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Biyolojik Çeşitlilik ve Koruma Üzerine Yayın Yapan Hakemli Uluslararası Bir Dergidir
An International Journal is About Biological Diversity and Conservation With Refree

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RAPD markers and morpho-physiological characterization of some Tunisian Barley ecotypes

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Abstract

The genetic variation and relationships among 12 local barleys and the varieties Martin, Rihane and Manel were evaluated using Random Amplified Polymorphic DNA (RAPD) markers and morpho-physiological traits. To fulfil this purpose, some ecotypes were collected from different bioclimatic regions and studied at morpho-physiological and molecular levels. Our results showed differences among the ecotypes studied based on the morpho-physiological criteria such as heading date, density and ear length and response to saline stress. The molecular analysis showed the limits of the morpho-physiological approach. In fact, identical ecotypes were found grown in different parts of the country and the morpho-physiological differences observed could be due to adaptation to environmental conditions and acquired over time. Also, accessions that were grown mixed together in the same area and having similar physiological behaviour were found different using the RAPD markers method. This result showed an important degree of genetic variability, which indicating the Tunisian germplasm richness.

Key words: Barley; Morpho-physiological traits; RAPD markers; Genetic diversity

1. Introduction

Cultivated barley (*Hordeum vulgare* L.) is one of the oldest cultivated plants. It was believed formerly that barley was originating from the desert areas of Southwest Asia, more than 10.000 years ago. However, recent researches attribute two origins for barley: mountainous areas of Ethiopia and Southeast Asia (Badr et al.,2000)

North Africa is considered as one of the main secondary cereal centers (Boeuf, 1931). Indeed, Tunisia constitutes an area of great cereal diversity. The local landraces are very adapted to stress conditions (drought and self), since they groom and produce a good feeding quality under harsh conditions (Hamza *et al.,2004*). They also contribute to genetic diversity and to new variety creations (Ben Naceur et al.,2001). However, replacing native germplasm by an improved and introduced materiel could lead to local phytogenetic resources erosion. Therefore, more importance should be given to local resource conservation.

Prospection, collection and assessment of genetic resources in the three Maghreb countries (Tunisie, Algeria and Morocco) started long time ago (Badr et al.,2000; Erroux, 1958) but the most recent, date back to 1982 (El Falah, 1998), 1990 (Benlaghlid *et a.*,, 1990) and 1994 (Ban Naceur *et al.*,1998). These studies were focused especially on the morphological variability of the vegetative part, ears and seeds (Benlaghlid et al.,1990) or on reserve protein diversifies (Bettaïeb and Attias, 1992; Bettaïeb et al.,2005). These studies were lacking precision and sometimes were contradictory since morphological traits and protein diversity; related to the differential genes expression in response to the plant environment vary according to environmental conditions (Liang and Pardee, 1992; Gibson and Somerville, 1993). At present the most reliable methods are the molecular marker techniques (Nuel et *al.*, 2000). Recent studies based on molecular variability have been carried out. (Lalaoui-Kamel and Assali, 1997) used RFLP to distinguish the genetic polymorphism on *Medicago* genus, Snoussi *et al*, (2004), used microsatellites to analyze the genetic diversity among grape varieties and Ben Naceur and Rouaïssi

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(2003), analyzed varietal polymorphism in wheat by AFLP method.

In Tunisia, attention is now given to study genetic variability among barley germplasm at both molecular and morphological level. The aim of this study is to characterize some barley ecotypes collected from parts of the country at the morpho-physiological and molecular level. Morpho-physiological traits and molecular RAPD markers polymorphisms were compared and checked whether we still have great genetic barley variability.

2. Materials and methods

2.1. Plant material

Twelve local winter barley ecotypes *(Hordeum vulgare, L.)* of diverse geographic origins were used in this study. These ecotypes were obtained after prospecting different Tunisian bioclimatic regions (Fig. 1). Once collected, these ecotypes were named according to their collection region. They were: Tozeur 1, Tozeur 2, Kébilli 1, Kébilli 2, Kébilli 3, Kasserine, Sidi Bouzid, Jendouba 1, Jendouba 2, Kalaâ, Kélibia 1 and Kélibia 2. Martin, Rihane and Manel varieties traditionally grown in Tunisia were also added.

