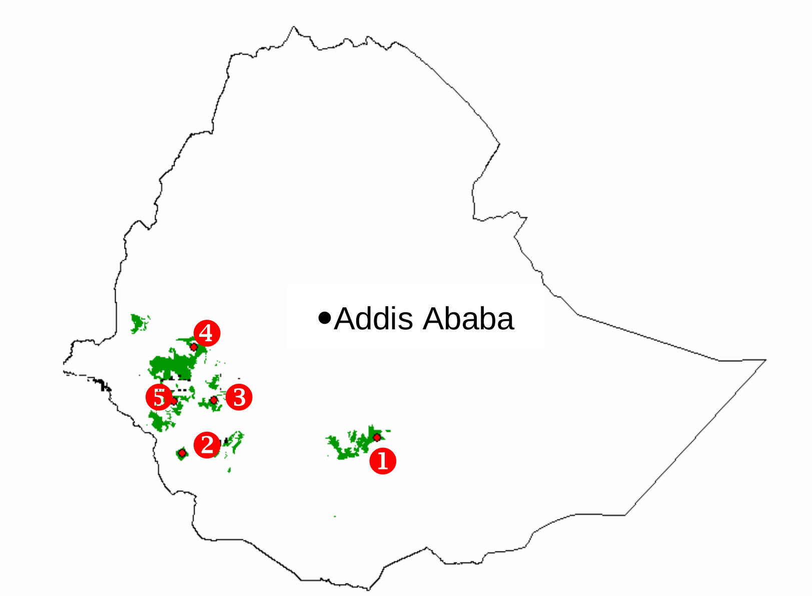


Figure 1 Map of Ethiopia and forest fragments with wild Arabica coffee populations (❶-Harenna; ❷-Maji; ❸-Bonga; ❹-Yayu and ❺-Berhane-Kontir).

These sites are the largest tracts of forest with wild coffee populations. Coffee grows and regenerates spontaneously as an understory plant in these rainforests between 1000 and 2100 m a.s.l. (Senbeta 2006). It grows well with an annual rainfall between 1000 and 2400 mm and monthly temperatures ranging from 15 to 20^0C (NMSA 1996); and on wide ranges of soil types. The soils are acidic to slightly acidic with low available Phosphorus (Purseglove 1968; Dubale and Shimber 2000). Although wild coffee is distributed over wider geographical ranges, its local distribution is sporadic and clumps. The locally patchy distribution of wild coffee might be due to habitat patchiness, substrate/geology, dispersal limitation, competition and degree of human interference.

Genetic diversity of Coffee

Of the genus *Coffea*, *C. arabica* is the most important economic species in the world because of its superior quality and because of the vast area coverage in Central and South America. It is the only tetraploid species of the genus (2n = 44), whereas all other species are diploid (2n = 22). A number of researchers (e.g., Monaco 1968; Tesfaye et al. 2005) have published evidences suggesting that the tetraploid Arabica coffee may be related to the wild diploid species *Coffee eugenioides*. A large genetic diversity is believed to exist in the wild Arabica populations in the rainforests of Ethiopia (Gebreegziabher 1990; Woldemariam et al. 2002; Tesfaye et al. 2005). In addition, it is assumed that a wide range of variability of genetic material exists among the different coffee production systems in Ethiopia (Monaco 1968; Shiferaw et al. 1989; Woldemariam 2003).

Economy of coffee

Ethiopia's economy is predominately dependent on agriculture. This is the major source of employment, revenue, export earnings and livelihoods. The agriculture-based economy is highly dependent on coffee production, as it contributes more than 67% to the total exchange earnings and over 6% to the gross national product (Wondimu 1998). Arabica coffee is one of the most valuable export commodities. Despite its economic importance, however, smallholder farmers dominate the production of coffee. It can be noted that around 25% of the Ethiopian population is engaged in coffee production, processing and marketing services, and derives their livelihood from the coffee industry. In addition, coffee is of enormous cultural, social and economic importance to the nation. Coffee production from wild coffee populations contributes around 10-15% of total coffee production in the country.

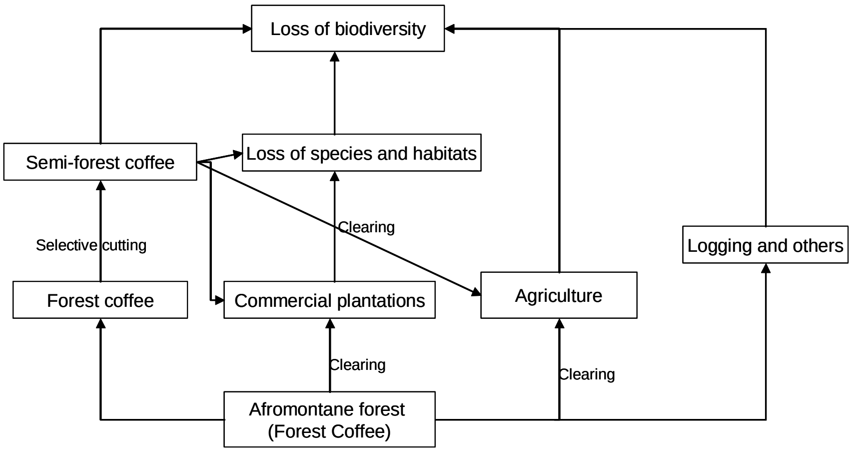
Threats to the Afromontane rainforests and wild coffee populations

Human-induced forest losses are still the major threats to the forest resources of Ethiopia. Originally, about 34 % of the country was covered by dense natural forest (Gamachu 1988), but this figure declined to about 4.4 % by 1960 (von Breitenbach 1962), to 3 % in the 1980s (Anon. 1988) and to ca. 2.7 % by 1989 (Rogers 1992). The main driving forces behind deforestation are the expansion of agricultural land, uncontrolled exploitation of forest resources, overgrazing, seasonal fire, non-forestry investment, mining and establishment of new settlements in the forested lands. Currently, Afromontane rainforest with wild coffee populations is the major remnant forest in the country.

Like that of other forests, these rainforests with the occurrence of wild coffee populations are under threat, and the wild coffee populations are at a greater risk than ever before (Figure 2). First, the occurrence of wild coffee in the rainforests is an attraction to new settlers. Second, there are a number of non-timber forest products that encourage people to settle in and around the forest who exploit these products. Third, the change in land management practices with the arrival of new settlers has enhanced degradation of the forest. The indigenous smallholder farmers open up farm plots through selective felling, light burning, no/less tillage, and fallow periods. In contrast, immigrant farmers clear the forest, burn it and employ soil tillage (Woldemariam et al. 2002). Finally, the continuous expansion of tea and coffee plantations is an additional threat to the forests. As a result, natural systems are transformed into artificial systems.

Figure 2 illustrates the various mechanisms of forest threats in the region. Concerning the major threats, detail explanation is given in the following sections.

Figure 2. Loss of habitat and biodiversity including wild *Coffea arabica* gene pools in the Afromontane rainforests of Ethiopia.



Commercial plantations

In southwest Ethiopia, since the 1970s over 30,000 ha of intact Afromontane rainforests with wild coffee populations have been cleared and converted into tea and coffee plantations (Table 1). It is to be noted that the practice of conversion is continuing. If the planned rubber plantation establishment is accomplished, this will be a great devastation to the Afromontane rainforests and their biodiversity.

Table 1. Total forest area converted to commercial plantations in southwest Afromontane rainforests of Ethiopia since the 1970s.

Type of plantation	Area (ha)	Year of establishment	Ownership
Tepi Coffee Plantation	7000	1970s	State
Wush-Wush Tea Plantation	3000	1980s	Private
East Africa–PLC Tea plantation	3000	1990s	Private
Lemu Coffee Plantation	7000	1980s	State
Bebeka Coffee Plantation	6000	1980s	State
Ethio-Coffee Plantation	3000	1990s	Private
Gumoro Tea Plantation	3000	1980s	Private
Rubber Plantation	25000	Planned	State?
Green Coffee	2000	2000/01	private
Total	59000		

(Sources: CTA, no date; Woldemariam et al. 2002; Tegene 2003).

Fragmentation

Logan (1946) and Vernede (1955) reported the existence of a vast block of rainforests in southwest Ethiopia. After 50-60 years, only fragmented forest patches exist in the region. Many of these fragments are under further fragmentation as they are close to the agricultural frontiers. Settlements, plantations and expansion of agriculture are the major causes of forest fragmentation. Some of these forest fragments have already been recognized as the "National Forest Priority Areas" for conservation. However, this has not yet materialized due to the financial constraints. In order to maintain and prolong the biodiversity of the Afromontane rainforests with their wild coffee populations the ongoing forest fragmentation should be minimized.

Settlement

In the past four decades, at least three settlement campaigns have caused a widespread change in land use cover across the country. First, land tenure/settlement policies changed in 1975 because of the proclamation to provide for the nationalization of rural land after the change of government in 1974. With the new land reforms, all land was nationalized and peasant associations created that determined land allocation among peasant members. This proclamation caused migrants to flood from the northern highlands to the western lowlands and highlands, because the change in land ownership allowed peasants access to land for the first time (McCann 1995). Again, because of the 1984/85 drought, the government developed a resettlement policy that allows the movement of people from drought-prone areas to areas not affected by drought. Following this, in 1985/86, the Ethiopian Ministry of Planning announced a new settlement policy, i.e., villagization. The purpose was to move dispersed homesteads into compact settlements so that people would have better access to health clinics, clean water and electricity (McCann 1995). All these policies and changes were spontaneous and mostly not well planned. As a result, the consequences for the forest resources and especially of the Afromontane rainforests with wild coffee were very significant. Consequently, many people migrated and settled in these forests and converted the forest into non-forestland. This trend is continuing.

Logging

Commercial logging is one of the major causes of forest destruction in Ethiopia. A good example of logging effects can be observed in the southwestern Ethiopia (e.g., around Tepi town), where extensive logging has destroyed a large tract of forest with wild coffee. In addition to logging, the roads established for logging enables landless people to enter the forest. In many parts of the southwest rainforest, land being cleared by peasant farmers is land that had been logged by saw millers.

Threats to coffee

In addition to the above-mentioned threats, agricultural practices are changing rapidly, and cultivation of improved varieties of crops is becoming more common, with new plant varieties replacing the old and traditional ones. Usually, the farmers replace the indigenous coffee cultivars by new cultivars for economic reasons, as most of the native cultivars are low yielding. This is threatening the genetic pools of wild coffee and also leading to habitat loss.

Challenges of *in-situ* conservation

Habitat degradation and loss are currently the major environmental problems in Ethiopia. Forest and forestlands are disappearing owing to human population pressure and the resulting demand for forest products and forestlands (Kuru 1988; McCann 1995; Reusing 1998; Reid et al. 2000). Unprecedented population growth and non-sustainable use of the forest genetic resources are not only degrading the land and its resources, but also decimating a wide variety of species and their habitats. At the same time, a number of social and economic problems are challenging *in-situ* conservation of rainforest genetic resources including wild coffee. The widespread poverty among the rural communities living in and around the forest is a great problem. People need the forest and forestland for food production; and alternative livelihoods hardly exist in the areas. Furthermore, the absence of a land use policy has increased the misuse of the forest and forestlands. In addition, the weak economic performance of the country and lack of finances for conservation are the major bottlenecks delaying *in-situ* conservation efforts.

Options for conservation

The Afromontane rainforests of Ethiopia are important sources of timber and non-timber forest products and this warrants the desire for conservation. They provide essential and renewable sources of fruits, medicines, spices, coffee, animal products, building materials and other materials to the rural communities (Senbeta 2004; Senbeta et al. 2005; Senbeta 2006; Senbeta and Denich 2006). These resources are vital to the economic, social and environmental development of the nation and to conservation of the coffee genetic resources. Exploitation and use of different forest products should complement to the future conservation and sustainable use of the forests with wild coffee populations. A balance must be achieved between the production of the goods and services needed to improve people’s material well-being and the protection of the forests and soils and their wealth of biological diversity so that the welfare of future generations is assured.

Afromontane rainforest conservation should rely on sustainable use of plant genetic resources within a system that provides food, income, employment opportunities and a high quality environment. More importantly, agricultural intensification could, however, be an alternative option to minimize human influences on forestlands. Intensification of the agricultural system will improve the productivity of the land and thereby improve the livelihood of the rural communities. Consequently, this will reduce habitat loss and threat to forest genetic resources. Development of sustainable agriculture to satisfy changing human and development needs, while maintaining the natural resource base and avoiding environmental degradation, will definitely reduce plant genetic resource loss.

Conclusion and recommendations

In Ethiopia, forest loss due to habitat destruction, over-harvesting, and agricultural expansion is increasing at an alarming rate and threatening the forest genetic resources and their services. Wild coffee gene pools are particularly under threat owing to habitat loss and fragmentation. Conservation of forest genetic resources including wild coffee populations will only be possible if there is sustainable utilization of the forest resources. Therefore, the following recommendations are made for effective conservation and sustainable use of the Afromontane rainforests with wild coffee populations:

1. The critical issue concerning conservation of Afromontane rainforests with wild coffee populations is the development of alternative livelihoods for the local communities dependent on the forest and forest products. Poverty is the major problem in the region and hence development strategies that address both poverty alleviation and sustainable utilization of the forest are required. The local communities can be supported through enhancing the market situation of coffee or other non-timber forest products by giving them fair prices for their harvest so that the farmers' income will be improved. Sustainable use of non-timber forest products such as honey, spices and coffee should be supported and encouraged by the government and NGOs.

2. The country should develop a land-use policy that promotes land uses according to suitability. Any rural development strategy should gear toward multifaceted approaches, which consider rural development based on the carrying capacity of the resource bases.

3. At least representative portions of the Afromontane rainforest areas should be kept aside for biodiversity conservation. In particular, special attention should be paid to forests with wild coffee populations in order to maintain the diversity of wild coffee genetic materials.

Acknowledgments
The first author is grateful to the Centre for Development Research (ZEF), University of Bonn and the German Federal Ministry for Education and Research (BMBF) for financing the study. We thank Mr. Assefa Tegene for providing area coverage of tea and coffee plantations projects in Ethiopia.

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DOCUMENTING AND COMPARING PLANT SPECIES DIVERSITY BY USING NUMERICAL AND PARAMETRIC METHODS IN KHAJE KALAT, NE IRAN

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Study of floristic composition and species diversity is crucial for conservation, managing ecosystems and maintaining biodiversity. Therefore a study was carried out in Pistacia forest of Khaje-Kalat in the North-East of Iran, located between geographical position of 36º 35´ N and 60º 30´ E with the mean annual precipitation and temperature of about 255 mm and 18ºC, respectively. The aim was to examine and document several aspects of numerical diversity such as species richness, species diversity and evenness and to compare diversity in different aspects of the area by using numerical and parametric methods. About 193 quadrats of 4 m^2 were located according to the nature of vegetation. Species composition and their abundance were recorded. The result of field investigation was collecting and identifying of the total 225 plant species belonging to 154 genera and 37 families. The collected data were subjected to analyses by diversity packages. Numerical indices were calculated and documented for monitoring purposes. The results of diversity in main slope aspects (N, S, E, W) showed a higher species richness and species diversity indices in the north aspect than in the others but it is not true with evenness indices. Diversity comparing by using rank-abundance plot as well as diversity ordering of Hill, Renyi and Patil & Taillie confirmed high species diversity in the north yet the result of ANOVA showed no significant differences in the four aspects. The result of diversity based on the models revealed that the area, in general, the south and the west aspects follow lognormal distribution, north aspect follows logarithmic whereas the east follows both lognormal and logarithmic distribution.

Keywords: *Species diversity, Numerical indices, Parametric methods, Khaje Kalat, Iran*

Introduction

There are different definitions for the word "Biological Diversity" or Biodiversity. The Convention on Biological Diversity define it as variability among living organisms from all sources including, *inter alia*, terrestrial and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (Johnson 1993; in Gaston 1997). Study of biodiversity has been widely improved to have successful management and logical exploitation of natural sesources. Species diversity was the best known subject because it was usually the easiest to measure in the field (Smith, 1996). It consists of the number (species richness) and relative abundance of each species (evenness), and is usually estimated in three levels of alpha, beta and gamma diversity. Changes of species number, species composition as well as the relative abundance and dominance of the species have been especially useful as indicator variables in monitoring programs to assess the environmental quality. Several aspects of diversity such as species richness, species diversity, evenness, diversity and related models, diversity based on the rank/abundance plots as well as methods of diversity ordering can be considered in species diversity investigations.

These include broad comparisons of community diversity (e.g. Auclair and Goff 1971, Glenn-Lewin 1977, Peet 1978), experimental studies of the effect of individual environmental factors such as grazing and fire (Colins and Barber 1985), theoretical and experimental studies of disturbance (e.g. Peet et al. 1983, Huston 1979). There is a long history of these studies ranging from the classical description of vegetation towards the more sophisticated relationship to the diversity (Huston 1979) and the stability (Noy-Meir et al. 1989, May 1977). In parallel, some ecological hypotheses such as intermediate disturbance hypothesis was proposed by Connel (1978) that stress the highest diversity is maintained at the intermediate levels of disturbance. It is well documented that under extreme environmental conditions the diversity of communities decreases (e.g. Fowler and Mooney 1990, Dumont et al. 1990, Rabatin and Stinner 1989). As Magurran (1988) stated species diversity measures can be divided into three categories. First are the species richness indices. These indices are essentially a measure of the number of species in a defined sampling unit. Although the species richness indices give an instant comprehensive measure of communities, but an important aspect of the numerical structure of communities is completely ignored when the composition of the community is described simply in terms of the number of species present. It misses the information that some species are rare and others common. Therefore, it seems to be important to couple the richness indices with the second group of indices which are based on the proportional abundances of species that consider both abundance (or biomass) parameters and species richness. A special method for the comparison of communities have been developed (Patil and Taillie 1979). It is well-known that different indices may inconsistently rank a given pair of communities (Hurlbert 1971) i.e. two communities are ranked in the opposite sense by the Shannon (H) and Simpson (D) indices. There are many reasons for this miss-ordering. Patil & Taillie (1979) emphasized that such inconsistencies are inevitable whenever one attempts to reduce a multidimensional concept like a community to a single number. A more straightforward illumination of the problem is related to the different sensitivities of diversity indices. A possible solution is to use parametric families of diversity indices instead of a numerical-valued diversity index. When we use a one-parameter family {$D\alpha$: (α real} of diversity indices then the family may be portrayed graphically by plotting diversities (D) against the scale parameter. This curve is frequently mentioned as the diversity profile of the community (Patil & Taillie, 1979, 1982). Using diversity profiles we can define the diversity ordering of communities (Tóthmérész 1993). Thirdly, there are species abundance models which describe the distribution of the species abundances. The species abundance models range from those which represent situations where there is high evenness to those which characterize cases where the abundances of species are very unequal. The diversity of a community may therefore be described by referring to the models which provides the closest fit to the observed pattern of the species abundance. Although species abundance data will frequently be described by one or more of a family of distributions (Pielou 1975), diversity is usually examined in relation to the four main models (May 1975). These are the geometric series, where a few species are dominant with the remainder fairly uncommon, the logarithmic series and the log normal where species of intermediate abundance become more common and indicate large, mature and varied natural communities and finally McArthur's broken stick model where species are as equally abundant as ever observed in the real world. Therefore a study was carried out in Pistacia forest of Khaje-Kalat in the North-East of Iran to examine and document several aspects of numerical diversity such as species richness, species diversity and evenness and to compare diversity of the area by using numerical and parametric methods.

Materials and Methods

This research was carried out in Pistacia forest of Khaje-Kalat in the North-East of Iran, located between geographical position of 36º 35´ N and 60º 30´ E with the mean annual precipitation and temperature of about 255 mm and 18ºC, respectively. Soil is classified in the orders of Entisols and Aridisols. The climate, based on De Martonne, is classified as dry. The dominant species is *Pistacia vera* with some understory species such as *Artemisia diffusa, Poa bolbusa, Amygdalus spinosissima, Ferula yommosa, Bunium persicum, Ephedra foliat, Zygophyllum atripelicoides,* etc. About 193 quadrats of 4 m^2 were located according to the nature of vegetation. Species composition and their abundance as well as some environmental variables such as slope and aspects were recorded in each quadrats. The geographical coordinates of the quadrats were also obtained by GPS.
Several aspects of diversity including species richness, species diversity, equitability of the whole area as well as diversity profiles and diversity based on the models (geometric-series, logarithmic-series, log-normal and broken-stick model) related to the different slope aspects were considered. Diversity was also ordered based on the families of diversity parameter including those of Patil and Taillie, Hill and Rényi. The abundance data were used in the analyses.

Results and Discussion

The result of field investigation was collecting and identifying of the total 225 plant species belonging to 154 genera and 37 families. Results of species richness of the whole area based on Menhinick and Margalef are displayed in Table 1. Number of species in the north, south, east and west aspects are 95, 52, 41 and 58, respectively (Table 2). The species richness indices in the north aspect are more than those in the others. Species richness, while giving a valuable insight into species diversity, can mask shifts in dominance/evenness relations. It would therefore appear important to couple an estimate of species richness with a measure of either dominance or evenness wherever possible. Table 3 gives diversity indices that take both abundances and species richness into consideration. The results for the whole area may be documented for monitoring vegetation of the area yet comparison of diversity in four aspects shows that most of indices are high in the north than the others but it is not the case for evenness. About 30 species such as *Acanthophyllum glandulosum, Acroptilon repens, Alcea tiliacea, Bromus sericeous, Astragalus turbinatus, Centaurea balsamita* etc., were just presented in the north aspect. This can be important in reducing the evenness. ANOVA showed no significant differences in diversity of the four aspects. In order to get a more clear-cut notion of the species abundance distribution of the sites, fitting of different distribution models were checked. According to Table 4, that shows a summary of the goodness of fit test, revealed that the whole area, in general, the south and the west aspects follow lognormal distribution, north aspect follows logarithmic whereas the east follows both lognormal and logarithmic distribution. In other word, a shift from being lognormal to logarithmic model was observed in the east aspect. Geometric model is clearly typical for extreme environments with high species dominance where one environmental factor, either stress or a disturbance factor dominates; and the log-normal distribution would refer to species-rich situation (Magurran 1988).

Table 1. Species richness of the area.

	Species Richness	
	Margalef Index	Menhinick Index
Study area	14.56	1.43

Table 2. Species richness of the area in the main four aspects.

	Species Richness			
	No. of Species	**Rarefaction**	**Margalef**	**Menhinick**
North	95	69.42	11.40	1.54
South	52	46.53	6.90	1.34
East	41	36.39	5.80	1.34
West	58	49.24	7.30	1.19

Table 3. Values calculated based on different indices of diversity and Pielou index of evenness for the whole area and the main four aspects.

	DIVERSITY					**EVENNESS**
	Shannon	**Brillouin**	**Simpson**	**McIntosh**	**Berger-parker**	**Pielou**
area	3.44	3.40	0.93	0.74	0.91	0.70
North	3.38	3.33	0.93	0.75	0.19	0.74
South	2.99	2.92	0.92	0.74	0.15	0.75
East	2.84	2.76	0.89	0.70	0.24	0.76
West	2.94	2.89	0.90	0.71	0.20	0.72

Table 4. Summarizing table of significance of fitting the models at the level of P=5%.

Four main related models of diversity

	Geometric	**Broken-stick**	**Logarithmic**	**Lognormal**
area	-	-	-	**1**
North	-	-	**1**	
South	-	-		**1**
East	-	-	**2**	**1**
West	-	-		**1**

*The numbers in the table indicate the significance order.

Diversity of the sites were also compared by using diversity profiles (Patil and Taillie 1979, Tóthmérész 1993). Figure 1 shows the results of diversity ordering for the four main aspects. As in the figure they have well ordered based on Patil and Taillie's diversity, but in the case of Hill's and Rényi's diversities, the north, south and east aspects are not comparable. However it is obvious that the diversity profile of the north lie above the diversity profile of the others. So, Diversity in the north aspect is higher than the others but not significant.

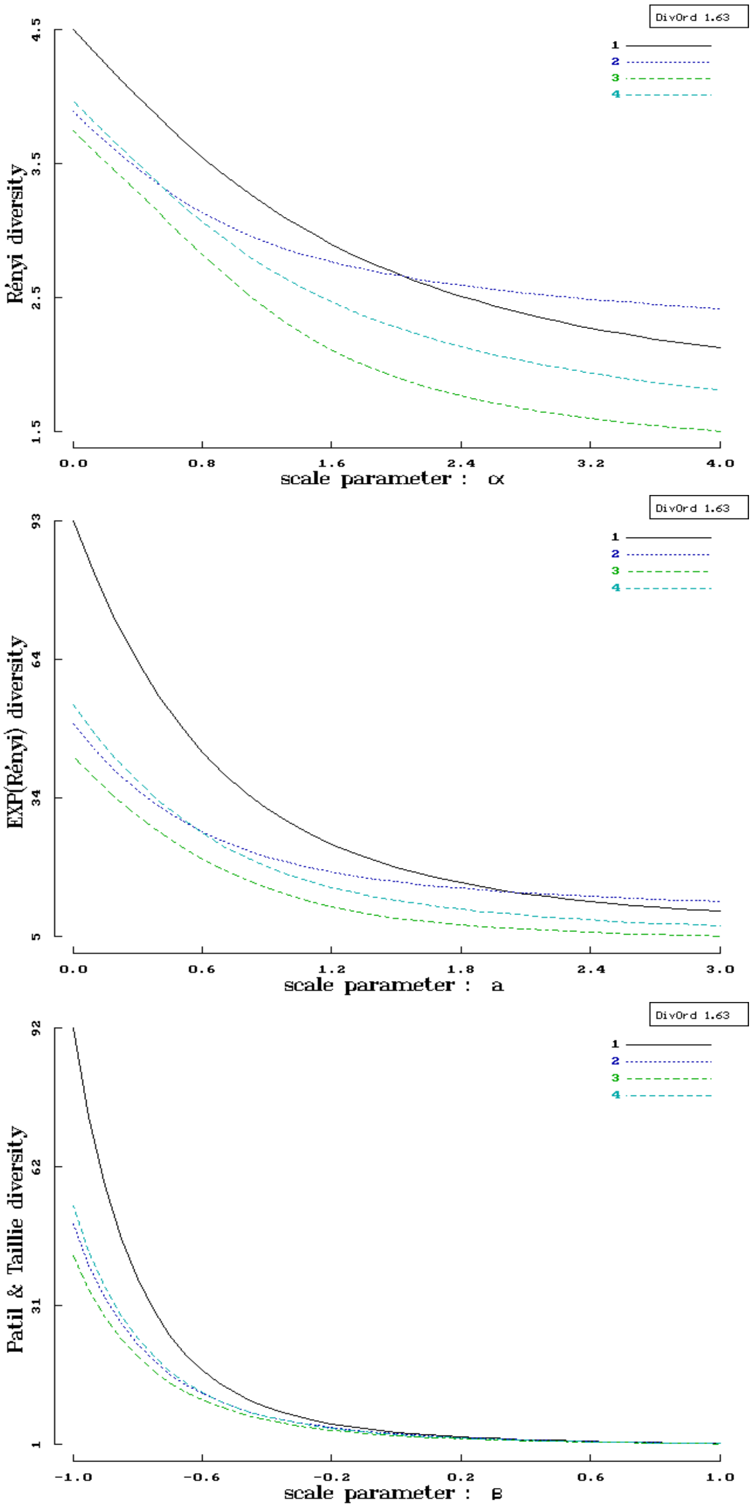

Fig. 1. Diversity ordering of the four main aspects (N, S, E and W) based on Renyi, Exp (Renyi) or Hill and Patil and Taillie's diversity.

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ENVIRONMENT EFFECT ON HETEROSIS EXPRESSION IN BARLEY F1 HYBRIDS (H. vulgare L.).

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The present study was conducted to analyse heterosis expression of F1 hybrids of diallel cross between six varieties of barley (H.vulgare L.) under rainfall and irrigated conditions. The results show a high and significant level of heterosis for yield for all the crosses in the two types of environments. However, the decreasing level of heterosis according to the mid and high parent was observed from irrigated conditions to the rainfall ones.

For yield components, the results show a variation in the heterosis expression for the hybrids in relation to the environment conditions.
Even so, for all the character, the lack of water has affected the heterosis expression for the most of the hybrids.

Keywords: *hybrids F1, heterosis, water stress, yield, yield components, barley*

INTRODUCTION

The variation of the environment causes different genotypic answers which result in differences in the genetic and phenotypic expression.
The genetic improvement for the drought tolerance implies to be able to evaluate a great number of species and varieties. The identified species or varieties as tolerant will be then used in selection. However, for any selection, the interest is to gather in the same genotype all the interesting characters of productivity and drought tolerance.

The heterosis is defined as being the increase of vigour for a given character or all the characters, shown by the individuals crossed with regard to the corresponding inbred lines. In other words, it is the superiority of the hybrid on the midparent. The heterosis is a direct function of the dominance. Generally, it depends on the average direction of the dominance on i loci controlling the considered character.
The determination of the heterotic effect with regard to the midparent puts in evidence the distances to the additive action (partial and total dominance) and the reference to the higher parent underlines the effects of superdominance.
The heterosis for a given character is raised as much as the parents of the hybrid complement each other for the genes involved in the variation of the character.

The objective of our study consists in realizing a diallel cross between several varieties from various origin in order to accumulate a set of dominant and favourable genes for the expression of a good productivity in grain and a big tolerance for the drought. The expression of the heterosis in F1 descendance is studied under two different environmental conditions.

MATERIALS AND METHODS

The study concern six genotypes different by their genetic diversity and their geographic origin. A diallel cross were realized in 1993/94 in the experimental station of the National Agronomic Institute in Algeria. The F1 was harvested and sowed with their parents under two environment conditions. The experiment is conducted in two trials of which one was irrigated (favourable conditions) and the other one was left under rainfull conditions. The trials were conducted in a complete random block with three repetitions. The amount of precipitations recorded during the study year shows a great variation. According to an average of 30 years, the study year records 192.9 mm of water deficit.

The heterosis is calculated following this equation :
According to the mid parent (mean heterosis = MH):

$MH = ((\overline{F_1} - \overline{P}) / \overline{P})100$; $\overline{F_1}$ = hybrid value.
$\overline{P}$ =average of respective parents.

According to the high parent (high heterosis = HH):

$HH = ((\overline{F_1} - hP) / hP)\ 100$; hP = higher parent.

RESULTS AND DISCUSSION

The results indicate that the most of the hybrids have a mean heterosis for the grain yield, high and significant varying between 8,02 % and 76,87 % in favourable conditions and between 8,96 % and 86,06 % in rainfull conditions (table1). These results join those of RAGHUVANSHI and *al.* (1989) and those of SINGH and MISHRA (1990) on wheat where they find an important heterosis for the grain yield.
According to these authors, the increase of hybrid vigour is due to the accumulation of a significant number of favourable alleles for the expression of this character. However, the heterosis of a character as complex as yield is an obvious phenomenon.

Moreover,IMMER (1941) quoted by RAMAGE (1983) confirm that it could be the highest compared with that of its components. Indeed, the evaluation of the average of yield's heterosis vary from 44,58 % in favourable conditions to 40,32 % in rainfull conditions whereas the yield's components heterosis vary from 10,35 to 25,76 % in favourable conditions and from 8,57 % to 33,87 % in rainfull conditions (table3).

GRAFIUS (1959) thinks that in barley, the heterosis of the grain yield can be explained by the epistasy and the dominance of the genes which affect the components of the yield. These two effects are not exclusive but the epistasy seems to be very important in this species.

The crossings Volga X Rihane, Tamaris X Rihane and Saïda X Tamaris, show an heterotic effect significant compared to the midparent for the number of ears per plant in the in the rainfull conditions with respectively 19,78 %, 31,07 % and 40,49 %. The other hybrids show from a mean heterosis to a low one(table1). For the same specy and for the same character, BENMAHAMMED (1996) finds an heterotic effect important one year out of two.

The hybrids Jaidor X Saïda, Tamaris X Jaidor show a strong significant rate of hétérosis for the number and the weight of the grains per ear and the weight of 1000 grains in the two environments (table1). For the other crossings, we observe a significant heterotic effect for one or two components only (table1)

Among the ten studied hybrids, we record an heterosis compared to the best parent, high and significant in the two environments for the grain yield in Jaidor X Saïda, Tamaris X Jaidor and Saïda X Tamaris with respective values 39,22 %, 42,41 % and 32,16 % in irrigated conditions and 33,36 %, 42,40 % and 44,11 % in rainfull conditions. The crossings Saïda X Rihane and Volga X Nevada show an heterotic earning compared to the best parent only in the irrigated trial (35,92 % and 42,67 % respectively) whereas for the crossing Rihane X Jaidor, it is rather, the rainfull conditions that make it to express the heterotic effect with 29,94 %.

For the grains number per ear, the grains weight per ear and the weight of 1000 grains, we record an heterosis compared to the best parent, high and significant in the two environments for the hybrid combining the parents Tamaris and Jaidor (table 2). This shows their contribution to the heterosis of the grain yield estimated to 40,4 %. These components are influenced by several factors but the yield remains a function of their interaction (RAMAGE, 1983).

For the harvest index , the hybrids Jaidor X Saïda, Tamaris X Rihane, Tamaris X Jaidor and Saïda X Tamaris show an heterosis compared to midparent, high and significant in the two environments(table 1). A significant heterosis compared to the best parent, is also observed for the same character and in the two environments for Saïda X Tamaris (11,3 % and 20,6 %) and for Volga X Nevada (13,16 % and 56,74 %). This heterosis for the harvest index is indicating the extent of the increase of the production in grain with the existence of a biomass in the plant.

The hybrid Volga X Nevada expresses the highest heterosis compared to the best parent in the rainfull conditions(56,74 %) whereas in the favourable conditions, the highest value is -15,51 % observed in Rihane X Nevada.

In wheat, SINGH and MISHRA (1990) find an important heterosis compared to the best parent, mattering an order of 61,7 % and 56,46 % respectively for the grain yield and the harvest index.

In rainfull conditions, the hybrid Saïda X Rihane and in favourable conditions the hybrid Saïda X Rihane have express a null heterosis compared to the best parent for the grain weight per ear and for the harvest index respectively (table 2). According to LEFORT-BUSON and DEVIENNE (1985), this case would be explained by an equal number of loci whose direction of dominance is opposite and which tends to cancel the total heterosis.

Table 1: Values of mean heterosis expressed in percentage in the two environments.

Character *Genotype*		YG/P	EN/P	GN/E	GW/E	TGW	HI
SXN	**FC**	8,02	- 9,82	- 6,97	- 7,09	38,10*	- 2,29
	RC	20,28	- 10,85	- 8,74	- 5,11	43,10*	16,11
VXR	**FC**	34,03	14,42	-30,07	-26,27	16,51*	2,12
	RC	41,08*	19,78*	-38,42	-31,74	12,71*	3,36
JXS	**FC**	51,99*	22,46	21,44*	33,33*	8,77	11,16*
	RC	44,20*	15,05	29,69*	48,28*	17,04*	30,59*
RXN	**FC**	8,96	0,45	-30,95	-20,00	40,06*	- 1,81
	RC	25,62*	- 7,34	-27,03	- 3,55	36,57*	36,39*
SXR	**FC**	38,67*	10,06	12,79	16,10*	8,63*	1,99
	RC	21,44*	2,09	12,67*	34,37*	3,22	3,26
RXJ	**FC**	38,23*	25,63	16,10*	22,48*	4,88	8,02
	RC	48,22*	16,10	17,28*	33,33*	4,12	19,62*
TXR	**FC**	66,69*	17,01	4,24	11,84	19,52*	28,91*
	RC	56,36*	31,07*	0,54	30,25*	6,73	22,65*
TXJ	**FC**	76,87*	17,21	27,76*	42,38*	24,50*	30,25*
	RC	22,45	- 4,69	30,77*	58,99*	14,65*	28,92*
SXT	**FC**	75,25*	13,16	23,59*	26,25*	17,82*	38,72*
	RC	86,06*	40,49*	27,46*	59,68*	8,15	43,86*
VXN	**FC**	47,16*	- 7,07	10,87	15,91	16,65*	21,00*
	RC	37,54*	-24,17	9,72	31,45	0,96	94,44*

Grain yield/plant : YG/P , Ear number/plant : EN/P, Grain number/Ear: GN/E
Grain Weight/Ear: GW/E, 1000 Grains Weight: TGW , Harvest Index: HI
Favourable conditions : FC, Rainfull conditions: RC
R : Rihane, J : J aidor, T : Tamaris, V : Volga, S : Saída, N : Nevada

Table 2 : Values of high heterosis expressed in percentage in the two environments.

Character *Genotype*		YG/P	EN/P	GN/E	GW/E	TGW	HI
SXN	FC	-6,37	-28,89	-32,81	-36,34	16,21*	-14,52
	RC	-3,27	-31,43	-35,16	-38,40	20,52*	-18,62
VXR	FC	11,37	-8,73	-49,11	-45,62	8,65	-6,59
	RC	-2,44	-3,37	-55,68	-51,90	4,49	-17,68
JXS	FC	39,22*	20,76	13,24	9,25	-2,80	9,26
	RC	33,36*	11,18	19,35*	19,47*	2,93	23,53*
RXN	FC	-7,14	-18,71	-52,03	-44,00	24,11*	-15,51
	RC	-3,90	-26,30	-50,21	-36,46	20,22	-7,06
SXR	FC	35,92*	6,40	5,81	30,66*	2,35	0,00
	RC	14,57	-2,45	5,12	0,00	-1,95	-1,75
RXJ	FC	24,37	22,26	2,05	3,62	9,61	4,25
	RC	29,94*	14,63	1,34	9,79	5,07	7,97
TXR	FC	24,01	16,46	-11,37	-14,87	5,25	1,93
	RC	16,22	11,40	15,87*	-10,38	-1,81	-1,31
TXJ	FC	42,41*	15,95	22,94*	24,91*	16,88	5,82
	RC	42,40*	-18,13	25,84*	27,50*	14,41	14,31
SXT	FC	32,16*	9,89	11,22	-6,50	-0,36	11,30*
	RC	44,11*	24,22*	13,28*	9,40	-4,98	20,60*
VXN	FC	42,67*	-8,81	2,80	6,80	10,65	13,16*
	RC	17,59	-25,53	0,40	16,43	-4,56	56,74*

The hybrid vigour so expressed is based on the complementation of the gametic contributions of the parents by favourable dominant genes. In this sense, the heterotic expression of the effect can be partly related to the non additive action of genes. According to JUNG and LELLY (1985), the absence of heterosis or its low value in barley probably reflects an important additive action of genes. Whereas BAILEY and *al*. (1980), think that the additive effect is the main cause of the heterotic response in a diallel and triallel cross diallèle and triallèle of the diploïd species.

The comparison of the evolution of the heterosis between the two conditions of the trials makes easy to observe that for the grain yield, the heterosis of the hybrids Saïda X Tamaris, Rihane X Jaidor and Rihane X Nevada increase clearly while passing from the favourable conditions to the rainfull ones. For Tamaris X Jaidor and Saïda X Rihane, the water stress tends to reduce their heterosis.
The heterosis expressed by Saïda X Tamaris and Tamaris X Rihane for the ear number per plant and the grain weight per ear is raised in rainfull conditions while the one of the hybrids Tamaris X Jaïdor and Volga X Nevada decreases. The same reduction is recorded for the weight of 1000 grains.
For the crossing Rihane X Nevada, the heterosis for the grain number per ear and the harvest index increases with the water stress whereas, the one of the weight of 1000 grains decreases.

Besides, the evaluation of the difference between the two environments of the average of the heterosis compared to the mid parent indicates some tolerance to the drought for the weight of 1000 grains (-31,48 %), for the grain weight per ear (-122,72 %) and for the grain number per ear (-10,45 %) (table 3).

Table3 : Evolution of the average of heterotic earning compared to the mid parent in the two environments.

Character	FC	RC	Difference in value	Difference in %
GY/P	44,58	40,32	4,26	9,56
EN/P	10,35	8,57	1,78	17,20
GN/E	4,88	5,39	-0,51	-10,45
GW/E	11,49	25,59	-14,10	-122,72
TGW	25,76	33,87	-8,11	-31,48
HI	26,48	-4,26	30,74	116,09

CONCLUSION

The works of UDDIN and *al*. (1992) show that the best hybrid for the grain yield didn't give a strong rate of heterosis. This observation underlines that it is rather the total yield which is important and not the extent of the heterosis because it is a relative measurement which depends on the hybrid and the parental performances.

In our case, although the hybrid Saïda X Rihane expressed a high grain yield (41,09 g) its heterosis compared to the mid and higher parent is medium but significant.

The extent of heterotic effect differs from an environment to another. The results of our study indicate clearly this difference of hybrid vigour for all the studied characters while passing from the favourable conditions to the rainfull ones or in the other way round .

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EXPERIENCES WITH FAST GROWING FOREST TREE SPECIES IN TURKEY

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The fast growing species have 50 year-old political background and 35-40 year-old scientific background in Turkey. For obtaining a great deal of progress in species and origins experiments and starting the model plantation phase, *Eucalyptus* sp., *Pinus pinaster*, *Pinus radiata*, hybrid poplars and some clones of *Populus nigra* are the important species. But, the desired outcomes about the American-originated species could not be achived because of establishing the experiments with few numbers of clones, which didn't represent the distribution area. Along with these species, studies should be focused on *Pinus brutia* which has broad distribution area, improvement potential, and fast growing character. Furthermore, *Pinus brutia* is evaluated as a species which will close the supply deficit in long run. Also, studies should be performed on *Fraxinus angustifolia* subsp. *oxycarpa*, *Pterocarya fraxinifolia* and *Alnus glutinosa* subsp. *barbata* which was experimented in regional base and showed the faster growing character than the other indigeneous alder species and native species.
Key words: *Plantation, Industrial wood, Exotic, Indigenious*

INTRODUCTION

The total area of Turkish forests is 21.2 million ha and this area occupies 27.2 % of whole country area. Half of Turkey's forests which are quite rich in point of biological diversity consist of conifer species, and the rest of broadleaved species. Overall tree volume, the mean annual volume increment, and the annual allowable cutting amount of the Turkish forests are 1.3 billion m^3, 36.3 million m^3 and 16.3 million m^3, respectively (Anonymous, 2006).

In Turkey, 3 million m^3 of industrial and 9 million m^3 of fire wood are exhausted per annum. 60-65 % of the industrial wood and 85%of the fire wood are obtained from state forests. The supply deficit which is due to low proportion and low standard of quality-log in industrial wood-assured in state forests is suppressed by means of imports (Fig.1). It was claimed that the wood obtained from the native forests would not be enough to meet wood demand (Birler, 1998). The fruition values of industrial wood consumption in last two decades as expressed in supply-demand projections of 9th Development Plan Period (2007-2013) are the indication to climb tendency, from 1970s to the present, in industrial wood consumption, along with population increase (Anonymous, 2006).

The major proportion of the industrial wood assurance outside the state forests has been fulfilled in poplar (over 90%) and eucalyptus plantations. According to some calculations and projections, supported by some researches, the annual industrial and fire wood amounts provided by private sector outside the forest area (poplar, willow, fruit trees etc.) are 3.3 nd 1.4 million m^3, sequentially (Anonymous, 2006; Birler, 1998). As to different supply sources, approximate wood consumption for 2005 is pointed in Fig.1.

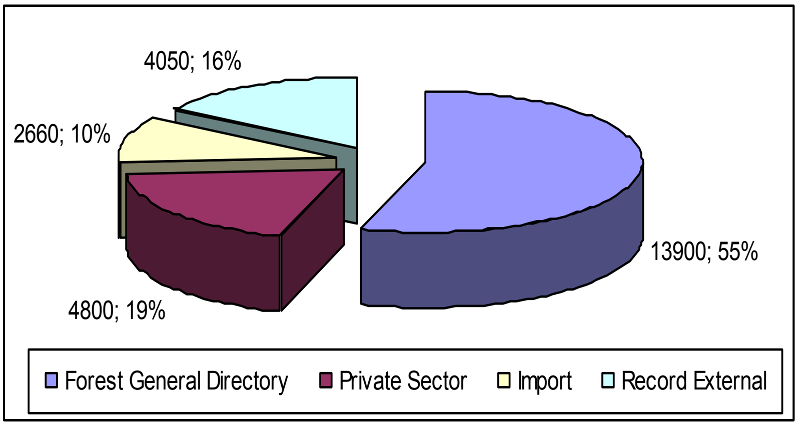

Figure 1. Consumption rates of Industrial and Fire Wood for 2005 as to the Supply Source in Turkey (1000 m^3)

From Fig 1, it's seen that, 16% and 10 % of Turkey's wood consumption are supplied by means of unregistered wood (as fire wood, at large proportion) and imports, respectively. If these values were taken into consideration as the basis, for saving Turkey's wood consumption from external addiction and unregistered supply, 26 % of total yearly consumption (25 410 million m^3) had to be provided from fast growing plantations, in the short run.

The production capability of Turkey forests declines gradually. Furthermore, in 2000s, some forest areas will probably turn from the production forest into the external-production forests due to the increasing in conservation and environmental sensivity. Thereby, in due course, the decrease in the amount of production forests is inevitable. In developed countries, the conservation areas occupy 10 % of whole country area. But, this rate is 5-6% in Turkey (Anonymous, 2006). So, enlarging the number and size of conservation areas is one of the priorities of country.

In Turkey both the supply deficit at present and politics, aiming at increase of the number and the size of conservation areas, will increase the wood deficit. To overcome this deficit, tree improvement is the first of the two alternatives. But, this method requires selection-trial-evaluation process in the long run. So, establishment of fast growing plantations in suitable sites should be appreciated as a way of solution of the wood deficit in short term.

In this study, by investigating the brief history of Turkey's fast growing plantations, obtained experiences, established plantation areas, potential areas and experimented species/origins/clones and conclusions, suggestions are stated on import trials and plantations of fast growing species for following years.

BRIEF HISTORY OF FAST GROWING PLANTATIONS

If the *Eucalyptus* plantations established for swamp dry at Tarsus-Karabucak in 1938 and *Pinus pinaster* Ait. used for sand stabilization around İstanbul-Terkos lake one century ago were not overrated (Asan, 1998), the fast growing species would have 50 year-old political background and 35-40 year-old scientific background. Poplar and Fast Growing Forest Trees Research Institute-İzmit, Eastern Mediterranean Forestry Research Instıtute (the old name is Eucalyptus Research Station) and other research institutes/organizations have taken active part in fast growing species import practises. The scientific studies were started on fast growing species by the organizations mentioned above in 1968 (Tunçtaner, 1998). The beginning of the researches on USA-originated species was attributed to the year 1940 (Yaltırık *et al.,* 1994).

Together with the species and origin trials enforced by different organizations, the studies were fulfilled on native and exotic fast growing species in the extend of a project entitled "TUR/71-521 Industrial Forestry Plantations" in 1972-1977 (Tunçtaner, 1998). Also, in 1969-1976, in the extent of the "Arboretum of Conifer Species" project, trials on various America originated species were carried out (Boydak *et al*., 1995).

Species and origin trials were established at coastal regions as Black Sea, Marmara, Aegean and Mediterrenean, intensively. The experimented species in these regions are given on Table 1.

Table 1. Exotic fast growing species experimented in Turkish Forestry (Boydak *et al*. 1995; Tunçtaner, 1998; Atasoy, 1998; Üçler, 1998; Eyüboğlu and Atasoy, 1988)

Number	Scientific Latin Names of Species	Provenance
1	*Picea pungens* Englemann	Colorado
2	*Abies amabilis* (Lood) Forb.	Darrington Washington
3	*Abies concolor* (Gord.) Hoopes	Colorado
4	*Abies concolor* var. *lowiana* Lemn.	Shady Cove-Oregon
5	*Abies magnifica* Murr.	Klamath-Oregon
6	*Abies balsamea (L.)* Mill.	Penobscot-Maine
7	*Pinus contorta* var. *latifolia* Eng.	Tillamook-Oregon
8	*Pinus banksiana* Lamb.	Marquetle-Michigan
9	*Pinus virginiana* Mill.	Prince Georgia-Maryland
10	*Pinus attenuata* Lemm.	Josephine-Oregon
11	*Pinus echinata* Mill.	Buckingham- Virginia
12	*Pinus pungens* Lamb.	Grant-W. Virginia
13	*Pinus rigida* Mill.	Burlington-New Jersey
14	*Pinus monticola* Dougl.	Klamath-Oregon
15	*Thuja pilicata* Donn.	Colville/Stevens Cob-Wash.
16	*Juniperus virginiana* L.	Adiron Dock Mt-New York
17	*Chamaecyparis lawsoniana* (A. Murr) ParI.	Germany
18	*Tsuga heterophylla* (Raf.) Sarg.	Mt. Vermon-Washington
19	*Cupressus arizonica* Greene	Arizona
20	*Larix occidentalis* Nutt.	Okanogan-Washington
21	*Larix lariciana* (Du Roi) K. Koch.	Hampshire-Graftan
22	*Pinus glabra* Walt.	Jones-Missisiphi
23	*Pinus serotinia* Michx.	Craven-North Carolina
24	*Pinus resinosa* Ait.	Forest-Pennsylvania
25	*Pinus balfouriana* A. Murr.	Siskiyou-California
26	*Pinus palustris* Mill.	Nansemond-Virginiana
27	*Abies lasiocarpa* (Hook) Nutt.	Yakima-Washington

Table 1. Cont.

28	*Abies fraseri* (Pursh) Poir.	Mitchel-North Carolina
29	*Picea engelmanii* (Parry) Eng.	Clackomas-Oregon
30	*Picea rubens* Sarg.	Penobsccot-Maine
31	*Taxodium distichum* var. *nutans* (A) Swe.	Baker -Florida
32	*Tsuga mentensiana* (Bong.) Carr.	Klamath-Oregon
33	*Picea abies* (L.) Karst.	Germany
34	*Chamaecyparis thyoides* (L.) B.S.P.	Bladen-North Carolina
35	*Abies grandis* (Dougl.) Lindl.	Deschuters-Oregon
36	*Picea breweriana* S. Watc.	Siskiyou-California
37	*Picea mariana* Mill. B.S.P.	Nortstar -Arkansas
38	*Sequoia sempervirens* (D. Don) EndI.	Blue Lake-California
39	*Pinus lambertiana* Dougl.	California
40	*Acer saccharum* Marsh.	Canada
41	*Pinus strobus* L.	Wisconsin
42	*Pinus jeffreyi* Grev. Balf.	California
43	*Pinus ponderosa* Laws.	California
44	*Sequoiadendron giganteum* (Lindl.) Buchh.	California
45	*Alnus cordata* (Loisel.) Duby	Italy
46	*Alnus rubra* Bong.	USA
47	*Alnus incana* (L.) Moench.	Norway
48	*Alnus sinuata* (Vill.) Lam.&DC. (Regel)	USA
49	*Robinia pseudoacacia* L.	Romania, USA
50	*Acer pseudoplatanoides* L.	Italy
51	*Larix decidua* Mill.	Germany
52	*Larix leptolepis* Gord.	Germany
53	*Larix x eurolepis* A. Henry.	Germany
54	*Acer negundo* L.	USA
55	*Picea sitchensis* Bong. Carr.	USA, England
56	*Pinus radiata* D. Don.	New Zealand, Spain
57	*Pinus pinaster* Ait.	France
58	*Pinus densiflora* Siebb.&Zucc.	Japan
59	*Pinus caribaea* Morelet.	New Zealand Australia
60	*Pinus canariensis* Chr. Sm. ex DC.	Kanarya Islands
61	*Pinus elderica* Medw.	Iran
62	*Pinus nigra* var. *corsicana*	Corsica
63	*Cedrus deodara* Loud.	China
64	*Cedrus atlantica* Manetti.	Morocco, Italy, France
65	*Pseudotsuga menziesii*	USA
66	*Pinus taeda* L.	USA
67	*Pinus elliotti* Engelm.	USA
68	*Cryptomeria japonica* (L. f.) D. Don.	Japan
69	*Pinus excelsa* Wall. Ex D. Don.	Central and Northern Europe
70	*Eucalyptus camaldulensis* Dehn.	Australia, Lake Albacutya, Willuna
71	*Eucalyptus grandis* W. Hill ex Maiden	Australia
72	*Populus x. euroamericana*	Italy
73	*Populus deltoides* Bartr. Ex Marsh.	Italy
74	*Quercus rubra* L.	USA
75	*Alianthus altissima* (P. Mill) Swingle	China
76	*Pseudotsuga menziessi* (Mirb.) Franco.	Washington, France
77	*Paulownia elongate* S. Y. Hu.	China
78	*Paulownia tomentosa* (Thunb.) Sieb.& Zucc. ex Steud.	China
79	*Paulownia fortunei* (Seem.) Hemsl.	China
80	*Paulownia tomentosa x fortunei*	China

As to the Table 1, the conifer species were used commonly (app. 80 %). Also, while some of the broadleaved species as *Populus x euroamericana P. deltoides, Eucalyptus camaldulensis, E. grandis, Alnus incana, A. sinuata, A. robusta, A. cordata, Acer saccharum, A. pseudoplatanoides, Acer negundo, Robinia pseudoacacia Quercus rubra* and *Ailanthus altissima* were experimented. For *Paulownia* Sieb.& Zucc. (Ulu *et. al.,* 2002; Ayan *et al*., 2006a) which was recognized by the Turkish forestry as plantation goals in 1990s, the studies could be expressed as openning stage. In addition, about two decades ago, it was stated that the studies on fast growing species in Turkey should also be focused on native broadleaved species such as *Fraxinus*, *Alnus* sp. *Populus tremula*, *Ulmus* etc. (Çiçek and Yılmaz, 2002).

POTENTIAL AREA OF INDUSTRIAL PLANTATIONS IN TURKEY
It was expressed by Boydak *et al.* (1955) referred to Saatçioğlu (1969) that at the first stage, 5% of the degraded forests which are comprised of 10 million ha and need rehabilitation, then 10 % of these forests as to the accurate results, even 15 % of them would be allocated for the fast growing exotic species. In Turkey, as Zoralioğlu (1990) stated, there was 1.5 milion ha of area suitable for industrial plantations by using intensive cultural methods. Öztürk (1998) confirmed above-mentioned 1.5 milion ha of area as potential site for fast growing plantations in degraded forest lands, state lands and agricultural lands. In Turkey, Boydak and Dirik (1998) referred to Birler alleged that, it was possible to establish 1 840 000 ha of industrial plantations consist of 455 000 ha of poplar, 1 385 000 ha of other native and exotic fast growing species.

2.2 million ha of land was identified as feasible for industrial plantations from technical and social aspect in 2006’s inventory (Anonymous, 2006). If, 1 million ha (roughly) of state potential land and forest areas, mislayed the natural regeneration conditions and have to be planted, were added to 2.2 million ha, the area requiring plantation would be extremely large in above-mentioned area.

PLANTATION AREA OF FAST GROWING SPECIES IN TURKEY
Currently, apart from poplar, the total area of established fast growing plantations is about 80 000 ha allover Turkey (Asan, 1998; Günay, 1998). This area is expressed as 120 000 ha by Aydın (1998). That 60 000 ha of exotic conifer plantations were only established in Black sea and Marmara Region, was stated by Kahveci (1998). There still are 53 901 ha of *Pinus pinaster*, 140 ha of *Pseudotsuga menziessi*, 1 692 ha of *Pinus radiata*, 17 ha of *Pinus taeda* (Çalışkan, 1998), 20 000 ha of *Eucalyptus camaldulensis* (Özkurt, 2002) plantations in Turkey (Çalışkan, 1998). Although there exist no clear record about poplar plantations owing to private sector investment character, 145 000 ha of established area is thought to be found (Anonymous, 2006).

PERFORMATION OF SOME FAST GROWING FOREST TREES

AMERICAN ORIGINATED CONIFER SPECIES
American originated species experimented in Turkey spread on the coastal zone of Atlantic and Passific (Boydak *et. al*. 1995). These are;

Pseudotsuga menziesii Mirb. Franco.; The use of this species which was firstly experimented in 1951 for aestatic and industrial goals is recommended for the plantation areas on Castanetum-Fagetum zone at the rate of 20%, in Eastern and Western Blacksea regions by 1250 m altitude. The origins are stated to reach to 10 m in height, 18 m^3/ha in volume increment at the age of 16 (Şimşek, 1987; Üçler, 1998; Tunçtaner, 1998). In this species which show faster growing at advanced years, no series insect harm and disease has been detected (Boydak *et. al*., 1995).

Sequoia sempervirens (Lamb.) Endl.**:** As to the observations in the experiment areas on Western Blacksea region, this species is a promising one on the coastal zone. But, in point of growing, important differences were determined among the individuals on the same area and at the same age. The change of diameter between 20-75 cm, and height between 11-25 m were found out among the equal individuals (Eyüboğlu *et al*., 1995). So, in this species, by selecting the origins with the help of the preliminary explorations on native spreading areas and systematically experiments on the individuals, selecting among the resistant ones against to the frost and capability of fast growing from industrial/ornamental aimed plantations, positive results could be attained. In other words, the experiments should be enforced together with the origin and clonal-based.

Picea sitchensis (Bong) Carr.***:*** According to the 13rd years results of experiments established in Trabzon-Maçka region, this species shows growth as fast as 3 times than *Picea orientalis* that is indigenous for the region. So, Üçler (1998) and Boydak *et. al.* (1995) emphasize the utilization of this species in plantations of Eastern Blacksea at 700-100 m elevations, at the rate of 10-15%.

Pinus contorta Dougl.**:** In respect of the results of the experiments conducted at the high region of Eastern Blacksea, planting of this species is suggested at 1200-2000 m elevations (even, above the timber line by 2500 m) at the rate of 10-15% (Eyüboğlu, 1986).

Pinus ponderosa Laws.***:*** This species has an important advantage owing to the suitability to experimental studies in the high region. Boydak *et. al.* (1995) suggested that this species should be experimented with convenient origins at Blacksea, Western and Southern Marmara, inner part of Aegean, Westhern Mediterrenean regions after having reliable preliminary studies.

Pinus radiata D. Don.***:*** This species reaches the fastest growth, in Western and Eastern Blacksea region and Eastern Marmara. So, this one is the most investigated species. (Tunçtaner, 1998). But, because of *Evetria buoliana* (Schiff.) harm, this species is the most controversial one, in point of passing to limited plantations stage (Boydak *et al*., 1995). The harm of *Evetria buoliana* on *Pinus radiata* intensifies on the unsuitable ecological conditions, as stated by Öztürk (1998). Toplu *et al*. (1987), in their study on resistance to the insect harm, determined Cedros-12785 as the most resistance origin.

Cupressus arizonica Greene***:*** This species which is represented with quite a few, even with a single origin in some region, is mainly used for ornamental goals in Mediterrenean, Aegean, Marmara and inner Anatolia region. Owing to the height and volume growth in some experiments, this species should be utilized in all suitable lands in Turkey after a conclusive testing of the convenient origins (Boydak *et al*., 1995). Tunçtaner (1998) clarified that this species has the most successful performance in Aegean region together with *Pinus pinea*.

In the fast growing trials and plantations at Marmara and Western Blacksea region, no or too little snow damage was perceived for the USA-originated species such as, *Pinus banksiana, P. monticola, P. contorta, P. ponderosa, P. muricata* and *P. radiata.* However, *Pinus taeda* and *P. eliottii* affected from the intensive snowing (Boydak *et al*., 1995).

EUROPEAN ORIGINATED SPECIES

Hybrid poplar and *Populus deltoides:* Poplar is broadleaved species, the most extensively studied species in Turkey. Both the plantation area broadness (145 000 ha) and the important role of them on wood supply (app. 3.3 milion m^3 /year) increase their importance (Anonymous, 2006). 55% of this production is ensured by means of fast growing plantations established with the clones of *Populus euramericana* (Hybrid poplar) and *Populus deltoides.* The clones of *Populus euramericana* named “I-214” and “45/51”, and *Populus deltoides*’s clone named “Samsun” are mainly used in the temperate region of Turkey. These clones have a rotation of 12-13 years and annual volume increment of 15-36 m^3/ha/year (Tunçtaner *et al*., 1994). Moreover, as an outcome of poplar breeding works, the clones of *Populus nigra* named “Gazi, Anadolu, Kocabey, Geyve, and Behiçbey” were selected for continental regions of Anatolia. These clones are widely used in the gallery poplar plantations and other plantations (Tunçtaner *et al*., 1994; 2004). In Turkey, more than 90% of wood assurance outside the state forest are composed of poplar production (Anonymous, 2006).

Picea abies L. Karst.: In the trials, since 1978, at 700-1500 m altitudes, in Eastern Blacksea region (Üçler, 1998), It was determined that this species showed as big as 2 times growth than the region’s native species (*Picea orientalis* L. Link.). So this species should be used in the plantations at the rate of 10-15%, in the regions represented by experimental area (Ayan, 1990). Yahyaoğlu (1988) satated that for using of the convenient origins of this species on the wider areas, observations have to be continued, minimally by the half of rotation period.

Pinus pinaster Ait. (Provenance from Land-France): This species was initially used in Turkey at Terkos dune plantation in 1880. It is grown especially in the north region of Turkey. Provenance trials for the species were established by Poplar and Fast Growing Forest Trees Research Institute in 1974-1979 (Özcan, 2002). In Turkey, *Pinus radiata* had a serious insect (*Evetria buoliana* Schiff.) problem and *Pinus pinaster* had some snow/wind damage and displayed many broken branches due to the weight of early snowfalls (Erkan, 2002; Özcan, 2002). It was determined that *Pinus pinaster* (provenance from Corsica) grows successfully in Marmara, Blacksea Region and that it is more resistant to insect, disease, snow and wind damages (Tunçtaner, 1998; Özcan, 2002). Also, Tunçtaner (1998) stated that this species would be used widely in some parts of Aegean region.

***Robinia pseudoacacia* L.:** Together with multiple purpose uses, on the loose and deep soils which have good humidity, the black locust shows fast growing character for industrial plantations. More than 10 m^3/ha yield could be gained in this species, at the areas having high site index and unlimited humidity together with intensive soil cultivation and maintenance (Kızmaz, 1998). Rédei (2002) reported that the black locust stands of yield class I-II have a rotation of 35 – 40 years and an annual increment of total volume of 12 – 14 m^3/ha/year. The stands of yield class III-IV have a rotation of 30 years an annual increment of 8 – 9 m^3/ha/year. Finally, the poorest sites (Yield Class V-VI) have a rotation of 20 – 25 years and an annual increment of 4 – 6 m^3/ha/year.

Also, about black locust, Rédei (2002) stated that in the future there would be two regions, where the fast spread of black locust could be expected. In Europe and in Mediterranean countries (Italy, Greece, Spain and Turkey), in Asia (China, Korea) may be the most prominent black locust growers.

AUSTRALIA ORIGINATED SPECIES

***Eucalyptus* sp.**: Eucalyptus genus was firstly introduced to Anatolia in 1885 as an ornamental plant for parks, gardens and edges of railroads (Özkurt, 2002). The first plantation of this species with economical mean was established in Tarsus-Karabucak in 1939. Now, the important part of the present amount of this species (20 000 ha) is owned by private sector. Since 1967, 609 origins of 191 eucalyptus species were experimented in point of rising by Eastern Mediterrenean Forestry Research Intitute (Gürses, 1990). In experiment conclusions, *E. camaldulensis* Dehn and E. *grandis* W. Hill ex Maiden were determined as the fastest growing species in Turkey (Avcıoğlu and Gürses 1984; 1986). At the results of origin trials, an annual increment of total volume of 35 m^3/ha/yıl for *E. camaldulensis* and 50 m^3/ha/yıl for *E. grandis* was obtained (Avcıoğlu and Gürses, 1988). In conclusion of clonal trials after origin trials, the mean volume increment of the best clone reached to 49 m^3/ha for *E. camaldulensis*(Gülbaba *et al.*, 1988) .

NATIVE FAST GROWING SPECIES

***Fraxinus angustifolia* Wahl. subsp. *oxycarpa* Bieb. Ex Willd.:** This species is a fast growing and indigenous tree species for Turkey. The mean annual icrement at the age of 30 and 3x 3 m intervals for good, medium and poor site are 20.7, 14.2 and 9.1 m^3/ha/year, respectively (Yavuz and Mısır, 2002). Also, Kapucu *et al.* (1998) stated that the normal yield table for *F. a.* subsp. *oxycarpa* stands of Middle and Western Black sea Region in Turkey shows that mean annual increment reaches to 23.1 m^3 /ha in plantation and 15.3 m^3 /ha in natural stands in site I class. Çiçek and Yılmaz (2002) stated that *F. angustifolia*, particularly, a suitable tree for lowland and sub-mountain areas, is a fast growing tree species.

***Pinus brutia* Ten.:** According to FAO's definition for fast growing species, Turkish red pine can be considered as fast growing species (Boydak and Dirik, 1998). Also, this species is evaluated as one of the species to close the anticipated future wood deficit in average term (Birler, 1998; Anonymous, 2001; Boydak, 2001) As to the recent years' studies, the annual volume increment and mean volume increment of natural forest of this species are 14.8 and 11.4 m^3/ha/year, respectively (Erkan, 1996). These increments can be promoted in an order by 27.8 and 15.4 m^3/ha/year in plantation areas at site class I (Usta, 1991). In natural forest and plantation in good site of Turkish red pine, mean annual increment can reach 10,5 m^3 at the age of 30 and 15,4 m^3 at the age of 27, respectively (Erkan, 2002). However, it is clear that the production could considerably be increased by tree breeding studies, because of the fact that the wide genetic base of this species gives an indication of the improvement potential. Many researchers and scientists reached an agreement on red pine's native and fast growing character and on the necessity of establishing the plantations, even on agricultural areas by using improved material (Tunçtaner 1998; Boydak *et al.*, 2006; Usta 1991). Also, quite wide potential area and improvement potential of this species, signifies its value for Turkish Forestry.

Alnus glutinosa Gaertn **subsp. *barbata*** (C. A. Mey.) Yalt.**:** Owing to faster growing character than other six taxa, *A. glutinosa* subsp. *barbata* is an economically valuable one among the other naturally distributed black alder taxa in Turkey. In Eastern Black sea region, the pure forests of this taxon cover an area of 43853 ha; mixed forests also cover an area of 63694 ha. In spite of little proportion (app. 1%) of this taxon's forest in Turkey's forest area (Saraçoğlu, 1998), fast growing character, high biological regeneration ability raise its importance, especially for the region. Also, this taxon is used in the region predominantly by the local public. At the same time, there are vast suitable potential plantation areas in the region (Çetin, 1988; Ayan *et al.*, 1998). As to the study results, general mean valume increment of this species is 21 m^3/ha, at the age of 20, in site I class (Batu and Kapucu, 1995).On the other hand, the streamsides in Turkey, which have big potential sites for fast growing broadleaves trees such as *Prunus sativum*, *Acer* sp., *Tilia*, *Pterocarya fraxinifolia*, *Salix* sp., *Ulmus* sp., *Populus tremula* and *Platanus* sp. should be tried with suitable origin in the rich sites (Çiçek and Yılmaz, 2002).

CONCLUSION AND SUGGESTIONS

In the light of data, observations and experiences obtained over 50 years, especially in the last 25-30 years, the below results and suggestions can be listed about the fast growing species plantations and exotic species- introduction studies in Turkey.

- In American originated species exception of *Pseudotsuga menziessi, Pinus radiata, P. taeda* ve *P. contorta*, the experiments were carried out with few number, even 1-2 of clones,which didn't represent the spreading area. Also, the studies were performed without reliable preliminary explorations and systematic researches (Boydak *et al.*, 1995). Owing to above mentioned reasons, the desired outcomes about the American-originated species could not be achived. So, the real performance of these species should be investigated again by selecting the origins representing the spreading area, and by relying on reliable preliminary explorations.
- When compared the potential area with the poplar area (145 000 ha) and plantation area of the other fast growing species (80 000-100 000 ha), the low rate (7.5 %) is seen. Therefore, Turkish Foresters have to progress much on fast growing species.
- In 1950s, in spite of determining the establishment policy of fast growing species plantations, the desired still haven't been achived from many numbers of fast growing species. Because of this, if the industrial plantation investments were not encouraged with the new approaches and legal arrangements, the wood deficit would be increase as time passes.
- When 50 year-old experiences, research findings and evaluations are taken into the consideration about fast growing species, the species that may be used in fast growing plantations in respect of the region, are listed in Table 2.
- The most convenient region for fast growing plantations is Marmara and Blacksea region in Turkey. And, the most successful and widely used exotic species are Populus *x euroamericana, P. deltoides, Eucalyptus camaldulensis, E. grandis, Pinus pinaster* and *P. radiata.*
- It's agreed by many scientists and researchers that advanced improvement studies should be carried on *Pinus brutia, Alnus glutinosa* subsp. *barbata, Fraxinus angustifolia* subsp. *oxycarpa, Pterocarya fraxinifolia* species and the clones of *Populus nigra* which are native in Turkey.

Table 2. The prominent species in fast growing plantations for Turkey.

REGION	SPECIES	ORIGIN	CLONE	LITERATURE
Eastern Black Sea	*Alnus glutinosa subsp. barbata* *Fraxinus angustifolia* subsp. *oxycarpa* *Pinus radiata* *Pinus pinaster*	Turkey Turkey Spain – New Zealand Corsica	- - - -	Pamay 1967 Ayan *et al.* 2006b Pamay 1967 Kapucu *et al.* 1998 Yavuz and Mısır 2002 Çiçek and Yılmaz 2002 Birler 1998, Özcan 2002
Middle & Western Black Sea and Marmara	*Populus deltoides* *Populus deltoides* *P. x. euroamericana* *P. x. euroamericana* *Fraxinus angustifolia* subsp. *oxycarpa* *Pterocarya fraxinifolia* *Pinus pinaster* *Pinus radiata*	Italy Italy Italy Italy Turkey Turkey Corsica New Zealand	Samsun İzmit I-45/51 I-214 - - - -	Tunçtaner *et al.* 1994 Tunçtaner *et al.* 2004 Birler 1998 Birler 1998 Kapucu *et al.* 1998 Yavuz and Mısır 2002 Çiçek and Yılmaz 2002 Çiçek and Yılmaz 2002 Kantay 2002 Özcan 2002 Birler 1998
Aegean	*Pinus brutia* *Pinus pinea* *Cupresus arizonica* *Pinus pinaster* *P. x. euroamericana*	Turkey Turkey (Kozak) USA Corsica Italy	- - - - I-214	Boydak and Dirik 1998 Erkan 2002 Birler 1998 Birler 1998 Birler 1998 Birler 1998
Mediterranean	*Pinus brutia* *Pinus pinea* *Eucalyptus camaldulensis* *Eucalyptus camaldulensis* *Eucalyptus camaldulensis* *Eucalyptus grandis* *P. x. euroamericana*	Turkey Turkey (Kozak) Australia Lake Albacutya (6845) Willuna (7046) Australia Italy	- - - - - - I-214	Boydak and Dirik 1998 Erkan 2002 Birler 1998 Birler 1998 Birler 1998 Birler 1998 Birler 1998 Birler 1998
Middle, Eastern and Southeastern Anatolia	*Populus nigra* *Populus nigra* *Populus nigra* *Populus nigra* *P. x. euroamericana* *P. x. euroamericana*	Turkey Turkey Turkey Turkey Italy Italy	Anadolu Gazi 77/10 67/1 I-214 I-45/51	Tunçtaner *et al.* 1994 Tunçtaner *et al.* 1994 Birler 1998 Birler 1998 Tunçtaner *et al.* 1994 Tunçtaner *et al.* 1994

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FRAMEWORK FOR EVALUATION OF BIODIVERSITY SERVICES: PROBLEMS AND PROSPECTS

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Preamble of Biodiversity Services

It is irrefutable that various biodiversity services are of paramount importance for wellbeing of humankind despite this it stands at risk due to overexploitation and scant regard to conservation. Processes such as plant production, decomposition and nutrient mineralization, biological control by natural predators, water purification, erosion control, regulation of atmospheric composition, pollination etc are considered as part of services. The very issue of conservation of species is a matter of concern for all the countries irrespective of the developmental status. In particular fish is a part of staple food for almost 70 percent of population all over the world and Indian subcontinent is a habitat for half of global fish diversity. As enshrined in the Convention on Biological Diversity (CBD) signed by more than 250 nations today that the countries should conserve all their bioresources with all their might. The same has also been envisioned in the World Summit on Sustainable Development (WSSD). The policies/ guidelines/ mandates needs serious rethinking on the very purpose of conservation, environmental degradation, technological advancement, bioprospecting, bioservices, Patents i.e. Intellectual Property Rights, and trade and development in the present context of globalization thrusting new challenges under World Trade Organization (WTO) regime. Needless to state therefore that the conditionality has to be seen in a more site specific manner as a policy issue for temporal thrust on developing world for furthering the prospect of strengthening the socioeconomic, cultural, scientific and technological development etc.

