SALVIA SPECIES OF CYPRUS AND SPATIAL DISTRIBUTION ANALYSIS OF SALVIA VENERIS HEDGE ENDEMIC TO NORTHERN CYPRUS

A THESIS SUBMITTED TO THE GRADUATE SCHOOL OF APPLIED SCIENCES OF NEAR EAST UNIVERSITY

By
İZEL HACIOĞULLARI

In Partial Fulfilment of the Requirements for the Degree of Master of Science in Landscape Architecture

NICOSIA, 2017

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NEU 2017

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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

İzel HACIOĞULLARI

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Date:

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To my Father Zafer Yılmaz HACIOĞULLARI…

ABSTRACT

There are 11 Salvia (Sage) species which are the members of the Lamiaceae family located in Cyprus. *Salvia veneris* Hedge was chosen as a study material which is endemic plant species to Northern Cyprus. Field surveys, conducted between March-June 2017, have attempted to determine the distribution area and population size of the species. For this purpose, sampling stations points are identified in the areas where the plant is located and coordinates of these points are taken with GPS. Also at these points adult and young individuals were counted. Distribution and population size analysis of this plant were performed with the Distance 7.0 software. As the result of the study 10 localities were determined for *S. veneris* species and these localities constitute an area of 10.19 km^2. The number of individuals in the field is 74,595. According to the IUCN (2012) categories, the threatened species category is CR B1b(i, ii, ii). *S. veneris* is a critically endangered plant species which has a narrow distribution area of less than 100 km^2 and the quality of habitat area continues to decline. For this reason, this species has a high risk of extinction in the wild.

Keywords: *Salvia veneris*; Lamiaceae; Distribution; Population size; Endemic; Cyprus

ÖZET

Kıbrıs'ta Lamiaceae familyasına ait 11 tane Salvia (Adaçayı) türü gözlemlenmektedir. Kuzey Kıbrıs'a endemik olan *Salvia veneris* Hedge türü çalışma materyali olarak seçilmiştir. 2017 Mart-Haziran ayları arasında gerçekleştirilen arazi çalışmaları ile bu türün yayılış alanı ve populasyon boyutu belirlenmeye çalışılmıştır. Bu amaçla bitkinin bulunduğu alanlarda noktasal çalışma istasyonları belirlendi ve bu noktaların GPS ile koordinatları alındı. Ayrıca bu noktalardaki ergin ve genç bireylerin sayımı yapılmıştır. Bitkinin dağılımı ve populasyon boyutu ile ilgili analizler Distance 7.0 programı ile gerçekleştirilmiştir. Bu çalışmadaki analizler sonucunda türün bulunduğu 10 lokalite belirlenmiş olup türün yaklaşık 10.19km² bir alanda yayılış gösterdiği belirlenmiştir. Çalışmalar sonucunda bu alan içerisindeki birey sayısı 74,595 olarak hesaplanmıştır. Bu verilere ve IUCN (2012) kategorilerine göre türün tehlike kategorisi CR B1b(i,ii,iii) olarak belirlenmiştir. IUCN kategorilerine göre *S. veneris* kritik derecede tehlike altındadır. 100 km²'den az, dar yayılış alanına sahip olması ve yaşam alanının kalitesi düşmeye devam etmesi sebebiyle vahşi doğada aşırı derecede yok olma riski ile karşı karşıyadır.

Anahtar Sözcükler: *Salvia veneris*; Lamiaceae; Dağılım; Populasyon boyutu; Endemik; Kıbrıs

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INTRODUCTION

The Mediterranean Basin is one of the world's richest places in terms of plant and animal diversity. This diverse region, is a mosaic of natural and cultural landscapes, where human civilization and wild nature have coexisted for centuries. The Mediterranean is particularly noted for the diversity of its plants about 25,000 species are native to the region, and more than half of these are endemic species (Cuttelod et al., 2008). This richness of biodiversity has led to the Mediterranean being recognized as one of the first 25 Global Biodiversity Hotspots (Myers et al., 2000).

Mediterranean Basin comprises one of the largest groups of islands in the world with almost 5,000 islands and islets. Mediterranean islands are showing extraordinary features, with high rates of endemism, and act as a natural laboratory (Cuttelod et al., 2008).

Cyprus is an island in Mediterranean Basin. It is the third largest island in the Mediterranean and it has an area of approximately 9,251 km^2. North Cyprus has an area of approximately 3,355 km^2. The climate of Cyprus is arid Mediterranean, with a relatively short, cool, wet winter, followed by long, dry, very hot summer. However, there is sufficient diversity in topography and microclimates to allow for an unexpectedly large range of plant communities (Meikle, 1977).

1.1 Flora of Cyprus

The first scientific study about flora of Cyprus began with the arrival of John Sibthorp and his companions at Larnaca, in April 1787 (Meikle, 1977; Tsintides, 1998). After Sibthorp many other botanists and collectors did studies about Cyprus flora and they did large number of different scientific publications. These botanists and collectors are the Austrian Karl Georg Theodor Kotschy, the Italian Gregorio Rigo, the German Paul Ernst Emil Sintenis, the Norwegian Jens Holmboe, Manoog Haradjian, Harald Lindberg, Mr. A. Syngrassides, A. K. Jackson, W. B Turrill, Mrs. E. W. Kennedy, Dr. P. H. Davis, Mr. G. A.

Mavromoustakis, Mrs. E. F. Chapman, Mr. L. F. H. Merton, Mr. Edwards C. Casey, Miss G. E. Atherton and Mrs. N. Macdonald (Meikle, 1977; Tsintides, 1998). Karl Georg Theodor Kotschy did the most valuable studies on the Island's flora and vegetation " Studies on the Vegetation of Cyprus (1914)" and Mrs E. F. Chapman wrote a valuable guide for Cyprus woody plants " Trees and shrubs of Cyprus (1949)" (Meikle, 1977; Tsintides, 1998). R.D. Meikle wrote a valuable book about flora of Cyprus. R.D. Meikle presented the first volume of "Flora of Cyprus" in 1977 and this study was completed later in 1985, with the edition of second volume (Tsintides, 1998). The book of "Flora of Cyprus" contains detailed description of all indigenous and main introduced plant taxa which were recorded and published in Cyprus by the time (Tsintides, 1998). In Cyprus flora, the pteridophyta has 9 family, 12 genus and 20 species; the gymnosperm has 3 family, 5 genus and 12 species, the dicotyledons 89 family, 465 genus, 1206 species; monocotyledons has 18 family, 138 genus, 339 species. There are 119 family, 620 genus and 1577 species in the flora of Cyprus (Meikle, 1977,1985). The Cyprus Flora comprises about 1800 indigenous plant taxa of which about 128 are endemics (Tsintides, 1998). Cyprus flora is as rich as other mediterranean countries. However Cyprus has already lost an unknown number of plants and plant taxa known to be common are now reported as rare, threatened or endangered (Tsintides, 1998).

1.1.1 Plant habitat groups in Cyprus

Tsindites (1998) divided Cyprus plant habitat into six large groups. These are pine forests, garigues and maquis, rocky areas, coastal areas, wetlands and cultivated areas (Tsintides, 1998).

1.1.1.1 Pine forests

Pine forests contitute the most important and largest natural habitat of the wild flora of the Cyprus. They are found in the entire altitudal spectrum, from sea level to highest level in Cyprus. Pine forests are the final vegetation community in areas where natural succession is not being constantly disrupted by human activities and where soil is not severely eroded (Tsintides, 1998).

Natural pine forests are not observed from Mesaria plain to Guzelyurt because of the low precipitation (under 350 mm). This low precipitation not allow establishment and development of natural pine forest. The pine forests divided into two zones. These are Brutia pine zone and Black pine zone. Brutia pine zone occur a tree species *Pinus brutia* Tenore. and Black pine zone occur a tree species *Pinus nigra* J.F.Arnold (Tsintides, 1998).

The Brutia pine zone: *Pinus brutia* forests distributed at the altitudes from sea level up to 1200 m and 1400 m on south facing aspects. It covers a total area of 100.000 ha, representing about 11 percent of the total area of the island. The mean annual precipitation in *Pinus brutia* zone ranges from 450 mm to 800 mm (Tsintides, 1998).

The Black pine zone: *Pinus nigra* forests distributed at the highest elevations of Trodos Forest between 1200-1900 m. *Pinus nigra* forests covers about 6000 ha but they include plant habitats which are most important to Cyprus. The mean annual precipitation in *Pinus nigra* zone ranges from 800-1000 mm. In this area snowfall and very low temperatures observed in winter (down to -10^0C) and summers are cool . The pine forests include the main habitats for 50 endemic plant taxa or 40 percent of the endemic plants of Cyprus (Tsintides, 1998).

1.1.1.2 Garigues and maquis

Garigues and maquis are anthropogenic origin and an important part of Cyprus landscape. These vegetations formed as a result of soil erosion, destruction of forests by fires and overgrazing. Garigues, maquis and pine forests are formed in this order where the soil is not seriously eroded and other ecological factors are favourable, and as a result of this forests occurs again. Garigues and maquis seem to be final vegetation community where soil is very eroded. This group of habitats distributed the entire altitudinal range of Cyprus. Also this group of habitats divided into 3 subgroups. These subgroups are garigue on dry, eroded soils; garigue on moderately eroded soils and maquis (Tsintides, 1998).

Garigue on dry, eroded soils: They are distributed at low altitudes on the dry, eroded hills of the Mesaria plain, around Nicosia and in the eastern part of Larnaka district. These habitats generally distributed at the white coloured dry hills where high shrubs are completely absent and the vegetation cover rarely exceeds 40-50 percent of the ground area. The main plant species are *Crataegus azarolus* L., *Zizyphus lotus* L., *Nonea mucronata* Forssk., *Phagnalon rupestre* L., *ssp. Rupestre*, *Thymus capitatus* L., *Fumana spp.*, *Sarcopoterium spinosum* L., *Asparagus stipularis* Forssk., *Helianthemum obtusifolium* Dunal, *Asperula cypria* Ehrend. etc. (Tsintides, 1998).

Garigue on moderately eroded soils: They are distributed from sea level up to the Trodos Range in areas with moderate soil erosion and where vegetation is periodically burnt (every 5-15 years). The garigue may develop into maqui where the soil has not been affected seriously and where fire allows. Vegetation is dominated by subshrubs and low shrubs. There are also found isolated high shrubs and trees. In this vegetation area total ground cover usually exceeds 50 percent. The main plant species are *Genista sphacelata* Spach., *Calicotome villosa* Poiret., *Cistus spp.*, *Lithodora hispidula* Sm., *Prasium majus* L., *Pterocephalus multiflorus* Poech, *Ephedra fragilis* Desf., *Thymus capitatus* L., *Fumana spp.*, *Salvia fruticosa* Miller, *Asperula cypria* Ehrend., *Lavandula stoechas* L. etc. (Tsintides, 1998).

Maquis: They are distributed near the coast areas with precipitation more than 450 mm and at higher altitudes up to 1000m. In this vegetation area dominant plants are evergreen, sclerophyllous shrubs of different heights (1-5m). Also isolated trees, subshrubs and herbs found in this vegetation area. The main plant species of the low altitude maquis are *Juniperus phoenicea* L., *Pistacia lentiscus* L. , *Ceratonia sliqua* L., *Olea europaea* L., *Cistus spp.*, *Salvia fruticosa* Miller. The main species of the high altitude are *Quercus alnifolia* Poech, *Arbutus andrachne* L., *Pistacia terabinthus* L., *Quercus coccifera* L., *Crataegus spp.* etc. (Tsintides, 1998).

1.1.1.3 Rocky areas

These areas are low or high altitudes of rocky outcrops, igneous or limestone formations and slopes. The vegetation on rocky sites are sparse as expected. Plants thrive only single or in small groups in pockets, clefts, fissures, crevices, cavities, etc. at rocky areas. Usually there is no trees and shrubs and when present they attain a dwarf form. The main species of rocky areas are *Sedum spp.*, *Umbilicus spp.*, *Arabis spp.*, *Ptilostemon chamaepeuce* Cass., *Thlaspi* *cyprium* Bornm., *Asperulla cypria* Ehrend., *Micromeria spp.*, *Gagea spp.*, etc.. There *are* about 24 endemic plant species in rocky areas. Some of these species are *Dianthus cyprius* A.K. Jacks. & Turrill, *Micromeria chionistrae* Meikle etc. (Tsintides, 1998).

1.1.1.4 Coastal zone

This zone includes a narrow belt 50-150m in width along the coast, which is permanently affected by the salinity of water in the soil and the air. The vegetation is mostly low and sparse. It is composed of plants which are adapted to the specific ecological conditions prevailing near the coast and characterized mainly by the high salinity of soil and air. The main species of coastal zone are *Pancratium maritimum* L., *Cakile maritima* Scop., *Centaurea aegialophila* Wagenitz., *Crithmum maritimum* L., *Echium angustifolium* Mill., *Limonium spp.*, *Medicago marina* L., *Verbascum sinuatum* L. etc.. Some of endemic plant species located in coastal zone are *Traxacum aphrogenes* Meikle and *glacucous ssp. cyprius* Meikle (Tsintides, 1998).

1.1.1.5 Wetlands

Wetlands are smallest habitat group in Cyprus. These areas contains salt lakes, main stream beds and small marshy areas. The main feature of these areas is the permanent, high availability of water and the high water table. In these areas sometimes the soil has the poor aeration because of the waterlogging of soil. In the case of salt lakes, there is high soil salinity and in these areas only certain plants can survive, such as plants belonging to the genera *Salicornia*, *Arthrocnemum, Sueda, Juncus,* etc.. The main species found in wetlands are *Alnus orientalis* Decne., *Arundo donax* L., *Laurus nobilis* L., *Mentha spp., Nerium oleander* L., *Platanus orientalis* L., *Rubus sanctus* Schreb., *Juncus spp.* etc.. Some of endemic plant species located in wetlands are *Mentha longifolia ssp.cyprica* Harley. and *Cyperus cyprius* C.B. Clarke (Tsintides, 1998).

1.1.1.6 Cultivated areas

Cultivated areas contains agricultural lands and edges of these lands. Also they include disturbed landscape areas and fallow areas. They occupy the largest area in Cyprus but their value as habitats is very limited. Some of endemic plant species located in cultivated areas are *Urtica dioica spp. dioica* Lindberg. and *Onopordum cyprium* Eig (Tsintides, 1998).

1.1.2 Botanical divisions in Cyprus

Meikle (1977), illustrate the internal distribution of each species in Cyprus with 8 botanical divisions. Botanical divisions map of Cyprus shown in Figure 1.1.

1.1.2.1 Division 1

Division 1 is located in Paphos Range in Cyprus. This area is very heterogeneous as a topographically, geologically and floristically, with much natural vegetation. Its topography is consist of hills, with deep narrow gorges cut through chalk, limestone or sandstone, and with interesting areas of serpentine in the west about Smyies. In this area coasts are generally low and sandy except for a limited range of steep cliffs just N.W. of the Baths of Aphrodite. The noteworthy species found in division 1 are *Cistus monspeliensis* L., *Alyssum akamasicum* B.L. Burtt, *Arenaria rhodia* ssp. *cypria* (Holmboe), *Pistacia* x *saportae* Burnat, *Trifolium argutum* Banks & Sol., *Arbutus unedo* L., *Phlomis lunariifolia* Sm., *Tulipa cypria* Stapf ex Turrill, *Scilla cilicica* Siehe, *Maillea crypsoides* Boiss. (Meikle, 1977).

1.1.2.2 Division 2

Division 2 is located in Trodos Range in Cyprus. Its topography consists of high but usually rounded or pyramidal, igneous peaks, with much of the ground above 4,000 feet, reaching 6,401 feet at the summit of Khionistra. It has a rich endemic flora. The most popular two endemics in division 2 are *Quercus alnifolia* Poeh and *Cedrus libani* ssp. *brevifolia* (Hook. f.) Meikle (Meikle, 1977).

1.1.2.3 Division 3

Division 3 is located in Limassol Range in Cyprus. Its topography is consists of rounded chalk hills, gradually rising inland towards the Trodos Range. Much of the ground in the Limassol Range consists of vineyards, and the coastal belt is extensively cultivated except in the west, where there are heavily grazed hills of calcareous marls and limestones. Special interest areas in this range are the Akrotiri peninsula and Salt Lake. The noteworthy species found in division 3 are *Alyssum chondrogynum* B.L. Burtt, *Linum maritimum* L., *Fagonia cretica* L., *Erodium crassifolium* L'Her. ex Aiton, *Astragalus macrocarpus* ssp. *lefkarensis* Kirchhoff & Meikle, *Neurada procumbens* L., *Artedia squamata* L., *Centaurea veneris*

(Sommier) Beg, *Marsdenia erecta* (L.) R. Br., *Convolvulus* x *cyprius, Ipomoea sagittata* Poir., *Euphorbia thompsonii* Holmboe and *Cladium mariscus* L. (Meikle, 1977).

1.1.2.4 Division 4

Division 4 is located in Larnaca and Famagusta Range in Cyprus. Much of the ground is cultivated or heavily grazed, with typical Mesaria plain cornfields in the north and numerous barren, eroded chalk or limestone hills in the south of the Larnaca Salt Lake. Larnaca Salt Lake provides a habitat for halophytes. The noteworthy species found in Division 4 are *Hymenolobus procumbens* (L.) Nutt., *Matthiola fruticulosa* (L.) Maire., *Erodium crassifolium* L. and *Urginea undulata* (Desf.) Steinh., *Crambe hispanica* L., *Galium pisiferum* Boiss., *Scilla hyacinthoides* L., *Ipomoea stolonifera* (Cyr.) J.F. Gmel., *Anemone hortensis* L., *Helianthemum chamaecistus* Mill. (Meikle, 1977).

1.1.2.5 Division 5

Division 5 is located in Lefkoniko Range in Cyprus. It occupied by the flat cornfields of the Mesaria plain, with interesting weed communities on waste and fallow land (Meikle, 1977).

1.1.2.6 Division 6

Division 6 is located in Morphou and Nicosia Range in Cyprus. This range is heavily cultivated, with cornfields in the centre and East. Morphou Range has extensive Citrus groves. The noteworthy species found in Division 6 are *Argyrolobium uniflorum* (Decne.) Jaub. & Spach., *Cyclamen graecum* Link, *Achillea santolina* L., *Convolvulus oleifolius* var. *pumilus* Pamp. and *Tulipa cypria* Stapf ex Turrill (Meikle, 1977).

1.1.2.7 Division 7

Division 7 is located in Kyrenia Range in Cyprus. Kyrenia Range harbour has the rugged limestone cliffs and pinnacles and it has the richest flora in the whole island. This area is rich in endemic and rare plants. The noteworthy species found in Division 7 is *Zelkova abelicea* (Lam.) Boiss. which is distributed in St. Hilarion (Meikle, 1977).

1.1.2.8 Division 8

Division 8 is located in Rizokarpaso Range in Cyprus. This area has fertile cultivated fields, low hills and extensive sandy or rocky shores. The noteworthy species found in Division 7 are *Fumaria gaillardotii* Boiss., *Enarthrocarpus arcuatus* Labill., *Helianthemum ledifolium* L. Mill., *Aizoon hispanicum* L., *Trifolium globosum* L., *Rosmarinus officinalis* L. and *Juniperus phoenicea* L. (Meikle, 1977).