- The Jendouba district is in the West-North of Tunisia, belonging to the humid inferior bioclimatic stage where the annual rainfall is 800 mm and the average annual temperature is 18°C (Monthly Bulletin of the National Meteorological Institute from 1975 to 2004).
- The Kélibia and Kalaâ districts belong to the East-North ofthe country. They are characterized by a sub-humid bioclimatic sector where the annual rainfall is 600 mm.
- The Kasserine and Sidi Bouzid district is in the Tunisian West-center and belonging to the aridsuperior bioclimatic region where the average annual rainfall is 300 mm.
- The Tozeur and Kébilli districts originated from Tunisia southern and belonging to the desert bioclimatic zone where the average annual rainfall is less than 150 mm.

2.2. Morpho-physiological traits:

The morpho-physiological criteria used were heading date, ear density and length, plant height and the response of the ecotypes to saline stress (length of epicotyl and chlorophyll content). Three different salt concentrations were applied (0, 6 and 12 g of NaCl L^{-1}) at the germination level. Each treatment was repeated five times. Twenty seeds were placed in a Petri dish on a filter paper soaked with 10 mL distilled water (control) or 10 mL saline solution (6 or 12 g /L of NaCl). Germination was achieved in obscurity at 25±1°'C using an incubator. The length of epicotyl was determined after 7 days.

The chlorophyll content, which represents photosynthetic potential of the plant, was also determined. It was measured during the heading stage. Four replications were carried out for each ecotypes and each treatment a Spadmètre instrument (KONICA MINOLTA) was used to determine the amount of chlorophyll. In fact Chlorophyll Meter SPAD is an instrument which measures the content chlorophyl directly on the leaf of the plants and indicates values SPAD. Measurements are instantaneous on the plant without having to cut sheets, simply by projecting light through the measured sheet. The chlorophyl concentration of the plants is strongly correlated with the state of nutrition nitrogenized of those.

2.3. DNA extraction

The DNA was extracted and purified from leaves, using a CTAB (Cetyl trimethyl ammonium Bromide) method (Webb and Knapp, 17). DNA was then quantified at 260 nm using a spectrophotometer (standard CECIL CE2501 series 2000/3000): 5 µL DNA samples was diluted in 995 µL of Tris-EDTA (TE) buffer and compared with a control containing 1000 µL of TE. The DNA concentration (C) was calculated as follows:

$C(\mu g\ \mu L^{-1}) = OD_{260} \times 10$. The OD_{260} / OD_{280} ratio was also calculated to determine DNA purity.

2.4. PCR amplification

Eighty Operon primers were tested on DNA samples. DNA amplification was carried out in a final volume of 25 µL containing 2.5 Mm $MgCl_2$, 200 µM dNTP, 20 pmol of Operon primer, 20 ng of DNA, 5X Taq buffer, 0.5 U of Taq polymerase and adjusted with distilled water. The program of amplification; using a thermocycler (Biometra UNO II); consisted of a pre-denaturation cycle of 4 min at 94°C, 40 cycles of a denaturation for 30 sec at 94°C, an annealing for 60 sec at 38°C, an extension for 2 min at 72°C followed by a post-extension cycle for 10 min at 72°C. The amplification products of each primer were electrophoresed at 80V for 2 h in horizontal l.8 % agarose gel prepared in 1x TAE (TRIS Acetate EDTA) buffer containing 0.01 % of ethidium bromide. For ach sample, 10 µL of the amplified product were mixed with 2 µL of loading dye (6X) and loaded in agarose gel (1.8%). Bands were visualized under UV light and photographed by using Polaroid camera system.