Threatened lives and livelihood

It is not a gross understatement that the earth is losing species at a rate comparable to the mass extinction of the dinosaurs. Recently it is reported that about five species have been added to the extinct category in the red data book of IUCN the World Conservation Union. Nearly 16000 species are listed as threatened with disappearing with more than 200 of them a possibly extinct and almost 3000 of them critically endangered. The list compiled by a worldwide network of 8000 scientists is the most authoritative statement of the planets biodiversity. Those lost include the St Helena Olive, a tree native to British Atlantic Island, the Golden Toad that lived on a mountain ridge in Costa Rica, the Hawaiian thrush, the Hawaiian crow and a Malagasy freshwater fish known as *Pantanodon madagascariensis.* No specialization is required to ascertain the reasons for loss of biodiversity but irrational use and gross neglect of the care as warranted by one and all despite being sensitized by various national and international agencies including UNEP.

Therefore the issue of sustainability has to asserted that in its core has the policy ingrained for conservation of life (read species) and it necessitates the fundamental policy changes in identifying the goals of sustainable development keeping in view the periodic assessment of biodiversity on the Conservation Assessment Management Plan (CAMP) and Biodiversity Conservation Prioritization Project (BCPP) as periodic strategy of Germplasm Management keeping in view various threats to life and also due to developmental impacts. Further future potential of economic growth coupled with trade and development and with conservation based and technology centered particularly in the third world. As per aspirations of CBD i.e. Convention on Biological Diversity for consensus on its conservation and sustainable utilization. Evaluation of biodiversity in terms of its services offered can provide a framework for its conservation and sustainable use livelihood for mankind. Thus biodiversity and its conservation is considered to be one of the priority areas in terms of its services offered and it transcends the geographical boundaries. Biodiversity services as like ecosystem services can be defined as the benefits that human beings obtain directly or indirectly from biological resources and their processes giving rise to valuable products. Although there is no clear definition of such services that is unanimously agreed by ecologists as well as economists.

Hypothetical background

The basic hypothesis is that the information of the biodiversity on the planet earth is critically insufficient and the available estimates of global diversity are ranging over many orders of magnitude in terms of levels and patterns. As much we know about the diversity has not been formally described and categorized in a catalogue form this has rightly been described as Linnaean shortfall due to increasing severity as the organisms decrease in size and complexity e.g. from vertebrate groups to invertebrates, down to nematodes. The other that is Wallacean shortfall where there is inadequate knowledge of their global, regional and even local distributions of species and taxa. Many areas of the world remain seriously under collected for most taxa, with the result that even for higher plants, reliable, systematic species range maps – the necessary basis for firm analyses of diversity patterns-but are available only for a fraction of earth's surface. Moreover, much of our distributional data and many of our compilations pertain to political geographical units and hence lack biological meaning.

Consequences of global change

Due to global change (i.e. climate change, land use changes and resource crunch etc) is required to be taken into account to design biodiversity conservation strategies. There is increasing impetus to preserve the biodiversity as well as the services currently supplied by ecosystems. The available methods for developing conservation schemes using species distribution or environmental variability, and their outcomes are questioned due to scarcity of represenatativeness of data used for the purpose. Moreover the information on distribution of species is usually fragmentary and the existing distribution models underplay the authenticity o the subsequent conservation schemes primarily due to uncertainty in estimated distributions and the distributional range shifts occurred due changing climate. Thus occurrence of theoretical linkage between ecosystem functions and the presence of a given species is blatantly missing.

Policy Mandates

Evaluation of biodiversity in terms of its services offered could provide a framework for its conservation and sustainable use. Conservation Assessment and Management Plan (CAMP) under Biodiversity Conservation Prioritization Project (BCPP) of UNEP was one such effort to ascertain the status of biodiversity to save the species through effective measures of in situ and ex situ conservation methods. Conservation assessment and planning require information on the distribution of biodiversity often across very large regions of the world. On the contrary biodiversity variables are based on assemblage descriptors like species richness, compositional variation, variation in community structure provide many practical and theoretical properties that makes them ideal for conservation. Therefore new reformulation of their use is needed due to biased efficiency of hot spot based approaches, recent updated in theoretical ecology and biogeography support use of such variables for effective conservation strategies for variety of reasons.

Is it a Problem of Prospects

Earlier attempt has been made for creating a frame work for coordination of biodiversity an habitat for assessment and quantitative change in Europe were inconclusive for want of common baseline The work on main drivers of ecosystem change in Europe based on the results of the European Union 5th framework program ATEAM (Advanced Terrestrial Ecosystem Analysis and Modeling) a modeling study that has focused on ecosystem service supply and human vulnerability to global change in Europe. Although no comparative studies have been carried out elsewhere taking it as a baseline approach. Such comparison is anticipated theoretically to provide alternative images of the future might unfold forms an appropriate with which one can analyze global change processes. It is highly unlikely that any single scenario to emerge, a set of alternative scenario may emerge with wide range of uncertainty.

Much less the scenario is attributable to the other countries on globe. It is widely felt that in order to achieve adequate data on the global changes with the inclusion of all externalities that influence to meet the target of 2010 and also to assess favorable conservation status with adequate baseline. It is envisaged that framework for assessment should link up these available data systems including the operational models for comprehensive evaluation of parameters for better predictions and for favorable policy instruments.

Of the available biomes the western Amazon basin and the eastern Andean slopes form the only remaining large scale neogene active orogeny and foreland belt where the vegetation patterns are still in a natural condition . The rest like the Shivaliks in Himalyas and the Alps in Europe have faced ecosystem alteration by human action long time ago.

Implications of Surveillance without Framework

The crisis would deepen further if it continues at the same rate and therefore threatens the very survival of the giant ecosystems. Such conditionality warrants assessment of the services rendered by these systems and suitable strategic interventions as a framework. This framework would have exclusive realm of surveillance and monitoring. An integrated programme for surveillance and monitoring was initiated in Britain for landscape features, habitats, vegetation and aquatic invertebrates studies were carried out by some workers and the estimates of the extent and changes in the parameters were made and thereby provided credible support for ecological and policy significance. As a matter of fact there is clear policy initiative for practical, transmissible and reproducible procedure for the surveillance and monitoring of biodiversity in Europe. But it requires to be emphasized that not only are checks on the effectiveness of protection in these sites necessary, but also that majority of the resources of nature conservation are outside the ambit of these sites which is only a miniscule part of the total land surface. Thus such procedures are needed to transgress the national boundaries and enabled regional monitoring programme to be part of a proposed common framework. Non availability of such framework has many demerits i)The disparity in terms of data access and operability ii) Predictability failures in general due to limited success at the specific location/site iii) Nonconformity with the common norms of assessment thus proves a bottleneck for assessment and monitoring of biodiversity services.

The genesis

Under current projection of economic development and population growth the many changes are expected to continue in this century and the growing concern and consensus among scientist and the general public that the climate change would influence habitat destruction, land use and biodiversity loss along with many other changes that are interrelated although attempt have been made to see them in isolation. Thus there is general agreement among all that biodiversity is under assault on global basis and that species are being lost at a greatly enhanced rate. The issues of survival and sustainability depend much on nature conservation that can be thought of as a movement working to develop or reassert certain values in society regarding the human-nature relationship. The modern conservation that emerged in late 19th century in response to fundamental changes in world views concerning human nature relationship, emanating from society of American East Coast and Western Europe. The movement was motivated by desire to preserve sites with special meaning for intellectual and aesthetic contemplation of nature and by acceptance that the human conquest of nature carries with it moral responsibility to ensure the survival of threatened life forms. The movement gained new momentum in the second half of the 20th century when science further expanded understanding of the society nature relationship.

Conclusion and Discussion:

Therefore the evaluation of services of biodiversity has a very broad framework of factors that it influences be it climate change or population pressure and the entire planet hence being identified as unitary unit. Under the changed global environmental policy scenario it is almost necessary to promote a framework of assessment of biodiversity with emphasis on its services could be very crucial as it would provide large inputs not only for the methods of conservation but for sustainable utilization in a real multipolar world.

Thus an attempt has been made to enquire into the services offered by biodiversity and its products. It also provides new view point for already existing dimensions of it that includes edaphic and other variables. It is argued by many that ecosystem services are affected by biodiversity that undermines its valuable services that are rendered not only in terms of value products but also the very means of survival. Thus the contrary viewpoints on this sensitive issue with regard to conservation and the problems and its consequences are desired to be addressed appropriately.

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CONSERVATION OF BIOLOGICAL DIVERSITY IN THE WORLD AND IN TURKEY

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Biological diversity or biodiversity refers to the variety of life forms: different plants, animals and microorganisms, the genes they contain, and the ecosystems they form. Humanity derives all of its food and many medicines and industrial products from the wild and domesticated components of biological diversity. Biotic resources also serve recreation and tourism, and underpin the ecosystems which provide us with many services. While the benefits of such resources are considerable, the value of biological diversity is not restricted to these.

Turkey is one of the richest areas in the middle latitudes in terms of plant diversity. The flora of Turkey is formed of 12 000 species and still a great number of species are being described. In Turkey, the rate of endemism is relatively high when compared with other European countries. While the rate of endemism is greater than 30% in Turkey, it is 14,9% in Greece, 2,9% in France, 18,6% in Spain and 0,1% in Poland. The number of endemic species in Turkey is greater than 3 000.

In this paper the term “biological diversity” is discussed and Turkey’s biological wealth is displayed. The protection methods of biological diversity and the protection efforts in global scale are described. Protection initiatives in Turkey are also discussed. Finally, the problems faced in protecting biological wealth in Turkey were evaluated and recommendations were given.

INTRODUCTION

As human activity continues to spread to the furthest corners of the earth, natural areas are changed and modified, resulting in increasing and widespread extinctions of plants, animals, and other types of species. Currently, many experts believe such extinctions are occurring at the fastest rate in human history and perhaps the fastest rate since the extinction of dinosaurs 65 million years ago. This loss of the Earth's biological diversity is said to be rapidly accelerating as desertification, deforestation (especially in the tropics), degradation of oceans and water resources, atmospheric change, and other environmental changes continue at a rapid pace. Consequences for human welfare include the loss of species that could provide future medicines, crops, and the basis for biotechnology research, as well as disrupting ecosystems that support rainfall cycles, control floods, and affect basic global systems such as climate (http://www.cnie.org/nle/crsreports/biodiversity/biodv-2.cfm, 2006).

The number of species on earth is not known. Estimates range from 5 million to over 100 million species. Some 1.5 million have been identified or studied, including plants, insects, mammals, birds, and other life forms; the great bulk of these are insects. Scientists now believe that thousands of species are being eliminated each year due to human activities. Nearly all scientists believe that the rapid and increasing loss of biological diversity occurring today is unprecedented in human history, and many argue that current extinction rates were last seen at the end of the dinosaur era (http://www.cnie.org/nle/crsreports/biodiversity/biodv-2.cfm, 2006).

Biological diversity is important to human welfare for many reasons. Agricultural crops derive from wild species, and the high-yielding hybrids of modern agriculture depend on continuing revitalization from wild genetic stock. Moreover, future crop species that could be used directly or modified by biotechnology are lost when entire ecosystems are wiped out. Plants are the basis of prescription drugs; a number of plants discovered in tropical rainforests or other wild areas have made significant contributions to treatment of serious diseases. In addition, loss of species often signals the breakdown of ecosystems that may have important roles in regulating rainfall, controlling floods, producing oxygen and storing carbon, affecting climate (regionally and globally), and providing other "ecosystem services" (http://www.cnie.org/nle/crsreports/biodiversity/biodv-2.cfm, 2006). The word 'biodiversity' or 'biological diversity' is used to refer to the richness and variety of the life on earth. The flowers, insects, bacteria, forests and coral reefs all constitute biodiversity. It embraces two somewhat different concepts; one is a measure of how many different living things there are, and the other is a measure of how different they are. Thus, the Convention on Biological Diversity, defines biodiversity as: "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part". While the definition may be clear enough, measurement of biodiversity is very complex because diversity is multi-dimensional and something that defines complex systems, and cannot be reduced to a single measure. It has become customary to address biodiversity at three hierarchical levels — genetic diversity, species diversity and ecosystem diversity (http://www.fcenter.keio.ac.jp/masakoy/awc/2005awc_azami.pdf, 2006). Genetic diversity means the variety within a species. This variety is measured by the genetic difference within a certain kind, population, variety, sub-species or race. Species diversity is described as the variety of the species in a certain region, area or the whole world. The number of species in a region (i.e., "species richness" of that region) is the measurement most frequently used in this regard. Ecosystem diversity, on the other hand, is related with the whole created by the groups of organisms that are in mutual interaction as ecological units and their physical environments (http://www.cbd.gov.tr/dosyalar/UBCSEP.doc, 2006).

CONSERVATION METHODS OF BIOLOGICAL DİVERSITY

There are two different methods that are widely accepted in the world, used in order to protect biological diversity. First of these is the "In Situ" Protection System that aims at protecting the plants within their own natural growth areas. The other system is the "Ex Situ" Protection System that envisages the protection of biological diversity features outside their natural living areas. Ex Situ method is composed of observation, gathering, storage, production and replacement, assessment, documentation, distribution and material exchange , preservation, education and cooperation and organization steps (Dokuzoğuz 1990).

In the "In Situ"system, the restricted areas where the genetic material is found are protected by minimizing the human and animal effects. The World Conservation Union (IUCN) divided the protected areas into the following categories in 1994 (Yücel 2005):

- Strick Nature Reserve
- Wilderness Area
- National Park
- Naturel Monument
- Habitat / Species Management Area
- Protected Landscape / Seascape
- Managed Resource Protected Area

Besides these categories, it is observed that countries develop others based on their regulations and institutional structure. Also, there are other protected areas like UNESCO Biosphere Reserves, World Heritage Areas, and RAMSAR Areas. While there are protected areas managed by national legislations and specific laws that belongs to the areas, at the same time, those are affected by the international conventions and agreements which are relevant with the conservation of biodiversity and natural resources, management and sustainable use of the values and sustainable development (Yalınkılıç and Yenilmez Arpa 2005).

Ex Situ conservation actions are an important complementary measure to In Situ habitat management. Ex situ conservation of wild plants is a central and unique role of botanic gardens. They have the appropriate facilities and staff expertise in botany and horticulture to be an ‘insurance policy’ against plant extinction. The Botanic Gardens ex situ program primarily employs three strategies—seed banking, tissue culture and genetic analysis of endangered plants. *Seed banking* is one of the most effective and useful ways of conserving genetic diversity ex situ, as the majority of wild plant species from dry land environments produce desiccation tolerant seeds that can be successfully stored for over 200 years. In most outbreeding species, the majority of the genetic diversity of the species may be captured by a single large seed sample. Conservation of population seed samples from these species provides insurance against loss of the wild population, whilst allowing biologists to develop germination protocols, propagation techniques etc. to support use of the species (Wyse Jackson and Sutherland 2000). *Tissue culture* is the propagation, under controlled laboratory conditions, of rare and endangered plants that are difficult to propagate from seed or whose seed does not store well. *Genetic analysis* of rare species through various techniques, including, Microsatellites, Sequencing, AFLP (Amplified Fragment Length Polymorphism and ISSR (inter-simple sequence repeats), is helping guide preservation and restoration activities (http://www.chicagobotanic.org/research/conservation/cs_exsitu.html, 2006).

PROTECTION INITIATIVES AT THE GLOBAL LEVEL

Considering the fact that effects of the pressures on biological diversity and their harmful results are at global level, it becomes obvious that the protection work should be carried out through common initiatives. The first step was taken in 1972 Stockholm Conference in this regard. One of the most important results of the Conference was that it emphasized that every human being has the right to live in a healthy environment and to participate in decision-making related with environmental protection. At the end of the Conference, United Nations Environment Programme (UNEP) was established under the United Nations. United Nations has established the World Environment and Development Commisson at its 1983 General Assembly and assigned the duty of preparing the global agenda of change to this Commission. The main theme emphasized in the Report was sustainability. At the United Nations World Environment and Development Conference held in Rio de Janerio in year 1992, twentieth anniversary of the Stockholm Conference, two principle declarations (Rio Declaration and Forest Principles) and one action plan (Agenda 21) on global sustainable development were accepted. Also, two international conventions prepared by UNEP (Climate Change Framework Convention and Biological Diversity Convention) have been opened to signature, while in year 2002 Johannesburg Conference was conducted where the Rio Conference process have been generally reviewed (Şengün and Alan 2005).

BIOLOGICAL DIVERSITY IN TURKEY

Turkey is one of the richest areas in the middle latitudes in terms of plant diversity. The main reasons for this are; climate varieties, geomorphologic and soil diversities, and the situation of the area at the junction of three flora region (Euro-Siberian, Mediterranean and Irano-Turanian). When all these factors are combined, it provides many properties for the plants to grow up and discrepant. The flora of Turkey is relatively rich (about 12 000 species) and still a great number of species are being described. In this flora, there are a lot of interesting species such as halophytic species, semi-desert plants, carnivorous plants and nickel hyperacumulators. In Turkey, the rate of endemism is relatively high when compared with other European countries. While the rate of endemism is greater than 30% in Turkey, it is 14,9% in Greece, 2,9% in France, 18,6% in Spain and 0,1% in Poland. The number of endemic species in Turkey is greater than 3000 (Figure 1, 2, 3, 4,). Verbascum and Astragalus are the genus that the rate of endemism is greater. Furthermore, there are endemic plants in genus level (Avcı 2005).

Figure 1. Centaurea tchihatcheffii (Ekim et al. 2000).

Figure 2. Onosma angustissimum

The most well-known study of the World Conservation Union (IUCN) is “Red List of Threatened Species, which was last published in 2004. This red list is accepted to be the most comprehensive source about latest status of threatened plant and animal species. IUCN cited the danger categories as 1.Extinct 2.Extinct in the wild 3.Critically endangered 4.Endangered 5.Vulnerable 6.Lower risk 7.Data deficient 8.Not evaluated (Ekim et al. 2000).

Figure 3. Allium huber-morathii

Figure 4. Astragalus angustifolius

In our country, after being completed 9 volume of Flora of Turkey as a main source in 1985, a list similar with this was started to be constituted with help of Turkish Association for the Conservation of Nature and Natural Resources and was published in 1989 with the name of "List of Rare Threatened and Endemic Plants in Turkey". After this publication, more and more floristic studies –especially the project investigating endemic plants of Turkey in detail, supported by DPT and TUBITAK- showed that some data in the first list should be changed or at least could be updated. Thereupon "Red Data Book of Turkish Plants" which was prepared and published in 2000 became a national list using new threat categories of IUCN.

This source is important in the sense that it shows Turkey's biological diversity and the status of species in terms of the danger categories. In order to protect biological diversity it is necessary to know about it and to create its database. In this study 3504 endemic and 1096 rare plants were assessed and listed in accordance with appropriate danger categories. According to this list, 46,6% of 3504 endemic plants (1633), and 77,4% of 1096 rare plants (848) is under threat. On the other hand, 13 plant takson in total, of which 12 was endemic, and one was rare, already extinct. While 270 endemic and 244 rare plant takson could not be placed under a danger category because of lack of data and were listed under DD-Data deficient category (Uzun et al. 2005).

CONSERVATION OF BIOLOGICAL DIVERSITY IN TURKEY

Protection initiatives in Turkey are mostly in the form of in situ protection. There are various protected areas in Turkey which are under different institutions' authority and supervision and defined under certain laws. There are 36 National Parks, 34 Natural Protection Areas, 102 Natural Statutes and 17 Natural Parks defined under National Parks Laws. In accordance with Land Hunting Law, 88 areas of Protection and Development of Wild Life were determined.

Under the Law on Forestry, the following areas were brought under protection: 54 areas as Protection Forests and 193 areas as Gene Protection Forests (Yalınkılıç and Yenilmez Arpa 2005). With the Law on Protection of Cultural and Natural Assets 188 urban sites, 125 historical sites, 5278 archeological sites and 831 natural sites were declared (Yücel 2005). Within the framework of "the Protocol on Biological Diversity and Special Protection Areas in Mediterranean", which is one of the Barcelona Convention protocols, 14 areas were announced as Special Environmental Protection Area, while 9 areas were determined as Ramsar area, in accordance with Ramsar Convention. According to the Convention on World

Heritage Areas, there are 7 areas listed as World Heritage Areas in Turkey. Additionally, there is one Biosphere Reserve Area in our country, which is registered by UNESCO (Yalınkılıç and Yenilmez Arpa 2005). Botanic gardens, which are the most significant applications of Ex situ protection methods, have been newly developing in our country. The first botanic garden to be established in Turkey is Istanbul University, Alfred Heilbronn Botanic Garden. It was established in 1935 under Istanbul University, Faculty of Applied Sciences, Department of Botany and it was given its current name in 2003. In this garden, there are 5 thousand genus and 6 thousand species belonging to 127 families, which are endemic and foreign homed. There are also seed banks and herbarium units in the garden. "Istanbul Botanic Garden Seeds Catalog was published" for the first time in 1935. The garden has been exchanging seeds with 373 botanic gardens from 63 countries. Istanbul University, Center for Research and Application of Natural Resources, established in relation with the Botanic Garden, aims at preventing the loss of rare and epidemic species of Turkish plant possessions by making them live in appropriate areas and conservatories (http://www.istanbul.edu.tr/iletim/80/haberler/u4.htm 2006).

The other important botanic gardens in Turkey, which carry out studies along the same lines, are Ankara University Botanic Garden, Ege University Botanic Garden, Çukurova University Botanic Garden and Nezahat Gökyiğit University Botanic Garden. Also, there are Süleyman Demirel University Botanic Garden, Gaziantep University Botanic Garden and Harran University Botanic Garden which are in the process of establishment.

CONCLUSIONS AND RECOMMENDATIONS

- Protection of nature and biological diversity is a global issue. Thus, main solutions should be searched at the global scale although there might be differences needed because of the features of the country and area. Today, a lot of countries come together and take common decisions aimed at environmental protection. Turkey is also a country who has her signature on various international treaties and tries to apply decisions taken for environmental protection. However, there are significant deficiencies in terms of conveying the decisions to the related institutions and agencies and at the application stages. It is necessary that opinions of related agencies are taken and they are informed about the aftermath sanctions of the treaties, before signing every international convention.
- It is an important problem that the protected areas are under different institutions' authority and responsibility and they are classified in accordance with different principles. There are found an excessive number of legal base for these areas and in practice, it is observed that laws and institutional duties clash. In order to provide for the full protection of these areas, inter-institutional cooperation and exchange of information, as well as clear definitions of authority and responsibility boundaries are needed.
- In Turkey, there are a large number of threats even in protected areas of various statuses. Especially, pressures of tourism are felt in these areas as well. Although there are certain rules about protection of these areas; lack of audits, insufficient number of staff with necessary training and irresponsible use by the people results in difficulties in protection. It is imperative that there should be sufficient number of trained staff, audits should be carried out in necessary intervals and with enough care and that people should be informed about how to use these areas.

- Botanic gardens, which are important in protection of rich natural flora of Turkey - especially those endemic ones - and for their transfer to future generations, should be developed. There should be established a National Botanic Garden that should carry work in collaboration with all other botanic gardens and it should assume the leading role. While equipping the existing botanic gardens with more facilities, especially in areas with rich biodiversity there should be established new ones. The role of botanic gardens in the efforts for the protection of biodiversity should be increased and their means for conducting scientific research and creating consciousness among people should be expanded. Within the botanic gardens, seed banks and herbariums should be developed in order to keep the alive and dried samples of protected plants.
- In order to protect biological diversity, first of all, material should be well known. In Turkey, there are still areas whose flora has not still been studied yet. Throughout the country, priority should be given to botanical research and enough resources should be provided for that. In "Red Data Book of Turkish Plants" de the endangered rare and endemic plants of Turkey are classified according to the IUCN categories. In this classification, however, because of lack of data some plants were listed under DD-Data deficient category. Only after evaluating the results of the studies conducted about these plants, this resource can be developed.
- Another method for protection of endemic species and prevention of their extinction is to make use of these plants in gardens and other living environments of people. By doing so, there would be an important step taken for increasing people consciousness. As people spend more time with natural plants, their protection motives and knowledge would certainly increase. However, providing the material for growing endemic and rare plants in gardens is an important issue. Seeds of the endangered plants should not be collected from the nature but should be provided from the seed banks if they have been collected before. If their seeds have not already been collected they should be taken from the nature by the specialized staff in necessary amounts and should be reproduced by making their cultures.
- For many years, flower bulbs and plants like Thymus and Salvia which have economic value have been being ripped out from the nature and being traded. Measures have been taken to some extend with the Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES) signed in 1973 and the Regulation on Ripping out, Production and Trade of the Natural Flower Bulbs, prepared by the Ministry of Agriculture in 2004 based on that Convention. However, the inspections should be stricter and their ripping out from the nature should be ceased altogether. The reason for illegal ripping is economic insufficiencies. Encouraging production by providing the main material and giving the appropriate support, would help solve the economic problems.
- It is important that government play the leading role with all of its institutions in the field of natural protection. However, people's participation is extremely important for providing complete protection. It is necessary that our biological wealth should be introduced and the expected results if these left unprotected should be told to people, and their awareness should be increased in all aspects. In this regard collaborative work of non governmental organizations and universities is important.

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SHOULD (EUROPEAN) TREES HAVE STANDING? IMPROVING ACCESS TO THE COMMUNITY JUDICATURE THROUGH IMPLEMENTATION OF THE AARHUS CONVENTION

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On 6 September 2006, the European Community adopted Regulation 1367/2006 in order to apply the Aarhus Convention on *Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters* to the institutions and bodies of the European Union. The purpose of the Aarhus Convention was to improve environmental protection through the promotion of environmental democracy. Its *modus operandi* involves a "three-pillared" approach comprising principles of public access to information, public participation and public access to justice in matters concerning the environment. Although the European Community has implemented a number of instruments to ensure the compliance of its Member States with the Convention, it has been slower to enact legislation applicable to its own institutions. Access to justice in the Community Courts regarding environmental matters, has proved particularly problematic because of restrictive *locus standi* requirements under the EC Treaty. This paper outlines how such requirements can constitute an obstacle to environmental justice in Europe and examines whether the new EC Regulation has the potential to overcome this obstacle. More specifically, it questions the appropriateness of the instrument's focus on environmental non-governmental organisations (as opposed to the public *per se)* as the natural mouthpiece for the "voiceless" environment.

The question of who will represent environmental interests in litigation to ensure State adherence to the Rule of Law has long been a matter of concern. Environmental interests cannot be easily categorised as private or public. They can create rights for individuals but are also "diffuse, collective and fragmented". The conceptual difficulty linked to providing legal protection for the Environment is perhaps caused by the anthropocentric assumptions of law enforcement. A law creates a legal interest for an individual, upon which he or she can litigate, thus creating an incentive for compliance. However, the capacity to litigate does not exist for the "voiceless" Environment and future generations. (Indeed the title of this paper is inspired by an essay originally published in 1972 by Christopher D. Stone entitled "*Should Trees Have Standing? Toward Legal Rights for Natural Objects"*, which advocated conferring legal rights on the Environment itself independent from proprietary/human interests[21]). The difficulty however comes in locating a mouthpiece for these environmental legal interests. The international community has signaled its position that the Environment's best advocate is the public. However, as will be seen, the EC is a long way from adopting a system of public interest litigation.

Introduction

On 6 September 2006, the European Community adopted Regulation 1367/2006[22] in order to apply the Aarhus Convention on *Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters*[23] to the institutions and bodies of the European Union. The purpose of the Aarhus Convention was to improve environmental protection through the promotion of environmental democracy. Its *modus operandi* involves a "three-pillared" approach comprising principles of public access to information, public participation and public access to justice in matters concerning the environment. Although the European Community has implemented a number of instruments to ensure the compliance of its Member States with the Convention, it has been slower to enact legislation applicable to its own institutions. Access to justice in the Community Courts regarding environmental matters, has proved particularly problematic because of restrictive *locus standi* requirements under the EC Treaty. This paper outlines how such requirements can constitute an obstacle to environmental justice in Europe and examines whether the new EC Regulation has the potential to overcome this obstacle. More specifically, it questions the appropriateness of the instrument's focus on environmental non-governmental organisations (as opposed to the public *per se)* as the natural mouthpiece for the "voiceless" environment.

The question of who will represent environmental interests in litigation to ensure State adherence to the Rule of Law has long been a matter of concern. Environmental interests cannot be easily categorised as private or public. They can create rights for individuals but are also "diffuse, collective and fragmented"[24]. The conceptual difficulty linked to providing legal protection for the Environment is perhaps caused by the anthropocentric assumptions of law enforcement. A law creates a legal interest for an individual, upon which he or she can litigate, thus creating an incentive for compliance. However, the capacity to litigate does not exist for the "voiceless" Environment and future generations. (Indeed the title of this paper is inspired by an essay originally published in 1972 by Christopher D. Stone entitled "*Should Trees Have Standing? Toward Legal Rights for Natural Objects"*[25], which advocated conferring legal rights on the Environment itself independent from proprietary/human interests[26]). The difficulty however comes in locating a mouthpiece for these environmental legal interests. The international community has signaled its position that the Environment's best advocate is the public[27]. However, as will be seen, the EC is a long way from adopting a system of public interest litigation.

[22] EC Regulation No 1367/2006 of the European Parliament and of the Council of 6 September 2006 *on the application of the provisions of the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters to Community Institutions and bodies*, OJ L 264/13

[23] The United Nations Economic Commission for Europe (UNECE) Convention on *Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters* adopted on 25 June 1998 in the Danish city of Aarhus (Århus)

[24] Ebbesson, *Access to Justice in Environmental Matters in the EU*, Kluwer Law International, 2002

[25] Stone, *Should Trees Have Standing? Toward Legal Rights for Natural Objects*, 45 Southern California Law Review 450 (1972)

[26] Significantly, Stone's treatise was favourably cited in the famous dissenting judgment of Justice William O'Douglas in the US Supreme Court case of *Sierra Club v. Morton* 405 U.S. 727 (1972) where the applicant was found to lack standing to challenge a permit granted to Walt Disney Enterprises for the construction of a ski resort in Mineral King Valley.

[27] See for example article 10 of the Rio Declaration on *the Environment and Development* and its elaboration in the Aarhus Convention (*supra* n. 2)

1. Environmental "Rule of Law" Litigation in the European Community

1.1 Rigidity of the Plaumann criteria

Article 230 (4) EC provides that legal or natural persons who are not the addressees of a decision by a Community institution, can only challenge its legal validity, where it is of *direct and individual* concern. The European Court of Justice has interpreted these conditions in such a way as to deny *locus standi* to environmental associations and individuals challenging measures of public interest. The restrictive approach was established in the case of *Plaumann v. Commission*[28] which found that persons will only be "individually concerned":

"If that decision affects them by reasons of certain attributes which are *peculiar* to them or by reasons of circumstances in which they are *differentiated* from all other persons and by virtue of these factors distinguishes them individually just as in the case of the person addressed."

The Court's conception of individual concern is subject to a further limitation in the requirement that the measure in question does not take effect by virtue of an objective legal or factual situation. Accordingly, in the judgment of *Arnaud and Others v. Council*[29], it was noted that:

"…the Court has consistently held that the possibility of determining more or less precisely the number or even identity of the persons to whom a measure applies by no means implies that it must be regarded as being of individual concern to them, as long as it is established that such application takes effect by virtue of an objective legal or factual situation defined by the measure in question"[30].

These conditions have been construed so strictly that in *Marie Therese et al*[31], the Court of First Instance held that applicants who suffered personal damage from the harmful effects of nuclear testing were not "individually concerned" for the purposes of article 230 (4) EC, because the damage caused affected everyone in the same geographic area. It might be said that this conception of individual concern effectively bars the possibility of judicial review of those Community measures which most gravely affect the environment. The greater the environmental damage caused, the more people affected, yet conversely the less chance of *locus standi* being granted to those who wish to challenge the decision.

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[28] Case C - 25/62, *Plaumann & Co v. Commission*, [1963] ECR 95
[29] Case C-131/92 *Arnaud and others v. Council* [1993] ECR I-2573
[30] *Idem* at para.13
[31] T-219/95R, *Marie-Therese Danielsson et al*, [1995] ECR :II 3051. Also cited in Ebbesson (*supra* n. 3)

Stichtung Greenpeace: An Attempt to Differentiate the Situation of the Environment

The *Plaumann* criteria were established before the principles of environmental protection made their way into primary Community law. In *Stichtung Greenpeace v. Commission*[32], the Court was presented for the first time with the opportunity to adjudicate on the definition of individual concern in the context of environmental protection. The case concerned an action for the annulment of a Commission decision to grant Spain financial assistance from the European Regional Development Fund for the construction of two power stations in the Canary Islands. The works in question were commenced without a prior environmental impact assessment, in possible contravention of Directive 85/337 EEC. The applicants comprised both associations and private individuals and argued that the *Plaumann* criteria should be reconsidered in this particular context of environmental and health protection.

The Court of First Instance dismissed the case on grounds of inadmissibility. It considered that the private individual litigants had not relied on any attribute "substantially distinct from those people who live or pursue an activity in the areas concerned[33]" in order to establish individual concern. With respect to the applicant associations, the Court of First Instance stated that it is established case-law that an association formed for the protection of the collective interests of a category of persons cannot be considered as directly and individually concerned by a measure "affecting the general interests of that category, and is therefore not entitled to bring an action for annulment where its members may not do so individually"[34].

On appeal, the appellants argued that because the interest of environmental protection is shared by everyone, the "closed class" of litigant required by the *Plaumann* formula would create a legal vacuum for environmental protection. However the Court of Justice endorsed the Order of the CFI to the effect that the action was inadmissible. In its judgment, it justified the finding on the ground that such a denial of admissibility would not mean an absence of any judicial protection for rights under the EIA Directive. This could be provided by actions before national courts which could, if need be, refer a question to the Community Court for a preliminary ruling.

The decision was a disappointing one for environmentalists. Indeed the relegation from Community court to national court, of the duty to ensure judicial protection has since been criticised in the Opinions of Advocates General and in some judgments of the CFI. In his Opinion in the case of *Union Pequenos Agricultores (UPA)*[35], Advocate General Jacobs considered that article 234 (on preliminary references from national courts) does not always provide effective judicial protection against general measures and that direct action pursuant to article 230 EC is more appropriate for actions involving the *validity* of measures as opposed to their *interpretation.* He opined that there must be a change in the case-law on individual concern in order to provide effective judicial protection to individuals who are directly, but not individually, concerned by a Community decision or regulation but would otherwise be denied a judicial remedy through indirect proceedings in their national courts[36].

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[32] Case C-321/95P, *Stichting Greenpeace v. Commission* [1998] ECR I-1651

[33] Case T-585/93, Stichtung Greenpeace v Commission [1995] ECR II-2205, para.54. For further discussion, see Kramer, *Casebook on Environmental Law*, Hart Publishing, 2002 p.406

[34] *Idem.* para.59

[35] Opinion of Advocate General Jacobs in Case C-50/00 *Union de Pequenos Agricultores v Council* [2002] I-06677

[36] *Idem* pt.59

Accordingly, AG Jacobs suggested a new interpretation of individual concern, whereby "a person is to be regarded as individually concerned by a Community measure where, *by reason of his particular circumstances, the measure has, or is liable to have, a substantial* ***adverse effect*** *on his interests.*[37]" This is a much larger conception of individual concern which arguably dispenses with the requirement that an individual applicant be differentiated from all others affected by the general measure in question.

In *Jego-Quere*[38], the CFI also favoured liberalization of standing requirements with an approach whereby the applicant must show that the impugned measure "affects his legal position, in a manner which is both definite and immediate, by restricting his rights or by imposing obligations on him. The number and position of other persons who are likewise affected by the measure, or who may be so, are of no relevance in that regard."[39]

Although the Court of Justice followed neither the CFI nor AG Jacobs in its judgments in *UPA*[40] and *Jego-Quere*[41], these overtures to liberalization are indicative of possible fluctuation in the interpretative approach of the Community judicature. Generally speaking, these cases dampened hopes for a radically new interpretation of article 230 (4) EC, but nevertheless left the door ajar for a more liberal approach to *locus standi* in environmental matters.

1.3 The Proposed Treaty establishing a Constitution for Europe

The proposed Treaty establishing a Constitution for Europe (which was rejected in referenda in both France and the Netherlands) also included a less restrictive standing requirement for article 230 actions. Article III-365(4) reads:Any natural or legal person may, under the conditions laid down in paragraphs 1 and 2, institute proceedings against an act addressed to that person or which is of direct and individual concern to him or her, and against a regulatory act which is of direct concern to him or her and does not entail implementing measures.

The provision would liberalise standing to the extent that individual concern would no longer be required where (i) the measure is "a regulatory act", (ii) it is of direct concern to the applicant and (iii) it does not entail implementing measures (direct concern). However, it leaves unchanged the position in the context of legislative acts where the applicant still has to overcome the "high hurdle of proving individual concern[42]" As explained by Tridimas, this revision continues to endorse a decentralised model of access to justice and continues to view access of individuals to the ECJ as exceptional[43]. Accordingly, as argued by Tridimas this Treaty amendment solves some of the "Jego-type" injustices but nonetheless fails to provide an adequate judicial review mechanism.

[37] *Idem* Pt.60
[38] Case T-177/01, *Jego-Quere et Cie SA v. Commission*
[39] *Idem* Para.51
[40] Case C-50/00 *Union de Pequenos Agricultores v Council* ECR [2002] I-06677
[41] Case C- 263/02 *Commission v. Jego-Quere* ECR [2004] I-03425
[42] Tridimas, *The European Court of Justice and the Draft Constitution: A Supreme Court for the Union?* Research Papers in Law 8/2003, European Legal Studies - College of Europe
[43] *Ibid* at page 15

The relaxation or removal of the requirement of individual concern, as forwarded by Advocate General Jacobs, the Court of First Instance and the proposed Treaty for a Constitution for Europe would certainly be to the benefit of environmental organizations in certain types of litigation. However, it remains the case that even these proposals remain anthropocentric in nature and would fall short of satisfying international obligations under the *Aarhus Convention* as will be explained below.

2. Community implementation of the "Third Pillar" of Aarhus

2.1 The Access to Justice Provisions of the Aarhus Convention

The United Nations Economic Commission for Europe (UNECE) Convention on Access to Information, Public Participation in decision-making processes and Access to Justice in Environmental matters (hereinafter the *Aarhus Convention*) was signed on 25 June 1998 and entered into force in October 2001. It seeks to provide for "three pillars" of democratisation of environmental protection, comprising information, participation and litigation rights. Under *Aarhus*, access to justice concerns the right to challenge decisions by public authorities which have been made without respecting:

(a) rights flowing from the first two pillars (access to information and public participation in decision-making processes) or,
(b) environmental law in general.

Recital 7 states that the Convention recognises:

> "every person has the right to live in an environment adequate to his or her health and well-being, and the duty, both individually and in association with others, to protect and improve the environment for the benefit of present and future generations'.

Recitals 8 and 18 explain that:

> In order "to be able to assert this right and observe this duty, citizens must have … access to justice in environmental matters" (Recital 8) and that effective judicial mechanisms should be accessible to the public, including organizations, so that its legitimate interests are protected and the law is enforced" (Recital 18)

More specifically, article 9(3) requires:

> "each Party [to] ensure that, where they meet the criteria, if any, laid down in its national law, members of the public have access to administrative or judicial procedures to challenge acts and omissions by private parties and public authorities which contravene provisions of its national law relating to the environment."

The EC ratified the Convention on 17 February 2005[44]. Thus far, the Community has gone a long way towards implementing the Convention into secondary law, with regard to enforcing the obligations of Member States[45]. However, the implementation process at a Community level has proved more tardy and piecemeal. Implementation of the access to justice pillar at Community level is a formidable task as any change to the Community legal order would require more than the adoption of secondary legislation; it would in fact involve Treaty revision. Although Regulation 1049/2001[46] provided for public access to documents at EC

[44] Council Decision 2005/370/EC, OJ L 124, 17.5.2005, p. 1
[45] Directive 2003/4/EC of the European Parliament and of the Council of 28 January 2003 *on public access to environmental information and repealing Council Directive 90/313/EEC,* OJ L 41, 14.2.2003, p. 26.
[46] Regulation (EC) No 1049/2001 of the European Parliament and of the Council of 30 May 2001 *regarding public access to European Parliament, Council and Commission documents,* OJ L 145, 31.5.2001, p. 43.

level, it wasn't until the recent enactment of Regulation 1367/2006 (which brings change in the rules of procedure of the institutions and bodies of the Community and becomes applicable on 28 June 2007) that a substantial legislative implementation at a Community level of the access to justice pillar of *Aarhus* commenced.

2.2 The Envisaged Solution under Regulation 1367/2006

The new Regulation aims to improve access to justice by providing for administrative and judicial review upon application from non-governmental organizations. The process envisaged under Title IV of the Regulation is to allow administrative acts (with legally binding and external effects) or omissions (where there is an obligation to adopt an administrative act under environmental law), to be open to a possible *"internal review"*[47]. This internal review can be requested by NGOs which meet certain requirements within a six week time-limit[48]. The institution or body is then required to consider such a request (unless it is clearly unsubstantiated), and to state its reasons in writing not later than 12 weeks after receipt of the request. In the case of delay, the institution or body must inform the relevant NGO as soon as possible and reply within a time limit of 18 weeks .

Where an NGO has made such a request for internal review, it may institute proceedings before the Court of First Instance. Nevertheless, this must be done "in accordance with the relevant provisions of the Treaty."

Importantly, the NGO is required to conform to a number of criteria. It must be:

- an independent non-profit-making legal person[49],
- Have as a primary stated objective the promotion of environmental protection in the context of environmental law
- Have existed for more than two years and be actively pursuing the abovementioned objective,
- Its objective and activities must cover the subject matter in respect of which the request for internal review is made.

Conclusion: Comments and Analysis

It is clear that even now, there is no complete system of judicial checks and remedies at Community level for public interest matters such as environmental protection. The new Regulation is in no way revolutionary as it does not create a new right of recourse to the Community Courts, nor does it create a new category of article 230 litigant *extra legem.* The Treaty requirement of individual concern continues to prevail, however by increasing the role of the NGO in the review process, the Regulation would appear to help it achieve this standing requirement. As regard the length to which the Regulation goes in satisfying public access to justice, there is a number of things to consider. One issue of particular importance is the focus on the environmental NGO as representative of the public. The administrative and judicial review mechanisms provided for in the Regulation apply not to the public *per se,* but rather to non-governmental organisations with environmental protection as their objectives. In this respect, it is useful to reexamine the *Aarhus* definitions of the word "public"

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[47] Recital 11 of Regulation (EC) 1367/2006 *supra* n.1

[48] Such a request must be made in writing and within a time limit not exceeding six weeks after the administrative act was adopted, notified or published, whichever is the latest, or, in the case of an alleged omission, six weeks after the date when the administrative act was required. The request shall state the grounds for the review. (Article 10 of Regulation 1367/2006 *supra* n.10)

[49] The requirements for legal personality and non-profit-making status are determined by the Member State's law or practice, article 2 of Regulation (EC) 1367/2006 *supra* n.1

Pursuant to article 2(4) of the Convention, "public" is defined as:"one or more natural or legal persons ***and***, in accordance with national legislation or practice their associations, organizations or groups." [emphasis added] Similarly, Recital 18 of the Convention states that "…effective judicial mechanisms should be accessible to the public, ***including*** organizations**,** so that its legitimate interests are protected and the law is enforced" [emphasis added]."
This conception of "public" would therefore appear to be *inclusive* as opposed to *constitutive* of such organisations.

It is submitted that relegation of all public interest representation to non-governmental organisations in this domain has the potential to render a disservice to both the public and the Environment. The recognition by the Aarhus Convention of the *role* of NGOs in public participation was important in so far as such entities often have the expertise, finance and organisation to facilitate smoother public involvement. However, the NGO would be better seen as supporting rather than constituting the public. There are certain situations where a group of individuals or citizen *ad hoc* initiative would prove more adept to responding to a particular environmental problem. The requirement under the Regulation of legal personality and of being in existence for two years would foreclose such groups from advocating on the part of the Environment. There are a number of other details in the Regulation which could prove problematic. The time-limit in requesting a review would present an obstacle to challenging the cause of environmental damage where the effects take longer to eventuate. In addition, the requirement that the objective and activities of the NGO cover the subject-matter of the review, would seem stagnant in nature. A more progressive approach to the implementation of the *Aarhus* Convention would recognise that environmental legal protection needs to be responsive to often rapid advances in science and technology. Environmental law is known to operate on the basis of precaution. In order to stay dynamic and relevant, an environmental NGO may need to change the focus of its activity over time.

Interestingly, there is a concerted effort in the Regulation to refer to the implementation process of the Aarhus Convention by the Community as an evolving and continuous process[50] and to describe the objective of the Regulation as a *contribution* to that process[51]. It might be said that the instrument is a mere step towards greater access to justice. However, the hurdle of individual concern will remain in place so long as the Treaty is not revised. Furthermore, the parallel implementation measures adopted by the Community but addressed to Member States (see for example Directive 2004/3) clearly focus on the environmental NGO for compliance with *Aarhus.*

Although the Regulation has the clearly laudable objective of implementation of *Aarhus*, it is important to understand its limitations in order to consider new ways for the Community to improve environmental democracy and in particular the environmental rights to litigate under European Community law.

[50] See Recital 4 of Regulation (EC) 1367/2006 *supra* n.1: *The Community has already adopted a body of legislation, which is evolving and contributes to the achievement of the objectives of the Aarhus Convention. Provision should be made to apply the requirements of the Convention to Community institutions and bodies.*
[51] Article 1 *ibid*

IN VITRO SHOOT REGENERATION OF IRONWORT (SIDERITIS STRICTA BOISS & HELDR.)

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Cultural procedures to improve *in vitro* shoot regeneration for ironworth (*Sideritis stricta* Boiss & Heldr.), an endemic of the Medditerrenian coasts are presented. Leaf segments and shoot explants (hypocotyl, single nodal segment and shoot tip) taken from *in vitro* growing plantlets and cultured on Murashige and Skoog (MS) (Murashige and Skoog, 1962) and Gamborg (B5) (Gamborg et al., 1968) media supplemented with combination of benzyl adenine (BA) (0.0, 1.0, 2.0 or 3.0 mg. L^{-1}) and naphtalene acetic acid (NAA) (0.0, 0.1 or 0.5 mg. L^{-1}) together with %3 sucrose and gelled with %0.6 agar. Cultures were incubated for 4 weeks in a growth chamber at 25 ± 2 °C under a 16-h light/ 8-dark photoperiod (40 µmol. m^{-2}.sn^{-1} light intensity). The single nodal segments were the most succesful explant in all hormone combinations used. B5 medium supplemented with 1.0 mg. L^{-1} BAP + 0.1 mg. L^{-1} NAA and 1.0 mg. L^{-1} BAP + 0.1 mg. L^{-1} NAA was the most effective media for shoot formation. However for all explants, MS medium with all phytohormone combinations had no effective success and therefore were not suitable on *in vitro* shoot regeneration.

Introduction

Plant belonging to *Sideritis* L. genus (*Lamiaceae*) are represented by 54 taxonand %74 of them are endemic (Davis et al., 1988). *S. stricta* is an endemic which grows in limited area of the Medditerrenian coasts.

Endemic plants greatly contribute to the richness and diversity of the flora of countries. There was a growing interest worldwide in medicinal and araomatic plants (Bajaj et al., 1988). Conservation of endemic, endangerd, medicinal and araomatic plants is beyond regional scope and becomes of global signifigance (IUCN, 2001). They should be protected by different methods including *in vitro* culture. *In vitro* propagation is a suitable method for plant regeneration, micropropagation and long-term storage of plant material. There is a few information about *in vitro* culture of *Sideritis* species in the current literature (Yürekli and Baba, 1995; Faria et al., 1998). Some species of these plants are well known in Anatolian folk medicine and widely used as herbal tea (Baytop, 1983; Kırımer et al., 1997; Kırımer et al. 1999; Aytaç and Aksoy, 2000; Tanker et al., 2004). They are of great economic importance which is not only related to their use as folk medicine and herbal tea. In fact, as recent studies have pointed out, ironworth is used traditionally in many other ways as their essential oils have antimicrobial, and antioxidant properties (Villar et al., 1986; Alcaraz et al., 1989; Palomino et al., 1996; Navarro et al., 2001; Koleva et al., 2002). This work attempts to develop procedure for *in vitro* shoot regeneration of this species.

Materials and Methods

Seeds of *S. stricta* were collected from a natural habitat in Antalya and were sterilized by immersion for 25 min in 10% sodium hypochlorite (NaOCl), then rinsed three times with sterile water. MS and B5 hormone-free media were used for seed germination *in vitro*. Seeds were germinated in a growth chamber at 25 ± 2 °C, continuously dark conditions. At the end of this period seedlings were incubated for 30-40 days under a 16-h light/ 8-h dark photoperiod (40 µmol. $m^{-2}.sn^{-1}$ light intensity) in the same media and conditions (Figure 1). Hypocotyl, shoot apex, leaf segments and single nodal segments excised from these seedlings (Figure 2) were cultured on MS and B5 media supplemented with BA (0.0, 1.0, 2.0 or 3.0 mg. L^{-1}) and NAA (0.0, 0.1 or 0.5 mg. L^{-1}) combinations, 3% sucrose and 0.6% agar. Incubation conditions were the same as indicated for seedling development. The experiments were set up in a completely randomized design. Data were analyzed by analysis of variance (ANOVA) to detect signifigant diferences between means (Sokal and Rohlf, 1995). Means differing significantly were compared using Duncan’s multiple ragne test (DMRT) at the 1 % porbability level.

Figure 1. 30-40 days old seedlings of *S. stricta* cultured on MS medium.

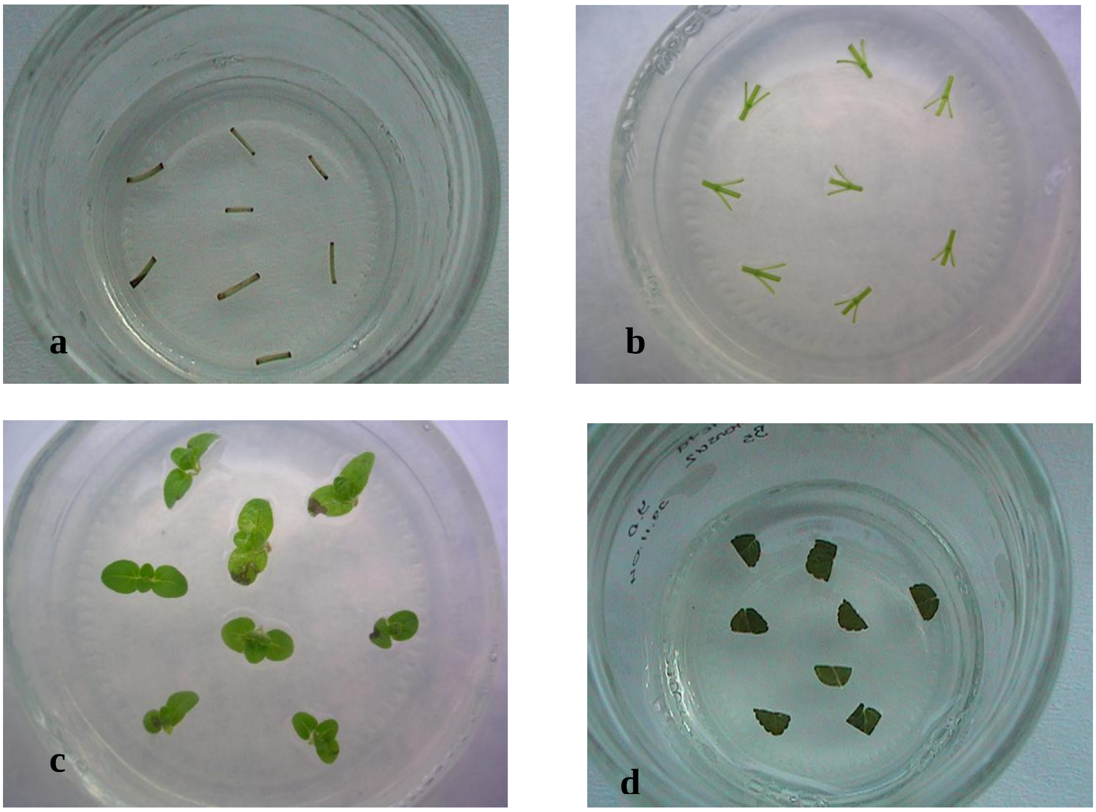

Figure 2. Explants excised from seedlings of *S. stricta*: hypocotyl (a), single nodal segments (b) shoot apex (c) and leaf segments (d).

Results and Discussion

Seeds cultured B5 hormone-free medium were 100% germinated. The influence of different BAP and NAA cominations of B5 medium and various explant types on shoot differentiation of *S. stricta* are given in Table 1. Single nodal segments are the best source for the highest shoot induction (3-4 shoot/ explant) (Table 1, Figure 3). However for all explants types this phytohormones combination and MS medium had no effective success and therefore were not suitable on *in vitro* shoot regeneration.

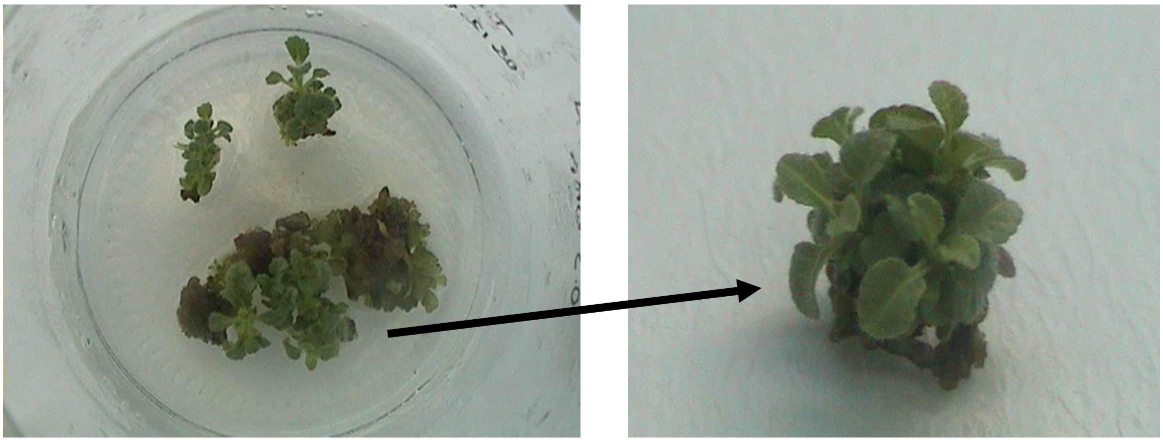

Figure 3. Shoot regeneration from single nodal segments of *S. stricta* on B5 medium supplemented with 1.0 mg. L^{-1} BAP + 0.1 mg. L^{-1} NAA.

Tablo 1. Influence of different BAP and NAA combinations of B5 medium and various explant types on shoot formation of *S. stricta*

Explant	BAP ($mg.\ L^{-1}$)	NAA ($mg.\ L^{-1}$)	Number of explant	Mean number of shoot / explant	Mean number of shoot/ shooted explant	Shooted explant (%)
hypocotyl	0.0	0.0	30	--	--	--
	1.0	0.0	30	--	--	--
	1.0	0.1	30	--	--	--
	1.0	0.5	30	--	--	--
	2.0	0.0	30	--	--	--
	2.0	0.1	30	--	--	--
	2.0	0.5	30	--	--	--
	3.0	0.0	30	--	--	--
	3.0	0.1	30	--	--	--
	3.0	0.5	30	--	--	--
Mean			**30**	**--**	**--**	**--**
single nodal segments	0.0	0.0	30	1.25 (50) ± 0.086 **a***	1.25 (50)	100
	1.0	0.0	30	0 (0)	0 (0)	0
	1.0	0.1	30	4 (160) ± 0.14 **d**	4 (160)	100
	1.0	0.5	30	3 (120) ± 0.10 **c**	3 (120)	100
	2.0	0.0	30	1(40) ± 0 **a**	1(40)	100
	2.0	0.1	30	1 (40) ± 0 **a**	1 (40)	100
	2.0	0.5	30	4 (160) ± 0.14 **d**	4 (160)	100
	3.0	0.0	30	2 (80) ±0.12 **b**	2 (80)	100
	3.0	0.1	30	0 (0)	0 (0)	0
	3.0	0.5	30	1 (40) ± 0 **a**	1 (40)	100
Mean			**30**	**1.725**	**1.725**	**80**
shoot apex	0.0	0.0	30	--	--	--
	1.0	0.0	30	**--**	**--**	**--**
	1.0	0.1	30	0.5 (20) ± 0 **e**	1 (20)	50
	1.0	0.5	30	--	--	--
	2.0	0.0	30	--	--	--
	2.0	0.1	30	--	--	--
	2.0	0.5	30	--	--	--
	3.0	0.0	30	--	--	--
	3.0	0.1	30	--	--	--
	3.0	0.5	30	--	--	--
Mean			**30**	**0.05**	**0.1**	**5**
leaf segments	0.0	0.0	30	--	--	--
	1.0	0.0	30	--	--	--
	1.0	0.1	30	--	--	--
				--	--	--
	2.0	0.0	30	--	--	--
	2.0	0.1	30	--	--	--
	2.0	0.5	30	--	--	--
	3.0	0.0	30	--	--	--
	3.0	0.1	30	--	--	--
	3.0	0.5	30	--	--	--
Mean			**30**	**--**	**--**	**--**

Numbers in the bracets () represent total shoot numbers.
*Means having different letters in same column are significantly different from each other ($p<0.01$) according to Duncan's multiple range test.
-- Non observation

The influence of NAA and BAP individually and combinations on shoot induction *in vitro*, seems to be general phenomenon (Celloreva, 1992; Kumari and Saradhi, 1992; Yürekli and Baba, 1995; Faria et al., 1998; Iyer and Pai, 2000; Minnas; 2001; Tepe et al., 2002). BAP was found to be the most efficient in promoting shoot regeneration as in Ayan et al. (2005) study's and micropropagation quantified by number of shoot/explant was higher in the presence of high BAP and low NAA concentrations therefore micropropagation was BAP-dependent. *In vitro* shoot formation may be subjected to change depending upon the explant types used (Zobayed and Saxena, 2003) Our results confirm those of Celloreva (1992), Iyer and Pai (1998, 2000) showing the achievement the shoot induction from nodal segments, that is the best source for the highest shoot induction. Similarly changeable response to shoot induction media from different explants was reported by different resaerchers (Gupta and Conger, 1998; Zobayed and Saxena, 2003; Ayan et al., 2005). In our study B5 medium had more effective success than MS medium. This shows that the importance of strength of the nutrient medium and the salts content of the MS medium may be toxic or excess for some species (Werbrouck and Debergh, 1994). This is the first report on clonal propagation of *S. stricta*. Propagating *S. stricta in vitro* can ensure a continious supply of enough plant material for further experiments on phytochemical studies.

Acknowledgements
This work was supported by a grant from Hacettepe University Research Foundation.

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BIODIVERSITY OF THE SPECIES BELONGING TO TRIGONELLA L.

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One should widely use leguminous plants for the improvement of the feeding quality of natural pastures, hayfields and for enlarging the grass stableness with the plants having good feed quality as well. Particularly leguminous plants play important role in the creating of pastures, hayfields and shift (planting) systems. One of such important plants are the species of Trigonella L. genus which belong to Fabaceae Lindl. Trigonella L. has 75 species in the world, 23 of them are in Caucasus, and 20 – in Azerbaijan. The species of Trigonella L. have fodder, herb, ornamental plant, technical and agricultural plants. In Azerbaijan only annual and biennial kinds of Trigonella are spread. They are to be found from lowland till the middle mountain zones in pastures. The most important kinds among them are distinquished by their chemical composition, food quality and biodiversity. Among them Trigonella spicata Sibth., T.temuis Fisch., T.arcuata C.A.M., T.monantщa C.A.M., T.noeana Boiss., T.orthoceras Kar., T.monspeliaca L., T.procumbens Rchb., T.gladiata Stev., T.radiata L., T.foenum graecum L. can be mentioned. The above-mentioned kinds of Trigonella are willingly eaten by horned cattle. Some of them have much feed masses and therefore are widely used in preparing silo.

In Azerbaijan only one cultivated kind of Trigonella is spread – T.foenum graecum L. Botanic description and areals of distribution of some kinds are given below:

Trigonella orthoceras Kar.
It is a 10-30sm high, multibranchy, hairy annual soft plant. The crown of this plant is yellow or light yellow. Its bean is soft and hairy. It has oblongated cylinder-shaped, bubbly seed. It flowers in April-May and seeds in June. It is widely spread in Azerbaijan. It can be found in Guba region of the Great Caucasus, Gobustan, Kura-Araks lowland, Kura plain, Absheron, Nakhchivan and in all regions of the Small Caucasus from plain till the middle mountain zones. It grows in dry stony, fine land, pebbly hill-sides and as well in ploughed fields, dry-farming lands as well.

Trigonella arcuare C.A.M.
It is an annual, branched in the lower parts and 15-30 sm high plant. Its flowers are yellow, the bean is narrow and soft hairy. It has oblongated, cylinder-shaped forms, brown seeds. The seeds have rough surface. It flowers in April-Mau months and seeds in July.

Mixed jungles are very poor in natural conditions. They are part of ephemeral wormwood formings in semi deserts of Kura-Araks plain. But it is not distinguished by its abundance and develops together with ephemerals in spring. In the period of seed-bearing it has 20,3% protein and 33% oil in its content. It testifies that it is of great nourishing value. It is spread in Apsheron, Gobystan, semi deserts, Bozqir plateau, in all regions of Nakhchiven, Diabar and Small amount in Kura-Araks plain from lowland till middle mountain zones. It grows most of all in semi desert plant groups, dry stony slopes, in dry-farming and arable lands.

Trigonella monantha C.A.M.
It is a 10-20(30) sm high annual or biennial plant. The seeds of this plant have cylindrical form, the length of the bean is 6-7 sm. It flowers in April-May and seeds in Ma-June months. It is considered one of the best fodder crops. It is one of the main plants in the South zones of the Small Caucasus in the lower and middle mountain zones. It grows most in dry slopes (hill-sides) and as weed in arable lands.

Trigonella spicata Sibth.
It is a 20-30 sm high annual plant. Its crown is yellow, the bean is single-seedy. Its seeds are egg-shaped, small and uneven. It flowers in May-June, and yields fruit in June-July. It is eaten up by all the kinds of cattle. But it is not considered as valuable fodder crop in our Republic on account of its not widely being spread on grass cover and small sizes. It is spread in all the regions of the Small Caucasus, in Kura-Araks plain. It grows as weed in dry slopes, at the edges of wood and in arable lands.

Trigonella tenius Fisch.
It is a 15-40 sm high annual with multibranchy trunk plant. Its crown is yellow, bean is narrow linear and harry. Its seeds have the forms of cylinder and longish. Its colour- is brown. It flowers in April-May and seeds in June. It is most spread in Great Caucasus, Nakhchivan, in the North part of the Small Caucasus, Bozqir plateau till middle mountain zone. It usually grows in dry and stony slopes, as weed in arable lands and dry-farming lands. It is willingly eaten up by horned cattle.

Trigonella noeana Boiss.
It is a 15-30 sm high annual plant. Its crown is yellow, many seeded. The seeds are very small. It flowers in May and seeds in June. It is eaten by all the kinds of cattle. It is considered as fattening fodder crop. It is stood the test in the conditions of dry-farming lands. Its early vegetative period is considered as its negative property.

Trigonella procumbens Rchb.
It is a 20-100 (110) sm high annual plant. Its crown is bluish, beans are single seedy. The seeds of this plant is a little small. It flowers in May-June and yields fruit in June-July. In Azerbaijan it is spread only in Ganja and Shamkhor regions of Small Caucasus, in lower mountain zones. It grows in humid meadows. It is considered as valuable fodder crop and eaten willingly up by animals.

Trigonella radiate L.
It is a 5-10 (15) sm high branchy annual. Its crown is pallid or light yellow. Bean’s edges are small-toothed and one can say that it bents down. The seed has the form of round-shaped. It flowers in April-May months and seeds in June. It can be found in the plain regions, in the lower and middle mountain zones of Azerbaijan. It grows in dry stony slopes, dry-farming and ploughed lands. It is eaten by cattle. It gives little fodder masses. Owing to having kumarin in its content it has little forage capability. It wasn’t studied forage capability of other kinds of Trigonella. To them belong: T.torulosa Grisb., T.strangulata Boiss., T.calliceras Fisch., T.cancellata Desf., T.astroides F.et M., T.capitata Boiss., T.brahycarpa Fisch.

Studying of forage capability and biodiversity of these kinds of Trigonella is of great importance for agriculture. Botanic description and areal of distribution of some above-mentioned kinds of Trigonella nutritious capability of which have not so far enough studied is given below.

Trigonella astroides F.et M.
It is an annual. It has a shield-shaped, sometimes straight, branchy, a little hairy. 5-15(20) sm high trunk. Its leaves are egg-shaped, pocket like, naked small toothed and have hollows in the upper parts. Flower-arrows are leaf-shaped. Flower group consists of 6-12 flowers and has the form of cupola-shaped. Its small cups are bell-shaped, spindle-shaped and toothed. Its crowns are 3-4 mm long. They are light yellow. The beans are thin, linear, star-shaped, straight, wrinkled in width, 10-15 sm long. Seeds are longish with protuberances. It flowers in IV-V months and in V-VI months it yields fruit. In Azerbaijan it can be mainly met in the South and in the north of the Small Caucasus, in the dry hills of Nakhchivan, at the lower foot of the mountains, dry stony slopes.

Trigonella calliceras Fisch.
It is an annual plant. It has a shield-shaped, sometimes straight, branchy, 10-30 (35) sm high trunk. Its leaves have egg-shaped form, toothed and almost are naked. The flower arrows are longer than the leaves and flower groups are umbrella like. It is slightly bent down. The crown of this plant is yellow, 5-6 mm long and twice as longer than its small cup. The beans are 1-2 sm long and have cylindrical form. The leaves are parallel veined. The seeds have longish or egg-shaped forms. They are yellow. Flowering and seeding take place in V-VI months. In Azerbaijan it can be found in the Great Caucasus, Apsheron, Kura-Araks plain, in the middle and north parts of the Small Caucasus in Lankaran. It is spread from plain till the foot of the mountain. It is met among weeds, shrubs and not very often in arable lands.

Trigonella torulosa Grisb.
It has a straight or shields-shaped, branchy 5-15(20) sm high trunk. Its leaves are egg-shaped, pocketlike, toothed. They have 5-10 mm in length and 4-6 mm in width. The flowers are dense and consist of 5-10 flowers. The small cup has the bell-shaped form, hairy and twice as shorter than its crown. The crown is yellow and has 5-6 mm in length. The beans are 2-3 sm long, 2-2,5 mm width, have cylinder-shaped form and bent as hooked downward, hairy. The seeds are egg-shaped or longish, kidney-shaped. They are 2,5 mm long and light grey. Its flowering takes place in IV-V months. It seeds in V-VI months. In Azerbaijan it is spread in the Small Caucasus, Nakhchivan, lower mountain foots and dry stony lands.

Trigonella strangulate Boiss.
It is an annual plant with a straight slightly branchy and 10-20 sm high trunk. Its leaf is egg-shaped, pocket-shaped. The upper part of this plant is hollowed and small toothed. The bunches of this kind of Trigonella are sparse and consist of 5-8 flowers. It has hairy, 3-4 mm long, trangular lancet-shaped small cups. Its crown is yellow and 5-6 mm long. The beans of this plant are 3-4 seeded, 10-15 mm long. They have the form of Stem cylindrical straight and a little bent form, hairy, 5-8 mm in length, arranged like a rosary. The seeds have almost longish or egg-shaped forms. Its flowering takes place in IV-V months. It seeds in V-VI months.

Trigonella cancellata Desf.
It is a hairy annual plant. Its trunk is branchy and 15-20(30) sm long. Its leaves have egg-shaped and longish forms, hairy. It has 15-20(30) sm long branchy trunk. Its leaves are egg-shaped and longish. It is toothed. The flower crown is thin and 2-3 sm long. The flower-group has umbrella-like form and consists of 3-5(6) flowers. The small cup has lancet-like form and toothed. The crown is yellow, 3-4 mm in length. Its beans are thin, with mixed protuberance and bent archedly. It is rarely met in Azerbaijan. It is most met in Kura plain in the shield-shaped like branched Small Caucasus, at the foot of the mountain in Nakhchivan. It mainly grows at the foots of the mountain, dry stony places and around rivers.

Trigonella capitata Boiss.
It is an annual plant. It has a straight, sometimes shield-shaped like branched, a little hairy, 40-60(70)sm high trunk. Its leaves are longish or lancet-like and toothed. The flower arrow is 2-3 times longer than its leaves. The flower group is thick and bulb-shaped. The small cups are shorter than its crown. Its pistils have spindle-form and longer than its tube. The crowns are 3-4 mm long, get narrowed as a little naked vessel nose of 1,5-2 mm long. Its seeds are small, even and 1 mm long. Its flowering takes place in V-VI months. It seeds in VI month. In Azerbaijan it is met in Kura-Araks plain and in low mountain foots, pastures and around rivers.

Trigonella brachysarpa Fisch.
It is an annual and biennial plant. It has branched, straight form, sometimes shield-shaped, 5-15 (23) sm high trunk. Its leaves have egg-shaped form. The upper leaves are large and toothed. The flower group has a bulb-shaped form and is on a short foot. The small cups have almost the same size as the crown and fine toothed. The crown of this plant is 2,5-3 mm long, yellow. The beans are parted vertically, small, thin, 5-6 mm long, 3-5 mm width, 2-3, sometimes single seedy. The seeds are egg-shaped, bulb-shaped and even. Its flowering takes place in IV-V months. It seeds in VI month. In Azerbaijan it is met in the Small Caucasus, in the mountain part, in the lower mountains foot of Nakhchivan. It grows in pastures, shrubby places and as a weed in vineyards.