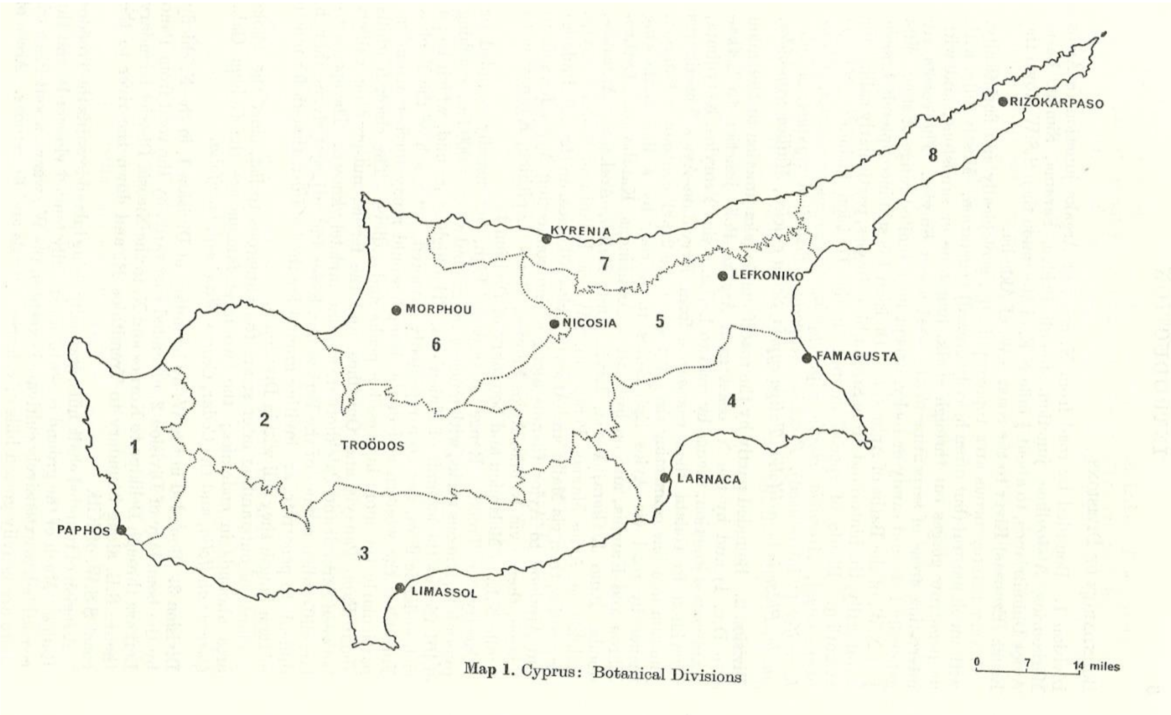

Figure 1.1: Botanical divisions map of Cyprus (Meikle, 1977)

1.2 Rare Plant Species

Plant population sizes vary in space and time both within among species and this variability is the result of complex interactions among the life history features of populations, local environmental conditions, and the historical ecology of particular species (Barrett & Kohn, 1991). Rare species are limited to a small number of population size (Estill & Cruzan, 2001). These species are contain few individuals and often have restricted geographical distributions. These species are all seen as highly vulnerable to climate change, habitat loss and competitive interactions with exotic species. Rare species have importance because they can contribute significantly to long term and large scale ecosystem functioning, eventually providing ecological insurance in variable environments where species abundances vary in time and despite its contribution to the ecosystem they destroyed disproportionately. This detruction may, in turn, alter the biogeochemical and dynamic properties of ecosystems (Mouillot et al., 2013). Rare species can be endemic at the same time if they lives in a narrow area and single geographical location (Primack, 2006).

1.3 Islands and Endemism

Islands contain a significant proportion of all plant species in the world and they contribute in a disproportionally substantial manner to global biodiversity, compared to their total surface area (Kreft et al., 2008). Their biota are often characterized by narrow distributions and are particularly sensitive to biological invasions and climate change (Kreft et al., 2008). Isolation, temperature and precipitation with about equally strong effects contribute species richness in the islands (Kreft et al., 2008).

An area of endemism is an area of where species unique to a defined geographical location and these species grown naturally only in this location. Endemic species are restricted to a geographical distribution area (Estill & Cruzan, 2001).

There are four type of endemism and these are paleoendemics, neoendemics, insular endemics, ecological endemics (Daubenmire, 1978). Paleoendemics are the remnants of a once more widespread taxon; neoendemics are newly derived taxa that may increase their distribution with time; ecological endemics are taxa that have evolved a highly restrictive ecological specificity that prevents them from colonizing areas outside of their specific habitat and Insular endemics are those species that are the product of a long period of isolation (Daubenmire, 1978). Insular endemics are prominent in many island floras (Estill & Cruzan, 2001).

The flora of islands have more endemics from large land masses and have high levels of endemism (Fay, 1992). These Endemic species do not distributed randomly all along an island (Steinbauer et al. 2012, 2013). Often these species are connected to climatic changes through the years, topography, natural vegetation communities and habitat dynamics (Garzón-Machado et al., 2010; Jansson, 2003; Jetz et al., 2004).

Because of the high level of endemism of island ecosystems and the considerable degree of threat they face, nine of the 25 global biodiversity hotspots include islands or archipelagos. Biodiversity hotspots, featuring richness of rare or taxonomically unusual species and each of the areas features a separate community or biota of species that fits together as a biogeographic unit (Myers et al., 2000).

Cyprus is a oceanic origin island in Mediterranean Basin which is geologically and biogeographically isolated and due to this isolation, a large number of animals and plants, which colonized the island evolved into endemic species (Hadjikyriakou & Hadjisterkotis, 2002). Because of the variety of habitats and climatic variation, Cyprus is one of the biodiversity hotspot in the Mediterranean Basin (Myers et al. 2000; Hadjisterkotis, 2001) .

There are 128 endemic plants in Cyprus and they include 91 different species, 22 subspecies, 12 varieties, one hybrid and one form (Tsintides, 1998). These endemic plant species includes 1 tree, 14 shrubs, 19 subshrubs, 21 annual herbs and 73 perennial herbs (Tsintides, 1998).

1.4 Distribution of Salvia Species in Cyprus

Salvia (Sage) is the largest genus of the Lamiaceae family and has nearly 1000 species (Kintzios, 2000). *Salvia* species are located in Central and South America (500spp.), in western Asia (200 spp.) and in eastern Asia (100 spp.) (Alziar, 1988–1993).

Salvia is an important plant genus that has been used for many purposes for centruries. Salvia species are used in food preparations as flavouring and natural antioxidants, as well as traditional medicines for different therapeutic properties, essential oils used in perfumery, the flowers used as rouge, the leaves used for varicose veins, the seed oil as an emollient, the roots as a tranquiliser (De Fellice et al., 2006; Kintzios, 2000).

There are 11 Salvia species distributed in Cyprus. These 11 species are *Salvia aethiopis* L., *Salvia dominica* L., *Salvia fruticosa* Mill., *Salvia hierosolymitana* Boiss., *Salvia lanigera* Poir., *Salvia pinnata*, *Salvia sclarea L.*, *Salvia verbenaca* L, *Salvia veneris* Hedge, *Salvia* *viridis* L. and *Salvia willeana* (Holmboe) Hedge. Only *S. veneris* Hedge and *S. willeana* are endemic to Cyprus. *S.veneris* Hedge located only Northern Cyprus.

Salvia aethiopis: Biennial, somtimes perennial herb. Can reach up to 50cm high. Stems are square, stands perpendicular and woolly at the base. Leaves are at the base and they are ablong 10-20 x 4-10 cm, ovate, wrinkled and has white woolly hairs both surface. Flowering from june to july. The colour of the corolla goes from white to yellowish. Very rare indigenous species of Cyprus and it is located near Trodos square (alt. 1,700 m). In the world İt is also found in Asia and Europe (Hadjikyriakou, 2007).

Salvia dominica L.: Aromatic shrub. Can reach up to 100 cm high. Leaves spread on stems. They are ablong 2.8-7.5 x 1.8-5 cm, ovate, grey-green with white hairs. Flowering from April to May. The colour of the corolla goes from white to cream. Rare indigenous species of Cyprus an it grows on rocky places near the theaters of Kourion and Soloi (alt. 20-150m). In the world it is also found in Egypt, Palestine, Syria and Lebanon (Hadjikyriakou, 2007).

Salvia fruticosa: Aromatic shrub. Can reach up to 120 cm high. Leaves are ovate, ablong 10-50 x 7-25 mm, grey green coloured and hairy. Flowering from February to July. The colour of the corolla purple, pink or white. Indigenous species of Cyprus and it is located Akamas, Lyso, Lemithou, Saittas, Prodomos, Madari,Stavrovouni, Limnatis, Lakkovounara, Agia Eirini, Karmi, Agios Amvrosios Keyneias, Akanthou, Kantara, Koilanemos, Rizokarpaso, Lefkara, Kormakitis and elsewhere (alt 0-1,500 m). In the world it is also found in Eastern Mediterranean, from Italy to Palestine (Hadjikyriakou, 2007).

Salvia hierosolymitana: Perennial herb. Can reach up to 1m high. It has purple square stems. Leaves are at the base and they are ovate and hairy. The colour of corolla dark pink or purple. Rare and scattered in meadows under Carob and facing slopes among Sytrax; recorded in recent years from near Bellapais, Çatalköyand Balalan; formerly from Yeşilköy and Yenierenköy. In the world it is also found in Syria, Lebanon and Israel (Viney, 1994).

Salvia lanigera: Aromatic subshrub. Can reach up to 40 cm high. Leaves spread on stems. Leaves are grey-green with white hairs. Flowering from January to April. The colour of the corolla are dark purple. Locally common native species of Cyprus and located in Tunnel beach at Episkopi Brtish base, Geri, Athlassa, Anthoupolis, Agia Erini- Syrianochori and the Larnaka area (Hadjikyriakou, 2007). Also found in central plain from Akdeniz and Kalkanlı through Ercan to Salamis. In the world also found in North Africa, Palestine, Iran and Saudi Arabia (Viney, 1994).

Salvia pinnata: Perennial herb. Can reach up to 60 cm high. Tetragonal Stems. Leaves spread on stems. Flowering April to May. The colour of the corolla are pink. A rare plant in Cyprus and located in Kyrenia, Melandrina, Antiphonitis. In the world also found in Turkey and Palestine (Meikle, 1985).

Salvia sclarea L.: Biennial or perennial herb. Can reach up to 1m high. Leaves are ovate, wrinkled, hairy and can be 15 cm long. Flowering from May to June. The colour of the corolla lilac or pale blue. Rare, indigenous species of Cyprus an it grows at roadsides, in the margins of vineyards and garrigue at Arsos Lemesou and Kollani (alt.600-700m). In the world it is also found in Mediterranean region and Asia (Hadjikyriakou, 2007).

Salvia verbenaca L: Perennial herb. Can reach up to 70 cm high. Stems are square, erect, hairy and mostly purple. Flowering from January to April. The colour of the corolla deep blue or pink. Common in most areas, in olive orchards, pinewoods, roadsides, damp garigue even on seashores in Cyprus. In the world also found in Europe and Mediterranean region (Viney, 1994).

Salvia veneris Hedge: Perennial herb. Can reach up to 40cm high. It has tetragonal, erect, hairy stems. Leaves are at the base of the stems, ovate shaped, 2.5-8 x 1.7-8 cm and they have woolly white hairs on both surface. The colour of the upper lip of corolla lilac and lower lip is yellowish. Corolla up to 25 mm long. Flowering from March to April (Hadjikyriakou, 2007). Salvia veneris Hedge is rare and endemic to North Cyprus. It is located in crumbling sandstone hills North and East of Değirmenlik (Viney, 1994). It is included in the Red List of Threatened Plants of the International Union Conservation of Nature (Walter & Gillet, 1998).

Salvia viridis L.: Annual herb. Can reach up to 40cm high. Stems are square, erect, hairy and often purple below. Flowering from February to April. The colour of the upper lip of corolla purple and lower lip is white. Common in most areas at low and middle altitudes on open rocky or grassy slopes and roadsides, and located between Salamis and Boğaz in Cyprus In the world also found in Mediterrenean region, Iran, Turkey, N.W. Africa (Viney, 1994).

Salvia willeana (Holmboe) Hedge: Aromatic subshrub. Can reach up to 60cm high. It has tetragonal, hairy stems. Leaves are ovate elliptic, 15-60 x 8-32mm and base of the leaves heart shaped or rounded . The colour of the corolla white-pink. Flowering from May to October. It is Endemic to Cyprus and located in the opholite rocks of the central Trodos area (alt. 1,000-1,950 m) (Hadjikyriakou, 2007). It is rare and included in the Red List of Threatened Plants of the International Union Conservation of Nature (Walter & Gillet, 1998).

1.5 The Aim of the Study

In Cyprus, total number of 128 endemic plant species have been determined and only 19 of them are endemic to Northern Cyprus (Meikle, 1977,1985; Tsintides, 1998; Viney, 1994,1996). *S. veneris* is endemic plant species to Northern Cyprus. The habitat areas of *S. veneris* is being destroyed due to human activities, stone quaries, forest fires and pollution an as a result of these actions it is under the threat of extinction (Gücel & Yıldız, 2008).It is included in the Red List of Threatened Plants of the IUCN (Walter & Gillet, 1998).

IUCN Council adopt the IUCN Red List Categories in 1994 and have become widely recognized internationally. Such broad and widespread use revealed the need for a number of improvements, and SSC was mandated by the 1996 World Conservation Congress (WCC Res. 1.4) to conduct a review of the system (IUCN, 1996). The purpose of the Red List categorization is to produce a relative estimate of the likelihood of extinction of the taxon and the Red List Criteria should be applied to a taxon based on the available evidence concerning its numbers, trend and distribution (IUCN, 2012a, 2012b).

There has not been any detailed research about distribution and population size of *S. veneris* species. Habitat distrubition modelling helps to identify the areas for species reserves, reintroduction, and in developing effective species conservation measures (Adhikari et al., 2012).

In this study distribution area and population size of *S. veneris* has been studied to determine how much this species is in danger of extinction with using IUCN Red List Criteria.

CHAPTER 2
THEORETICAL FRAMEWORK

2.1 Distribution and Population Size Analysis of Plants

Distance sampling method used for prediction of biological size at the field surveys and distance sampling data used at Distance software for calculate distribution of species.

2.1.1 Distance sampling

Distance sampling is a technique which used widely for prediction animal or plant population density or size. Distance sampling is an important method for generating prediction of size or density in difficult terrain conditions (Thomas et al., 2010).

Distance sampling methods are point transect distance sampling and line transect distance sampling. These sampling methods have been used successfully in a very various array of plant or animal taxa, including herbs,shrubs and trees, reptiles, amphibians, insects, birds, marine mammals, land mammals and fish (Buckland et al., 2005).

In the distance sampling method, the observer record the distance from the point or line to the material for each study material detected, and detection of each individual of study material is not compulsory. Distance sampling analysis can be predict the proportion of objects missed during the surveys with a detection function fit to the examined distances. This sampling method is predict population size by dividing the total count by the total area observed (Buckland et al., 2005).

Line transect distance sampling method: At the line transect method, one or more observers move throughout a line and counting all study materials within a previously decided distance of the line (Buckland et al., 2005).

Point transect distance sampling method: At the point transect method, the observer counts number of study materials (usually plants or birds) in a circle at a point. In this sampling method, an observer visits points which randomly determined at field surveys. Also this sampling method is more appropriate from line transect sampling for difficult terrain because observer can focus on study material in field surveys instead of navigate along a line (Buckland et al., 2005).

2.1.2 Distance software

According to Thomas et al. (2010), Distance software is used at many distance sampling designs and most analyses.

- It is important to design a good survey to achieve reliable results. The Distance software built a survey design engine in the geographic information system. This property of software allows varied recommended designs to be generation of survey plans and to be analyzed via simulations.
- In the first step, the software analyzes distance sampling data by detection probability modelling. This software include 3 analysis engines for this step. First one is classic distance sampling and it models possibility of perceiving as a function of distance from the transect and assumes all materials are detected at zero distance. Second one is multiple covariate sampling and it provides covariates in addition to distance. Third one is mark recapture sampling and it provides to relaxes the estimate of specific detection at zero distance.
- These engines provide prediction of density and size.
- The Distance software can analyze line transect and point transect distance sampling.
- Distance software occurs from a graphical interface which provides users to input, import and view data. Also users can design surveys and run analysis of these survey datas.
- Geographical data, in the form of ESRI shapefiles, can also be related with each layer.

CHAPTER 3
LITERATURE REVIEW

3.1 Studies about Flora of Cyprus

Meikle (1977,1985) carried out research in Cyprus about the flora of Cyprus. Meikle wrote the book of “Flora of Cyprus” and this book contains detailed description of all indigenous and main introduced plant taxa which were recorded and published in Cyprus by the time. The book includes 9 family, 12 genus and 20 species of the pteridophyta; 3 family, 5 genus and 12 species of the gymnosperm, 89 family, 465 genus, 1206 species of the dicotyledons; 18 family, 138 genus, 339 species of the monocotyledons.

Viney (1994,1996) carried out research in North Cyprus about the flora of North Cyprus. This study is the first comprehensive and fully illustrated Flora (grasses and sedges excepted) of any part of Cyprus, or indeed, apart from the *Flora Palaestina*, of any Eastern Mediterranean region. This study includes habitats, locations and distributions of the native flowering plants species.

Tsindites (1998) carried out research in Cyprus about the endemic plants of Cyprus. This study contains detailed description about the endemic plants of Cyprus. This study includes 128 endemic plant species of Cyprus.

Hadjikyriakou (2007) carried out research in Cyprus about aromatic and spicy plants of Cyprus. This study contains detailed description about aromatic and spicy plants of Cyprus.

Hand (2000) carried out research in Cyprus on vascular plants. They used data of 61 species complete the knowledge about chorology and ecology especially in the western part of the island. In this research an emphasis is put on the distribution of species. They found two taxa, *Paronychia echinulata* Chater and *Hordeum murinum* L., were previously not known to occur in Cyprus.

Hand (2001) carried out research in Cyprus on vascular plants. They used 174 vascular plant species data and chorological aspects. They found *Setaria adhaerens* var. *fontqueri* Calduch and *Saccharum strictum* (Host) Spreng. which are new records for Cyprus and new taxonomic considerations result in the new combinations *Scutellaria cypria* subsp. *elatior* (Meikle) Hand and *Valantia hispida* var. *eburnea* (Brullo) Hand.

Hand (2003) carried out research in Cyprus on vascular plants. They used ecelogical and chorological data of 84 taxa of vascular plants. This study include detailed documents for the first time about *Aira elegantissima* subsp. *ambigua* (Arcang.) Doğan, *Euphorbia taurinensis* All., *Plantago major* subsp. *intermedia* (DC.) Arcang., *Ranunculus repens* L. and *Trifolium grandiflorum* Schreb.. They found taxonomic considerations result in the validation of the new combinations *Limonium cyprium* (Meikle) Hand & Buttler and *Phlomis cypria* subsp. *occidentalis* (Meikle) Hand.

Hand (2004) carried out research in Cyprus on vascular plant species. They used chorological data of 164 taxa of vascular plant species. Result of the study new record of *Chenopodium striatiforme* Murr and *Chenopodium strictum* Roth subsp. *strictum* are found.

Hand (2006) carried out research in Cyprus on vascular plant species. They used ecological and chorological data of 179 taxa of vascular plant species. They found new records of *Aethionema arabicum* (L.) DC., *Bellium minutum* L., *Cynara syriaca* Boiss., *Echium judaeum* Lacaita, *Epilobium lamyi* F.W. Schultz, *Epilobium tournefortii* Michalet, *Gypsophila linearifolia* (Fisch. & C.A. Mey.) Boiss., *Herniaria hemistemon* J. Gay, *Lolium rigidum* subsp. *lepturoides* (Boiss.) Sennen & Mauricio, *Malcolmia africana* L. R. Br. and *Silene argentea* Ledeb..

Hand (2009) carried out research in Cyprus on vascular plant species. They used chorological data of 126 taxa of vascular plant species. They found new records of 16 plant taxa species in the island. Some of these species are *Campanula fastigiata* Dufour ex Schult., *Ferula tingitana* L., *Lactuca undulata* Ledeb., *Minuartia montana* L. subsp. *montana*, *Rochelia disperma* (L. f.) K. Koch, *Sedum aetnense* Tineo and *Veronica bozakmanii* M.A. Fisch.