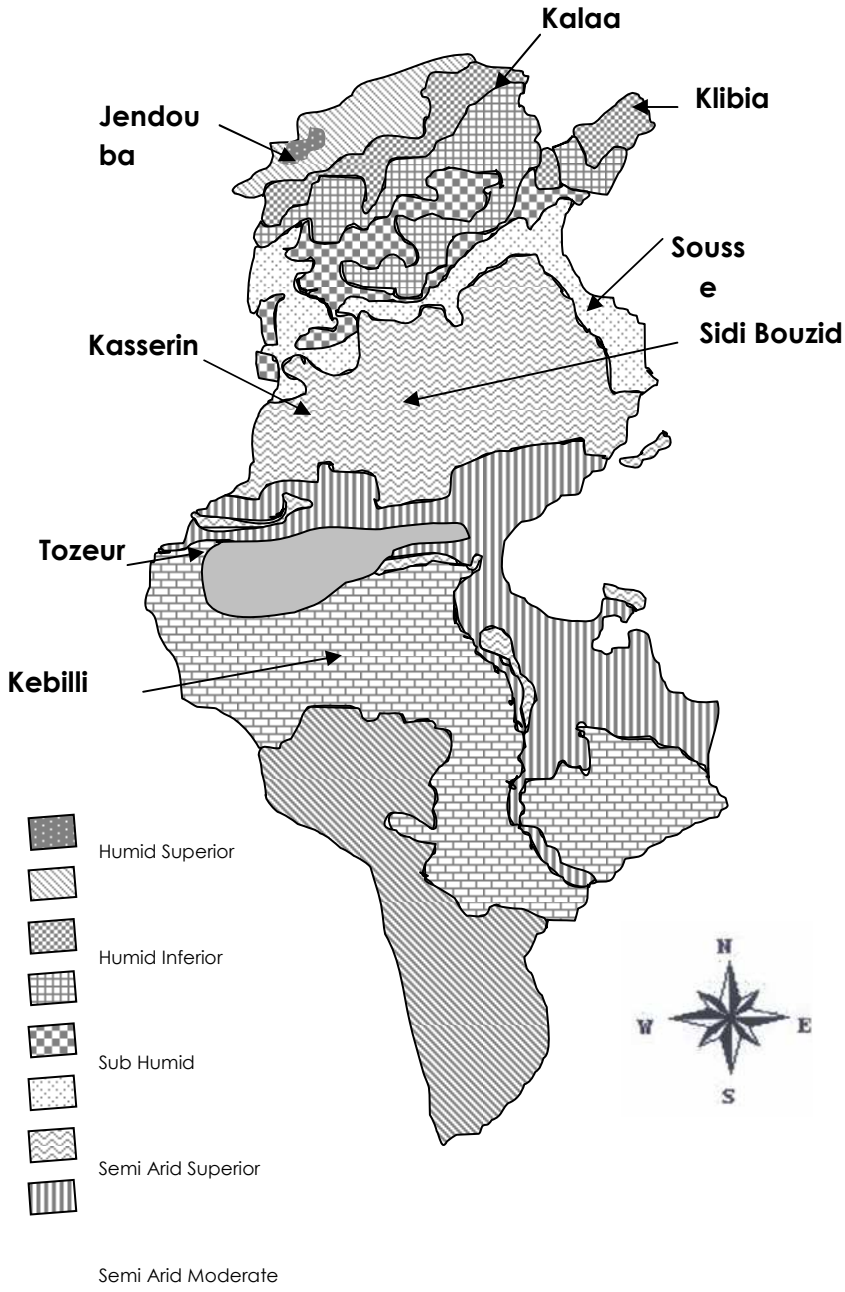

Figure 1. The origin of bioclimatic ecotypes

2.5. Data and Statistical Analysis

Eighty primers were used but only fefteen primers showed clear, reproducible and polymorphic bands. These primers were considered to make binary matrix, study similarity and discuss polymorphism between ecotypes. Data obtained were scored in a binary form as presence (1) or absence (0) of bands for each accession and entered into a data matrix (Hou et al.,2005). Genetic Similarity (GS) between ecotypes was calculated according to Nei and Li,

(1979) formula. Based on the similarity matrix, a dendrogram showing the genetic relationships between ecotypes was constructed using the Unweighted Pairgroup Method with Arithmetic Average (UPGMA) (Sneath and Sokal, 1973) by means of NTSYS software. All measurements were replicated at least five times. The data presented are the mean values of the repetitions. Data were subjected to Analysis of Variance (ANOVA) by STATITCF software package at the 5% level.