Trigonella gladiata Stev.
It is an annual, 10-12 mm high hairy, branched plant. The crown is faded yellow. The bean has 5-7 egg-shaped-round seeds. Vegetative period lasts 90-115 days. It flowers in April-May, and seeds in May-June. In Azerbaijan it is mainly spread in the Great Caucasus, in the regions around Guba, Samur-Davachi and Kura-Araks plains, Gobustan, in Bozqir plateau, in all regions of the Small Caucasus and from lowland till middle mountain zone in mountainous parts of Nakhchivan. It grows in dry stony slopes and at the sides of the roads. In Azerbaijan only one kind of Trigonella – T.foenum graecum L. is spread in a cultured way. This plant is of medicinal fodder, vegetable importance. Stocking with the seeds of this plant is provided by the cultivated lands in Nakhchivan. The seeds of this East countries. In spite of having a bitter kumarin substance in its composition it is willingly eaten up by cattle. It is stable to dry weather and gives high yield of grass during rainy season. This plant draws special attention by its biodiversity. That’s why it is of great importance to cultivate it.

This kind of Trigonella is of great importance in plain and in the regions of mountain foots, especially in cotton- growing zones. Since ancient times T.foenum graecum L. was cultivated in Rome and ancient Greece. At present it is cultivated in North Africa, Iran, Afganistan and other countries, including in Azerbaijan.

T.gladiata Stev. as having little green mass is willingly eaten up by cattle. As cultivated fodder plant it can be considered as the ancestor of T.foenum graecum.

From the wild forms of Trigonella one can show the most important species T.radiata L. It is used as aromatic substance in food industry. All species of Trigonella have honey-carrying capability. Besides of the noted qualities these species take part in the fertility of the soil by nitrogen bacteries which they have in their roots.

Through studying of the species of Trigonella must be one of the most important task of the future.

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ALLELOPATHIC PROCLIVITIES OF TREE LEAF EXTRACTS ON SEED GERMINATION AND GROWTH OF WHEAT AND WILD OATS

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Pot experiment was conducted in NWFP Agricultural University Peshawar during January 2003. Grinded leaves of *Prosopis juliflora*, *Eucalyptus camaldulensis* and *Acacia nilotica* were soaked in tap water for 5 hr at room temperature. The concentration of each tree species was 150, 100 and 50 g L^{-1}. Completely randomized design having four repeats was used. Ten seeds of each species were sown in pots and then irrigated with the respective extracts soon after sowing. Results showed that germination %age and plant height of both species were significantly affected by different concentrations. *Prosopis* showed stimulatory effect on germination of both the species. In wheat, maximum germination and plant height of 52.50 % and 32.22 cm, respectively was recorded in *Prosopis* treated pots as against 15.00 % and 31.50 cm in control however in *Eucalyptus* @150 g L^{-1} also 15% germination of wheat was recorded. Similarly, for wild oats, maximum germination percentage and plant height of 47.5 % and 51.9 cm was recorded in *Prosopis* treated pots. Low concentration of *Prosopis* proved stimulatory as compared to higher concentrations. *Eucalyptus* showed slight negative effect on the species tested. The effect of other concentrations of tree extracts was comparable to each other in the species tested. Hence it can be concluded from the results that allelopathy of trees can be used as viable weed management technique in the future as allelopathins stimulate the germination of wild oats which give the chance of making soil seed bank weaker.

Keywords: *allelopathy, wheat, weeds, trees*

INTRODUCTION

The word allelopathy derives from two separate words. They are *allelon* which means "of each other", and *pathos* which means "to suffer". Allelopathy refers to the chemical inhibition of one species by another. The "inhibitory" chemical is released into the soil environment where it affects the development and growth of neighboring plants. Allelopathic chemicals can be present in any part of the plant. They can be found in leaves, flowers, roots, fruits, or stems. They can also be found in the surrounding soil. These toxins affect target species in many different ways. The toxic chemicals may inhibit shoot/root growth, they may inhibit nutrient uptake, or they may attack a naturally occurring symbiotic relationship thereby destroying the plant's usable source of a nutrient (Conn, 1980). Not all plants have allelopathic tendencies. Some, though they exhibit these tendencies, may actually be displaying aggressive competition of a non-chemical form. Much of the controversy surrounding allelopathy is in trying to distinguish the type of competition being displayed. In general, if it is of a chemical nature, then the plant is considered allelopathic. There have been some recent links to plant allelotoxins directed at animals, but data is scarce. Allelopathy is emerging as a new discipline in agricultural sciences because it is hoped that the use of this science will be proved environment friendly, cost effective and cheaper. Numerous scientists have argued that detailed study of allelopathy can reduce the reliance on herbicides. Sidhu and Hans (1988) reported that as the concentration of extracts of *Eucalyptus* increased, the growth of the plant decreased.

Phlomina and Srivasuki (1996) reported that leaf leachates of 5 multipurpose tree species (*Eucalyptus camaldulensis, Acacia nilotica, Derris indica, Cassia siamea* and *Sesbania grandiflora)* had varying degrees of inhibitory and stimulatory effects on germination percentage. May and Ash (1990) concluded that *Eucalyptus* inhibited the growth of several species. Hunshal et al, (2000) reported the allelopathic studies and chemical composition of tree species. Cheema et al, (2003) have advocated the commercial utilization of sorghum water extracts for weed management in wheat. Khan et al, (2004) reported that *Prosopis, Eucalyptus* and *Acacia* retarded the growth and development of several weeds.
There is convincing evidence that allelopathic interactions between plants play crucial role in natural as well as in manipulated ecosystems. In recent times evidence is accumulating that all types of plants viz. herbs, shrubs and trees, allelopathitically affect the patterning of vegetation, largely in their immediate vicinity.
Keeping in view the importance of the allelopathic potential of some forest tree species, an experiment was conducted to investigate the allelopathic potential of some tree species with the following objectives;

a) appraisal of allelopathic status of different forest trees
b) response of wheat and wild oats under the varying regimes of allelopathins.

MATERIALS AND METHODS

Pot experiment was conducted in the Department of Weed Science, NWFP Agricultural University Peshawar during January 2003 to assess the allelopathic proclivities of tree leaf extracts on seed germination and growth of wheat (*Triticum aestivum*) and wild oats (*Avena fatua*). The fresh green leaves of *Prosopis juliflora*, *Eucalyptus camaldulensis* and *Acacia nilotica* were collected in September and dried in shed. The leaves were then grinded with the help of grinder. The grinded material was then soaked in tap water for 5 hrs at room temperature (23 ^{0}C). The concentrations of each tree species were 150, 100 and 50 g L^{-1}. Control (tap water) was also included for comparison. The experiment was laid out in completely randomized design (CRD) and repeated four times. Ten seeds of each species i.e. wheat (Takbeer variety) and wild oats were sown in pots containing 5 kg soil and then irrigated with the respective extracts soon after sowing. The pots were irrigated with the concerned tree leaf extracts as mentioned earlier when needed. No fertilizer was applied during the course of the experiment. Data on germination percentage was recorded three weeks after sowing and plant height (cm) was recorded three months after sowing when the crops reached maturity. Numbers of wheat plants that emerged from the soil were counted in each pot and then average was calculated. To record the plant height, all the tillers present in each pot were measured from ground level to the tip of the spike excluding awns at maturity and then the average was computed.
The data recorded was statistically analyzed according to the design and LSD test was used for means comparison (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Germination percentage of wheat

Statistical analysis of the data showed that seed germination of wheat was significantly affected by different concentrations of different tree leaf extracts (Table 1). The data revealed that maximum germination (52.50 %) was recorded in *Prosopis* treated pots as compared to 15 % germination in the check. However, the germination percentage in all concentrations of *Prosopis* was statistically similar to each other. Thus it can be concluded from the experiment that *Prosopis* stimulated the germination of wheat might be due to presence of certain chemicals that act as germination stimulant. Not only the wheat seeds germination was stimulated but the seeds of wild oats were also stimulated. While all other treatments of different tree extracts were statistically comparable with the check, which shows that these tree extracts have no effect on seed germination of wheat. Maximum germination percentage in the two species studied is low due to the fact that experiment was conducted in January when the temperature is low. While these two species need comparatively high temperature during germination and early growth. Thus from these results, it is concluded that there are some chemicals in *Prosopis* which stimulate the germination of wheat and wild oats. Thakur and Bhardwaj (1992) reported that wheat seeds were exposed to leachates from leaf extracts of *Eucalyptus globulus, Populus ciliata, Juglans regia* and *Robinia pseudoacacia* and germination was not affected. Analogous results were reported by Chellamuthu et al, (1997). They reported that *Prosopis juliflora* stimulated black gram growth. This statement indicates that there are certain chemicals in *Prosopis* which acts as hormone.

Plant height (cm) of wheat

Statistical analysis of the data showed that plant height of wheat was significantly affected by various leaf extracts. Minimum plant height (14.75 cm) was recorded in the pots treated with *Acacia* @100g L^{-1}, followed by *Acacia* @ 150 g L^{-1}. *Prosopis* and *Eucalyptus* leaf extract and Check pots gave statistically the same value of plant height. It can be concluded from the data that *Acacia* at higher concentrations retarded the growth of wheat while other tree leaf extracts have negligible effect on the growth of wheat crop. In the present studies, germination as well as the growth of both the test species was mostly negatively affected by *Eucalyptus* as compared to other tree extracts. Our results are in agreement with those reported by Smith (1989). He reported that some tree extracts negatively affect only seed germination while other affect plant growth. Velu et al, (1996) reported that *Acacia* sp. retard the plant growth and development.

Germination percentage of wild oats

Statistical analysis of the data revealed that germination percentage of wild oats was significantly affected by various tree leaf extract at various levels of concentrations. Table-1 shows that statistically maximum germination percentage of 47.5 was recorded in *Prosopis* @ 50 g L^{-1} treated pots followed by the different concentrations of the same tree species. While all other tree leaf extracts showed similar effect on the germination percentage of wild oats. It is interesting to note that similar stimulatory response was recorded in wheat germinations. Similar results were reported by Mukhopadhyay et al, (1995). They reported that seeds of some species are affected while other remain unaffected by different leaf extracts of the plants. May be the same extract act differently for two different species because physiological and biochemical processes are involved in such cases.

Plant height (cm) of wild oats

The data in table-1 revealed that plant height of wild oats was also significantly affected by various leaf extracts and their concentrations. It was noted that for maximum plant height, Prosopis @150, 100 and Acacia @100 g L^{-1} were statistically at par with 49.50, 51.90 and 50.75 cm, respectively while minimum 17.00 cm plant height was recorded in *Eucalyptus* @ 150 g L^{-1}. It might be due to the presence of allelochemicals in *Eucalyptus*. Our results are in agreement with those of Smith (1989) who reported that allelopathic tree extracts retard germination or growth of crop plants. Similarly, Mukhopadhyay et al, (1995) reported that extracts of *Eucalyptus* decreased the plant growth of rabi crops and concluded that the inhibitory effect of *Eucalyptus* leaf extracts on germination and growth was attributed to the essential oil content.

Table 1. Germination percentage and plant height (cm) of wheat and wild oats as affected by various concentrations of different tree extracts.

Treatment	Germination %age		Plant Height (cm)	
	Wheat	Wild oats	Wheat	Wild oats
Pr 150	42.50 ab	45.00 a	32.22 a	49.50 a
Pr 100	32.50 abc	40.00 ab	31.50 a	51.90 a
Pr 50	52.50 a	47.50 a	32.00 a	44.00 ab
Euc 150	15.00 cd	10.00c	28.08 ab	17.00 c
Euc 100	17.50 cd	7.50 c	22.00 abc	23.00 bc
Euc 50	25.00 bcd	7.50 c	30.33 a	22.25 bc
Ac 150	5.00 d	15.00 c	16.75 bc	39.75 abc
Ac 100	12.50 cd	17.50 c	14.75 c	50.75 a
Ac 50	17.50 cd	7.50 c	28.75 ab	36.00 abc
Control	15.00 cd	20.00 bc	31.50 a	29.25 abc
LSD (5%)	22.27	20.76	13.20	24.07

Means sharing different letters are significantly different from each other.
Pr = *Prosopis juliflora*
Euc = *Eucalyptus camaldulensis*
Ac = *Acacia nilotica*

Acknowledgements

The authors are grateful to Prof. Dr. Gul Hassan, Department of Weed Science for technical and financial assistance during the course of the experiment.

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PLANT DIVERSITY AND SUSTAINABLE USE OF GRASSLANDS IN ÇANAKKALE-TURKEY AND THEIR ROLES IN EROSION CONTROL

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Pastures in Turkey are a source of high erosion but also have an important potential for controlling erosion. Pastures have lost most of their vegetation due to their misuse for years. In Marmara Region they meet only 22 days portion of hay consumption and soil erosion problem occurs in 90% of the region. The pastures in Aegean and Mediterranean regions overcome the erosion problem with shrub vegetation, whereas Central and East Anatolian parts lessen the effect of erosion with dwarf scrub species such as *Astragalus*, *Thymus* and *Acantholimon*. In Mediterranean vegatation zone, although annual plant species are dominant there are also some shrubs (e.g. *Quercus*, *Citrus*, *Juniperus*, *Sarcopoterium* and *Paliurus* species) and perennial grasses which may be effective in controlling erosion. In this study, floristic composition and vegetation values were determined in order to define plant species which can be used in controlling soil erosion. Experiment was conducted using 5 different pasture types and 22 different pasture areas in 2006. At the end of study, 95 plant species were identified and the most effective ones among these species were determined in terms of controlling soil erosion. 48.42 percent of these are annuals (therophytes) and percentage of the species with tap root is 82.11 percent.

***Keywords**: Erosion, Pasture, Biodiversity and Sustainability.*

INTRODUCTION

Soil is one of the main components in order to sustain life on the earth. Growing plants, consequently human and animal life depend on soil. A majority of the countries all over the globe are accepting the soil as a source of richness and are taking measures to control and reduce soil erosion. The formation of a 2.5 cm soil layer requires 300-1000 years [1]. Therefore the soil lost can not be brought back with in a short period. Soil erosion as a natural process occurs due to wind and water. Apart from these destruction of flora and unplanned use also causes soil erosion. Misuse of meadows by farmers dealing with animal husbandry too increases soil erosion. Accesive number of animals in a meadow, grazing grasses with their roots and early grazing in spring cause destruction of vegetation and reduction of meadow quality.

Turkey shows sloppy land characteristics due to its topographical features. Moderately high sloppy areas are 29% of total area. Proportion of sloppy land is more in pastures. The parts of these lands without vegetation are rapidly drifted away by the heavy rainfall and flooding. In Turkey the soils are facing light (7.2%), moderate (20%), heavy (36.4%), and very heavy (22.3%) erosion. In the Marmara region, generally light and heavy erosion occurs. The erosion in Asian part is more noticeable than European part. The region provides only 22 days of hay consumption for animal feeding and 90 % of the region faces soil erosion problem [2,3]. Erosion in the land covered with vegetation occurs less then those without vegetation and vegetation reduces mechanical effects of precipitation on soil. Moreover plant roots hold soil and prevent drifting. Therefore meadows in Marmara, Ege, and Mediterranean with shrubby species versus central and eastern Anatolia region with dwarf shrub plant species such as, *Astragalus*, thyme (*Thymus*), and (*Acantholimon*) try to prevent soils against high erosion. In Çanakkale, area of pastures is 49.291 ha (5.06%). Proportion of grasslands among pastures is very small. Rocky area without vegetation, flooded area by streams, marshes and sandy areas on coastal parts cover 7.03% (68.492 ha) of total area and there is no soil or little. When grasses dry out in summer and winter the Mediterranean bushy vegetation in Çanakkale ; represented by the species of *Quercus*, *Cistus*, *Juniperus*, *Sarcopoterium* and *Paliurus* ; control the sustainability of soils. In this study, floristic composition and vegetation values were determined in order to define plant species which can be used in controlling soil erosion.

MATERIAL AND METHOD

Research was conducted on 22 pastures in the Çanakkale Province. Plants were identified with the help of Flora of Turkey and the East Aegean Islands Davis [4]. These pastures were classified under 3 main groups according to their features. These groups, distribution of 22 sampling points and their characteristics are given in Table 1.

Table 1. List of the pastures surveyed.

Pasture Types	Distribution
Shrub Pasture	Ezine Taştepe village pasture
	Bayramiç Türkmenli village pasture
	Biga Balıklıçesme pasture
	Biga Güreci village pasture
	Eceabat Kabatepe pasture
	Eceabat Kilitbahir pasture
	Ayvacık Nusratlı village pasture
	Ezine Mahmudiye town pasture
	Ezine Üvecik village pasture
	Ayvacık Behramkale pasture
	Yenice pasture
	Yenice Kırmaçakıl village pasture
	Yenice Çan pasture
	COMU Terzioğlu campus
	Bayramiç Kurşunlu village pasture
Coastal Pasture	Biga Güvemalan village pasture
	Eceabat
	Gelibolu Evreşe town pasture
Mountain Pasture	Eceabat-İstanbul, 20 th km
	İntepe
	Bayramiç Evciler
	Yenice Karaköy

In pastures given above, the plants species thought to be effective in controlling erosion were determined. In addition to this the soils were classified. The life form, canopy degree, plant root type, and intensity of the investigated species were recorded [3]. Moreover, in the pastures facing erosion, land classification was done after determination of soil characteristics.

RESULTS AND DISCUSSION

Pasture Types

The study in pastures of Çanakkale province showed that there were 3 different pasture types. These include shrub pasture, coastal pasture, and forest pastures. The key plant species and their characteristics were evaluated.

Shrubby Range

Most of the pastures in Çanakkale are covered with shrubs. These embody 59 species belonging to 26 families (Table 2). The evergreen species are; *Quercus coccifera*, *Q. infectoria*, *Tamarix tetranda*, *Ajuga chamaepitys*, *Thymus zygioides*, *Veronica jacquinii* and *Osyris alba*, and phanerophytes like *Anagyris foetida* and *Bellardia trixago*. These protect soil from erosion effectively throughout the year by both their roots and canopies. Shrubs cover 70-80% of the soil in rangelands where grazing pressure is less that reduces erosion to minimum. In the lands where shrubs are rare herbaceous plants protect the soil.

25 of these are annual (therophytes), rest are perennials. Annual ones mostly grow up rapidly in early spring and cover 80% of soil surface. Annual plants in the pasture are rather effective in preventing erosion. Only water erosion is seen in Çanakkale due to precipitation. 21.33% of total rainfall is in early spring. Grasses forming fibrous root (*Briza maxima*, *Bromus hordeoceus* ssp.*molliformis*, *Bromus tectorum*, *Dasypyrum villosum*, *Poa bulbosa*) hold the soil surface tightly by their shallow and dense roots.

Table 2. Life forms, root types, land use classes and vegetation covers of the brush pastures (Phanerophyte;Ph, Hemicryptophyte;Hm., Therophyte;Th, Chamaephyte;Ch., Cryptophyte; Cry., Tap root; Tr., Rhizomatous; Rh., Tuberous, Tb., Bulbous; Blb., Semi-parasite;Sm., Fibrous root; Fb., AKKS; Land use classes, VC; vegetation cover)

Family	Species	Life Form	Root Type	AKKS	V.C.
Fabaceae	*Anagyris foetida* L.	Ph.	Tr.	V	I
	Hedysarum varium Willd.	Hm.	Tr.	V	I
	Lathyrus digitalis (Bieb.) Fiori	Th.	Tr.	VI	II
	Lathyrus saxatilis (Vent.)Vis	Th.	Tr.	VI	I
	Lotus corniculatus L. var. *corniculatus*	Th.	Tr.	VI	II
	Medicago orbicularis L	Th.	Tr.	V	II
	Melilotus neapolitana Ten.	Th.	Tr.	V	I
	Onobrychis aequidentata (Sibth & Sm) d'Urv	Th.	Tr.	VI	II
	Trifolium arvense L	Th.	Tr.	V	III
	Trifolium campestre Schreb.	Th.	Tr.	V	I
	Trifolium purpureum Lois var. *purpureum*	Th.	Tr.	VI	I
	Trifolium spumosum L.	Th.	Tr.	V	II
	Vicia villosa Roth. subsp. *eriocarpa* (Hausskn.) P.W.Ball	Th.	Tr.	VI	II
Lamiaceae	*Ajuga chamaepitys* (L.) Schreber subsp. *chia* (Schreber) Arcangeli var. *chia*	Ch.	Tr.	V	I
	Lamium moshatum Mill. var. *rhodium* (Gand.)(End.)	Th.	Tr.	IV	I
	Prunella vulgaris L.	Th.	Tr.	IV	I
	Salvia verbenaca L.	Th.	Tr.	V	II
	Thymus zygioides Griseb.	Ch.	Tr.	V	I
	Lavandula stoechas L. subsp. *stoechas*	Ph.	Tr.	V	I
Boraginaceae	*Buglossoides arvensis* (L.) Johnston	Hm.	Tr.	III	I
Ranunculaceae	*Anemone pavonina* Lam.	Cry.	Tb.	IV	I
	Ranunculus rumelicus Griseb.	Th.	Tr.	IV	I
Brassicaceae	*Sinapis alba* L.	Hm.	Tr.	V	I
	Raphanus raphanistrum L.	Hm.	Tr.	V	I
Liliaceae	*Asphodeline lutea* (L.) Reichb	Cry.	Rh.	VII	II
	Asphodelus aestivus Brot.	Cry.	Rh.	VII	II
	Muscari comosum (L.) Mill.	Cry.	Blb.	V	II
	Ornithagalum montanum Cyr.	Cry.	Blb.	V	I
Poaceae	*Briza maxima* L.	Th.	Fb.	V	II
	Bromus hordaceus L. subsp. *molliformis*	Th.	Fb.	V	III
	Bromus tectorum L.	Th.	Fb.	V	II
	Dasypyrum villosum (L.) Cand.	Th.	Fb.	V	III
	Poa bulbosa L.	Th.	Fb.	V	III
Resedaceae	*Reseda lutea* L. var. *lutea*	Th.	Tr.	VI	I

Table 2. Cont.

Compositae	*Sonchus oleraceus* L.	Hm.	Tr.	IV	I
	Calendula arvensis L	Th.	Tr.	IV	I
	Chysanthemum segetum L.	Hm.	Tr.	V	I
Schrophulariaceae	*Veronica jacquinii* Baumg	Ch.	Tr.	V	II
	Bellardia trixago (L.) All	Ph.	Tr.	IV	I
	Linaria pelisseriana (L.) Mill.	Th.	Tr.	III	I
Dipsaceae	*Pterocephalus plumosus* (L.) Coulter	Th.	Tr.	IV	I
Polygonaceae	*Rumex tuberosus* L. subsp. *tuberosus*	Cry.	Tb.	VI	II
Linaceae	*Linum bienne* Mill.	Th.	Tr.	IV	I
Orchidaceae	*Serapias vomeraceae* (Burm. f.) Briq. subsp. *laxiflora*	Cry.	Tb.	VI	I
Convolvulaceae	*Convolvulus arvensis* L.	Th.	Tr.	V	II
Araceae	*Dracunculus vulgaris* Schott	Cry.	Tb.	VIII	I
Santalaceae	*Osyris alba* L.	Ch.	Sm.	VI	I
Fagaceae	*Quercus coccifera* L.	Ph.	Tr.	VI	II
	Quercus infectoria Olivier subsp. *infectoria*	Ph.	Tr.	VI	II
	Ouercus ithaburensis Decne subsp. *macrolepis* (Kotschy) Hedge& Yalt.	Ph.	Tr.	VI	II
Papaveraceae	*Hypecoum imberbe* Sibth. & Sm.	Th.	Tr.	III	II
Oleaceae	*Jasminum fruticans* L.	Ch.	Tr.	III	II
Rubiaceae	*Sherardia arvensis* L.	Th.	Tr.	IV	I
Orobanchaceae	*Orobanche minor* Sm.	Th.	Tr.	III	I
Rosaceae	*Pyrus eleagnifolia* Pallas. subsp. *eleagnifolia*	Ph.	Tr.	VI	I
	Rubus canescens DC.	Ph.	Tr.	VI	II
Tamaricaceae	*Tamarix tetranda* Pall. Ex M.Bieb	Ph.	Tr.	VI	I
Thymelaeaceae	*Thymelaea tartonraira* (L.) All. subsp. *argentea* (Sm.) Holmboe var. *angustifolia* (d'Urv.)Meissner	Ch.	Tr.	VI	I
Caprifoliaceae	*Lonicera caprifolium* L.	Ph.	Tr.	IV	I

Coastal Pastures

Çanakkale is located on the sea coast. The coastal pastures are thus very important. A majority of these pastures are shrubby, but some of them are sandy and salty. These kinds of pastures were examined. 12 species belonging to 9 families were determined (Table 3). These species generally protect soil against wind blowing from the sea by holding sands in their places with their tap roots. Species like *Medicago marina* is highly effective in protecting soil because of its spreading nature.

Table 3. Life forms, root types, AKKS and vegetation covers of the plants in coastal pastures.

Family	Species	Life Form	Root Type	AKKS	V.C
Fabaceae	*Hymenocarpus circinnatus* (L.) Savi	Th.	Tr.	VII	I
	Medicago marina L.	Th.	Tr.	VII	II
	Medicago truncatula Gaertn. var. *longiaculeata* Urb.	Th.	Tr.	VII	I
	Trifolium tomentosum L.	Th.	Tr.	VII	I
Boraginaceae	*Myosotis ramossima* Rochel ex Schultes subsp. *ramossima*	Ph.	Tr.	VII	I
Brassicaceae	*Mathiola tricuspidata* (L.) R. Br.	Hm.	Tr.	VII	I
Liliaceae	*Tulipa orphanidea* Boiss. ex Heldr.	Cry.	Blb.	VII	I
Caryophyllaceae	*Cerastium brachypetalum* Pers.	Th.	Tr.	VII	I
Compositae	*Centaurea spinosa* L. var. *spinosa*	Ch.	Tr.	VII	II
Cyperaceae	*Cyperus capitatatus* Vandelli	Cry.	Rh.	VII	I
Ephedraceae	*Ephedra distachya* L.	Ph.	Tr.	VII	II
Irıdaceae	*Iris pseudacorus* L.	Cry.	Rh.	VII	I

Mountain Pastures

In these pastures, 24 species belonging to 17 families were determined (Table 4). 13 species were annuals and 9 were perennials. Former were effective in controlling erosion whereas *Cistus salviiformis* shrub controls erosion during whole year. Grazing of these species with an appropriate management will be even more effective against erosion. *Platanus orientalis* with its deep and wide root system holds soil very well. When it is at leafy stage, it reduces kinetic energy of rainfall droplets. Thus, it reduces erosion caused by rain splash. In this pasture therophytes are dominant and species have taproots. *Schrophularia canina* and *Platanus orientalis* are effective in controlling erosion during the whole year.

Table 4. Life forms, root types, AKKS and vegetation cover of the plants found in mountain pastures.

Family	Species	Life Form	Root Type	AKKS	V.C
Fabaceae	*Scorpirus muricatus* L. var. *subvillosus* (L.) Fiori	Th.	Tr.	VI	I
	Trifolium stellatum L. var. *stellatum*	Th.	Tr.	VI	I
Boraginaceae	*Alkanna tinctoria* (L.)Tausch subsp. *tinctoria*	Hm.	Tr.	III	I
	Echium plantagineum L.	Hm.	Tr.	III	I
	Onosma aucheranum DC.	Hm.	Tr.	III	I
Ranunculaceae	*Ranunculus arvensis* L.	Th.	Tr.	IV	I
Caryophyllaceae	*Silene italica* (L.) Pers	Th.	Tr.	V	I
	Moenchia mantica (L.) Bartl. subsp. *mantica*	Th.	Tr.	V	I

Table 4. Cont.

Compositae	*Centaurea solstitialis* L. ssp. *solstitialis*	Ch.	Tr.	III	I
	Pallenis spinosa (L.) Cass	Th.	Tr.	VI	I
Euphorbiaceae	*Euphorbia oblongata* Griseb	Ch.	Tr.	III	I
Cistaceae	*Cistus salviifolius* L.	Ch.	Tr.	III	II
Solanaceae	*Hyocyamus niger* L.	Hm.	Tr.	VIII	I
Plantaginaceae	*Plantago lagopus* L.	Th.	Tr.	III	I
Geraniaceae	*Erodium ciconium* (L.) L'Herit.	Hm.	Tr.	III	II
Gentianaceae	*Centaurium spicatum* (L.) Fritsch	Th.	Tr.	VI	I
Platanaceae	*Platanus orientalis* L.	Ph.	Tr.	VI	I
Lamiaceae	*Sideritis montana* subsp. *remota* (d'Urv.) P. W. Ball	Th.	Tr.	V	II
	Lamium cariense R. Mill	Hm.	Tr.	VI	I
Resedaceae	*Reseda alba* L.	Th.	Tr.	VI	I
Schrophulariaceae	*Schrophularia canina* L. subsp. *bicolor* (Sm.) Greuther	Ch.	Tr.	III	I
Polygonaceae	*Rumex bucephalophorus* L	Th.	Tr.	VI	II
Apiaceae	*Tordylium apulum* L.	Th.	Tr.	III	I

Plant Characteristics

The study was conducted in 22 pastures, a total of 78 genera and 95 species belonging to 39 families were recorded. The distribution of species is presented in Table 5.

Table 5. The distribution of plants inhabiting the pastures in Çanakkale on the basis of their features.

Characteristics	Plant Species Number	Ratio (%)	Pasture Type	Number	Ratio (%)
Root Type			Shrub Pasture	59	62,10
Tap root	78	82,11	Coastal Pasture	12	12,63
Tuberous	4	4,21	Mountain Pasture	24	25,26
Rhizomatous	4	4,21			
Fibrous root	5	5,26			
Bulbous	3	3,16			
Semi-parasite	1	1,05			
Life Form	Number	Ratio(%)	AKKS	Number	Ratio(%)
Chamaephyte	11	11,58	III	15	15,79
Phanerophyte	13	13,68	IV	12	12,63
Hemicryptophyte	13	13,68	V	27	28,42
Therophyte	47	49,47	VI	25	26,31
Cryptophyte	11	11,58	VII	14	14,74
			VIII	2	2,11

CONCLUSIONS

This investigation revealed that the total area of pastures in 2004 in Çanakkale was 13.379 ha. Out of these 4.757 ha, 3.197 ha and 5.425 ha were in 1., 2. and 3. sub-regions respectively.

1. As a result of mismanagement of pastures, proportion of annual plant species (49.47%) highly increased. Although these species have a short life period, they contribute by controlling the erosion by covering soil surface during spring when erosion increases.
2. Ratio of perennial plant species covering soil surface for a longer period and having deep root system is low. Therefore, effectiveness of grass species apart from growing period of annual plant species is generally low.
3. The evergreen shrubs effectively control erosion throughout the year. Erosion controlling ability of shrubs and tress depends on their density. Intensively grazed pastures have a low potential in controlling erosion.
4. There are two ways for preventing soil erosion; strengthening present vegetation and including new plant species into vegetation [5]. Therefore, controlled grazing in pastures should be followed, especially on the slopes. In addition, new species should be introduced by seeding.
5. The plant species suitable under the climate and soil characteristics of Çanakkale show a wide range of adaptation ability. These include *Dasypyrum villosum* (L.) from the family *Gramineae* and *Hedysarum varium* Willd., *Lathyrus digitalis* (Bieb.) Fiori, *L.saxatilis* (Vent.)Vis., *Lotus corniculatus* L. var. *corniculatus*, *Medicago orbicularis* L., *M. truncatula* Gaertn. var. *longiaculeata* Urb., *Melilotus neapolitana* Ten., *Onobrychis aequidentata* (Sibth & Sm) d'Urv, *Trifolium campestre* Schreb., *T. spumosum* L., *T. stellatum* L. var. *stellatum*, *T. tomentosum* L., *Vicia villosa* Roth. ssp. *eriocarpa* (Hausskn.) P.W. Ball from the family *Leguminosae*. Main features of these species include rapid growth in heavily grazed pastures, high regeneration ability, prevention of soil erosion and good contribution to the soil organic matter content.
6. Under the semiarid climatic conditions of Çanakkale (629.1 mm of annual total rainfall), seeding the pastures with perennial plant species staying green for a longer period and having a strong root system such as *Medicago sativa*, *Trifolium repens*, *Lotus corniculatus*, *Lolium perenne*, *Dactylis glomerata* and *Festuca arundinacea* could be helpful for both preventing erosion and sufficient feeding of livestock .
7. Production of forage crops should be increased in order to reduce intensive usage of pastures.

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International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

ECOLOGY OF CENTAUREA SOLSTITIALIS SUBSP. SOLSTITIALIS L.

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Centaurea solstitialis subsp. s*olstitialis* is regarded as an important weed. This annual summer flowering taxon is widely distributed between 0 to 2000 m in Turkey. The seeds germinate soon after dispersal but maximum germination is observed on the wet habitats under light, between 10^0-20^0C. However, they show secondary dormancy at high temperatures. The soils collected from 17 localities were analysed for their physico-chemical parameters and the results were correlated with the mean annual precipitation, mean temperature, altitude and parent rock. The simple correlation was used to investigate the effects of physical factors on the chemical characteristcs of the soil. No correlation was observed between the altitude and other factors. However, mean temperature and Mg++ as well as mean precipitation and soil pH and Mg++ showed a positive correlation significant at 5 % level. The effects of parent rock on soil chemical characteristics was investigated by simple varians analysis. Mg^{++} and Cu^{++} showed differences from the parent rock significant at 5% level. This taxon is a water spender and depletes soil moisture reserves at places where it grows, theirby threatening the ecosystems. In this paper interactions between some edaphic and physiographic features are presented.

Key Words: *C. solstitialis ssp. solstitialis, Soils, Parent Rock, Precipitation, Temperature, Altitude.*

INTRODUCTION

Nearly 8000 problematic weed species are reported from all over the world, out of which 1500 have been recorded from Turkey [1]. One of these is a very widespread genus namely *Centaurea* L. (*Asteraceae*) comprised of over 1.000 species [2]. The genus *Centurea* L. is represented by 187 taxa in Turkey out of which 114 are endemics, thus showing an endemism ratio of 61.6%. The gene center of this genus lies in Turkey [3-5]. During our previous studies covering a survey of all weeds including *Centaurea* genus in the pastures of east Mediterranean region of Anatolia it was observed that *Centaurea* weeds are important in pasture areas of Turkey. Nearly 20 *Centaurea* species are responsible for an economic loss in the cultivated lands, pastures, orchards and nurseries, the dominant knapweed species being *C. solstitialis*, *C. calcitrapa*, *C. cyanus*, *C. depressa*, *C. triumfetti*, *C. carduiformis*, *C. iberica* and *C. virgata*. A lot of work has been done on their distribution and density but not much on their management [1]. Their coverage is increasing year by year because they are spiny and nonedible to livestock. Investigations on biological control of *C. solstitialis* with emphasis on Ceratapion basicorne are in progress in the middle and south Turkey [1]. In this paper are presented. In this study results obtained on the interactions between some edaphic and physiographic features of *C. solstitialis* subsp. *solstitialis* comonly known as yellow star thistle are presented.

MATERIAL AND METHOD

Plant specimens were collected from 17 sites; Karaman; Kazımkarabekir, Niğde; Ulukışla, Bolkar Mountain, Konya; Ermenek, Kızıldağ, Kayseri; Yeşilkent - Göksun, Kayseri; Pınarbaşı, Çukuryurt Köyü, Sivas; İmralı - Zara , Doğançal Village, K.Maraş; Göksun, Mehmetbey Village, Erzincan; Kemaliye – İliç, Sivas; Ulaş, Tecer Dağı, Ovacık Viilage, Erzincan; Erz.- Rehahiye, 30 km, Ağrı; Diyadin, Mollakara (Malakar) Village, Erzurum, Oltu- Olur, Yeşilbağlar Village and Yozgat; Cayıralan, Cat -Eşikli Village. These were identified according to Wagenitz [3] and are deposited in the herbarium of Biology Department, Çanakkale Onsekiz Mart University. Soil samples (0-10, 10-20 and 20-30 cm deep) were collected from the same sites from where the plant specimens were taken. The soil samples brought to the laboratory were left for air drying and then subjected to an analysis of different parametrers (Table 1), according to the methods given by Walkley and Black [6], Jackson [7], Chapmann and Pratt [8], and Olsen and Sommers [9].

RESULTS AND DISCUSSION

MORPHOLOGY

C. solstitialis subsp. *solstitialis* is a successful summer weed in southern Turkey. It is a native of the Balkans-Asia Minor, the Middle East, southcentral Europe [10], and center of origin is believed to lie in Eurasia. The species possesses a strong ability to dominate the native plant community theirby reducing biodiversity as well as the productivity of pastures because sheep, goats and cattle avoid the spiny flower heads in pastures, rangelands, and some croplands in the eastern Mediterranean region of Turkey and in central Anatolia [11-13]. It is toxic to horses, causing brain lesions that eventually kill the animal [14], and a high population stand can become a fire hazard along roadsides and irrigation canals. The plants germinate in spring, grow during the summer and mature at the end of summer. Flowering time is between June and August. C. solstitialis subsp. solstitialis is an annual, 15-60 cm long, with adpressed- tomentose hairs. Basal and lower leaves (mostly withered at flowering time) are lyrate to pinnatipartite with 3-4 pairs of lateral segments, median and upper ones are lanceolate to linear lanceolate, lobed or toothed to entire, decurrent into narrow entire wings. Involucre (11-) 13-16 x 16 x (6-)8-12 (-15) mm, arachnoid-tomentose. Appendage is a patent straw- colored or red 8-25 (-30) mm spine, with 2-3 spinules (2-4 cm) mm on each side at base, outher phyllaries have short spinules. Flowers yellow, marginal not radiant.

CLIMATOLOGY

C. solstitialis subsp. *solstitialis* is distributed in Erzincan (mean annual temperature 10,8 ^oC, precipitation 374,3 mm), Sivas (mean temperature 9,0 ^oC, precipitation 450,7 mm), Ermenek (mean temperature 9,0 ^oC, precipitation 450,7 mm), Pınarbaşı (mean temperature 7,6 ^oC, precipitation 395,1 mm), Ulukışla (mean temperature 9,6 ^oC, precipitation 321,5 mm), Zara (mean temperature 8,5 ^oC, precipitation 545,8 mm), Kazımkarabekir (mean temperature 11,4 ^oC, precipitation 307,0 mm), Göksun (mean temperature 8,8 ^oC, precipitation 607,2 mm), Refahiye (mean temperature 6,1 ^oC, precipitation 358,8 mm), Ermenek (mean temperature 12,9 ^oC, precipitation 457,8 mm), Kemaliye (mean temperature 13,3 ^oC, precipitation 808,6 mm), Oltu (mean temperature 9,9 ^oC, precipitation 342,4 mm), Diyadin (mean temperature 4,9 ^oC precipitation 345 mm). The climatic data is presented in Table 4 and Fig.1.

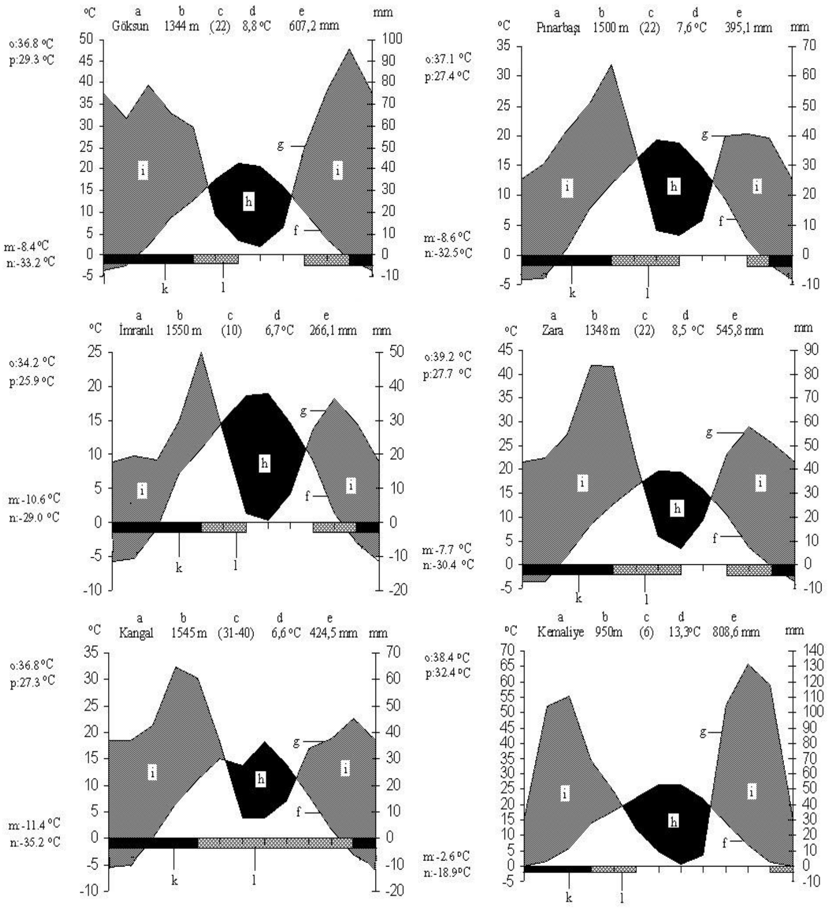

Figure 1. Climatic diagrams of the representative sites of *C. solstitialis* subsp. *solstitialis* (a : Station, b: Altitude, c: Temperature and precipitation measurement year, d: Mean annual temperature (^{o}C), e: Mean annual precipitation (mm), f: Temperature curve, g: Precipitation curve, h: Dry period, i : Wet season , k: Mean minimum temperature-months below 0 ^{o}C, l: Absolute minimum temperatures of the months below 0 ^{o}C, m: Mean lowest temperature of the coldest month (^{o}C), n: Absolute minumum temperature (^{o}C), o: Absolute maximum (highest) temperature (^{o}C), p: Mean maximum temperature of the hottest month (^{o}C))

DISPERSAL AND DISTRIBUTION

Human activities are the primary mechanisms for the long distance movement of *C. solstitialis* subsp. *solstitialis* seeds. These are transported in large amounts by road maintenance equipment and on the undercarriage of vehicles. The movement of contaminated hay and uncertified seed are also important long distance transportation mechanisms. Once at a new location, seed is transported in lesser amounts and over short to medium distances by animals and humans. The short, stiff, pappus bristles are covered with microscopic, stiff, appressed, hair-like barbs that readily adhere to clothing and to hair and fur. The pappus is not an effective long distance wind dispersal mechanism as wind moves seeds less than a meter [15]. It has negative effects on animals. When ingested by horses it causes a neurological disorder of the brain called nigropallidal encephalomalacia or "chewing disease." Continued feeding results in brain lesions and ulcers in the mouth [16]. The species is distributed in the states of all phytogeographical areas in Turkey.

STATISTICAL ANALYSIS OF SOIL, CLIMATOLOGY AND ALTITUDE

Studies on the interactions of soil chemical characteristics of *C. solstitialis* subsp. *solstitialis* from 17 different natural sites in Turkey (Karaman, Kazımkarabekir, Niğde, Ulukışla, Bolkar Dağı, Konya, Ermenek, Kızıldağ, Kayseri, Yeşilkent – Göksun, Kayseri, Pınarbaşı, Yozgat, Çayıalan, Sivas, İmralı – Zara,K.Maraş, Göksun, Erzincan, Kemaliye – İliç, Sivas, Ulaş, Tecer Dağı, Erzincan,Erzincan- Rehahiye, Erzincan, Refahiye, Erzincan, Erzincan – Kelkit, Erzincan, Keşiş Dağı , Ağrı, Diyadin, Erzurum, Olur) against average annual precipitation, average annual temperature, altitude and main rock revealed that no correlation exists between altitude and soil chemical properties. A positive correlation was however observed between average temperature and Mg^{++} content of soil and average annual precipitation, pH degree and Mg^{++} content of soil at 5% level (Table 1). Effect of main rock dissimilarity on soil chemical features was investigated by simple variance analysis. Mg^{++} and Cu^{++} amounts varied according to main rock at 5% level (Table 2). The Duncan test showed that Mg^{++} is higher than others in gypsum main rock types (limestone, ultrabasic rocks and serpentine), Cu^{++} is maximal in the soils which are above limestone and minimal in the soils which are above gypsum main rock (Table 3).

Table 1. Relationships between soil characters and altitude, avarage temperature and yearly total precipitation (n=17)

Variable	Altitude (m)	Mean Temperature (^{0}C)	Total Annual Precipitation(mm)
pH	-0.287	-0.371	0.532*
Total $CaCO_3$ %	-0.430	0.007	-0.311
Organic Matter %	0.133	-0.090	0.229
P_2O_5 %	0.193	0.075	0.161
Tuz	0.236	-0.068	-0.341
N %	0.138	-0.158	0.211
Ca^+	0.338	0.256	-0.011
Mg^{++}	-0.020	-0.159	-0.009
Na^+	-0.333	0.047	-0.176
K^+	0.221	-0.159	0.028
Fe^{++}	0.099	-0.200	-0.030
Mn^{++}	-0.460	0.593*	0.497*
Zn^{++}	-0.294	0.059	0.369
Cu^{++}	-0.289	0.186	0.449

*Correlation is significant at the 0.05 level

Table 2. The results of Duncan test.

Bedrock/soil variables	Mg^{++}	Cu^{++}
Limestone	1503.33a	54.63b
Ultrabasic rocks and ve Serpantine	1545.00a	47.33ab
Jips	3031.67b	27.83a

*No difference exists among the variables with same letter (P<0.05)

Table 3. Oneway anova test of soil characteristics in accordance with bedrock

Variables	Sum of Squares			df			Mean square		F	Significant
	Between groups	Within groups	Total	Between groups	Within groups	Total	Between groups	Within groups		
pH	0.176	0.990	1.166	2	14	16	0.08797	0.07073	1.244	ns
Total $CaCO_3$ %	516.219	3701.84	4218.06	2	14	16	258.109	264.417	0.976	ns
Organic Matter %	9.367	152.223	161.590	2	14	16	4.684	10.873	0.431	ns
P2O5 %	142.77	40931.04	41073.80	2	14	16	71.385	2923.64	0.024	ns
NaCl	0.108	1.123	1.231	2	14	16	0.05405	0.08019	0.674	ns
N %	0.05060	0.495	0.546	2	14	16	0.0253	0.0354	0.715	ns
Ca^+	5795733	89506766	95302499	2	14	16	2997866	6393340	0.453	ns
Mg^{++}	7030250	15453067	22483316	2	14	16	3515124	1103790	3.185	*
Na^+	62.597	550.710	613.307	2	14	16	31.299	39.366	0.796	ns
K^+	0.249E+9	1.01E+10	1.26E+10	2	14	16	1245135524	721703509	1.725	ns
Fe^{++}	9174703	2.33E+08	3.24E+08	2	14	16	45623501	16644018	2.741	ns
Mn^{++}	9241.02	77761.92	87002.94	2	14	16	4620.51	5554.42	0.832	ns
Zn^{++}	165.799	4605.194	4770.993	2	14	16	82.900	328.942	0.252	ns
Cu^{++}	1991.176	2879.321	4870.497	2	14	16	995.588	205.666	4.841	*

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International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

INVESTIGATIONS ON THE *Helianthus annuus* L. GROWN FROM SEEDS EXPOSED TO THE MAGNETIC FIELD

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In this research, the seeds of. Nonexposed seeds were used as control. The seeds were exposed to magnetic field one and three times, the strength and the period of the magnetic field were changed. *Helianthus annuus* variety AS 508 seeds were exposed to 3.8 - 4.8 mT magnetic fields and seedlings obtained were exposed to different strengths of magnetic field under optimum conditions in the climate chamber. The rates of germination, height of the seedlings and the length of the roots were recorded. In this phase, the samples taken from the roots, stem and leaves were put into Carnoy fixative and they were passed through alcohol, xylol and paraffin at 70 ºC. Cross sections of root, stem and leaf were taken with the help of a rotary microtome in 7 µm thickness and stained by safranin and crystal violet and then the anatomic scructures of the fixed preparation were examined. As a result, it was observed that the effect of magnetic field stimulated the rapid growth of trachea elements at conduction cluster grown from root, stem and leaf of the plant germination from the seeds exposed to magnetic field.

***Key word**: Magnetic field, Helianthus annuus, anatomy, morphology*

INTRODUCTION

The fact that earth's magnetic field (MF about 50µT) can affect natural component of the environment for living organisms has been known for more than 2000 years. Previously many researchers believed that permanent magnetic field are not effective on the normal functions of livings. However, the results obtained have revealed the sensivity of biological object to magnetic field. In the last years research into the biological action of magnetic fields has attracted the attention of biologists, medical men and agriculturists in connection with the effective results given by their use. At the research done on the cell level, it was determined that at the G1 phase of the cell cycle. RNA and protein synthesis were affected by the magnetic field strength. At cells exposed to magnetic field strength, it was determined that cell division was affected by the magnetic field and was also seen that there was an increase on the rate of cell division [1-5]. At the numerous experiments done with various crops like cotton, sunflower, soybean, positive effects of the magnetic field on the seedling growing were determined [6-9]. However, the effect of magnetic field was different in some plant species. At same study seedlings of different plant species placed in weak magnetic field have shown that the growth of their primary roots is inhibited during early germination stages in comparison with control [10-12].

The proliferative activity and cell reproduction in meristem of plant roots are reduced in weak magnetic field [2]. Extensive research on the effect of magnetic fields on seeds and seedlings shows that consistent results are lacking. This would suggest that the response to magnetic treatment may only occur under specific environmental conditions as yet not clearly known. A systematic and extensive study is necessary to determine the mechanism of magnetic action in plants and identify its useful application. For this purpose it is necessary to consider a wide range of factors including magnetic parameters (field strength, time of exposure, polarity etc.), seed physiologic parameters (germination, vigor, respiration rate, heat loss and moisture content) and seed biochemical parameters (nitrate reductase activity, auxin effect etc.) [13].

In nourishment of human being, a big amount of oil need has been supplied from the plants and as vegetable oils are more useful than animal oils for health. Therefore, *Helianthus annuus* L. has been an important crop in the area of nourishment. *Helianthus annuus* L. being a member of *Asteraceae* (*Compositae*) family is very important. Since it has a wide ecological tolerance and supplies high seed and oil yield. It has a large planting field and productional proportion especially in Black Sea and Aegean Region as dry agricultural plant in Turkey [14]. In our country, according to the data in 2002, 950000 tonnes of production and 1597 kg/ha yield had been obtained. Researches have carried out various reforms to obtain higher yield and quality from unit field of *Helianthus annuus* L. which becomes important in the agricultural arena [14]. In these studies, the aim is to creata and develop a variation and new varieties by using different techniques and among them, according to the goal, high productive, resistant to disease, pestisits, drought and harmful insects, including high capacity of nitrogen linkage, qualified from the point of view of oil and protein being used of techniques to get hereditary mutation in getting culture plants gained desired spesifications, in the short run, is to bring to light new varieties. Therefore, various mutagenic factors can gain new special features by making hereditary changes in the chromosome structure and numbers or in the structure of genes [15, 16].

Generally, the experiments regarding the magnetic field were done on the various crops. In this study, we studied the effects of magnetic fields (MFs) on the growth, and germination of sunflower (*Helianthus annuus* L.) seed.

MATERIAL AND METHOD

In this study, the seeds belonging to AS 508 sunflower (*Helianthus annuus* L.) variety were used as testing material provided from Turkish Sugar Factories Corporation Lüleburgaz sarımsaklı Agriculture Enterprise. For magnetic field experiments, we used 10 magnets of 0.45 x 0.065 x 0.022 m dimensions. In JINR (Joint Institue Nuclear Research; Dubna-Moscow, Russia) laboratories, these magnets prepared by magnetic field group were mounted onto belt system which rotated with a rate of 1m/second in laboratories Universty of İstanbul (University of İstanbul, Faculty of Science, Department of Biology, İstanbul, Turkey). The magnet height from the belt system could be adjusted. In this research, magnetic flux density of 3.8 - 4.8 mT was used. The seeds were passed through 1 and 3 times.

In this research, two experiments were done. In the first experiment the seeds were passed 1 and 3 times and through magnetic field. Then exposed seeds and control seeds were germinated and grown in pots in the laboratory and the possible effects of the magnetic field on the growing plant were examined. In the second experiment, the seeds were exposed to magnetic field (1 and 3 times) and control seeds were germinated on humid filter papers at 25ºC in petri dishes under controlled conditions and then, the root lengths on the 5th day and germination rate on the 7th were measured.

Sunflower seedlings were grown from the seeds exposed to force of magnetic field and control, at the optimum conditions in the climate chamber and seedling heights on the 14th day were measured. On the 14th day, the samples were taken from roots, stems and leaves of the plant were first fixed by using FAA (formalin acetic alcohol) [17-18]. The samples were passed through an alcohol histoclear series for dehydration. Paraplast was added to the histoclear and the samples placed in an oven. Cross sections of root, stem and leaf were taken with the help of a rotary microtome in 7 µm thickness and stained by safranin and cyristal violet. Experiments were carried out under a light microscope and photographs of the cross sections were taken by a microphotography apparatus (JENA).

RESULTS AND DISCUSSION

In this research, the seeds belonging to AS 508 sunflower variety were exposed to the force of magnetic field. Seeds were passed 1 and 3 times through a magnetic field of 3.8-4.8 mT. Germination rate, seedling heights, growth of roots and anatomic scructures of the samples taken from the roots, stem and leaves were observed. The results of germination rate are presented at Table 1.Young seedling of sunflower were seen firstly on the 7th day of the germination period at control seeds. On the 7th day, it was measured that the germination rate of those which were passed through magnets 3 times was higher than control. (But during the period of germination on the 8th, 9th and 10th days, the germination rate decreased). The root lengths of grown seedlings were shown at table 2. Radicula was seen on the 2nd day of germination period and root length was a little bit longer than those which were passed through the magnet 3 times according to the control. Lentgh of root of all the magnet experiment period was also longer than than control on the 3th and 4th days. On the 5th day, the length of root which was passed through the magnet once was higher than according to the control (Table 2). On the 14th seedling heights were measured and average seedling heights were shown at Table 3. Average seedling heights were decreased according to control at As 508.

Table 1. Effect of Magnetic Field on germination percantage of seed belonging to *Helianthus annuus* L. AS508 *Passing number through magnetic system.

Variety	MagneticField Influence*	Seed number	Germination percantage (%)			
			7th day	8th day	9th day	10th day
AS 508	Control	60	35,67	87,67	95,67	95,67
	1	60	28,67	84,33	92,67	92,67
	3	60	39,33	85,67	94,33	94,33

Table 2. Avarege height of 14th day seedling belonging to Helianthus annuus L. variety which were exposed to magnetic field of 3.8-4.8 Mt

Variety	Magnetic Field Effect	Seed numbers	Avarege seedling height (cm)	Seedling %
AS 508	Control	60	12,6 ± 0.1	100
	1 time	60	12.4 ± 0.1	98.41
	3 times	60	12.1 ± 0.2	96.03

Root Anatomy

A transverse section of the root showed that a broken epidermis is present on the outermost. Below it lays cortex tissue with 7-10 layered, well–arranged, and spherical cells. The cortex occupies a wide arcade up to the endodermis and parenchyma cells out of endodermis have been flattened. Endodermis is not easily distinguised. But pericycle has been distinguished below endodermis.The phloem takes up a small part in the vascular cylinder, xylem with the trachea, and tracheids ocupy most of vascular cylinder and distributed all around the pith (Fig. 1). The trachae are different formed and are very development. Pith is filled with xylem elements (Fig. 2).

While endodermis in the root anatomy of the control plants was formed by well–arranged parenchymatic cells, the cells in the roots of the plants exposed to magnetic field 1 and 3 times were not arranged. It was observed that especially tracheas are the best developed in xylem and that pith was filled with the elements of xylem (Fig. 3, 4). The sizes of the trachea were measured and it was seen that the sizes of the trachea were increased in the plants exposed to magnetic field 1 and 3 times (Table 4). All of the measurements were statistically analyzed.

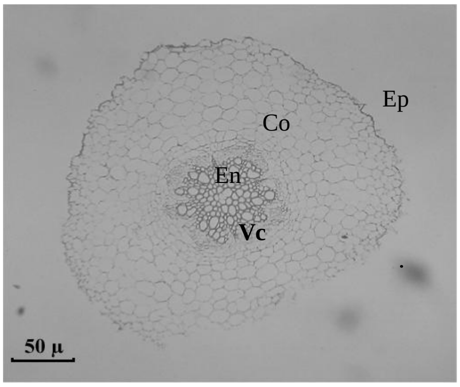

Fig 1. Control – General view of root
Ep: Epidermis, Co: Cortex, En: Endodermis, Vc: Vascular cylinder, Vb: Vascular bundle, Pi: Pith.

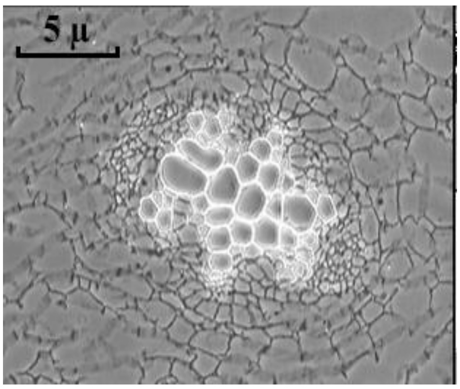

Fig 2. Control – Vascular cylinder of root

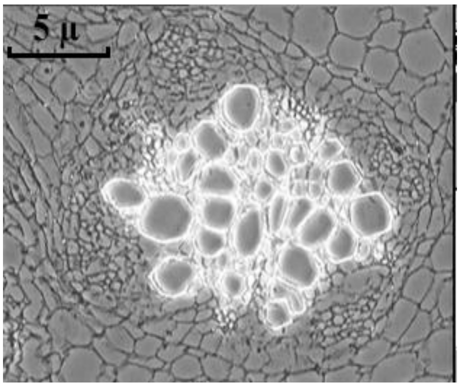

Fig 3. MF 1 time – Vascular cylinder of root

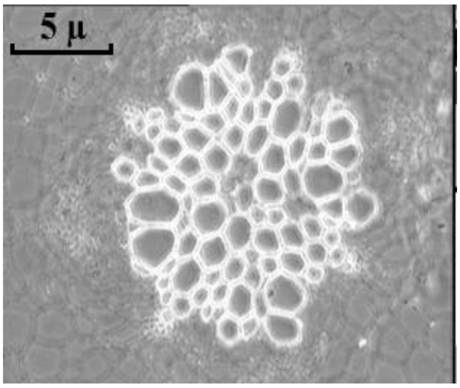

Fig 4. MF 3 times – Vascular cylinder of root

Table 4. Biometrical measurement of tracheal element of root, stem and leaf anatomy of *Helianthus annuus* L. AS 508

		Control			Magnetic field using					
					1 time			3 times		
	Dimension	Average	Min	Max	Average	Min	Max	Average	Min	Max
Root	Trachea num.	16.6±0.1	16	22	19.3±0.2	18	21	21±0.2	18	24
	Trachea height (μ)	35.4 x 39.3	20 x 22	40 x 64	44.2 x 45.4	30 x 32	54 x 64	40 x 64	20 x 22	35.4 x 39.3
Stem	Trachea num.	5±0.1	2	7	5±0.1	3	8	7.5±0.1	7	8
	Trachea height (μ)	17.2 x 19.3	13 x 14	23 x 24	23.5 x 24.1	15 x 20	27.5 x 32.5	15.3 x 16.9	9 x 14	17 x 25
Leaf	Trachea num.	4.6±0.1	3	7	5.5±0.1	4	7	3.5±0.1	3	4
	Trachea height (μ)	11.1 x 13.1	9 x 10	18 x 18	16.1 x 20.1	11 x 12	18 x 26	15.7 x 16.5	12.5 x 12.5	21 x 21

Anatomy of Stem

On outermost a single layered epidermis is found, followed by 1-2 layered hypodermis. Collenchyma and parenchyma cells are formed in the cortex that 5-7 layered below hypodermis. Vascular bundles are scattered in a circular form with phloem on outer side and xylem iner (Fig. 5). The phloem, as in root, occupies a small area and xylem makes up most of bundles. The cambium is composed 2-3 layers in vascular cylinder. Pith is parenchymatous (Fig. 6).

While hypodermis in the stem anatomy of the control plants was one layered, hypodermis in the stem of the plants exposed to magnetic field 1 and 3 times were two layered. It was observed that especially tracheas are best developed in xylem in the stem of the plants exposed to magnetic field 1 and 3 and that pith was indifferent (Fig. 7, 8). The sizes of the trachea were measured and it was seen that their sizes were increased in the plants exposed to magnetic field 1 and 3 times (Table 4). All of the measurements were statistically analyzed.

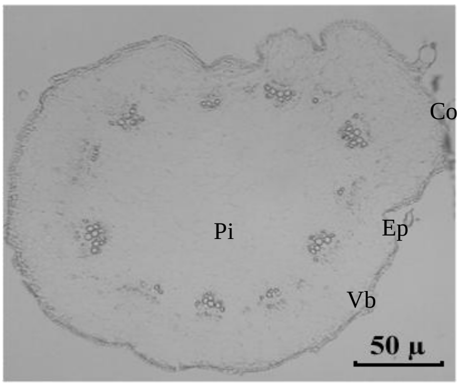

Fig 5. Control – General view of stem

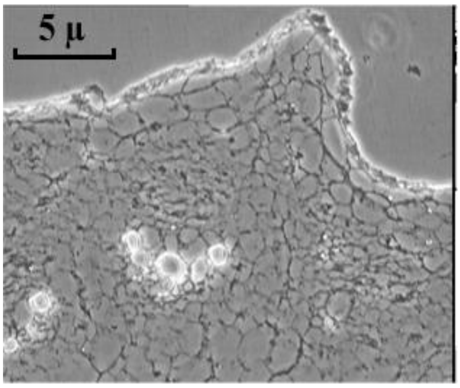

Fig 6. Control – Vascular cylinder of stem

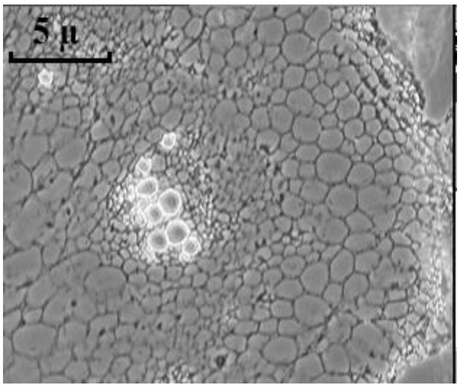

Fig 7. MF 1 time – Vascular cylinder

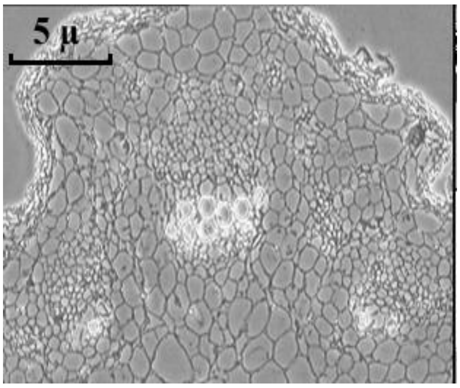

Fig 8. MF 3 times – Vascular cylinder of stem

Leaf Anatomy

The leaf is bifasial type, in which 2-3 layers of palisade parenchyma are found on upper surface of mesophyl that are sparsely cells and spongy parenchyma are composed with wide intercellular spaces on lower surface of mesophyl. Upper epidermis cells are bigger than lower epidermis cells (Fig. 9). Mesophytic stomata are found on both sides of the leaf (amphystomatic). The phloem, as in root and stem, occupies a small area and xylem makes up most of bundles (Fig. 10).

The leaf anatomy of the control plants is indifferent when the leaf anatomy of the plants are exposed to magnetic field 1 and 3 times. Only it was observed that especially trachea are best developed in xylem in the leaf of the plants exposed to magnetic field 1 and 3 (Fig. 11, 12). The sizes of the trachea were measured and it was seen that were developed in the plants exposed to magnetic field 1 and 3 times (Table 4). All of the measurements were statistically analyzed.

In our study, it was observed that the effect of magnetic field stimulated the rapid development of tracheal elements at conduction cluster grown from root, stem and leaf of the plant germination from the seeds exposed to magnetic field. The data obtained from this study may be helpful to explain the mechanism of the biological effect of MF.

It was shown that magnetic field was effective on the various crops. The previous studies regarding the effects of magnetic field on the rates of germination, seedling heights, and root formation of various plants were available [6-8, 12, 19].

In a study done with *Allium cepa* L. and *Oryza sativa* L.germination rates of the seeds which were exposed to EMF of 108 Oe for 30 minutes increased (7). ATP content in germination seeds of *Phaseolus aureus* Roxb which were exposed to EMF of 0.2 T for 60 minutes was increased [20].

Therefore, some positive effects of MF and EMF on the growth of different plants have been shown previously [1, 9, 13, 14, 21-23]. However, numerous experiments with seedlings of different plant species placed in weak (low) magnetic field (WMF) have shown that the growth of their primary roots is inhibited during early germination stages in comparison with control. The proliferative activity and cell reproduction in meristem of plant roots are reduced in weak magnetic field. Cell reproductive cycle slows down due to the expansion of G1 phase in many plant species while other phases of cell cycle remain relatively stable. In plant cells exposed to weak magnetic field, the functional activity of genome at early pre-replicate period is decreased. Weak magnetic field causes intensification of protein synthesis and disintegration in plant roots [25].

Apart from this, plants in the conditions of the geomagneticfield (GMF) and this 10-10 fold screening have been investigated. It was shown that in condition of screening the capacity for germination of seed and growth of the seedling was delayed and inhibited respectively, growth of seedling in GMF condition was faster [12].

The data presented suggest that prolonged exposures of plants to weak magnetic field may cause different biological effects at the cellular, tissue and organ levels.

Detailed analysis of the alterations in cellular structure of meristem cells of pea seedling roots exposed to WMF was performed by Belyavskaya. Some changes in the structural organazition of some organalles and cellular compartments were observed in comparison to the control roots [25, 26].

Finally, there is a large body of experimantal data demonstrating various effects of WMF on plants. In most cases WMF suppress the growth processes, cell division and differention, induce significant changes at the cellular and subcellular level, and alter the Ca^{+2} balances, enzymes activities and various metabolic processes [24].

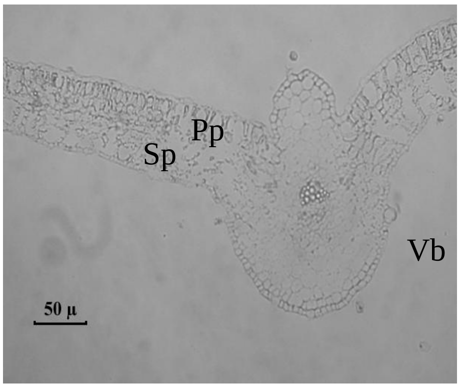

Fig 9. Control – General view of leaf

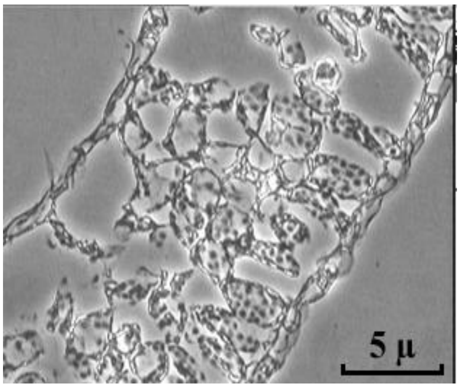

Fig 10. Control – Leaf mesophyll

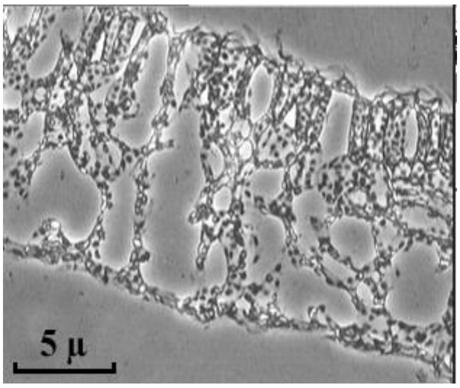

Fig 11. MF 1 time – Leaf mesophyll

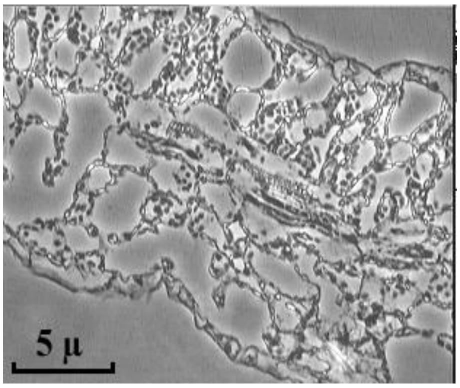

Fig 12. MF 3 times – Leaf mesophyll

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THE FIRST RECORD OF *MACROBRACHIUM NIPPONENSE* (DE HAAN, 1849) FROM IRAN

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Importing exotic species heightens the risk these becoming introduced pest species. In a study on ponds in Golestan Province, a number of shrimp specimens were caught and identified as *M. nipponense*. The species is recorded for the first time in Iran. Due to morphological similarities between *M. nipponense* and *M. rosenbergii*, it might have been mistakenly introduced instead of *M. rosenbergii* or might have come with other released aquatics. At present it has only been identified from these sites in Golestan Province.

Keywords: *Iran; Macrobrachium; M. nipponense; Shrimp*

Preferred Presentation Format: Platform

INTRODUCTION

Culturing shrimps for protein and export revenue is a priority of the Iranian Fisheries Organization. Hence, this organization arranges programs to import key aquaculture species such as *Macrobrachium rosenbergii*.
However, other unwanted species may sometimes be introduced with the imported species.