Hand (2011) carried out research in Cyprus on vascular plant species. They used chorological data of 76 taxa of vascular plant species. They found that one taxon is new to science, *Papaver paphium* M.V. Agab., and three new combinations *Maresia nana* var. *glabra* (Meikle) Christodoulou & Hand, *Rosa micrantha* subsp. *chionistrae* H. Reichert & Hand and *Papaver cyprium* (Chrtek & Slavik) M.V. Agab.. They also found new records of several taxa. Some of these are *Centaurea calcitrapa* L. subsp. *calcitrapa*, *Euphorbia hypericifolia* L., *Euphorbia maculata* L., *Euphorbia prostrata* Aiton, *Euphorbia serpens* Kunth subsp. *serpens*, *Lathyrus clymenum* L., *Lysimachia dubia* Sol., *Marsilea aegyptiaca* Willd. and *Silene noctiflora* L..

Hand (2015) carried out research in Cyprus on vascular plant species. They used taxanomy, chorological and ecological data of 104 taxa of vascular plant species. They found two new combinations of *Myosotis paucipilosa* (Grau) Ristow & Hand and *Allium cyprium* subsp. *lefkarense* (Brullo & al.) Christodoulou & Hand. They also found 15 plant taxa are new for Cyprus. Some of these new plant taxa are the indigenous species *Alcea acaulis* (Cav.) Alef., *Euphorbia berythea* Boiss. & Blanche, *Atriplex davisii* Aellen, *Rumex crispus* L. and alien plan taxa are *Sisymbrium altissimum* L. and *Cirsium arvense* (L.) Scop..

Chrtek & Slavik (1993) carried out research in Cyprus on 152 plant species and subspecies. They did floristic investigations. They found new record of *Otanthus marilimlls* subsp. *atlanticus* and two species new for Cyprus, *Anagallis latifolia* and *Garhadiolus angulosus.*

Chrtek & Slavik (1994) carried out research in Cyprus on 85 plant species. They did floristic investigations. They found one plant species new for Cyprus: *Saccharum sponraneum* and two new combinations of *Bromus scoparius* subsp. *chrysopogon* and *Bellevalia pieridis.* They also found 34 plant taxa as new for Cyprus.

Chrtek & Slavik (2000) carried out research in Cyprus on 159 plant taxa. They did floristic investigations. They found two new combinations of *Ranunculus cyprius* and *Pinus pallasiana* subsp. *caramanica; Lathyrus aphaca* subsp. *cyprius*. In this study *Bassia indica, Fumaria capreolata* and *Galium divaricatum* and *Lolium multiflorum* subsp. *gaudini* are reported as new for Cyprus.

3.2 Endemic Plant Species Studies in Islands in the World

Fenu et al. (2011) carried out research in Sardinia on critically endangered, extremely narrow endemic *Lamyropsis microcephala*. They used global positioning system ArcView for generate distribution map, ANOVA and Statistical v.6.0 for statistical tests. They found distribution area and status of *L. microcephala.*

Klinger et al. (2002) carried out research in Santa Cruz Island in California on herbaceous vegetation and endemic plant species. They used point transect sampling and Canonical Correspondence Analysis (CCA). Also they observed the response of herbaceous vegetation and endemic plant species to the disappearence of sheep. They found the relationship between site characteristic and species abundance. They found that total population size of endemic plant species increased and bare ground decreased after sheep were disappearence from the island.

Mauchamp et al. (1998) carried out research in four Galapagos Islands on eight endemic species. These species are *Scalesia atractyloides* Arn. (2 subspecies) on Santiago, *Lecocarpus darwinii* Adsersen and *Calandrinia galapagosa* St. John on San CristoÂbal, *Alternanthera nesiotes* Johnston, *Psychotria angustata* Anderss., *Lippia salicifolia* Anderss., and *Linum cratericola* Eliasson on Floreana, and *Lecocarpus lecocarpoides* (Robins. and Grenm.) Cronq. & Stuessy, on Espanaola. They used herbarium specimens and did field surveys. They found total surface area and population size of the species.

Affre et al. (1997) carried out research on four Balearic islands in Southern France on endemic perennial herb *Cyclamen balearicum* Willk.. They used BIOSYS analysis to calculate observed heterozygosity and FSTAT software for analyze population structure. They found that population differentiation was greater among terrestrial islands. Also they found that population sizes reduced with changes in climate and human land use that may have.

Maki (2001) carried out research in Ryuku Islands on the insular endemic plant species *Aster miyagii*. They used populations sampling method, enzyme electrophoresis and a phenogram based on the standard genetic distance was obtained using the neighbor joining method using

PHYLIP version 3.5c for statistical analysis. They found population differentiation size of the *A. miyagii* species.

Furches et al. (2008) carried out research in San Clemente Island on the endemic perennial herb *Lithophragma maximum*. They used plant collection methods and DNA extraction for genetic analysis. Also they used FSTAT software for analyze population structure and several Bayesian methods of analysis to detect underlying patterns of genetic structure and recent migration of this species. They examined the impact of historical and current threats to maintenance of genetic variation of this species. They found positive correlation between genetic and geographic distances, indicative of isolation by distance.

Juan et al. (2004) carried out research in western Mediterranean on endemic plant species *Medicago critina*. They used unweighted pair group method using arithmetic avarages (UPGMA) and principle coordinates analysis (PCOA) for analysed data. They found population differentiation between subpopulations.

Isık & Yucel (2017) carried out research in Antalya (Beydağları) on a monotypic relict endemic plant species *Dorystoechas hastata* Boiss et Heldr. Ex Bentham. They used specimens which collected from research area as a material and mesured morphological characters with using digital caliper under stereomicroscope. Also they used soil samples to determine soil characteristics. They examined *D. hastata* in terms of biological and ecological aspects.

3.3 Population Size Studies of Plant Species in the World

Jensen & Meilby (2012) carried out research in Northern Laos on critically endangered species *Aquilaria crassna*. In this research they used line transect distance sampling method. They found average density of *Aquilaria crassna* tree species. They also found the estimated densities of living saplings, small trees and larger trees of *A. crassna* species.

Schorr (2013) carried out research in Colorado on rare alpine calciphilic plant *Saussurea weberi* Hultén. In this research they used distance sampling techniques to found population size. They found predicted density, abundance and variability of population size of *S. weberi* species.

Pauchard & Alaback (2004) carried out research in protected areas of South Central Chile on alien plant species. They used transect sampling method. They found population size of the alien plant species and effects of roads to their population density.

Acharya et al. (2000) carried out research in Nepal on rare tree species. These species are *Daphniphyllum himalayense* Muell. Arg., *Schima wallichii* Choisy, *Michelia kisopa* Buch. Ham.. They used systematic adaptive cluster sampling method. They found population size and distribution of these species.

Kessler (2001) carried out research in the Bolivian Andes on Acanthaceae, Araceae, Bromeliaceae, Melastomataceae, Palmae, and Pteridophyta plant groups. They used transect distance sampling method in 204 vegetation plots of 400 m^2. They found population size of these groups and change of population size of them with elevations.

Fischer & Matthies (1998a) carried out research in Switzerland on rare, short lived plant species *Gentianella germanica* (Börner) Willdenow. They used environmental conditions (topography, climate, soil) data, performance of plants in the fields, common garden experiments and statistical analysis. They found relationships between, reproduction, population size and population growth rate in 23 populations of the *Gentianella germanica*. They also found a possible relationship of population size effects on environmental variation in vegetation, topography, climate, soil, and management.

Fischer & Matthies (1998b) carried out research in Switzerland on rare plant species *Gentianella germanica* (Börner) Willdenow. They used RAPD (random amplifed polymorphic DNA) profiles. They found the distribution of genetic variation and the correlation between genetic variation and population size.

Schmidt & Jensen (2000) carried out research in Germany on the rare biennial plant species *Pedicularis palustris*. They used amplified fragment length polymorphism (AFLP) profiles to analyze genetic similarities among 129 individuals of plant. They found plant reproduction in relation to genetic structure, population size and habitat quality in 13 populations of *P. Palustris.*

Paschke et al. (2002) carried out research in Bavaria on narowly endemic monocarpic perennial plant species *Cochlearia bavarica.* They used flowering individuals of 24 populations of *C. bavarica* and path analyses. They found population viability in relation to population size and allelic variation. They also found that population size showed positive correlations with number of flowers, fruit set per plant, number of seeds per fruit and output per plant.

3.4 Distribution Studies of the Plant Species in the World

Karousou & Kokkini (1997) carried out research in Crete island on native plant species *Salvia fruticosa* Mill. *(Labiatae).* They used herbarium specimens and fieldwork data. They foun distribution and variation of morphological characters and essential oil content of the *S. fruticosa* species.

Dobson et al. (1997) carried out research in the United States on endangered species. They used a published data of endangered and threatened species in the United States. Also they used Geographic Information System (GIS) for generating distribution maps. They found total distribution area which needs to be managed to protect threatened and endangered species.

Guisan et al. (1999) carried out research in Spring Mountains in Nevada on higher plant species. They used Generalized Linear Models (GLM) and Canonical Correspondence Analysis (CCA) models. Their results show that GLM models predict better than CCA models because in GLM models a specific subset of explanatory variables can be selected, but in CCA models, all species are modeled using the same set of composite environmental variables. Also both models can be easily ported to a Geographic Information Systems (GIS).

Guisan & Zimmermann (2000) carried out a review in Switzerland on predictive habitat distribution models in ecology. In this review they present methods for predictive habitat distribution models. These are Bayesian models, Generelized Linear Model (GLM), ordination and classification methods, neural networks and combinations of these models. They found that new powerful statistical techniques and GIS tools increased so predictive habitat distribution models has rapidly increased in ecological modelling.

Nieder et al. (2000) carried out research in lowland Amazonian rainforest of Southern Venezuela on vascular epiphytes. They used statistical tests with using Statistica 5.0 and Morisita's index of dispersion for distribution analysis. They found vertical and horizontal distribution of vascular epiphytes.

Vetaas & Grytnes (2002) carried research in Nepal on flowering plants. They used published data about distribution area and altitudes of the Napalese flora. They also evaluate the diversity patterns with use of correlation, regression and graphical analysis. They found that location of species density in the elevation zones. They also found that the ratio of endemic species increases steadily from low to high altitudes.r

McGlone et al. (2002) carried out research in New Zealand on vascular plants. They used an analysis of the factors correlated with distribution and endemism for alpine plants. Also they used ANOVA models. They modelled the relationship between the number of alpine regions that species occupy and the predictor variables. They evaluate competing views on the origin and distribution of the New Zealand flora by testing hypothesis that the geographical distribution of species is unrelated to ecological traits such as habitat requirements and dispersal ability.

Peterson et al. (2003) carried out research in North America on four alien plant species. These species are *Alliaria petiolata* (Bieb) Cavara & Grande ALAPE, *Elaeagnus angustifolia* L. ELGAN, *Hydrilla verticillata* (L.f.) Royle HYLLI and *Lespedeza cuneata* (Dum.-Cours.) G. Don LESCU. They used gereferenced occurence points of species, GARP models and geographic information system. They found that geographic distributional models and ecological niches of native distributional areas were highly statistically significant. Also they found a potential distribution area of each species.

Kriticos et al. (2004) carried out research in Australia on *Chromolaena odorata*. They used climate data and computer based eco-climatic modelling package CLIMAX. They found potential distribution of *C. odorata* in the world.

Vargas et al. (2004) carried out research in Ecuador on 36 endemic and 47 non-endemic *Anthurium* (Araceae) species. They used herbarium specimen data and Geographic Information System (GIS). They found potential distribution models of these species.

Dirnböck & Dullinger (2004) carried out research in N.E. Calcareous Alps in Austria about on alpine plants. In this research they used cover abundance values of plant species as the response and environmental variables for derived ordinal logistic regression models. Then they were added the four spatial variables for each species to its ‘environment only’ model and correlations of residual spatial patterns and functional traits were analysed by ANOVA. They found that there is a significant correlation of the amount of residual spatial autocorrelation with the dispersal capacity of the respective species.

Römermann et al. (2007) carried out research in Germany on prediction of grid based plant species distribution in mesoscale. In this research they used Generalized Linear Models (GLM) and a spatially independent optimization model. Also they used NATURA 2000 habitat maps for modelling frequencies of 24 habitats. They found that habitat frequencies and distribution could be retrieved on the basis of habitat specific species co occurrences per grid cell for the national scale.

Ullah et al. (2006) carried out research in Southern Western Ghats on narrowly endemic plant species *Aglaia bourdillonii* Gamble. They used ecological niche modelling (ENM), based on relationship between distribution data of species and climatic data. They found ecological and geographic distribution of *A. bourdillonii* species. They also found that ENM modelling is a useful tool for understanding the natural history of rare and endangered species.

Pattison & Mack (2008) carried out research in the United States on invasive tree species *Triadica sebifera*. They used a generic modelling tool which based on the climate data (CLIMEX). They found potrntial distribution model of *T. sebifera* species.

Giriraj et al. (2008) carried out research in India on endemic tree species *Rhododendron arboreum* Sm. ssp. *nilagiricum* (Zenker) Tagg. They used bioclimatic and topographic data, Genetic Algorithm for Rule-set Prediction (GARP) and an ecological niche modelling (ENM) method. They found spatial distribution of *R. Arboreum* species.

Kumar & Stohlgren (2009) carried out research in New Caledonia on threatened and endangered tree *Canacomyrica monticola*. They used species occurrence records, GIS environmental layers (bioclimatic,topographic), Maximum entropy distribution modelling approach to predict potential suitable habitat for *C. Monticola.* They found most suitable habitat for *C. Monticola.*

Essl et al. (2009) carried out research in Austria on endemic vascular plant species. They used grid cells, statistical analysis with R, version 2.5.1. They found distribution patterns, altitudinal distribution, habitat preference, correlation of range size and niche breadth of endemic species.

Nowak & Nobis (2010) carried out research in Zerevashan Mts in Tajikistan on 86 species of endemic vascular plants. They used literature data about distribution, life form, altitudinal range and habitat preferences. They also used herbarium records and fieldwork data. They calculate the area between all known localities of these species. They found the taxonomic structure, dsitribution, habitat preferences and conservation status of these 86 species.

Yoshino et al. (2010) carried out research in high moor near Akanuma in Kushiro on wetland plant communities. They used high spatial resolution of colour photographs taken with 35 mm non-metric camera mounted on cabled balloon flown over the study area. Also they used geostatistics, texture analysis and landscape metrics for environment monitoring. They found characteristics of spatial distribution of wetland plant communities.

Nowak et al. (2011) carried out research in Tadzhikistan on 1486 endemic vascular plants. They used literature and fieldwork data. They found distribution and habitat preferences of these species. They also presented conservation of these endemic species.

Adhikari et al. (2012) carried out research in Northeastern India on critically endangered tree species *Ilex khasiana* Purk.. They used 250mx250m grid cell for the pixel dimension and the model was developed using maximum entropy modelling (MaxEnt) for habitat modelling. They superimposed the predicted potentail areas on Google Earth and then the predicted suitabilty maps were exported in KMZ format for using at Geographic Information System. They found potential habitat and total suitable area of *I. Khasiana.*

Taylor et al. (2012) carried out research in Australia on invasive shrub species *Lantana camara* L.. They used CLIMEX eco-climatic modelling package. They found potential distribution area of *L. camara* plant species under current and future climate.

Lansdown et al. (2016) carried out research in Cyprus on critically endangered species *Callitriche pulchra* Schotsm. They used known status, distribution and ecology of *C. pulchra*. Also they used Google Earth to generate distribution map. In this article they describe providing details of the new sites supporting *C. pulchra* on Cyprus and new information on the size and extent of the population on Gavdos.

3.5 *Salvia veneris* Hedge Studies

Gücel & Yıldız (2008) carried out research in North Cyprus on 10 endemic plant taxa *Ferulago cypria* (Post) H. Lindb., *Limonium albidum subsp. cyprium* Meikle, *Onosma caespitosum* Kotschy, *Origanum syriacum* L. var. *bevanii* (Holmes) Ietswaart, *Phlomis cypria* Post var. *cypria*, *Pimpinella cypria* Boiss., *Salvia veneris* Hedge, *Scutellaria sibthorpii* (Benth.) Halacsy, *Sideritis cypria* Post and *Teucrium cyprium* Boiss *subsp. kyreniae* P.H. Davis. In this research they used the micrographs of the seeds. They also used the fresh and dried samples for record of detailed morphological features. They found the germination posibility and survival capacity of these endemics in ex-situ conditions. In this research they found *S. veneris* can developed vegetatively and developed fruits in ex-situ conditions.

Yıldız & Gücel (2006) carried out research in Northern Cyprus on 16 endemic taxa *Arabis cypria* Holmboe, *Brassica hilarionis* Post, *Delphinium caseyi* B.L. Burtt, *Dianthus cyprius* A. K. Jackson & Turrill, *Hedysarum cyprium* Boiss., *Onosma caespitosum* Kotschy, *Origanum syriacum* L., *Phlomis cypria* Post var. *cypria, Pimpinella cpria* Boiss., *Rosularia pallidiflora* (Holmboe) Meikle, *Salvia veneris* Hedge, *Scutellaria sibthorpii*, *Sedum lampusae* (Kotschy) Boiss., *Sidetris cypria, Teucrium cyprium* subsp. *kyreniae* and *Silene fraudatrix* Meikle. In this research they collected mature seeds from plants in the field and the seeds were germinated on filter paper placed inside petri dishes. They found that chromosome numbers and basic chromosome number in 13 plant taxa were the same as previously reported for other species in the genus and *S. veneris* is one of them.

Dereboylu et al. (2010) carried out research in Cyprus on endemic species *Salvia willeana* (Holmboe) Hedge and *Salvia veneris* Hedge. In this research they used PRIOR binocular light microscope for anatomical studies and palynological observations. They compared anatomical and palynological characteristics of *Salvia veneris* and *Salvia willeana* with other studies conducted on Salvia genus.

Yıldız et al. (2009) carried out research in Northern Cyprus on 19 endemic plant taxa *Arabis cypria* Holmboe, *Brassica hilarionis* Post, *Delphinium caseyi* B.L.Burtt, *Dianthus cyprius* A.K. Jackson et Turrill, *Ferulago cypria* H.Wolf, *Hedysarum cyprium* Boiss., *Limonium albidum* (Guss.) Pignatti subsp. *cyprium* Meikle, *Onosma caespitosum* Kotschy, *Origanum syriacum* L. var. *bevanii* (Holmes) Ietswaart, *Phlomis cypria* Post var. *cypria, Pimpinella cypria* Boiss., *Rossularia cypria* (Holmboe) Meikle, *Rosularia pallidiflora* (Holmboe) Meikle, *Salvia veneris* Hedge, *Scutellaria sibthorpii* (Benth) Hal., *Sedum lampusae* (Kotschy) Boiss., *Silene fraudatrix* Meikle, *Sideritis cypria* Post and *Teucrium cyprium* Boiss. subsp. *kyreniae* P.H.Davis. They used light (LM) and scanning electron microscopy (SEM) for investigate palynology of these endemics. They found that the largest pollen grains were found in *S. veneris*.

Kadis et al. (2010) carried out research in Cyprus on rendemic, rare and threatened aromatic plants *Micromeria cypria*, *Salvia veneris*, and *Teucrium divaricatm* ssp. *canescens, Salvia willeana* and *Nepeta troodi*. Seeds of these species collected and they did germination experiments. They did experiments in Petri dishes lined with two filter paper discs and moistened with 2.5- 3ml of deinoized water, GA3 or KNO3 solution. They used temperature controlled plant growth cabinets. They found that seed germination in the dark for the S. veneris species is favored at relatively low temperatures (10-20^{0}C).