3. Results and discussion

3.1. Morphological traits

The heading date, which represents the difference between sowing date and inflorescence emergence period, showed that Tozeur is the earliest and Jendouba is the latest one with 25 days difference between them. However, for the other ecotypes, this criterion is intermediary and varied from 2 to 15 days. Furthermore, plant length showed that Kébilli 3 and Sidi Bouzid were the longest. However, Kalaâ was the shortest. The other ecotypes were medium. Both density and ear length showed clear differences among and within collected ecotypes from the same geographic region. The most distinctive morphological trait is ear density which varies from very loose to very compact (Table 1). In fact, collected ecotypes from Kébilli region showed different ear structure; the same remark observed for Tozeur's ecotypes. However, a similar ear density was observed for collected ecotypes from different regions.

The study of the morphological traits showed that Sidi Bouzid, Jendouba 1 and Jendouba 2 shared the same criteria and have some common traits with the variety Martin which could be due to a common ancestor. Same remark is given for the accessions Tozeur 1 and Kébilli 1. They also shared some morphological traits with the other southern accessions (Tozeur 2, Kébilli 2 and Kébilli 3). The northern accessions also presented some common morphological traits like ear attitude and sterile spikelet attitude (Table 1).

Table 1. Morphological traits of ecotypes

Ecotypes	Plant length (cm)	Ear length (cm)	Ear density	Beginning of inflorescence emergence related to sowing date	End of inflorescence emergence related to sowing date	Growth habit	Ear: attitude	Ear: density	Sterile spikelet: attitude (in mid-third of ear)
Tozeur 1	110.5	8.43	Very loose	133 days	140 days	Prostrate	Semi erect	very dense	divergent
Tozeur 2	111.0	6.00	Compact	135 days	143days	Erect	Semi erect	Dense	Parallel to weakly divergent
Kébilli 1	115.0	5.00	Compact	138 days	145 days	Prostrate	Semi erect	very dense	divergent
Kébilli 2	115.0	4.50	Very compact	147 days	154 days	Semi erect	Semi erect to horizontal	medium	parallel
Kébilli 3	122.0	7.00	Half-loose to half compact	153 days	160 days	Erect	Semi erect	very dense	parallel
Kasserine	111.5	7.50	Loose	153 days	160 days	Semi erect	erect	lax	Parallel to weakly divergent
Sidi Bouzid	134.0	6.95	Loose	147 days	154 days	Semi prostrate	Semi erect	lax	Parallel to weakly divergent
Jendouba 1	134.0	6.95	Loose	153 days	160 days	Semi protrate	Semi erect	lax	Parallel to weakly divergent
Jendouba 2	144.7	10.00	Loose	153 days	160 days	Semi protrate	erect	lax	Parallel to weakly
Rihane	111.7	8.00	Loose	147 days	154 days	intermediate	Semi erect	Very dense	parallel
Martin	132.0	7.75	Compact	147 days	154 days	intermediate	erect	dense	parallel
Kalaâ	105.0	6.50	Very compact	147 days	154 days	Erect	erect	intermediate	Parallel to weakly divergent
Kélibia 1	125.0	7.00	Compact	153 days	160 days	Dense	dense	erect	parallel
Kélibia 2	128.0	8.25	Compact	153 days	160 days	intermediate	Semi erect	lax	parallel
Manel	130.5	5.25	Compact	147 days	154 days	Dense	erect	intermediate	Parallel to weakly

We used the percent similarity and median joining method to draw morphological distances (Fig. 2). The Comparison of morphological characters using similarity percentage gave five accession groups. The first group consisted of 'Tozeur l', `Tozeur 2' and 'Kébilli l' with a percentage similarity that varies between 53% and 83 %. `Kébilli 2', 'Kébilli 3' and 'Kasserine' form the second with a similarity that oscillates between 73% and 91%. 'Sidi Bouzid' and 'Jendouba l', showing a very high similarity (92.5%), occupy the third position. The accessions 'Jendouba 2', `Rihane' and `Martin' constituted the fourth group; they are assembled with a percentage spread out between 81% and 86%. Nevertheless, 'Kalaâ', 'Kélibia l', 'Kélibia 2' and 'Manel' share the latest group with a high similarity situated between 75% and 90%. Referring to the dendrogram, we remark that accessions collected from the same origin have high similarity rates as examples, 'Kébilli 2/ Kébilli 3' with 93 %.