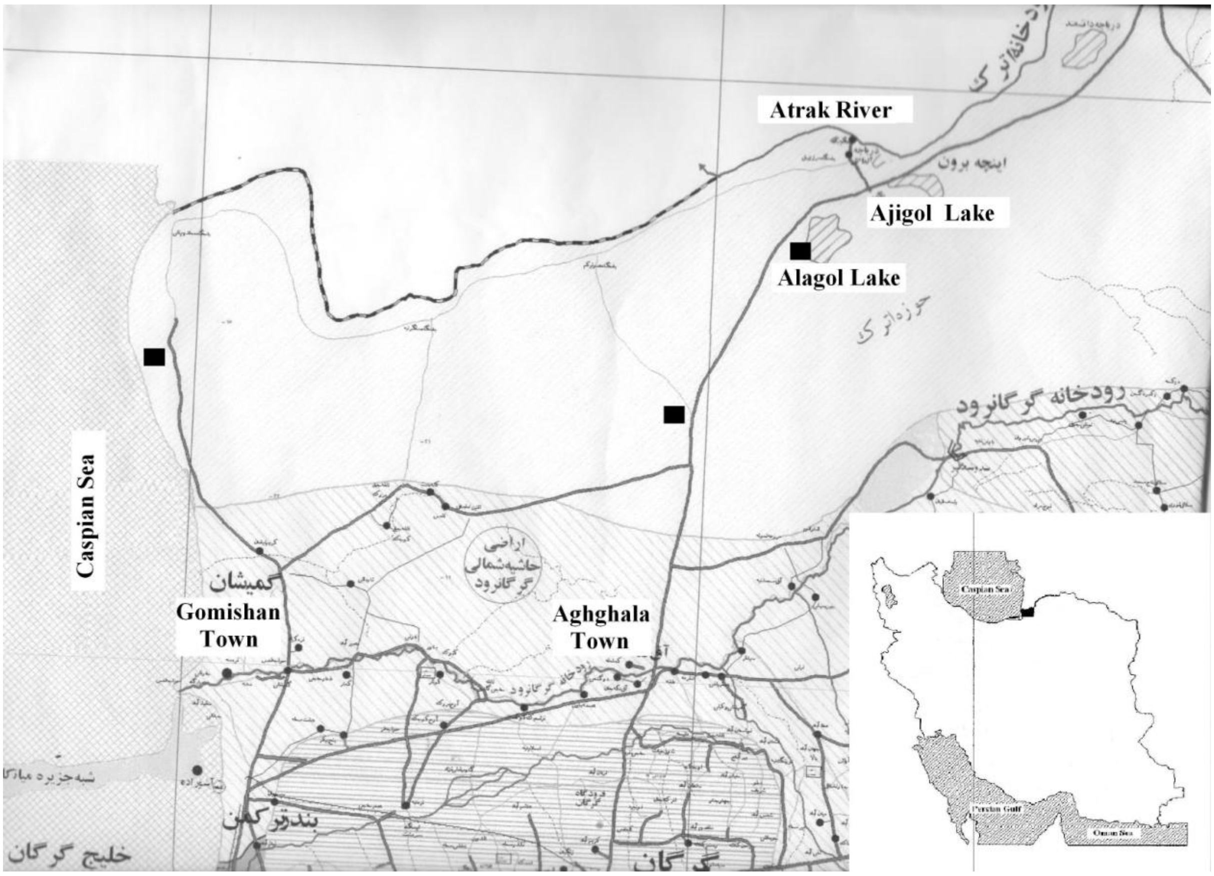

Fıgure 1: Location of sampling sites in Golestan province.

In June 2005, a sampling for identifying some biological characters of *M. nipponense* was done in Alagol Lake which is located 75 km, North West of Gonbad town (Golestan Province) (fig.1). The sampling was carried out in the lake margin with a hand made net, with very small mesh size (14 mm). Specimens were fixed in 70% alcohol which was changed after 24 hours. Then, specimens were carried to laboratory for further studies.
Total number of the specimens was 24 and some specific parameters were studied for all the specimens, such as total length (from the tip of the rostrum to the end of the body), carapace length and weight. To measure the length, a Caliper with accuracy of 0.1 mm and for weight a scale with accuracy of 0.1 gram was used.
It is worth mentioning that some specimens were caught from Dastgheib pond which is 25km. North of Aghghala by experts of Fisheries organization of Golestan province, but only one specimen was subjected to investigation. Some materials were also observed in Fish ponds of the province which were recorded by the author. No statistical pattern was applied to the sampling.

RESULTS

In a case study on some ponds of Golestan Province, shrimp specimens identified as *Macrobrachium nipponense* were detected (Figs. 2 and 3). This is the first record of this species from Iran. Morphological charactistics of the specimens analysed are presented in Table 1. The study of the specimens shows that ratio of the females to males is 0.69. At the sampling time, some females were also caught carrying eggs but to estimate the exact time of spawning further study is required.

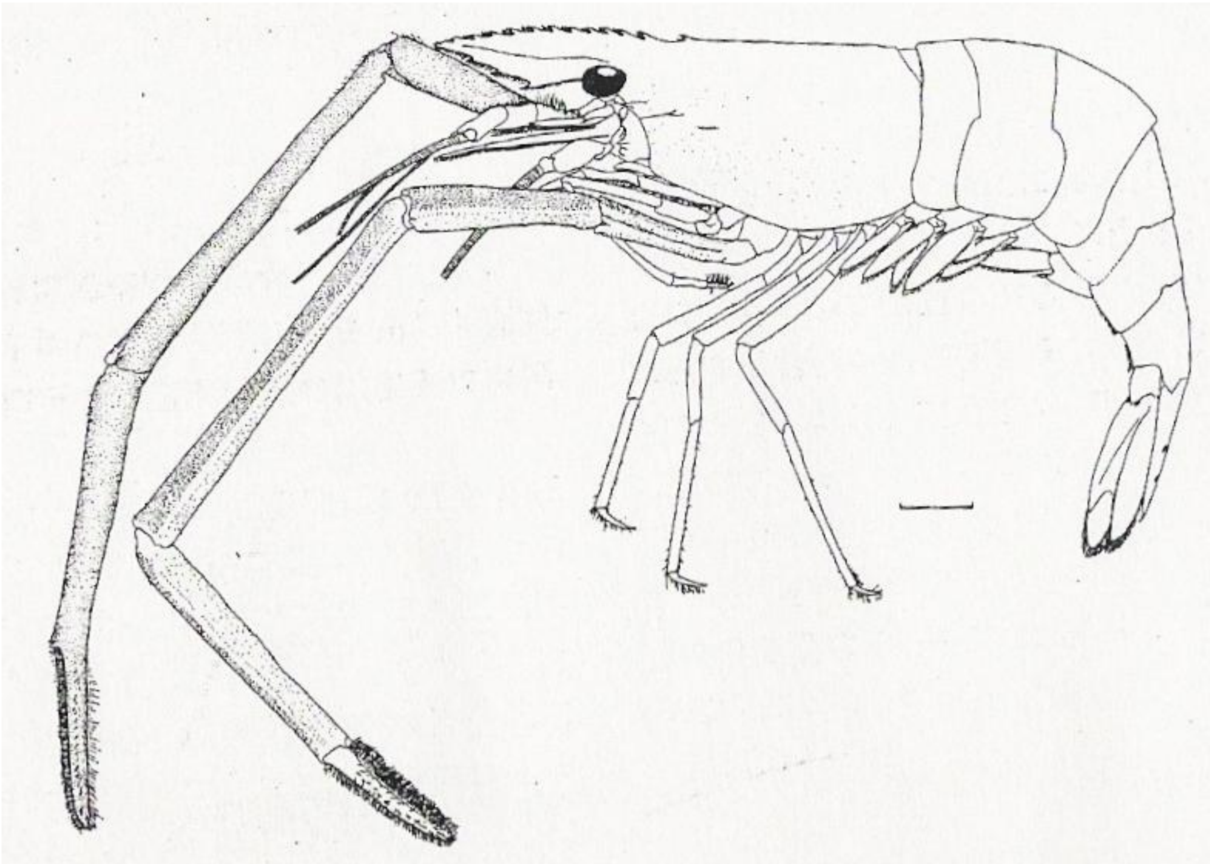

Figure 2: *M. nipponense*

Figure 3: *M. nipponense*

Table 1: Total length, carapace length and weight of the specimens of *M. nipponense* collected from Golestan Province, Iran.

Specimens	Characters	average	minimum	maximum
Male specimens	Total length (mm)	62.8	36.8	76.3
	Carapace length (mm)	17.4	8.8	22.9
	Weight (gr)	3.5	0,6	7,1
Female specimens (without eggs)	Total length (mm)	53.9	48	57,1
	Carapace length (mm)	13.6	12,9	14,4
	Weight (gr)	1.6	1,1	2,2
Female specimens (with eggs)	Total length (mm)	58.7	51	68
	Carapace length (mm)	15.9	13,1	19,6
	Weight (gr)	2.9	1,8	4,3

DISCUSSION AND CONCLUSIONS

M. nipponense is a commercially important species found in brackish and freshwaters throughout China and Taiwan (Yao, 2004). The species is one of the most important freshwater prawns for aquaculture in China, especially in the southern regions of the country (Fu, 2004).

Historically the species has been known only from Japan and China. But, it was found recently also in Hong Kong and Vietnam, and even in Singapore and Philippines. It seems that the species is expanding its territory, probably being carried there with vegetation and specimens for fish and shrimp culture. In 1971, some specimens of *M. nipponense* were found in heated power station ponds near Moscow. They probably were introduced there with Chinese fish and at that time, they were often sold at the animal markets in Moscow.
In 1989, some specimens of *M. nipponense* were found in a freshwater reservoir near Alma-Ata in Kazakhstan. The reservoir obtained its water from a river that originated in China (L. B. Holthuis, personal communication). Also, some specimens of *M. nipponense* were found in the Syr-Darya drainage basin in Arnasai system of brackish lake in Uzbekistan (Alekhnovich, 2001). There is no record of the existence of the species in countries adjacent to Iran or in any water body that flows to Iran. For this reason and because of very similar morphological attributes of *M. nipponense* with *M. rosenbergii*, it might have been mistakenly introduced as *M.* r*osenbergii* or might have come with other released aquatics. At present it is found in some ponds of Golestan Province.

This species is found in different water bodies of the province at the moment. Due to the low salinity of the Caspian Sea and some other water bodies which flow to this sea, it is probable that the species may also be found in Caspian Sea. This species is so well adapted to the region it may already be a common species.

ACKNOWLEDGMENTS

It is incumbent upon the author to thank Professor L. B. Holthuis, National Museum of Natural History, The Netherlands, for his very useful help and guidance. Also, my thanks go to Dr. Nasrollahzadeh, scientific staff of Guilan University for his information about Guilan materials and to Mr. Alimohammadi, Miss Zafari and Miss Rezazadeh for their materials from different parts of the Golestan Province.

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BIOLOGICAL CONTROL OF AQUATIC PLANTS USING GRASS CARP: IMPLEMENTATIONS IN TURKEY

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The grass carp (*Ctenopharyngodon idella*, Val. 1844) among Chinese carps has been receiving worldwide attention as a biological control agent for aquatic plants and as a source of food. It was first introduced outside its native area after 1945.

The benefits of using grass carp for aquatic plant control include longevity of the method, constant feeding activity against the growing macrophytes, low long-term costs and the potential for conversion of weed biomass to fish protein. However, the possible effects of grass carp on the ecosystem are complex and depend on the stocking rate, size of stocked fish, macrophyte abundance and the complexity of the ecosystem. Grass carp was introduced in Turkey in 1972. Initially, necessary investigations couldn't be maintained continuously. After the determination of side effects of chemical macrophytes control in 1980s, necessary attention has been paid to the grass carp in order to provide biological control of macrophytes rather than using it as food. In this study, the effects of grass carp on aquatic environment will be discussed with reference to some implementations in Turkey.

Introduction

Aquatic plants have important role in water systems. They are mainly the source of oxygen in water as being photosynthetic organisms and provide spawning habitats and shelter for small organisms to avoid themselves against to predation and also source of food for fish (Atay 1987, Altınayar et al. 1994, Cirik and Koru 1994, Scheffer 2001, Dodds 2002). However, aquatic plant control may be required to meet the objectives of domestic, industrial recreational and agricultural consumption of the water. Extensive infestations of obnoxious aquatic weeds cause problems in the recreational uses of the water resources, caused great oxygen fluctations, difficulties in fish motion and also encouraged the development of parasites and the other organisms against the growth of fish. Besides these, aquatic weeds inhibited the utilization of fishing techniques. As a result, aquaculture production is decreases (Atay 1987, Altınayar et al 1994).Among aquatic weed control methods, the use of mechanical and chemical technologies are rooted in the notion of a quick and possibly complete, though temporary, elimination of an aquatic plant problem. Rapid plant regrowth is only one of the concerns connected with them. There has been widespread and sometimes justified, fear of chemicals and mechanical/physical techniques are found to be too slow or subject to frequent breakdowns. In biological control, the use of herbivorous fish species appearing to be promising possibility. A desirable effect from the point of view of human interests could possibly be achieved without danger of chemical methods and furthermore could assist in avoiding labor outlay and the costs of mechanical vegetation control. In a biological control agent following attributes must be found;

1. It must be attack only the target plan or plants and not desirable plants and animals,
2. It must be able to survive in the new environment into which it is to be introduced,
3. It must be capable of reducing the aquatic weed population to an acceptable level (Riemer 1984).

The fish that has the greatest potential for controlling aquatic weeds is beyond all doubt, the grass carp (*Ctenopharyngogon idella*, Val. 1844). The use of grass carp appeared to have considerable advantages because it was reasonably selective, less expensive and lasts considerably longer than other methods (Opuszynski 1979, Shireman and Smith 1983, Çelikkale 1988).

Grass carp is native to large river systems of eastern Asia, from the Amur River on the Russian Chinese southward. Grass carp has been extended by man to include much of Asia and North America and virtually all Europe for foodfish culture and mainly aquatic vegetation management since 1945s (Riemer 1984, Opuszynski and Shireman 1995, Masser 2002).

The effectiveness of grass carp based upon its apparent obligatory herbivorous feeding preference. Temperature, age and the size of the fish greatly affect food consumption rates. The consumption of aquatic plants commences at 12^{o}C and the fishes begin intensive feeding temperatures from 22^{o}C to 23^{o}C even on non preffered plants (Colle et al 1978, Cooke et al 2000). Above 33^{o}C feeding activities decrease (Opusynzki and Shireman 1995). Besides the temperature, research studies have shown that the size and the type of vegetation are the factors that influence consumption rates the most. Generally grass carp prefers the soft, tender tips of young, growing plants and submerged vegetation. Young grass carp (<1 kg) prefers soft vegetation and consume species such as *Lemna*, filamentous algae and *Chara*. Any preference for filamentous appears to decrease with age. The most preffered plants are succulent and low fiber. As grass carp grow, more plant species and less succulent ones are added to the diet (Table 1).

Table 1. A few aquatic plants eaten by grass carp in the approximate order of preference (Sutton and Vandiver 2000)

Order of preference	Aquatic plants
1	*Hydrilla verticillata* (L.f) Royle
2	*Chara* spp.
3	*Najas quadalaupensis* (Spreng,)
4	*Egeria densa* Planch.
5	*Wolffia* sp
6	*Lemna* spp
7	*Azolla caroliniana* Willd.
8	*Potamogeton* spp.
9	*Ceratophyllum demersum* L.
10	*Panicum repens* L.
11	*Stratioties aloides* L.
12	*Nasturtium officinale* R. Br.
13	*Myriophyllum spicatum* L.
14	*Vallisneria americana* Mischx.
15	*Myriophyllum aquaticum* (Vell.) Verdc.
16	*Eichhornia crasssipes* (Mart.)
17	*Pistia straiodes* L.
18	*Nymphaea* spp.

Research studies have shown that juveniles (6 to 15 cm) consume 6 to 10 % of their body weight each day. Fish weighing 1 to 1.2 kg can consume more than their body weight each day. Reportedly, fish heavier than 4.5 kg eats only 20 to 30% of their body weight. Obviously, at these consumption rates grass carp can quickly reduce vegetation if stocked in proper numbers, in good quality water and at optimum temperature (Shireman and Smith 1983, Shireman and Opusynzki 1995, Sutton and Vandiver 2000). While grass carp live many years, their effectiveness for vegetation control decreases significantly after 5-7 years. Ponds usually need to be restocked with grass carp every 5 to 7 years; or, each year 20% of the original number can be stocked to ofset mortality (Masser 2002).

Imlementations inTurkey

Grass carp was introduced in Turkey from Romania by General Directorate of State Hydroulic Works in 1972. Initially, necessary investigations couldn't be maintained continously. After determination of side effects of chemical aquatic weed control in 1980s, necessary attention has been paid to the grass carp in order to provide biological control of aquatic weeds rather than using it as food. Sixteen investigations were carried out in fish ponds (5), irrigation and drainage channels (9) and natural lakes(2) to measure the ability of grass carp in biological control between 1972 and 1994 years. In fish ponds, good results were obtained with a 58.3 kg/ha (grass carp, 105 g in weight, 4.4 cm in total lenght) stocking rate in 7 months and with a 199 kg/ha (grass carp, 211.6 g in weight, 8 cm in total lenght) stocking rate in one month. In irrigation and drainage channels and natural lakes, the experiments weren't successful because fish couldn't be maintained in the channels and the grass carp stocked in natural lakes were not in suitable size for using in biological control (Altınayar et al 1994). Baran and Seçer (1979) were stocked 2 years old 25 grass carps (16.8 cm in total lenght and 105 g in weight) with 1 year old common carps as policulture to the fish pond with size 450 m^2 in April. The 75% of the pond surface was covered with submerged plants such as *Myriophyllum verticulatum, M. spicatum, Chara fragilis, Carex curvula, Potamogeton natans, P. nodosus, Ceratophyllum demersum, C.submersum, Nasturtium aquaticum.* When the water temperature reached to 24 ^{o}C in June, there was a sharp decrease in vegetation and at the end of the experiment in October, only plants with hard tissue that couldn'be consumed by grass carp were found in the pond. Grass carp gained 930 g in weight and 27.2 cm in lenght at the end of the experiment.

Reproduction studies have been carried out successfully in the hatcheries of General Directorate of State Hydraulic Works that was located in different regions of country since 1972 to stock grass carp to the reservoirs that was builted by this foundation. Kırkağaç and Atay (2001) carried out a reproduction study to prepare a data base for further studies about reproduction of grass carp under artificial conditions and rearing to size that can be utilized in biological control. In the study 4 female and 4 male were used. The amount of stripped eggs were changed between 91.8 g/kg body weight (60965±2460 eggs g/kg) and 105.1 g/kg body weight (71881±2842 eggs g/kg); the volume of stripped sperm from male spawners were differed between 4.0 ml/kg body weight and 6.1 ml/kg body weight; the fertilization rate was determined as 94.0±0.56% and 98.6±0.52%, while the hatching rate was between 83.7±1.63% and 90.84±0.48%. The larvae feeding experiment was conducted with two experimental groups. The first experimental group was given the starter feed including 51% raw protein for the first 9 days and than was given the feed including 43% raw protein for the following 14 days. However, the natural food including zooplankton were given to the second experimental group. It was determined that larvae feeding 51% of raw protein was found to be superior to natural food in the first 9 days of experiment. However feeding with 43% of raw protein gave lower growth values compared to natural food in subsequent 14 days of the experiment. At the end of the larvae feeding period, larvae reached to17.2±1 mm in lenght and 0.04±0.8 g in weight in three weeks in tank conditions. In the feeding experiment of fry, raw protein contents of feeds were as 20%, 37% and 43% to the experimental groups, respectively. The best growth was observed in the experimental groups that fed with the feed including the highest raw protein. The fry reached to 18.5±0.5 cm in lenght and 74.06±7.52 g in weight in one year in aquarium conditions.

Kırkagaç (2003) carried out a research to determine the gut content of grass carp fry, at what size the fry change their feeding habits from omnivorous to herbivorous. Grass carp fry (0.04±0.01 g weight; 1.48 ±0.03 cm total length) were stocked into an earthen pond in June. Every week for twelve weeks, fifteen fish were sacrificed and the content of their guts was examined. At the first week, animal material represented 74% of the gut contents. From the second week onwards, plant material was higher (mean value 79%). In the seventh week, when grass carp reached 4.83±0.09 cm, filamentous algae were replaced by macrophyte fragment. Besides the macrophytes, animal material such as the rotifers *Monostyla* and *Lecane* and the cladoceran *Bosmina* were found and the proportion of animal material in the gut varied 11-28% from week 2 to the end of the investigation (Table 2). This showed that grass carp while feeding on macrophytes, ingest all living organisms associated with plants, including rotifers, oligochaetes, chironomid larvae and other aquatic organisms.

Kırkağaç and Pulatsü (2000), were in order to determine the role of grass carp in eutrofication, they fed the fish with *Potamogeton pectinatus* for 72 hours in a laboratory experiment. The phosphorus determinations were done in water, plant and feces. The release phosphorus from feces and consumed plant material were determined and retention by grass carp was estimated 74.4%. The results of this experiment supported that the utilization of grass carp in order to remove of phosphorus in aquatic systems might be an effective method.

There are other studies were designed to obtain more field information on the effects of the grass carp on pond environments by comparing some water quality parameters, phytoplankton, zooplankton and benthos in ponds with and without grass carp.

A preliminary study on the effects vegetation elimination by grass carp on water quality, zooplankton and benthos was conducted between September 1988 and August 1999 in an irrigation and recreation pond (1.3 ha) by Kırkağaç and Pulatsü (2001). The 80% of the pond was covered with submerged plants and was stocked with 480 grass carp, 15.02±0.58 cm in length and 52.67±0.88 g in weight. Grass carp consumed *Myriophyllum* sp, *Potamogeton pectinatus* and *Ceratophyllum demersum* during research period. *Phragmites australis* and *Typha* sp. were the plants only that couldn't be consumed.

Table 2. Food components in the gut of grass carp (n=15) in an earthen nursing pond(%)

Week	Sampling date	Zooplankton	Phytoplankton	Benthos	Macrophytes	Sand
1	June 28	58	26	16	-	-
2	July 7	27	72	1	-	-
3	July 14	16	79	4	-	1
4	July 21	12	80	7	-	1
5	July 28	15	76	7	-	2
6	August 4	6	89	5	-	-
7	August 11	17	24	9	50	-
8	August 18	15	34	1	50	-
9	August 25	15	40	3	42	-
10	Septem. 1	19	36	1	44	-
11	Septem. 7	18	28	4	50	-
12	Septem. 14	17	16	3	64	-

Fish reached to size and weight 31.30 ±0.67 cm and 375.77± 0.36 g, at the end of the research period, respectively. Water quality parameters were in acceptable limits for grass carp. Zooplankton composition was dominated by rotifers and also composed of small cladocerans such as *Bosmina longirostris* in the experiment. Before stocking grass carp, big cladocerans such as *Diaphanosoma* sp and *Ceriodaphnia* sp, *Cyclops* from copepoda were found in the pond. Benthic fauna was consisted of Chironomid larvae and *Tubifex* sp in September. Afterwards *Tubifex* was dominated in benthic fauna. Removal of vegetation and the predation of the other fishes such as *Cyprinus carpio* caused differences in zooplankton and benthic fauna composition in the pond.

Kırkagac and Demir (2004), stocked grass carp in different rates to the earthen ponds and investigated the indirect impacts of biological reduction of vegetation on water quality, phytoplankton, chlorophyll *a*, zooplankton and benthic fauna between May and September 2000. Four earthen ponds with an area of 100 m^2 were used and one of them was selected as control. The other ponds were stocked at rates of 200, 400 and 600 fish per ha in May. The survival rate of harvested grass carp was 100% in September and the highest weight gain of 428 g occured at the minimum stocking rate. *Cladophora* and *Zygnema* species of aquatic plants were consumed in June by grass carp; however, *Chara* was eliminated completely by August when the water temperature reached to its highest value, 25.5^{o}C. At the end of the stocking period, *Phragmites* was the only plant not consumed by the grass carp. Plant biomass increased 1.4 times in the pond without grass carp but was decreased 2.5 times in the pond stocked with 600 grass carp per ha. The lowest values of nitrite-nitrogen, nitrate-nitrogen, and total phosphate were measured in the pond without grass carp ($p<0.05$). There were no differences in species number of zooplankton between control and the ponds with grass carp. During the experiment the differences in species number were affected from seasonal succession. In the ponds with grass carp zooplankton abundance was affected from increasing nutrients and phytoplankton after elimination of vegetation. Benthic fauna abundance 2 to 3 times in ponds with grass carp in comparison to the control pond. The elimination of the vegetation by grass carp caused an increase in benthic fauna growth. Phytoplankton abundance was encouraged by grass carp after consuming macrophytes.

However, the lowest values of phytoplankton abundance and chlorophyll *a* concentration were found in the pond with highest stocking rate of grass carp. It could be explained with the highest abundance of zooplankton and benthic fauna in this pond. In the experiment, the highest values of phytoplankton, zooplankton, benthic fauna abundance and chlorophyll *a* were found in the ponds with fish ($p< 0.05$).

Due to the excessive plant growth in the spring originated pond which supplies water to a trout farm, Kırkağaç and Demir (2006) stocked grass carp a rate of 2 fish/100 m^2 on March 2004 and its effects on aquatic plants, water quality, plankton, chlorophyll *a* and benthic macroinvertebrates were investigated until November 2004. A net cage with a dimension of 7x7x2 m was placed to the pond as control (without fish). Aquatic plant samples from eight stations and water, plankton, benthic macroinvertebrate samples from two stations were taken monthly. The variance of aquatic plant biomass, dissolved oxygen, pH, total hardness, ammonium nitrogen, nitrate nitrogen, nitrite nitrogen, total phosphorus, chlorophyll *a*, zooplankton and benthic macroinvertebrates were found statistically significant by months and stations ($p<0.01$). During the research period, the cage was covered by the aquatic plants such as *Potamogeton pectinatus*, *Ceratophyllum submersum* and *Lemna trisulca* and the plant biomass was changed between 96±4 g and 690±15 g dry weight/m^2. Outside the cage the plant biomass was changed between 41±2 and 103±7 g dry weight/m^2. These aquatic plants were preferred primarily by grass carp and disappeared in the pond. Filamentous algae, *Cladophora* sp., Z*ygnema* sp. and *Spirogyra* sp. decreased but did not disappear. The aquatic plant biomass increased 7 times inside the cage and decreased 2.5 times in the pond at the end of the study period. Phytoplankton abundance and chlorophyll *a* concentration were found higher inside the cage than those in the pond whereas zooplankton and benthic fauna were found higher in the pond than those in the cage ($p<0.05$).

Yavuzcan and Kırkağaç (2003) were also evaluated the stress response of grass carp (120±15.07 g) to salinity 10 ‰ by assessing the levels of hematocrit, leucocrit, plasma, glucose, sodium, potassium and calcium in 200 l tanks. Mean hematocrit values increased following exposure to salinity. Mean leucocrit values elevated after exposure to salinity for 24 h, then decreased. Mean plasma glucose increased during saline exposure for 48 h and then went to normal values. Plasma sodium and chloride levels were went up to their highest values after 48 h. while plasma potassium value increased with exposure time, plasma calcium values were not affected by salinity exposure. This study showed that grass carp appears to have the ability to survive at salinity of 10‰ considering the variables of secondary stress response altough its tolerance to brackish water has not been studied in long terms. This may mean that the fish could migrate from one river system to another by passing through an estuary and grass carp can, naturally, control the vegetation in estuaries.

Conclusion

As stated in the experiments it is obvious that the grass carp is an efficient aquatic weed eating fish and has a direct effect on submerged plants. It was reported that water quality parameters may increase in the short term (first year), but will return to prestocking levels in the subsequent years (Shireman et al 1985). Other biological effects are mostly secondary consequences. The nutrients released from broken stems, decay of uneaten plants and decaying feces can cause increased phytoplankton, however increase of phytoplankton may not occur in all cases and in some cases phytoplankton decrease. It depends on the amount of vegetation controlled and trophic state of water body. Zooplankton assemblages shifted to small suspension feeders such as rotifers after removal of vegetation. In the case of macroinvertebrates, species composition changes from those that crowl and live on substrates to those that burrow in the sediments. Removing the macrophytes in lakes with higher trophic states may actually cause fish standing crops to increase and species composition may change the species that rely on phytoplankton-based food chain (Opunszynski and Shireman 1995).

A number of factors should be considered before a body of water is stocked. Due to possible predation small fish (<20 mm) should not be stocked. The growth rate of fish and consumption rates of different sizes of stocked fish should be known in order to predict the amount of vegetation that will be eaten over the course of the initial stocking. Plant selection also varies with size. Water temperature must be considered as feeding rates are dependent upon water temperature. The species of aquatic plants in the system must be identified as the grass carp consumes aquatic plants at different rates, depending upon their palatability. Highly preffered plants were eaten quickly and palatability changes as temperature increases. Therefore, the stocking rate used should be based upon a management objective. To achieve this objective, local conditions, including climate, amount of vegetation, size of the fishes, and the palatability of the vegetation in the system should be considered before they are stocked (Opuszynski and Shireman 1995).

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INTERACTIONS BETWEEN DROUGHT STRESS AND LEAF ROLLING OF *CTENANTHE SETOSA* (ROSC.) EICHLER

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The changes of leaf rolling degree in different drought stress conditions were studied and some morphological and biochemical changes were reported in this study. The plants were vegetatively propagated and grown in plastic pots and then they incubated in a growth chamber at 25^{o}C in a cycle of 12 h light (250 µmol m^{-2}s^{-1}) and 12 h darkness with 70 % relative humidity. Leaf rolling is not only a response to water deficit stress in plant, but also some biochemical changes in the leaves also ocurred together with leaf rolling. Proline, reducing and soluble sugars levels increased with the increasing degree of leaf rolling. Some antioxidant enzyme activities changed during leaf Rolling. Nitrate reductase activity declined in rolled leaves. On the other hand, total chlorophyll and carotenoids decreased during early rolling. But rised later phases of the rolling. Phospholipids, glycolipids and total lipids declined in rolled leaves in comparison with unrolled leaves. While phenolic acid content rised. In addition rising lipid peroxidation measured first, but for later rolling degrees lipid peroxidation lessened. Moreover altering phytohormones levels were observed with progressing leaf rolling. Endogenous polyamines accumulated during leaf rolling, however exogenously treated polyamines impeded leaf rolling. It has been reported that the leaf rolling increased drought resistance in *Ctenanthe* as well as grasses. The first rolling was observed around 30 days after withholding water. All leaves were rolled around 45 days after withholding water. Maximum rolling (79 %) was obtained between 56 and 64 days after withholding water. It has been found that water deficit and air temperature affected the degree of leaf rolling, and irradition increased the rolling together with water deficit but not alone in *Ctenanthe.* On the other hand, RNA isolations during leaf rolling showed that RNA content decreased in rolled leaves. 18s rRNA sequence of *C. setosa* was determined for the first time with our studies.

Introduction

Drought stress is one of the major factors limiting the growth of plants. Some adaptive responses, such as leaf movements, are observed during drought stress in plants. Leaf rolling, among the leaf movements, is a common response to water stress. Leaf rolling controls plant water metabolism by relieving water stress and increases drought resistance in cereal crops (Townley-Smith et al. 1979). Biochemical changes in plants are also important for adaptation to stress. For instance, the tolerant plants have a high proline accumulation under the stress condition (Sivaramakrishnan et al. 1988). In addition, the changes in the activities of some enzymes may be an important factor in tolerance of various plants to environmental stress (Rensburg and Kruger, 1994).

It is known that plants response to stress at morphologic, physiologic and molecular levels. To explain the mechanism of drought resistance, many studies have recently been made on genes which are induced by the effect of stress (Shinozaki and Yamaguchi-Shinozaki, 1997). In addition, it has recently been determined by Kadioglu et al. (1998, 1999-2006) that *C. setosa* is a nice model plant to use in leaf rolling studies. *C. setosa*, a species that shows a leaf rolling response to drought, is a member of a small family of tropical herbaceous perennials, and is cultivated as a greenhouse ornamental and houseplant for its attractive foliage (Heywood, 1978). This study comprises of our recent and previous works aiming to clarify the mechanism of leaf rolling and its relation to drought stress. Here, this mechanism is tried to put into light by looking through different issues having a role about drought avoider leaf rolling.

Result and Discussion

Effects of Environmental Factors on Leaf Rolling

It has been reported that water deficit and air temperature enhanced the degree of leaf rolling, and irradiation increased the rolling together with water deficit but not alone in *C. setosa* (Turgut and Kadioglu 1998). When only one of those stress factors was exist, rolling process needed longer time period.

Relative water content

Most researchers showed that RWC decreased in response to drought stress (Fu and Huang, 2001; Shaw et al., 2002). In present study, relative water content also decreased, while degree of leaf rolling increased (Fig 1). After a 64- day drought, it was determined that the decrease in RWC of leaves was from 94% to 78 %. Due to the fact that the reduction in RWC happened after a long drought period and was in small amount, it was thought that the plant avoids itself from drought by decreasing water loss and showed resistance to drought via leaf rolling mechanism.

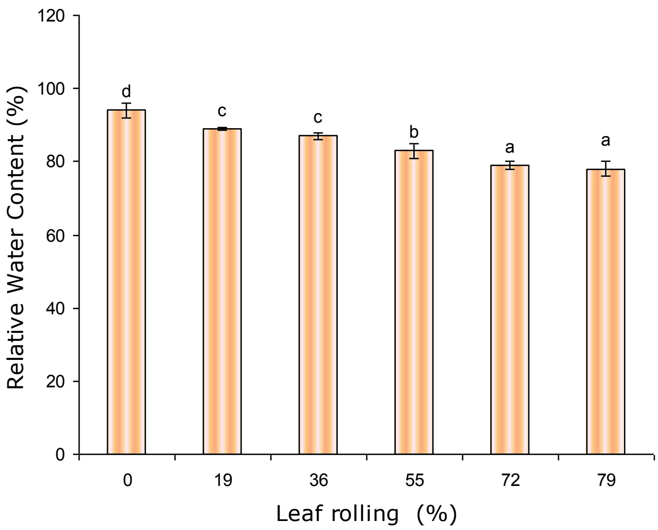


Fig1. Relative water content throughout leaf rolling (unpublished results)

Leaf Rolling Effects on The Content of Photosynthetic Pigments

Total chloropyll and total carotenoid levels decreased up to 36 % degree of leaf rolling and then increased up to 79 % degree of leaf rolling (Fig 2). Chlorophyll and carotenoid contents in drought tolerant plants have been found higher than those of drought sensitive plants (Krause et al., 1995). These results supported that leaf rolling enhanced the drought tolerance mechanism in *C. setosa*.

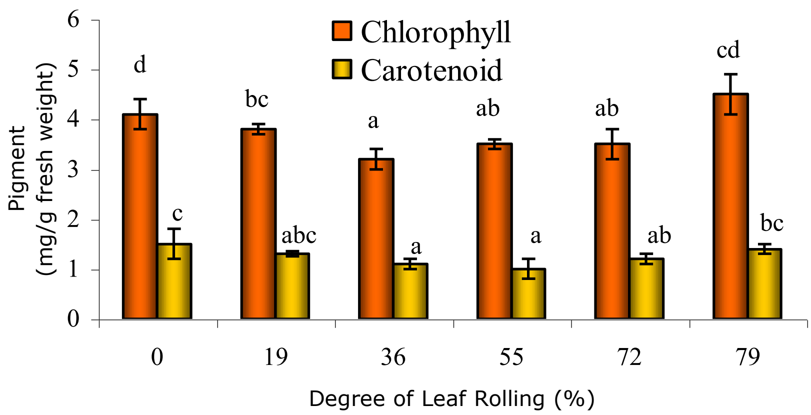


Fig 2. Changes in total chlorophyll and carotenoid content during leaf rolling in *C. setosa* (Terzi and Kadioglu, 2006)

Leaf Rolling Effects on the Content of Proline, Soluble and Reducing Sugars

There was an increase in the levels of reducing and soluble sugars with increasing of the degree of leaf rolling in *C. setosa*. Leaves of stressed plants tended to accumulate more carbohydrates of low molecular weight (fructose, glucose, inositol and sucrose). Proline level also enhanced with the increasing leaf rolling degree (Fig 3). Many studies showed that there was an accumulation of sugars and proline in plants under stress (Binzel et al., 1989; Gzik, 1996). These such soluble substances are of major importance as a contributor to osmotic adjustment during leaf rolling. The apparent increase in the amount of fructose, glucose, inositol and sucrose, however, indicates metabolic adaptations in the leaves.

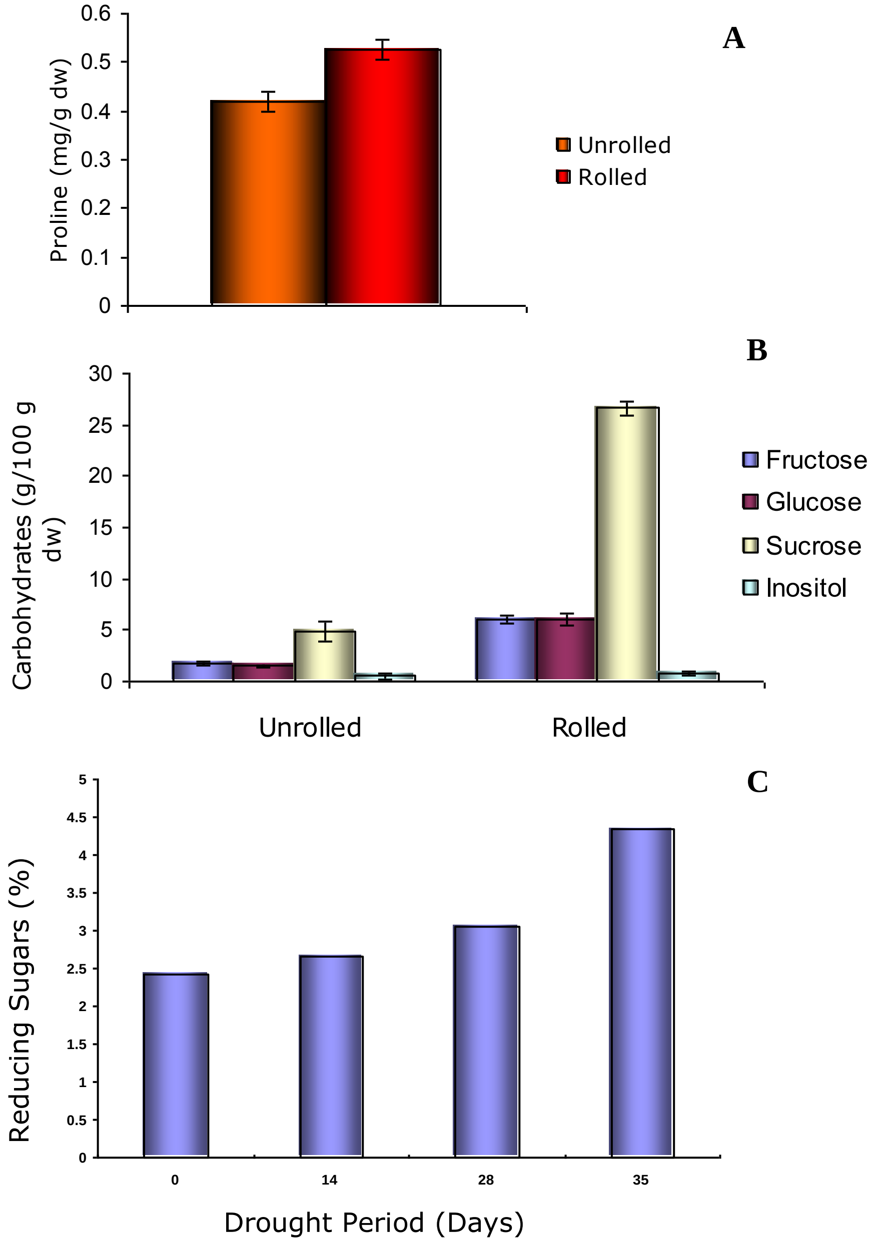
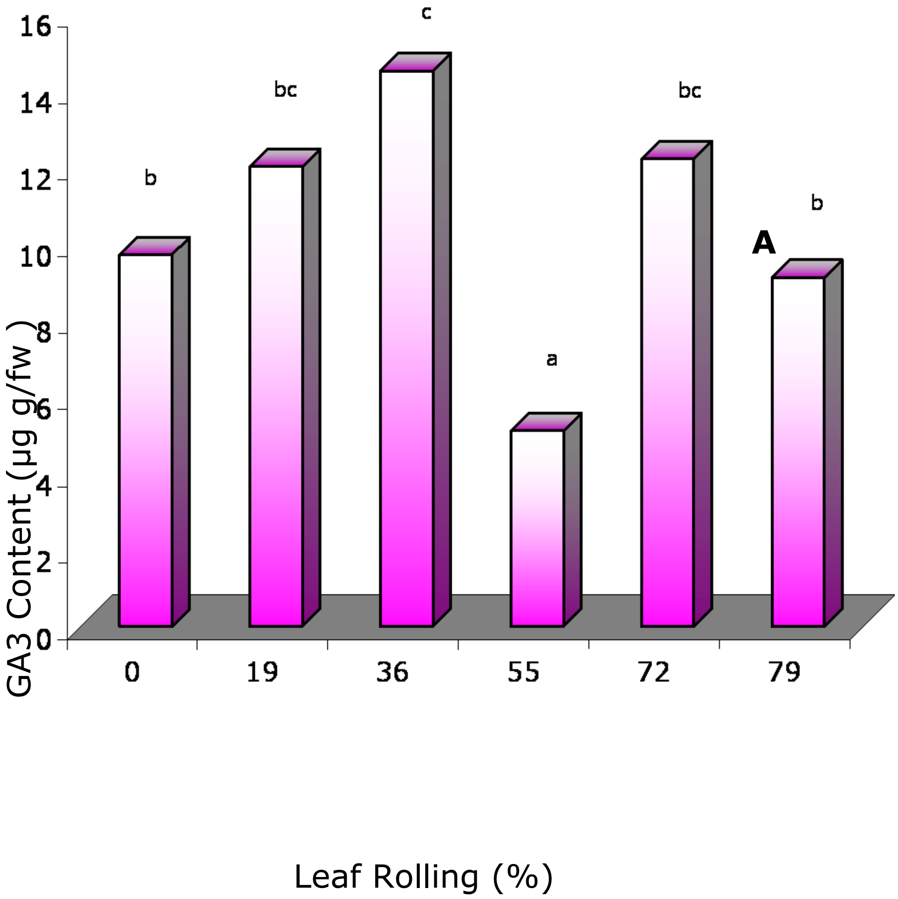
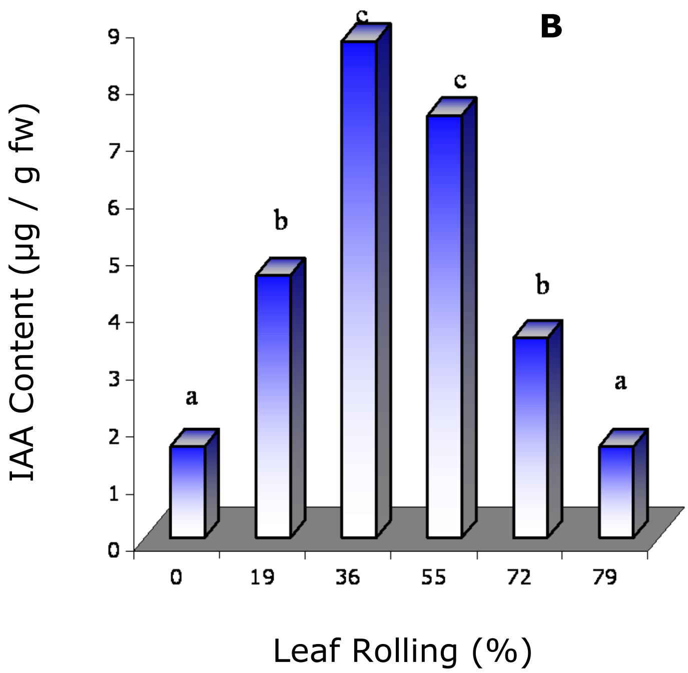


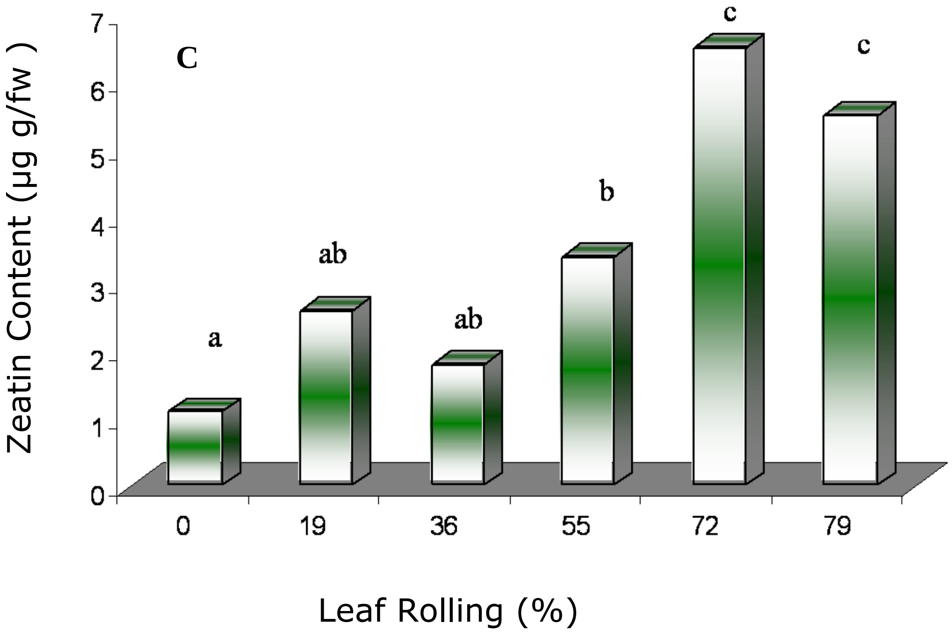
Fig 3. Changes in contents of proline (A), soluble (B) and reducing (C) sugars during leaf rolling (Kadioglu and Turgut, 1999; Ayaz et al., 2000). Amounts of proline and soluble sugars were detected 35 days after withholding water at 79 % degree of leaf rolling.

Leaf Rolling Effects on the Content of Some Phytohormones

GA3 content did proportionally changed with leaf rolling. IAA content firstly increased and then decreased during rolling. Zeatin and abscisic acid contents also increased during the rolling period (Fig 4). GA is less important than the other hormones for controlling water loss (Hosoki et al., 1987).


A
GA3 Content (µg g/fw)
16
14
12
10
8
6
4
2
0
b
bc
c
a
bc
b
0
19
36
55
72
79
Leaf Rolling (%)


B
IAA Content (µg / g fw)
9
8
7
6
5
4
3
2
1
0
a
b
c
c
b
a
0
19
36
55
72
79
Leaf Rolling (%)



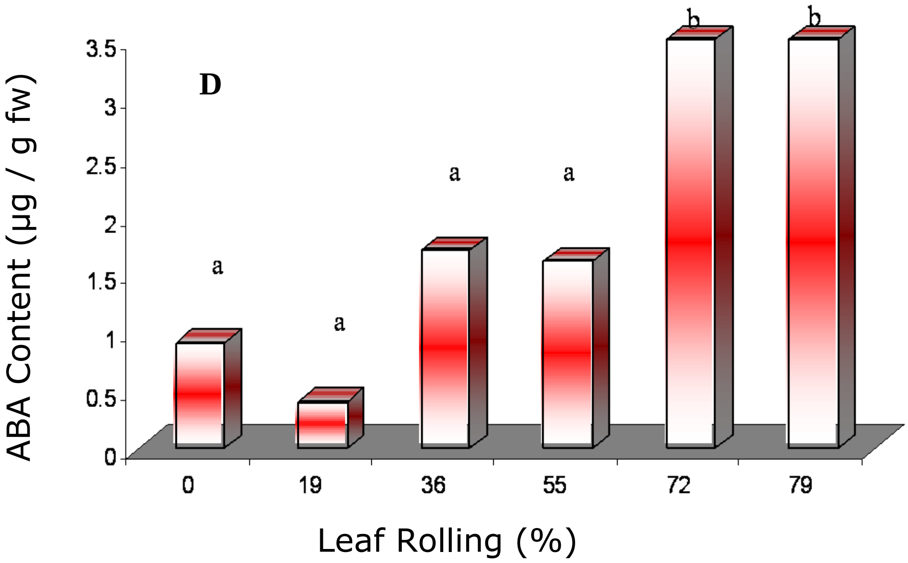
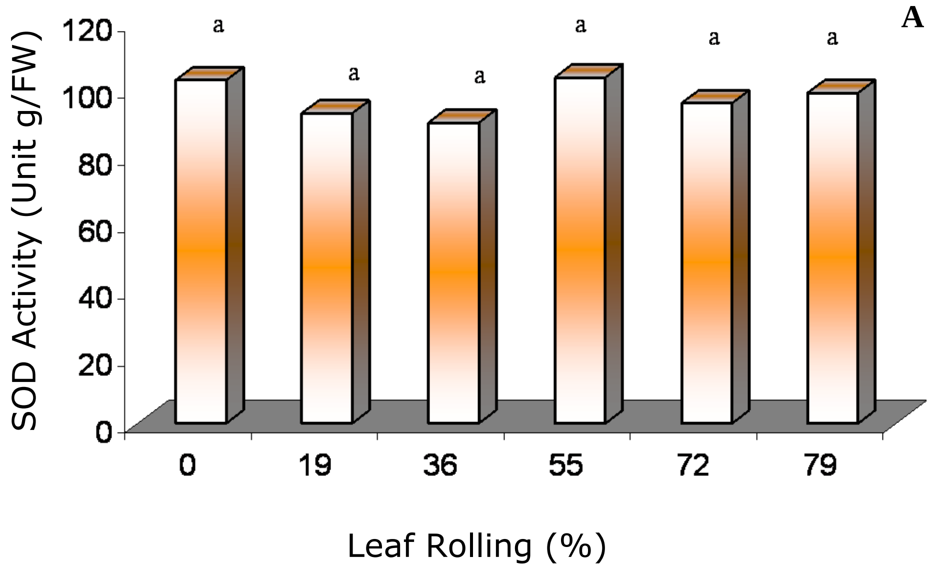
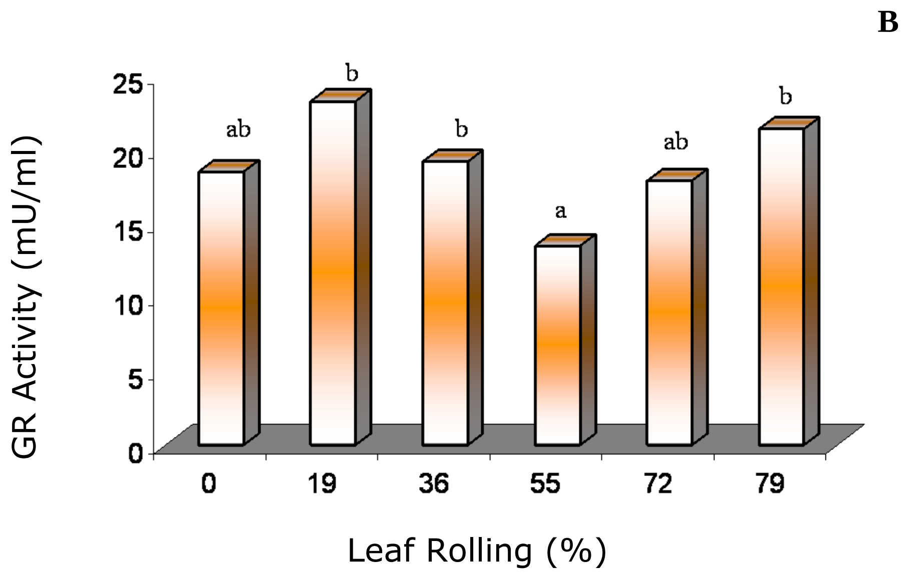


Fig 4. Changes in GA_3 (A); IAA **(**B) Zeatin (C) and ABA (D) content during leaf rolling in *C. setosa* (Unpublished data)

Leaf Rolling Effects on The Activity of Some Antioxidant Enzymes

It was detected that SOD activity did not change in an important level, while GR activity decreased first and then increased again compared to the control (Fig 5). On the other hand, POD activity rised to a high level was observed. Increasing of antioxidant enzyme activity may contribute to tolerance to drought stress in plants (Krause et al., 1995). While an antioxidant enzyme can decrease, other can increase or not change. For example, it has been reported that POD activity is increased in water stressed spinach leaves, whereas SOD activity show little (Tanaka et al., 1990). We can say that *C. setosa* is a tolerant species to the imposed drought stress and protects itself from oxidative damage by increasing POD activity in leaves during drought conditions.





C

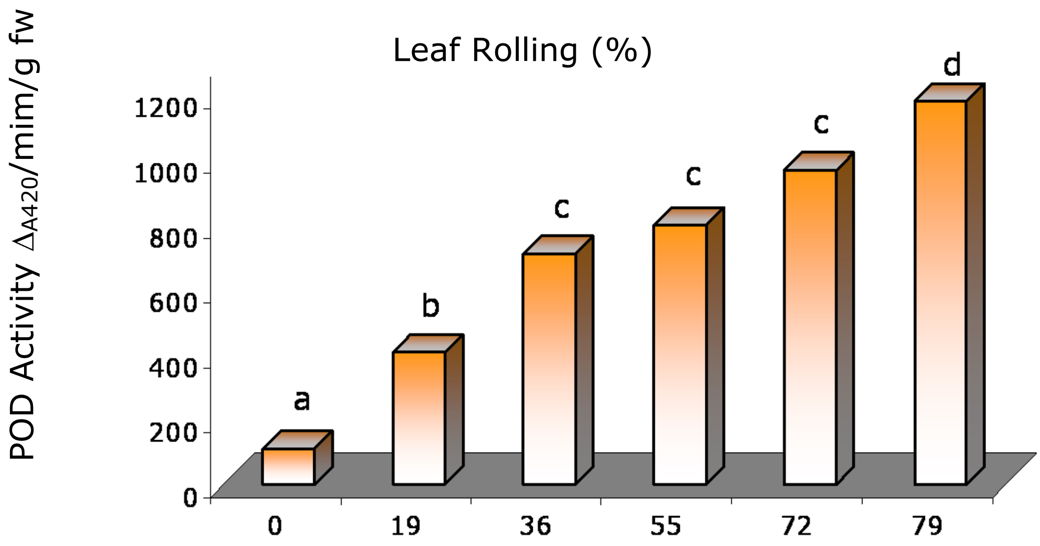


Fig. 5. Activity changes of SOD **(**A); GR (B) and POD (C) in *C. setosa* leaves during leaf rolling (Terzi and Kadioglu 2006)

Lipid Peroxidation

Lipid peroxidation in *C. setosa* leaves was measured during leaf rolling**.** malondialdehyde (MDA) content increased up to 36 % of leaf rolling then a decreasing trend was observed progressing degree of rolling (Fig 6). Ascending lipid peroxidation was also reported in similar studies (Sairam et al 2001). Changes in lipid peroxidation might depends on the either decrease in relative water content or differences in photosynthetic pigment content (Terzi and Kadioglu, 2006).

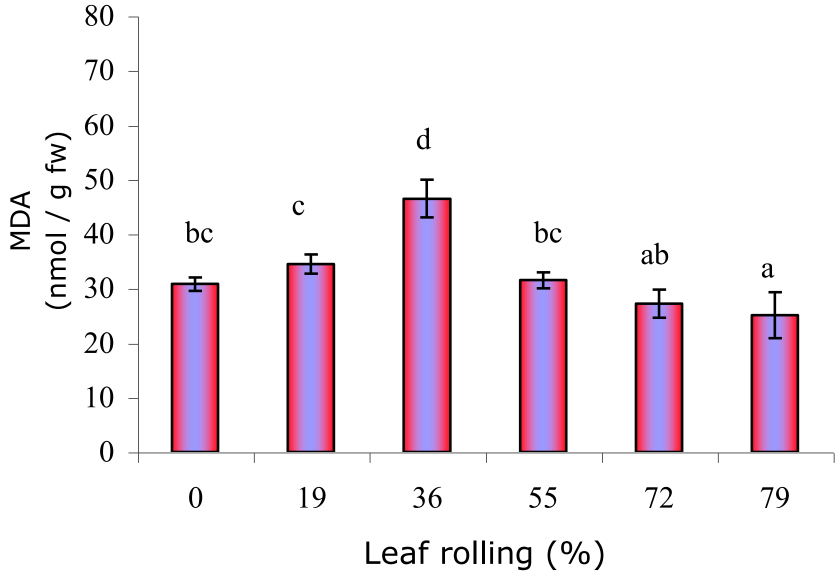


Fig 6. Malondialdehyde (MDA) content during leaf rolling (Terzi and Kadioglu 2006)

Nitrate Reductase

Nitrate reductase, is an enzyme having a role in nitrogen metabolism, is affected in stress conditions (Larsson et al 1989). Nitrate reductase activity in drought stressed leaves declined (Fig 7). Under water stress conditions, similar results from rice roots and shoots were obtained by Foyer et al., (1998). Decreasing NR activity may provide the plant with a biochemical adaptation by hampering nitrat assimilation during drought. After declined activity, intercellular nitrate content may rise and so conribute to osmotic adjustment

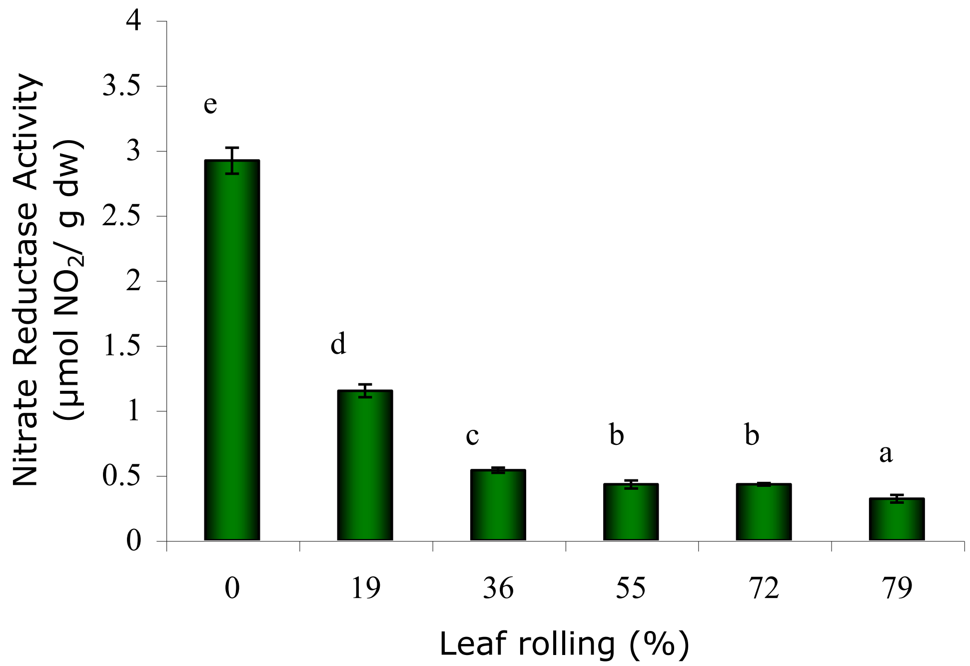


Fig 7. Nitrate Reductase Activity during leaf rolling (Unpublished data)

Leaf Rolling Effects on The Content of Polyamines

Polyamines have important roles throughout leaf rolling in *C. setosa*. Increased amounts of endogenous polyamines during rolling were detected (Fig 8). That exogenously applied polyamines retarted leaf rolling to a high extend was observed (Kadioglu et al., 2002). Moreover, risen level of some soluble compounds such as proline, reducing sugar and proteins was resulted from exogenously treated polyamines (Saruhan et al., 2006). Polyamines throughout the drought period may protect the plant against water deficit stress. Therefore, rolling may also be retarted.

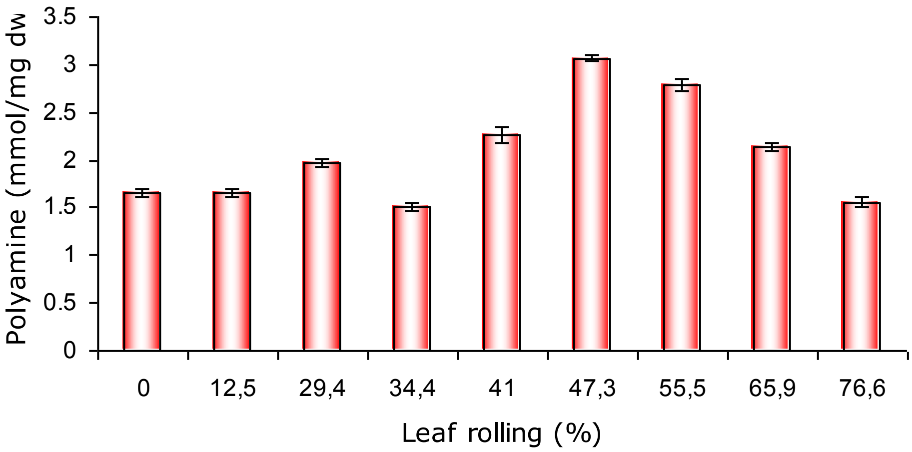


Fig. 8. Changes in polyamine levels during leaf rolling in *C. setosa* (Kadioglu et al., 2002).

Leaf Rolling Effects on Lipid And Fatty Acid Composition

It has been found that phospholipids, glycolipids and total lipids decreased in rolled leaf in comparison with the controls. The percentage composition of palmitic acid(16:0), stearic acid (18:0) and linolenic acid (18:3) decreased in rolled leaves, but linoleic acid (18:2) increased (Fig 9). The degree of unsaturation in phospholipid and glycolipid and total lipid was significantly altered during leaf rolling. The increase in saturation degree may regulate membrane permeability and thus adapt the leaves to water stress in drought environment. Many studies have reported a decrease, often drastic, of the phospolipids and the galactolipids or total fatty acids as a response to water deficit stress. In some cases also the cıntrary, a total increase in polar lipids has been reported or no change in the levels but increased unsaturation (Navari-Izzo et al., 1989;1993). From the above observations it is clear that the variations in the lipids following water-deficit could in part be the results of damage occuring at the membrane level. Our observations are consistent with previous findings, and the mechanism by which the plants maintains its unsaturation level could help to alleviate the membrane disorganization resulting from the decrease in polar lipids.

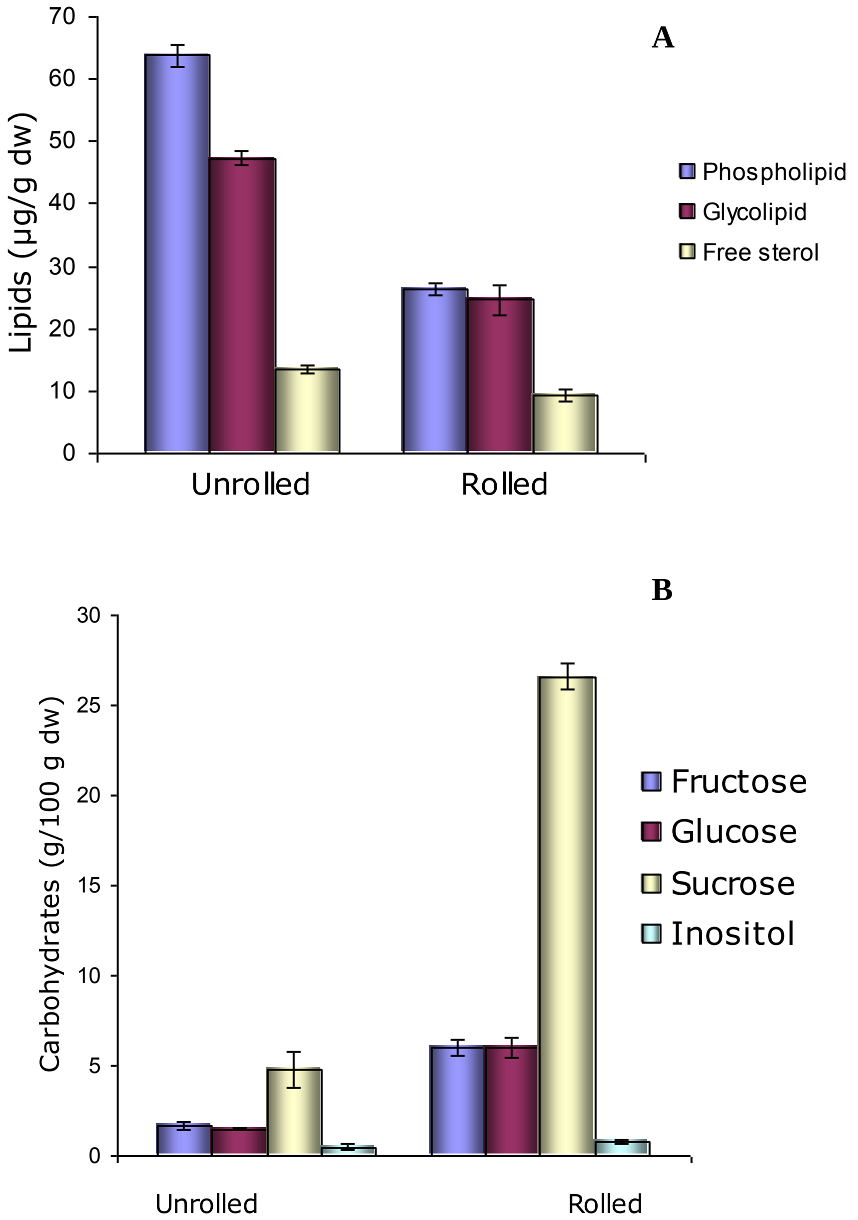


Fig 9. Changes in lipid (A) and fatty acid (B) levels during leaf rolling in *C. setosa* (Ayaz et al., 2001)

Leaf Rolling Effects on The Content of Phenolic Acids

All phenolic acid concentrations (except for salicylic acid) in the benzoic group increased in rolled leaves in comparison with unrolled leaves. In the cinnamic group, the amounts of *cis*- and *trans*-*p*-coumaric and caffeic acids were greater in rolled leaves than in unrolled leaves (Fig 10). Coumaric and caffeic acids are the starting substances for lignin biosynthesis (Raskin 1992). According to our results, an increase in the content of phenolic acids in rolled leaves could be related with increasing level of amino acid synthesis induced during water stress. However, the increasing levels of aminoacids (mainly phenylalanine and tyrosine) may trigger the production of phenolic acids (cinnamic acid pathway) leading to lignin biosynthesis. The increase of phenolic acid content may be linked to the lignification of cell walls and, in part, the synthesis of certain amino acids maintaining osmotic adjustment in cell.

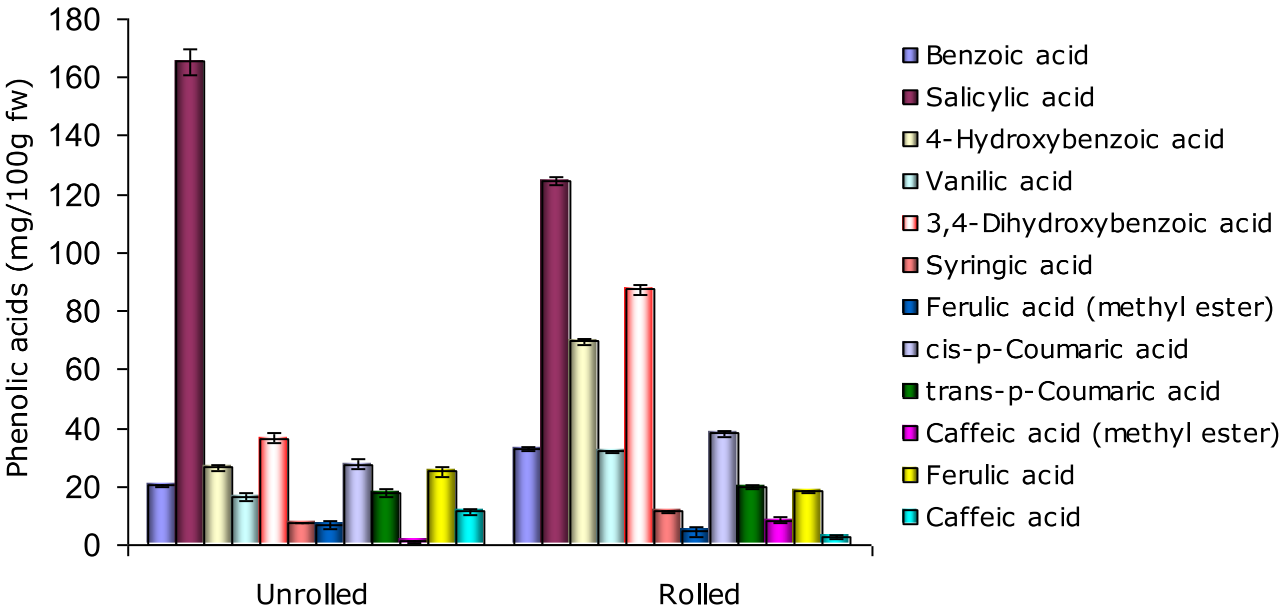


Fig. 10. Changes in phenolic acid levels during leaf rolling in *C. setosa* (Ayaz et al., 2000).

Leaf Rolling Effects on Total RNA

The amount of RNAs declined compared to the control during leaf rolling. Similarly, Barathi et al. (2001), determined a reduction in the content of RNA of mulberry plants exposed to drought.

Clonning studies were resulted in determining of 18S rRNA belongs to *C. setosa* (Fig 11). We suggest that this sequence can be used as control for furture PCR studies. When it was compared with the data in gene banks, 18S rRNA sequences was similar with *Maranta bicolor* from same family in proportion as 99 %. We have done some analyses to determine sequences of lp3 gene incuded by water stress (Fig 12). The obtained sequences of lp3 was not identical to any protein but transcription factors were detected.

Table 1. RNA amount during leaf rolling in *C. Setosa*. (Unpublished data)

Degree of leaf rolling (%)	Amount of Total RNA µg/mg FW
0	2,1 ± 0,2*
55	1,8 ± 0,2
79	1,3 ± 0,1

For future molecular level studies will include RNA isolation from rolled and unrolled leaves and cDNAs will be produced. Analysing the sequences of these cDNAs to find whether there is any differences will be investigated. Moreover, it is planned that the sequences researhes of genes coding the antioxidant enzymes which are mentioned above will be done.

*** Standart deviation of measurement of three samples**

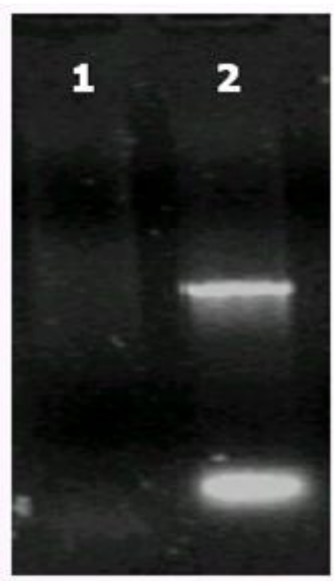


Fig 11. DNA fragment multiplied by PCR of 18 S rRNA gene of *C. setosa*. [1: negative control, 2:18S rRNA gene (upper) and primer interaction (lower)] (Unpublished data)

Fig 12. DNA fragment multiplied by PCR of lp3 gene of *C. setosa*. [(1:negative control, 2: lp3 gene (upper) and primer interaction (lower), 3: + control (18S rRNA gene of *Pinus taeda* L. (upper) and primer interaction (lower)] (Unpublished data)

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International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

THE FLORISTIC AND FAUNISTIC (LEPIDOPTERA) INVESTIGATION OF ANAMUR HIGHPLATEAUS (ABANOZ-AKPINAR)

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The research area (Mersin, C_4) is the south cost of the Turkey. The Mediterranean Climate with the sunny and dry period is typical. Total annual precipitation ranges between 20 -40 inches per year because of this the biodiversity is attractive.
In the floristic determination studies, it is known that the research which is based dry and wet river side (Anamur and Dragon) were not published before.
On the area, most of the genera are: Centaurea, Sideritis, Salvia, Stachys, Marrubium, Pholomis, Origanum, Sedum, Astragalus, Vicia, Aegilops, Bromus, Rhus, Pistacia, Hypericum, Digitalis, Muscari, Campanula and also mediterrenaean elements.
In this area, Asteraceae, Lamiaceae, Fabaceae, Poaceae, Rosaceae, Liliaceae and Campanulaceae familias are dominant. Also the common families of Lepidoptera on the area are: Papilionidae, Pieridae, Argynnidae, Satyridae, Lycaenidae and Hesperiidae. On the area, most of the genera (Lepidoptera) are: Iphiclides, Papilio, Allancastria, Parnassius, Anthocharis, Euchleoe, Pieris, Pontia, Colias, Colias, Gonepterix, Vanessa, Aporia, Cynthia, Limenitis, Melanargia, Hipparchia, Pseudochazara, Pseudochazara, Issoria, Polyommatus, Lycaena, Quercusia, Satyrium, Callophrys, Coenonympha, Maniola, Pontia, Euchloe, Lampides, Thymelicus and Pyrgus.