Polatoğlu et al. (2015) carried our research in Norhern Cyprus on endemic species *Salvia veneris* Hedge. They used PC3, HeLa, CaCo-2, MCF-7, U87MG, HEK293, Mpanc-96 cell lines for evaluated cytotoxicity of the species.. They report the biological activities of ethanol extract of this species.

Polatoğlu et al. (2017) carried our research in Norhern Cyprus on endemic species *Salvia veneris* Hedge. They collected *S veneris* during the flowering period and then isolate essential oils of it. They used gas chromatography-mass spectometry analysis. They found that the essential oil composition of *S. veneris* afforded very high fumigant insecticidal activity against the primary stored product insects namely *Sitophilus granarius* and *Sitophilus oryzae* as well as *Oryzaephilus surinamensis.* The oil of *S. veneris* also has remarkable contact toxicity against *Spodoptera exigua*.

Toplan et al (2017) carried out research in Cyprus on endemic plant species *Salvia veneris* Hedge. They used GC-MS and LC-MS/MS methods for analyze the essential oil and phenolic compounds of methanol extract from aerial parts of *S. veneris* species. Firstly they found rosmarinic acid as a major compound in the methanol extract. Secondly they found significant correlation between antioxidant activity and phenolic compounds. They also found potential of *S. veneris* species for food industries, cosmetic and pharmaceutical.

CHAPTER 4
MATERIALS AND METHODS

4.1 Study Area

The survey area is located in Northern Cyprus, at the south of the Beşparmak Mountains and north of the Mesaria plain. It consists four villages. These are from west to east Hamitköy, Taşkent, Güngör and Değirmenlik. Hamitköy is at the east and north of Nicosia, at the west of Haspolat, at the south of Dikmen, Kaynakköy and Taşkent. Taşkent is at the east and south of Kaynakköy, at the west of Güngör and at the north of Haspolat and Hamitköy. Güngör is at the east of Taskent, at the west of Değirmenlik, at the north of Minareliköy and Haspolat and at the south of Arapköy. Değirmenlik is at the east of Güngör, at the west of Alevkayasi, at the north of Minareliköy, Demirhan, Beyköy and at the south of Arapköy. The study area has crumbling sandstone hills, plains and dry stream beds. Physical map of Cyprus shown in Figure 4.1 and survey area shown in Figure 4.2.

Figure 4.1: Physical map of Cyprus

Figure 4.2: Survey area –Map generated with Google Earth. Sembols are from west to east H: Hamitköy, T: Taşkent, G: Güngör, D: Değirmenlik

In the literature review, it was seen that *Salvia veneris* is a rare plant species of Değirmenlik and it is found above pillow lava outcrops. Güngör, Taşkent and Hamitköy nearby Değirmenlik also they have similar soil and topography properties which *S. veneris* can grow. Different areas with similar habitat characteristic were also checked for presence of *S.veneris*. For these reasons this study area was chosen. Study area map shown in Figure 4.3.

Figure 4.3: Study area map –Map generated with Google Earth.

4.2 Material

In this study our material is *Salvia veneris* which is a endemic plant species to Northern Cyprus. Field surveys about research material was conducted at the flowering phase of *S. veneris* H. between April – June 2017. Young individual of study material shown in Figure 4.3 and mature individual of study material shown in Figure 4.4.

Figure 4.4: General view of young *Salvia veneris* individual -Photo taken with Canon Eos 100D by İzel Hacıoğulları.

Figure 4.5: General view of mature *Salvia veneris* individual -Photo taken with Canon Eos 100D by İzel Hacıoğulları.

4.3 Methods

4.3.1 Field survey

In this study distance sampling method used in field surveys. The main methods for distance sampling are line transect distance smapling and point transect distance sampling. These methods used for estimating the size or abundance of plant and animal populations. Point transect sampling method used in field surveys. In this sampling method, an observer visits points which randomly determined at field surveys. This sampling method selected because it is more appropriate from line transect sampling for difficult terrain. Also the observer can focus on study material in field surveys instead of navigate along a line (Buckland et al., 2005).

The coordinates of all points were recorded with GPS. Young and mature individuals of the material counted in order to determine the population size.

4.3.2 Distribution and population size analysis

The distribution and population size of *S. veneris* species was analyzed with distance 7.0 software using the GPS data and the counted number of individuals received in field survey. This software used for design and analysis of distance sampling data. Also this software predict size and abundance of a population (Laake et al.,1996). The Distance software was selected because it can analyze of distance sampling data which is point transect.

CHAPTER 5
RESULTS & DISCUSSION

5.1 Results

In this section, results about distribution area and individual number of study material *S. veneris* has been given. In the field studies *S.veneris* was obsereved only around Hamitköy, Taşkent, Güngör and Değirmenlik unlike the previous reports. No other populations were observed in other areas. In this study it was observed that this species flowering phase between March and June.

5.1.1 Hamitköy Sampling Stations of *Salvia veneris* Hedge

In the field studies, the coordinates of 76 sampling stations of *S. veneris* in Hamitköy were taken with GPS. These coordinates entered into Google Earth. Hamitköy sampling stations map shown in Figure 5.1. Coordinates of sampling stations and individual numbers of study material in Hamitköy shown in Table 5.1.

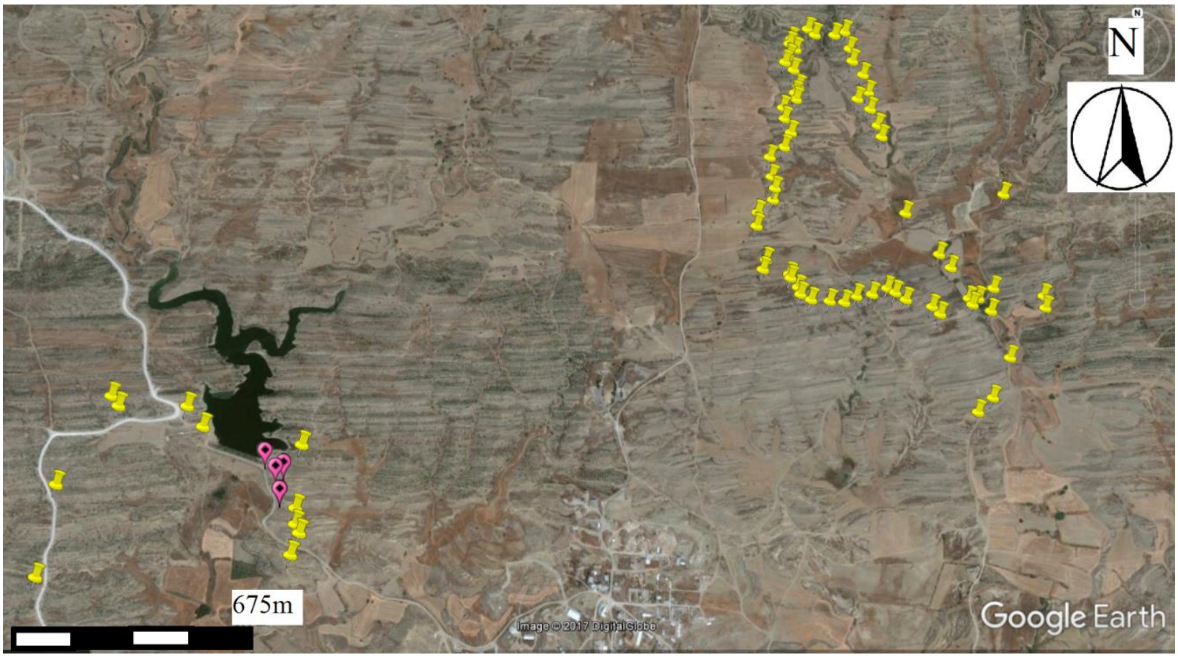

Figure 5.1: Hamitköy sampling stations of *S. veneris* – Map generated with Google Earth. *S. veneris* is seen at pink points and not seen at the yellow points.

Table 5.1: Hamitköy sampling stations of *S. veneris*

	Latitude	Longitude	Altitude	Young individual Number	Mature individual Number	Number of *Salvia veneris*
H1	**35°14'7.11"N**	**33°21'49.92"E**	**164m**	**67**	**69**	**136**
H2	**35°14'5.97"N**	**33°21'52.18"E**	**170m**	**46**	**57**	**103**
H3	**35°14'5.62"N**	**33°21'51.25"E**	**168m**	**225**	**332**	**557**
H4	**35°14'3.48"N**	**33°21'51.84"E**	**168m**	**0**	**4**	**4**
H5	**35°14'2.33"N**	**33°21'53.33"E**	**169m**	**0**	**0**	**0**
H6	**35°14'0.81"N**	**33°21'53.33"E**	**167m**	**0**	**0**	**0**
H7	**35°13'60.00"N**	**33°21'53.82"E**	**165m**	**0**	**0**	**0**
H8	**35°13'57.97"N**	**33°21'52.87"E**	**163m**	**0**	**0**	**0**
H9	**35°14'8.27"N**	**33°21'53.81"E**	**171m**	**0**	**0**	**0**
H10	**35°14'10.00"N**	**33°21'42.06"E**	**164m**	**0**	**0**	**0**
H11	**35°14'11.95"N**	**33°21'40.16"E**	**168m**	**0**	**0**	**0**
H12	**35°14'11.96"N**	**33°21'32.24"E**	**175m**	**0**	**0**	**0**
H13	**35°14'12.89"N**	**33°21'31.39"E**	**179m**	**0**	**0**	**0**
H14	**35°14'4.52"N**	**33°21'25.57"E**	**175m**	**0**	**0**	**0**
H15	**35°13'55.94"N**	**33°21'23.85"E**	**169m**	**0**	**0**	**0**
H16	**35°14'11.47"N**	**33°23'12.80"E**	**176m**	**0**	**0**	**0**
H17	**35°14'12.84"N**	**33°23'14.60"E**	**178m**	**0**	**0**	**0**
H18	**35°14'16.69"N**	**33°23'16.91"E**	**177m**	**0**	**0**	**0**
H19	**35°14'21.52"N**	**33°23'21.34"E**	**182m**	**0**	**0**	**0**
H20	**35°14'22.67"N**	**33°23'21.19"E**	**184m**	**0**	**0**	**0**
H21	**35°14'23.46"N**	**33°23'15.36"E**	**180m**	**0**	**0**	**0**
H22	**35°14'32.78"N**	**33°23'17.12"E**	**186m**	**0**	**0**	**0**
H23	**35°14'21.23"N**	**33°23'14.93"E**	**179m**	**0**	**0**	**0**
H24	**35°14'21.84"N**	**33°23'12.73"E**	**183m**	**0**	**0**	**0**
H25	**35°14'20.87"N**	**33°23'8.74"E**	**190m**	**0**	**0**	**0**
H26	**35°14'21.59"N**	**33°23'7.84"E**	**192m**	**0**	**0**	**0**
H27	**35°14'22.27"N**	**33°23'4.74"E**	**192m**	**0**	**0**	**0**
H28	**35°14'22.96"N**	**33°23'3.52"E**	**193m**	**0**	**0**	**0**
H29	**35°14'23.39"N**	**33°23'2.62"E**	**193m**	**0**	**0**	**0**
H30	**35°14'22.81"N**	**33°23'0.82"E**	**188m**	**0**	**0**	**0**
H31	**35°14'22.63"N**	**33°22'58.94"E**	**189m**	**0**	**0**	**0**
H32	**35°14'22.02"N**	**33°22'57.50"E**	**190m**	**0**	**0**	**0**
H33	**35°14'22.13"N**	**33°22'55.74"E**	**192m**	**0**	**0**	**0**
H34	**35°14'22.24"N**	**33°22'53.51"E**	**196m**	**0**	**0**	**0**
H35	**35°14'22.74"N**	**33°22'52.25"E**	**200m**	**0**	**0**	**0**
H36	**35°14'23.42"N**	**33°22'51.96"E**	**203m**	**0**	**0**	**0**
H37	**35°14'24.32"N**	**33°22'51.10"E**	**206m**	**0**	**0**	**0**
H38	**35°14'24.68"N**	**33°22'50.95"E**	**207m**	**0**	**0**	**0**
H39	**35°14'25.12"N**	**33°22'47.82"E**	**212m**	**0**	**0**	**0**
H40	**35°14'26.09"N**	**33°22'48.22"E**	**209m**	**0**	**0**	**0**

Table 5.1: (Continued). Hamitköy sampling stations of *S. veneris*

H41	**35°14'29.47"N**	**33°22'47.24"E**	**205m**	**0**	**0**	**0**
H42	**35°14'30.80"N**	**33°22'47.42"E**	**204m**	**0**	**0**	**0**
H43	**35°14'32.10"N**	**33°22'49.30"E**	**202m**	**0**	**0**	**0**
H44	**35°14'33.25"N**	**33°22'49.55"E**	**203m**	**0**	**0**	**0**
H45	**35°14'34.40"N**	**33°22'49.19"E**	**205m**	**0**	**0**	**0**
H46	**35°14'36.38"N**	**33°22'49.04"E**	**204m**	**0**	**0**	**0**
H47	**35°14'37.43"N**	**33°22'50.81"E**	**203m**	**0**	**0**	**0**
H48	**35°14'38.90"N**	**33°22'51.67"E**	**204m**	**0**	**0**	**0**
H49	**35°14'40.31"N**	**33°22'50.95"E**	**206m**	**0**	**0**	**0**
H50	**35°14'41.42"N**	**33°22'50.77"E**	**206m**	**0**	**0**	**0**
H51	**35°14'42.32"N**	**33°22'52.39"E**	**204m**	**0**	**0**	**0**
H52	**35°14'42.97"N**	**33°22'52.28"E**	**204m**	**0**	**0**	**0**
H53	**35°14'43.62"N**	**33°22'52.72"E**	**204m**	**0**	**0**	**0**
H54	**35°14'45.35"N**	**33°22'52.21"E**	**205m**	**0**	**0**	**0**
H55	**35°14'46.14"N**	**33°22'51.17"E**	**208m**	**0**	**0**	**0**
H56	**35°14'46.75"N**	**33°22'51.67"E**	**206m**	**0**	**0**	**0**
H57	**35°14'47.51"N**	**33°22'52.54"E**	**204m**	**0**	**0**	**0**
H58	**35°14'48.08"N**	**33°22'51.78"E**	**205m**	**0**	**0**	**0**
H59	**35°14'48.59"N**	**33°22'52.03"E**	**204m**	**0**	**0**	**0**
H60	**35°14'49.67"N**	**33°22'54.12"E**	**202m**	**0**	**0**	**0**
H61	**35°14'49.09"N**	**33°22'54.98"E**	**201m**	**0**	**0**	**0**
H62	**35°14'49.06"N**	**33°22'57.36"E**	**200m**	**0**	**0**	**0**
H63	**35°14'49.38"N**	**33°22'58.62"E**	**202m**	**0**	**0**	**0**
H64	**35°14'47.62"N**	**33°22'59.16"E**	**201m**	**0**	**0**	**0**
H65	**35°14'46.36"N**	**33°22'59.45"E**	**200m**	**0**	**0**	**0**
H66	**35°14'44.95"N**	**33°23'0.71"E**	**197m**	**0**	**0**	**0**
H67	**35°14'43.15"N**	**33°23'1.28"E**	**195m**	**0**	**0**	**0**
H68	**35°14'42.47"N**	**33°22'59.95"E**	**195m**	**0**	**0**	**0**
H69	**35°14'41.42"N**	**33°23'1.46"E**	**193m**	**0**	**0**	**0**
H70	**35°14'39.77"N**	**33°23'2.29"E**	**192m**	**0**	**0**	**0**
H71	**35°14'38.62"N**	**33°23'2.72"E**	**191m**	**0**	**0**	**0**
H72	**35°14'30.91"N**	**33°23'5.28"E**	**184m**	**0**	**0**	**0**
H73	**35°14'26.81"N**	**33°23'9.10"E**	**181m**	**0**	**0**	**0**
H74	**35°14'25.48"N**	**33°23'10.39"E**	**182m**	**0**	**0**	**0**
H75	**35°14'22.45"N**	**33°23'12.34"E**	**182m**	**0**	**0**	**0**
H76	**35°14'22.45"N**	**33°23'13.49"E**	**182m**	**0**	**0**	**0**

5.1.2 Taşkent Sampling Stations of *Salvia veneris* Hedge

In the field studies, the coordinates of 146 sampling stations of *S. veneris* in Taşkent were taken with GPS. These coordinates entered into Google Earth. Taşkent sampling stations map shown in Figure 5.2. Coordinates of sampling stations and individual numbers of study material in Taşkent shown in Table 5.2.

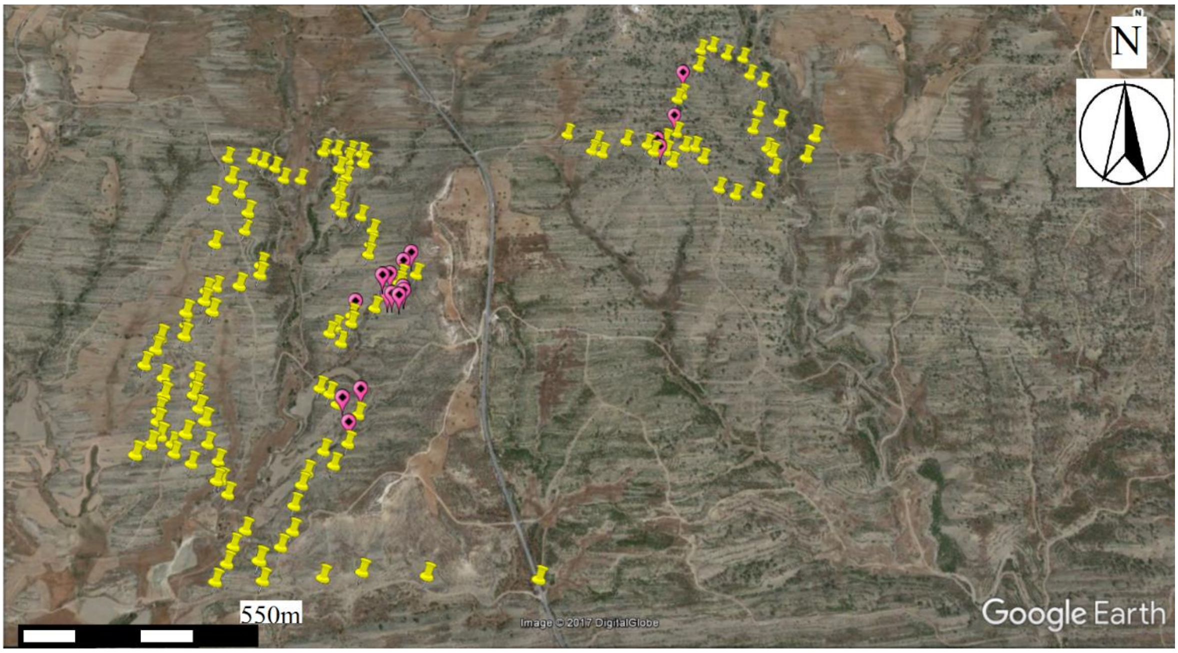

Figure 5.2: Taşkent sampling stations of *S. veneris* – Map generated with Google Earth. *S. veneris* is seen at pink points and not seen at the yellow points.