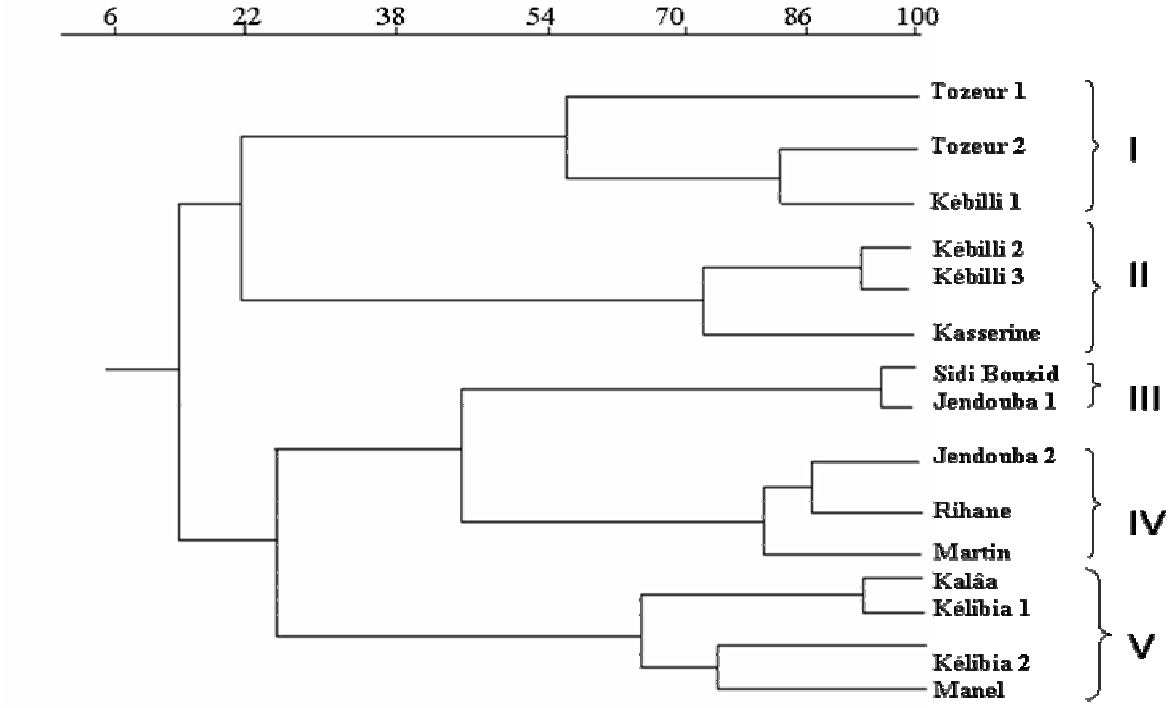

Figure 2. Morphological classification of the accessions based on median constrained distance using MVSP 3.131.

3.2.Physiological parameters:

3.2.1.Epicotyl's length at the germination level

Table 2 showed that even moderate saline stress of 100 mM (6 g NaCI L^{-}') could affect seriously the epicotyl's length. In deed, the ecotypes Jendouba 2, Martin, Kalaâ and Kélibia 1 showed low epicotyl's length percentage of 38%, 40%, 42% and 36%. The other ecotypes showed percentage more than 50% compared to their control. Similar observations were, reported by Touraine and Ammar, (1985) for triticale and barley and by Ben Naceur et al. (1998) for wheat.

For more severe stress of 200 mM (12 g NaCI L^{-}'), the aerial part length was more affected for Jendouba 2 (-80% of the control), Kélibia 2(-82%) and Kalaâ (-80%). However, Kébilli 1, Tozeur 2, Kébilli 3, Sidi Bouzid were able to keep more than 50% of their control length and particulary Kébilli 2 with 60%. Our results were similar to those of Garcia-Legaz et al,(1993) and Mwai et al,(2004) that showed a variable stress effect on the aerial part growth of many plant species. This result showed behavioural differences between and within the ecotypes collected from the same-origin confirming the results from morphological traits.