INTRODUCTION

Middle Taurus zone in Mediterranean Region has remarkable features for endemic and redundant number of types. Basic information related to the area can be found in Flora of Turkey and West Aegean Islands Flora (Davis,1985) and Turkey Vegetation books (Atalay,1994 and Akman,1995) and on the web site including Turkey Plants database prepared by Babaç (1987-1997) (1-7). It is known that floristic research for dry and wet streambed in Anamur that differs from the other districts of Mersin upon the increase of rainfall climatically. For this reason, Kaş, Abanoz and Akpınar areas that are the main big high plateaus of Anamur have been selected as the subject.

MATERIAL and METHOD:

Research area is in C4 square, on the road line that is used as high plateu in summer, in north-south direction. There are Anamur and Dragon rivers and many dry and wet streams parallel to this line. This area can be reached from Mersin-Antalya highway that lasts for 3.5 hours and over Forest Region Office turn from Anamur coast.

Climate:
The high plateaus around Anamur with annual rainfall of approximately 1600 mm differ from the other Mersin high plateaus that have 750-1350 mm rainfall, and vegetation differs in accordance with this (16).

Collected plants were pressed in the area and dried in Biology Department, and shocked in deep freezer and started to be defined by means of key books (8-13, 14). The determination of Lepidoptera was based on the method of Hesselbart, Kocak and Pfeiffer (28-30).

Definition of the area:
Research area ANAMUR: It contains 3 main high plateaus directed by Forest Administration Offices. The soil on the carstic topography is composed of red Mediterranean, brown forest soil and organic, sometimes koluvial under the forest and pebbly debris on the stream bank.

Kaş high plateau: On the high plateau that is on 1600 m height, there are juniper, cedrus and abies trees and it has sea view, and Ormancık and Sarıağaç villages are on the sides with red pines.

There is farming, apple, pear farming and stockbreeding in Halkalı, Beşoluk, Çandır area, Sarıova, Gözlügöl and Kayagöl connected with the research area and used as high plateau at some places.

Abanoz high plateau is a high plateau that has 12000 population in summer and 100 in winter, and that has 2-3 memorial cedrus. Its height is 1629 m, total forest area is 87.5 hectare, total agriculture area is 8.00 hectare, total housing area is 18.00 hectare and open area is 5.00 hectare. It has a past of 350-400 years.

Abanoz; Armutkırı is the area in which first cedrus plantation was made, and besides there is 79,8 % forest land with red pine, Quercus cerris, rarely Quercus ilex, there are heights of 766 m (Ağzıtepe) and 1400 m, and there are almond, apricot and sumac, Cotynus cogyra and peanut in all mountain villages. Known Mediterranean plants are makebate, Cercis siliquastrum, Vitex agnus-castus, caper berry, gum, Genista, spruce and Astragalus, Inula and Capparis.

Generally, people inhabit in Abanoz high plateau for 2 months. It is seen that 1/3 of it is plantation, and it is pinus nigra. Verbascum and Astragalus are common and besides *Juniperus excelsa, Abies cilicica, Pinus nigra* is also seen. "Su Olmaz Passage", 1690 m, in which Juniperus are more common besides large forests differs with having Buxus sempervirens. Apple and cherry is cultivated in villages. It is possible to see oaks in Sarıdana high plateau that is above Abanoz high plateau.

Akpınar high plateau is 1634 m-high, and it is used generally by Nasrettin villagers of Anamur. It has 16191 hectare forest land with red pine, cedrus, abies and juniper. It is important due to old cattleguard, cereal production and its being on Central Anatolia-Mediterranean transition line (14, 18, 19).

RESULTS

There is a forest cover in the area consisting mostly of red pine (Kaş high plateau; 400-700 m), Abies and Cedrus (Abanoz high plateau; 700-1600 m), juniper (Akpınar high plateau; 1600-1800m). There are steppe plants (Acanthus, Acantholimon) at high levels and there are aromatic Lamiaceae species and Asteraceae. Campanula, Vitis and Nerium are very common in riversides.

Pteridophyta
Equisetaceae
Equisetum ramosissimum Desf.
Pteridaceae
Pteridium aquilinum (L.) Kuhn.(x)
Adianthaceae
Adianthum capillus-veneris (L.) Medik. (x)
Aspleniaceae
Ceterach officinarum DC.
Spermatophyta
Gymnospermae
Pinaceae
Abies cilicica (Ant.- Kotschy) Carr., *Cedrus libani* A. Rich., *Pinus nigra* Arn., (x) *P. brutia* Ten. (x)
Cupressaceae
Juniperus drupacea Lab., *J. oxycedrus* L. subsp. oxycedrus, *J. excelsa* Bieb.
Angiospermae
Dicotyledones
Ranunculaceae
Anemone blanda Schott &Kotschy (x), *Clematis flammula* L., *C. cirrhosa* L. (x)
Papaveraceae
Corydalis solida subsp. solida (L.) Sw., *C. rutifolia* (Sibt.&Sm) DC, *Hypecum procumbens* L. (x), *Glacum flavum* Crantz, *Roemeria hybrida* (L.) DC.
Brassicaceae
Cardaria draba (L.) Desf. (x), *Fibigia eriocarpa* (DC) Boiss.
Nasturtium officinale R. Br. (x), *Erysimum* sp.
Capparaceae
Capparis spinosa L. var. *inermis* Turra(x)
Cistaceae
Helianthemum racemosum L.
Violaceae
Viola heldreichiana Boiss.
Thymelaceae
Daphne sericea Vahl.
Hypericaceae
Hypericum olympicum L., *H. perforatum* L. (x)
Polygalaceae
Polygala sp.
Caryophyllaceae

Saponaria kotschyi Boiss., *Arenaria leptocladus* Reichb. (x)
Dianthus sp., *Gypsophila* sp., *Silene dichotoma* Ehrh.
Tamaricaceae
Tamarix sp. (x)
Polygonaceae
Polygonum sp.
Malvaceae
Althea officinalis L.
Geraniaceae
Geranium tuberosum L. subsp. tuberosum
Oxalidaceae
Oxalis pes-caprae L. (x)
Aceraceae
Acer monspessulanum L. subsp. monspessulanum
Vitaceae
Vitis vinifera L.
Rhamnaceae
Paliurus spina-christii Miller(x), Rhamnus oleides (x)
Anacardiaceae
Rhus coriaria L., Pistacia terebinthus subsp. palaestina (Boiss.) Engler (x), *P. lentiscus* L. (x)
Fabaceae
Medicago sativa subsp. *sativa* L., *Lotus palustris* Willd., *Lotus corniculatus* L., *Astragalus angustifolius* subsp. *pungens* Lam., *Genista lydia* Boiss var. lydia, *Chamaecytisus hirsutus* (L.) Link, *Calycatome villosa* (Poiret) Link (x), *Lathyrus aphaca* L (x)., *Cercis siliquastrum* L.(x), *Trifolium stellatum* L. (x), *T. repens* L. (x), *Lotus sp.*, *Vicia villosa* Roth.
Rosaceae
Prunus armeniaca L., *P. domestica* L., *Rosa canina* L. *Rosa hemisphaerica* J. Herrm. , *Rubus caesius* L., *Rubus sanctus* Schreb., *Cerasus prostrata* (Lab.) Ser. *Cerasus mahaleb* (L.) Miller, Gard., *Crataegus monogyna* Jacq. (x), *Crataegus aronia* L., *Sanguisorba minor* Scop., *Pyrus elaeagnifolia* Pallas subsp. *kotschyana*, *Pyrus syriaca* Boiss. var. *microphylla*, *Pyrus sp.*, *Potentilla reptans* L.
Myrtaceae
Myrtus communis L. subsp. *communis*
Onagraceae
Epilebium hirsitum L. (x), *E. parviflorum* Schreber
Crassulaceae
Umbulicus rupestris (Salisb.) Dandy (x), *Sedum album* L.
Apiaceae
Bupleurum rotundifolium L., Laser sp., Ferula communis L. (x), *Turgenia latifolia* (L.) Hoffm. (x)
Araliaceae
Hedera helix L. (x)
Caprifoliaceae
Sambucus ebulus L. (x)

Dipsacaceae
Cephalaria sp., Knuatia sp., Scabiosa argentea L(x)*., Pterocephalus pinardii* Boiss. (x), *P. plumosus* L. (x)
Asteraceae
Bombicilaena erecta (L.) Smoljan(x), *Bellis perennis* L. (x), *B. annua* L. (x), *Filago* sp., *Tussilago farfara* L., *Pallenis spinosa* (L.) Cass. (x), *Cichorium inthybus* L. (x), *Achillea nobilis* L., *Centaurea ensiformis* P. H. Davis, *Scolymus hispanicus* L. (x), *Anthemis pestalozzae* Boiss., *Jurinea sp., Centaurea sp., Carthamus lanatus* L. (x).
Campanulaceae
Campanula lyrata Lam., *C. latifolia* L., *C. drabifolia* Sm., *Asyneuma rigidum* (Willd.) Grossh. var. rigidum, *A. linifolium* (Boiss. &Held) Bornm. subsp. linifolium
Ericaceae
Arbutus unedo L., *A. andrachne* L.(x)
Styracaceae
Styrax officinalis L. (x)
Oleaceae
Fontanesia philliraeoides Labill. subsp. *philliraeoides*
Apocyanaceae
Nerium oleander (x)
Asclepiadiaceae
Vincetoxicum tmoleum Boiss.
Boraginaceae
Arnebia densiflora (Nordm) Ledeb., *Onosma* sp., *Cynoglottis chetikiana* Vural&Kit-Tan., *Nonea pulla* (L.) DC., *Anchusa azurea* Miller(x)
Scrophulariaceae
Digitalis cariensis Boiss ex Jaub., *Linaria corifolia* Desf.
Acanthaceae
Acanthus spinosus L.
Verbenaceae
Vitex agnus-castus L.
Plantaginaceae
Plantago lanceolata L. (x)
Lamiaceae
Scutellaria diffusa Bentham, *S. rubicunda* Hornem subsp. *brevibracteata*, *S. salviifolia* Bentham, *Phlomis monocephala* P.H. Davis, *P. pungens* Willd. var. *hispita*, *P. armeniaca* Wild., *P. longifolia* Boiss. ex Bl. var. *longifolia*, *P. amanica* Vierh., *P. chimerae* Boiss., *P. lycia* D. Don., *Mentha longifolia* (L.) Hudson(x), *Stachys cretica* L. subsp. *mersinaea* (Boiss.) Rech. (x), *S. lavandulifolia* var. *lavandulifolia* Vahl., *Marrubium vulgare* L., *M. lutescens* Boiss., *Lamium garganicum* L., *Sideritis libatonica* Labill, *Melissa officinalis* L. (x), *Thymus sipyleus* Boiss., *T. capitatus* Hoff., *Teucrium polium* L., *Origanum onites* L. (x), *Calamintha sylvatica* Bromf., *Salvia virgata* Jacq., *Clinopodium vulgare* L., *Sideritis syriaca* L., *Teucrium chamaedrys* L.subsp. chamaedrys, *Salvia fruticosa* Miller, *Ziziphora capitata* L., *Nepeta nuda* L. *subsp. glondulifera N. nuda* L. subsp. *albiflora*, *N. nuda* L. subsp. *lydiae* Davis, *N. cilicica* Boiss., *Ballota saxatilis* Sieber ex J.&C. Presl. subsp. *saxatilis*

Platanaceae
Platanus orientalis L.
Buxaceae
Buxus sempervirens L.
Morinaceae
Morina persica L.
Plumbaginaceae
Plumbago europea L. (x), *Acantholimon ulicinum* (Willd&Sch.) Boiss.
Thymelaceae
Daphne oleoides Sch.
Aristolochiaceae
Aristolochia sp.
Euphorbiaceae
Euphorbia sp.
Ulmaceae
Ulmus glabra Hudson
Fagaceae
Quercus pubescens Willd., *Q. infectoria* Olivier(x)
Salicaceae
Populus sp. Salix sp.
Rubiaceae
Galium sp., Galium verum L., *Galium murale* (L.) All.
Monocotyledones
Araceae
Arum creticum Boiss&Heldr., *A. dioscoridis* Sm. var. dioscoridis(x), *Arisarum vulgare* Targ.-Tazz. subsp. vulgare(x)
Juncaginaceae
Triglochin palustris L.
Liliaceae
Smilax aspera L. (x), *Urgenia maritima* (L.) Baker (x), *Muscari comosum* (L.) Miller, *M. armeniacum* Leichtlin ex Baker, *Allium* sp., *Ornithagalum* sp., *Muscari* sp., *Gagea* sp., *Orchis* sp., *Tulipa* sp., *Allium sphaerocephalon* L.
Cyperaceae
Cyperus longus L.
Poaceae

**Triticum durum* Desf., *Hordeum bulbosum* L., *H. vulgare* L., *Rostraria obtusiflora* Boiss., *Gastridium phleoides* (Nees & Meyen) C.E.Hubb., *Phragmites australis* (Cav.) Trin. Ex Steduel, *Dactylis glomerata* L., *Aegilops triuncialis* L., *A. cylindrica* Host., *A. biuncialis* Vis., *A. umbellulata* Zhukovsky, *A. geniculata* Roth., Lolium multiflorum Lam., *Briza humilis* Bieb., *Piptatherum miliaceum* (L.) Cosson., *Paspalum paspalodes* (Michx.) Schribner, *Agrostis stolonifera* L., *A. olympica* Boiss., *Polypogon viridis* (Gouan) Breistr., *Catapodium rigidum* (L.) C.E. Hubbard ex Dony. *C. rigidum* subsp. *rigidum* var. *majus* (L.) C.E. Hubbard ex Dony., *Psilurus incurvus* (Gouan) Schinz&Thell., *Vulpia myuros* (L.) C. C. Gmellin, *Melica eligulata* Boiss., *M. ciliata* L., *M. minuta* L., *Bromus sterilis* L., *B. arvensis* L., *B. alopecuros* Poiret, *B. diandrus* Roth., *B. japonicus* Thurb., *B. japonicus* subsp. *anatolicus,* *Brachypodium sylvaticum* (Hudson) P. Beauv, *Milium pedicellare* (Bornm.) Roshev. ex Melderis, *Phleum subulatum* (Savi) Aschers.& Graebn., *Phalaris aquatica* L., *P. truncata* Guss. ex Bertor., *Hordeum bulbosum* L., *Stipa holosericea* Trin.

In this area, Asteraceae, Lamiaceae, Fabaceae, Poaceae, Rosaceae, Liliaceae and Campanulaceae familias are dominant.

Also the common families of Lepidoptera on the area are: Papilionidae, Pieridae, Argynnidae, Satyridae, Lycaenidae and Hesperiidae.
On the area, most of the specieses are:

Iphiclides podalirius (Linnaeus, 1758);
Papilio machaon syriacus Pfeiffer, 1931;
Allancastria deyrollei (Oberthür, 1869);
Parnassius mnemosyne (Linnaeus, 1758);
Anthocharis cardamines (Linnaeus, 1758);
Euchleoe ausonia taurica (Röber, 1907);
Pieris brassicae brassicae (Linnaeus, 1758);
Pontia edusa edusa (Fabricius, 1777);
Colias aurorina aurorina Herrich-Schaffer, (1850);
Colias crocea crocea (Fourcroy, 1785);
Gonepterix farinosa turcirana De Freina, 1983;
Vanessa atalanta atalanta (Linnaeus, 1758);
Aporia crataegi crataegi (Linnaeus, 1758);
Cynthia cardui cardui (Linnaeus, 1758);
Limenitis reducta herculeana Stichel, (1908);
Melanargia larissa (Geyer, [1828]);
Hipparchia syriaca syriaca (Staudinger, 1871);
Pseudochazara anthelea (Hübner, [1824]);
Pseudochazara mniszechii mniszechii Herrich-Schaffer, (1851);
Issoria lathonia lathonia (Linnaeus, 1758);
Polyommatus icarus (Rottemburg, 1775);
Lycaena phlaeas timeus (Cramer, [1777]);
Quercusia quercus quercus (Linnaeus, 1758);
Satyrium ilicis ilicis (Esper, [1779]);
Callophrys rub rubi (Linnaeus, 1758);
Coenonympha pamphilus pamphilus (Linnaeus, 1758);
Maniola jurtina phormia (Fruhstorfer, 1909);
Lampides boeticus boeticus (Linneaus, 1767);
Thymelicus sylvestris syriacus (Tutt, [1905]);
Pyrgus melotis ponticus (Reverdin, 1914).

DISCUSSION

The most common species in the area are Centaurea, Sideritis, Salvia, Stachys, Marrubium, Pholomis, Origanum, Sedum, Vicia, Rhus, Pistacia, Hypericum, Digitalis and Campanula. It has been seen in the other studies near the area that the common species are Alyssum, Silene, Galium, Allium, Astragalus, Euphorbia, Medicago, Vicia and Centaurea. 23 species Ir-Tur., 27 species Medit., 4 species Euro-Sib., 2 cultivation species were collected from Taseli, however, most of the plants in the area are Mediterranean elements (20-23).
For approximately 143 species collected in this area in 2005, it is observed that Asteraceae, Lamiaceae, Fabaceae and Rosaceae, Liliaceae and Campanulaceae families are dominant for now, and this is consistent with the results of the other studies (20-27).
Some of these plants which signed by (x) is found also in North Cyprus (31-35). The Lepidoptera species prefer to feed on especially Asteraceae, Lamiaceae and grasses (Poaceae) among the other families.

Dominant families according to number of species	Anamur (Kaş-Akpınar) 2005	Gevne valley (Alanya-Hadim) Duman et al., 2000	Saklıkent Dinc, 1997	Termessos Alçılıtepe, 1998	Taseli plateau Sümbül& Erik, 1990
Fabaceae	**8**	32	74	74	105
Asteraceae	**7**	48	69	73	121
Lamiaceae	**14**	38	45	-	75
Brassicacea	4	22	7	40	76
Caryophyllaceae	5	18	7	22	57
Rosaceae	**7**	16	-	24	-
Apiaceae	5	15	22	24	37
Campanulaceae	5	6	-	-	-
Boraginaceae	5	11	21	24	40
Liliaceae	**9**	16	34	33	50
Poaceae	27	-	38	38	36

THANKS

Thanks to Mersin University Research Fund was supported this project.

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A KARYOLOGICAL STUDY ON *MATTHIOLA ODORATISSIMA* (PALL.) R.BR. OF THE FAMILY CRUCIFERAE IN TURKEY

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The present study on wild taxon belonging to family Cruciferae has been carried out from the cyctological view-point. The somatic chromosome count for *Matthiola odoratissima* (Pall.) R.Br. 2n=12, and the base number for this species is x=6. Its karyotype was studied by Image Analysis System. Also, the chromosome morphology of *M. odoratissima* was identified by calculating arm and centromeric index, the ratio length of its chromosome arms, and its ideogram was done. In this taxon, chromosome length is 6.06-2.85 μm, karyotype formula is 4m+2sm. The chromosome number and morphology of the species has been studied for the first time.

Introduction

The Cruciferae is a large natural family of major economic importance, containing a wide array of crop plants grown as salads, vegetables, for oilseed, animal feed and condiments, and several well-known garden ornamental plants such as the *Matthiola* R.Br. and *Hesperis* L. The genus of *Matthiola* (Cruciferae) is grows in the Europe, Asia and Africa. The genus is represented approximately by 50 species in the world, also 11 species in Turkey (Heywood, 1993; Cullen, 1965).

Some molecular (Grierson & Hemleben, 1977; Hemleben & Werts, 1988; Sánchez *et al*., 2004), phytochemical (Bouchereau *et al*., 1991; Hisamatsu *et al*., 1998; Halbwirth *et al*., 2006), and physiological studies on *Matthiola* species were carried out by different authors (Summerfield *et al*., 1977; Thanos *et al*., 1994). But no chromosome morphology study about *Matthiola* was met in the literature data. The aim of this study is to determine the chromosome number and caryological specialties of the species.

The caryological researchs on taxa which belong to the genus of *Matthiola* showed that taxa chromosome numbers were 2n=10, 12 and 14. Chromosome number in *M. livida* (Del.)DC. 2n=10; in *M. fruticulosa* (L.) Maire subsp. *fruticulosa*, *M. fruticulosa* subsp. *perennis* (Conti) Ball., *M. fruticulosa* subsp. *valesiaca* (L.) Maire, *M. parviflora* (Schousb.) R. Br., *M. longipetala* (Vent.) DC., and *M. bolleana* Webb ex Christ. 2n=12; in *M. incana* (L.) R. Br., *M. sinuata* (L.) R. Br., *M. tricuspidata* (L.) R. Br. and *M. arabica* Boiss., 2n=14; (Darlintong & Wylie 1955; Dahlgren *et al*., 1971; Polatschek, 1983; Soliman & Parker, 1986; Izuzquiza, 1989; Canzobre & Castroviejo, 1993; Soliman, 2002; Sánchez *et al*., 2004).

Our aim is to determine the chromosome number and chromosome morphology of *Matthiola odoratissima*.

Material and Methods

The seeds of *Matthiola odoratissima* were obtained from Başet Dağı (B9 Van) in Turkey. Seeds were germinated in room temperature on moist filter paper in Petri dishes. Root tips for karyotypical studies were pretreated with α-mono-bromonaphthalene at 4° C for 16 hours, and were fixed in a mixture of ethanol: glacial acetic acid (3:1) for 24 hours in refrigerator. The root tips were hydrolyzed with 1 N HCl for 16 minutes at room temperature. They were stained with 2% acetic orcein for 2 hours in squashed root meristems then were counterstained with 45% acetic acid. Permanent slides were made with the standard liquid nitrogen method. Slides were examined under Olympus BX-50 Photomicroscope with an oil immersion objective (100 X). Photographs were taken with the same microscope. The ideogram was prepared with measurements taken on enlarged micrographs of five well spread metaphase plates. The classification of chromosomes, the length of long and short arm, arm ratio, centromeric index, and relative chromosomal length were measured by software image analysis loaded on a personal computer. The classification of chromosomes into metacentric (m), submetacentric (sm), acrocentric (ac), and telocentric (t) was based on the analysis of metaphase chromosomes (Levan *et al*., 1964). Karyograms of the best metaphases and ideograms of each taxa were arranged in order of decreasing length.

Table 1. Measurements (μm) of somatic chromosomes in *Matthiola odoratissima*

Chromosome Pair no.	Chromosome arms (μm)		Total length (μm)	Arm ratio (L/S)	Relative length (%)	Chromosome type
	Long arm (L)	Short arm (S)				
1	3.49	2.58	6.06	1.35	24.15	m
2	3.45	1.35	4.80	2.54	19.12	sm
3	2.46	1.72	4.18	1.43	16.65	m
4	2.43	1.35	3.78	1.80	15.06	sm
5	1.96	1.48	3.43	1.33	13.66	m
6	1.50	1.35	2.85	1.11	11.35	m
Total length of haploid complement: 25.10 μm						

Results and Discussion

The chromosome number of *Matthiola odoratissima* were determined to be 2n=12 (Fig. 1). Total chromosome length is between 6.06-2.85 μm. Chromosomal classification was based on arm ratio and centromeric index as proposed by Levan *et al*. (1964), and it was given in the Table 1. The total length of the haploid set is 25.10 μm. As a result of classification, six chromosome pairs of the species were found to be four metacentric (m), two submetacentric (sm). The ideogram and karyogram were given in Figure 2-3.

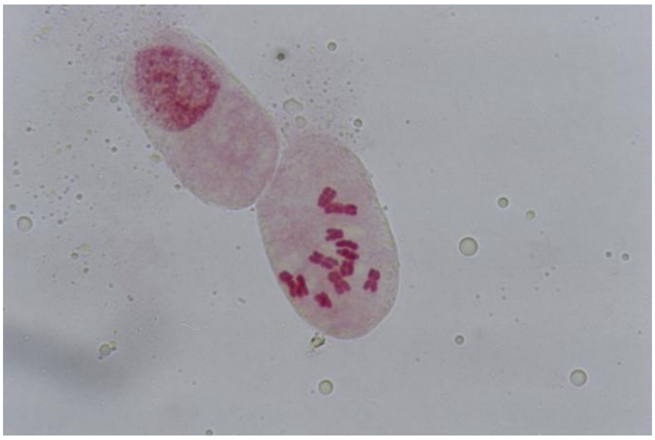

Fig. 1. Mitotic metaphase chromosomes in *Matthiola odoratissima* 2n=12 Bar: 10 μm

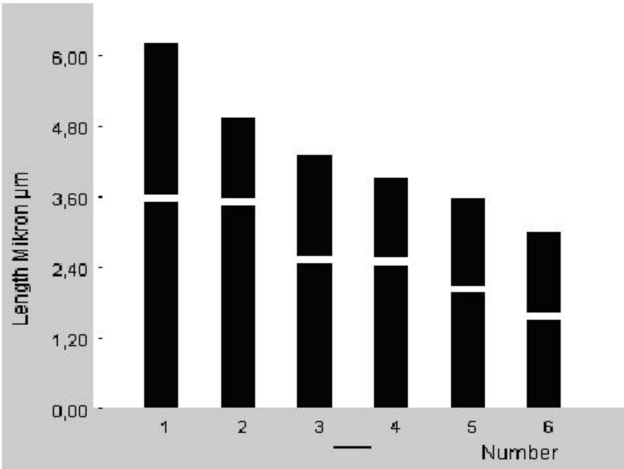

Fig. 2. Ideogram of *Matthiola odoratissima* 2n=12 Bar: 2 μm

Fig. 3. Karyogram of *Matthiola odoratissima* 2n=12 Bar: 10 μm

The caryological research on taxa which belong to the genus *Matthiola* showed that chromosome numbers were 2n=10, 12 and 14. Diploid chromosome number was 2n=12 in *M. fruticulosa* (L.) Maire subsp. *fruticulosa*, subsp. *perennis* (Conti) Ball., subsp. *valesiaca* (L.) Maire, *M. parviflora* (Schousb.) R. Br., *M. longipetala* (Vent.) DC., *M. livida* (Del.)DC. and *M. bolleana* Webb ex Christ. (Darlintong & Wylie, 1955; Dahlgren *et al*., 1971; Polatschek, 1983; Soliman & Parker, 1986; Izuzquiza, 1989; Canzobre & Castroviejo, 1993; Soliman, 2002; Sánchez *et al*., 2004).

It was reported in the caryological research on taxa which belongs to the genus *Matthiola M. fruticulosa* subsp. *fruticulosa* and *M. fruticulosa* subsp. *valesiaca* that chromosome numbers were as 2n=12 (Izuzquiza, 1989). In this study on *M. odoratissima* species of chromosome numbers were the same as the other subspecies.

In a molecular genetic study on *Matthiola bolleana*, the mitotic chromosome numbers indicated that 2n=12 (Sánchez *et al*., 2004). Our study shows that there is parallelism with this results.

Caryological study on the genus of *Matthiola*, *Erucaria*, *Cakile*, and *Eremobium* belonging to *Cruciferae* family, the chromosome numbers, and karyotypes of these taxa were reported (Soliman, 2002). In this study, diploid chromosome numbers of *Matthiola* is follows; *M. arabica* 2n=14, *M. livida* 2n=10, 12 ve *M. longipetala* 2n=12. In our study, diploid chromosome numbers of *M. odoratissima* shows similarity with the other species of diploid chromosome numbers.

According to Soliman (2002), the formula of three species are as follows; *M. arabica* 2M, 4nm, 4nsm(-), 2nsm (+), 2nst (-), *M. livida* (2n=10), 2M, 4nm, 4nsm (-), *M. livida* (2n=12) 2M, 4nm, 6nsm (-), *M. longipetala* 2M, 6nm, 2nsm (-), 2nsm (+). In our study on *M. odoratissima*, karyotype formula (4m+2sm) was different from the other species.

When we compare the total length of *Matthiola* species, we can see that there are some differences. For example, while the total length of *M. arabica* 15.00 µm, *M. livida* 11.77, 11.37 µm and *M. longipetala* 15.66 µm in *M. odoratissima* 25.10 µm were measured.

So far we have not met any studies on chromosome numbers and chromosome morphologies of the genus of *Matthiola* which naturally grows in Turkey. We hope that this study will contribute to the future cytotaxonomical studies on the genus *Matthiola*.

Acknowledgements

We express our thanks to TUBITAK (Project no. TBAG–1748) and Scientific Investigation Project to Coordinate of Selçuk University (project no: 05401046) for financial support.

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International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

TRAGACANTHIC ASTRAGALUSES, A GOOD CUSHION PLANT IN ENVIRONMENTAL SUSTAINABILITY AND RURAL DEVELOPMENT

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Astragalus with over 5000 known species in the world is the largest genus of the flowering plants. These plants are highly adapted to the harsh environments of the arid environments, by morphological and anatomical changes. Cushion growth form, hard spines and chemical compounds in Astragalus, which has a diverse utilization in medicine and industry. Of the total 1000 known Astragalus species in Iran, 45 species are known as Tragacanthic species of which 22 species are in Khorasan province. These species are scattered in 2.6 million hectares of rangelands in the province. The objectives of this study were to investigate; 1-The best method for sustainable harvesting of Tragacanth. 2- The ability of amount production of Tragacanth in habitats of Khorassan province.

Results showed that there are considerable differences between slop directions in terms of morphological and anatomical features of the indivial plants. In drier areas Tragacanth yield was higher that in more temperate areas. Economical density in terms of production for these plants showed to be 157 plants per hectare in the Northern areas and 496 plants in mid altitude areas of the provience, with yield of 2.85 and 1.48kg dried Tragacanth, respectively. Increasing the number of cuts from 1 to 7 increased the plant exudation, but yield per cut was decrease. The highest and lowest amount of exudation per plant was 51.78 and 0.41g, respectively and the production potential of Tragacanth is 1040 tons in habitats of Khorassan province.

***Key words**: Astragalus, Tragacanth, Khorasan province, medical plant, harsh environments, rural development*

Introduction

Pastoralism is an important job in the mountainous rural area of Middle East. Decrease the plant density in effect of drought and increase the animal numbers in rangelands over the environment resistance, is an important factor for decline the environment and added to immigration in rural areas of Khorassan province.

Notice to the natural product after understanding of second effect of chemical product, made this material to an economic potential in development of environmental product in rural areas. Hundreds of crops have been domesticated and cultivated by humankind during the history of agriculture, utilized for food, forage, fiber and medicine. However, some of material necessary for human survival was provided with wild plants.

Astragalus is a member of fabaceae family and originated in a warm – temperate area of Asia Minor and Middle East with a moderate rainfall, but it has become adapted to mountainous colder and drier regions. It is insensitive to drought; because it can escape damage with deep root system that able to tap subsoil water. Also, Spiny stems and small leaves made them a good cushion plant for mountainous environment conservation. Tragacanth (gum exudates of some species of Astragalus) is a historical product in Iran. It has been used medicinally for thousands of years, dating back several centuries before the Christian era. Gum Tragacanth is the second most important commercial gum and is produced by several shrubby plants of the genus *Astragalus*, growing from Pakistan to Greece, particularly in Iran and Turkey. It is important food additives besides being used in medicines, textiles, adhesives and etc.

North and middle mountains in Khorassan province is a biome of Tragacanthic Astragalus. Harsh environments and economic difficulty in these areas made immigration to an important problem in rural site of Khorassan and similar biomes in Middle East.

Harvesting the extract of Tragacanth made new jobs in this area and help to increase the economic development in this sits.

Great habitat of traganthic Astragalus's in high land, different uses of Tragacanth and economic coast of them in Iran made them to a good cushion plant in Environmental Sustainability in Iran and a potential for rural development.

Botany

The genus Astragalus is probably the largest genera of flowering plants in the world. There are currently 5250 names in the genus, which occur in both the Old and New Worlds (maassoumi 1998).

Tragacanthic Astragalus's are small spiny bushes 30-60 cm tall with small flowers clustered along the stems in the axils of spine-tipped leaves (figure 2). The flowers and 1-seeded pods are generally pretty well hidden in white pubescence or trichomes. Number of Tragacanthic species in Iran is over 100 species, there is over 23 Tragacanthic species In Khorassan province (naghavizadeh1999) (table1). They grow wild in dry regions, usually between altitudes of 4000 to 10000 ft. (1219 to 3040 m). Much of the Old World is divided into regions. These include: West Asia, East Asia, Middle East, South Asia, Europe and the various republics of the former Soviet Union which share a common border with East Asia, Middle East and west Asia (Lock, 1991).

Tragacanth

Tragacanth gum is the dried exudates produced by tapping the tap root and branches of certain shrubby species of Astragalus (figure 1), Tragacanth is also known as bassora gum, hog gum, Syrian gum. particularly those which occur wild in Iran and Turkey. It is a water-soluble carbohydrate gum containing the polysaccharides tragacanthin and bassorin. Chemically, it is a complex mixture of acidic polysaccharides, mostly present as calcium, magnesium and potassium salts.

Figure 1-A ribbon of gum exuding from the exposed upper taproot

Figure 2-An Iranian gum Tragacanth showing the spiny shrub

The name Tragacanth, from the Greek Tragos (goat) and akantha (horn), probably refers to the curved shape of the ribbons, the best of commercial gum. It is also available in Flakes.

Quality

Tragacanth is bought from origin as ribbons or flakes; loss of viscosity of gum which has been powdered and stored for long periods means that powdered Tragacanth is always produced in the importing country. Iranian Tragacanth, which is generally regarded as superior to Turkish, is sold in about 12 different grades: five ribbons (Ribbon no. 1, Ribbon no. 2, etc.) and the remainder flake.

Ribbon no. 1 is the top grade, being the palest and cleanest. Ribbon grades are usually used for pharmaceutical purposes; flake is used for food applications. The lower flake grades are appreciably darker and contain some foreign matter. When powdered for the end-user, Tragacanth is sold and specified by viscosity.

An FAO specification exists for food grade Tragacanth and includes limits on arsenic, lead and heavy metals, as well as some other parameters. Tragacanth is also specified in many pharmacopoeias for pharmaceutical use, including the United States pharmacopoeia XVII, 1965 or British Pharmacopoeia.

Uses

Tragacanth swells rapidly in water to form highly viscous colloidal sols or semi-gels, which act as protective colloids and stabilizing agents. The high viscosity of Tragacanth solutions results from the molecular characteristics of the gum, and these depend on the grade and physical form of the gum, and the manner in which it is taken up in water. Its superior water absorbing qualities make it an excellent thickening agent.

Gum Tragacanth has many industrial uses, including cloth finishing, calico printing and waterproofing of fabrics. In folk medicine it has been used for a laxative, persistent cough, diarrhea, and as an aphrodisiac. Modern pharmaceutical uses include an adhesive agent for pills and tablets, and for emulsifying oil droplets in lotions, creams and pastes. Gum Tragacanth is used in many everyday commercial products, from cosmetics and toothpaste to jellies and salad dressings. It is also used in syrups, mayonnaise, sauces, liqueurs, candy, ice cream and popsicles. Dr. D-T. Chu et al. indicated that Astragalus may be useful in the treatment of certain cancers and virally-induced diseases, such as AIDS and chronic cervicitis (Chu 1988).

COLLECTION

The most striking feature of the gum-producing Astragalus is a central gum cylinder in the tap root. The gum is contained in the cylinder at high pressure and, when cut, exudes rapidly and hardens into the characteristic ribbons of Tragacanth.

The process of tapping in Khorassan entails clearing away the earth surrounding the tap root and making one till seven cuts into the upper part of the root. The cuts are usually made longitudinally to the root, 2-5 cm long. Sometimes the branches are also cut but this usually yields an inferior gum. After a period of time which varies according to local custom or circumstances, but may be a few days or a week or more, the tapper returns to the plants he has cut to collect the gum. Further collections may be made thereafter but the quality of the gum soon deteriorates to a point when it is not worth while to continue.

Tapping is carried out in the dry summer months and continues until the autumn rains. The collector sells the gum to the local merchant who then sells it on to the main trader. He, in turn, takes it to the main sorting and grading centre where it is graded and packaged for export.

Astragalus in Khorassan

Khorassan province with 31.3 million hectare is largest province in North-East of Iran. Kopehdagh, Binalood, Hezarmasjid and east part of Alborz mountains are the important highlands in province. Middle and south part of province is arid desert. Pastoralism is the most important job in rural area and grazing pressure is an important factor in damages them. Although, Astragalus species are grown in different site of province, but Tragacanthic Astragalus's could seen in elevation 1200 to 4000 m.

Table 1 - Important Tragacanthic Astragalus's species in Khorassan

row	Scientific name	subjenus	habitat
1	***A.chrysostachys***	Calycophysa	Binalood mountain
2	***A.dactylocarpus***	Astragalus	Sabzevar
3	***A.ebornea***		North & west of Torbat e heidarie
4	***A.echidna***		North & west of Torbat e heidarie
5	***A.glaucacanthus***	Calycophysa	Bojnord
6	***A.gossypinus***		Binalood mountain-Torbat e heidarie
7	***A.gummifer***		North of Khorassan
8	***A.heratensis***		North of Khorassan
9	***A.keratensis***	Calycophysa	East of bojnord
10	***A.khorassanica***		North of Khorassan
11	***A.khoshjalensis***	Calycophysa	Khaf
12	***A.kopehdaghi***	Phaca	North & west of Khorassan
13	***A.maymanensis***	Phaca	North of Khorassan
14	***A.parrawianus***		South of Daregaz
15	***A.persicus***	Calycophysa	Binalood mountain
16	***A.raddei***	Calycophysa	North of Khorassan
17	***A.retamocarpus***	Phaca	North of Khorassan
18	***A.schistocalyx***	Phaca	Binalood mountain
19	***A.schmalhousenii***	Trimeniaeus	High lands in Khorassan
20	***A.schurbicus***		Bojnord
21	***A.siliquiformis***		East of Shirvan
22	***A.tragacantha***		North and East of Khorassan
23	***A.verus***	Tragacantha	Sabzevar

Potential of product

North and middle mountainous area in Khorassan is the habitat of Tragacanthic Astragalus's (figure 3). There are three watersheds, Atrak, Ghareghoom and central desert (figure 4). In an academic search in year 1999, mean product of Tragacanth in every plant measured in different aspect in two important region of North Khorassan (Kohmish in South of Sabzevar city in middle and Ferizi in south of Chenaran city in north region of Khorassan).

Figure 3- A habitat of Traganthic Astragalus in Khorassan

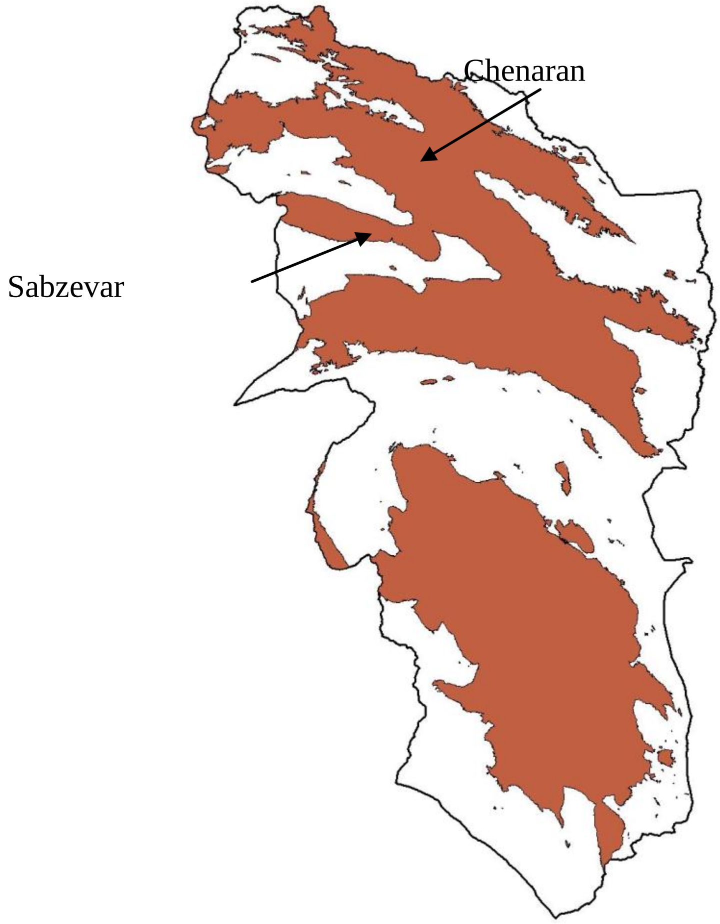


Figure 4-Habitat of Tragacanthic Astragalus's in great Khorassan

In primary examination measured effect of number of cuts on exudates. In This exam, used of 1 – 5 cut in a shrub. Weight of exudates that product of each plant and cut registered and hold gum in different bags (chart 1).

Experiment showed that added to the Number of cuts increase the weight of gum collected in a plant, but in more than two cuts decrease the mean of exudates in shrub.

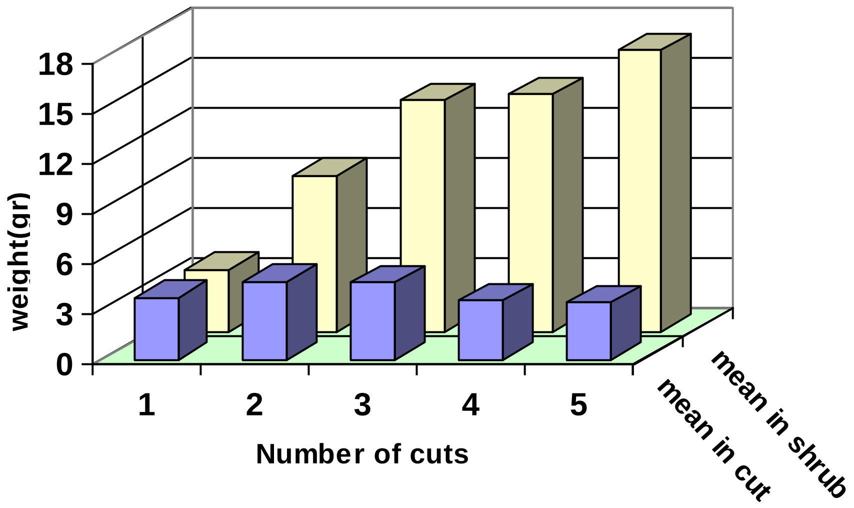
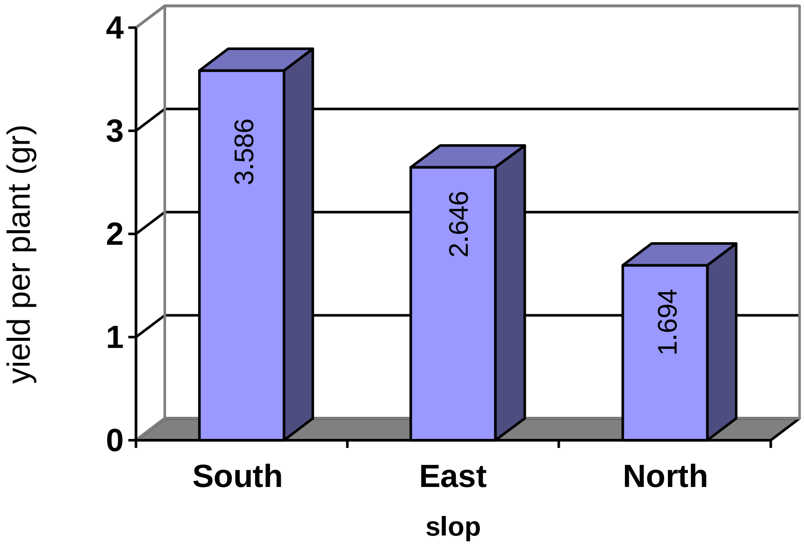


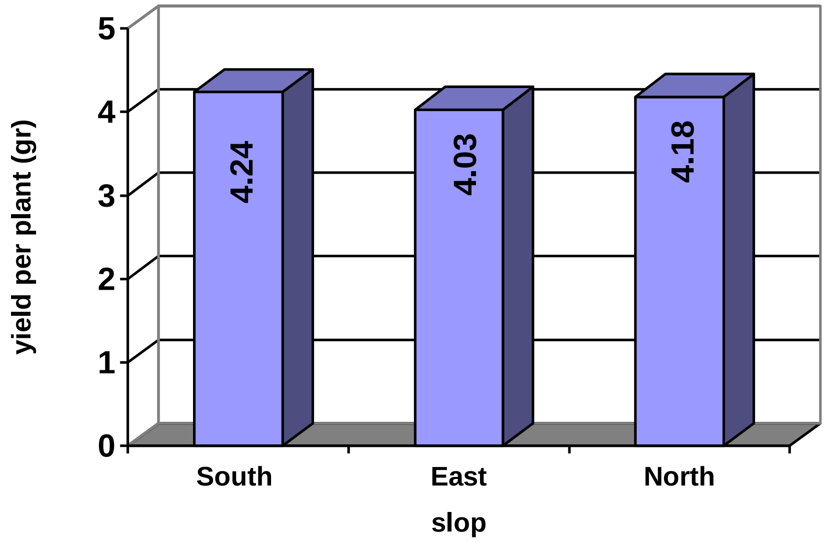
Chart 1- mean yield in cut and plant in different cuts

Largest gum collected was 22.73 gr from a shrub with only one cut. And Most Tragacanth collected from a shrub was 51.78 in a plant with 5 cuts.

Yield of every plant registered and mean of product determined in different aspect in Kohmish and Ferizi region (chart 2, 3). Results showed that there are considerable differences between slop directions in terms of morphological and anatomical features of the individual plants. Economical density in terms of production for these plants showed to be 157 plants per hectare in the Northern areas and 496 plants in mid altitude areas of the province. Sabzevar with desert climate show the distribution amount of Tragacanth in different aspect, but in the Chenaran with moderate climate disturb was low. In different aspect, South slop has largest pieces.



Yield of Tragacanth in different slop in Sabzevar



Yield of Tragacanth in different slop in Chenaran

Means of gum collected in shrub with one cut was 2.85 gr in Chenaran and 157 shrubs per hectare and 1.48 gr in Sabzevar in middle province with 494 shrubs per hectare. Distribution of economic Tragacanthic Astragalus's habitat in different watersheds in Khorassan was 932780 ha in Atrak, 585985 ha in Ghareghoom and 1073200 ha in central desert.

Therefore, sustainable production with collect near 500 ton with cost 50 million dollars, and job made near 300000person-day or 2000 person for 6 month in year is the first aim for notice to this industrial product.

Decrease of soil erosion, flood dangers, immigration from rural areas and increase of subsoil water, range product's, productive jobs in rural areas and increase economic condition in rural areas and country are second aims that make Tragacanthic Astragalus to an important plant in rural areas. And needed search to new uses of this product.

Important terms in collecting of gum:

- Use of special cutter for tapping the plants
- Cut only on tap root and don't cut the stems
- Use only one cut in a shrub, added to cuts decrease the gum quality and plant health
- Harvesting in rotation system help to soil and water conservation and sustainable production
- Cutting in parallel direction of root and don’t use of anti-parallel cutes
- Cut and collection of gum in warm and dry season rain in period of cutting till collecting of gum damage to quality product.

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International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

CYTOTAXONOMICAL INVESTIGATIONS ON THE SPECIES *C. CHRYSANTHUS*(HERBERT) HERBERT

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In this study, some samples of species *C. chrysanthus* (Herbert) Herbert which is one of the taxa of *Crocus* L. and has an enviromental importance because of its decreasing number in geographical distribution areas have been examined in the point of chromosome number and morphology. Materials of investigation have been selected from the samples which have yellow anthers, black lobed anthers and black lined anthers. Of the plants used as study material in the present study, *C. chrysanthus* samples with yellow anthers was collected from the area around Kamışlı village of Pozantı county of Adana city, *C. chrysanthus* samples with black lobed anthers was collected from Mountain Spil from Manisa, *C.chrysanthus* samples with purple perianth tube was collected from Kütahya-Afyon Road, 10. km. Squashed preparation method has been used. Chromoosome numbers and morphologies as regards samples were determined by examining mitosis preparates. On the other hand, karyograms of all samples were examined in a detailed way. As a result of investigation it was found that, chromosome number of *C. chrysanthus* samples with yellow anthers was 2n=8, chromosome number of samples with black lobed anthers was 2n=12 and chromosome number of samples with purple perianth tube was 2n=14.

Key words: *C. chrysanthus (Herbert) Herbert, Cytotaxonomy.*

INTRODUCTION

Crocus species (about 85 species) show distribution only in northern hemisphere. Most *Crocus* species are found in Mediterranean basin. Their distribution extends from Portugal and Morocco on the west to Kyrgyzstan and Senyang state of Western China and Ala Tau and Tien Shan Mountains of Mongolia on the east. Most of the taxa defined are in Balkans and Turkey. Number of the taxa decreases rapidly out of these regions. For example, only 4 species are known in Iber peninsula and 3 species around Caspian Sea. Distribution area extends from south Poland near Krakow with *Crocus vernus* Berger on the north to south Iran and Jordan with *Crocus pallasii* Goldb. on the south. Thus, geographical distribution area of whole species is between 10^{O}W and 80^{O}E attitudes and between 30^{O}N and 50^{O}S attitudes (Mathew, 1982). Of the *Crocus* species, 70 taxa show distribution in Turkey (Davis, 1984; Davis, 1988; Güner, 2000). Due to taxon diversity, Turkey might be considered as the mainland of Crocus. The first cytological studies on this species was done by Mathew (1932), Pathak (1940), Karasawa (1932-1956), Darlington and Wylie (1955), Bolkhovskikh et al. (1969) and it was observed that chromosome number varied greatly. Materials used in these studies, however, were those cultured in garden and rarely, those of unknown origin (Brighton et al., 1973).

In 1957 and 1958, Feinburn studied on the samples he collected from Israel, Syria, Lebanon and Greece and Sopova (1972) studied on the samples he collected from natural environments of Macedonia and they noted that studies on this species should be performed on the natural populations (Brighton 1977). Brighton et al. noted, for instance, that chromosome numbers of complex biflorus species varied in a wide range as 2n = 8, 10, 12, 18, 20 and 22 and that this indicated the presence of more than 1 taxa. Furthermore, they also emphasized that it was impossible to separate among some complex species like this one unless the data obtained was not increased by linking chromosome numbers with such factors as geographical distribution, habitat, and morphology (Brighton ve ark., 1973). Aneuploidy was observed in the samples of *C.biflorus* Mill. (2n=11), *C.asturicus* Herb. (2n=23) and *C.imperati* Ten.(2n=27). It is important that this was detected in related studies on the samples cultured in garden. *C.olivieri* J.Gay, *C.pulchellus* Herb. and *C.nevadensis* Amo&Campo taxa have been observed to exhibit spontaneous polyploidy (Brighton et al., 1973). In conclusion, the investigators have noted that such a condition as allopolyploidy might exist in the species rather than autopolyploidy; however, they also noted that further studies are clearly needed on this subject. Furthermore, they noted that the plants with low number of chromosomes (2n = 6 or 2n = 8) are found in Anatolia whereas those with high number of chromosomes (2n = 48 or 2n = 64) in Spain. This might suggest that Anatolia was gene center of the species. However, they also noted that such studies as SEM imaging of pollen and germ testa, pollen fertility, improvement works, DNA measuring and hybridization are required (Brighton at al., 1973).
Chromosome number within the genus shows great variation (2n = 6, 8, 10, 11, 12, 14, 16, 18, 20, 22, 23, 24, 26, 27, 28, 30, 32, 34, 44, 48 and 64) and at occasion, B chromosomes of which numbers ranges between 0 and 11 are encountered (Brighton et al., 1973). Furthermore, infra-specific variation is seen in some species and some groups have significant and steadily increasing taxonomic characteristics. Candan et al. made a cytotaxonomical research on *C. cancellatus subsp. lycius*, *C. fleischeri*, *C. pallasii subsp. pallasii*, *C. pulchellus*. When karyograms as regards these taxa investigated, usually submetacentric chromosomes can be seen (Candan et al., 2006). Kesercioğlu et al. noted that all chromosome pairs of *C. flavus subsp. flavus* and 3 chromosome pairs of *C. flavus subsp. dissectus* are submetacentric (Kesercioğlu et al., 2006). Kesercioğlu et al. made an investiagation as regards pollen and seed micromorphology of *C. ancyrensis*, *C. chrysanthus*, *C. sieheanus* and *C. flavus*. In this study, *C. chrysanthus* samples with yellow anthers and with black lobed anthers were examined in the point of pollen and seed(Kesercioğlu et. al., 2006). As can be understood from the studies in the literature, the species belonging to *Crocus* genus both exhibit great variation in chromosome number and have variations in their chromosome morphology. On the other hand, considering the fact that no studies has been performed so far on the samples

MATERIALS AND METHODS

a)MATERIALS

Information on the localities from which the samples of C. chrysanthus(Herbert) Herbert constituting the study materials is as follows:
a) *C. chrysathus*(samples with yellow anthers)
C5: ADANA, Pozantı, near Kamışlı village, N 37° 33’, E 34° 55’, 1362 m., 25.03.2005.
b) *C.chrysanthus*(samples with black lobed anthers)
B1:MANİSA, Mountain Spil, N 38°32’, E 27°25’, 1100 m., 25.02.2005.
c) *C.chrysanthus*(samples with purple perianth tube)
B2: KÜTAHYA, Kütahya to Afyon, 10. km, N 39°19', E 30° 03', 1113 m.,
For identification of the plants, the book “Flora of Turkey” was used (Davis 1984).

b) METHODS

Root tips of the plants were used for observing the mitotic chromosomes. Pretreatment was applied for 3 hours in 8-hydroxyquinoline solution and root tips were placed into carnoy solution containing alcohol and glacial acetic acid with a rate of 3:1. Materials stored at +4C were stained with acetoorceine. Preparations that were prepared with squashed method were examined with Carl Zeiss Jena research microscope and photogram of the cells chosen were taken and chromosome number of these cells were counted and their karyotypes were prepared.

FINDINGS

The chromosomes were observed to be large and low in number in cytological studies on root tips of *C. chrysanthus* samples belonging to genus *Crocus* which was the subject of the current study. During the methaphase stage of mitosis division, chromosomes were counted, their karyograms were prepared and chromosome morphologies were compared. Furthermore, chromosome behavior was also examined during division stages. The chromosomes were usually found to be submetacentric and chromosome distribution to be regular. The following features were observed in the examinations on the taxon examined in the current study.

a) Number of chromosomes as regards *C. chrysanhus samples with yellow anthers* was found to be 2n = 8. Chromosome distribution is regular(figure 1a). All of the chromosomes are submetacentric (Fig. 1b).
b) Number of chromosomes as regards *C. chrysanthus* with black lobed anthers is 2n=12. It was found that 5 pair of chromosomes were submetacentric and 1 pair of chromosomes to be telocentric(the 6^{th} pair) and 3B chromosomes were observed. It can be seen that chromosome distribution was regular.
c) Number of chromosomes related to *C. chrysanthus* with purple perianth tube was found to be 2n = 14. All chromosomes were observed to be submetacentric. Additionally, chromosome distribution was observed to be regular

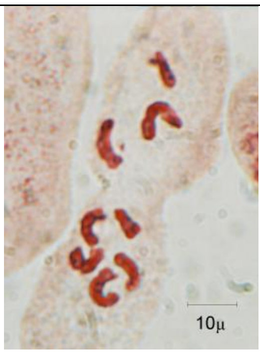

Fig. 1a. Metaphase stage of mitosis division, 2n=8

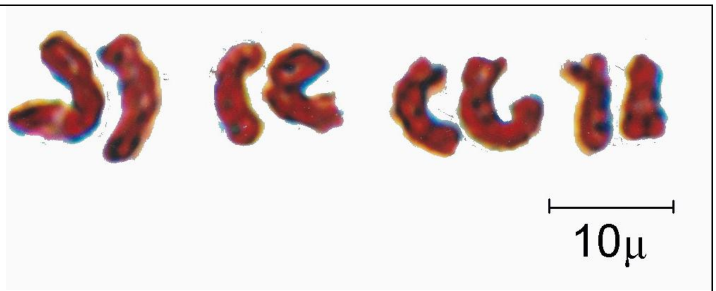

Fig. 1b.Karyogram of the sample

DISCUSSION AND RESULTS

The fact that *Crocus* genus which have a wide geographic distribution around the world exhibits wide morphological variations because of cytological heterogeneity they have has been known for long time. It is natural to experience problems at occasion in taxonomic separation of the taxa because of diverse morphological variations in the genus with chromosome spectrum beginning from 6 and reaching to high polyploidy values(i.e., 2n = 64). The genus was discovered in the book 'The Crocus' (Mathew, 1982). Furthermore, new specieses that were not included in that book are also encountered at occasion. Despite all these differences, the book "Flora of Turkey" didn't mentioned cytological, chemotaxonomic and other features (palinological and micromorphological) at all.
This study about *C. chrysanthus* especially examined in a detailed way included in the study because of their cytological characteristics.

One can say that polyploidy was not observed because the samples collected from different localities were usually of low chromosome number. Because it is seen in comprehensive studies by Brighton(1977) that basic chromosome number for the genus *Crocus* begins from 6, 8, 10. Our samples were seen to have lowest number of chromosome at the lowest level.
On the other hand, when karyograms were examined, it was seen that the samples examined suggested the concept of a new species because of heterogeneous shape and submetacentric characteristics of most chromosomes. As well known, that the metacentric chromosomes are unique to karyograms related to elements of the former floras.
2n=12+3B chromosome number related to *C. chrysanthus* samples with black lobed anthers were observed. The fact that there are several studies reporting B chromosome in the samples collected from Aegean islands suggests that this chromosome represents an accommodative process to the extreme environmental conditions in these islands. As well known, adaptation of the species to the environmental conditions is good when B chromosomes are less whereas sterility increases despite good environmental adaptation when B chromosomes are much.

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International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

NUTRITION (N.P.K) OF OAK (Q.CASTANEIFOLIA C. A. MEY) SEEDLING IN DIFFERENT LIGHT INTENSITIES

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For considering the nutrition of oak (*Q. castaneifolia*) seedling in different condition light, oak seeds were sewn under 4 different canopy densities with light intensities (LI) of 30%, 50%, 70%and 90% in Noor Forest (North of Iran). The results by analysis of variance (ANOVA) showed that except stem K in first year, other elements were unaffected by LI (p>5%). The highest amount of stem p was in 50 and 90% LI levels in first year and the lowest was in 30 and 70% LI. N in all LI levels, P in 30, 50 and 90% and K in 50 and 90% LI level have significant differences in two years. The Pierson Correlation showed that only root N and stem N and K have significant correlation with LI in first year.

Neither of main elements of nutrition in root and leaf in two years were unaffected by canopy, but root N in 30, 70and 90% LI levels and K in root in all L environment was different contrary to K. The N and K in leaf were different in all LI levels in two years but no K. As a whole, low to medium shade was the best environment for development of *Q. castaneifolia* seedling.

Key words: *biomass, canopy, density, growth, nutrition, oak, seedling*

Introduction:

The natural regeneration of oak (*Quercus spp*.) in the whole of world (North of America and some part of Europe and Asia) nearly have difficult (Ashton and Thandahi, 1995, Kausch and Ziegenhagen, 1995). Grazing seeds and seedlings (Wittwer et al., 1990), the danger of frostbit and drowning the seedlings, severely humidity compaction of weeds, low light of under story and slowly growth of seedling are effective factors in natural regeneration of oak (Champan and Lorimer, 1994; Johnson and Larsen, 1998; Hodges and gardiner, 1998).

Security the first desirable situation of seedling growth is very important for sylviculturist (Larsen and Maden, 1997). In otherwise without sylvicultural interferences the generation of oak in under story of dense stand in rich sites were failed (Jansen and Larsen, 1998), for this reason considering the effective factors on primitive growth of oak seedling is necessary for recovery the ecological situation of oak natural regeneration in dens stands (Pinzaut and minotta,1996).

Although oak under heavy shade has little growth but low and medium shade is suitable for oak regeneration (Johnson, 1993). Light intensity has very important role in forest regeneration and during the primitive phase of living low light may be induce a decrease in growth and vitality quality of oak seedling (Dai, 1996).

The oak forests of Iran is one of the valuable forest types of North forests of Iran and *Q.castaneifolia* are contained 6.6% of area and 7% of volume of northern forests of Iran (Ersali,1999; Mirkazemi:1997). In attention to different usage of oak wood in industry (Mirkazemi, 1997), fast growth, good quality of wood, suitability and good stability in Caspian Forests (Jalali and Hosseini, 2000), protection of this species is very important.

In the most of oak stands in the north of Iran because of human interference, presence of domesticated animal and pig, in technical exploitation of trees, reduce of mother trees, the oak natural regeneration have difficulty and most of oak stands replace by other species (Jalali and Hosseini, 2000, Mohajer, 1999, Mirkazemi, 1997).

Therefore in this research we consider that we can improve the vacancy of forest without regeneration and the quality and quantity characteristics of artificial oak seedling in four vacancies with different canopy during two years.

Material and methods:

This research was carried out in Sourdar Forest in North Forests of Iran. The longitude is 52^o, $3^{\prime}$ eastern and the latitude is 36^o, $28^{\prime}$ northern. The average annual rainfall is 803mm, and the average annual temperature is $16^{o\cdot c}$. The minimum and maximum of temperature is $1.9^{o\cdot c}$ and $29.5^{o\cdot c}$ respectively. The period of drought is 70days; the period of plant growth is 9-10 month. The climate of this area is humid on the base of de Martin system and humid temperate on base of Emberger system. The mother stone of this area is calcareous that located on marl layer that belong the sediment of myosin period of Cenozoic tertiary. The type of soil is forestry brown with 1.5m depth (Forests and Pastoral org. of Iran, 1994).
The shrubs and trees in this area are fallow:

Quercus castaneifolia, Zelcova carpinifolia, Carpinus betulus, Acer cappadosicum, Acer velutinum, Prunus avium, Crataegus monogyna, Mespilus germanica,Ilex spinigera.

We used a completely randomized design where three repetitions were in every canopy closure and in every macro plot two repetition were selected. We selected four canopy classes' densities (30%, 50%, 70% and 90% in three repetitions) in center of macro plots. The form of macro plots was circular with $1000m^2$ areas, two micro plots in each macro plot with square shape and $16m^2$ areas (4*4m). All macro plots were protected using the fence. Then the oak acorns were cultivated with a poker in bands with 50cm distance between two rows and 20cm cm between two acorns. There were two bands in each micro plot that 40 seeds planted in each micro plot. After planted the seeds all holes were filled with soil and humus. One year after sowing at the end of growing season we root out randomly three seedlings in every micro plot (6seedlings in every macro plot) and transferred them to laboratory. After we separated the root, leaf and stem of seedling we put on them in oven for thirty hours in 70 then we weighted them with microgram accuracy and determined the nitrogen with Kejeldal method, phosphor by burning method and with spectrophotometer and potash by atomic spectrogram method. The data were analyzed with EXCEL and SPSS.

Results and discussion:

The results of one way ANOVA showed that except stem potassium in first year, other stem elements didn't affected on canopy (p>%5). By Duncan test the highest amount of stem potassium in first year was in %50 and %90 canopies and the lowest in %30 and %70 canopies. The T-test showed that N in all canopies, P in %30, %50 and %90canopies and K in %50, %90 canopies between two years have significant different. The results of Pierson correlation showed that except root nitrogen and stem nitrogen and potassium in first year that have a significant reverse correlation with canopy, the other stem elements haven't significant correlation with canopy density both in two years.

The results of each years showed that nutrient elements of root and leaf wasn't affected by canopy. Root N in %30, %70 and %90 and root P in all stands were significantly different but potassium didn't remarkably different in all stands. Contrary to K the N and P of leaves were significantly different in each year (tab.1).

On the base of this research, the canopy cover has not significantly effect on amount of N, P, K of root, leaf and stem in first year. This result is in agreement with results of study of Vilar Salvador et al. (2004) on natural seedling of *Q.ilex* occurred under %45 canopy. Opposite to our study Ottosson and Welander (2000) found that amount of N of branch and leaf of *Q.rubra* reduced with increasing of light intensity. The canopy cover by indirect effect on temperature, humidity, decomposition of leaves affect on process of soil nutrient in forest stands. In other hands the temperature and water stress influenced on soil nutrient in plant (Jalilvand, 2003).

Tab. (1): The amount of N.P.K. of stem, root and leaf of oak seedling during two years:

Canopy %	stem						root						leaf					
	First	year		Second	year		first	year		second	year		first	year		second	year	
	N	P	K	N	P	K	N	P	K	N	P	K	N	P	K	N	P	K
25-35	13.6±0.6	0.44±.07	3.5±.3[b]	7.8±.1	1.1±0.14	3.3±.4	13.0±0.6	0.50±.05	3.2±.3	5.6±.4	1.8±0.3	2.9±0.9	27.2±1.4	0.18±.01	5.4±0.68	20.4±.50	1.6±0.09	5.3±.6
45-55	16.8±2.3	0.46±0.1	5.0±.3[a]	7.6±.2	1.0±0.07	3.0±.1	14.9±3.4	0.58±.07	3.6±.5	6.8±1	1.3±0.1	3.3±0.3	28.1±0.6	0.17±0.0	5.4±0.64	19.4±.53	1.6±0.15	5.3±.6
65-75	16.2±0.8	0.51±0.2	4.2±.2[b]	6.5±.9	1.1±0.2	4.0±1	15.4±1.3	0.57±.06	3.7±.6	6.4±.3	1.7±0.2	3.3±0.3	27.7±0.9	0.20±0.0	5.4±0.68	19.5±.50	1.±0.02	5.3±.6
85-95	20.2±1.5	0.54±.05	5.3±.2[a]	7.5±.4	1.0±0.14	3.1±.4	22.1±1.9	0.55±.06	4±1..3	5.6±.9	1.9±0.3	3.6±0.1	25.3±0.4	0.16±.01	5.35±.67	18.7±.75	1.55±.08	4.8±.1

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NATURAL OR MANMADE RESTORATIONS OF PLANT COVER OF SPOIL MATERIALS IN ROMANIA

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The paper presents a comparison between the plant species growing spontaneous and the experiment of rehabilitation of herbaceous vegetation on spoil materials and quarries from the montane belt of the Retezat Mountains (Southern Carpathians), in the area where hydrotechnical works were performed. The substrate of spoil material and quarries is represented by rough texture. The diversity of species is quite great given the harsh environmental conditions but their stability in time is lower while their quantitative representation, abundance and degree of coverage are even lower. The experiment had been taken in the area using seeds of herbaceous species in various proportions. The seedlings succeeded to cover 30-60% of the ground; some native ecotypes of the same species developed vigorously and reached the fructification stage.

The ecological results of seeding the grass cover on the spoil materials without soil addition is the self-fixation of organic matter to its surface, alive at the beginning and than as dead matter, which also deposits and enclosure the neighboring trees and brush litter, creating the conditions for a proper installation of native vegetation.

Key words: *Southern Carpathians, spoil material, quarries, natural and manmade restoration*

Introduction

In the Retezat Mountains, where in 1935 the first National Park of Romania was established, becoming later (1980) Biosphere Reservation too, the hydrotechnical works for the construction of Râul Mare dam and for the organization of the entire hydropower system displayed a particular interest for land restoration – as landscape and biodiversity, as close as possible to the original data.

Material and Method

Spoils materials and quarries resulted from hydrotechnical works "Raul Mare" in Retezat Mountains (South Carpathians) at the boundary of Retezat Biosphere Reserve, there are placed between the secondary pasture of *Festuca rubra* s.l. – *Agrostis capillaris* and the beech forest (1100 m altitude). The material excavated from the gallery and stored as spoil materials between the years 1993-2004, is rough, 2-5 cm diameter, the total height exceeding 100 m. The slope is 1:2 . During this period were made experiences of restoration using the seeding with herb seeds, direct on the native materials without soil and in comparison with natural recover with vegetation of spoils. Eleven sites were observed.

Conclusions

- Under the soil and climate hard conditions existing in the mountain area, the spoil materials areas would be restorated in a shorter period by artificial seeding using certain mixtures of seeds of local growing plant species, but the sustainability of vegetation is provided by the species disseminated naturally from the local flora.
- The essential effect of the seeding vegetation cover on the spoil materials not covered in soil is the self-fixation of organic matter on their surface, live in the beginning and than as dead matter, supplemented by the fixation and conservation of neighboring tree and bush litter and of the one brought by the wind on this ground during its development.
- Restoration of the vegetation cover on the spoil materials takes place naturally too, by the dissemination of the species growing in the neighbouring ecosystems and of the ruderal species, with a larger dissemination area, but the density of the populations, the degree of coverage and their stability in time and space are very low.
- Rare, endemic and even endangered species were observed growing on the spoil materials, particularly the species growing on rocks.