Table 5.2: Taşkent sampling stations of *S. veneris*

	Latitude	Longitude	Altitude	Young individual Number	Mature individual Number	Number of *Salvia veneris*
T1	**35°14'31.31"N**	**33°23'48.44"E**	**208m**	**0**	**0**	**0**
T2	**35°14'31.42"N**	**33°23'37.90"E**	**202m**	**0**	**0**	**0**
T3	**35°14'31.63"N**	**33°23'31.74"E**	**199m**	**0**	**0**	**0**
T4	**35°14'31.16"N**	**33°23'28.07"E**	**195m**	**0**	**0**	**0**
T5	**35°14'30.84"N**	**33°23'22.42"E**	**194m**	**0**	**0**	**0**
T6	**35°14'32.10"N**	**33°23'18.71"E**	**189m**	**0**	**0**	**0**
T7	**35°14'30.73"N**	**33°23'17.88"E**	**187m**	**0**	**0**	**0**
T8	**35°14'33.47"N**	**33°23'19.07"E**	**188m**	**0**	**0**	**0**
T9	**35°14'34.73"N**	**33°23'20.00"E**	**189m**	**0**	**0**	**0**
T10	**35°14'37.57"N**	**33°23'17.70"E**	**187m**	**0**	**0**	**0**
T11	**35°14'38.65"N**	**33°23'16.40"E**	**189m**	**0**	**0**	**0**
T12	**35°14'38.72"N**	**33°23'16.84"E**	**189m**	**0**	**0**	**0**
T13	**35°14'40.24"N**	**33°23'16.26"E**	**191m**	**0**	**0**	**0**
T14	**35°14'41.64"N**	**33°23'14.96"E**	**194m**	**0**	**0**	**0**

Table 5.2: (Continued). Taşkent sampling stations of *S. veneris*

T15	**35°14'39.98"N**	**33°23'13.70"E**	**194m**	**0**	**0**	**0**
T16	**35°14'40.74"N**	**33°23'11.90"E**	**199m**	**0**	**0**	**0**
T17	**35°14'41.53"N**	**33°23'11.51"E**	**200m**	**0**	**0**	**0**
T18	**35°14'40.50"N**	**33°23'8.06"E**	**197m**	**0**	**0**	**0**
T19	**35°14'41.38"N**	**33°23'9.39"E**	**200m**	**0**	**0**	**0**
T20	**35°14'42.09"N**	**33°23'10.19"E**	**201m**	**0**	**0**	**0**
T21	**35°14'42.32"N**	**33°23'12.68"E**	**200m**	**0**	**0**	**0**
T22	**35°14'43.47"N**	**33°23'14.33"E**	**198m**	**0**	**0**	**0**
T23	**35°14'43.30"N**	**33°23'9.66"E**	**201m**	**0**	**0**	**0**
T24	**35°14'44.21"N**	**33°23'9.54"E**	**201m**	**0**	**0**	**0**
T25	**35°14'44.49"N**	**33°23'13.58"E**	**201m**	**0**	**0**	**0**
T26	**35°14'45.63"N**	**33°23'12.83"E**	**203m**	**0**	**0**	**0**
T27	**35°14'45.56"N**	**33°23'9.81"E**	**203m**	**0**	**0**	**0**
T28	**35°14'46.49"N**	**33°23'12.92"E**	**204m**	**0**	**0**	**0**
T29	**35°14'47.35"N**	**33°23'12.71"E**	**205m**	**0**	**0**	**0**
T30	**35°14'47.06"N**	**33°23'9.44"E**	**203m**	**0**	**0**	**0**
T31	**35°14'48.21"N**	**33°23'7.19"E**	**202m**	**0**	**0**	**0**
T32	**35°14'49.59"N**	**33°23'8.07"E**	**205m**	**0**	**0**	**0**
T33	**35°14'50.66"N**	**33°23'8.31"E**	**206m**	**0**	**0**	**0**
T34	**35°14'50.82"N**	**33°23'10.80"E**	**208m**	**0**	**0**	**0**
T35	**35°14'51.94"N**	**33°23'10.72"E**	**209m**	**0**	**0**	**0**
T36	**35°14'52.99"N**	**33°23'10.50"E**	**208m**	**0**	**0**	**0**
T37	**35°14'53.12"N**	**33°23'13.26"E**	**210m**	**0**	**0**	**0**
T38	**35°14'54.09"N**	**33°23'12.22"E**	**211m**	**0**	**0**	**0**
T39	**35°14'55.04"N**	**33°23'12.22"E**	**210m**	**0**	**0**	**0**
T40	**35°14'55.46"N**	**33°23'13.24"E**	**212m**	**0**	**0**	**0**
T41	**35°14'55.55"N**	**33°23'15.62"E**	**212m**	**0**	**0**	**0**
T42	**35°14'56.68"N**	**33°23'17.58"E**	**210m**	**0**	**0**	**0**
T43	**35°14'57.59"N**	**33°23'17.50"E**	**210m**	**0**	**0**	**0**
T44	**35°14'59.57"N**	**33°23'12.26"E**	**215m**	**0**	**0**	**0**
T45	**35°15'0.97"N**	**33°23'15.25"E**	**216m**	**0**	**0**	**0**
T46	**35°15'2.70"N**	**33°23'15.23"E**	**215m**	**0**	**0**	**0**
T47	**35°15'4.04"N**	**33°23'11.18"E**	**218m**	**0**	**0**	**0**
T48	**35°15'4.64"N**	**33°23'13.96"E**	**217m**	**0**	**0**	**0**
T49	**35°15'6.10"N**	**33°23'12.77"E**	**219m**	**0**	**0**	**0**
T50	**35°15'8.35"N**	**33°23'11.98"E**	**220m**	**0**	**0**	**0**
T51	**35°15'8.35"N**	**33°23'14.75"E**	**215m**	**0**	**0**	**0**
T52	**35°15'7.99"N**	**33°23'15.94"E**	**215m**	**0**	**0**	**0**
T53	**35°15'7.52"N**	**33°23'17.34"E**	**213m**	**0**	**0**	**0**
T54	**35°15'6.41"N**	**33°23'18.49"E**	**212m**	**0**	**0**	**0**
T55	**35°15'6.37"N**	**33°23'20.36"E**	**212m**	**0**	**0**	**0**
T56	**35°15'9.29"N**	**33°23'22.42"E**	**215m**	**0**	**0**	**0**
T57	**35°15'9.54"N**	**33°23'22.60"E**	**215m**	**0**	**0**	**0**
T58	**35°15'9.40"N**	**33°23'23.96"E**	**215m**	**0**	**0**	**0**

Table 5.2: (Continued). Taşkent sampling stations of *S. veneris*

T59	**35°15'9.36"N**	**33°23'25.51"E**	**216m**	**0**	**0**	**0**
T60	**35°15'9.14"N**	**33°23'26.77"E**	**217m**	**0**	**0**	**0**
T61	**35°15'8.38"N**	**33°23'25.30"E**	**215m**	**0**	**0**	**0**
T62	**35°15'8.04"N**	**33°23'27.12"E**	**216m**	**0**	**0**	**0**
T63	**35°15'7.47"N**	**33°23'24.46"E**	**213m**	**0**	**0**	**0**
T64	**35°15'6.73"N**	**33°23'25.40"E**	**214m**	**0**	**0**	**0**
T65	**35°15'5.04"N**	**33°23'24.97"E**	**212m**	**0**	**0**	**0**
T66	**35°15'5.44"N**	**33°23'24.58"E**	**212m**	**0**	**0**	**0**
T67	**35°15'3.71"N**	**33°23'24.68"E**	**210m**	**0**	**0**	**0**
T68	**35°15'3.06"N**	**33°23'25.37"E**	**211m**	**0**	**0**	**0**
T69	**35°15'2.66"N**	**33°23'27.56"E**	**214m**	**0**	**0**	**0**
T70	**35°15'1.15"N**	**33°23'29.08"E**	**220m**	**0**	**0**	**0**
T71	**35°14'59.78"N**	**33°23'29.00"E**	**219m**	**0**	**0**	**0**
T72	**35°14'58.81"N**	**33°23'28.90"E**	**219m**	**0**	**0**	**0**
T73	**35°14'56.11"N**	**33°23'31.09"E**	**219m**	**31**	**28**	**59**
T74	**35°14'56.22"N**	**33°23'31.88"E**	**221m**	**18**	**9**	**27**
T75	**35°14'56.04"N**	**33°23'32.53"E**	**223m**	**0**	**0**	**0**
T76	**35°14'56.65"N**	**33°23'32.68"E**	**225m**	**0**	**0**	**0**
T77	**35°14'57.37"N**	**33°23'33.22"E**	**229m**	**45**	**11**	**56**
T78	**35°14'58.09"N**	**33°23'34.01"E**	**234m**	**14**	**2**	**16**
T79	**35°14'56.69"N**	**33°23'34.33"E**	**232m**	**0**	**0**	**0**
T80	**35°14'54.89"N**	**33°23'32.68"E**	**221m**	**0**	**0**	**0**
T81	**35°14'54.92"N**	**33°23'33.43"E**	**224m**	**2**	**2**	**4**
T82	**35°14'54.60"N**	**33°23'33.54"E**	**224m**	**4**	**8**	**12**
T83	**35°14'54.20"N**	**33°23'33.07"E**	**221m**	**25**	**12**	**37**
T84	**35°14'54.38"N**	**33°23'32.28"E**	**218m**	**58**	**11**	**69**
T85	**35°14'54.35"N**	**33°23'31.81"E**	**216m**	**3**	**2**	**5**
T86	**35°14'53.77"N**	**33°23'30.19"E**	**211m**	**0**	**0**	**0**
T87	**35°14'53.70"N**	**33°23'28.50"E**	**211m**	**12**	**23**	**35**
T88	**35°14'53.09"N**	**33°23'27.82"E**	**210m**	**0**	**0**	**0**
T89	**35°14'52.40"N**	**33°23'27.89"E**	**208m**	**0**	**0**	**0**
T90	**35°14'52.01"N**	**33°23'26.34"E**	**207m**	**0**	**0**	**0**
T91	**35°14'51.47"N**	**33°23'25.73"E**	**205m**	**0**	**0**	**0**
T92	**35°14'50.60"N**	**33°23'27.06"E**	**205m**	**0**	**0**	**0**
T93	**35°14'46.57"N**	**33°23'25.44"E**	**200m**	**0**	**0**	**0**
T94	**35°14'46.07"N**	**33°23'26.52"E**	**202m**	**0**	**0**	**0**
T95	**35°14'45.17"N**	**33°23'27.42"E**	**203m**	**0**	**0**	**0**
T96	**35°14'45.06"N**	**33°23'28.32"E**	**204m**	**84**	**45**	**129**
T97	**35°14'45.82"N**	**33°23'30.08"E**	**206m**	**211**	**61**	**272**
T98	**35°14'44.27"N**	**33°23'29.69"E**	**205m**	**0**	**0**	**0**
T99	**35°14'42.94"N**	**33°23'29.26"E**	**206m**	**215**	**126**	**341**
T100	**35°14'41.78"N**	**33°23'29.04"E**	**208m**	**0**	**0**	**0**
T101	**35°14'41.17"N**	**33°23'26.66"E**	**201m**	**0**	**0**	**0**
T102	**35°14'39.95"N**	**33°23'27.92"E**	**208m**	**0**	**0**	**0**

Table 5.2: (Continued). Taşkent sampling stations of *S. veneris*

T103	**35°14'39.37"N**	**33°23'25.30"E**	**200m**	**0**	**0**	**0**
T104	**35°14'38.36"N**	**33°23'24.94"E**	**200m**	**0**	**0**	**0**
T105	**35°14'36.67"N**	**33°23'24.50"E**	**202m**	**0**	**0**	**0**
T106	**35°14'34.66"N**	**33°23'24.68"E**	**200m**	**0**	**0**	**0**
T107	**35°14'33.43"N**	**33°23'23.71"E**	**197m**	**0**	**0**	**0**
T108	**35°14'32.28"N**	**33°23'21.80"E**	**193m**	**0**	**0**	**0**
T109	**35°15'11.09"N**	**33°23'49.70"E**	**240m**	**0**	**0**	**0**
T110	**35°15'10.33"N**	**33°23'52.98"E**	**242m**	**0**	**0**	**0**
T111	**35°15'10.33"N**	**33°23'56.26"E**	**248m**	**0**	**0**	**0**
T112	**35°15'9.94"N**	**33°23'58.60"E**	**248m**	**0**	**0**	**0**
T113	**35°15'9.90"N**	**33°24'0.07"E**	**247m**	**3**	**28**	**31**
T114	**35°15'9.97"N**	**33°24'3.89"E**	**238m**	**0**	**0**	**0**
T115	**35°15'8.22"N**	**33°24'1.37"E**	**243m**	**0**	**0**	**0**
T116	**35°15'10.58"N**	**33°24'0.61"E**	**246m**	**0**	**0**	**0**
T117	**35°15'12.56"N**	**33°24'1.98"E**	**243m**	**3**	**30**	**33**
T118	**35°15'11.41"N**	**33°24'1.87"E**	**243m**	**0**	**0**	**0**
T119	**35°15'15.08"N**	**33°24'2.02"E**	**244m**	**0**	**0**	**0**
T120	**35°15'15.59"N**	**33°24'2.56"E**	**244m**	**0**	**0**	**0**
T121	**35°15'17.28"N**	**33°24'3.02"E**	**248m**	**1**	**5**	**6**
T122	**35°15'18.65"N**	**33°24'4.50"E**	**250m**	**0**	**0**	**0**
T123	**35°15'20.48"N**	**33°24'4.79"E**	**255m**	**0**	**0**	**0**
T124	**35°15'20.88"N**	**33°24'6.12"E**	**253m**	**0**	**0**	**0**
T125	**35°15'20.09"N**	**33°24'7.78"E**	**247m**	**0**	**0**	**0**
T126	**35°15'19.91"N**	**33°24'9.68"E**	**243m**	**0**	**0**	**0**
T127	**35°15'18.07"N**	**33°24'10.40"E**	**239m**	**0**	**0**	**0**
T128	**35°15'17.32"N**	**33°24'11.88"E**	**234m**	**0**	**0**	**0**
T129	**35°15'14.11"N**	**33°24'11.20"E**	**232m**	**0**	**0**	**0**
T130	**35°15'12.20"N**	**33°24'10.51"E**	**230m**	**0**	**0**	**0**
T131	**35°15'10.26"N**	**33°24'11.99"E**	**226m**	**0**	**0**	**0**
T132	**35°15'9.76"N**	**33°24'12.56"E**	**224m**	**0**	**0**	**0**
T133	**35°15'8.17"N**	**33°24'12.71"E**	**222m**	**0**	**0**	**0**
T134	**35°15'5.54"N**	**33°24'10.66"E**	**223m**	**0**	**0**	**0**
T135	**35°15'5.22"N**	**33°24'8.24"E**	**229m**	**0**	**0**	**0**
T136	**35°15'5.80"N**	**33°24'6.48"E**	**233m**	**0**	**0**	**0**
T137	**35°15'8.78"N**	**33°24'4.79"E**	**236m**	**0**	**0**	**0**
T138	**35°15'9.94"N**	**33°24'2.77"E**	**240m**	**0**	**0**	**0**
T139	**35°15'9.36"N**	**33°24'0.72"E**	**245m**	**0**	**0**	**0**
T140	**35°15'9.11"N**	**33°24'0.36"E**	**245m**	**0**	**1**	**1**
T141	**35°15'9.25"N**	**33°23'59.32"E**	**248m**	**0**	**0**	**0**
T142	**35°15'9.11"N**	**33°23'53.63"E**	**240m**	**0**	**0**	**0**
T143	**35°15'9.40"N**	**33°23'52.51"E**	**240m**	**0**	**0**	**0**
T144	**35°15'11.42"N**	**33°24'17.35"E**	**228m**	**0**	**0**	**0**
T145	**35°15'9.29"N**	**33°24'16.27"E**	**224m**	**0**	**0**	**0**
T146	**35°15'13.07"N**	**33°24'13.57"E**	**228m**	**0**	**0**	**0**

5.1.3 Güngör Sampling Stations of *Salvia veneris* Hedge

In the field studies, the coordinates of 170 sampling stations of *S. veneris* in Güngör were taken with GPS. These coordinates entered into Google Earth. Güngör sampling stations map shown in Figure 5.3. Coordinates of sampling stations and individual numbers of study material in Güngör shown in Table 5.3.

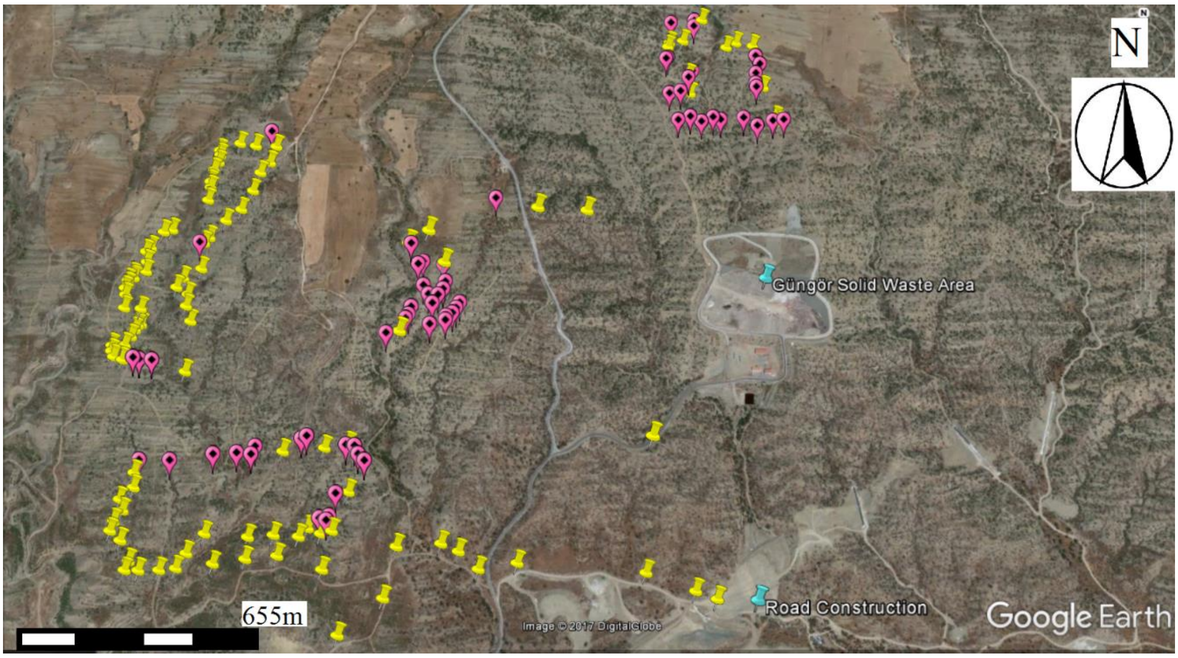

Figure 5.3: Güngör sampling stations of *S. veneris* – Map generated with Google Earth. *S. veneris* is seen at pink points and not seen at the yellow points.