3.2.2. Chlorophyll content variation

Salt-induced restriction in water supply can cause stomata closure, which will in turn lead to decreased absorption of CO_2 and eventually result in reduction of photosynthesis (Delfine et *al.*, 1998; Sultana et *al.*,1999). Chlorophyll content is associated directly with light harvesting potential and is normally considered as one of the important components in photosynthetic capacity *(*Delfine et *al.*, 1998). In the current study, salt stress caused a significant reduction in the contents of chlorophyll compared to control plants (fig 3). However, this response varied according to stress intensity and to the ecotypes. Similar results showing a decrease in leaf chlorophyll content under salt stress were reported for tomato by (El-Khlil et al.,2002) and for wheat by (Kingsbury et al., 1983). The same observations were also made by Wang et al (2004), for Thellungiella halophila. They recorded that high salt

Table 2. Percentage of epicotyl's length under salt stress intensity compared to control

Ecotype	6 g Nacl L^{-1}	12 g Nacl L^{-1}
Tozeur 1	67,90	43,27
Tozeur 2	69,17	57,84
Kébilli 1	70,75	48,94
Kébilli 2	69,65	57,33
Kébilli 3	72,03	48,67
Kasserine	74,10	45,29
Sidi Bouzid	66,87	30,38
Jendouba 1	63,02	20,24
Jendouba 2	37,42	20,23
Martin	39,86	33,55
Kalaâ	42,93	22,02
Kélibia 1	35,61	20,63
Kélibia 2	51,37	18,37
Rihane	56,73	20,90
Manel	51,67	20,69

concentrations disturbed plant growth, which exhibited anthocyanine production and chlorophyll degradation. When the stress was 12 g NaCI l^{-1}, the chlorophyll content was affected, especially for Martin, Kalaâ, Rihane and Manel, where the reduction percentage was ≥ 50% compared to control. The plant photosynthetic capacity is determined by several factors including photosynthetic pigment composition (chlorophyll content), CO_2 fixation capacity, light intensity and various enzyme activities (Mwai *et al.*, 2004). Furthermore, light-capture efficiency is directly correlated to chlorophyll concentration of leaves (Lutts *et al*, 30). Therefore, slight decline observed in leaf chlorophyll concentration at Tozeur 2, Kébilli 1, Kébilli 2 and Sidi bouzid ecotypes (≤ 15% of the controls) could explain their better tolerance to salt and could contribute to their photosynthesis and plant growth stability.