Stage of use of the spoil materials and the presence of rare, endemic and endangered plant species growing on these spoil materials

No	Site	No. species	Rare endemic and threatened species
1	Valea Bârlii spoil materials	1	*Laserpitium archangelica (R)*
2	Valea Râuşor – spoil materials Lu	0	-
3	Valea Nucşoara– spoil materials Lu	2	*Heracleum palmatum (E, R)* *Dactylorhiza maculata (P)*
4	Debuşare lac (V.Lăpuşnic) - spoil materials Lu	2	*Silene nutans dubia (E)* *Dactylorhiza maculata (P)*
5	Valea Netiş – rock quarry Pr*	5	*Centaurea phrygia ratezatensis (E.Ret.)* *Veronica bachofenii (E,R)* *Dactylorhiza maculata (P)* *Pinus sylvestris (P)* *Abies alba (P)*
6	Valea Netiş – spoil materials Pr**	7	*Peltaria alliacea (R)* *Centaurea phrygia ratezatensis (E.Ret.)* *Veronica bachofenii (E,R)* *Anthemis macrantha (R)* *Silene nutans dubia (E)* *Abies alba (P)* *Pinus sylvestris (P)*
7	Valea Jurii – spoil materials Pr***	2	*Silene nutans dubia (E)* *Dactylorhiza maculata (P)*
8	Valea Mare -spoil materials Pr*	3	*Centaurea phrygia melanocalathia (E)* *Dactylorhiza maculata (P)* *Pinus sylvestris (P)*
9	Valea Ciurilii – spoil materials Pr***	2	*Abies alba (P)* *Pinus sylvestris (P)*
10	Castelul de echilibru – spoil materials Pr***	1	*Silene nutans dubia (P)*
11	Râu de Mori – clay quarry Pr*	1	*Thymus longicaulis (R)*

Lu = still in work in 2004;*Pr = come back to forestry use in 2001;**Pr = come back to forestry use in 1999;***Pr = come back to forestry use before 1998; E = endemic species; P= endangered species; R = rare species

Dynamics of species number on spoil materials and quarries

Site	Species number along the time	The number of plant species in differently noticed years					
		1993	1995	1999	2000	2001	2002
Bârlii	101	28	56	27	-	49	74
Râuşor	78	-	59	-	-	55	63
Ciurila	44	-	-	-	27	39	44
Nucşoara	82	78	-	-	54	58	56
Brazi	77	69	-	-	-	66	
Netis-anr.	106	88		82	80	63	81
V.Seaca	59			56	56		59
Jurii	91	81				91	

Vegetation cover on spoil materials Bârlii
(seeded land in May , measured in October the same year)

Species	Frequency (%)	Density ind/m^2
Dactylis glomerata	30	353
Festuca arundinacea	25	616
Festuca rubra	20	354
Festuca pratensis	20	329
Cardaminopsis arenosa	10	2
Epilobium montanum	5	1
Coronilla varia	5	1
Tussilago farfara	5	1
Vegetation cover (%) : 51,83		

Dynamics of Cormophyta presence on spoil materials from Valea Bârlii

No.	T a x o n	Vegetal formation	1993	1995	1999/ 2000	2001	2002
1	*Abies alba (plantule)*	Pd	-	-	+	+	+
2	*Acer pseudoplatanus (plantule)*	Pd	-	-	+	+	+
3	*Achillea millefolium*	Pj	-	+	+	+	+
4	*Agrostis capillaris*	Pj	-	+	+	+	+
5	*Agrostis stolonifera*	Pj	+	-	-	+	+
6	*Alnus incana (plantule)*	Pj	-	-	+	+	+
7	*Angelica sylvestris*	Pj	-	+	+	-	-
8	*Anthoxanthum odoratum*	Pj	-	-	-	+	+
9	*Anthriscus sylvestris*	Pd	-	+	-	-	+
10	*Betula pendula*	Pd	+	+	+	+	+
11	*Campanula abietina*	Pd	-	-	-	+	+
12	*Campanula glomerata*	Pj	-	-	-	+	+
13	*Cardaminopsis arenosa*	Pj	-	-	+	+	+
14	*Carduus personata s.l.*	R	-	+	-	-	-
15	*Carex ovalis*	Lu	-	-	-	+	+
16	*Carex echinata*	Lu	-	-	-	+	+
17	*Carex remota*	Lu	-	-	-	-	+
18	*Centaurea rhenana*	Pj	-	+	-	-	+
19	*Cerastium fontanum triviale*	Pj	-	+	-	+	+
20	*Chamomilla recutita*	R	+	-	-	-	+
21	*Chenopodium album album*	R	+	-	-	-	-
22	*Cichorium intybus*	Pj	-	+	-	-	-

Experimental VARIANTS in V. Bârlii (species and %)
Var.1: *Phleum pratense* 60%, *Festuca pratensis* 15%, *Dactylis glomerata* 10%, *Lolium perenne* 5%, *Trifolium pratense* 5%, *Trifolium repens* 5%. **Var.2**: *Festuca pratensis* 50%, *Phleum pratense* 20%, *Lolium perenne* 10%, *Festuca arundinacea* 10%, *Trifolium pratense* 5%, *Trifolium repens* 5%. **Var.3**: *Festuca arundinacea* 65%, *Festuca pratensis* 10%, *Phleum pratense* 5%, *Dactylis glomerata* 5%, *Lolium perenne* 5%, *Trifolium pratense* 5%, *Trifolium repens* 3%, *Lotus corniculatus* 2%. **Var.4**: *Festuca rubra* 25%, *Agrostis capillaris* 20%, *Agrostis gigantea* 20%, *Lolium perenne* 15%, *Dactylis glomerata* 5%, *Festuca pratensis* 5%, *Lotus corniculatus* 5%, *Trifolium pratense* 3%, *Trifolium repens* 2%.

International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

ECOTOXICOLOGAL EFFECT OF SOME DIFFERENT ALKALINE METAL SALTS (NACL, KNO_3) AND STRONG ACID (HCL, H_2SO_4) CONCENTRATION ON GERMINATION OF *CEDRUS LIBANI* SEEDS

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Taurus Cedar (*Cedrus libani*) seeds were germinated with different alkaline metal salt (NaCl, KNO_3) and strong acid (HCl, H_2SO_4) solutions. Alkaline metal salt (NaCl, KNO_3) and strong acid (HCl, H_2SO_4) concentrations were 0.50%, 1%, 2% and 3%. The result indicated that, while low NaCl concentration (0.50%) had no effect on seed germination ratios, high concentration (1 to 3 %) had significant inhibitory effect; all concentrations reduced germination rate. All concentrations of KNO_3 had inhibitory effect on germination ratios and reduced germination rate. HCl and H_2SO_4 had significant inhibitory effects, all concentrations of these solutions reduced germination ratios and germination rate. HCl high concentration (3 %) stress almost stopped germination.

Keywords: *Cedrus libani, seed, ecotoxicology, germination*

INTRODUCTION

Taurus cedar (*Cedrus libani* A. Rich) naturally stands in Turkey and Lebanon [1]. Range of dispersion in Lebanon had been destroyed but it stands in a small area around Cebelebanon. West border of dispersion in Turkey starts from Fethiye and Koycegiz, passes Taurus Mountains on the east, gravitates South Amanos from Goksun and Kahramanmaras [2]. Besides this natural dispersion in South Anatolia, it stands as an insulated clan in Kelkit-Yesilirmak environment in north Anatolia and Afyon-Cay (Denirsek Village) in west Anatolia. This species which approximately has 109 440 ha range of dispersion in our country, occasionally forms virgin forest between 1250-2000 meters, in general forms mixed forest with Taurus fir, Anatolian black pine and a kind of juniper. In this wide range of dispersion, most dense and high quality forests stand in west Taurus, Elmali environment, Ciglikara, Bucak, Katrandagi and Susuz Mountain. Ranges of dispersion were devastated in other region. According to Saatcioglu [3], these regions called as “Forest present Cedar” instead of “Cedar Forest”.

Because of usage in dry soils, Taurus cedar is a tree species frequently used for restoration of bad ecosystem and having narrow annual circle and enduring wood, it has wide range of usage. Besides being an origin of dispersion in Turkey, Taurus cedar forests have significant value because of historical, cultural, aesthetic, biological and scientific point.

According to the IUCN Red List of Threatened species, *Cedrus libani* is listed as LR/nt. It is at a Lower Risk, meaning that it doesn't fulfill the criteria for any of the categories of Critically Endangered, Endangered or Vulnerable. The designation "nt" means it is near threatened, and is close to qualifying for Vulnerable. It is not threatened in Turkey, although it is heavily threatened in Lebanon and extremely restricted in Syria. On account of this feature, having priority species for “Our Country Tree Reform and Seed Production Program” [4].

It was thought that the investigation of *Cedrus libani*’s seed germination characteristic in alkaline metal salts and strong acid will be useful because of having wide range of dispersion, valuable wood and capability of dried areas afforest and potentiality of devastated natural dispersion area’s restoration.

The aim of this study is to examine the effects of ecotoxicological effect of some alkaline metal salts (NaCl, KNO_3) and strong acid (HCl, H_2SO_4) concentration on germination of Taurus Cedar seeds.

MATERIAL AND METHODS

Seeds were collected from 1000-1200 altitude of Mersin-Erdemli natural areas of Turkey in December. The experiments were carried out in plant growth chambers. For the duration of the experiments a constant temperature (+25°C) and a white light source (2800 lux) and photo-period of 8 hours light, 16 hours darkness were maintained. Four main treatment series were tested (NaCl, KNO_3, HCl, H_2SO_4 and control group). In each series, seeds were treated with 0.5%, 1%, 2% and 3% concentrations of NaCl, KNO_3, HCl and H_2SO_4. They were treated with the salt of acid for the entire 40 days. For the control group, pure distilled water was used. For each concentration in each experiment series 100 seeds were used in repetitions of four. Germination tests were performed with the four replicates in a Petri dish (9cm diameter lined with two discs of filter paper). Experiments were terminated on the 40th day, owing to a complete cessation in germination. Seeds were considered germinated when the radical was touching the seed bed (filter paper). Seed germination rates were calculated according to Yucel [5]. For evaluation of the results the ANOVA “Duncan” test was applied.

RESULTS

The Taurus Cedar seeds used in this study were collected from areas of natural distribution in Mersin-Erdemli, Turkey. Collected seeds were experimented about their germination characteristic by designated methods and evidences were given in Table 1.

According to univariate analysis of variances which is about differences among obtained evidences; effect of alkaline metal salts and strong acid on seed germination percentage (Table 2) and rates (Table 3) were found statistically significant at $p<0,001$ reliability level.

Table 1. Ecotoxicological effect of some different alkaline metal salts (NaCl, KNO_3) and strong acid (HCl, H_2SO_4) concentration on germination of *Cedrus libani* seeds

Application No.			Germination percentage Mean		Mean		Germination rate Mean		Mean	
1	Control	Concentrations	40	j			10	ef		
2	KNO3	0.50%	30	i	24	d	9	d	8	a
3		1%	31	i			8	c		
4		2%	19	f			7	b		
5		3%	14	d			6	a*		
6	NaCl	0.50%	27	h	15	c	10	ef	8	a
7		1%	24	g			9	d		
8		2%	4	c			8	c		
9		3%	3	bc			6	a*		
10	HCl	0.50%	17	e	9	b	10	f	9	a
11		1%	15	d			9	de		
12		2%	3	bc			8	c		
13		3%	1	a*			8	c		
14	H2SO4	0.50%	4	c	3	a*	10	ef	8	a*
15		1%	2	ab			7	bc		
16		2%	2	ab			7	ab		
17		3%	2	ab			6	a		

*Within each column, means with the same letter are not significantly (P=0.05);
Annova Duncan-test; p, 0.0001.

Table 2. Tests of Between-Subjects Effects (Germination, %)

Dependent Variable: Germination

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	10241,765(a)	19	539,040	718,720	,000
Intercept	16332,840	1	16332,840	21777,120	,000
Applications	934,766	9	103,863	138,484	,000
Error	36,000	48	,750		
Corrected Total	10277,765	67			

Table 3. Tests of Between-Subjects Effects (Germination rate)

Dependent Variable: Germination

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	156,412(a)	19	8,232	32,609	,000
Intercept	4019,560	1	4019,560	15922,141	,000
Applications	9,937	9	1,104	4,374	,000
Error	12,118	48	,252		
Corrected Total	168,529	67			

In the control group germination

In the control group germination began on day 5 and was completed by day 18 and 40 % germination was observed.

Toxic effects of KNO_3 on seed germination

In the 0.5%, 1%, 2% and 3 % KNO3 series, germination had begun on days 6 to 9 and was completed by days 18 to 22 and 30% to 14% germination was observed. Germination rate was slowed and its duration extended, starting 1 to 4 day later than the control group. In 0.5% to 3% KNO3 series germination was inhibited, it was delayed and decreased significantly (2 %) compared to the control group (Table 2).

Toxic effects of NaCl on seed germination

Seeds germinated in the 0.5% NaCl series achieved 27% germination. The germination was started on the 6th days and was completed within 16 days.

In the 1% NaCl series achieved 24% germination. Germination rate was slowed and its duration extended, starting 1 day later than the control group.

In the 2% NaCl series achieved 4% germination (Table 1). Germination rate was slowed and its duration extended. Germination began during day 10 and was completed during day 17.

In the 3%NaCl series, while germination was further delayed and inhibited (Table 1). The lowest germination percentage was achieved 3%, with germination beginning during day 16 and was completed during day 22.

Toxic effects of HCl on seed germination

In the 0.5 % HCl series 17 % germination was achieved, although germination was delayed and inhibited in all series and germination percentages and rates were lower than the control group (Table 1).

In the 1% HCl series achieved 15% germination. In the 2% HCl series achieved 3% germination (Table 1), germination rate was slowed and its duration extended, and germination began during day 11 and was completed during day 16.

In 3% HCl series germination was inhibited, the lowest germination percentage was achieved 1%, with germination beginning during day 16.

Toxic effects of H_2S0_4 on seed germination

In the 0.5 % H_2S0_4 series 4 % germination was achieved, although germination was delayed and inhibited in all series and germination percentages and rates were lower than the control group (Table 1).

In 1 to 3% H_2S0_4 series germination was inhibited, it was delayed and decreased significantly (2 %) compared to the control group (Table 1).

DISCUSSION

In this study, the effects of concentrations of NaCl, KNO_3, HCl and H_2S0_4 on germination of seeds of one of Turkey's most important forest trees, Taurus cedars, was investigated. It is known that there are differences among the variations [6] and seed germination [7] on Taurus cedars.

There are many geographical variations, showing morphological differences within the wide natural distribution of Taurus cedars. Although Taurus cedars show distribution over quite a wide area, as the most widely planted species, it is important that; If *Cedrus libani* seeds are resistance to extreme conditions, such as strong acid and metal salts.

It is known that; *Cedrus libani* seeds have germination dormancy and suggested 30 days calm-wet pre operation to pass over this dormancy. Seeds which are used in this study; most number of germination ratio found at control group (40 %). Same germination ratio was found at calm- wet pre operation applied seeds. According to Cedrus seeds standard; these seeds are classified three classes. These classes are: 60 % germination and above I. Class, 50-59% germination II. Class and 40-49% III. Class. Also, seemed that; seeds are collected from Karadeniz-Amasya (Catalan) area have lowest germination percentage such as 33,7 % [8]. In our study, used seeds had 40% germination so that these seeds are called as III. Class.

Salinity affects the fertility of soil and also significantly reduced production. High salt-concentration inhibits germination [9]. In this study, it was established that 0.5% to 3% NaCl concentrations inhibit germination and germination rate that these findings are statistically significant at 0.05 reliability level (Table 2). Nevertheless, at all salt concentrations' germination-rate was lower than the control group and because this difference was found to be statistically significant, it was concluded that salt decreases germination rate (Table 3).

Although KNO_3 is held to be one of the growth-regulating and germination-stimulating substances, but in this study, all concentrations inhibit germination and germination rate. These findings are statistically significant at 0.05 reliability level (Table 2). Further, the coefficient of germination rate of all KNO_3 series being found to be lower than the control group, it was established that this substance decreases germination rate and the difference is statistically significant (Table 3). These results were similar in other study [10].

Strong acids (HCl, H_2SO_4) are known inhibitors or terminators of germination even at low concentrations [11]. This study obtained similar findings; HCl, H_2SO_4 were seen to have inhibited germination at all concentrations, with the germination percentage and rate falling significantly at low concentrations (0.5 to 1%) and stopping altogether at higher concentrations (Tables 2,3).

Seed germination rates are as important as seed germination. Because of this, any experimental series' seed germination rates were calculated. In respect of regression analysis result, linear relation declared by primary equation between germination rate and germination ratio were determinated [Germination Rate = 7,2779 b_o + 0618b_1 (Rsq=0,233 ; d.f.=66; F=20,06; Sigf=0,000)] (Figure 1).

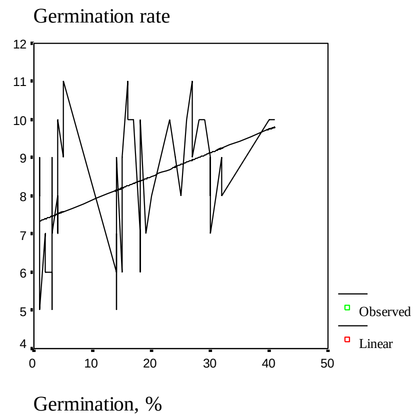

Figure 1. Relation between germination percentage and germination rate in Taurus cedar seeds.

At the end of germination experiment with metal salts' (NaCl, KNO_3) and strong acids' (HCl, H_2SO_4) different concentrations, results of variance analysis which related to evidence of germination percentage value, between each chemical application including control group differences were found significant at p<0,001 reliability level (Tables 2,3). Duncan test was applied so as to determine homogeneous subsets. 10 homogeneous subsets were formed by Duncan test (Table 4).

When results were compared in terms of germination rate; according to the result of variance analysis related to germination rate value, we determined that different germination area was important for germination percentage as $p<0,001$ (Table 3). According to Duncan test results; 6 homogeneous subsets were determined in terms of germination rate (Table 5).

As a result; we determinated that alkaline metal salts (NaCl, KNO_3) and strong acids (HCl, H_2SO_4) have a significant inhibitory effect on germination rates and percentage of Taurus cedar.

Table 4. Homogeneous Subsets (Germination, %)
Duncan

Applications	N	Subset									
		1	2	3	4	5	6	7	8	9	10
13	4	1,25									
15	4	2,00	2,00								
16	4	2,00	2,00								
17	4	2,00	2,00								
12	4		3,00	3,00							
9	4		3,25	3,25							
14	4			4,00							
8	4			4,25							
5	4				14,25						
11	4				15,00						
10	4					17,00					
4	4						18,75				
7	4							24,00			
6	4								27,25		
2	4									30,00	
3	4									30,75	
1	4										40,25
Sig.		,272	,073	,067	,227	1,000	1,000	1,000	1,000	,227	1,000

Table 5. Homogeneous Subsets (Germination rate)
Duncan

Applications	N	Subset					
		1	2	3	4	5	6
5	4	6,00					
9	4	6,00					
17	4	6,00					
16	4	6,75	6,75				
4	4		7,00				
15	4		7,25	7,25			
3	4			8,00			
8	4			8,00			
12	4			8,00			
13	4			8,00			
2	4				9,00		
7	4				9,00		
11	4				9,25	9,25	
1	4					10,00	10,00
6	4					10,00	10,00
14	4					10,00	10,00
10	4						10,25
Sig.		,058	,191	,064	,513	,058	,528

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AN INVESTIGATION ON COMPARISON OF ECOLOGICAL AND BIOLOGICAL PROPERTIES OF TWO ENDEMIC CENTAUREA SPECIES FOR TURKEY (*CENTAUREA LYCIA* AND *CENTAUREA LUSCHANIANA*)

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In this study, ecological and morphological properties of two endemic Centaurea species for Turkey, *Centaurea lycia* Boiss. and *Centaurea luschaniana* Heimerl were invastigated. Ecologically, structural characteristics of the populations belonging to the species were investigated by analysing climatic data and main rock-soil properties. Relationships between soil properties and morphological characteristics of the species were determined by analysing statiscally. Also, germination characteristics of species were determined.

At the end of the analysis, both species prefer mesothermal climate type. Moreover, these two species grow on calcerous mainrock and basic soils. Morphological characters are affected positivitely and negatively by changing nutrient concentations of plant and soils ($p<0,01$). *C. lycia* seeds best germinated when 8L/16D period was applied, however, decreasing of light time decreased the germination speed. Other species, *C. luschaniana*, best germinate when 16L/8D period was applied and maximum germination speed was shown during 8L/16D period.

Key words: *Centaurea, ecology, morphology, Turkey*

1. Introduction

Turkey has a rich floristic structure because of its geographical location, ecological, paleogeographical and historical properties. 30% of total nearly 10.000 plant species in Turkey is endemic whereas total number of endemic species in all European countries is almost 2750 (Taşkın, 2000). This situation clearly shows that Turkey is richer than European countries in terms of endemic plant species although it covers an area which is nearly one fifth of Europe continent.

Almost 600 species belonging to genus *Centaurea* L. naturally distributes in Asia, North Africa and America (Brummitt, 2004). In Turkey, the genus is represented by 187 species and 118 of them are endemic (Köse, 2006; Davis 1975 , Davis *et al.* 1988, Wagenitz *et al.* 1988 , Duran & Duman 2002; Turkoglu *et al.* 2003, Uzunhisarcikli *et al.* 2005, Aytaç & Duman, 2005). Of these species, *C. lycia* and *C. luschaniana* in *Phalolepis* section are also in EN (Endangered) risk category (IUCN, 2001).*C. lycia* Boiss. and *C. luschaniana* Heimerl., endemic species for Turkey, naturally distributes around Antalya province. Both of these species are perennial, tomentose and xerophyte plants (Figure 1, 2). These species, formerly in LR (cd) category (Ekim et al., 2000), were transferred into EN category by Köse (2006).
In this study, it is aimed to investigate ecological and morphological characteristics of these two endemic *Centaurea* species (*C. lycia* Boiss. and *C. luschaniana*) comperatively.

2. Material and Methods

Plant samples were collected from their natural distribution areas between the years 2003 and 2005 (Table 1). Main rock samples were also taken from the same areas and petrographic identification of these samples were made. Besides, relationships between all species in the Phalolepis section and geological structure of the area were investigated by using the geology maps (Scale 1:500.000) prepared by the General Directorate of Mineral Research and Exploration, Turkey (Duberted, 1973).

Plant samples were considered as 3 different parts; root, stem and leaves. N, P, Ca, Mg, K, Na, Fe, Cu, Zn, and Mn determined according to the methods of Walkley & Black (1934), Jackson (1962), Chapmann & Pratt (1961) and Olsen & Sommers (1982).

The soil samples from a depth of 0-30 cm from the localities of collected specimens were taken. Soil colorwere determined according to Standart Soil Color Charts on international color scale released in 1970. The texture by hydrometer method (Bouyoucos 1962), pH with glass electrode (1/2.5 soil-solution ratio), total calcium carbonate ($CaCO_3$) with Scheibler calcimeter, total nitrogen by Semimicro-Kjeldal (Bremner 1965), organic matter by Walkley-Black method (Wakley & Black 1934), and available phosphorus (P_2O_5) by Olsen method (Olsen & Sommers, 1982). Soil extracts were prepared by using ammonium acetate method (Jackson, 1962). These extracts were analyzed in Perkin-Elmer 3030 B atomic absorption spectrophotometer in 0,01 ppm sensivity. Values are means of 3 replicates. Fe, Cu, Zn and Mn were determined according to Walkley and Black's wet-combustion method. Identified values were considered according to Schröder (1972).

Climate types of distribution areas of the species were determined according to Thornthwaite method. Mean climatic data of recent years were obtained from the General Directory of Meteorological Affairs.

Germination studies were carried out in growth cabinet (MLR-350 Model Sanyo, Japan). During the experiments, temperature was stabilized (25 $^{o}C \pm 1$ ^{o}C) and white light source were used. In every experiment serie, 100 mature seeds were germinated for each concentration. Experiments were made in petri disches (9 cm wide) and on filter paper. Three different photoperiods were applied for each origin: 8h dark-16 h light, 16 h light-8 h dark and 24 h dark period. Germination studies were ended in 45th day in series which all germinations stopped. Germination speeds were calculated according to Yücel (1997).

For diagnostic characteristics, measurements were taken from 10 different individuals of each locality. Aritmetic values were used and correlation analysis were applied in the relationship between morphological characteristics and nutrients in plant organs. Statistical analyses were carried out by using SPSS 10.0.

Table 1. Localities of plant samples

Species	Saple area	Localities
C. lycia	1	Antalya: Antalya-Korkuteli yolu, 20. km, yol kenarı, kayalık, 538 m, 2 vi 2003, N 37^0 01' 35.7" E 30^0 27' 39.6"
	2	Antalya: Saklıkent yolu, tesislere 9 km kala, taşlık yamaç, 1142 m, 5 vii 2003
	3	Antalya: Kozdağı, Tahtalı dinlenme yeri yolu, kayalık yamaçlar, 1130 m, 5 vii 2003, N 36^0 53' 51.5" E 30^0 22' 21.5"
	4	Burdur: Kızılkaya-Korkuteli yolu, Dik kayalıklar, 844 m, 2 vii 2005, N 36^0 18' 32.6'' E 30^0 21' 26.9''
C. luschaniana	1	Antalya: Elmalı-Korkuteli arası, Karaman beli, kayalık, 1300 m, 5 vii 2003, N 36^0 56' 52.5" E 30^0 09' 43.8"
	2	Antalya: Elmalı-Korkuteli yolu, yol kenarı, kalker kayalar, 1156 m, 4 vii 2003, N 36^0 45' 09.6" E 29^0 54' 22.6"
	3	Antalya: Korkuteli-Elmalı arası 30. km, 1308 m, 4 vii 2003, N 36^0 56' 37.7" E 30^0 07' 04.4"
	4	Antalya: Korkuteli-Elmalı arası, 14. km, kayalık, 1265 m, 3 vii 2005, N 36^0 58' 17.3'' E 30^0 09' 05.7''

Table 2. Nutrition elements in roots of species

Species	Localitiese	N %	Na ppm	Mg ppm	Ca ppm	Fe ppm	K ppm	Mn ppm	Zn ppm	Cu ppm	P ppm
C. lycia	1	2,0476	1500	1250	17590	445	15000	43,5	90	33,5	1550
	2	1,1029	575	1175	4740	680	7250	82	72,5	20	1050
	3	1,4509	625	1010	7915	215	10500	14	72	9	900
	4	1,2018	625	2130	22805	3995	11000	154,5	37	20,5	1300
C. luschaniana	1	1,1653	775	1780	13495	2025	10500	113,5	419,5	37	1250
	2	0,8293	600	940	8675	980	8750	90	84	44	700
	3	0,969	350	995	14485	1335	6250	91	80,5	56,5	950
	4	0,3327	575	1135	15300	520	8750	42,5	18,5	13,5	450

3. Conclusions
3.1. Climate

Ombrothermic diagrams were drawn according to the Thornthwaite method based on the data obtained from Antalya, Korkuteli, Burdur and Elmalı meteorology stations and climate types were determined.

When ombrothermic diagram of Antalya is investigated (Figure 1), it could be seen that water excess in soils continue until the end of April. Although precipitation gets lower, reserved water in soils could be enough for water need until June. After this period, absolute dry period starts and continue until October. Then, water is started to reserve in soil based on the increased precipitation in October. Climate type in Antalya is, “humid, mesothermal, high water shortage in summer, oceanal climate type”.

When ombrothermic diagram of Korkuteli prepared according to Thornwaite method is investigated (Figure 2), it could be seen that water excess in soils continue until the second half of March, reserved water in soils is enough for water need during May. Absolute dry period is between June and October. Later, water is started to reserve in soil based on the increased precipitation. Climate type in Korkuteli is “dry, less humid, mesothermal, with no or little water excess, similar to oceanal climate effect” climate type.

When ombrothermic diagram of Burdur is investigated (Figure 4), it could be seen that water excess in soils continue until the first half of May, reserved water in soils is enough for water need until June. Later, absolute dry period starts and continues until mid October. After this period, water is started to reserve in soil based on the increased precipitation. In Burdur, “dry, less humid, mesothermal, water excess in winter, similar to oceanal climate effect” climate type was determined.

When ombrothermic diagram of Elmalı is investigated (Figure 4), it is seen that water excess in soils continue until the first half of April, reserved water in soils is enough for water need during April and May. Water shortage is seen between June and October, after this period, water is started to reserve in soil. In Elmalı, “dry, less humid, mesothermal, high water excess in winter, similar to oceanal climate effect” climate type was determined.

3.2. Nutrients in Plant Organs

Nutrients in *C. lycia* roots; total N % 1,10 - % 2,04; Ca 4740 – 22805 ppm; Mg 1010-2130 ppm; Na 575 – 1500 ppm; K 7250-15000 ppm; P 900-1300 ppm; Fe 215-3995 ppm; Mn 14-154,5 ppm; Cu 9-33,5 ppm; Zn 37-90 ppm, stem; total N % 0,73-1,62; Ca 4790-22700 ppm; Mg 1155-1980 ppm; Na 200-625 ppm; K 6500-14000 ppm; P 300-1200 ppm; Fe 280-515 ppm; Mn 9,5-25 ppm; Cu 7-125,5 ppm; Zn 16,5-101 ppm, leaves; total N % 1,46-2,88; Ca 11205-37405 ppm; Mg 2310-3860 ppm; Na 450-575 ppm; K 6500-13750 ppm; P 500-1300 ppm; Fe 1230-3725 ppm; Mn 56-118 ppm; Cu 10,5-114,5 ppm; Zn 26,5-107 ppm were identified. (Table 2, 3, 4).

Nutrients in *C. luschaniana* roots; total N % 0,33 - % 1,16; Ca 8675 – 15300 ppm; Mg 940-1780 ppm; Na 350 – 775 ppm; K 6250-10500 ppm; P 450-1250 ppm; Fe 520-2025 ppm; Mn 42,5-113,5 ppm; Cu 13,5-56,5 ppm; Zn 18,5-419,5 ppm, in stem; total N % 0,32-0,98; Ca 7525-16875 ppm; Mg 755-2330 ppm; Na 175-475 ppm; K 5250-8750 ppm; P 500-1100 ppm; Fe 210-505 ppm; Mn 13,5-29 ppm; Cu 5,5-42,5 ppm; Zn 20-181,5 ppm, in leaves; total N % 0,49-1,42; Ca 16480-35340 ppm; Mg 1330-5800 ppm; Na 250-375 ppm; K 5750-11000 ppm; P 600-1100 ppm; Fe 855-2250 ppm; Mn 52-91,5 ppm; Cu 10-51,5 ppm; Zn 28,5-74,5 ppm were identified (Table 2, 3, 4).

Table 3. Nutrition elements in stem of species

Species	Localities	N %	Na ppm	Mg ppm	Ca ppm	Fe ppm	K ppm	Mn ppm	Zn ppm	Cu ppm	P ppm
C. lycia	1	1,6296	625	1320	15790	365	10500	25	101	125,5	1200
	2	1,4202	200	1155	4790	375	6500	18,5	83,5	11,5	300
	3	1,5348	275	1350	14070	280	14000	9,5	63,5	12,5	750
	4	0,7383	550	1980	22700	515	8500	22	16,5	7	950
C. luschaniana	1	0,984	325	1265	11850	505	8750	28,5	181,5	42,5	1100
	2	0,6869	475	1145	11835	385	7000	29	75,5	30,5	700
	3	0,7157	250	755	7525	280	5500	15,5	93	23	650
	4	0,325	175	2330	16875	210	5250	13,5	20	5,5	600

Table 4. Nutrition elements in leaves of species

Species	Localities	N %	Na ppm	Mg ppm	Ca ppm	Fe ppm	K ppm	Mn ppm	Zn ppm	Cu ppm	P ppm
C. lycia	1	2,2657	450	2310	36200	2700	8750	113,5	107	114,5	1300
	2	1,4619	500	2610	11205	3165	6500	118	93,5	44	500
	3	2,8814	450	2515	37405	3725	13750	104	70	49	1300
	4	1,5095	575	3860	34610	1230	10000	56	26,5	10,5	1050
C. luschaniana	1	1,4243	275	1330	17055	915	8750	55	58,5	22,5	950
	2	1,1122	375	1365	16480	855	10000	61,5	40	20	1050
	3	1,3064	250	1725	22455	2250	11000	91,5	74,5	51,5	1100
	4	0,4922	325	5800	35340	1490	5750	52	28,5	10	600

3.3. Nutrients in Soils

Main material of the 20th km of Antalya-Korkuteli road, Antalya-Kozdağ, Burdur-Kızılkaya and Antalya-Saklıkent, natural distribution areas of *C. lycia*, was limestone. When the geological structure of the region is evaluated, it can be seen that there are mesozoic-tersier aged rocks on the 20th km of Antalya-Korkuteli, Antalya-Kozdağ and Antalya-Saklıkent whereas Burdur-Kızılkaya has holosene aged rocks. Main material of all sample areas belonging to *C. luschaniana* were determined as limestone. Karaman beli, 14th and 30th km of Elmalı-Korkuteli road show Holosene characteristics whereas other locality shows Miocene characteristics.

In the distribution areas of *C. lycia*; clay, sand with clay and sandy clay were determined and this situation indicates that *C. lycia* has wide tolerance in terms of soil physical properties (Table 5).Of soils on the distribution areas of *C. luscahaniana*, 75% of them are clay and the rest is sandy clay (Table 5).

Table 5. Physical properties of soil in plant sample area

Species	Localities	Soil texture			Soil type	Soil color	
		Sand %	Clay %	Loam %		Dry	Wet
C. lycia	1	41,17	41,08	17,75	Clay	5 YR – 5/4	5 YR – 3/6
	2	86,31	7,5	6,18	Sand with clay	2,5 Y – 5/3	10 YR – 3/2
	3	76,04	9,55	14,41	Sandy clay	5 YR - 4/2	5 YR – 2/2
	4	48,91	13,21	37,87	Clay	7,5 YR - 4/3	7,5 YR – 3/3
C. luschaniana	1	56,02	38,95	5,03	Sandy clay	7,5 YR – 5/4	2,5 YR – 2/4
	2	31,23	38,51	30,25	Clay	5 YR – 5/6	2,5 YR – 3/4
	3	41,47	32,35	26,17	Clay	5 YR – 4/4	2,5 YR – 2/4
	4	43,75	33,57	22,68	Clay	7,5 YR – 6/6	7,5 YR – 5/8

3.4. Seed Germination Experiments

It was determined that 65.26% of *C. lycia* seeds germinated during 16L/8D period at the end of 30 days and germination speed was 29.25. At the end of 45 days in 16D/8L period, 67.5% of the species germinated and germination speed was 17.5. And, in 24D period, at the end of 37 days, 39.75% of them germinated and germination speed was 11 (Table 7).

It was also identified that 77.75% of C. *luschaniana* seeds germinated during 16L/8D period in 32 days and germination speed was 27.8. At the end of 22 days in 16D/8L photoperiod, 72.5% of the species germinated and germination speed was 29.5. And, in 24D period, at the end of 34 days, 73.5% of them germinated and germination speed was 20.75 (Table 7).

Table 6. Chemical properties of soil in plant sample area

	Localities	pH 1/2,5	Salt ms/cm	$CaCO_3$ %	Org. matter %	N %	Na ppm	Mg ppm	Ca ppm	Fe ppm	K ppm	Mn ppm	Zn ppm	Cu ppm	P_2o_5 ppm
C. lycia	1	8,26	0,41	44,5	2,02	0,2045	51	204	7781	0,6	416	9,4	1,13	0,93	18,54
	2	8,09	0,34	0,9	0	0,0644	52	331	5673	0,4	98	6	1,13	0,62	21,63
	3	7,98	0,44	39,2	1,33	0,3746	21	334	7631	1,2	165	3,2	0,93	0,62	18,54
	4	8,21	0,72	25	11,33	0,5546	74	366	7917	1,7	1525	15,2	0,84	8,51	18,9
C. luschaniana	1	8,23	0,29	6,96	12,07	0,4188	37	581	8175	0,6	783	1,3	1,07	0,75	24,61
	2	8,39	0,26	13,04	2,59	0,2657	37	296	8055	0,9	411	3,3	0,74	0,74	22,05
	3	8,22	0,3	10,1	3,66	0,3265	53	262	8140	0,8	318	2,3	0,95	0,74	19,08
	4	8,64	0,4	54,4	0,93	0,036	31	427	7381	0,5	258	0,7	0,72	10,61	27,81

Table 7. Germination percentage and speed of seed of *Centaurea* species

	Germination percentage												Germination speed											
	16L/8D, 25 ^oC				8L/16D, 25 ^oC				24D, 25 ^oC				16L/8D, 25 ^oC				8L/16D, 25 ^oC				24D, 25 ^oC			
	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d
C. lycia	72	66	61	62	70	73	64	63	39	39	48	33	32	23	31	31	7	33	8	22	12	12	10	10
C. luschaniana	74	85	68	84	72	65	75	78	73	80	68	73	27	28	24	29	28	37	22	31	19	25	19	20

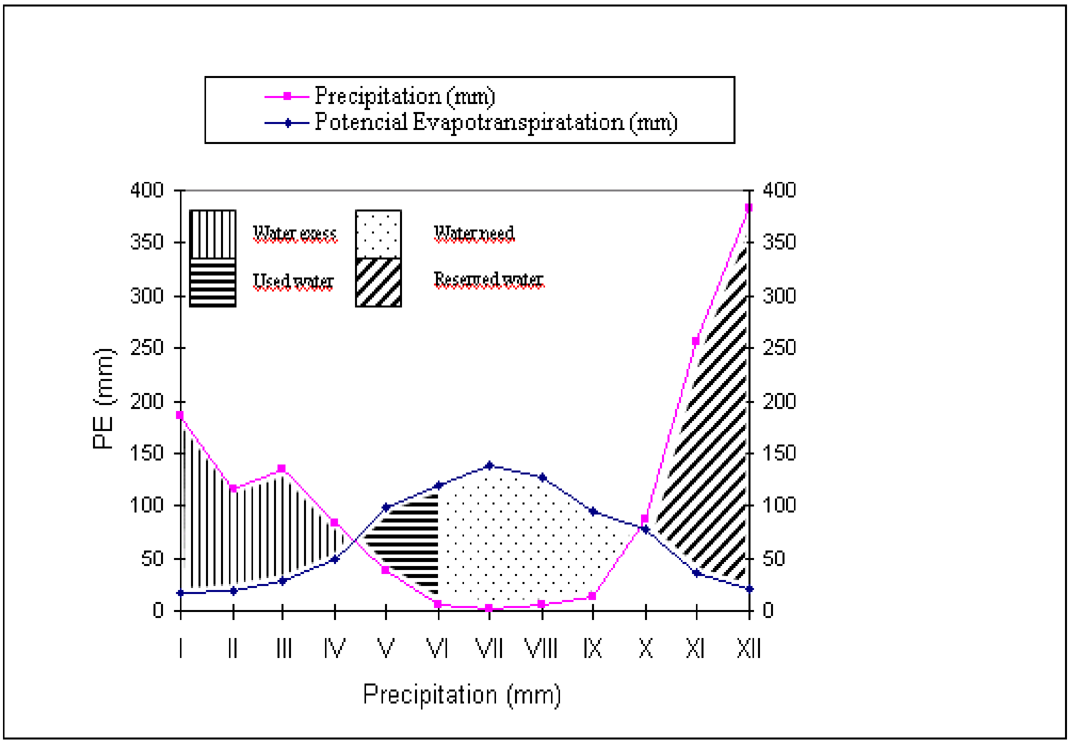

Figure 1. Ombrothermic diagram of Antalya

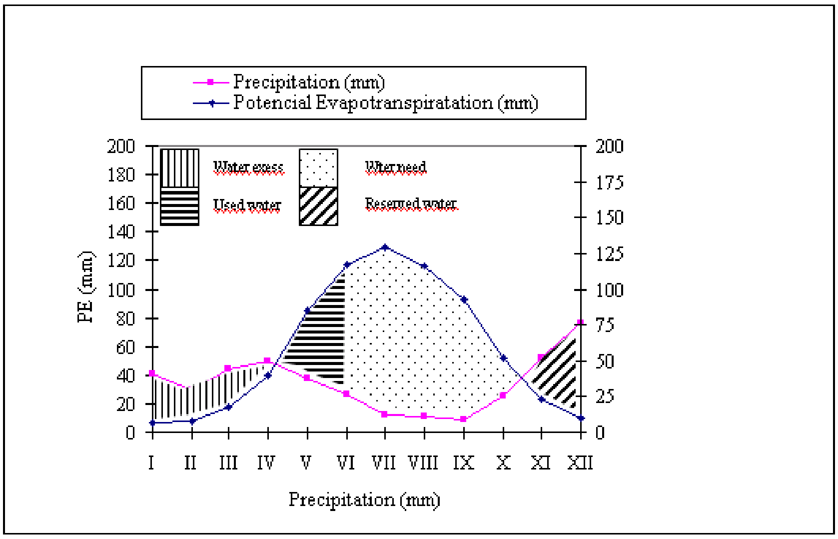

Figure 2. Ombrothermic diagram of Korkuteli

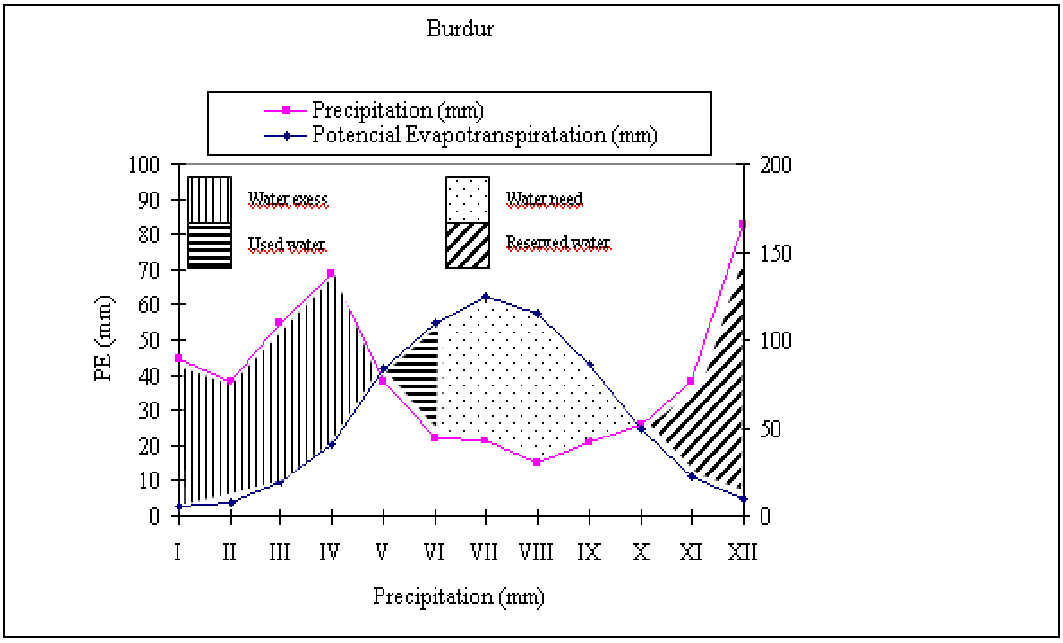

Figure 3. Ombrothermic diagram of Burdur

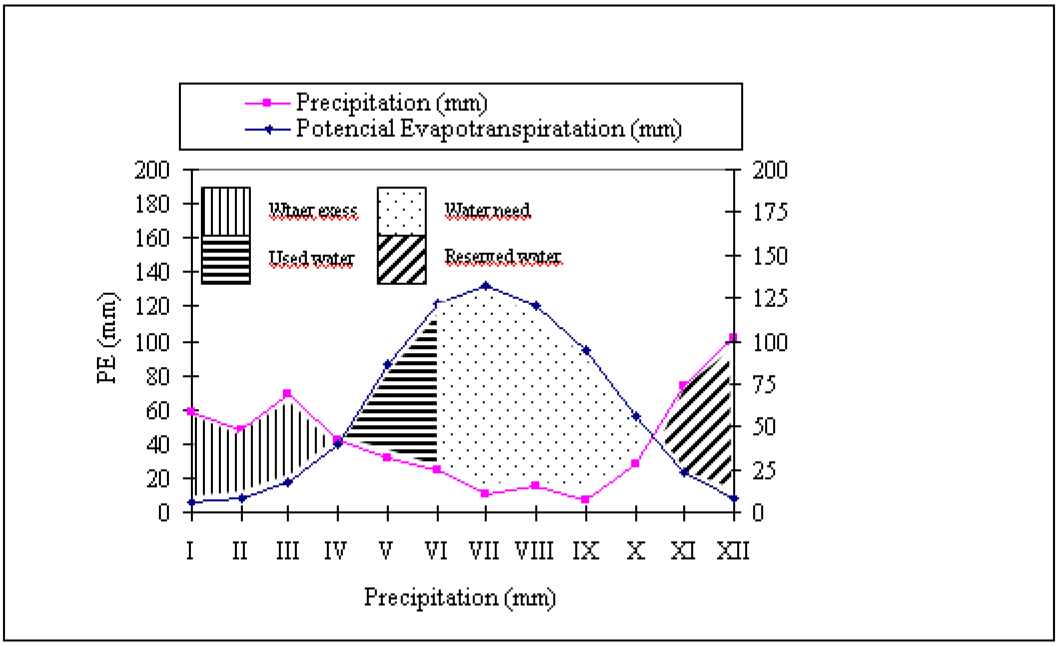

Figure 4. Ombrothermic diagram of Elmalı

3.5. Morphological Chracteristics

Taxonomically important characters in the section like flowered root length, root width, stem length, stem indumentum, cauline leaf length, cauline leaf width, shape and colour of cauline leaf, basal leaf length, basal leaf width, involucrum width, involucrum length, achene width, achene length, outer row length of pappus, inner row length of pappus were measured for each species. These values were obtained from 10 different individuals in each of 4 different sample areas for each species. Measurements were made 10 replicates and mean values were used.

4. Results and Discussion

When N concentrations in different organs of *C. lycia* and *C. luschaniana* were investigated, it was seen that the highest ratios were in leaves. Besides, Mg amounts in leaves and stems in sample area 4 of *C. luschaniana* are clearly higher than the other distribution areas and the samples of *C. lycia.*

Soil types of natural distribution areas of *C. lycia* are mostly wet clay, sandy wet clay, clay with sand. This situation shows that *C. lycia* has wide tolerance in terms of soil texture characteristics. 75 % of total soils in distribution areas of *C. luschaniana* are wet clay and the other 25 % are clay with sand. Because of growing on calcerous material, *C. lycia* and *C. luschaniana* prefer the soils showing basic characteristic and having high calcer. Besides soil with high K concentration in sample area 4 and soil with low calcer concentration and no organic matter in sample are 2 of *C. lycia* were determined.

When correlations between morphological characteristics and plant-soil nutrients are considered in *C. lycia*, it is seen that width of basal leaf and Fe concentration in root are negatively (r= -0.993, n=4 $p<0.01$); width of cauline leaf and N concentration in leaf are positively (r= 0.996, n=4 $p<0.01$); length of outer involucrum bract (phyllary) and Cu concentration in stem are positively (r= 0.993, n=4 $p<0.01$); plant height and N concentration in 0-10 cm of soil are negatively (r= -0.990, n=4 $p<0.01$); cauline leaf length and Zn concentration in 0-10 cm of soil are negatively (r= -0.994, n=4 $p<0.01$) correlated.

In *C. luschaniana*, root length and Cu concentration in stem are positively (r= 0.999, n=4 $p<0.01$); plant height and Mg concentration in leaf are positively (r= 0.999, n=4 $p<0.01$); involucrum width and Zn concentration in stem are positively (r= 0.996, n=4 $p<0.01$); root length and Cu amount in 0-10 cm of soil are positively (r= 0.993, n=4 $p<0.01$); plant height and Cu concentration in 0-10 cm of soil are positively (r= 0.995, n=4 $p<0.01$); cauline leaf length and Mn concentration in 0-10 cm of soil are negatively (r= -0.996, n=4 $p<0.01$) correlated.

Mean 67.5 % of *C. lycia* seeds during 8L/16D photoperiod, mean 65.25 % of them during 16L/8D photoperiod and mean 39.75 % of them during 24D dark photoperiod germinated. Germination speed decreases when lighting period decreases.

In the germination experiments with *C. luschaniana* seeds, it was determined that mean 77.75 % of them during 16L/8D dark period, 72.5 % of them during 8L/16D dark period and 73.5 % of the during 24D period germinated. According to these results, it can clearly be seen that lighting period is not effective on the germination rate. Germination speed decreases when lighting period decreases.

Because of limited distribution areas, population of both these species, *C. lycia* and *C. luschaniana* are under risk of being extinct. Having narrow habitat let these two species be damaged by any natural or antropogenic activity. Tourism activities (Saklıkent, Termessos), agriculture, road construction, grazing and building activities in the region are the most dangerous activities for future of these two species populations. Conservation strategies must be performed immediately for these species.

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AN INVESTIGATION OF THE EFFECT OF PLANT DENSITY IN INTERCROPPING BETWEEN MAIZE AND BEAN ON YIELD AND COMPONENT OF YIELD IN EAST AZARBIJAN, IRAN.

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The aim of this research is to compare influences of intercropped systems (Maize/Bean) on yield and some component of yield with sole crops in organic farming .The experimental site was located in the farm of the Islamic Azad University in the south-east of Tabriz, situated in East Azarbaijan province in the north-west of Iran (Lat38º 5' N and Long 46º 17' E) at an altitude of 1360 m above sea level. Annual mean temperature is 13.04ºC. The region is classified as cold and semiarid. Annual precipitation is 232.14mm. This trial was conducted in the two years (2004-2005). Experiment: System performance of this research observed in the field experiment (sandy-loam soil, randomized complete block design, 13 treatments with 3 replications, plots: 3×4 m, 40 cm inter-row spacing). Plant density were 40×9 – 30× 9 – 20×9 – 45×8 – 35×8 – 45×7 – 35×7 plants m^{-2} of bean and maize respectively in intercropping and the 6.58 – 7.93 – 9.47 for Maize and 20 – 30 – 40 plants m^{-2} for Bean plant density in sole cropping. Maize/bean intercropping had some yield advantage relative sole species cropping. Intercropped maize and bean both had a higher area based productivity than when grown alone.

Key words: *Intercropping, Maize, Bean, Yield, Component of yield.*

Introduction:

Intercropping is defined as the growing of two or more crops simultaneously on the same area of ground (Willey, 1980). Organic farming is often based on intercropped plants growing in plant mixtures, especially intercropped maize and grain legumes.Intercropping of cereals and grain legumes for grain production has been common crops among organic farmers in Iran. Intercropping may have several advantages such as improved utilization of environmental sources for plant growth, higher or more stable yields and reduced yield losses due to pathogens, insects and weeds. Intercropping through more effective use of water, nutrients and solar energy can significantly enhance crop productivity to the growth of sole crops (Francis, 1989).

Maize (Zea mays L.) is a crop from the (sub) tropics. During the latter part of the last century it has also been cultivated at higher geographical latitudes. Maize is a crop of major importance, the third most consumed cereal over the world. It is grown on about 137.6 million ha in the world.

However intercropping the simultaneous growth of more than one species in the same field, legumes with nonlegumes may ensure a more efficient use of N sources. The intercropping practice builds on basic ecological theories of the effects of diversity and competition (Willey, 1980).

The aim of this research is to compare influences of intercropped systems (Maize/Bean) on yield and some component of yield with sole crops in organic farming.

Materials and Methods:
The experimental site was located in the farm of the Islamic Azad University in southeastern of Tabriz, situated in the East Azarbaijan region in northwest of Iran (Lat38º 5' N and Long 46º 17' E) at an altitude of 1360 m above sea level.Annual mean temperature is 13.04ºC. The region is classified as cold and semiarid. Annual precipitation is 232.14mm. The soil is a very poor (LS). This trial was conducted in the two years (2004-2005).
Experiment: System performance of this research observed in the field experiment (Loamy-sandy soil, randomized complete block design, 13 treatments with 3 replications, plots: 3×4m, 40cm inter-row spacing). Characteristics of soil in 2004 were: 8.2 – 8.5 pH, organic carbon under %1, C/N = 11.72, CEC ($CM^{(+)}/Kg$) = 6.90 – 18.20.
Plant density were 40×9 – 30× 9 – 20×9 – 45×8 – 35×8 – 45×7 – 35×7 plants m^{-2} of bean and maize respectively in intercropping and the 6.58 – 7.93 – 9.47 for Maize and 20 – 30 – 40 plants m^{-2} for Bean plant density in sole cropping.

Results and Discussion:
Maize/bean mixture produced 10483(for Maize), 3024.7(for Bean) Kg ha-1 grain yield in 350× 70 treatment, and in sole Maize 13245 Kg ha-1(in 94700), in sole Bean 2398.88 Kg ha-1 (in 300000).
Intercropping effect were detected, with Max [RVT, LER (in 350×70)], min [RVT, LER (in 200×90)].
When 1 rows of maize were intercropped with 1 rows of bean both total yield and grain yield of both crop species (in 350×70) where significantly higher than of sole maize bean and Land Equivalent Ratio (LER)is 1.26 and Relative Value Total (RVT) is 1.3.This results showed that maize was to stronger competitor.

Conclusions:
Maize/bean intercropping had some yield advantage relative sole species cropping.
Intercropped maize and bean both had higher area based productivity than when grown alone.
Further studies will be necessary in order to deep insight into the mechanisms responsible for the changes in intercropping.

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International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

EVALUATION OF ALFALFA, CLOVER, AND SAINFOIN DIVERSITY IN EAST AZARBAIJAN, IRAN

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Fodder plants as a nutrition source for animal has important role. There is a high diversity in Azarbaijan. A study conducted to evaluate climatic emission, growth altitude, and dangers effected different species. They were evaluated base on growth altitude, type and arrangement of culture. 227 alfalfa, 53 sainfoin and 206 clover accessions collected, clustered, and factor analysis. Cluster analysis showed 8, 5 and 3 cluster in alfalfa, clover and sainfoin, respectively.
Factor analysis showed 4 factors. Temperature differences was the most distinguishes factor between genotypes. Irrigated or dryland cultivated was the second factor. The third factor was wild or improved plants. Results showed that the high exist genetic diversity was very important in current and modern plant breeding.

Key notes: *Medicago spp., Trifolium spp., Onobrychis spp., genetic diversity.*

Introduction:

As Iran has a large surface and climatic diversity, she has many plants growing on it. These species use for nutrition, medicinal, industry and feeding animals. These genetic sources are very important. Improving high performance cultivars are very important for nutrition security and depend to these sources.

There is more than 8000 species in Iran. Therefore, Iran is an important center for appearance and crops diversity as like as wheat, barleys, oats, ryes, peas, lentils, safflowers, fruit trees, fodder plants, vegetables, and medicinal plants. Conservation, exploration and sustainable use of this superior diversity are essential for any breeding or bio-technologic programs. Exist genetic diversity of plants is a valuable capital which inheritance throw ages and is a interaction between genotypes and environment. Although more than 1200 landrace crops grow in Iran, More than 20% of these genotypes are endemic.

There are some arid and semi arid climate and desertification problems which intensifies by deficiency of ecologic base management and lead to a disaster in future. West of Iran is one of plants diversity center in world. But excessive grazing of cattle led these fertile pastures to low efficiency dry-lands and soil erosion do not let to trees rejuvenation.

Fodder crops exist genetic diversity led to continuing cultivate of alfalfa, clover, and sainfoin in natural environment along cold and freezing years or warm and drought years. Establishment of these plants is well in mountainous climate of province. Some pastureland plants with deep and scattered roots can conserve soil and inhibited soil erosion. These plants grow in mountainside, slope, saline and alkaline lands.

Materials and methods:
In this study, three important fodder genus, alfalfa (annual and perennial), clover and sainfoin, which had high cultivation surface, was collected from East Azarbaijan, northwest of Iran and evaluated base on growth altitude, type and arrangement of culture. 227 alfalfa, 53 sainfoin and 206 clover accessions collected, clustered, and factor analyzed by SPSS13.

Results and discussion:

Alfalfa has high broadcasting and cultivation surface in Azarbaijan. It is cultured in 300-2500 m altitude. There were five annual alfalfas in restricted pastures that eupeptic to cattle and exposed to genetic erosion. Cluster analysis showed 8 clusters(table 2).

Clover is cultivated very rarely. It has 14 species that grows in humid places and pastures. This diversity has economic importance because they adapted to winter freezing and very cold temperature. Most growers mixed this diversity to insure their yield. Cluster analysis showed 5 clusters(table3).

Sainfoin has 12 species. Its broadcast is less than alfalfa. It grows in slopes and mainly cultivated mixed with alfalfa. Some of species are endemic but most are exotic and exposed to genetic erosion. Cluster analysis showed 3 clusters(table 4). Factor analysis showed that four main factor determined 89.49% of total variance. Type of family or extensive culture showed only 12.06% and wild and endemic genotypes with water salinity showed 20.37% of differences. Irrigation also showed 20.37%. Climate factor showed the highest differences determination and that 35.29%.

Table 1: components value of collected fodder crops attributes

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.529	35.292	35.292	3.529	35.292	35.292
2	2.177	21.770	57.062	2.177	21.770	57.062
3	2.037	20.370	77.432	2.037	20.370	77.432
4	1.206	12.059	89.491	1.206	12.059	89.491
5	.986	9.856	99.347			
6	.065	.653	100.000			
7	2.92E-016	2.92E-015	100.000			
8	.000	.000	100.000			
9	-7.68E-017	-7.68E-016	100.000			
10	-1.67E-016	-1.67E-015	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix(a)

Table 2. Dendrogram using Average Linkage (Between Groups) for alfalfa genotypes

	Component			
	1	2	3	4
Cold region	.734			
Temperate region	-.720			
No salinity	.694			
Saline water	-.694			
Extensive system	.664			.550
Family system	-.664			-.550
irrigated		-.933		
dryland		.933		
wild genotypes			.676	
Improved lines			-.676	

Rescaled Distance Cluster Combine

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  C A S E      0        5       10       15       20       25
Label      Num  +---------+---------+---------+---------+---------+
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Table 2. Dendrogram using Average Linkage (Between Groups) for alfalfa genotypes

                           Rescaled Distance Cluster Combine

   C A S E          0         5        10        15        20        25
  Label         Num  +---------+---------+---------+---------+---------+

  m.orbienla    226   ⇩⇘
  m.orbienla    227   ⇩▫
  m.orbienla     13   ⇩▫
  m.orbienla    223   ⇩▫
  m.orbienla    225   ⇩▫
  m.orbienla    219   ⇩▫
  m.orbienla    221   ⇩▫
  m.orbienla     20   ⇩▫
  m.orbienla     21   ⇩▫
  m.orbienla     17   ⇩⇳⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇘
  m.orbienla     19   ⇩▫          ⇔
  m.orbienla     15   ⇩⇙           ⇔
  m.rijidula    187   ⇩⇘           ▫⇩⇩⇩⇩⇩⇘
  m.rijidula    203   ⇩▫          ⇔     ⇔
  m. sativa      90   ⇩▫          ⇔     ⇔
  m.orbicularis 163   ⇩⇳⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇙       ⇔
  m.orbicularis 179   ⇩▫                ▫⇩⇩⇩⇘
  m. sativa      95   ⇩⇙                ⇔    ⇔
  m.polymorph   164   ⇩⇘                ⇔    ⇔
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m.minime         188   ⇩▫            ⬄   ⬄
m.  sativa        68   ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬃   ⬄
m.  sativa        69   ⇩⬃               ▫⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬂
m.  sativa        70   ⇩✖⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬂       ⬄          ⬄
m.  sativa        75   ⇩⬃         ⬄      ⬄          ⬄
m.minime         214   ⇩⬂         ⬄      ⬄          ⬄
m.minime         215   ⇩▫        ⬄       ⬄          ⬄
m.lupolina         1   ⇩▫        ▫⇩⇩⇩⇩⇩⇩⇩⇩⇩⬃         ⬄
m.lupolina       209   ⇩▫        ⬄                 ⬄
m.minime         213   ⇩▫        ⬄                 ⬄
m.minime           8   ⇩▫        ⬄                 ⬄
m.minime           9   ⇩▫        ⬄                 ⬄
m.lupolina         3   ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬃

⬄
m.minime           7   ⇩▫                          ⬄
m.lupolina         2   ⇩⬃                          ⬄
m.polymorph      150   ⇩⬂                          ⬄
m.orbicularis    154   ⇩▫                          ⬄
m.minime         142   ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬂                 ⬄
m.orbicularis    145   ⇩⬃         ⬄                 ⬄
m.polymorph      152   ⇩⬂         ⬄                 ⬄
m.polymorph      153   ⇩▫        ⬄                 ⬄
m.  sativa        24   ⇩▫        ⬄                 ⬄
m.rigidula       148   ⇩▫        ⬄                 ⬄
m.rigidula       149   ⇩▫        ⬄                 ⬄
m.  sativa       108   ⇩▫        ⬄                 ⬄
m.  sativa       112   ⇩▫        ⬄                 ⬄

m.  sativa        98   ⇩▫        ⬄                 ⬄
m.  sativa        99   ⇩▫        ⬄                 ⬄
m.  sativa        96   ⇩▫        ⬄                 ⬄
m.  sativa        97   ⇩▫        ⬄                 ⬄
m.  sativa        86   ⇩▫        ⬄                 ▫⇩⇩⇩⇩⇩⬂
m.  sativa        91   ⇩▫        ⬄                 ⬄    ⬄
m.  sativa        78   ⇩▫        ⬄                 ⬄    ⬄
m.  sativa        79   ⇩▫        ⬄                 ⬄    ⬄
m.  sativa        76   ⇩▫        ⬄                 ⬄    ⬄
m.  sativa        77   ⇩▫        ⬄                 ⬄    ⬄
m.  sativa        73   ⇩▫        ▫⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬂        ⬄    ⬄
m.  sativa        74   ⇩▫        ⬄        ⬄         ⬄    ⬄
m.  sativa        71   ⇩▫        ⬄        ⬄         ⬄    ⬄
m.  sativa        72   ⇩▫        ⬄        ⬄         ⬄    ⬄
m.  sativa        60   ⇩▫        ⬄        ⬄         ⬄    ⬄
m.  sativa        61   ⇩▫        ⬄        ⬄         ⬄    ⬄
m.  sativa        51   ⇩▫        ⬄        ⬄         ⬄    ⬄
m.  sativa        54   ⇩▫        ⬄        ⬄         ⬄    ⬄
m.  sativa        49   ⇩▫        ⬄        ⬄         ⬄    ⬄
m.  sativa        50   ⇩▫        ⬄        ⬄         ⬄    ⬄
m.  sativa        45   ⇩▫        ⬄        ⬄         ⬄    ⬄
m.  sativa        48   ⇩▫        ⬄        ⬄         ⬄    ⬄
m.  sativa        38   ⇩▫        ⬄        ⬄         ⬄    ⬄
m.  sativa        44   ⇩▫        ⬄        ⬄         ⬄    ⬄
m.  sativa        34   ⇩▫        ⬄        ⬄         ⬄    ⬄
m.  sativa        35   ⇩▫        ⬄        ⬄         ⬄    ⬄
m.  sativa        32   ⇩▫        ⬄        ⬄         ⬄    ⬄
m.  sativa        33   ⇩▫        ⬄        ⬄         ⬄    ⬄
m.  sativa        29   ⇩▫        ⬄        ⬄         ⬄    ⬄
m.  sativa        30   ⇩▫        ⬄        ⬄         ⬄    ⬄
m.  sativa        26   ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬃        ⬄         ⬄    ⬄
m.  sativa        28   ⇩▫                 ⬄        ⬄    ⬄
m.  sativa        25   ⇩⬃                 ▫⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬃    ⬄
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m.orbicularis 155
m.orbicularis 156
m. sativa      27
m. sativa     131
m. sativa     136
m. sativa     126
m. sativa     128
m. sativa     115
m. sativa     124
m. sativa     113
m. sativa     114
m. sativa     110
m. sativa     111
m. sativa      83
m. sativa     109
m. sativa      63
m. sativa      82
m. sativa      55
m. sativa      56
m. sativa      40
m. sativa      47
m. sativa      31
m. sativa      39
m. sativa     125
m. sativa     127
m. sativa      58
m. sativa      62
m. sativa      41
m. sativa      46
m. sativa      57
m. sativa      42
m.polymorph   200
m.rigidula    204
m. sativa     101
m.minime      198
m.minime      199
m.rigidula    196
m.orbicularis 197
m.orbicularis 176
m.orbicularis 180
m.rigidula    174
m.polymorph   175
m.polymorph   172
m.rigidula    173
m.minima      141
m.minime      144
m. sativa     105
m. sativa     106
m. sativa     102
m.niyidula    217
m.niyidula    218
m.minime        4
m.minime      212
m.niyidula    216
m.minime      210
m.minime      211
m.niyidula     11
m.niyidula     12
m.minime        6
m.niyidula     10
m.minime        5
m. sativa      37
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m. sativa      53  ⇩⬋                ⇔    ⇔          ⇔
m. sativa     116  ⇩⬊                 ⇔    ⇔          ⇔
m. sativa     117  ⇩▫                 ⇔    ⇔          ⇔
m. sativa      22  ⇩▫                 ⇔    ⇔         ▫⇩⇩⇩⬊
m. sativa     104  ⇩▫                 ⇔    ⇔          ⇔  ⇔
m. sativa     107  ⇩▫                 ⇔    ⇔          ⇔  ⇔
m. sativa     100  ⇩▫                ▫⇩⇩⇩⇩⇩⬋          ⇔  ⇔
m. sativa     103  ⇩▫                 ⇔              ⇔   ⇔
m. sativa      80  ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬊  ⇔               ⇔  ⇔
m. sativa      81  ⇩▫              ⇔  ⇔               ⇔  ⇔
m. sativa      23  ⇩⬋              ⇔   ⇔              ⇔   ⇔
m.minina      201  ⇩⬊              ⇔   ⇔              ⇔   ⇔
m.minina      202  ⇩▫              ⇔  ⇔               ⇔  ⇔
m.orbicularis 161  ⇩▫             ▫⇩⇩⇩⬋              ⇔   ⇔
m.rigidula    185  ⇩▫              ⇔                 ⇔   ⇔
m.orbicularis 195  ⇩▫              ⇔                 ⇔   ⇔
m.polymorph   177  ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬊     ⇔                  ⇔  ⇔
m.minime      178  ⇩▫        ⇔     ⇔                  ⇔  ⇔
m.orbicularis 171  ⇩⬋        ⇔      ⇔                 ⇔   ⇔
m.rigidula    162  ⇩⬊        ▫⇩⇩⇩⇩⇩⇩⇩⬋                 ⇔  ⇔
m.minina      186  ⇩▫        ⇔                       ⇔   ⇔
m. sativa      87  ⇩▫        ⇔                       ⇔   ⇔
m.minime      143  ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬋                       ⇔   ⇔
m.minime      146  ⇩▫                               ⇔   ⇔
m. sativa      92  ⇩⬋                                ⇔  ⇔
m.polymorph   205  ⇩⬊                                ⇔  ⇔
m.polymorph   207  ⇩▫                               ⇔   ⇔
m.rigidula    166  ⇩▫                               ⇔   ⇔
m.minina      193  ⇩▫                               ⇔   ⇔
m.minina      194  ⇩▫                               ⇔   ⇔
m.minina      191  ⇩▫                               ⇔   ⇔
m.orbicularis 192  ⇩▫                               ⇔   ⇔
m.orbicularis 170  ⇩▫                               ⇔   ⇔
m.orbicularis 190  ⇩▫                               ⇔   ⇔
m.minina      168  ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬊                       ⇔   ⇔
m.minina      169  ⇩▫        ⇔                       ⇔   ⇔
m.minina       67  ⇩⬋        ⇔                        ⇔  ⇔
m.lupulina    182  ⇩⬊        ⇔                        ⇔  ⇔
m.lupulina    183  ⇩▫        ⇔                       ⇔   ⇔
m. sativa      89  ⇩▫       ▫⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬊             ⇔  ⇔
m.orbicularis 159  ⇩▫        ⇔          ⇔             ⇔  ⇔
m.polymorph   181  ⇩▫        ⇔          ⇔             ⇔  ⇔
m.rigidula    157  ⇩▫        ⇔          ⇔             ⇔  ⇔
m.rigidula    158  ⇩▫        ⇔          ⇔             ⇔  ⇔
m.luplina     147  ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬋          ⇔             ⇔  ⇔
m.orbicularis 151  ⇩▫                  ⇔             ⇔   ⇔
m. sativa      94  ⇩⬋                   ⇔             ⇔  ⇔
m.polymorph   206  ⇩⬊                   ⇔             ⇔  ⇔
m.polymorph   208  ⇩▫                  ⇔             ⇔   ⇔
m. sativa      36  ⇩▫                  ⇔             ⇔   ⇔
m.lupulina    165  ⇩▫                  ⇔             ⇔   ⇔
m.lupulina    189  ⇩▫                  ⇔             ⇔   ⇔
m. sativa     134  ⇩▫                  ⇔             ⇔   ⇔
m. sativa     139  ⇩▫                  ▫⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬋  ⇔
m. sativa     120  ⇩▫                  ⇔                ⇔
m. sativa     123  ⇩▫                  ⇔                ⇔
m. sativa      84  ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬊ ⇔                ⇔
m. sativa      85  ⇩▫                 ⇔ ⇔                ⇔
m. sativa      52  ⇩⬋                 ⇔ ⇔                ⇔
m. sativa     138  ⇩⬊                 ⇔ ⇔                ⇔
m. sativa     140  ⇩▫                 ⇔ ⇔                ⇔
m. sativa      43  ⇩▫                 ⇔ ⇔                ⇔
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  m. sativa     135   ⇩▫                                   ⇔  ⇔                          ⇔
  m. sativa     137   ⇩▫                                   ⇔  ⇔                          ⇔
  m. sativa     132   ⇩▫                                   ⇔  ⇔                          ⇔
  m. sativa     133   ⇩▫                                   ⇔  ⇔                          ⇔
  m. sativa     129   ⇩▫                                   ⇔  ⇔                          ⇔
  m. sativa     130   ⇩▫                                   ▫⇩⇙                          ⇔
  m. sativa     121   ⇩▫                                   ⇔                            ⇔
  m. sativa     122   ⇩▫                                   ⇔                            ⇔
  m. sativa     118   ⇩▫                                   ⇔                            ⇔
  m. sativa     119   ⇩▫                                   ⇔                            ⇔
  m. sativa      88   ⇩▫                                   ⇔                            ⇔
  m. sativa      93   ⇩▫                                   ⇔                            ⇔
  m. sativa      66   ⇩▫                                   ⇔                            ⇔
  m. sativa      67   ⇩▫                                   ⇔                            ⇔
  m. sativa      64   ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇘                          ⇔                            ⇔
  m. sativa      65   ⇩▫              ⇔                ⇔                            ⇔
  m. sativa      59   ⇩⇙              ⇔                ⇔                            ⇔
  m.orbienla    222   ⇩⇘              ▫⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇙                                ⇔
  m.orbienla    224   ⇩▫              ⇔                                            ⇔
  m.orbienla     14   ⇩▫              ⇔                                            ⇔
  m.orbienla     18   ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇙                                                 ⇔
  m.orbienla    220   ⇩▫                                                          ⇔
  m.orbienla     16   ⇩⇙                                                          ⇔
  m.lupulina    160
⇩×⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇙
  m.lupulina    184   ⇩⇙
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table 3: Dendrogram using Average Linkage (Between Groups) for sainfoin genotypes

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                          Rescaled Distance Cluster Combine