Table 5.3: Güngör sampling stations of *S. veneris*

	Latitude	Longitude	Altitude	Young individual Number	Mature individual Number	Number of *Salvia veneris*
G1	**35°15'4.42"N**	**33°25'8.87"E**	**244m**	**17**	**13**	**30**
G2	**35°15'3.90"N**	**33°25'8.48"E**	**243m**	**11**	**8**	**19**
G3	**35°15'3.41"N**	**33°25'8.08"E**	**242m**	**24**	**12**	**36**
G4	**35°15'2.72"N**	**33°25'7.31"E**	**241m**	**41**	**9**	**50**
G5	**35°15'2.32"N**	**33°25'5.53"E**	**239m**	**185**	**30**	**215**
G6	**35°15'3.12"N**	**33°25'7.36"E**	**241m**	**171**	**76**	**247**
G7	**35°15'4.34"N**	**33°25'5.70"E**	**241m**	**87**	**35**	**122**

Table 5.3: (Continued). Güngör sampling stations of *S. veneris*

G8	**35°15'5.17"N**	**33°25'6.31"E**	**248m**	**42**	**7**	**49**
G9	**35°15'5.73"N**	**33°25'6.86"E**	**243m**	**5**	**4**	**9**
G10	**35°15'6.46"N**	**33°25'7.08"E**	**244m**	**36**	**40**	**76**
G11	**35°15'8.13"N**	**33°25'6.74"E**	**245m**	**6**	**0**	**6**
G12	**35°15'9.07"N**	**33°25'6.42"E**	**246m**	**0**	**0**	**0**
G13	**35°15'8.40"N**	**33°25'4.36"E**	**245m**	**3**	**20**	**23**
G14	**35°15'8.16"N**	**33°25'3.80"E**	**244m**	**5**	**2**	**7**
G15	**35°15'6.06"N**	**33°25'4.56"E**	**243m**	**16**	**26**	**42**
G16	**35°15'5.20"N**	**33°25'5.20"E**	**241m**	**16**	**17**	**33**
G17	**35°15'3.96"N**	**33°25'3.29"E**	**240m**	**12**	**9**	**21**
G18	**35°15'3.22"N**	**33°25'3.02"E**	**238m**	**37**	**29**	**66**
G19	**35°15'2.83"N**	**33°25'2.71"E**	**238m**	**31**	**51**	**82**
G20	**35°15'2.30"N**	**33°25'1.66"E**	**236m**	**0**	**0**	**0**
G21	**35°15'1.42"N**	**33°25'0.57"E**	**235m**	**26**	**8**	**34**
G22	**35°15'10.18"N**	**33°25'2.85"E**	**248m**	**16**	**13**	**29**
G23	**35°15'10.90"N**	**33°25'2.13"E**	**249m**	**0**	**0**	**0**
G24	**35°15'12.20"N**	**33°25'4.40"E**	**252m**	**0**	**0**	**0**
G25	**35°15'14.85"N**	**33°25'12.52"E**	**256m**	**8**	**0**	**8**
G26	**35°15'14.70"N**	**33°25'17.08"E**	**256m**	**0**	**0**	**0**
G27	**35°15'14.66"N**	**33°25'22.88"E**	**242m**	**0**	**0**	**0**
G28	**35°14'53.02"N**	**33°25'30.85"E**	**213m**	**0**	**0**	**0**
G29	**35°15'26.46"N**	**33°25'32.95"E**	**247m**	**20**	**38**	**58**
G30	**35°15'26.82"N**	**33°25'34.32"E**	**241m**	**193**	**226**	**419**
G31	**35°15'27.50"N**	**33°25'35.15"E**	**236m**	**0**	**0**	**0**
G32	**35°15'28.48"N**	**33°25'35.33"E**	**234m**	**230**	**97**	**327**
G33	**35°15'29.27"N**	**33°25'35.83"E**	**231m**	**42**	**27**	**69**
G34	**35°15'29.56"N**	**33°25'34.97"E**	**234m**	**0**	**0**	**0**
G35	**35°15'30.42"N**	**33°25'32.56"E**	**240m**	**304**	**191**	**495**
G36	**35°15'30.56"N**	**33°25'32.77"E**	**239m**	**3**	**10**	**13**
G37	**35°15'32.69"N**	**33°25'32.45"E**	**236m**	**0**	**0**	**0**
G38	**35°15'33.16"N**	**33°25'32.63"E**	**234m**	**0**	**0**	**0**
G39	**35°15'33.44"N**	**33°25'34.32"E**	**232m**	**0**	**0**	**0**
G40	**35°15'34.27"N**	**33°25'36.01"E**	**233m**	**400**	**346**	**746**

Table 5.3: (Continued). Güngör sampling stations of *S. veneris*

G41	**35°15'34.56"N**	**33°25'33.17"E**	**235m**	**6**	**47**	**53**
G42	**35°15'34.88"N**	**33°25'36.08"E**	**234m**	**2**	**12**	**14**
G43	**35°15'35.78"N**	**33°25'36.66"E**	**236m**	**0**	**0**	**0**
G44	**35°15'32.76"N**	**33°25'39.65"E**	**233m**	**0**	**0**	**0**
G45	**35°15'33.23"N**	**33°25'40.84"E**	**236m**	**0**	**0**	**0**
G46	**35°15'32.87"N**	**33°25'42.89"E**	**239m**	**0**	**0**	**0**
G47	**35°15'30.89"N**	**33°25'43.57"E**	**239m**	**235**	**171**	**406**
G48	**35°15'30.02"N**	**33°25'44.08"E**	**238m**	**86**	**49**	**135**
G49	**35°15'29.02"N**	**33°25'43.57"E**	**237m**	**4**	**15**	**19**
G50	**35°15'28.30"N**	**33°25'44.08"E**	**237m**	**0**	**0**	**0**
G51	**35°15'27.94"N**	**33°25'43.54"E**	**235m**	**150**	**11**	**161**
G52	**35°15'27.54"N**	**33°25'43.61"E**	**235m**	**63**	**23**	**86**
G53	**35°15'24.98"N**	**33°25'45.44"E**	**240m**	**0**	**0**	**0**
G54	**35°15'24.41"N**	**33°25'45.91"E**	**240m**	**0**	**0**	**0**
G55	**35°15'23.90"N**	**33°25'46.78"E**	**241m**	**6**	**12**	**18**
G56	**35°15'23.80"N**	**33°25'45.48"E**	**240m**	**5**	**2**	**7**
G57	**35°15'23.36"N**	**33°25'43.64"E**	**232m**	**4**	**11**	**15**
G58	**35°15'24.26"N**	**33°25'42.02"E**	**227m**	**28**	**3**	**31**
G59	**35°15'24.05"N**	**33°25'39.25"E**	**225m**	**25**	**16**	**41**
G60	**35°15'24.30"N**	**33°25'38.32"E**	**226m**	**10**	**25**	**35**
G61	**35°15'23.69"N**	**33°25'36.88"E**	**233m**	**19**	**16**	**35**
G62	**35°15'24.12"N**	**33°25'35.51"E**	**238m**	**15**	**25**	**40**
G63	**35°15'23.65"N**	**33°25'34.03"E**	**242m**	**26**	**35**	**61**
G64	**35°15'21.20"N**	**33°24'45.47"E**	**269m**	**20**	**11**	**31**
G65	**35°15'20.44"N**	**33°24'45.76"E**	**269m**	**0**	**0**	**0**
G66	**35°15'18.79"N**	**33°24'45.14"E**	**264m**	**0**	**0**	**0**
G67	**35°15'17.82"N**	**33°24'44.06"E**	**258m**	**0**	**0**	**0**
G68	**35°15'16.02"N**	**33°24'43.31"E**	**250m**	**0**	**0**	**0**
G69	**35°15'14.18"N**	**33°24'42.05"E**	**242m**	**0**	**0**	**0**
G70	**35°15'13.07"N**	**33°24'40.32"E**	**237m**	**0**	**0**	**0**
G71	**35°15'11.38"N**	**33°24'38.52"E**	**231m**	**0**	**0**	**0**
G72	**35°15'10.84"N**	**33°24'37.94"E**	**230m**	**0**	**0**	**0**
G73	**35°15'10.12"N**	**33°24'37.84"E**	**228m**	**36**	**13**	**49**

Table 5.3: (Continued). Güngör sampling stations of *S. veneris*

G74	**35°15'8.28"N**	**33°24'37.91"E**	**225m**	**0**	**0**	**0**
G75	**35°15'7.31"N**	**33°24'35.93"E**	**224m**	**0**	**0**	**0**
G76	**35°15'6.41"N**	**33°24'35.24"E**	**223m**	**0**	**0**	**0**
G77	**35°15'5.72"N**	**33°24'36.65"E**	**223m**	**0**	**0**	**0**
G78	**35°15'4.57"N**	**33°24'36.61"E**	**222m**	**0**	**0**	**0**
G79	**35°15'3.10"N**	**33°24'37.30"E**	**220m**	**0**	**0**	**0**
G80	**35°14'58.27"N**	**33°24'37.30"E**	**213m**	**0**	**0**	**0**
G81	**35°14'58.52"N**	**33°24'33.84"E**	**216m**	**1**	**0**	**1**
G82	**35°14'58.56"N**	**33°24'32.44"E**	**219m**	**13**	**15**	**28**
G83	**35°14'58.70"N**	**33°24'31.72"E**	**220m**	**24**	**11**	**35**
G84	**35°14'59.24"N**	**33°24'30.06"E**	**221m**	**0**	**0**	**0**
G85	**35°14'59.50"N**	**33°24'29.02"E**	**222m**	**0**	**0**	**0**
G86	**35°15'0.04"N**	**33°24'28.69"E**	**222m**	**0**	**0**	**0**
G87	**35°15'0.58"N**	**33°24'28.66"E**	**222m**	**0**	**0**	**0**
G88	**35°15'0.65"N**	**33°24'30.13"E**	**222m**	**0**	**0**	**0**
G89	**35°15'1.48"N**	**33°24'30.71"E**	**222m**	**0**	**0**	**0**
G90	**35°15'2.16"N**	**33°24'31.07"E**	**222m**	**0**	**0**	**0**
G91	**35°15'2.70"N**	**33°24'31.68"E**	**222m**	**0**	**0**	**0**
G92	**35°15'2.59"N**	**33°24'31.32"E**	**222m**	**0**	**0**	**0**
G93	**35°15'3.28"N**	**33°24'31.39"E**	**222m**	**0**	**0**	**0**
G94	**35°15'4.21"N**	**33°24'31.43"E**	**223m**	**0**	**0**	**0**
G95	**35°15'4.25"N**	**33°24'29.52"E**	**224m**	**0**	**0**	**0**
G96	**35°15'5.54"N**	**33°24'29.45"E**	**225m**	**0**	**0**	**0**
G97	**35°15'6.19"N**	**33°24'29.30"E**	**225m**	**0**	**0**	**0**
G98	**35°15'6.55"N**	**33°24'29.56"E**	**225m**	**0**	**0**	**0**
G99	**35°15'6.95"N**	**33°24'29.52"E**	**226m**	**0**	**0**	**0**
G100	**35°15'7.24"N**	**33°24'30.17"E**	**226m**	**0**	**0**	**0**
G101	**35°15'7.52"N**	**33°24'29.99"E**	**226m**	**0**	**0**	**0**
G102	**35°15'7.88"N**	**33°24'31.50"E**	**226m**	**0**	**0**	**0**
G103	**35°15'8.82"N**	**33°24'31.46"E**	**227m**	**0**	**0**	**0**
G104	**35°15'9.86"N**	**33°24'31.21"E**	**228m**	**0**	**0**	**0**
G105	**35°15'10.26"N**	**33°24'31.75"E**	**228m**	**0**	**0**	**0**
G106	**35°15'11.88"N**	**33°24'33.01"E**	**229m**	**0**	**0**	**0**

Table 5.3: (Continued). Güngör sampling stations of *S. veneris*

G107	**35°15'12.10"N**	**33°24'33.98"E**	**229m**	**0**	**0**	**0**
G108	**35°15'15.16"N**	**33°24'37.91"E**	**236m**	**0**	**0**	**0**
G109	**35°15'16.45"N**	**33°24'38.05"E**	**238m**	**0**	**0**	**0**
G110	**35°15'17.03"N**	**33°24'37.94"E**	**239m**	**0**	**0**	**0**
G111	**35°15'18.25"N**	**33°24'38.23"E**	**241m**	**0**	**0**	**0**
G112	**35°15'19.04"N**	**33°24'38.74"E**	**244m**	**0**	**0**	**0**
G113	**35°15'19.76"N**	**33°24'38.84"E**	**246m**	**0**	**0**	**0**
G114	**35°15'20.23"N**	**33°24'38.74"E**	**248m**	**0**	**0**	**0**
G115	**35°15'20.88"N**	**33°24'41.22"E**	**255m**	**0**	**0**	**0**
G116	**35°15'20.56"N**	**33°24'43.20"E**	**261m**	**0**	**0**	**0**
G117	**35°14'38.69"N**	**33°25'38.06"E**	**188m**	**0**	**0**	**0**
G118	**35°14'39.34"N**	**33°25'35.69"E**	**191m**	**0**	**0**	**0**
G119	**35°14'40.85"N**	**33°25'30.25"E**	**189m**	**0**	**0**	**0**
G120	**35°14'41.46"N**	**33°25'16.10"E**	**200m**	**0**	**0**	**0**
G121	**35°14'40.85"N**	**33°25'11.89"E**	**202m**	**0**	**0**	**0**
G122	**35°14'42.36"N**	**33°25'9.62"E**	**206m**	**0**	**0**	**0**
G123	**35°14'43.01"N**	**33°25'7.68"E**	**210m**	**0**	**0**	**0**
G124	**35°14'42.65"N**	**33°25'2.86"E**	**217m**	**0**	**0**	**0**
G125	**35°14'40.52"N**	**33°24'54.86"E**	**212m**	**0**	**0**	**0**
G126	**35°14'41.64"N**	**33°24'49.75"E**	**205m**	**0**	**0**	**0**
G127	**35°14'41.32"N**	**33°24'46.19"E**	**198m**	**0**	**0**	**0**
G128	**35°14'43.26"N**	**33°24'46.22"E**	**196m**	**0**	**0**	**0**
G129	**35°14'43.48"N**	**33°24'49.10"E**	**201m**	**0**	**0**	**0**
G130	**35°14'43.37"N**	**33°24'51.95"E**	**206m**	**0**	**0**	**0**
G131	**35°14'44.12"N**	**33°24'52.88"E**	**208m**	**0**	**0**	**0**
G132	**35°14'43.66"N**	**33°24'54.40"E**	**212m**	**0**	**0**	**0**
G133	**35°14'43.91"N**	**33°24'55.62"E**	**216m**	**0**	**0**	**0**
G134	**35°14'44.27"N**	**33°24'54.54"E**	**213m**	**3**	**2**	**5**
G135	**35°14'44.09"N**	**33°24'55.33"E**	**216m**	**5**	**1**	**6**
G136	**35°14'44.45"N**	**33°24'55.62"E**	**216m**	**2**	**0**	**2**
G137	**35°14'46.50"N**	**33°24'56.16"E**	**218m**	**26**	**8**	**34**
G138	**35°14'47.40"N**	**33°24'57.17"E**	**221m**	**0**	**0**	**0**
G139	**35°14'49.49"N**	**33°24'59.11"E**	**224m**	**11**	**5**	**16**

Table 5.3: (Continued). Güngör sampling stations of *S. veneris*

G140	**35°14'50.06"N**	**33°24'58.36"E**	**223m**	**17**	**6**	**23**
G141	**35°14'50.82"N**	**33°24'57.89"E**	**223m**	**35**	**1**	**36**
G142	**35°14'50.89"N**	**33°24'56.92"E**	**223m**	**80**	**0**	**80**
G143	**35°14'51.72"N**	**33°24'56.77"E**	**224m**	**0**	**0**	**0**
G144	**35°14'51.36"N**	**33°24'54.07"E**	**217m**	**0**	**0**	**0**
G145	**35°14'51.68"N**	**33°24'52.34"E**	**215m**	**14**	**3**	**17**
G146	**35°14'51.43"N**	**33°24'51.77"E**	**213m**	**0**	**3**	**3**
G147	**35°14'51.00"N**	**33°24'49.32"E**	**209m**	**0**	**0**	**0**
G148	**35°14'50.67"N**	**33°24'46.54"E**	**203m**	**84**	**16**	**100**
G149	**35°14'49.94"N**	**33°24'46.15"E**	**202m**	**127**	**21**	**148**
G150	**35°14'50.06"N**	**33°24'44.50"E**	**202m**	**5**	**2**	**7**
G151	**35°14'49.88"N**	**33°24'41.90"E**	**203m**	**18**	**0**	**18**
G152	**35°14'49.24"N**	**33°24'37.12"E**	**203m**	**34**	**15**	**49**
G153	**35°14'49.20"N**	**33°24'33.70"E**	**204m**	**29**	**5**	**34**
G154	**35°14'48.80"N**	**33°24'32.87"E**	**205m**	**0**	**0**	**0**
G155	**35°14'47.47"N**	**33°24'32.98"E**	**203m**	**0**	**0**	**0**
G156	**35°14'46.36"N**	**33°24'31.64"E**	**205m**	**0**	**0**	**0**
G157	**35°14'45.38"N**	**33°24'32.11"E**	**203m**	**0**	**0**	**0**
G158	**35°14'44.41"N**	**33°24'31.32"E**	**204m**	**0**	**0**	**0**
G159	**35°14'43.55"N**	**33°24'31.07"E**	**204m**	**0**	**0**	**0**
G160	**35°14'42.72"N**	**33°24'32.29"E**	**201m**	**0**	**0**	**0**
G161	**35°14'40.13"N**	**33°24'33.12"E**	**198m**	**0**	**0**	**0**
G162	**35°14'40.92"N**	**33°24'33.44"E**	**198m**	**0**	**0**	**0**
G163	**35°14'40.13"N**	**33°24'34.56"E**	**194m**	**0**	**0**	**0**
G164	**35°14'40.20"N**	**33°24'36.72"E**	**187m**	**0**	**0**	**0**
G165	**35°14'40.38"N**	**33°24'38.52"E**	**187m**	**0**	**0**	**0**
G166	**35°14'41.71"N**	**33°24'39.53"E**	**190m**	**0**	**0**	**0**
G167	**35°14'43.48"N**	**33°24'41.36"E**	**194m**	**0**	**0**	**0**
G168	**35°14'40.85"N**	**33°24'42.59"E**	**191m**	**0**	**0**	**0**
G169	**35°14'38.15"N**	**33°25'1.78"E**	**217m**	**0**	**0**	**0**
G170	**35°14'34.94"N**	**33°24'57.20"E**	**219m**	**0**	**0**	**0**

5.1.4 Değirmenlik Sampling Stations of *Salvia veneris* Hedge

In the field studies, the coordinates of 94 sampling stations of *S. veneris* in Değirmenlik were taken with GPS. These coordinates entered into Google Earth. Değirmenlik sampling stations map shown in Figure 5.4. Coordinates of sampling stations and individual numbers of study material in Değirmenlik shown in Table 5.4.

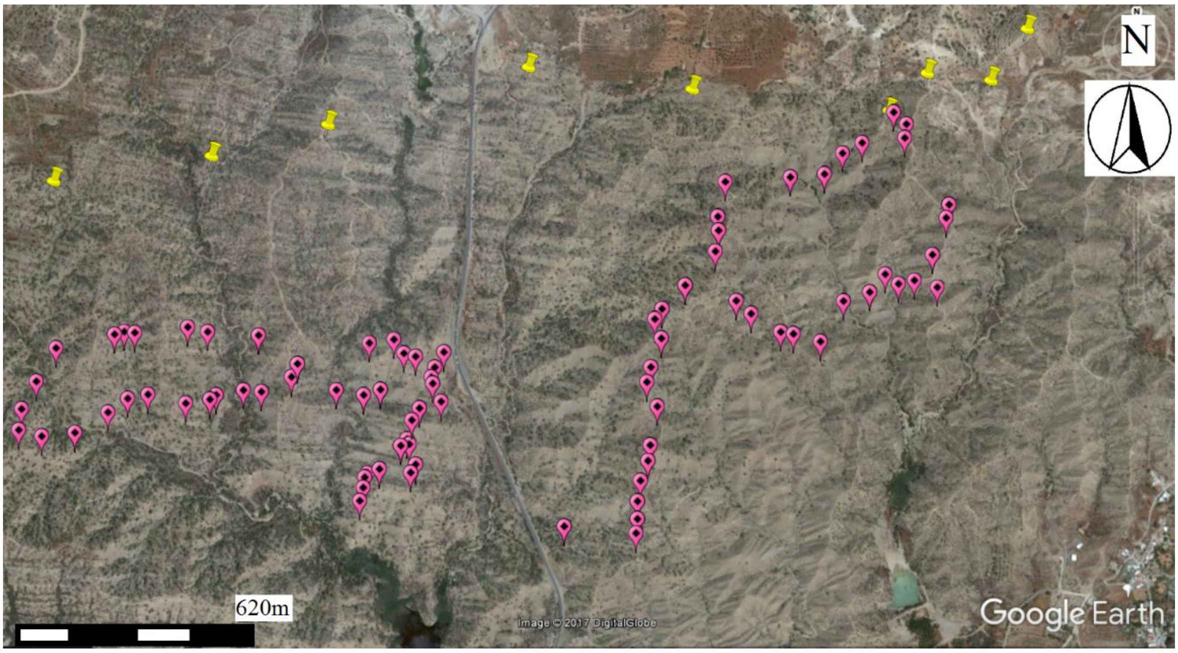

Figure 5.4: Değirmenlik sampling stations of *S. veneris* – Map generated with Google Earth. *S. veneris* is seen at pink points and not seen at the yellow points.