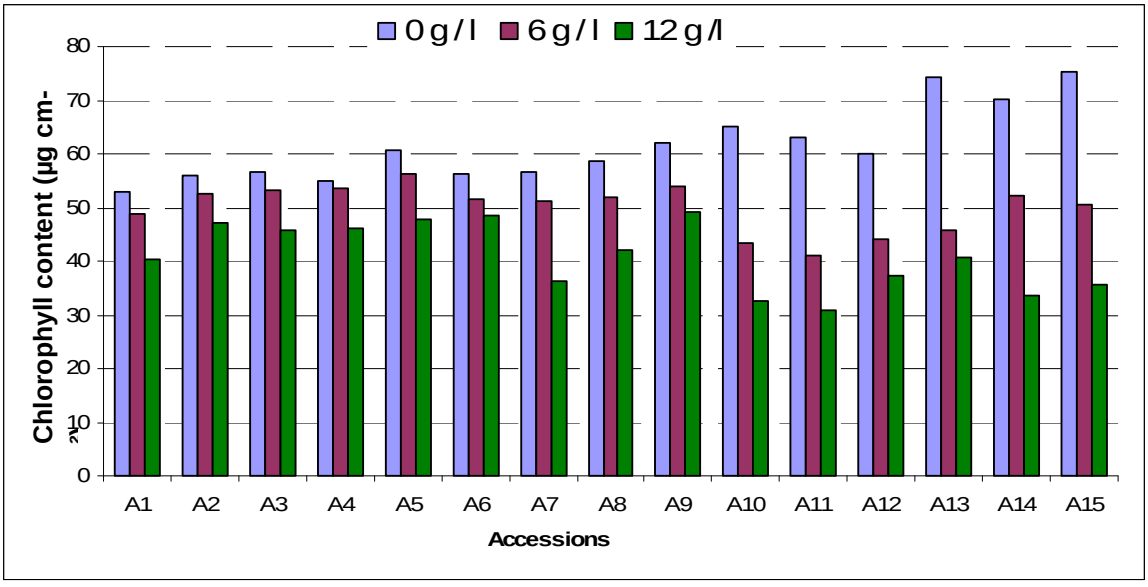

Figure 3. Chlorophyll content of barley accessions under different salt concentrations.
A1: Tozeur 1; A2: Tozeur 2; A3: Kebilli 1; A4: Kebilli 2; A5: Kebilli 3; A6: Kasserine; A7: Sidi Bouzid; A8: Jendouba 1; A9: Jendouba 2; A10: Martin; A11: Kalâa; A12: Klibia 1; A13: Klibia 2; A14 : Manel et A15: Rihane

3.3. Molecular study:

Electrophoresis of the amplified DNA products for the 80 primers tested, showed only 15 primers, which were able to generate visible and reproducible band profile (fig.4). The other primers generated scarcely visible bands and/or monomorphic patterns, which resulted from amplification where the annealing temperature should be optimized or where the cocktail would require a higher concentration of $MgC1_2$ (Pomper et al., 1998). A total of 93 bands were detected, among which 69 bands were polymorphic with the mean of 4.6 per primer (Table 3). For each primer, the bands number

ranged from 4 to 10, with an average of 6.2. Band size varied from 3 to 0.25 Kb, but we only took account of those that were clearly visible. All clear bands generated from 15 RAPD primers were subjected to calculate the Genetic Similarity (GS) among the 15 barley ecotypes. The dendrogram (Fig. 4) based on Similarity matrix was implemented according to the NTSYS software's UPGMA cluster (Unweighted PairGroup Method using Arithmetic Average), which separated studied ecotypes into 5 groups.

The first group is composed of three accessions: 'Kébilli 3', 'Martin' and 'Manel', the similarity percentage between accessions of the first group, varies between 60 % and 65 %. Indeed, within this group, same characters of similarity (biological and morphological) were observed such as the length of the stem, (134 cm), a very early heading date (120 -125 days after sowing) (Cheik-Mhamed, 2004), in the same way for the size and the shape of ears which is short and pyramidal.

Table 3. Number of bands and fragments generated by the RAPD primers.

Primers	**Primer's sequence 5'—3'**	**Band's number /gel**	**Number of total bands/ primer**	**Number of polymorphic bands/primer**
OPD02	GGACCCAACC	60	8	6
OPD10	GGTCTACACC	32	6	5
OPD18	GAGAGCCAAC	25	4	2
OPD20	ACCCGGTCAC	47	9	7
OPG12	CAGCTCACGA	45	8	6
OPG14	GGATGAGACC	30	5	2
OPG10	AGGGCCGTCT	40	8	3
OPJ10	AAGCCCGAGG	27	4	2
OPF03	CCTGATCACC	72	10	8
OPH13	GACGCCACAC	67	9	7
OPE03	CCAGATGCAC	30	4	3
OPE07	AGATGCAGCC	38	5	3
OPE12	TTATCGCCCC	45	8	5
OPB05	TGCGCCCTTC	47	7	6
OPB18	CCACAGCAGT	42	6	4
Total		647	93	69
Average		43.13	6.2	4.6

The second is subdivided in three sub-group ('Tozeur 2' and 'Kébilli 1'); ('Kébilli 2') and ('Rihane'). Their similarities vary from 68 % to 78 %. From morphological point of view, the accessions of the second group present features of similarity at the levels of the size of ears (long size) and the fitting of the grains on the rachis (parallel) also the length of the barbs (long beards) and a late heading date (143-145 days after sowing). Six accession composed the third group which were subdivided on three sub-group ('Kasserine','Sidi Bouzid' and 'Jendouba 1); ('Kalâa' and 'Kilibia 2') and ('Jendouba 2'). The similarity percentage between accessions of the first sub-group varies between 77 % and 83 %; but that of the second sub-group and the last sub-group was ranged between 67 % and 75%.