    C A S E        0         5        10        15        20        25
  Label       Num  +---------+---------+---------+---------+---------+

  t.scabrom        205   ⇩⇘
  t.scabrom        206   ⇩▫
  شبدر               1   ⇩▫
  شبدر             149   ⇩▫
  t.scabrom        204   ⇩▫
  شبدر             145   ⇩▫
  شبدر             148   ⇩▫
  شبدر             133   ⇩▫
  شبدر             144   ⇩▫
  شبدر             131   ⇩▫
  شبدر             132   ⇩▫
  شبدر             129   ⇩▫
  شبدر             130   ⇩▫
  شبدر             127   ⇩▫
  شبدر             128   ⇩▫
  شبدر              65   ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇘
  شبدر             126   ⇩▫                             ⇔
  شبدر               6   ⇩▫                             ⇔
  شبدر              37   ⇩⇙                             ⇔
  شبدر             104   ⇩⇘                             ⇔
  شبدر             106   ⇩▫                             ▫⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇘
  شبدر              81   ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇘      ⇔           ⇔
  شبدر              83   ⇩⇙                         ⇔    ⇔          ⇔
  شبدر              54   ⇩⇘                         ⇔    ⇔          ⇔
  شبدر              55   ⇩▫                        ⇔    ⇔          ⇔
  شبدر              13   ⇩▫                        ⇔    ⇔          ⇔
  شبدر              52   ⇩▫                        ▫⇩⇩⇩⇙           ⇔
  شبدر              53   ⇩▫                        ⇔              ⇔
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شبدر 27 ⇩▫ ⇔ ⇔
شبدر 51 ⇩▫ ⇔ ⇔
شبدر 25 ⇩▫ ⇔ ⇔
شبدر 26 ⇩▫ ⇔ ⇔
شبدر 23 ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬃ ⇔
شبدر 24 ⇩▫ ⇔
شبدر 18 ⇩⬃ ⇔
t.pratans 199 ⇩⬂ ⇔
t.pratans 200 ⇩▫ ⇔
شبدر 4 ⇩▫ ⇔
t.hybridum 197 ⇩▫ ⇔
t.pratans 198 ⇩▫ ⇔
t.hybridum 195 ⇩▫ ⇔
t.hybridum 196 ⇩▫ ⇔
شبدر قرمز 189 ⇩▫ ⇔
شبدر قرمز 191 ⇩▫ ⇔
شبدر شيرين 187 ⇩▫ ⇔
شبدر قرمز 188 ⇩▫ ⇔
شبدر سفيد 184 ⇩▫ ⇔
شبدر سفيد 185 ⇩▫ ⇔
شبدر سفيد 182 ⇩▫ ⇔
شبدر سفيد 183 ⇩▫ ⇔
شبدر سفيد 180 ⇩▫ ⇔
شبدر سفيد 181 ⇩▫ ⇔
شبدر ايران 178 ⇩▫ ⇔
شبدر ايران 179 ⇩▫ ⇔
شبدر 176 ⇩▫ ⇔
شبدر 177 ⇩▫ ⇔
شبدر 174 ⇩▫ ⇔
شبدر 175 ⇩▫ ⇔
شبدر 165 ⇩▫ ⇔
شبدر 173 ⇩▫ ⇔
شبدر 163 ⇩▫ ⇔
شبدر 164 ⇩▫ ⇔
شبدر 161 ⇩▫
▫⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬂
شبدر 162 ⇩▫ ⇔ ⇔
شبدر 152 ⇩▫ ⇔ ⇔
شبدر 153 ⇩▫ ⇔ ⇔
شبدر 141 ⇩▫ ⇔ ⇔
شبدر 143 ⇩▫ ⇔ ⇔
شبدر 138 ⇩▫ ⇔ ⇔
شبدر 140 ⇩▫ ⇔ ⇔
شبدر 134 ⇩▫ ⇔ ⇔
شبدر 135 ⇩▫ ⇔ ⇔
شبدر 80 ⇩▫ ⇔ ⇔
شبدر 103 ⇩▫ ⇔ ⇔
شبدر 78 ⇩▫ ⇔ ⇔
شبدر 79 ⇩▫ ⇔ ⇔
شبدر 76 ⇩▫ ⇔ ⇔
شبدر 77 ⇩▫ ⇔ ⇔
شبدر 73 ⇩▫ ⇔ ⇔
شبدر 74 ⇩▫ ⇔ ⇔
شبدر 71 ⇩▫ ⇔ ⇔
شبدر 72 ⇩▫ ⇔ ⇔
شبدر 69 ⇩▫ ⇔ ⇔
شبدر 70 ⇩▫ ⇔ ⇔
شبدر 67 ⇩▫ ⇔ ⇔
شبدر 68 ⇩▫ ⇔ ⇔
شبدر 64 ⇩▫ ⇔ ⇔
شبدر 66 ⇩▫ ⇔ ⇔
شبدر

58 ⇩¤ ⇔ ⇔

شبدر 59 ⇩¤ ⇔ ⇔

شبدر 46 ⇩¤ ⇔ ⇔

شبدر 57 ⇩¤ ⇔ ⇔

شبدر 44 ⇩¤ ⇔ ⇔

شبدر 45 ⇩¤ ⇔ ⇔

شبدر 42 ⇩¤ ⇔ ⇔

شبدر 43 ⇩¤ ⇔ ⇔

شبدر 40 ⇩¤ ⇔ ⇔

شبدر 41 ⇩¤ ⇔ ⇔

شبدر 38 ⇩¤ ⇔ ⇔

شبدر 39 ⇩¤ ⇔ ⇔

شبدر 31 ⇩¤ ⇔ ⇔

شبدر 36 ⇩¤ ⇔ ⇔

شبدر 29 ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬂ ⇔

شبدر 30 ⇩¤ ⇔ ⇔ ⇔

شبدر 5 ⇩¤ ⇔ ⇔ ⇔

شبدر 9 ⇩⬀ ¤⇩⇩⇩⇩⇩⇩⇩⇩⬀ ⇔

شبدر 82 ⇩×⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬂ ⇔

⇔

شبدر 105 ⇩⬀ ⇔ ⇔ ⇔

شبدر 7 ⇩⬂ ¤⇩⇩⇩⇩⇩⇩⬀ ⇔

شبدر 8 ⇩¤ ⇔ ⇔

شبدر 2 ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬀

⇔

شبدر 3 ⇩⬀ ⇔

شبدر 92 ⇩×⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬂

⇔

شبدر 115 ⇩⬀ ⇔ ⇔

شبدر 50 ⇩⬂ ¤⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩¤

شبدر 75 ⇩¤ ⇔ ⇔

شبدر 21 ⇩¤ ⇔ ⇔

شبدر 47 ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬀

⇔

شبدر 49 ⇩¤ ⇔

شبدر 22 ⇩⬀ ⇔

شبدر 120 ⇩⬂ ⇔

شبدر 125 ⇩¤ ⇔

شبدر 91 ⇩¤ ⇔

شبدر 118 ⇩¤ ⇔

شبدر 119 ⇩¤ ⇔

شبدر 114 ⇩¤ ⇔

شبدر 116 ⇩¤ ⇔

شبدر 97 ⇩¤ ⇔

شبدر 102 ⇩¤ ⇔

شبدر 95 ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬂

⇔

شبدر 96 ⇩¤ ⇔ ⇔

شبدر 93 ⇩⬀ ⇔ ⇔

شبدر قرمز 190 ⇩⬂ ⇔ ⇔

شبدر قرمز 192 ⇩¤

¤⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬂ ⇔

شبدر 14 ⇩¤ ⇔ ⇔ ⇔

شبدر 107 ⇩¤ ⇔ ⇔ ⇔

شبدر 108 ⇩¤ ⇔ ⇔ ⇔

شبدر 84 ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬀ ⇔

⇔

شبدر 85 ⇩¤ ⇔ ⇔

شبدر 19 ⇩⬀ ⇔ ⇔

t.hybridum 193 ⇩⬂ ⇔ ⇔

t.hybridum 194 ⇩¤ ⇔ ⇔

شبدر

```
              28    ⇩▫                                   ⇔ ⇔
شبدر           171  ⇩▫                                      ⇔ ⇔
شبدر           172  ⇩▫                                      ⇔ ⇔
شبدر           166  ⇩▫                                      ⇔ ⇔
شبدر           167  ⇩▫                                      ⇔ ⇔
شبدر           159  ⇩▫                                      ⇔ ⇔
شبدر           160  ⇩▫                                      ⇔ ⇔
شبدر           154  ⇩▫                                      ⇔ ⇔
شبدر           155  ⇩▫                                      ⇔ ⇔
شبدر           139  ⇩▫                                      ⇔ ⇔
شبدر           142  ⇩▫                                      ⇔ ⇔
شبدر           136  ⇩▫                                      ⇔ ⇔
شبدر           137  ⇩▫                                      ⇔ ⇔
شبدر           123  ⇩▫                                      ⇔ ⇔
شبدر           124  ⇩▫                                      ⇔ ⇔

شبدر           121  ⇩▫                                      ▫⇩⬃
شبدر           122  ⇩▫                                      ⇔
شبدر           112  ⇩▫                                      ⇔
شبدر           117  ⇩▫                                      ⇔
شبدر           110  ⇩▫                                      ⇔
شبدر           111  ⇩▫                                      ⇔
شبدر           100  ⇩▫                                      ⇔
شبدر           101  ⇩▫                                      ⇔
شبدر            98  ⇩▫                                      ⇔
شبدر            99  ⇩▫                                      ⇔
شبدر            89  ⇩▫                                      ⇔
شبدر            94  ⇩▫                                      ⇔
شبدر            87  ⇩▫                                      ⇔
شبدر            88  ⇩▫                                      ⇔
شبدر            61  ⇩▫                                      ⇔
شبدر            62  ⇩▫                                      ⇔
شبدر            34  ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬂
⇔
شبدر            56  ⇩▫                  ⇔                   ⇔
شبدر            33  ⇩⬃                  ▫⇩⇩⇩⇩⇩⬂              ⇔
شبدر            90  ⇩×⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬂      ⇔     ⇔
⇔
شبدر           113  ⇩⬃               ▫⇩⇩⇩⇩⇩⬃    ⇔            ⇔
شبدر   شيرين     186 ⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬃       ⇔            ⇔
شبدر            86  ⇩⬂                        ⇔              ⇔
شبدر           109  ⇩▫                        ⇔              ⇔
شبدر            35  ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬂
▫⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬃
شبدر            63  ⇩⬃                    ⇔  ⇔
شبدر           169  ⇩⬂                    ⇔  ⇔
شبدر           170  ⇩▫                    ⇔  ⇔
شبدر           146  ⇩▫                    ⇔  ⇔
شبدر           158  ⇩▫                    ⇔  ⇔
شبدر           168  ⇩▫                    ⇔  ⇔
شبدر           156  ⇩▫                    ▫⇩⇩⇩⬃
شبدر           157  ⇩▫                    ⇔
شبدر           150  ⇩⇧⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬂        ⇔
شبدر           151  ⇩▫            ⇔       ⇔
شبدر           147  ⇩⬃            ⇔       ⇔
t.scabrom      202  ⇩⬂            ⇔       ⇔
t.scabrom      203  ⇩▫            ⇔       ⇔
شبدر            10  ⇩▫            ⇔       ⇔
شبدر            60  ⇩▫            ▫⇩⇩⇩⇩⇩⇩⇩⬃
t.scabrom      201  ⇩▫            ⇔
شبدر            32  ⇩▫            ⇔
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شبدر          48  ⇩▫        ⬄
شبدر          17  ⇩▫        ⬄
شبدر          20  ⇩▫        ⬄
شبدر          15  ⇩⇳⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬃
شبدر          16  ⇩▫
شبدر          11  ⇩▫
شبدر          12  ⇩⬃
```