Table 5.4: Değirmenlik sampling stations of *S. veneris*

	Latitude	Longitude	Altitude	Young individual Number	Mature individual Number	Number of *Salvia veneris*
D1	**35°15'7.63"N**	**33°27'42.05"E**	**200m**	**2**	**5**	**7**
D2	**35°15'7.22"N**	**33°27'49.62"E**	**213m**	**86**	**95**	**181**
D3	**35°15'8.42"N**	**33°27'49.75"E**	**210m**	**90**	**101**	**191**
D4	**35°15'9.93"N**	**33°27'49.72"E**	**212m**	**17**	**43**	**60**
D5	**35°15'11.70"N**	**33°27'49.99"E**	**216m**	**72**	**56**	**128**
D6	**35°15'13.42"N**	**33°27'50.74"E**	**220m**	**106**	**219**	**325**

Table 5.4: (Continued). Değirmenlik sampling stations of *S. veneris*

D7	**35°15'14.76"N**	**33°27'50.95"E**	**222m**	**254**	**405**	**659**
D8	**35°15'18.09"N**	**33°27'51.62"E**	**226m**	**2**	**8**	**10**
D9	**35°15'20.17"N**	**33°27'50.47"E**	**232m**	**9**	**9**	**18**
D10	**35°15'21.46"N**	**33°27'50.86"E**	**235m**	**35**	**46**	**81**
D11	**35°15'23.94"N**	**33°27'51.91"E**	**239m**	**25**	**35**	**60**
D12	**35°15'25.59"N**	**33°27'51.18"E**	**241m**	**11**	**18**	**29**
D13	**35°15'26.48"N**	**33°27'51.92"E**	**243m**	**12**	**20**	**32**
D14	**35°15'28.53"N**	**33°27'54.30"E**	**252m**	**173**	**352**	**525**
D15	**35°15'31.51"N**	**33°27'57.43"E**	**255m**	**67**	**89**	**156**
D16	**35°15'33.31"N**	**33°27'57.73"E**	**256m**	**110**	**172**	**282**
D17	**35°15'34.51"N**	**33°27'57.63"E**	**258m**	**102**	**315**	**417**
D18	**35°15'37.58"N**	**33°27'58.39"E**	**255m**	**7**	**20**	**27**
D19	**35°15'22.43"N**	**33°27'28.87"E**	**213m**	**19**	**31**	**50**
D20	**35°15'21.10"N**	**33°27'27.94"E**	**209m**	**22**	**1**	**23**
D21	**35°15'20.23"N**	**33°27'27.58"E**	**209m**	**80**	**96**	**176**
D22	**35°15'19.69"N**	**33°27'27.76"E**	**209m**	**49**	**64**	**113**
D23	**35°15'18.14"N**	**33°27'28.69"E**	**206m**	**35**	**16**	**51**
D24	**35°15'17.53"N**	**33°27'26.42"E**	**207m**	**8**	**31**	**39**
D25	**35°15'16.49"N**	**33°27'25.63"E**	**205m**	**41**	**7**	**48**
D26	**35°15'14.83"N**	**33°27'25.16"E**	**202m**	**11**	**18**	**29**
D27	**35°15'14.40"N**	**33°27'25.42"E**	**202m**	**34**	**7**	**41**
D28	**35°15'14.26"N**	**33°27'24.52"E**	**202m**	**9**	**1**	**10**
D29	**35°15'12.67"N**	**33°27'26.14"E**	**197m**	**66**	**27**	**93**
D30	**35°15'11.95"N**	**33°27'25.63"E**	**196m**	**16**	**32**	**48**
D31	**35°15'12.20"N**	**33°27'22.28"E**	**194m**	**1**	**14**	**15**
D32	**35°15'11.81"N**	**33°27'20.95"E**	**190m**	**22**	**37**	**59**
D33	**35°15'11.45"N**	**33°27'20.70"E**	**188m**	**24**	**35**	**59**
D34	**35°15'10.55"N**	**33°27'20.56"E**	**186m**	**29**	**83**	**112**
D35	**35°15'9.40"N**	**33°27'20.20"E**	**181m**	**55**	**51**	**106**
D36	**35°15'22.00"N**	**33°27'25.88"E**	**214m**	**34**	**33**	**67**
D37	**35°15'22.25"N**	**33°27'24.62"E**	**213m**	**13**	**10**	**23**
D38	**35°15'23.44"N**	**33°27'23.51"E**	**215m**	**12**	**15**	**27**
D39	**35°15'23.11"N**	**33°27'20.81"E**	**203m**	**80**	**46**	**126**

Table 5.4: (Continued). Değirmenlik sampling stations of *S. veneris*

D40	**35°15'21.17"N**	**33°27'13.25"E**	**204m**	**113**	**31**	**144**
D41	**35°15'23.59"N**	**33°27'8.94"E**	**201m**	**130**	**37**	**167**
D42	**35°15'23.80"N**	**33°27'3.53"E**	**205m**	**66**	**29**	**95**
D43	**35°15'24.16"N**	**33°27'1.51"E**	**213m**	**21**	**17**	**38**
D44	**35°15'23.58"N**	**33°26'55.90"E**	**213m**	**75**	**53**	**128**
D45	**35°15'23.65"N**	**33°26'54.78"E**	**214m**	**90**	**19**	**109**
D46	**35°15'23.40"N**	**33°26'53.77"E**	**214m**	**38**	**30**	**68**
D47	**35°15'22.12"N**	**33°26'47.42"E**	**203m**	**88**	**48**	**136**
D48	**35°15'19.19"N**	**33°26'45.49"E**	**204m**	**114**	**84**	**198**
D49	**35°15'16.78"N**	**33°26'44.34"E**	**215m**	**44**	**43**	**87**
D50	**35°15'14.98"N**	**33°26'44.27"E**	**220m**	**21**	**12**	**33**
D51	**35°15'14.47"N**	**33°26'46.57"E**	**212m**	**65**	**60**	**125**
D52	**35°15'14.83"N**	**33°26'49.85"E**	**200m**	**109**	**74**	**183**
D53	**35°15'16.63"N**	**33°26'53.12"E**	**194m**	**13**	**1**	**14**
D54	**35°15'17.86"N**	**33°26'55.18"E**	**195m**	**63**	**31**	**94**
D55	**35°15'18.25"N**	**33°26'57.37"E**	**198m**	**42**	**19**	**61**
D56	**35°15'17.55"N**	**33°27'1.43"E**	**197m**	**29**	**25**	**54**
D57	**35°15'17.93"N**	**33°27'3.92"E**	**193m**	**46**	**20**	**66**
D58	**35°15'18.32"N**	**33°27'4.57"E**	**192m**	**20**	**2**	**22**
D59	**35°15'18.79"N**	**33°27'7.45"E**	**191m**	**10**	**4**	**14**
D60	**35°15'18.68"N**	**33°27'9.43"E**	**196m**	**62**	**8**	**70**
D61	**35°15'20.02"N**	**33°27'12.67"E**	**205m**	**47**	**29**	**76**
D62	**35°15'18.97"N**	**33°27'17.35"E**	**188m**	**57**	**5**	**62**
D63	**35°15'18.58"N**	**33°27'20.30"E**	**190m**	**20**	**8**	**28**
D64	**35°15'19.08"N**	**33°27'22.14"E**	**197m**	**88**	**81**	**169**
D65	**35°15'38.31"N**	**33°28'5.51"E**	**226m**	**185**	**191**	**376**
D66	**35°15'38.70"N**	**33°28'9.23"E**	**2218m**	**79**	**35**	**114**
D67	**35°15'40.50"N**	**33°28'11.06"E**	**229m**	**74**	**21**	**95**
D68	**35°15'41.36"N**	**33°28'13.04"E**	**240m**	**52**	**29**	**81**
D69	**35°15'44.93"N**	**33°28'15.46"E**	**251m**	**0**	**0**	**0**
D70	**35°15'44.02"N**	**33°28'16.28"E**	**253m**	**11**	**7**	**18**
D71	**35°15'42.98"N**	**33°28'17.62"E**	**253m**	**17**	**8**	**25**
D72	**35°15'41.76"N**	**33°28'17.44"E**	**253m**	**137**	**41**	**178**

Table 5.4: (Continued). Değirmenlik sampling stations of *S. veneris*

D73	**35°15'36.11"N**	**33°28'22.40"E**	**233m**	**31**	**9**	**40**
D74	**35°15'34.96"N**	**33°28'22.12"E**	**232m**	**29**	**16**	**45**
D75	**35°15'31.75"N**	**33°28'20.78"E**	**220m**	**17**	**0**	**17**
D76	**35°15'28.94"N**	**33°28'21.40"E**	**211m**	**21**	**8**	**29**
D77	**35°15'29.52"N**	**33°28'18.98"E**	**209m**	**42**	**9**	**51**
D78	**35°15'29.20"N**	**33°28'17.33"E**	**205m**	**11**	**4**	**15**
D79	**35°15'30.02"N**	**33°28'15.89"E**	**207m**	**27**	**10**	**37**
D80	**35°15'28.44"N**	**33°28'14.30"E**	**200m**	**121**	**35**	**156**
D81	**35°15'27.60"N**	**33°28'11.47"E**	**202m**	**76**	**38**	**114**
D82	**35°15'23.98"N**	**33°28'8.87"E**	**221m**	**31**	**12**	**43**
D83	**35°15'24.59"N**	**33°28'5.95"E**	**224m**	**40**	**1**	**41**
D84	**35°15'24.73"N**	**33°28'4.58"E**	**226m**	**21**	**4**	**25**
D85	**35°15'26.24"N**	**33°28'1.38"E**	**233m**	**54**	**12**	**66**
D86	**35°15'27.32"N**	**33°27'59.76"E**	**239m**	**15**	**0**	**15**
D87	**35°15'48.19"N**	**33°28'19.53"E**	**253m**	**0**	**0**	**0**
D88	**35°15'47.94"N**	**33°28'26.73"E**	**227m**	**0**	**0**	**0**
D89	**35°15'52.52"N**	**33°28'30.56"E**	**236m**	**0**	**0**	**0**
D90	**35°15'46.36"N**	**33°27'54.42"E**	**253m**	**0**	**0**	**0**
D91	**35°15'48.17"N**	**33°27'36.85"E**	**241m**	**0**	**0**	**0**
D92	**35°15'42.70"N**	**33°27'15.55"E**	**241m**	**0**	**0**	**0**
D93	**35°15'39.94"N**	**33°27'2.81"E**	**214m**	**0**	**0**	**0**
D94	**35°15'37.33"N**	**33°26'46.23"E**	**226m**	**0**	**0**	**0**

5.1.5 Hamitköy *Salvia veneris* H. Population Counts

Total number of *S. veneris* at the sampling stations are 800, 462 of them are mature individual and 338 of them are young individual. %57.8 of the research species are mature individual and reproduction can continuing with them. %42.2 of the research species are young individual and these shown that seeds can germinate. The percentage chart of mature and young individuals in Hamitköy is shown in Figure 5.5. and individual number of study material in Hamitköy is shown in Table 5.5.

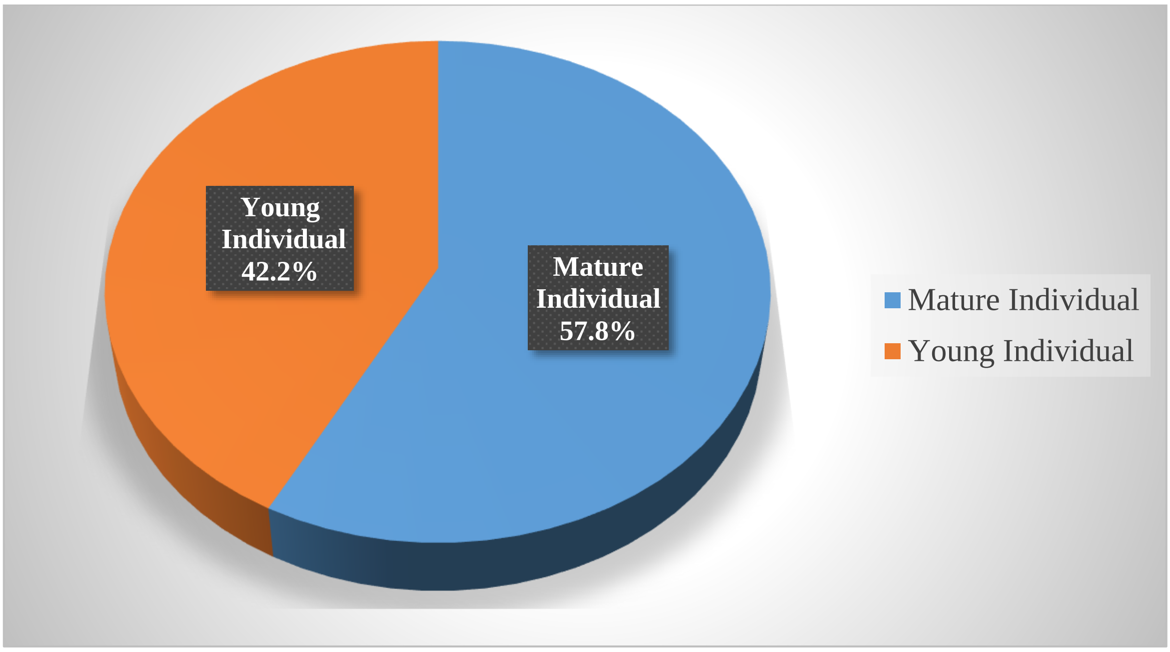

Figure 5.5 Percentage of mature and young individuals of *S. veneris* in Hamitköy

Table 5.5: Population counts of *S. veneris* in Hamitköy

	Young Individual Number	**Mature Individual Number**	**Total Number of *Salvia veneris***
H1	**67**	**69**	**136**
H2	**46**	**57**	**103**
H3	**225**	**332**	**557**
H4	**0**	**4**	**4**

5.1.6 Taşkent *Salvia veneris* H. Population Counts

Total number of *S. veneris* at the sampling stations are 1133, 404 of them are mature individual and 729 of them are young individual. %35.7 of the research species are mature individual and reproduction can continuing with them. %64.3 of the research species are young individual and these shown that seeds can germinate. The percentage chart of mature and young individuals in Taşkent is shown in Figure 5.6. and individual number of study material in Taşkent is shown in Table 5.6.

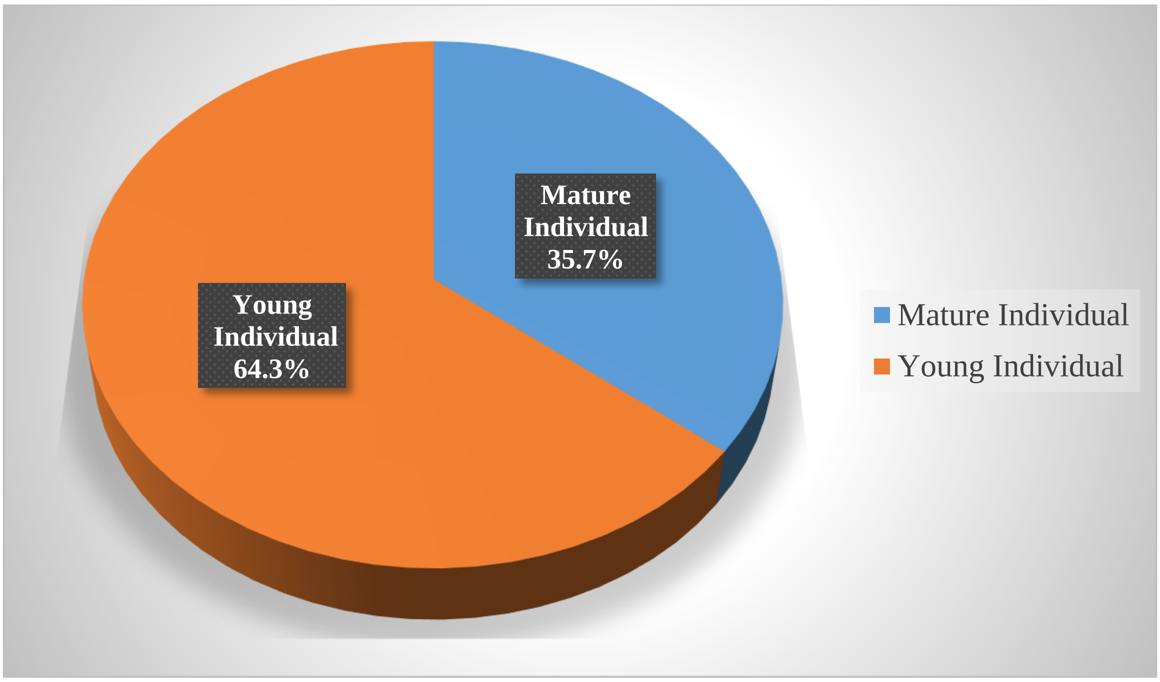

Figure 5.6 Percentage of mature and young individuals of *S. veneris* in Taşkent

Table 5.6: Population counts of *S. veneris* in Taşkent

	Young Individual Number	Mature Individual Number	Total Number of *Salvia veneris*
T73	31	28	59
T74	18	9	27
T77	45	11	56
T78	14	2	16
T81	2	2	4
T82	4	8	12
T83	25	12	37
T84	58	11	69
T85	3	2	5
T87	12	23	35
T96	84	45	129
T97	211	61	272
T99	215	126	341

Table 5.6: Population counts of *S. veneris* in Taşkent

T113	**3**	**28**	**31**
T117	**3**	**30**	**33**
T121	**1**	**5**	**6**
T140	**0**	**1**	**1**

5.1.7 Güngör *Salvia veneris* H. Population Counts

Total number of *S. veneris* at the sampling stations are 5210, 1955 of them are mature individual and 3255 of them are young individual. %37.5 of the research species are mature individual and reproduction can continuing with them. %62.5 of the research species are young individual and these shown that seeds can germinate. The percentage chart of mature and young individuals in Güngör is shown in Figure 5.7. and individual number of study material in Güngör is shown in Table 5.7.

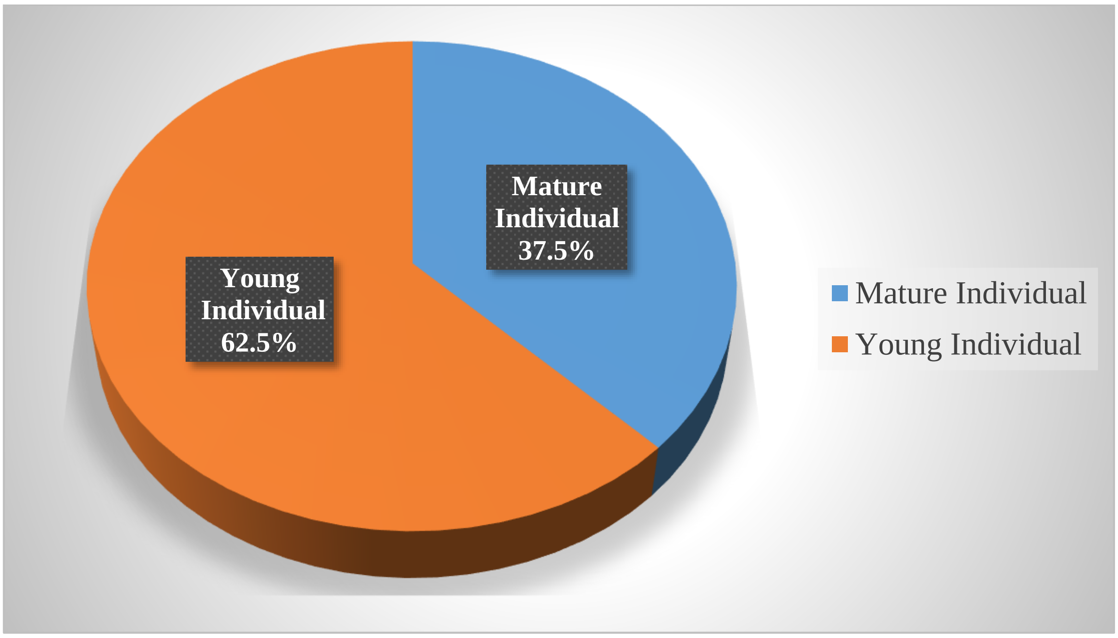

Figure 5.7 Percentage of mature and young individuals of *S. veneris* in Güngör

Table 5.7: Population counts of *S. veneris* in Güngör

	Young Individual Number	Mature Individual Number	Total Number of *Salvia veneris*
G1	**17**	**13**	**30**
G2	**11**	**8**	**19**
G3	**24**	**12**	**36**
G4	**41**	**9**	**50**
G5	**185**	**30**	**215**
G6	**171**	**76**	**247**
G7	**87**	**35**	**122**
G8	**42**	**7**	**49**
G9	**5**	**4**	**9**
G10	**36**	**40**	**76**
G11	**6**	**0**	**6**
G13	**3**	**20**	**23**
G14	**5**	**2**	**7**
G15	**16**	**26**	**42**
G16	**16**	**17**	**33**
G17	**12**	**9**	**21**
G18	**37**	**29**	**66**
G19	**31**	**51**	**82**
G21	**26**	**8**	**34**
G22	**16**	**13**	**29**
G25	**8**	**0**	**8**
G29	**20**	**38**	**58**
G30	**193**	**226**	**419**
G32	**230**	**97**	**327**
G33	**42**	**27**	**69**
G35	**304**	**191**	**495**
G36	**3**	**10**	**13**
G40	**400**	**346**	**746**

Table 5.7: (Continued). Population counts of *S. veneris* in Güngör

G41	**6**	**47**	**53**
G42	**2**	**12**	**14**
G47	**235**	**171**	**406**
G48	**86**	**49**	**135**
G49	**4**	**15**	**19**
G51	**150**	**11**	**161**
G52	**63**	**23**	**86**
G55	**6**	**12**	**18**
G56	**5**	**2**	**7**
G57	**4**	**11**	**15**
G58	**28**	**3**	**31**
G59	**25**	**16**	**41**
G60	**10**	**25**	**35**
G61	**19**	**16**	**35**
G62	**15**	**25**	**40**
G63	**26**	**35**	**61**
G64	**20**	**11**	**31**
G73	**36**	**13**	**49**
G81	**1**	**0**	**1**
G82	**13**	**15**	**28**
G83	**24**	**11**	**35**
G134	**3**	**2**	**5**
G135	**5**	**1**	**6**
G136	**2**	**0**	**2**
G137	**26**	**8**	**34**
G139	**11**	**5**	**16**
G140	**17**	**6**	**23**
G141	**35**	**1**	**36**
G142	**80**	**0**	**80**
G145	**14**	**3**	**17**

Table 5.7: (Continued). Population counts of *S. veneris* in Güngör

G146	**0**	**3**	**3**
G148	**84**	**16**	**100**
G149	**127**	**21**	**148**
G150	**5**	**2**	**7**
G151	**18**	**0**	**18**
G152	**34**	**15**	**49**
G153	**29**	**5**	**34**

5.1.8 Değirmenlik *Salvia veneris* H. Population Counts

Total number of *S. veneris* at the sampling stations are 8325, 3923 of them are mature individual and 4402 of them are young individual. %47.1 of the research species are mature individual and reproduction can continuing with them. %52.9 of the research species are young individual and these shown that seeds can germinate. The percentage chart of mature and young individuals in Değirmenlik is shown in Figure 5.8. and individual number of study material in Değirmenlik is shown in Table 5.8.

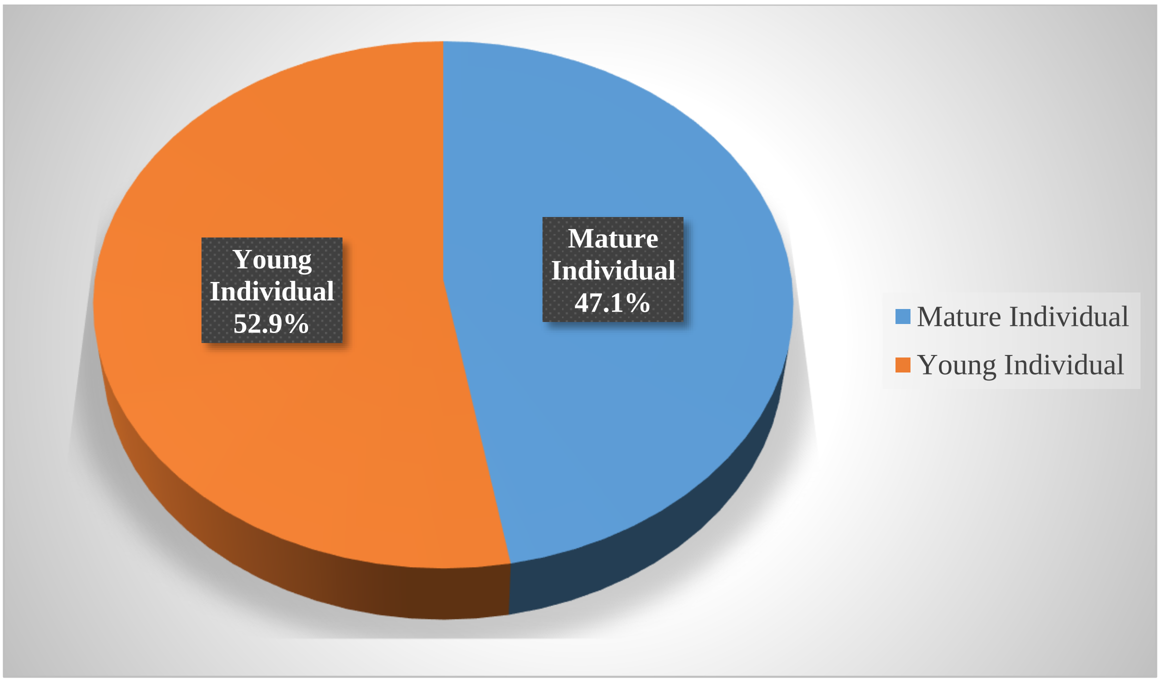

Figure 5.8 Percentage of mature and young individuals of *S. veneris* in Değirmenlik

Table 5.8: Population counts of *S. veneris* in Değirmenlik

	Young Individual Number	Mature Individual Number	Total Number of *Salvia veneris*
D1	**2**	**5**	**7**
D2	**86**	**95**	**181**
D3	**90**	**101**	**191**
D4	**17**	**43**	**60**
D5	**72**	**56**	**128**
D6	**106**	**219**	**325**
D7	**254**	**405**	**659**
D8	**2**	**8**	**10**
D9	**9**	**9**	**18**
D10	**35**	**46**	**81**
D11	**25**	**35**	**60**
D12	**11**	**18**	**29**
D13	**12**	**20**	**32**
D14	**173**	**352**	**525**
D15	**67**	**89**	**156**
D16	**110**	**172**	**282**
D17	**102**	**315**	**417**
D18	**7**	**20**	**27**
D19	**19**	**31**	**50**
D20	**22**	**1**	**23**
D21	**80**	**96**	**176**
D22	**49**	**64**	**113**
D23	**35**	**16**	**51**
D24	**8**	**31**	**39**
D25	**41**	**7**	**48**
D26	**11**	**18**	**29**
D27	**34**	**7**	**41**
D28	**9**	**1**	**10**
D29	**66**	**27**	**93**
D30	**16**	**32**	**48**

Table 5.8: (Continued). Population counts of *S. veneris* in Değirmenlik

D31	**1**	**14**	**15**
D32	**22**	**37**	**59**
D33	**24**	**35**	**59**
D34	**29**	**83**	**112**
D35	**55**	**51**	**106**
D36	**34**	**33**	**67**
D37	**13**	**10**	**23**
D38	**12**	**15**	**27**
D39	**80**	**46**	**126**
D40	**113**	**31**	**144**
D41	**130**	**37**	**167**
D42	**66**	**29**	**95**
D43	**21**	**17**	**38**
D44	**75**	**53**	**128**
D45	**90**	**19**	**109**
D46	**38**	**30**	**68**
D47	**88**	**48**	**136**
D48	**114**	**84**	**198**
D49	**44**	**43**	**87**
D50	**21**	**12**	**33**
D51	**65**	**60**	**125**
D52	**109**	**74**	**183**
D53	**13**	**1**	**14**
D54	**63**	**31**	**94**
D55	**42**	**19**	**61**
D56	**29**	**25**	**54**
D57	**46**	**20**	**66**
D58	**20**	**2**	**22**
D59	**10**	**4**	**14**
D60	**62**	**8**	**70**
D61	**47**	**29**	**76**

Table 5.8: (Continued). Population counts of *S. veneris* in Değirmenlik

D62	**57**	**5**	**62**
D63	**20**	**8**	**28**
D64	**88**	**81**	**169**
D65	**185**	**191**	**376**
D66	**79**	**35**	**114**
D67	**74**	**21**	**95**
D68	**52**	**29**	**81**
D70	**11**	**7**	**18**
D71	**17**	**8**	**25**
D72	**137**	**41**	**178**
D73	**31**	**9**	**40**
D74	**29**	**16**	**45**
D75	**17**	**0**	**17**
D76	**21**	**8**	**29**
D77	**42**	**9**	**51**
D78	11	4	15
D79	**27**	**10**	**37**
D80	**121**	**35**	**156**
D81	**76**	**38**	**114**
D82	**31**	**12**	**43**
D83	**40**	**1**	**41**
D84	21	4	25
D85	**54**	**12**	**66**
D86	**15**	**0**	**15**

5.1.9 *Salvia veneris* H. Population Counts

Total number of *S. veneris* at the sampling stations are 15468, 6744 of them are mature individuals and 8724 of them are young individuals. %43.6 of the research species are mature individuals and %56.4 of the research species are young individual. Reproduction is continuing with mature individuals and young individuals shown that germination of seeds.

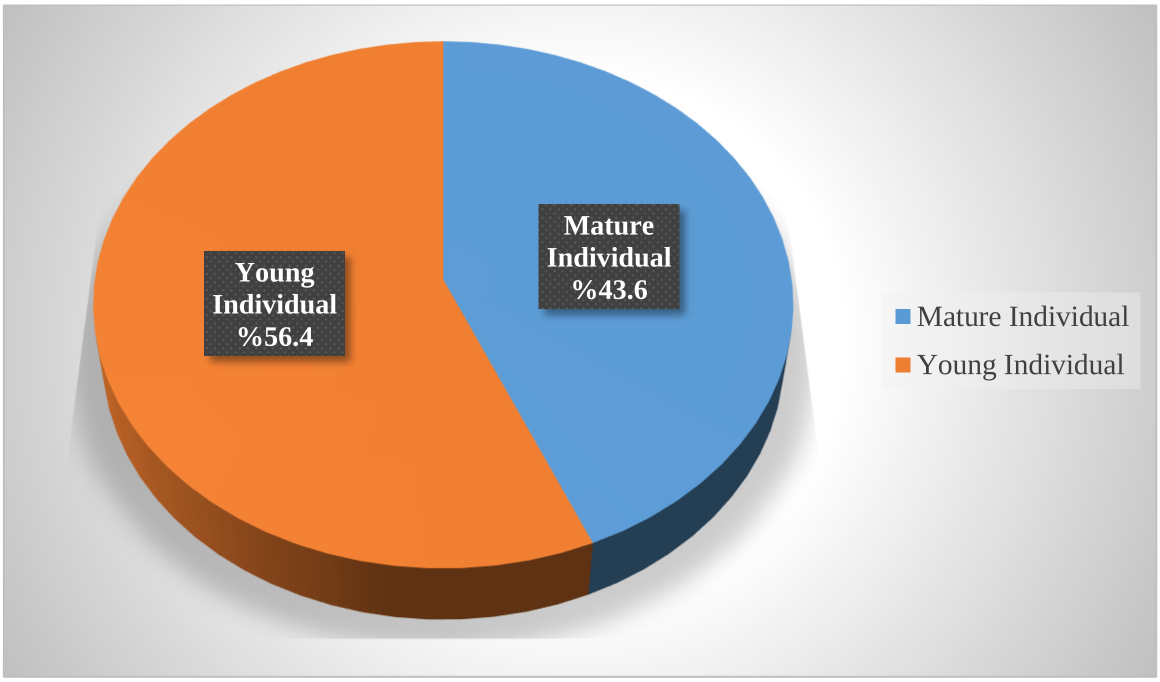

Figure 5.9 Percentage of mature and young individuals of *S. veneris* in the study area

5.1.10 Distrubiton area and population size of *Salvia veneris*

As a result of the analysis made in the Distance 7.0 program, the study areas are shown and divided by the program into 10 locations. As a result of analysis approximate number of individuals and distribution area of *S. veneris* are calculated.

Occupancy area of *S. veneris* is 2.113 km^2 and at the Distance 7.0 program analysis shown that occurrence area of this species is 10.19 km^2 . In this study 15468 individuals are counted and at the Distance 7.0 program analysis shown that estimated population size is 74595.

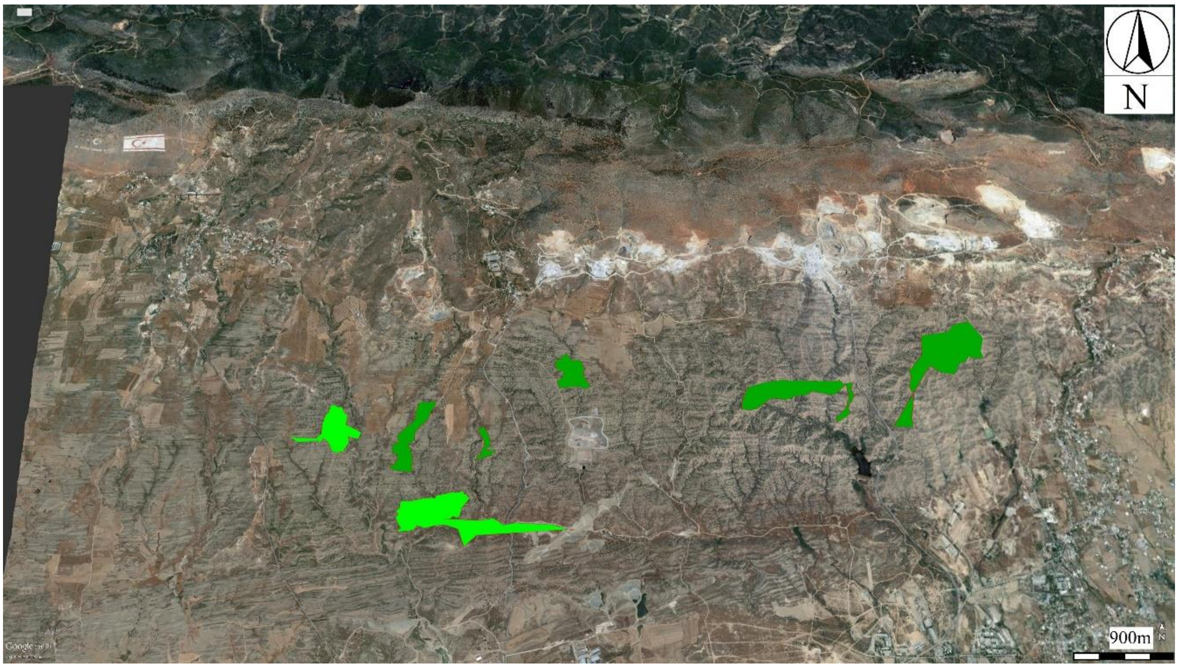

Figure 5.10 Study area of *S. veneris* - Map generated with Distance 7.0.

Table 5.9: Distrubition area and population size of *S.veneris*

	Area of Occupancy	Area of Occurrence	Counted individuals	Estimated pop size
Hamitköy 1	0.29 km^2	-	800	-
Hamitköy 2	0.34 km^2	-	0	-
Taşkent	0.43 km^2	-	1062	-
Taşkent 1	0.12 km^2	-	71	-
Güngör	0.11 km^2	-	1204	-
Güngör 1	0.28 km^2	-	578	-
Güngör 2	0.023 km^2	-	144	-
Güngör 3	0.1 km^2	-	3284	-
Değirmenlik	0.18 km^2	-	3556	-
Değirmenlik 2	0.24 km^2	-	4769	-
Total	2.113	10.19 km^2	15468	74595

5.2 Discussion

The reason for the study of *S. veneris* is that it has a narrow distribution area, its population is low and it is endemic to the Northern Cyprus. Due to these sensitive conditions of this plant species, there is a risk of extinction in the future, so studies have been conducted on the number of individuals and their distribution area of these populations.

In this study observed that there are mature and young individuals in the population. There is no problem with reproduction of mature individuals and observation of young individuals is an indication of germination of seeds. At the end of the study, when the percentages of individual numbers are examined, 43.6% adults and 56.4% young individuals are seen and this shows that this population is a balanced.

Although the population is balanced under natural conditions, it may be threatened by human activities in the future. These threats that observed in this study:

- In Hamitköy *S. veneris* individuals are near Baştanlıkdere Pond and it is recreationally open to human use. At the same time it was close to the areas where livestock activities were shown and there is road construction.
- In Güngör *S. veneris* individuals are close to road constructions and solid waste storage area.
- Military activities seen in Değirmenlik and Güngör.
- In all areas where *S. veneris* is seen, the stones in the hills are gathered by destroying the hills. Also solid waste pollution and afforastation is seen in all areas.

In the future this species may face the threat of extinction due to the proximity of human activities and threats which mentioned above causing habitat fragmentation of this species. In this study, the *S. veneris* species was observed more intensely in the Değirmenlik region because of the difficulty to reach inner zone. The hills of the Değirmenlik is higher than in other study areas, and there is no roads to go to the inner zone due to the army zone.

10 localities were determined as the result of the study for *S. veneris* species and these localities constitute an area of 10.19 km^2. The number of individuals in the field is 74,595 and according to the IUCN (2012) categories, the threatened species category is CR B1b(i, ii, ii). *S. veneris* is a critically endangered plant species which has a narrow distribution area of less than 100 km^2 and the quality of habitat area continues to decline. For this reason, this species has a high risk of extinction in the wild.

CHAPTER 6
CONCLUSION

6.1 Conclusion

It is recommended that similar and more detailed studies should be carried out so that this study can reach more precise data. Studies on reproductive biology about *S. veneris* should be carried out to determine whether there is a problem with the proliferation of this species in the future. It is recommended to conduct research on whether or not the developments in the study area have an effect on the species.

S. veneris is a critically endangered species and measures must be taken to protect at the distribution area of the species. In situ protection methods can be used for this species. For example, in some areas where species are found can be fenced around to prevent grazing. Education and information related studies about protection of the *S. veneris* species should be conducted.

S. veneris also can protected with using ex-situ protection methods. For example, botanical park can be planned and *S. veneris* species can be used in some areas of this botanic park.

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