Table 4: Dendrogram using Average Linkage (Between Groups) for sainfoin genotypes

```
                      Rescaled Distance Cluster Combine

    C A S E      0         5         10        15        20
25
  Label       Num  +---------+---------+---------+---------+--------
-+

  o. vicifolia 53  ⇩⬂
  o. vicifolia 54  ⇩▫
  o.michauai   16  ⇩▫
  o. vicifolia 45  ⇩▫
  o. vicifolia 46  ⇩▫
  o. vicifolia 40  ⇩⇳⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬂
  o. vicifolia 42  ⇩▫        ⬄
  o.michauai   17  ⇩▫        ⬄
  o.michauai   18  ⇩⬃        ▫⇩⇩⇩⬂
  o.motena     27  ⇩⬂        ⬄   ⬄
  o.motena     28  ⇩▫        ⬄  ▫⇩⇩⇩⇩⇩⬂
  o.mohenac    21  ⇩⇳⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬃  ⬄    ⬄
  o.mohenac    22  ⇩⬃           ⬄    ⬄
  o.mohenac    19  ⇩✘⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬃   ▫⇩⇩⇩⇩⇩⬂
  o.mohenac    20  ⇩⬃                ⬄    ⬄
  o.vicirefo   31  ⇩✘⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬂       ⬄    ⬄
  o.vicirefo   32  ⇩⬃        ▫⇩⇩⇩⇩⇩⇩⇩⇩⇩⬃    ⬄
  o.hobryehi   14  ⇩✘⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬃           ⬄
  o.hobryehi   15  ⇩⬃                    ▫⇩⇩⇩⇩⇩⇩⇩⇩⇩⬂
  o.vicirefo   36  ⇩⬂                    ⬄       ⬄
  o.vicirefo   37  ⇩▫                    ⬄       ⬄
  o.buhsenea    7  ⇩⇳⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬂         ⬄       ⬄
  o.buhsenea    8  ⇩▫           ⬄        ⬄        ⬄
  o.vicirefo   35  ⇩⬃           ▫⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬃       ⬄
  o.subniten   29  ⇩✘⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⇩⬂  ⬄                ⬄
  o.subniten   30  ⇩⬃        ⬄   ⬄                ⬄
  o. vicifolia 48  ⇩⬂        ▫⇩⇩⇩⬃                ⬄
  o. vicifolia 49  ⇩▫        ⬄
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o.helicarp    12
o.helicarp    13
o. vicifolia  51
o. vicifolia  52
o. vicifolia  50
o. vicifolia  43
o. vicifolia  44
o.auchdii      1
o.auchdii      3
o. vicifolia  41
o.auchdii      2
o.vicirefo    33
o.vicirefo    34
o. vicifolia  47
o.motena      25
o.motena      26
o.buhsenea     5
o.buhsenea     6
o.buhsenea     4
o.buuyei      10
o.buuyei      11
o.buuyei       9
o.viliaefo    38
o.viliaefo    39
o.molenncf    23
o.molenncf    24
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THE POTENTIALS AND CHALLENGES FOR COMMERCIAL TREE PLANTING IN UGANDA: EXPERIENCES FROM NANSEGA FORESTS AND RESORTS

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Nansega Forests and Resorts, is a project based on a partnership between two private investors. We plant trees and engage in community mobilisation and dissemination of forestry information, and promote eco-resorts for the promotion of eco-tourism. We have 180 hectares for planting *Pinus Caribaea* and *Eucalyptus grandis* by 2008, and we have planted 40 hectares of *Pinus Caribaea*. The objectives are to raise income for the proprietors, to support the conservation of the environment through afforestation, Conserve ecological biodiversity, to provide employment to communities as a contribution to poverty eradication in rural Uganda, Raise awareness on the importance of commercial tree planting as both an income generation and a conservation activities and sequester carbon. Among our achievements so far are: 40 hectares of forests planted, the Forests launched on the August 19th, 2006. The first Nansega resort for researches and writers is under construction, it will have a botanical garden and houses will be grass-thatched, community Based Organization for sensitization activities. The lessons learnt are that Commercial tree planting is an opportunity for both income and environmental protection and Environmental concerns need commercial incentives because benefits are far into the future. We conclude that Nansega Forests and resorts is viable development project despite the challenges as we look for other partnerships and support.

Introduction and background to the project

This paper wishes to share the experiences of private commercial tree planting in Uganda highlighting the potentials for both income generation and environmental gains, while at the same time pointing out challenges. Nansega Forests and Resorts, is a project by two private investors. We plant trees and engage in community mobilisation and dissemination of forestry information, and promote eco-resorts for the promotion of eco-tourism. We have 180 hectares for planting *Pinus Caribaea* and *Eucalyptus grandis* by 2008, and we have planted 40 hectares of *Pinus Caribaea*.

The government of Uganda is committed to Poverty eradication through the Poverty Eradication Action Plan (PEAP). Provision of employment in rural areas is one way in which NANSEGA Forests will help rural people to acquire jobs, earn regular income, and get out of rural poverty. Timber from pine is useful in construction, shuttering and making furniture. The eucalyptus also is used in construction, fuel and poles. This will lead to subsequent improvement of rural life through nearer access to better forest products. The main purpose of establishing plantation in this reserve is to produce saw logs for industrial timber which is becoming scarce as the old conifer plantations are diminishing fast. The rotation of 18-20 years for *Pinus caribaea*, and 8-10 years for *Eucalyptus grandis* shall be followed.

Objectives of the Project

- To raise income for the proprietors.
- To support the conservation of the environment through afforestation.
- Conserve ecological biodiversity.
- To provide employment to communities as a contribution to poverty eradication in rural Uganda
- Raise awareness on the importance of commercial tree planting as both an income generation and conservation activities.
- Sequester carbon.

Area and Location

The plantation sites are located in three districts namely; Mpigi, Mityana and Luwero, The following table shows the details of the various areas and their locations.

Location of Nansega Forests

NAME	LOCATION	ACRAGE	STATUS
NANSEGA I-Mpigi	Mengo District, Mawokota County: Butuntumula Sub-county near the Equator 8km off Masaka Road at Kayabwe Town. Block 382, Plot 319.	21.61 hectares	19 ha planted with *Pinus Caribaea*
NANSEGA II-Mityana	Mubende District, Busujju county. Block 79, Plot 32.	16.19 hectares	Not planted yet but to be planted with *Eucalyptus grandis*
NANSEGA III-Luwero		33 hectares	20 ha planted *Pinus caribaea*
NANSEGA IV-Luwero	East Buganda, Buruli County: Block 239, Plot 14., at Kabale Kakooge.	110.2 hectares	Not planted: to be planted with *Pinus caribaea and Eucalyptus grandis*
		180.80 HA	

The proprietors own a total of **180** ha of land all of which is aimed for establishing saw log plantations. Out of this **40** hectares have already been planted with *Pinus caribaea*. The planting which is planned to cover 50 ha per year in 2007 and 2008 is under the contract of the well-experienced and dedicated team of **KAMUSIIME MEMORIAL RURAL DEVELOPMENT SCHEME**[52]. Half of the trees in Nansega I in Mpigi are one year old (planted in May 2005) part is 6 months old (Planted in September 2005). The Nansega III in Luwero was planted in April 2006. The remaining part is in plan for planting during the August-September 2006 season. The pine species are fast growing and is estimated to reach the average harvestable size of 25-30 cm diameter at breast height (dbh) in 18 to 20 years, but they require intensive management during the first five years. Operations such as clean weeding and climber removal are a must during the first three years. Clear felling method shall be adopted at the end of the respective rotation ages but under this rotation programme.

The potentials of Nansega Forests and Resorts

The following are the potentials from the project.

Over 40 hectares of forests planted

Nansega has so far planted 40 hectares of pine and 5 hectares of eucalyptus. The following table shows the plans.

Schedules of planting NANSEGA Forests

Planting Season	***Area Planted (ha)***
2006	40
2007	40
2008	50
2009	50
Total area	180

These trees will make a big impact on the environment around. In terms of economics, the project uses are as follows:

52 This is a private venture that raises seedlings for commercial purposes; they have also planted trees in the Western part of the country.

Projected thinning regimes for the Species of the plantation

Pinus Caribea				
Type	***Age (Yrs)***	***Stems per ha***		**Remarks**
		From	***To***	
1	5-7	1372	864	Thin to Waste
2	8-10	864	655	Selective for poles
3	12-14	655	424	Low quality timber.
Clear fell	18-20	424		Industrial timber
Eucalyptus grandis				
Type	***Age (Yrs)***	***Stems Per Ha.***		***Remarks***
		From	***To***	
1	2-3	1372	833	Fuel wood
2	5-6	833	486	Building poles
3	8	486	287	Poles and/or Timber
Fell	18	287		Industrial timber

All trees of timber size and age will be harvested at end of rotation. Those which can be sold as poles will be removed depending on market availability lest they can also be converted into timber. NANSEGA Partners are seriously thinking of establishing a small-scale industry to produce matches, paper or plywood. This will enable the utilisation all the parts of the tree without any wastage. Plans are under way for the feasibility study.

The Forests launched on the August 19th, 2006.
The forests were officially launched on August 19th 2006. The function was officiated by the Vice President of Uganda. This showed political support to environmental concerns in Uganda. The function also was used as dissemination endeavor. Over 150 people attended and saw what can be done with trees. Many of them were impressed and a number of them made pledges to start planting trees, albeit on small scale. Leaders also made pledges to support people in their efforts. To us this was a big success to increase awareness of the importance of tree planting.

The first Nansega resort for researches and writers
As another potential, we are planning to start a series of resorts to be connected with our forests and promote eco-tourism. These will be mainly for people interested in trees, bird watching and the like. They will be mainly houses constructed according to our heritage; e.g., grass-thatched. We are also thinking of botanical gardens and medicinal plants. The first one, which will be the center, is being constructed at the lakeside of lake Victoria, off Entebbe Road, where the International Airport is found. This will offer a quite place for researchers and writers. Fro here visitors will be able to visit other sites of Nansega forests and resorts.

Community Based Organization for sensitization activities.
Besides the above, NANSEGA has arrangements to engage the local communities around their plantations into tree planting culture by sensitising them on its importance and finally offering to them some seedlings for planting besides other plantation products like prunings and 1st thinnings. As a result the community members working in Nansega forest of Mpigi district have formed a Community based Organization. Theirs will be community mobilization for environmental concerns. We are writing proposal to solicit funds for more income generating activities for poverty eradication.

Challenges of Commercial tree planting in Uganda
Funding
The major challenge is funding. The project is a private venture and partners fund the project from their personal savings. This is a big challenge considering the meager resources and the work of planting maintaining and monitoring all the four sites. The following sections show illustrate the point.

Weeding
Tending operations dealing with weed management are very crucial in excellent plantation maintenance. The first three years are particularly crucial. Many trees and shrubs, especially the thorny ones, coppice very well can easily suffocate seedlings in a matter of weeks. Thicket bush also consists of climbers (woody and other types, which can suffocate the planted trees. Both manual and chemicals methods are being used to control weeds in NANSEGA FORESTS. NANSEGA I- in Mpigi is mainly manual, while pre-planting spraying has been done in NANSEGA III-Luwero. Both pre-plant and post-plant weeding operations will be carried out when necessary to ensure that there are no weeds and that the ground is kept free of all weeds, be they grasses, herbs, coppicing trees and climbers in both Eucalyptus and Pine plantations.

Fire protection.
Fire can destroy an investment of millions in the shortest possible time. Fire is a serious threat to plantations and everything possible is being done to keep it out. This needs extra effort will be put in fire prevention and fighting during the fire season. We have long spells of draught, and during this time people just start fires anyhow in search of pastures. To keep these fires it requires extra vigilance, added manpower and fire fighting equipment, which all require funds. Nansega is taking into account the following:

- The establishment and maintenance of cleared fire breaks between forests and the boundaries and within the forests.
- Establishment and maintenance of efficient communication systems for fire prevention and fighting.
- A specific budget allocation for fire fighting annually.

In case fire breaks out, a dedicated fire fighting team will put it out using a combination of the following: water applied through pressure pumps, light soil, beating using fire beaters, and back firing/counter fire.

Protection from animals

There is a likely problem of roaming animals like goats and cows. This is a threat sometimes, however, where it emerges, the plantation shall be fenced off and animal owners talked upon and subsequently warned and area Local Council leader informed.

Protection from pests, disease and Vermin

There are a few observed pests and diseases, except for a few wild animals that are a threat to the newly planted trees, but it is hoped that they will move away as bush clearing continues and their hideouts are exposed. Developing and application of forest hygiene practices that minimize the spread of fungal or insect pests and diseases will be practiced.

Protection from local people of bad hearts

We have so far encountered bad-hearted people who destroy trees maliciously. In one of the plantations, they destroyed about ten trees of one year old. They just remove the shoots. In other locations we have experienced people

Buildings

Each forest plantation is supposed to have a building where tools and equipment are kept, and each should have a caretaker. Some buildings will be rented while others have own buildings. Our plan is to build small permanent structures (two or three rooms) on each forest to ease management of the forests. Workers locally recruited will commute from their homes for work. All these require funds, and the fact that our plantations are scattered aggravates the matter.

Labor needs/availability

Currently communities are enthusiastic about working in the forest plantations however, where this becomes in short supply, the contractor can indeed bring more from Western Uganda where they have more of it. Accordingly therefore, reliable labour is difficult to get in the area that will undertake the establishment activities. Therefore, we are importing labour from neighboring area. Women from the area may be employed on less demanding tasks as planting and weeding in a bid to promote good community/forest relations in the area.

Lessons learnt

- Commercial tree planting is an opportunity for both income and environmental protection.
- Environmental concerns need commercial incentives because benefits are far into the future.

Future Plans

- We are looking for international partnerships to support our activities.

Conclusions

Nansega Forests and Resorts is development project, which is technically feasible and financially viable. Although we are facing challenges, we are determined to continue and our hope and joy lies in seeing the trees grow and knowing that they are going to be useful to the people of Uganda today and in the future.

Readings

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International Conference on Environment: Survival and Sustainability 19-24 February 2007
Near East University, Nicosia-Northern Cyprus

OBSERVATIONS ON THE URBAN FLORA OF ISTANBUL (TURKEY)

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This study was carried out between 2001 - 2004 in Eminönü, Fatih, Üsküdar, Kadiköy, Kartal and Pendik, Administrative Districts of Istanbul.

Totally, 720 taxa belonging to 116 families were determined in this study. 564 taxa (78.33 %) are native whilst 156 taxa (21.67 %) are exotic.

4 taxa within 3 families belong to Pteridophyta Division whilst 716 taxa within 113 families belong to Spermatophyta Division. In the Spermatophyta Division, 40 taxa (27 of them are exotic) belonging to 8 families are within Gymnospermae whilst 676 taxa (129 of them are exotic) belonging to 105 families are within Angiospermae. 564 taxa (112 of them are exotic) belonging to 93 families are members of the Magnoliopsida / Dicotyledoneae whilst 109 taxa (17 of them are exotic) belonging to 12 families are members of the Liliopsida / Monocotyledoneae within Angiospermae.

Asteraceae / Compositae is the biggest family represented with 80 taxa (11.11 %) followed by Fabaceae / Leguminosae (62 taxa, 8.61 %) and Poaceae / Gramineae (47 taxa, 6.53 %) in this study.

Trifolium L. is the biggest genus represented with 15 taxa (2.08 %) followed by Ranunculus L. (10 taxa, 1.39 %) and Pinus L. (9 taxa, 1.25 %) in this study.

Total number of the endemic taxa included exotics is twelve.

Phanerophyta is the biggest group (236 taxa, 32.78 %) followed by Hemicryptophyta (190 taxa, 26.39 %) and Therophyta (188 taxa, 26.11 %) in the biological spectrum of this study.

The Mediterranean originated taxa are the biggest groups represented with 68 taxa followed by Euro - Siberian (59 taxa), East - Mediterranean (27 taxa) and unknowns (291 taxa) as phytogeographical elements.

This study is aimed finding out of the floristic (native and exotics) and biodiversity characteristics of İstanbul, that has been degragaded rapidly and representing solvation suggests for this.

Key Words *: Urban Flora, Istanbul, Turkey*

INTRODUCTION

General

As known, the studies on the urban flora and urban vegetation increased especially in the last five decades. Because, botanists noticed that the cities have a quite rich flora because of the different habitats such as gardens, parks, recreation areas, industrial areas, cemeteries, railways, roadsides etc. The urban habitats are very suitable for the plants. Because, the competition in the urban habitats is less than in the rural areas and the kinds of the habitats are more than in the rural areas in the urbans (GILBERT, 1989).

We aimed finding out of the floristic (native and exotics) and biodiversity characteristics of İstanbul, that has been degragaded rapidly and representing solvation suggests for this.

A lot of botanical studies were carried out and collected many plant specimens in and around Istanbul (DAVIS, 1965-1988). AZNAVOUR's (1897) study is the oldest of them. BAYTOP (1960, 1961, 1962, 1966, 1971 - a and b, 1985) carried out some studies in different parts and around of Istanbul. Most of the other studies are on only one genus in and around Istanbul (ÇIRPICI, 1975, KOKTAY, 1974, KÜÇÜKER, 1985, ÖZHATAY, 1979). AKSOY (1994 and 2001) realized landscape architectural works in different parts of Istanbul. YALTIRIK, EFE and UZUN (1997) found out the exotic tree and bush species of Istanbul's parks, gardens and groves. YILDIZCI (2000) found out the inventory of the plant taxa in the Gülhane Park, a touristic park in Eminönü. ŞAHIN (2002) studied on the urban flora and ecological characteristics of Eminönü and Fatih Towns. OSMA (2003) studied on the urban flora and ecological characteristics of Kadiköy Town. ALTAY (2004) studied on the urban flora and ecological characteristics of Kartal Town. MUTLU (2004) studied on the urban flora and ecological characteristics of Üsküdar Town. ÖZHATAY et al. (2003) carried out some studies in and around Istanbul. In addition, DAVIS et al. (1965-1988) studied on the flora of Turkey included the plant taxa in İstanbul.

AKAYDIN and ERIK (1997) studied on the urban flora of Ankara, the capital of Turkey.

Study Area

This study was carried out between 2001-2004 in Eminönü, Fatih (at the European side) , Üsküdar, Kadiköy, Kartal and Pendik (at the Anatolian side), Administrative Districts of Istanbul.

The Geographical Position and Topographical, Geological and Edaphological Characteristics of Istanbul

As known, Istanbul, the biggest city of Turkey, is located in a place, where the Asia and Europe continents meet. The Bosphorus (in Turkish : Boğaziçi) divides it into two sides: European side and Anatolian side. Istanbul is located between 40 0-420 parallels and 280-300 meridians. It's about 5110 km2. There is the Black Sea in the north, the Marmara Sea in the south, Kocaeli city in the east and Tekirdag city in the west (Figure 1).

A low plateau that has about 100-200 m. elevation is the main of the topograpical structure. There are a lot of hills and a few streams in the city.

The geological structure of Istanbul is diverse. The geological stucture of the city consists of the formations originated Silurian, Devonian, Carboniferous and Tertiar ages.

There are different kinds of the rock and structures consist of the granitic plutons, quarsites, grovacs, clayed schsists and radiolarites in Istanbul. There are different kinds of the rock and structures consist of the granitic plutons, quarsites, grovacs, clayed schsists and radiolarites in Istanbul.

As edaphological characteristics; Istanbul city has a lot of kinds of the soils. The brown forest soils cover the biggest area. The non-calcerous brown soils are the second. This kind of soil is suitable for growing of the plants because of plenty of organic matters. The rendzinas are important too. They cover especially the European side of the city.

In addition, the alluvial soils where carried out the agricultural activities distribute in Istanbul (YALTIRIK, EFE ana UZUN, 1997).

Istanbul is the biggest industrial city and has a population about twelve million.

Climatological and Bioclimatological Characteristics of Istanbul

Istanbul is a transition zone between little rainy Mediterraneal climate and Oceanic climate generally.

Little precipitation and high heat is seen in Istanbul in summers. The annual mean temperature was measured as 14.5 oC in the second twenty years. The months with the temperature above 30 oC are generally between May and September. The seldom days with the temperature below 0 oC are between November and April.

If we accept the daily mean temperature is continuously 8 0C as vegetation period; this period is about 280 days (between 15 March and 20 December) in Istanbul. The other period of the year is accepted as paused period because of the temperature under 8 0C.

In winter, the daily mean temperature is mostly not under 0 0C. Even, it is between 5-8 0C in the coldest period which is between the second half of December and the first half of March.

The annual maximum, minimum and mean temperature degrees for the last decade in

Table 1: The annual maximum, minimum and mean temperature degrees for the last decade in Istanbul.

Istanbul are seen in Table 1:

Meteorological Factors	MONTHS											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Mean Temperature (0C)	5.8	6.0	7.4	11.8	16.5	21.2	23.5	23.3	19.8	15.5	11.4	8.0
Mean Maximum Temperature (0C)	8.8	9.4	11.3	16.4	21.3	26.1	28.5	28.4	24.9	20.0	15.2	11.0
Mean Minimum………………… Temperature (0C)	3.2	3.2	4.3	8.0	12.1	16.4	18.9	19.0	15.6	12.1	8.4	5.3

The daily mean temperature begins to increase after the cold period from the middle of December to the first half of March when the temperature is between 4.8-8.0 0 C. It exceeds 10 0 C at the end of March. It continues 10-14 0C in April and 14-18 0C in May. The mean daily temperature which increases in June is 19-22 0C in June and 22-23 0C in July and August. The temperature that decreases about 21 0C from the last days of August is 17 0C in September and 14 -17 0C at the end of September. It is under 15 0C in the middle of October and the decreasing continues 9-13 0C along November and 8-9 0C until the first half of December (ANONYMOUS, 2003)

It is seen that the daily mean temperature does not reach to low values that limits the vegetation period of the plants. We can see the effect of this on the vegetation growing in Istanbul.

The mean total precipitation in a year is 682,3 mm in the study area. The winter months are plenty of rain. Despite the rain is seen along the year, 40 % of the total precipitation falls in winter. In general, the rains are seen in December and January. But the ratio of precipitation in summer is more than the typical Mediterranean stations. For example; Antalya, a city on the coast of the Mediterranean Sea and Izmir, a city on the coast of the Aegean sea. Hence, this characteristics is next to the Oceanic climate. The least rain is seen in July and August and its ratio is about 8 %. Precipitation ratio is little in spring (about 20-21 %), whilst it increses in autunm (about 28-29 %). The amount of the mean annual rainy days are about 120. Snow is very rare.

The type of the rain regime is Winter-Autumn-Spring-Summer (W.A.Sp.Su). Therefore, the rainiest season is winter. Autumn, spring and summer follow it. The type of the rain regime is "Central Mediterranean Rain Type" (AKMAN, 1990).

The ratio of the relative humidity is between 73-77 % in the city. This ratio decreases to 65 - 68 % in summer despite the effect of the sea. Even it is 51-56 % around the noon in summer. These results increase the evapotranspiration. The low ratio of the relatively humidity, especially in the dry period forms the xerophytic vegetation.

The dominant wind in the city is the northeast originated winds.

For Istanbul;

Q (Precipitation - temperature criterion) = 81

P (Annual total precipitation -mm) = 682.3 mm

Hence; the dominant climate of Istanbul is "little rainy Mediterraneal climate" (AKMAN, 1990).

The ombrothermic diagram is seen in Figure 2:

a: Station and altitude

b: Observation period (For temperature and precipitation)

c: Mean annual temperature(oC)

d: Mean annual precipitation (mm)

e: Rainy period

f: Dry period

g: Rain graphic

h: Temperature graphic

The General Vegetation

We can divide the vegetation of Istanbul into two categories: 1. Forest and maquis vegetation especially in the North and in the South of the city, 2. The urban vegetation on the center of the city.

The forest vegetation located especially in the North of the city. They are; Belgrad Forests on the European side and Alemdag Forests on the Anatolian side. They are humid forests. The dominant taxa are Quercus robur L., Q. frainetto Ten. and Q. petraea L. . Some of the other tree taxa; Fagus orientalis Lipsky, Carpinus betulus L., Castanea sativa Miller, Populus tremula L., Corylus avellana L., Acer campestre L., A. trautvetteri Medw., Ulmus minor Miller., Tilia argentea Desf. ex DC., Alnus glutinosa (L.) Gaertner, Salix caprea L., S. cinerea L. The lianas like Hedera helix L., Clematis vitalba L., Smilax excelsa L. exist in this vegetation. There are some Euro - Siberian originated taxa like Laurocerasus officinalis Roemer, Ilex colchica Poj and Euonymus europaeus L. too.

Outside of the forest vegetation, there is a maquis and pseudomaquis vegetation especially in the places where the forest vegetation destroyed near the coasts. Maquis vegetation distributed especially in the South coasts (and in the North locally) despite the pseudomaquis vegetation distributed in the northern coasts. The numbers of the maquis elements distributed in the North of the city where the forest vegetation was destroyed are less, but abundant effected under the Black Sea. Arbutus unedo L., Laurus nobilis L., Phyllirea latifolia L. are some of them. The pseudomaquis vegetation distributes in the places the forest vegetation destroyed especially in the North coasts.

The maquis vegetation distributes especially in the slopes of the Bosphorus and in the southern coasts of Istanbul and in the Princess Islands. Some of the taxa of the maquis are as follows: Arbutus unedo L., Erica arborea L., E. manipuliflora Salisb., Quercus coccifera L., Phyllirea latifolia L., Pistacia terebinthus L., Cistus salvifolius L., C. creticus L., Juniperus oxycedrus L., Sarcopoterium spinosum (L.) Spach, Spartium junceum L., Lavandula stoechas L., Olea europaea L.

Some taxa in the floristic list are native in different regions of Turkey, but have not natural distribution in Istanbul. However, they were brought and / or planted in Istanbul by people or their diaspores came to Istanbul by means of different ways.

MATERIALS AND METHODS

This study was carried out in the Administrative Districts of Eminönü, Fatih, Üsküdar, Kadiköy, Kartal and Pendik. The native and exotic plant taxa were collected from the different habitats as ruderal areas, waste places, cemeteries, parks, gardens, roadsides, water canals, railways, around the buildings etc.

All the plant samples were collected, then dried by pressing. Nomenclature follows to DAVIS et. al. (1965-1988) and GÜNER et al. (2001). Most of the samples are kept in MÜFE (Marmara University, Science and Arts Faculty) Herbarium.

The floristic list is arranged according to CRONQUIST (1968). The exotic taxa, life forms and if known, phytogeographical origins of the taxa were pointed out in the list.

The ombrothermic diagram was drawn by using the meteorological records of Göztepe Meteorological Station (Istanbul).

Some floristic and landscape architectural studies in and around Istanbul carried out in the past were scanned.

The determination of some exotic taxa was carried out by using the exotic plant lists from Istanbul Municipality.

Abbreviations :

End.	: Endemic
Medit El.	: Mediterraneal Element
E. Medit. El.	: East Mediterraneal Element
Euro - Sib. El.	: Euro - Siberian Element
G	: Geophyte
Ph	: Phaneropyte
Ch	: Chamaepyte
Th	: Therophyte
H	: Hemicryptophyte
Hy	: Hydrophyte
He	: Helophyte

RESULTS AND DISCUSSION

Totally, 736 taxa belonging to 116 families were determined in this study. 580 taxa (78.81 %) are native whilst 156 taxa (21.19 %) are exotic.

Four taxa within three families belong to Pteridophyta Division whilst 732 taxa within 113 families belong to Spermatophyta Division. In the Spermatophyta Division, 41 taxa (27 of them are exotics) belonging to eight families are within Gymnospermae whilst 691 taxa (129 of them are exotics) belonging to 105 families are within Angiospermae. 580 taxa (112 of them are exotics) belonging to 93 families are members of the Magnoliopsida /

Dicotyledoneae whilst 111 taxa (17 of them are exotics) belonging to 12 families are members of the Liliopsida / Monocotyledoneae within Angiospermae.

The floristic list is in appendix.
The families that have the most taxa, the taxa numbers and their ratios are seen on the table below (Table 2):

Table 2 : The families that have the most taxa, their taxa numbers and ratios:

Families:	Taxa numbers:	Ratios (%):
Asteraceae / Compositae	80 (4 of them are exotic)	11.11
Fabaceae / Leguminosae	62 (9 " " " ")	8.61
Poaceae / Gramineae	47	6.53
Rosaceae	43 (15 " " " ")	5.97
Liliaceae	31 (5 " " " ")	4.31
Lamiaceae / Labiatae	28 (1 " " " ")	3.89
Caryophyllaceae	18 (2 " " " ")	2.50
Brassicaceae / Cruciferae	19 (2 " " " ")	2.64
Scrophulariaceae	18 (2 " " " ")	2.50
Pinaceae	18 (10 " " " ")	2.50
Cupressaceae	15 (12 " " " ")	2.08
Ranunculaceae	15	2.08

As seen in the Table 2, Asteraceae, Fabaceae and Poaceae are the families that include the most number of the taxa. This is a very normal result. Becase, these are the families that have the most taxa in Turkey. The genera that have the most taxa, the taxa numbers and their ratios are seen on the table below (Table 3) :

Table 3 : The genera that have the most taxa, their taxa numbers and ratios.

Genera:	Taxa numbers:	Ratios (%):
Trifolium L.	15	2.08
Ranunculus L.	10	1.39
Pinus L.	9 (4 of them are exotics)	1.25
Ornithogalum L.	8	1.11
Quercus L. 8	1.11	
Vicia L.	8	1.11
Euphorbia L.	7	0.97
Acer L.	8 (3 of them are exotics)	1.11
Prunus L.	7 (3 “ “ “ “)	0.97
Veronica L.	6	0.83
Crepis L.	7	0.97
Juniperus L.	5 (3 of them are exotics)	0.69
Hypericum L.	5	0.69
Medicago L.	5	0.69
Geranium L.	6	0.83
Thuja L.	5 (All of them are exotics)	0.69
Lathyrus L.	5	0.69
Inula L.	4	0.56
Cirsium Miller	5	0.69
Allium L.	5	0.69

The total number of the endemics within the native taxa is ten. Total endemism ratio is 1.39 % whilst 1.77 % for the native taxa. The endemic taxa are seen below:

Abies nordmanniana (Stev.) Spach. subsp. bornmuelleriana (Mattf.) Coode & Cullen (Pinaceae)

Lathyrus undulatus Boiss. (Fabaceae / Leguminosae)

Lavandula stoechas L. subsp. cariensis (Boiss) Rozeria (Lamiaceae / Labiatae)

Ballota nigra L. subsp. anatolica P.H. Davis (Lamiaceae / Labiatae)

Campanula lyrata Lam. subsp. lyrata (Campanulaceae)

Cirsium polycephalum DC. (Asteraceae / Compositae)

Taraxacum turcicum van Soest (Asteraceae / Compositae)

Crepis macropus Boiss. & Heldr. (Asteraceae / Compositae)

Crocus pestalozzae Boiss. (Iridaceae)

Colchicum micranthum Boiss. (Liliaceae)

As seen above, the endemism ratio is low in Istanbul. Because, Istanbul has not special habitats and microclimates that endemic taxa can exist.

As the life forms, the Phanerophytes have the most taxa and ratios. The life forms and their ratios are seen on the Table 4 :

Table 4 : The life forms and their ratios.

Life Forms:	Taxa Numbers:	Ratios (%):
Ph	236	32.78
H	190	26.39
Th	188	26.11
G	80	11.11
Ch	22	3.06
He	3	0.43
Hy	1	0.14

As seen on the table above, the ratios of phanerophytes, hemicryptophytes and therophytes are high whilst geophytes, chamaepytes and the others are low. As known, the hemicryptopytes are the highest in the flora of Turkey. However the phanerophytes are the highest in the table. Because, about half of the phanerophytes are exotics.

Phytogeographically, the most taxa are the Mediterraneal elements. The Euro - Siberian elements are in the second row followed by East Mediterraneal, Euxine and Irano - Turanian elements. The phytogeographycal origins, their taxa numbers and ratios of them are seen on the Table 5 :

Table 5 : The phytogeographycal origins, their taxa numbers and ratios:

		Ratios (%)	
Phytogeographical Origins:	Taxa Numbers:	For the native taxa:	Totally:
Mediterranean	68	12.06	9.44
Euro - Siberian	59	10.46	8.19
East Mediterranean	27	4.79	3.75
Euxinian	10	1.77	1.39
Irano - Turanian	2	0.35	0.28
Cosmopolitan and widespread	115	20.39	15.97
Unknown	291	51.6	40.42

As seen on the table, the ratios of the Mediterranean and Euro - Siberian elements are high. This is a very normal result. Because, Istanbul is under the effect of Mediterraneal and Semi - Oceanic climates.

Totally, about 2000 natural taxa are distributed in the city borders of Istanbul (www. tubitak.gov.tr / tubives / index. php). The soil diversity, geographical position, climate diversity, topography and different habitat kinds caused this floristic richness. The taxa we recorded in this study are distributed only in the urban flora in Eminönü, Fatih, Üsküdar, Kadiköy, Kartal and Pendik Administrative Districts.

As known, there are a lot of different habitats in the cities. For instance, industrial areas, railways, roads, parks, cemeteries, gardens, rivers etc. Natural and exotic plant taxa prefer one or more kinds of these habitats. Some of them are ruderal taxa and they are similar to the ruderal taxa growing in London (GILBERT, 1989), Berlin (SUKOPP and WITTIG, 1998), Thessalonika (OBERDORFER, 1954). They are as follows:

Sisymbrium orientale, Hirschfeldia incana, Hordeum murinum, Capsella bursa - pastoris, Lamium amplexicaule, Senecio vulgaris, Urtica urens, Veronica polita, Ecballium elaterium, Parietaria judaica, Sisymbrium irio, S. officinale, Matricaria chamomilla, Euphorbia helioscopia, Papaver rhoeas, Anagallis arvensis, Cichorium intybus, Avena barbata, Datura stramonium, Polygonum aviculare, Achillea millefolium, Conyza canadensis, Cirsium arvense, Bellis perennis.

Some spontaneous taxa in the urban flora of Istanbul are distributed in the urban flora of the Central Europe too. Some of them are: Polygonum aviculare, Plantago major, Lolium perene, Trifolium repens, Spergularia rubra, Poa annua, Capsella bursa - pastoris, Hordeum murinum, Bromus sterilis, Chenopodium album, Conyza canadensis, Sisymbrium officinale, Sonchus oleraceus, Cirsium arvense (SUKOPP and WITTIG, 1998).

The taxa above are urbanophyl and most of them are adapted the conditions in the cities.

AKAYDIN and ERIK (1996) carried out a floristic study on the urban flora of Ankara, Capital of Turkey. They recorded totally 38 taxa. However, there are not similarities between their records and ours. There is only one same taxa: Alcea lavaterifolia (DC.) Boiss. (Malvaceae). This taxa is distributed all the Turkey. According to us, the cause of the differences between urban flora of Istanbul and Ankara originated mainly the climatical and edaphical differences.

The endemism ratio in the city border of Istanbul is 2.77 % (www. tubitak.gov.tr / tubives / index. php). This ratio totally in the study area is 1.39 % whilst 1.77 % for the native taxa. The ratio 2.77 % includes the endemic taxa in the natural areas out of the city in Istanbul too, but generally the ruderal and cosmopolitan taxa are distributed in the study area. Therefore, the endemism ratio (for the native taxa) is lower than the ratio in the city border of Istanbul.

There are a lot of taxa recorded from Istanbul in the past (BAYTOP, 1962). But we were not able to record in the study area. According to us, the races of these taxa came to an and in the study area because of the anthropogenic pressures. Some of these taxa are below:

Nigella damascena L. (Ranunculaceae), Agrostemma githago L., Dianthus pallens Sibth. & Sm. (Caryophyllaceae), Centaureum maritimum (L.) Fritsch (Gentianaceae), Kickxia commutata (Bernh. & Reichb.) Fritsch.(Scrophulariaceae), Ajuga laxmani (L.) Benth.(Lamiaceae), Lemna minor L.(Lemnaceae), Cephalanthera longifolia (L.) Fritsch., Spiranthes spiralis (L.) Chevall. (Orchidaceae), Carex divulsa Stokes, C. tomentosa L. (Cyperaceae).

Centaurea hermannii F. Hermann (Asteraceae) were collected in Aydos in 1950's by BAYTOP, but this taxon exists today only Çatalca, far from İstanbul.

There are some other taxa that recorded from Istanbul before, but we were not able to record in this study. For instance, Galanthus plicatus Bieb. subsp. byzanthinus (Baker) D.A. Webb (Amaryllidaceae), Euphorbia amygdaloides L. var. robbiae (Turrill) Radcliffe - Smith (Euphorbiaceae), Thymus aznavouri Velen. (Lamiaceae), Hypericum aviculariifolium Jaub. & Spach. subsp. byzanthium (Azn) Robson (Hypericaceae) and so on. Either we were not able to collect these taxa because of the limited study area (as pointed above, we carried out this study in a limited area in Istanbul) or the races of these taxa came to an and too because of the anthropogenic effects.

There are not any records of some taxa from Istanbul in the past. But they exist now in Istanbul. During the urbanization, some habitats in the city became suitable for these taxa. As a result, these taxa in question are distributed in the city today.

The existing of the exotic taxa is important too. There are a lot of exotic taxa in the urban flora of Istanbul. Generally, these exotic taxa are trees or shrubs and they planted by the people or municipality. Some of them are adaptable taxa and expand their distribution area in Istanbul along the years. For example; Sophora japonica (Fabaceae), Buxus sempervirens (Buxaceae), Aesculus hippocastanum (Hippocastanaceae), Acer japonicum, A. palmatum (Aceraceae) etc.

Buildings (it increased 90 % in the last decade), mining activities, forest fires, ignorantly agricultural activities and planting and so on threaten the flora. 240 taxa of the flora of Istanbul can be regarded as threatened taxa (ÖZHATAY and BYFIELD, 1998). Cirsium polycephalum DC. (Asteraceae), Lathyrus undulatus Boiss. (Fabaceae), Onosma propontica Aznav. (Boraginaceae), Verbascum bugulifolium Lam. (Scrophulariaceae) are some of them.

As a result, the urban ecological characteristics of Istanbul have to found out and urbanization of the city has to carried out by using these ecological characteristics.

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APPENDIX
The floristic list is below:

PTERIDOPHYTA

EQUISETACEAE
Equisetum ramosissimum Desf.
Widespread , G
E. telmateia Ehrh. G

HYPOLEPIDACEAE
Pteridium aquilinum (L.) Kuhn G

POLYPODIACEAE
Polypodium vulgare L. subsp. vulgare G

SPERMATOPHYTA

GYMNOSPERMAE

GINKGOACEAE

Ginkgo biloba L. Ph Exotic.

PINACEAE

Abies nordmanniana (Stev.) Spach subsp. bornmuelleriana (Mattf.) Coode & Cullen End., Euxine El., Ph

Picea orientalis (L.) Link. Ph
P. pungens Engelm Ph Exotic.

P. agabeyes (L.) Karst. Ph Exotic.

P. glauca 'conica' (Moench) Voss. var. albertiana Rehd. Ph Exotic

Cedrus libani A Rich Medit. El., Ph

C. atlantica Manetti var. glauca-pendula Carr. Ph Exotic

C. deodora (Roxb.) Loud. Ph Exotic

Pinus sylvestris L. Euro.-Sib. El., Ph

P. nigra Arn. subsp. pallasiana (Lamb.) Holmboe Ph

P. brutia Ten. E. Medit. El., Ph

P. halepensis Miller Ph

P. pinea L. Scattered, Ph

P. griffithii McClelland. Ph Exotic

P. strobus L. Ph Exotic

P. mugo Turra. Ph Exotic

P. pinaster Ait. Ph Exotic

TAXODIACEAE

Sequoia sempervirens (Lamb.) Endl. Ph Exotic

Cryptomeria japonica (L. F.) D. Don var. elegans Mast. Ph Exotic

CUPRESSACEAE

Cupressus sempervirens L. Ph

C. goveniana Gord. Ph Exotic

C. arizonica Grene. 'glauca' Ph Exotic

C. macrocarpa Gord. Ph Exotic

Juniperus oxycedrus L. subsp. oxycedrus Widespread, Ph

J. communis L. subsp. nana Syme Widespread, Ph

J. chinensis L. Ph Exotic

J. horizontalis (Pers.) Moench Ph Exotic

J. squamata Lamb. Ph Exotic

Chamaecyparis. lawsoniana (Murr.) Parl. 'ellwoodii' Ph Exotic

Thuja occidentalis L. var. globosa Gord. Ph Exotic

T. occidentalis L. var. compacta-aurea Hort. Ph Exotic

T. occidentalis L. var. douglasii- pyramidalis Spa. Ph Exotic

T. orientalis L. Ph Exotic

T. plicata Don. Ph Exotic

CEPHALOTAXACEAE

Cephalotaxus harringtonia L. Ph Exotic

ARAUCARIACEAE

Araucaria araucana (Molina) Koch Ph Exotic

TAXACEAE

Taxus baccata L. Ph

EPHEDRACEAE

Ephedra campylopoda C. A. Meyer Scattered, Ch

ANGIOSPERMAE

MAGNOLIOPSIDA / DICOTYLEDONEAE

MAGNOLIACEAE

Liriodendron tulipifera L. Ph Exotic

Magnolia grandiflora L. Ph Exotic

LAURACEAE

Laurus nobilis L. Medit. El. Ph

ARISTOLOCHIACEAE

Aristolochia clematitis L. Euro.-Sib. El. H

NYMPHAEACEAE

Nymphea capensis Thunb. Hy Exotic

BERBERIDACEAE

Berberis vulgaris L. Ph

B. thunbergii (Koch) DC. var. atropurpurea Chenault Ph Exotic

Nandina domestica Thunb. Ph Exotic

Mahonia aquifolium (Pursh) Nutt. Ph Exotic

M. aquifolium (Pursh) Nutt. 'atropurpurea' Ph Exotic

RANUNCULACEAE

Nigella arvensis L. var. glauca Boiss. Widespread, Th

Anemone coronaria L. Scattered in Outer Anatolia, Medit. El., G

A. pavonina Lam. G

Clematis vitalba L. Ph

C. cirrhosa L. Medit. El., Ph

Ranunculus neapolitanus Ten. H

R. repens L. Widespread, H

R. constantinopolitanus (DC.) d'Urv. Widespread & Common, H

R. paludosus Poiret G

R. marginatus d'Urv. var. marginatus Th

R. marginatus d'Urv. var. trachycarpus (Fisch. & Mey.) Azn., Th

R. muricatus L. Th

R. arvensis L. Widespread, Th

R . ficaria L. subsp. ficariiformis Rovy & Fouc. G

R. ficaria L. subsp. calthifolius (Reichb.) Arc. G

PAPAVERACEAE

Chelidonium majus L. Euro.-Sib. El., H

Glaucium flavum Crantz Widespread, H

Papaver rhoeas L. Widespread, Th

P. lacerum Popov. Scattered, Th

P. dubium L. Th

P. hybridum L. Th

P. orientale L. Th Exotic

Fumaria kralikii Jordan Medit. El., Th

F. densiflora DC. Scattered, Th

F. officinalis L. Scattered, Th

PLATANACEAE

Platanus orientalis L. Widespread Ph

P. hybrida L. Ph Exotic

P. acerifolia (Ait.) Willd Ph. Exotic

CORYLACEAE

Carpinus orientalis Miller subsp. orientalis Ph

Corylus maxima Miller Euro.-Sib. El. Ph

C. avellana L. var. avellana Euro.- Sib. El. Ph

FAGACEAE

Quercus petraea L. subsp. iberica Ph

Q. robur L. subsp. robur Euro.- Sib. El. Ph

Q. frainetto Ten. Ph

Q. hartwissiana Steven Ph

Q. pubescens Willd. Ph

Q. ilex L. Ph

Q. cerris L.var. cerris Medit. El. Ph

Q. coccifera L. Medit. El. Ph

Castanea sativa Miller Ph

CACTACEAE

Opuntia ficus-indica Mill. Ph Exotic

AIZOACEAE

Carpobrotus acinaciformis Th Exotic

CARYOPHYLLACEAE

Stellaria media (L.) Vill.subsp. media Th

S. media (L.) Vill. subsp. pallida (Dumort.) Aschers.& Graebn. Th

S. holostea L. Euro.-Sib. El., Ch

Cerastium anomalum Waldst. & Kit. Th

C. glomeratum Thuill Cosmopolitan, Th

C. gracile Duf. Th

C. tomentosum (Ten.) L. Th Exotic

Moenchia mantica (L.) Bartl. subsp. mantica Th

Sagina maritima Don Th

Spergularia rubra (L.) J. & C. Presl Widespread in N hemisphere, Th

S. bocconii (Scheele) Aschers. & Graebn. Th

Telephium imperati L. subsp. orientale (Boiss.) Nyman H

Dianthus leptopetalus Willd. H

D. barbatus L. H Exotic

Petrorhagia prolifera (L.) Ball & Heywood Th

Silene vulgaris (Moench) Garcke var. vulgaris H

S. alba (Miller) Krause Th

S. nocturna L. Medit. El., Th

ILLECEBRACEAE

Scleranthus perennis L. Ch

S. annuus L. subsp. verticillatus (Tausch) Arc Th.

NYCTAGINACEAE

Mirabilis jalapa L. Ph Exotic

AMARANTHACEAE

Amaranthus retroflexus L. Th

Celosia argentea L. var. cristata Kuntze Th Exotic

Gomphrena globosa L. Th Exotic

PHYTOLACCACEAE

Phytolacca americana L. H

CHENOPODIACEAE

Chenopodium album L. subsp. album var. album Th

C. album L. subsp. album var. microphyllum (Boenn.) Aellen Th

Atriplex hastata L. Th

A. halimus L. Th Exotic

Salsola tragus L. Th

PORTULACACEAE

Portulaca oleracea L. Th

P. grandiflora Hook. Th Exotic

POLYGONACEAE

Polygonum lapathifolium L. Th

P. aviculare L. Cosmopolitan, Th

P. convolvulus L. H

P. bistorta L. Th Exotic

Rumex acetosella L. Cosmopolitan, G

R. scutatus L. H

R. crispus L. H

R. conglomeratus Murray H

R. pulcher L. H

PLUMBAGINACEAE

Limonium sinuatum (L.) Miller Medit. El. Ch

PAEONIACEAE

Paeonia suffruticosa Andr. H Exotic

THEACEAE

Camelia japonica (Nois.) L. Ph Exotic

HYPERICACEAE / GUTTIFERAE

Hypericum calycinum L. Euxine El. Ch

H. perfoliatum L. H

H. montbretii Spach. H

H. origanifolium Wiild. H

H. perforatum L. H

TILIACEAE

Tilia argentea Desf. ex DC. Euro.-Sib. El., Ph

MALVACEAE

Malva sylvestris L. H

M. nicaeensis All. Th

M. neglecta Wallr. Th

Alcea pallida Waldst. & Kit. H

A. lavateriflora (DC.) Boiss. H

Althaea officinalis L. H

Hibiscus syriacus L. Ph Exotic

ULMACEAE

Ulmus glabra Hudson Ph

U. minor Miller Ph

Celtis australis L. Medit. El. Ph

MORACEAE

Morus alba L. Ph

M. nigra L. Ph

Morus alba L. 'pendula' Dipp. Ph Exotic

Ficus carica L. subsp. carica Widespread Ph

Maclura pomifera (Rafin) Schneider Ph Exotic

Broussonetia papyrifera (L.) Vent. Ph Exotic

URTICACEAE

Urtica dioica L. Th

Parietaria judaica L. Widespread H

VIOLACEAE

Viola alba Beser Widespread, H

V. sieheana Becker H

V. kitaibeliana Roem. & Schult. Th

V. tricolor L. Scattered, Th

PASSIFLORACEAE

Passiflora coerulea L. Ph Exotic

CISTACEAE

Cistus creticus L. Medit. El., Ph

C. salviifolius L. Ph

C. laurifolius L. Medit. El., Ph

Helianthemum racemosum (L.) Pau Medit. El., H

TAMARICACEAE

Tamarix parviflora DC. Ph

T. smyrnensis Bunge Ph

T. hispida Willd. Ph Exotic

CUCURBITACEAE

Ecballium elaterium (L.) A. Rich. Medit. El. H

SALICACEAE

Salix alba L. Widespread Euro.-Sib.El. Ph

S. babylonica L. Ph

S. matsudona Koidz. Ph Exotic

S. caprea L. Ph Exotic

Populus alba L. Euro.-Sib. El. Ph

P. tremula L. Widespread Euro.-Sib. El. Ph

P. nigra L. subsp. nigra Ph

P. canescens (Ait.) Sm. Ph Exotic

BRASSICACEAE / CRUCIFERAE

Sinapis alba L. Th

S. arvensis L. Widespread, Th

Diplotaxis tenuifolia (L.) DC. H

Raphanus raphanistrum L. Th

Calepina irregularis (Asso) Thellung Th

Lepidium graminifolium L. Scattered, H

Cardaria draba (L.) Desv. subsp. draba Widespread, H

Thlaspi perfoliatum L. Widespread, Th

Capsella bursa- pastoris (L.) Medik. Widespread, Th

Neslia apiculata Fisch Widespread, Th

Alyssum minus (L.) Rothm. var. minus Widespread, Th

A. maritimum L. Th Exotic

Erophila verna (L.) Chevall. subsp. spathulata (Lang) Walters Th

Cardemine hirsuta L. Cosmopolitan, Th

Alliaria petiolata (Bieb.) Cavara & Grande Scattered, Th

Sisymbrium officinale (L.) Scop. Widespread, Th

S. irio L. Th

Arabidopsis thaliana (L.) Heynhold Th

Cheiranthus allionii L. H Exotic

RESEDACEAE

Reseda lutea L. var. lutea Widespread, H

ERICACEAE

Erica arborea L. Ph

E. manupuliflora Salisb. Ph

E. carnea L. Ph Exotic

Arbutus unedo L. Ph

EBENACEAE

Diospyros lotus L. Ph Exotic

D. kaki L. Ph Exotic

PRIMULACEAE

Primula vulgaris Huds. subsp. sibthorpii (Hoffmanns.) W. W.Sm. & Forrest

Euxine El. H

Anagallis arvensis L. var. arvensis Th

arvensis L. var. caerulea (L.) Gouan Th

PITTOSPORACEAE

Pittosporum tobira (Thunb.) Ait. 'nana' Ph Exotic

ROSACEAE

Lauracerasus officinalis Roemer Ph

Prunus spinosa L. subsp. dasyphylla (Schur) Domin Euro.- Sib.El. Ph

P. x domestica L. Ph

P. divaricata Ledeb. subsp. divaricata Widespread Ph

P. cerasifera L. Ph

P. serrulata Lindl. Ph Exotic

P. domestica L. Ph Exotic

P. mume Sieb. & Zucc. Ph Exotic

Cerasus avium (L.) Moench Ph

Persica vulgaris Miller Ph

Rubus discolor Weihe & Nees Ph

R. canescens DC. var. canescens Widespread Ph

R. canescens DC. var. glabratus (Godron) Davis & Meikle Widespread Ph

R. tereticaulis P. J. Mueller Ph

Potentilla recta L. H

P. reptans L. H

P. fruticosa (Rydb.) L. H Exotic

Geum urbanum L. Widespread H

Sarcopoterium spinosum (L.) Spach H

Sanguisorba minor Scop H

Rosa canina L. Ph

R. multiflora Thunb. Ph Exotic

R. grandiflora L. Ph Exotic

R. damascena L. Ph Exotic

Cotoneaster nummularia Fisch. & Mey. Ph

C. horizontalis Decne Ph Exotic

C. dammeri (Duthie) Schneid. Ph Exotic

Mespilus germanica L. Ph

Pyracantha coccinea Roemer Ph

Crataegus orientalis Pallas ex Bieb Ph.

C. cf. curvisepala Lindman Ph

C. monogyna Jacq. subsp. monogyna Ph

Sorbus aucuparia L. Euro.-Sib.El. Ph

S. cf. umbellata (Desf.) Fritsch Ph

Cydonia oblonga Miller Ph

Malus sylvestris Miller subsp. orientalis (A. Uglitzkich) Browicz var. orientalis Ph

M. floribunda Sieb. Ph Exotic

Pyrus communis L. Ph

Eriobotrya japonica (Thunb.) Lindl. Ph Exotic

Spireae bumalda (Bean) Burv. Ph Exotic

S. x vanhouttei (Briot) Zab. Ph Exotic

Kerria japonica (L.) DC. Ph Exotic

Chaenomeles japonica (Thunb.) Spack. Ph Exotic

CRASSULACEAE

Umbilicus rupestris (Salisb.) Dandy Ch

Sedum sediforme (Jacq.) Pau. Ch

S. hispanicum L. Ch

S. pallidum Bieb. var. pallidum Ch

SAXIFRAGACEAE

Philadelphus coronarius L. Ph Exotic

Hydrangea macrophylla (Thunb.) Ser. Ph Exotic

FABACEAE / LEGUMINOSAE

Gleditsia triancanthos L. Ph

Cercis siliquastrum L. var. siliquastrum Ph

Genista carinalis Gris. Ph

Spartium junceum L. Medit. El. Ph

Calicotome villosa (Poiret) Link Medit. El. Ph

Lupinus angustifolius L. subsp. angustifolius Th

L. varius L. Medit. El. Th

Robinia pseudoacacia L. Ph

R. hispida L. Ph Exotic

Psoralea bituminosa L. Medit. El. H

Vicia cracca L. subsp. cracca H

V. ervilia (L.) Willd. Widespread Th

V. laxiflora Brot. Medit. El Th

V. hybrida L. Th

V. sativa L. subsp. sativa Th

V. sativa L. subsp. nigra (L.) Ehrh. Th

V. bithynica L. Th

V. galilaea Plitm. & Zoh. Th

Lathyrus digitatus (Bieb.) Fiori E. Medit. El. H

L. laxiflorus (Desf.) O. Kuntze H

L. undulatus Boiss. End. H

L. ochrus (L.) DC. Medit. El. Th

L. nissolia L. Widespread Th

Ononis spinosa L. subsp. leiosperma (Boiss.) Sirj. Widespread H

Trifolium uniflorum L. Medit. El. H

T. repens L. var. repens H

T. hybridum L. var. hybridum H

T. nigrescens Viv. subsp. petrisavii (Clem.) Holmboe Widespread Th

T. campestre Schreb. Widespread Th

T. glomeratum L. Th

T. resupinatum L. var. resupinatum Th

T. pratense L. var. pratense Widespread H

T. stellatum L. var. stellatum Th

T. lappaceum L. Medit. El. Th

T. arvense L. var. arvense Widespread Th

T. angustifolium L. var. angustifolium Th

T. constantinopolitanum Ser. Widespread Th

T. pauciflorum d'Urv. E. Medit. El. Th

T. subterraneum L. Th

Melilotus officinalis (L.) Desr. Widespread H

M. alba Desr. Widespread H

Medicago orbicularis (L.) Bart. Th

M. sativa L. subsp. sativa Widespread H

M. minima (L.) Bart. var. minima Widespread Th

M. polymorpha L. var. vulgaris (Benth.) Shinners Widespread Th

M. rigidula (L.) All. var. agrestis Burniat Th

Dorycnium pentaphyllum Scop. subsp. herbaceum (Vill.) Rouy H

Lotus peregrinus L. var. peregrinus Th

L. ornithopodioides L. Medit. El. Th

L. corniculatus L. var. corniculatus Widespread H

L. corniculatus L. var. tenuifolius L. Widespread H

Hymenocarpus circinnatus (L.) Savi Medit. El. Th

Ornithopus compressus L. Medit. El. Th

Onobrychis gracilis Beser H

Sophora japonica L. var. pendula Loud. Ph Exotic

Caesalpinia gilliesii Wall. Ph Exotic

Acacia dealbata Link. Ph Exotic

Albizzia julibrissin (Willd.) Durazz. Ph Exotic

Wistaria floribunda (Willd.) DC. Ph Exotic

W. sinensis Sweet. Ph Exotic

Cassia floribunda L. Ph Exotic

Laburnum anagyroides Medicus. Ph Exotic

LYTHRACEAE

Lythrum salicaria L. Widespread Euro.-Sib. El. H

Lagerstroemia indica L. Ph Exotic

MYRTACEAE

Myrtus communis L. subsp. communis Ph

Callistemon citrinus (Curt.) Spapf Exotic

Eucalyptus camaldulensis Dehnh. Ph Exotic

PUNICACEAE

Punica granatum L. Ph

ONAGRACEAE

Oenothera biennis L. H

Epilobium angustifolium L. Widespread H

CORNACEAE

Cornus mas L. Ph

C. alba L. Ph Exotic

ELAEAGNACEAE

Elaeagnus angustifolia L. Widespread Ph

E. pungens Thunb. Ph Exotic

SANTALACEAE

Osyris alba L. Medit. El. Ph

CELASTRACEAE

Euonymus japonicus L. var. aureo-variegatus Regel Ph Exotic

AQUIFOLIACEAE

Ilex colchica Poj. Euxine El. Ph

BUXACEAE

Buxus sempervirens L. Ph

B. sempervirens L. 'aurea-variegata' Ph Exotic

B. microphylla Sieb. & Zucc. Ph Exotic

EUPHORBIACEAE

Chrozophora tinctoria (L.) Rafin. Widespread Th

Mercurialis annua L. Th

Euphorbia stricta L. Euro.-Sib. El. Th

E. helioscopia L. Th

E. peplus L. var. peplus Th

E. peplus L. var. minima DC. Th

E. falcata L. Th

E. seguieriana Necker subsp. niciciana (Borbas ex Novak) Rech. fil. H

E. amygdaloides L. var. amygdaloides Euro.- Sib. El. Ch

RHAMNACEAE

Paliurus spina- christi Miller Ph

VITACEAE

Vitis sylvestris Gmelin Ph

V. vinifera L. Ph

SAPINDACEAE

Koelreuteria paniculata Laxm. Ph Exotic

HIPPOCASTANACEAE

Aesculus carnea (Loisel) Hayne Ph Exotic

A. hippocastanum L. Ph Exotic

ACERACEAE

Acer tataricum L. Ph

A. pseudoplatanus L. Euro.-Sib. El. Ph

A. platanoides L. Euro.-Sib. El. Ph

A. campestre L. subsp. campestre Ph

A. negundo L. Ph

A. palmatum (Sieb. & Zucc.) Thunb. Ph Exotic

A. cappadocicum Gleditsch Ph Exotic

A. japonicum Thunb. 'Atropurpureum' Ph Exotic

ANACARDIACEAE

Rhus coriaria L. Ph

Pistacia terebinthus L. subsp. terebinthus Ph

P. lentiscus L. Medit. El., Ph

P. atlantica Desf. Ph

SIMAROUBACEAE

Ailanthus altissima (Miller) Swingle Ph

MELIACEAE

Melia azaderach L. Ph Exotic

RUTACEAE

Ruta montana (L.) L. H

Citrus limon (L.) Burnm. Ph

Skimmia japonica Thunb. Ph Exotic

ZYGOPHYLLACEAE

Tribulus terrestris L. Th

JUGLANDACEAE

Pterocarya fraxinifolia (Poiret) Spach Hyrcano- Euxine El. Ph

Juglans regia L. Ph

LINACEAE

Linum trigynum L. Medit. El., Th

L. bienne Miller H

L. corymbulosum Reichb. Medit. El., Th

GERANIACEAE

Geranium lucidum L. Th

G. purpureum Vill. Th

G. robertianum L. Th

G. molle L. subsp. molle Th

G. sanguineum L. Euro.-Sib. El. H

G. pyrenaicum Burm. fil. H

Erodium malacoides (L.)L'Herit. Medit. El. Th

E. cicutarium (L.) L'Hérit subsp. cicutarium Th

Pelargonium zonale (L.) Ait. H Exotic

P. hortorum Bailey H Exotic

OXALIDACEAE

Oxalis corniculata L. Cosmopolitan weed G

O. articulata Savigny G

O. floribunda L. G Exotic

POLYGALACEAE

Polygala vulgaris L. Euro. - Sib. El., Ch

ARALIACEAE

Hedera helix L. Ph

H. canariensis Willd. Ph Exotic

Fatsia japonica (Thunb.) Decne & Panch Ph Exotic

APIACEAE / UMBELLIFERAE

Eryngium campestre L. var. virens Link Widespread H

Scandix pecten-veneris L. Widespread Th

Pimpinella anisum L. Th

Foeniculum vulgare Miller H

Conium maculatum L. H

Tordylium apulum L. Medit. El. Th

Torilis nodosa (L.) Gaertner Th

Daucus carota L. G

D. broteri Ten. Medit. El. Th

D. guttatus Sm. Th

GENTIANACEAE

Centaurium erythraea Rafn. subsp. erythraea Euro.-Sib. El. H

APOCYNACEAE

Nerium oleander L. Medit.El. Ph

Vinca herbacea Waldst. & Kit. H

V. major L. H Exotic

V. minor L. H Exotic

ASCLEPIADACEAE

Perioplaca graeca L. var. graeca Widespread E.Medit. El. H

Cionura erecta (L.) Griseb. Widesperad E. Medit. El. H

OLEACEAE

Jasminum fruticans L. Ph Medit. El. Ph

J. officinale L. Ph Exotic

Fraxinus ornus L. subsp. ornus Ph

F. excelsior L. subsp. excelsior Euro.-Sib. El. Ph

F. angustifolia Vahl.subsp. oxycarpa (Breb. Ex Willd.) Franco & Rocha Euro.-Sib.El. Ph

Ligustrum vulgare L. Euro.- Sib. El. Ph

L. lucidum Ait. Ph Exotic

L. japonicum Thunb. Ph Exotic

L. ovalifolium (Hort.) Hassk. Ph Exotic

Olea europaea L. var. europaea Ph

Phillyrea latifolia L. Medit. El. Ph

Syringia vulgaris L. Ph Exotic

Forsythia intermedia Zabel Ph Exotic

SOLANACEAE

Solanum nigrum L. subsp. nigrum Th Cosmopolitan Th

S. dulcamara L. Widespread Euro.-Sib. El. H

Datura stramonium L. Widespread Cosmopolitan Th

Hyoscyamus niger L. Widespread Th

Petunia hybrida Vilm. Th Exotic

CONVOLVULACEAE

Convolvulus cantabrica L. H

C. arvensis L. H

Calystegia sepium (L.) R. Br. subsp. sepium H

C. silvatica (Kit.) Griseb. H

Ipomea purpurea (L.) Roth Th

BORAGINACEAE

Heliotropium europaeum L. Th

H. hirsutissimum Grauer Widespread E. Medit. El. Th

Myosotis cf. incrassata Guss E. Medit. El. Th

Echium italicum L. H

vulgare L. Euro.-Sib. El. Th

Onosma proponticum Aznav. E. Medit. El. End. H

Trachystemon orientalis (L.) G. Don Euxine El. H

Anchusa cf. leptophylla Roemer & Schultes H

Anchusa azurea Miller var. azurea H

VERBENACEAE

Phyla nodiflora (L.) Greene Widespread H

Verbena officinalis L. Widespread H

V. hybrida (Vilm.) Voss. H Exotic

Lantana camara L. Ph Exotic

Vitex agnus-castus L. Ph

LAMIACEAE / LABIATAE

Ajuga reptans L. Euro - Sib. El. G.

Rosmarinus officinalis L. Medit. El. Ph

Lavandula stoechas L. subsp. stoechas Medit. El. Ch

L. stoechas L.subsp. cariensis (Boiss.) Rozeria E. Medit. El. END. Ch

L. angustifolia Miller subsp. angustifolia Ch

L. latifolia (Auth.) Vill. Ch Exotic

Lamium garganicum L. subsp. leavigetum Arcangeli Euxine El. H

L. amplexicaule L. Widespread Euro. -Sib. El. Th

L. purpureum L. Th

Ballota nigra L. subsp. anatolica P. H. Davis End. H

Marrubium vulgare L. H

Stachys cretica L. H

S. annua (L.) L. subsp. annua var. annua Widespread Th

S. arvensis (L.) L. Th

Melissa officinalis L. H

Prunella vulgaris L. Widespread Euro.-Sib. El. H

Origanum vulgare L. subsp. vulgare Euro.-Sib. El. H

O. vulgare L. subsp. hirtum (Link) Ietswaart E. Medit.. El. H

Calamintha nepeta (L.) Saxi subsp. glandulosa (Req.) P. W. Ball. H

Clinopodium vulgare L. H

Acinos rotundifolius Pers. Widespread Th

Thymus longicaulis C.Presl subsp. longicaulis Ch

Mentha pulegium L. G

M. longifolia (L.) Hudson subsp. longifolia Euxine El. G

M. longifolia (L.) Hudson subsp. typhoides (Brig.) Harley var. typhoides Widespread G
Lycopus europaeus L. Euro.Sib. El H

Salvia forskahlei L. Euxine El. Ch

S. verbenaca L. Medit. El. Ch

PLANTAGINACEAE

Plantago major L. subsp. intermedia (Gilib.) Lange Widespread H

P. coronopus L. subsp. coronopus H

P. lanceolata L. H

SCROPHULARIACEAE

Verbascum bugulifolium Lam. Euro.-Sib. El. H

V. blattaria L. Widespread H

V. lagurus Fisch & Mey Euro.-Sib. El. H

Antirrhinum majus L. subsp. majus H

Linaria genistafolia (L.) Miller subsp. genistafolia Euro.-Sib. El . H

Cymbalaria muralis Gaertner subsp. muralis H

Kickxia spuria (L.) Dumort subsp. integrifolia (Brot) R. Fernandes Th

Digitalis lanata Ehrh. H

Veronica pectinata L. var. pectinata Th

V. polita Fries Widespread Th

V. persica Poiret Th

V. cymbalaria Bodard Medit. El. Th

V. hederifolia L. Widespread Th

V. chamaedrys L. Euro.-Sib.El. H

Parentucellia latifolia (L.) Caruel subsp.latifolia Medit. El. Th

Bellardia trixago (L.) All. Th

Paulownia tomentosa (Sieb. & Zucc.) Steud. Ph Exotic

Hebe Comm. sp. Ph Exotic

OROBANCHACEAE

Orobanche ramosa L. Scattered G

O. pubescens d'Urv. Medit. El. G

O. minor L. G

O. hederae Duby. G

BIGNONIACEAE

Catalpa bignonioides Walt. Ph Exotic

Campsis radicans (L.) Seem. Ph Exotic

ACANTHACEAE

Acanthus mollis L. H Exotic

CAMPANULACEAE

Campanula lyrata Lam. subsp. lyrata Widespread END. H

RUBIACEAE

Sherardia arvensis L. Th

Galium verum L. subsp. verum Euro.-Sib. El. H

G. subuliferum Somm. & Lev. H

G. aparine L. H

Cruciata laevipes Opiz H

C. taurica (Palas ex Willd.) Ehrend. Widespread Ir.-Tur. El. H

Rubia tinctorum L. Widespread Ir.-Tur. El. H

CAPRIFOLIACEAE

Sambucus ebulus L. Euro.-Sib. El. Ph

S. nigra L. Euro.-Sib. El. Ph

Lonicera etrusca Santi var. etrusca Medit.El. Ph

Viburnum opulus L. Ph Exotic

V. tinus L. Ph Exotic

Lonicera japonica Thunb. Ph Exotic

L. pileata Oliv. Ph Exotic

L. americana Koch.   Ph   Exotic

Abelia floribunda (Mar. & Gal.) Decne   Ph   Exotic

Weigela florida (Sieb. & Zucc.) A. DC.   Ph Exotic

Symphoricarpos albus (L.) Blake   Ph Exotic

VALERIANACEAE

Centranthus ruber (L.) DC.   H

DIPSACACEAE

Knautia orientalis L.   E. Medit. El.   Th

K. integrifolia (L.) Bert. var. bidens (Sm.) Borbas   E. Medit. El.   Th

Scabiosa columbaria L. subsp. columbaria var. columbaria   H

S. columbaria L. subsp. ochroleuca (L.) Celak. var. ochroleuca (L.) Coulter   H

ASTERACEAE / COMPOSITAE

Xanthium spinosum L.   Th

X. strumarium L. subsp. strumarium   H

X. strumarium L. subsp. cavanillesii (Scouw) D. Löve & P.Dansereau   H

Pallenis spinosa (L.) Cass.   Th

Inula salicina L.   Widespread   G

I. vulgaris (Lam) Trevisan   Euro.-Sib. El. H

I. aschersoniana Janka   H

I. viscosa (L.) Aiton   Medit. El.   H

Erigeron acer L. subsp. pycnotrichus (Vierh.) Grierson Widespread Euro.-Sib.El. H

Conyza canadensis (L.) Cronquist   Th

Bellis perennis L.   Euro. -Sib. El.   H

Doronicum orientale (L.)   G

Senecio vulgaris L. Th

Tussilago farfara L. Widespread Euro.-Sib. El. G

Calendula officinalis L. H

C. arvensis L. H

Anthemis cretica L. subsp. tenuiloba (DC.) Grierson H

A cf. chia L. E. Medit. El. Th

A. tinctoria L. var. tinctoria Widespread H

A. austriaca Jacq. Widespread Th

Achillea millefolium L. subsp. millefolium Euro.-Sib. El. H

Chyrsanthemum segetum L. Th

C. coronarum L. Th Exotic

Tanacetum parthenium (L.) Schultz & Bip. Widespread H

Matricaria chamomilla L. subsp. chamomilla Th

Artemisia absinthum L. H

A. maritima L. H Exotic

A. dranculus L. H

Arctium minus (Hill.) Bernh. subsp. minus H

Onopordum acanthium L. Widespread H

Silybum marianum (L.) Gaertner Medit. El. H

Cirsium ligulare Boiss. H

C. polycephalum DC. End. H

C. cf. lappaceum (Bieb.) Fischer H

C. creticum (Lam.) d'Urv. subsp. creticum E. Medit. El. H

C. arvense (L.) Scop. subsp. arvense H

Picnomon acarna (L.) Cass. Widespread Medit. El. Th

Carduus nutans L. subsp. leiophyllus (Petr.) Stoj. & Stef. H

C. pycnocephalus L. subsp. albidus (Bieb.) Kazmi H

Centaurea diffusa Lam. Medit. El. H

C. solstitialis L. subsp. solstitialis H

C. iberica Trev. ex Sprengel H

C. calcitrapa L. H

Crupina crupinastrum (Moris)Vis. Widespread Th

Cnicus benedictus L. var. benedictus Th

Carthamus lanatus L. Widespread Th

Cardopatium corymbosum (L.) Pers. E.Medit. El. H

Carlina oligocephala Boiss.& Kotschy subsp. oligocephala H

Echinops ritro L. H

E. microcephalus Sm H.

Scolymus hispanicus L. Medit. El. H

Cichorium intybus L. Widespread Ch

Tolpis virgata (Desf.) Bertol. Medit. El. H

Scorzonera cana (C. A. Meyer) Hoffm. var. cana Widespread H

S. mollis Bieb. subsp. mollis H

Tragopogon longirostris Bisch. ex Schultz Bip. var. longirostris H

T. cf. pratensis L. Euro.-Sib. El. H

Hypochoeris glabra L. Th

Leontodon cichoraceus (Ten.) Sanguinetti Medit. El. G

L. tuberosus L. Medit. El. G

Picris altissima Delile Medit. El. Th

Helminthotheca echioides (L.) Holub Th

Urospermum picnoides (L.) F. W. Schmidt Medit. El. Th

Sonchus asper L. subsp. glaucescens (Jordan) Ball Widespread H

S. oleraceus L. H

Scariola viminea (L.) F. W. Schmiat Widespread H

Lapsana communis L. H

Taraxacum hyberniforme van Soest Ch

T. gracilens Dahist. Ch

T. turcicum Van. Soest END. Ch

Chondrilla juncea L. var. juncea Widespread H

Crepis smyrnaea DC. E. Medit. El. H

C. macropus Boiss. & Heldr. END. H

C. reuterana Boiss. subsp. reuterana E. Medit. El. H

C. sancta (L.) Babcock Widespread Th

C. cf. micrantha Czer. Widespread Th

C. neglecta L. Th

C. vesicaria L. Th

Tagetes tenuifolia (Bart.) Cav. Th Exotic

LILIOPSIDA / MONOCOTYLEDONEAE

POACEAE / GRAMINEAE

Brachypodium sylvaticum (Hudson) P. Beauv. Widespread, Euro - Sib. El. G

Aegilops neglecta Req. ex Bertol. Medit. El . Th

Triticum baeoticum Boiss. subsp. baeoticum Th

T. vulgare L. Th

Hordeum murinum L. subsp. leporinum (Link) Arc. var. leporinum Widespread Th

H. bulbosum L. Widespread G

H. vulgare L. Th

Bromus sterilis L. Widespread Th

B. madritensis L. Th

Avena sterilis L. subsp. sterilis Th

A. fatua L. var. fatua Th

A. barbata Pott ex Link subsp. barbata Medit. El. Th

Helictotrichon compressum (Heuffel) Henrard H

Trisetum flavescens (L.) P. Beauv. Euro.-Sib. El. H

Aira caryophyllea L. Euro.-Sib. El. Th

Corynephorus divaricatus (Paurr.) Breistr. Medit. El. Th

Holcus lanatus L. Euro.-Sib. El. H

Apera spica-venti (L.) P. Beauv. Euro.-Sib. El. Th

Agrostis capillaris L. var. capillaris H

Alopecurus myosuroides Hudson var. myosuroides Widespread Euro.-Sib. El. Th

Phleum pratense L. Widespread Euro.-Sib.El. H

Festuca beckeri (Hackel) Trautv. G

Lolium perenne L. Euro.-Sib. El. Th

L. rigidum Gaudin var. rigidum Th

Catapodium marinum (L.) C.E. Hubbard Medit. El. Th

Poa annua L. Cosmopolitan Th

P. infirma Kunth Th

P. trivialis L. H

P. pratensis L. Widespread G

Dactylis glomerata L. subsp. glomerata Euro.-Sib. El. H

D. glomerata L. subsp. hispanica (Roth) Nyman H

Cynosurus cristatus L. Euro.-Sib.El. H

C. echinatus L. Medit. El. Th

Briza maxima L. Th

Melica ciliata L. subsp. ciliata Widespread H

M. uniflora Retz. Euro.-Sib. El. G

Phragmites australis (Cav.) Trin. ex Steudel Widespread Euro.-Sib. El. He

Cynodon dactylon (L.) Pers var. dactylon H

C. dactylon (L.) Pers. var. villosus Regel H

Panicum capillare L. H

P. miliaceum L. Th

Echinochloa crus-galli (L.) P. Beauv. Th

Paspalum paspalodes (Michx.) Scribner H

Setaria viridis (L.) P. Beauv. Widespread Th

Sorghum halepense L. var. halepense H

Chrysopogon gryllus (L.) Trin. subsp. gryllus Widespread H

Bothriochloa ischaemum (L.) Keng H

JUNCACEAE

Juncus heldreichianus Marsson ex Parl. G

J. acutus L. G

Luzula multiflora (Ehrh. Ex Retz.) Lej. H

CYPERACEAE

Cyperus cf. longus L. Widespread Th

C. papyrus L. Th Exotic

Carex flacca Schreber subsp. flacca Euro.-Sib. El. G

TYPHACEAE

Typha latifolia L. He

T. domingensis Pers. Widespread He

CANNACEAE

Canna hortensis L. G Exotic

ARECACEAE / PALMAE

Chamaerops humilis L. Ph Exotic

C. excelsa L. Ph Exotic

Phoenix canariensis Chabaud. Ph Exotic

Washingtonia filifera (J. Linden) H. A. Wendl. Ph Exotic

Trachycarpus fortunei (Hooker) H. Wendl. Ph Exotic

IRIDACEAE

Iris sintenisii Janka Euro.-Sib. El. G

I. suaveolens Boiss.& Reuter E. Medit. El. G

I. germanica Forsak G Exotic

Crocus pestalozzae Boiss. E. Medit. El. END. G

C. biflorus Miller subsp. adamii (Gay) Mathew G

C. sativus L. G Exotic

Romulea linaresii Parl. subsp. graeca Bég. E. Medit. El. G

R. columnae Seb. & Mauri subsp. columnae Medit. El. G

LILIACEAE

Smilax excelsa L. Euxine El. G

Ruscus aculeatus L. var. angustifolius Boiss. G

Asparagus acutifolius L. Medit. El. G

A. officinalis L. G

Asphodelus fistulosus L Medit. El. G

A. aestivus Brot.. Medit. El. G

Allium neapolitanum Cyr. Medit. El. G

A. ampeloprasum L. G

A. paniculatum L. subsp. paniculatum Medit. El. G

A. scorodoprasum L. subsp. rotundum (L.) Stearn Widespread Medit. El. G

A. orientale Boiss. G Exotic

Scilla autumnalis L. Medit. El. G

Ornithogalum fimbriatum Willd. E.Medit. El. G

O. pyrenaicum L. G

O. sigmoideum Freyn & Sint. Euro.-Sib. El. G

O. montanum Cyr. E.Medit. El. G

O. umbellatum L. G

O. ortophyllum Ten. Widespread G

O. narbonense L. Widespread Medit. El. G

O. nutans L. E. Medit. El., G

Muscari comosum (L.) Miller Widespread Medit. El. G

M. neglectum Guss. Widespread G

M. tenuiflorum Tausch Widespread G

M. armeniacum Leichtlin ex Beker Widespread G

Gagea bohemica (Zauschn) Schultes & Schultes fil. G

Colchicum micranthum Boiss. END. G

C. lingulanthum Boiss. & Spruner ex Boiss. E. Medit. El. G

Lilium candidum L. G Exotic

Hemerocallis fulva (L.) L. G Exotic

Hyacinthus orientalis L. subsp. orientalis G Exotic

Narcissus tazetta L. G Exotic

AMARYLLIDACEAE

Sternbergia lutea (L.) Ker-Gawl. ex Sprengel Widespread Medit. El. G

Galanthus gracilis Celak E. Medit. El. G

AGAVACEAE

Agave americana L. Ph Exotic

Yucca filamentosa L. Ph Exotic

Y. glariosa L. Ph Exotic

DIOSCOREACEAE

Tamus communis L. subsp. communis G

ORCHIDACEAE

Orchis mascula (L.) L. subsp. pinetorum (Boiss. &Kotschy) G. Camus Widespread

E. Medit. El. G.

Serapias vomeracea (Burnm.fil.) Brig . subsp. orientalis Greuter E.Medit. El. G

DESERT VEGETATION OF THE MIL PART OF KURA-ARAKS LOWLAND

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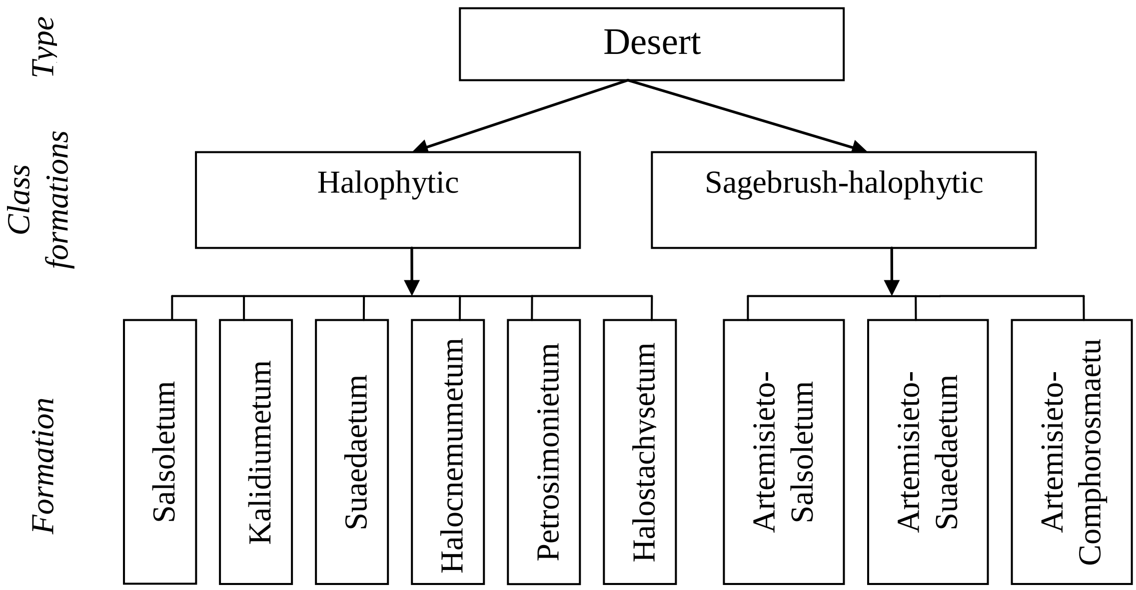
According to climate, the degree of maturity of top-soil the more wide-spread types of vegetation is desert vegetation. The desert type of vegetation in studied region ranges in parallel with the river Araks. The degree of top-soil depends on soil chemism, its texture and water regime. Precipitations in this territory do not exceed 200 mm per one year. In spring, summer and fall the desert has three different views. In spring because of accumulation of precipitations in soil begin to grow ephemers, particularly annuals (as well as bulbous and tuberous) which can finish their vegetation process until the height of summer.

In the flush of ephemers development with perennials have a rather colourful view resembling a meadow. To the end of March this picture sharply changes: after fruitage the ephemers quickly disappear, they dry up and are blowed by a wind. Soil more outcrops, phytocenosis consists of sparse perennials which continue to vegetate within hot summer due to their deep root system. Autumnal aspect of desert cenosis usually is characterized by two layered phitocenosis: at first layer – perennials, at second one- ephemers.

At the territory prevail sagebrush desert (Artemisietum fragrans) and in various places it is characterized with its ephemer composition. At salt light-soils the sagebrush formed a mixed phytocenosis with saltwort. In the desert type of the Mil steppe vegetation of Kura-Araks lowland the following classes of formation were picked out by us: 1. Halophyte-halophytic; 2. Sagebrush-halophytic.

From Halophytic class of formation the following formations were picked out by us (Scheme-classification #1): Salsoletum, Kalidumentum Suaedaetum, Holocnemumetum, Petrosimonietum, Halastachysetum.

Scheme classification #1
Scheme classification of desert vegetation of the Mil part of Kura-Araks lowland



Sagebrush-halophytic class of formation is subdivided into the following formations: Astemisieto-Salsoletum, Astemisieto-Suaedaetum, Artemisieto Comphorosmaetum.

1.1. Formation of Salsoletum. The dominate species of this formation are Salsola dendroides and S.nodulosa. S.nodulosa is a little undershrub with short stalk. Vegetation process begins earlier in spring. The flowering begins by the end of June. With the beginning of hot weather the body height is strongly slowed down and S.nodulosa passes in a stage of summer dormancy (1). Common projective cover usually makes up 30-40 %.

1.2. Formation of Kalidumentum. The dominate species of this formation is saltwort (Kalidium caspicum).

Saltwort is a bush 25-60 cm in height, with fleshy leaves. Common projective cover makes up 35-50 %.

1.3. Formation of Suaedaetum. The dominate species of this formation is seepweed (Suaeda dendroides). The given formation is widely spread in studied territory and is characteristic for alkaline lands. Height of the bush reaches to 30-70 cm. Projective cover makes up 45-65 %.

1.4. Formation of Halocnemumetum. The dominate species of this formation is Halocnomum strobillasosum.

Halocnomum strobillasosum is strongly branchy, aphyllous bush, xerophyte and halophyte. The vegetation process begins in March and comes to end in November. Shoots occur in April and May (3). Height of the bush reaches to 30-50 cm. Projective cover makes up 20-25 %.

1.5. Formation of Petrosimonietum. The dominate species of this formation are Petrosimonia glauca and P.brachiata.

In the spring period P.glauca with its fine reddish flowers forms reddish-green aspect in cenosis. Height reaches to 10-30 cm. The projective cover in spring makes up 45-65 %.

P.brachiata is an annual plant. 5-40 cm in height, from the basis spread apart branchy, crowded- villous. The vegetation process begins in April and bear fruit in October. The projective cover depending on season makes up 30-90 %.

1.6. Formation of Halostachysetum. The studied formation is shaped as tall bush. Halostachys capsicum is wide-spread on plump of alkaline lands, and also in strongly salted places of the river of Araks (4). H.caspicum is a succulent, halophytic bush 50-140 cm in height, the diameter of crone 100-170 cm. Halostachys capsicum is capable to accumulate in tissues more than 30 % salts (2). The projective cover makes about 45-55%.

2.1. Formation of Asrtemisieto-Salsoletum.
Asrtemisieto-Salsoletum occupies flat parts in weakly salted soils. As against annuals the alkaline lands formation has a wide expansion. Edificator of the given formation is subshrub Artemisia fragrans and Salsola nodulosa. Height is 30-40 cm. The projective cover changes within the limits of 45-50 %.

2.2. Formation of Artemisieto-Suaedaetum.
The dominate species of this formation are Artemisia fragrans and subdominate - Suaeda dendroides. After them appear separate kinds of cereals, leguminous and motley grasses from ephemeres. They occur at dark-grey soil and solonetzic habitat. Common projective cover makes up 50-65 %.

2.3. Formation of Artemisieto-Comphorosmaetum.
The dominate species of this formation are Artemisia fragrans and subdominate - Camphorosma lessingii. In comparison with other formations Artemisieto-Comphorosmaetum is poorly wide-spread phytocenosis. Its floristical structure is very poor, only 16-18 kinds. The basic background in phytocenosis make Artemisia fragrans and Camphorosma lessingii. Camphorosma lessingii is in height of 20-70 cm, lower parts of stalk lignify, and common projective cover reaches to 50-70%.

To national economic importance of the semidesert type vegetation of Kura-Araks lowland we can add winter pastures and rich natural sources of various vegetative raw materials. Many kinds of this family due to the rich contents of mineral salts, especially carbonic, serve for production of soda and potash (5). Many kinds of desert plants are fodder, food plants, dye plants, alkaloidal, chemozoophobic plants, medicinal etc.

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CARBOHYDRATE METABOLISM IN PEPPER (*CAPSICUM ANNUM* L.) SEEDLINGS UNDER HIGH TEMPERATURE STRESS

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Effects of high temperature on the carbohydrate metabolism were studied in pepper seedlings (*Capsicum annum* L. *cv.* Kekova and Amazon). Seedlings were grown using compost mixture in 14x12 cm pots for four weeks at 25/10^{o}C day/night temperatures in a greenhouse. One half of the grown plants were transferred to a growth chamber with constant 35^{o}C, 70% relative humidity, 16/8 h (light/dark) photoperiod regime and 1200 lux light intensity. Then, temperature was increased stepwise, 5^{o}C in every 24 h., to 40 and 45^{o}C to impose a "gradual heat treatment (GHT)". In addition to other plants, new plants were transferred from greenhouse to the growth chamber at each temperature step to impose a "shock heat treatment (SHT)". Activity of acid invertase and sucrose synthase were evaluated in the leaves of pepper seedling under heat stress. In addition, sucrose and glucose contents in the leaf tissues of these plants were also measured. Our results demonstrated that acid invertase and sucrose synthase activity significantly decreased by heat stress in the leaves of the pepper seedlings. Glucose contents of the leaves of the seedlings exposed high temperatures (35, 40 and 45^{o}C) significantly declined compare to the control seedling (25^{o}C). On the other hand, heat stress dramatically increased the sucrose concentration in the pepper leaf tissues. Both cultivars, “Amazon” and “Kekova”, showed similar trend in terms of reduction in the activity of both sucrose synthase and acid invertase. Sucrose content of pepper leaf tissues went up with exposure to increasing temperatures in both cultivars but the cultivar, “Amazon” contained significantly higher concentration of sucrose than “Kekova”.

Key Words: *Pepper, (Capsicum annum L.), carbohydrate, sucrose synthase, acid invertase*

Introduction

Heat stress due to exposure to high temperature beyond the ambient temperature for plant growth can limit the plant development and cause reduction in the yield and quality of crop plants. Exposure to high temperature can increase or alter metabolic activities and can increase energy demand of plant for growth (Karim *et al.*, 2000). Heat stress can restrict the supply of photo assimilates including carbohydrate since leaf photosynthesis is highly affected by elevated temperatures (Camejo *et al.*, 2005).

Due to the oxidative damage to cells, exposure to heat stress can alter the metabolic pathways and change the amount of both primary and secondary metabolites. Primary metabolites from carbohydrate metabolism are important for osmotic adjustment of cells and build up of cellular structures (Taiz and Zeiger, 2002). Among these primary metabolites, soluble sugars participates in regulation of osmotic activities and protection of cell from stresses such as water, salt and heat stress causing osmotic strain on the plant cell (Wang *et al.*, 2003; Bohnert *et al.*, 2006).

Pepper which is an economically important vegetable crop can be easily exposed to heat stress since it has been grown in the tropics or in the summers of subtropical and temperate climates. Previous study with pepper leaf disk showed that pepper leaves can tolerate heat up to 45^{o}C without significant injury (Anderson, 2002) and the author found that activity of catalases (CAT), major detoxifiers of hydrogen peroxide, was high in pepper leaves. In this study, changes in the activity of enzyme related to the carbohydrate metabolism were evaluated in the 4-week old pepper seedlings exposed to increasing temperature up to 45^{o}C. In addition, effects of increasing temperatures on the concentration of sucrose and glucose in the pepper leaf tissues were investigated.

Materials and Methods

Plant material

Pepper seedlings (*Capsicum annum L. cv*. Kekova and Amazon) were planted in 14x12 cm pots using compost mixture. Plants were grown for four weeks at 25/10^{o}C day/night temperatures in a greenhouse and watered on a needs basis avoiding any additional stress factors.

Heat stress treatments

One half of the grown plants were transferred to a growth chamber with constant 35^{o}C, 70% relative humidity, 16/8 h (light/dark) photoperiod regime and 1200 lux light intensity. Then, temperature was increased stepwise, 5^{o}C in every 48 h., to 40 and 45^{o}C to impose a "gradual heat treatment (GHT)". In addition to these plants, new plants were transferred directly from greenhouse to the growth chamber at 40 and 45^{o}C to impose a "shock heat treatment (SHT)". Plants were kept watered on a needs basis in the growth chamber. Also, control plants were kept in the greenhouse during the treatments.

Determinations of Soluble Sugars

Sugars were extracted by suspending 100 mg of leaves in 5 ml 80 % (v/v) ethanol at 80 ^{0}C for 30 min, then collecting the ethanolic liquid. This procedure was repeated three times. The ethanolic solutions were combined and evaporated to dryness at 40^{o}C with the aid of continuous ventilation. The dried sugars were dissolved in 1 ml distilled water and kept frozen at -20^{o}C until determination. Sucrose concentrations were determined by the anthrone reagent method, as modified for the determination of non-reducing sugars (Van Handel, 1968). Reducing sugar concentrations were determined colorimetrically with dinitro-salicylic acid (Miller, 1959).

Enzymatic activity
Soluble (cytosolic) acid invertase activity in leaf tissue was determined according to Aloni et al. (1991). In short, tissue samples of approximately 300 mg were ground in 5 ml ice-cold grinding medium containing 25 mM HEPES buffer (N2-2-ethanesulphonic acid) pH 7.2, 5 mM $MgCl_2$, 2 mM DDT (DL-Dithiothreitol) and 3 mM DIDCA (diethyldithiocarbamic acid) as antioxidant. This mixture was centrifuged at 20 000 g for 20 min at 4 ^{0}C. Aliquots of 100 µl of the supernatant were incubated in 10 ml 0.1 N phosphate citrate buffer pH 5.0 and 20 mM sucrose. The incubation was carried out for 30 min at 37 ^{0}C and was terminated by addition of 1 ml dinitrosalicylic acid reagent. After boiling for 5 min. the resulting sugars were determined colorimetrically. Sucrose synthase activity was determined by the method developed for melon fruits by Schaffer et al. (1987) and optimised for pepper tissue by Aloni et al. (1996). Following extraction as described for acid invertase the mixture was dialysed overnight in order to remove the internal sugars. The enzymatic activity was determined as sucrose breakdown on aliquots of 200 µl incubated in incubation medium containing 0.1 M phosphate-citrate buffer pH 7.0, 200 mM sucrose and 5 mM UDP. After incubation at 37 ^{0}C for 30 min. the resulting fructose was determined by the dinitrosalicylic acid reaction. The data were expressed on fresh mass basis. Total soluble protein contents of the crude enzyme extracts were determined according to Bradford (1976).

Statistics
The experiment designed as randomized complete block design with tree replication. Following analysis of variance of the data, mean separations were tested by Duncan's multiple range test using the computer program SPSS v.13.0.

Results and Discussion
The activities of acid invertase and sucrose synthase were measured in leaves of pepper seedlings exposed 35, 40 and 45^{o}C. Acid invertase and sucrose synthase activity in these leaves showed similar trend and the activities of both enzymes decreased significantly with increasing temperature for both SHT and GHT (Table 1; Figure 1). In the cultivar, "Kekova", sucrose synthase activity declined with increasing temperatures from 25^{o}C (control) to 45^{o}C by 5^{o}C every 48 hours to impose GHT (Figure 1a). The effects of shock treatment of 40 and 45^{o}C were more severe on the activity of sucrose synthase in the leaves of "Kekova" seedlings. On the other hand, there was no difference between GHT and SHT on the activity of sucrose synthase in the leaf tissues of "Amazon" seedlings although GHT reduced the sucrose synthase activity significantly compare to the control (25^{o}C). Acid invertase activity was declined significantly with GHT in the leaves of both pepper cultivars and SHT resulted in more dramatic reduction in the acid invertase activity in these leaves (Figure 1b). The difference between GHT and SHT is probably due to the ability of pepper seedlings to adapt themselves to heat stress since pepper seedlings exposed to gradual heat treatment can have enough time to alter its metabolic activity.

Table 1.
Acid invertase and sucrose synthase activity, and glucose and sucrose content in the leaves of pepper seedlings[a].

	Acid invertase (mg/g prot./h)	Sucrose synthase (mg/g prot./min)	Glucose (mg/gFW)	Sucrose (mg/gFW)
Cultivars				
Amazon	0.83ns	0.09ns	1.65ns	15.16a
Kekova	0.86ns	0.11ns	1.52ns	7.89b
Temperatures				
Control	1.75 a	0.17a	1.66b	1.53d
GHT-35ºC	1.06b	0.13ab	1.32c	2.75cd
GHT-40ºC	1.07b	0.10bc	1.03c	6.40c
GHT-45ºC	0.55c	0.08c	1.23c	17.18b
SHT-40ºC	0.32c	0.06c	2.07a	14.27b
SHT-45ºC	0.33c	0.08c	2.20a	22.45a

[a] Means within a column followed by the same letter are not significantly differ at $P \leq 0.05$ using Duncan's multiple range test.
ns: Not significant
GHT: Gradual heat treatment; SHT: Shock heat treatment

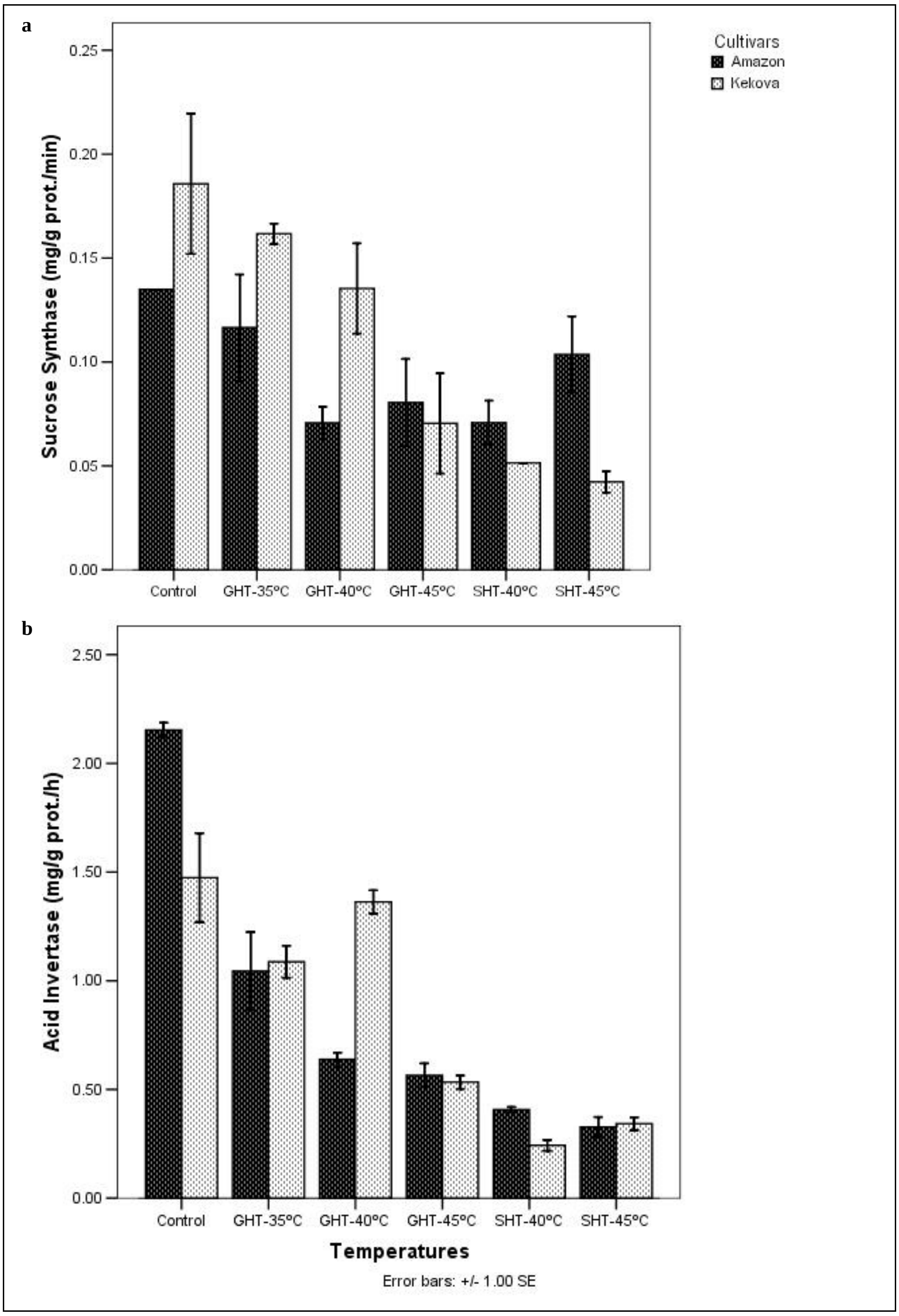

Figure 1. Changes in the sucrose synthase (a) and acid invertase (b) activities in the leaves of pepper seedlings under heat stress. GHT stands for gradual heat treatment while SHT indicates shock heat treatment.

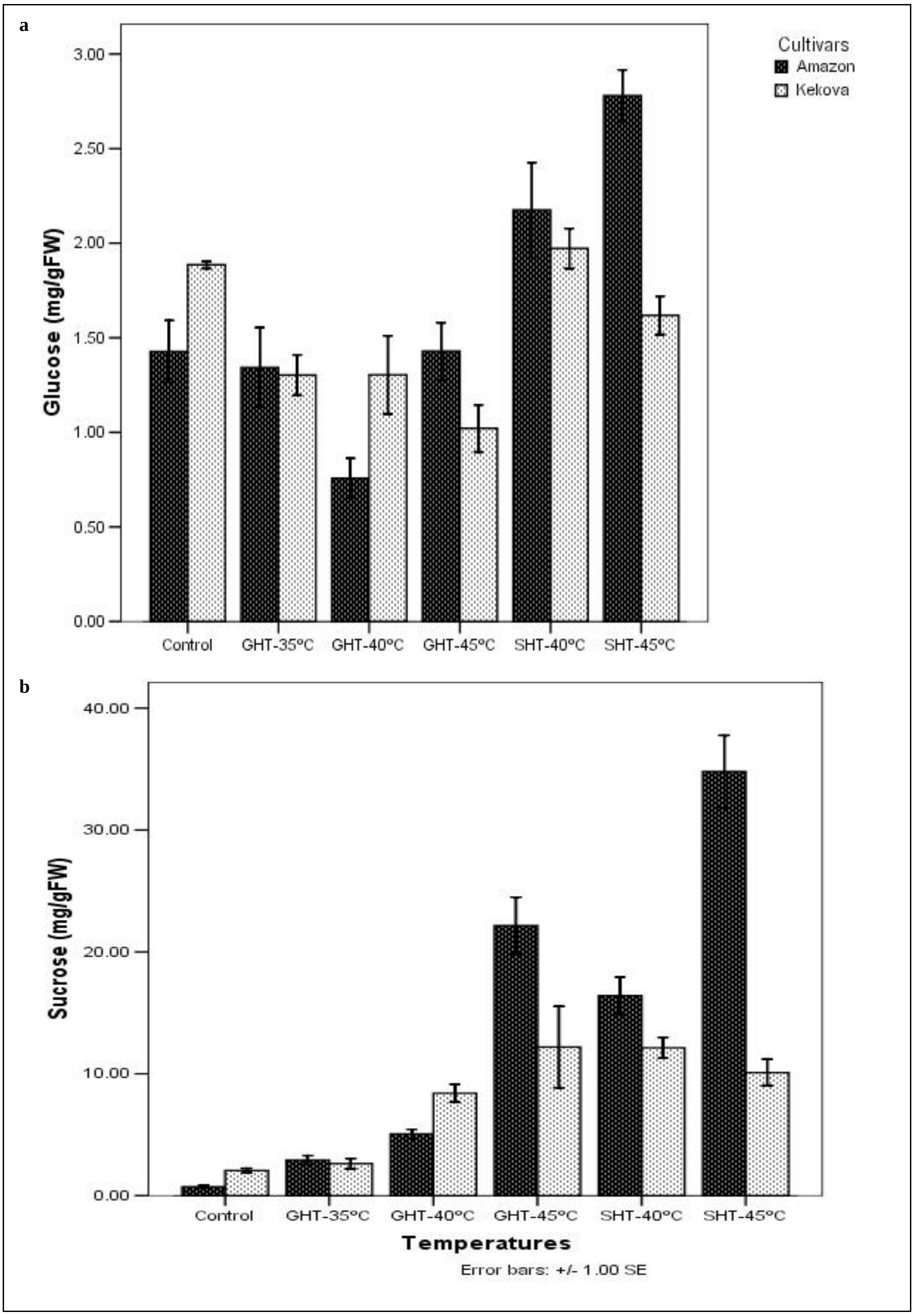

Figure 2. Effects of heat stress on glucose (a) and sucrose (b) concentrations in the leaves of pepper seedlings. GHT stands for gradual heat treatment while SHT indicates shock heat treatment.

Glucose and sucrose contents of the leaves of pepper seedlings treated with increasing temperature were also determined. Although over all glucose content in pepper leaves was decreased significantly with GHT compare to the control plants (Table 1), glucose contents in the leaves of both cultivars fluctuated with GHT (Figure 2a). However, SHT caused significant increase in the glucose content but this increase was probably due to water deficit in these seedlings because of sudden increase in the temperature (Figure 2a). Sucrose concentration in the leaves of pepper seedlings was elevated significantly under heat stress but the increase in the sucrose content of these leaves exposed to 40 and 45^{o}C was dramatic (Table 1; Figure 2b). Similarly, Sepulveda and Kliewer (1986) found significantly high concentration of sucrose in the leaves of grapevines exposed to 40 ^{o}C. In the leaves of sugarcane seedlings exposed to 40^{o}C, soluble sugar concentration increased significantly compare to control (28^{o}C) (Wahid, 2006). Pepper seedlings responded to heat similarly and heat stress increased sucrose concentration in pepper leaves. Our results showed that sucrose concentration in the pepper leaves under heat stress depends on plant genotype. While “Kekova” contained significantly higher concentrations of sucrose in the leaves of control plants than “Amazon” (Figure 2b), sucrose concentration was significantly higher in the leaves of “Amazon” exposed to 40 and 45^{o}C than “Kekova”. This result suggested that plant response to heat stress is genotype dependent.

Dramatic increase in the sucrose concentration under heat stress (Table 1; Figure 2b) is probably resulted from reduction in the activity of acid invertase since invertase breaks down sucrose into glucose and fructose

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RAPD-PCR ANALYSE OF HYPERACCUMULATOR PLANTS *A. corsicum* AND *A. murale* INDUCED BY NI TREATMENT

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Environmental pollution with metals is a worldwide problem and the development of phytoremediation technologies has emerged in the last decade for the plant based clean up of contaminated soils and ground waters. Several microbes, fungi and plants are being tested in lab and field conditions for decontaminating the pollute in the environment. Approximately 400 plants that hyperaccumulate metals have been reported in recent years. The families of hyperaccumulator plants are *Asteraceae, Brassicaceae, Caryophyllaceae, Cyperaceae, Cunouniaceae, Fabaceae, Flacourtiaceae, Lamiaceae, Poaceae, Violaceae* and *Euphorbiaceae*. Among these, *Brassicaceae* had the largest number of hyperaccumulator taxa; 11 genera and 87 species. To date 48 different taxa in the genus *Alyssum (Brassicaceae)* have been found to contain high levels of Ni in leaf dry biomass.

This study reports the changes occuring in random amplified polymorphic DNA (RAPD) profiles of *A. corsicum* and *A. murale* shoots following Ni treatment included variation in band intensity, loss of normal bands and appearance of new bands compared with normal seedlings. These results indicate that genomic DNA was significantly affected by nickel treatment.

Keywords; *Alyssum, RAPD-PCR, Nickel, Metal Hyperaccumulation*

1. INTRODUCTION

The prospect of using plants in the bioremediation of sites contaminated with heavy metals gained considerable currency in recent years (Chaney et al, 1997)**.** The term phytoremediation refers to a diverse collection of plant-based technologies that use either naturally occuring or genetically engineered plants for cleaning contaminated environments (Cunningham et al, 1995). Advantages compared with existing remediation methods include minimal site destruction and destabilisation, low environmental impact and favourable aesthetics (Nedelkoska and Doran, 2000). Hyperaccumulator plants are found in *Brassicaceae*, *Euphorbiaceae*, *Asteraceae*, *Lamiaceae* or *Scrophulariaceae* plant families (Macnair, 1993). The largest group of these so-called ‘metal hyperaccumulators’ is found in the genus *Alyssum* (*Brassicaceae)*, in which nickel concentrations can reach %3 of leaf dry biomass (Kramer et al, 1996).

Environmental pollutants can have deleterious effects on living organisms. At high concentrations, or at high activities, they can cause acute toxicity damaging cells, tissues and organs. Chronic toxification, on the other hand, can also cause serious damage from bio-accumulation. (Conte et al, 1998).

Pure nickel is a hard, silvery-white metal, which has properties that make it very desirable for combining with other metals to form mixtures called alloys and is used in many industrial settings. It is essential to animals and probably to humans in small amounts also. Nickel does not degrade and is not destroyed by combustion. It cycles between the soil, the atmosphere, surface waters and ground water. High levels of nickel can cause allergic reactions and kidney damage. Dust or fumes of nickel can be a human carcinogen. Nickel usage and pollution should be reduced wherever possible (EPA).

To some extent, plants could overcome environmental pollution by developing efficient and specific physio-biochemical mechanisms, but an excess of toxic heavy metal ions induces several cellular stres responses and damage to different cellular components such as membranes, proteins and DNA (Liu et al, 2005)

Different methodologies using molecular markers are widely used to analyse the pattern of variation within and among natural populations . Among the various maker systems, RAPDs are one of the most popular DNA-based approaches. They are the least technically demanding and offer a fast method for providing information from a large number of loci. Moreover, the diversity assessed with RAPDs is comparable with that obtained with allozymes or RFLP (Fontaine et. Al, 2004). The random amplified polymorphic DNA (RAPD) assay and related techniques has been shown to detect effects on DNA (Atienzar, 2002).

The aim of this study is to analyse the DNA changes in hyperaccumulator *A.. corsicum* and *A. murale* induced by Ni treatment by using RAPD-PCR method..

2. MATERIALS AND METHODS

Plant growth conditions

Alyssum murale and *Alyssum corsicum* seeds are taken from the collection of N.Adıgüzel. Seeds were sown into the pots filled with torf (Klassmann Potground 4390). Pots were inserted into vessels, placed in a greenhouse and watered as needed. After a month randomly choosen control pots were watered with Hoagland (1938) solution and the experiment pots were watered with the same solution containing 3.10^{-4} mM $NiCl_2.6H_2O$ for 20 days. At the end of this time plants were harvested shoots were washed to remove adhering soil particles in a distilled water and immediately frozen in liquid nitrogen to save in -80°C until the DNA isolation.

DNA isolation and RAPD-PCR

DNA isolation was performed according to the CTAB method (Rogers et al, 1985) and RAPD-PCR experiments were applied according to the method of Williams et al, 1990. Primers with random nucleotid sequence were choosen from Operon Technologies (Table 2.1). PCR reaction products were seperated alongside DNA molecular size markers by electrophoresis in %2 agarose gels in TAE buffer.

Table 2.1 The primers used in RAPD-PCR

Primer	Sequences (5'.....3')	% G+C content
Primer 1	AGGCCCGATG	70
Primer 2	TGCGCCCTT	70
Primer 3	CACCACGCCT	70
Primer 4	CTGCGCTGG	70
Primer 5	AAGTCCGCT	60
Primer 6	TGCTCTGCCC	70
Primer 7	CTGCTGGGAC	70
Primer 8	GAAACGGGTG	60
Primer 9	GAGGGTGGCGGTTCT	66,7

3. RESULTS AND DISCUSSION

A. murale and *A. corsicum* plants were grown in greenhouse and treated with 3.10^{-4} mM $NiCl_2.6H_2O$. Total genomic DNA of the plants were isolated and RAPD-PCR was applied to evaluate the effects of Ni, in order to estimate the environmental risk connected with its potential mutagenic effects in the plant *Alyssum*.

Total 9 primers were tested in RAPD-PCR experiments. The RAPD fingerprints showed the differences between unexposed and exposed plants with apparent changes in number, size and the intensity of amplified DNA fragments (Figure 3-1,3-2).

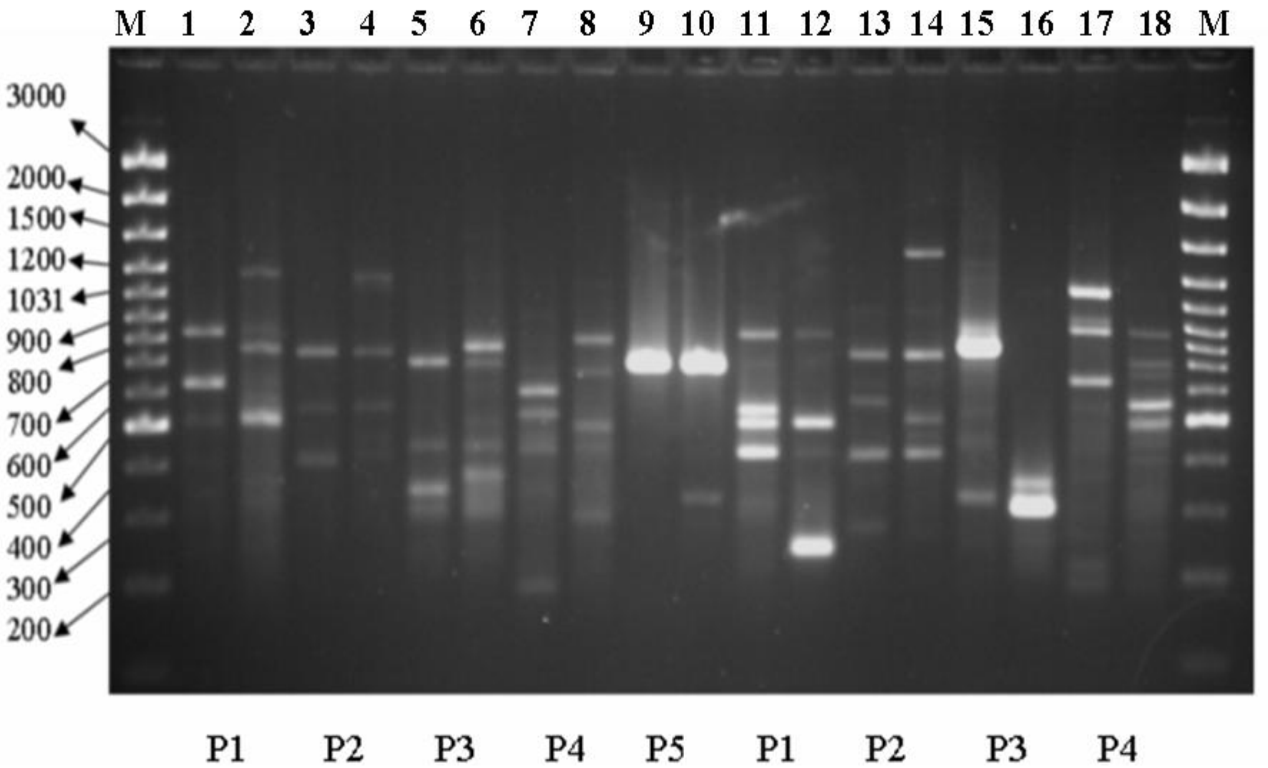

Figure 3.1 RAPD profiles of genomic DNA from the shoots of *A. murale* and *A. corsicum* plants (control and exposed to 3.10^{-4} mM Ni)

M- Marker (100 bp DNA Ladder)
1- *A. murale* Ni primer 1
2- *A. murale* Control primer 1
3- *A. murale* Ni primer 2
4- *A. murale* Control primer 2
5- *A. murale* Ni primer 3
6- *A. murale* Control primer 3
7- *A. murale* Ni primer 4
8- *A. murale* Control primer 4
9- *A. corsicum* Ni primer 5
10- *A. corsicum* Control primer 5
11- *A. corsicum* Ni primer 1
12- *A. corsicum* Control primer 1
13- *A. corsicum* Ni primer 2
14- *A. corsicum* Control primer 2
15- *A. corsicum* Ni primer 3
16- *A. corsicum* Control primer 3
17- *A. corsicum* Ni primer 4
18- *A. corsicum* Control primer 4
M- Marker (100 bp DNA Ladder)

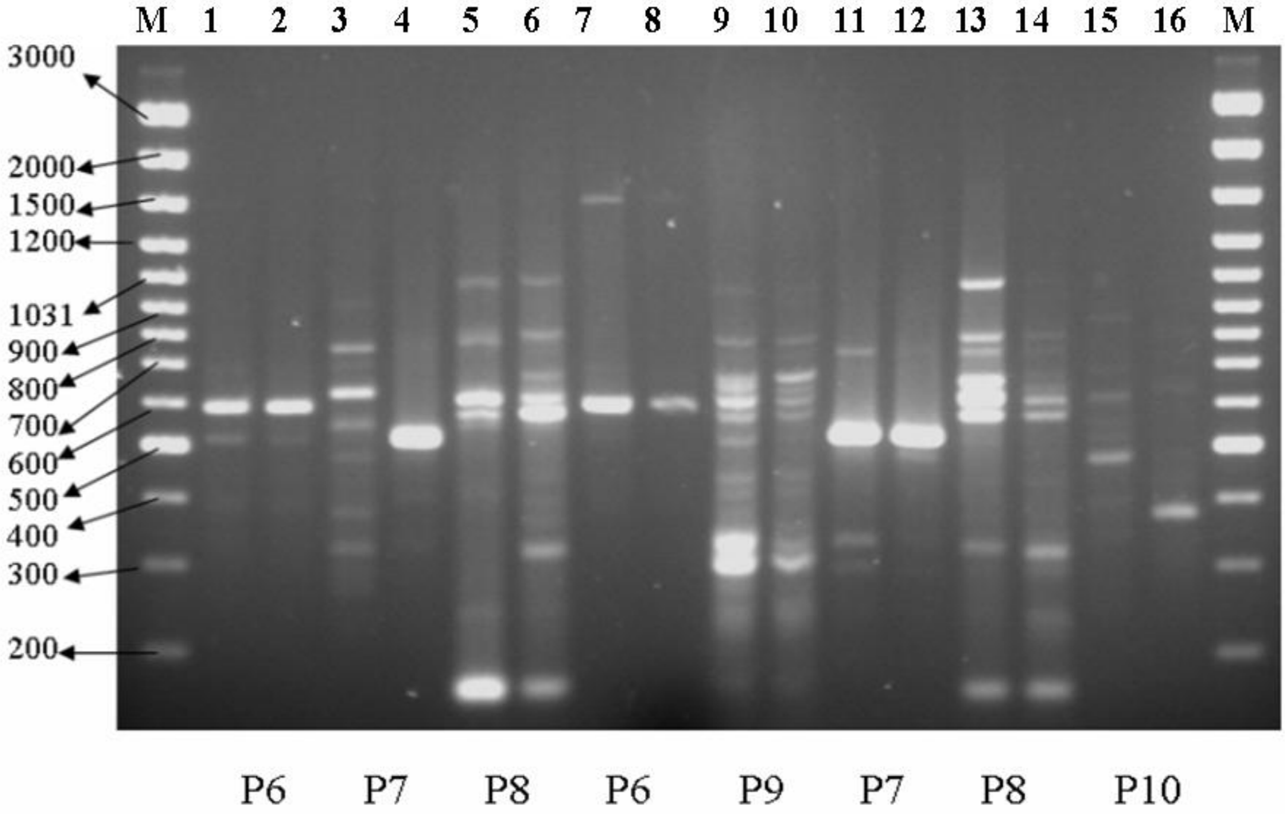

Figure 3.2 RAPD profiles of genomic DNA from the shoots of *A. murale* and *A. corsicum* plants (control and exposed to3.10^{-4} mM Ni)

M- Marker (100 bp DNA Ladder)
1- *A. murale* Ni primer 6
2- *A. murale* Control primer 6
3- *A. murale* Ni primer 7
4- *A. murale* Control primer 7
5- *A. murale* Ni primer 8
6- *A. murale* Control primer 8
7- *A. corsicum* Ni primer 6
8- *A. corsicum* Control primer 6
9- *A. corsicum* Ni primer 9
10- *A. corsicum* Control primer 9
11- *A. corsicum* Ni primer 7
12- *A. corsicum* Control primer 7
13- *A. corsicum* Ni primer 8
14- *A. corsicum* Control primer 8
15- *A. murale* Ni primer 10
16- *A. murale* Control primer 10
M- Marker (100 bp DNA Ladder)

Different polymorphic bands were detected with all the primers tested, expect primer 6 tested with *A. murale* and primer 9 tested with *A. corsicum*. In each cases polymorphisms were due to the loss and/or gain of the bands in the Ni treated samples compared with the control. Also differences occured with the changes in the intensity of the bands (Table 3.1).

A total of 49 RAPD fragments in RAPD profiles of *A. murale* were detected by using eight random primers that gave bands ranging between 100-1200 bp . The most obvious band losses of *A. murale* was; at primer 1, (800-700 bp bands), at primer 4, (800bp band) and at primer 7 (500 bp band). In contrast, Ni treated plants had some different bands compared with the control plants; at primer 1 (700bp), at primer 4 (600 kb), at primer 7 (800, 700 bp).

A total of 72 RAPD fragments in RAPD profiles of *A. corsicum* were detected by using nine random primers that gave bands ranging between 100-1200 bp . The obvious band losses of *A. corsicum* was; at primer 1 (300bp band), at primer 2 (1500bp), at primer 3 (300 bp) at primer 4 (600 and 500 bp). The bands differing from the control plants are at primer 1 (600 bp) at primer 2 (600 bp) at primer 3 (800 bp) at primer 4 (1200 bp) and at primer 8 (700 bp).

Table 3.1. Changes of total bands in control and Ni treated *Alyssum* species

	A. murale				*A. corsicum*			
	A	B	C	D	A	B	C	D
Primer 1	2	2	1	-	1	1	-	-
Primer 2	-	1	-	-	2	2	-	-
Primer 3	1	2	-	1	3	2	-	-
Primer 4	3	4	-	-	2	4	-	-
Primer 5	No amplification				-	1	-	-
Primer 6	-	-	-	-	1	-	-	1
Primer 7	5	1	-	-	3	-	-	-
Primer 8	-	2	1	2	4	1	-	2
Primer 9	No amplification				-	-	-	2
Primer 10	2	1	-	-	No amplification			

*A: appearance of new bands, B: disappearance of bands C: decrease in band intensity D: increase in band intensity

Previous studies with different heavy metals have shown the DNA changes at various plant species induced by the treatment of these metals (Atienzar et. al., 2002; Conte et. al., 1998; Enan, 2006). These results also supported that RAPD method offers an appliable assay in determining the effects of heavy metals on DNA profiles.

In this study results suggested that changes in RAPD profiles were significantly affected at the concentration (3.10^{-4} mM Ni) of the tested heavy metal. In the other hand, in our studies about the effects of Ni, on hyperaccumulator species, interestingly either plants growing in greenhouse or the plants growing in tissue culture with different concentrations of Ni showed no obvious morphological difference when compared with the control plants expect for the high concentrations. Finally, a comparison between untreated and treated genomes shows that RAPD analysis can be used to evaluate how the environmental pollutants modify the structure of DNA in *Alyssum* species.

In the future studies genes expressed in various concentrations of Ni existance and the ones that have been lost under Ni treatment will be investigated.

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SOME INFORMATION ABOUT NEAR EAST UNIVERSITY

Near East University was established in 1988 and since then has grown to become one of the fastest growing universities in the world setting itself the strategic goal of joining the "top 500 universities in the world".

From 1988 until now, the University has managed to expand its physical infrastructure and improve its quality of education and scientific research to meet international standards. Near East University is a member of the European University Association, the International Association of Universities and the Federation of the Universities of the Islamic World. The University has over 3,000 staff, of which 1,000 are academic personnel. 17,000 students from 53 different countries are attending 14 faculties and more than 60 departments at the university. It has luxury halls of different sizes which in total cover an area of 350,000m^2 and have the capacity to hold a total of 5,000 people. There are also 14 dormitories with a capacity of 5,000 students, but the construction of new dormitories is also planned.

Near East University has adopted life long education as its main mission. Thus, we begin with our Kindergarten, Junior College and Secondary High School which have a total number of 2,000 students. The faculties and departments offering undergraduate and graduate degrees are as follows:

FACULTIES

1. Faculty of Architecture
    - Architecture
    - Interior Design

2. Faculty of Arts and Sciences
    - English Language & Literature
    - Mathematics
    - Turkish Language & Literature
    - Psychology

3. Faculty of Economics & Administrative Sciences
    - Banking & Finance
    - Business Administration
    - Computer Information Systems
    - Economics
    - European Union Relations
    - Human Resources Management
    - International Business
    - International Relations
    - Marketing
    - Political Sciences
    - Information & Records Management

4. Faculty of Communication
    - Radio-Television-Cinema
    - Motion Picture Production
    - Journalism
    - Public Relations & Advertising

5. Atatürk Faculty of Education
    - English Language Teaching
    - Computer & Teaching Technologies
    - Pre-school Teaching
    - Elementary Teaching
    - Turkish Language Teaching
    - Guidance & Psychological Counseling
    - Human Resources
    - History Teaching

6. Faculty of Engineering
    - Civil Engineering
    - Computer Engineering
    - Electrical & Electronic Engineering
    - Mechanical Engineering
    - Biomedical Engineering

7. Faculty of Fine Art & Design
    - Graphic Design
    - Plastic Arts

8. Faculty of Maritime Studies
    - Department of Deck
    - Maritime Management
    - Marine Engineering

9. Faculty of Law
    - Law

10. Faculty of Performing Arts
    - Dramaturgy & Dramatic Authorship
    - Acting

11. Faculty of Pharmacy
    - Pharmacy

12. Faculty of Dentistry
    - Dentistry

13. Faculty of Health Sciences
    - Nutrition and Dietetics
    - Nursing

14. Faculty of Medicine

SCHOOLS

1.School of Physical Education & Sports
-Coaching Education
-Physical Education and Sports Teaching
-Sports Administration

2.School of Tourism & Hotel Management
-Tourism & Hotel Management

3. School of Maritime
-Deck
-Marine Engineering
-Maritime Management

INSTITUTES

-Institute of Education Sciences
-Institute of Sciences
-Institute of Social Sciences
-Institute of Health Sciences

With the opening of the NEU Grand Library in December 2005, the University has passed a new and critical mileage stone entering truly the information age. The Grand Library is fully computerized and linked to many major world libraries and research institutions throughout the world. The library has a collection of more than 600,000 printed materials and access to more than 110 million electronic articles. The library has recently been elected as the central library for the Turkic world and now serves universities of several different countries such as Azerbaijan, Kyrgyzstan and Turkmenistan. The library is open 24 hours a day serving not only the university but the whole community.

The University has until now organized 14 International Conferences & Congresses and many local and regional conferences, seminars and panel discussions on a variety of subjects. Near East University believes that the role of the University is not merely to provide formal education but to establish close relations with the wider community. As such, it places special emphasis on strengthening and developing campus-community relations. The University set up a Lifelong Education Centre (YABEM) which provides a wide variety of adult education courses. The University also makes the use of its facilities for cultural, sports and recreation activities available to the public.

As you can see, NEU is one of the fastest growing Universities of the world. The last two years has been devoted towards Health Sciences. This year, we began education in the Faculty of Dentistry, Faculty of Pharmacy and Faculty of Health Sciences. Another important improvement that has been made in our university regarding Health is that in September 2008, education has begun in the Faculty of Medicine. The Faculty of Medicine Research Hospital will be opened in July 2009. The Hospital will have a capacity of 500 beds with a 4,5000m^2 closed area. The faculty will be giving full service but a special emphasis will be given to researches on Oncology and Cardiology.

NEU does not have boundaries in development. Therefore, a protocol was signed with IBM International in June 2007 for the construction of the NEU Innovation Centre. The building having a closed area of 8,500m^2 was opened last year. It consists of 3 sections: NEU-IBM Innovation Centre, NEU-IBM Advanced Research Centre and the NEU Technopark. The 'super computers' used in the building have a capacity of 12 trillion processes per second. The research areas consist of Global Warming, Earthquake Stimulation, Defense Research (military), Space Research, High Physical Energy, Nanotechnology and Biotechnology research and product design, Medical, Pharmaceutical, Microbiological, Health Science and Social Sciences. NEU Innovation Centre is unique with its facilities in Eastern Europe, Middle East, Central Asia and Northern Africa.

BRIEF INFORMATION ABOUT TURKISH REPUBLIC OF NORTHERN CYPRUS

History: Cyprus has been occupied successively by Assyrians, Babylonians, Egyptians, Persians, Romans, Lusignans and Venetians who have sought the island's wealth of minerals and timber since the 8th century BC. The Ottoman Empire conquered the island in 1571 and ruled it until the island was leased to the British Empire in 1878. In 1963, the Republic of Cyprus was established by the Turkish Cypriot and Greek Cypriots, based on political equality. The Turkish Cypriots were forcefully ejected from the state mechanism in 1963. Intercommunal clashes which broke out in 1960 continued until 1974. A military coup by Greece in 1974 aiming to annex the island to Greece was aborted by the intervention of Turkey, which was one of the Guarantor Countries. Following the Exchange of Populations Agreement in 1975, Turkish Cypriots moved to the north and Greek Cypriots moved to the south of the island. Consequently, the Turkish Cypriots established their own administration and in 1983, the Turkish Republic of Northern Cyprus was proclaimed.

Negotiations between the two sides under the auspices of the UN started in 1968, with the aim of finding a comprehensive settlement in Cyprus. The latest negotiation process came to an end when the compromise plan, Annan Plan, prepared by the then UN Secretary General Kofi Annan, was overwhelmingly rejected by the Greek Cypriot people. During the referendum held on 24 April 2004, whilst 65% of the Turkish Cypriots voted "Yes", 75% of the Greek Cypriots voted against the plan; thus, eliminating the possibility of establishing a new partnership republic. Despite their obstructionist attitude, the Greek Cypriot administration unilaterally entered the European Union under the usurped title of the "Republic of Cyprus", on 1 May 2004. The then UN Secretary General Kofi Annan, expressed his regret and noted that *"he hoped ways would be found to ease the plight in which the (Turkish Cypriot) people find themselves through no fault of their own"* (24 April 2004). In his report to the Security Council, he called upon the international community to *"cooperate both bi-laterally and in international bodies to eliminate unnecessary restrictions and barriers that have been the effect of isolating the Turkish Cypriots and impeding their development"* (S/2004/437). The current UN Secretary General Ban Ki-moon also referred to the economic and social isolation of the Turkish Cypriot people in his report to the UN Peacekeeping Force in Cyprus (UNFICYP) in December 2007, pointing out that promoting the development of the Turkish Cypriot people would make the reunification of the island "occur in as seamless a manner as possible." Observing the injustice against the Turkish Cypriots, who have been experiencing all kinds of inhuman restrictions for years, the EU also expressed its will to enhance the economic development of Turkish Cypriots through an aid package. The EU Commission adopted a proposal, which had foreseen the transfer of 259 million Euros financial aid. However, the Turkish Cypriots have not been effectively benefiting from the EU aid due to Greek Cypriot administrations' pressures.

After the Presidential elections in February 2008 on the Greek Cypriot side, President Mehmet Ali Talat has reiterated once again his readiness for a new process of full-fledge negotiations and expressed his sincerity towards a solution.

Places to visit: In Lefkoşa (capital): Selimiye Mosque, Mevlevi Museum, Sultan Mahmut Library, Dervish Pasha Mansion and Lapidary Museum. In Gazimağusa: Antique Ruins of Salamis, Kantara Castle, Othello Castle, Lala Mustafa Paşa Mosque, Canbolat Museum, Ruins of Ayios Philion, St. Barnabas Icon Museum and Apostolos Andreas Monastry. In Girne: Kyrenia Castle, Bellapais Abbey, St. Hilarion Castle and Buffavento Castle, and in Güzelyurt: Soli Ruins, St. Mamas Monastry and Vouni Palace.

Nature: North Cyprus hosts over 1,600 plant species (22 are endemic), 350 species of birds (7 are endemic), and there are 26 different species of reptiles and amphibians. Every year, 250 different kinds of birds, around 100 million, migrating from Europe to Egypt pass through North Cyprus. The country also became home to some 50 different varieties of butterflies. Visitors are amazed to see that there are 30 different varieties of orchids on the island, 7 of them unique to North Cyprus. Rich underwater plant life and 200 different types of fish are making the blue Mediterranean waters attractive for sea lovers. 30% of the turtles in the Mediterranean, amongst them Carretta Caretta, Chelania Mydas (Green Turtle) and Dermachelys Corniacea, come to the coasts of North Cyprus for breeding.

Life-style, Culture: Turkish Cypriots are well-educated, social and hospitable people. North Cyprus is popular with its handicrafts, cuisine, traditional music and folk dancing. The Turkish Cypriot Cuisine is famous for its kebab dishes and starters called “mezes”. Daily fresh fish, meat, vegetables and fruit used in the Turkish Cypriot cuisine make the dishes both tasty and healthy. Local alcoholic drinks include rakı, brandy and red and white wine. Baklava, kadayıf and katmer are deserts favoured by most and Turkish Coffee is a must at the end of every dinner. The cultural and art facilities make the country attractive both for the tourists and foreign students. During the hot summer months, people prefer to relax by the sea whereas during the fall season, people go on picnics and long walks in the mountains and countryside. Indoor activities like exhibitions, cinemas, theatres and concerts are always available.

Electricity: 240 volts A/C. 50 Hz.

Traffic: Driving is on the left and international traffic and road signs are used. Maximum speed on highways is 100 km/hr. Vehicles entering North Cyprus must be insured upon arrival. Please refer to the Turkish Embassy or TRNC Representative Office in your country to check visa requirements.

Climate: North Cyprus enjoys a Mediterranean climate with long, dry summers and short wet winters. The average annual temperature is 19ºC. The weather in winter is very mild with temperatures ranging between 9ºC-12ºC. Average annual rainfall is 500mm.

Emergency telephone numbers: Fire 199, Police 155, First Aid 112


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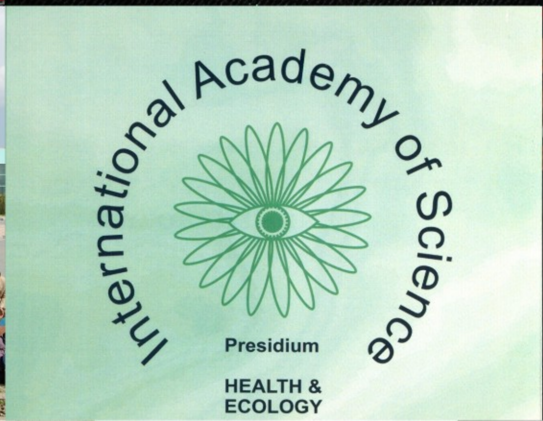
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