In fact, cultivars of this group represent morpho-physiological similarities with known length of the barbs (long), the size of ears (short) as well as the precocity of heading (130-133 days after sowing). Finally, the accessions 'Tozeur l' (62%), and 'Kélibia l'(64%) form, respectively, groups IV and V. On the morphological level the accession Tozeur 1 (62%) is characterized by the short size of its ears and its barbs that comparable with the accession Klibia 1 (64%) which, on the contrary, present vigorous ears with long beards. Although they present genetic similarities, these two cultivars are morphological different and cultivated in two geographically distant areas (figure 1). That can be due to the forms of climatic adaptation especially that these two accessions belong to two differents bioclimatic regions (El Falah et *al*.,2004). It should be noticed that the best results were obtained with primers contained 70% of bases in the form of G+C, the proportion of G was relatively equilibrated with that of C and the primer ended in 3' by G or C, in accordance with what Monna et al,(1994) and Jenderek et al,(1997) showed in their study. But the primers that did not generate visible polymorphic bands were those whose G and C bases were highly imbalanced and ended in 3' by A or T, which is in accordance with the results of Monna et al,(1994).

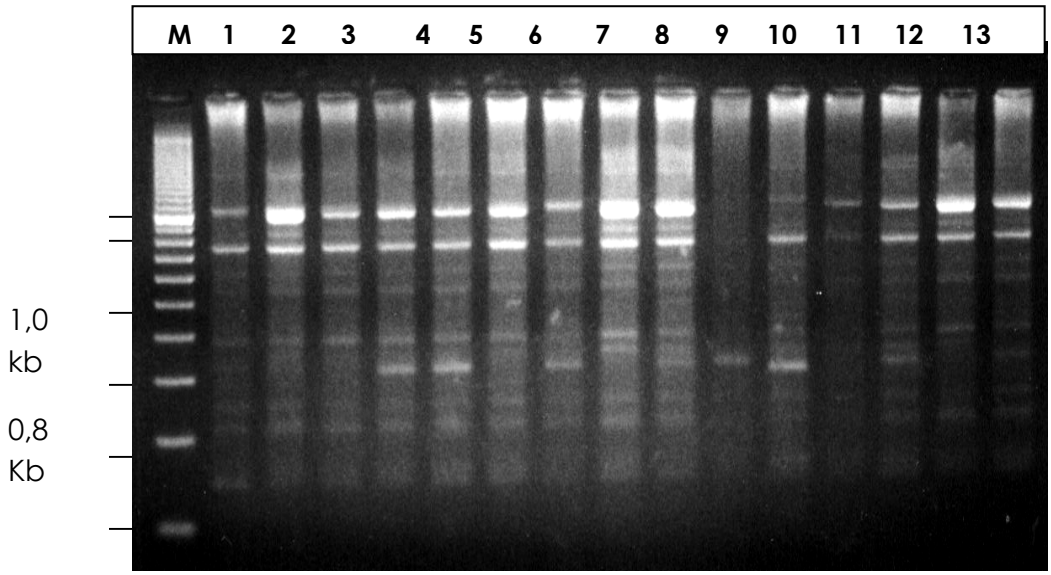

Figure 4. Typical examples of amplification products obtained by OPD20 RAPD primer using genomic DNA template of Tunisian barley accessions. M: marker (100 bp PCR Molecular Ruler, Biorad). Numbered wells correspond to the studied accessions. 1= Tozeur1, 2 = Tozeur2, 3 = Kebilli1, 4 = Kebilli2, 5 = Kebilli3, 6 = Sidi Bouzid, 7 = Kasserine, 8 = Jendouba1, 9 = Jendouba2, 10 = Martin, 11 = Kalâa, 12 = Klibia1, 13 = Klibia2, 14 = Rihane, 15 = Manel.

Dendrogram corresponding to morpho-physiological parameters showed no correlation between accessions originating front the same geographic area, which is in contradict with what Julier et *al*, *36* have shown. In fact, they found that the geographic origin of the collected material was sufficient to obtain a reasonable structuration in groups.

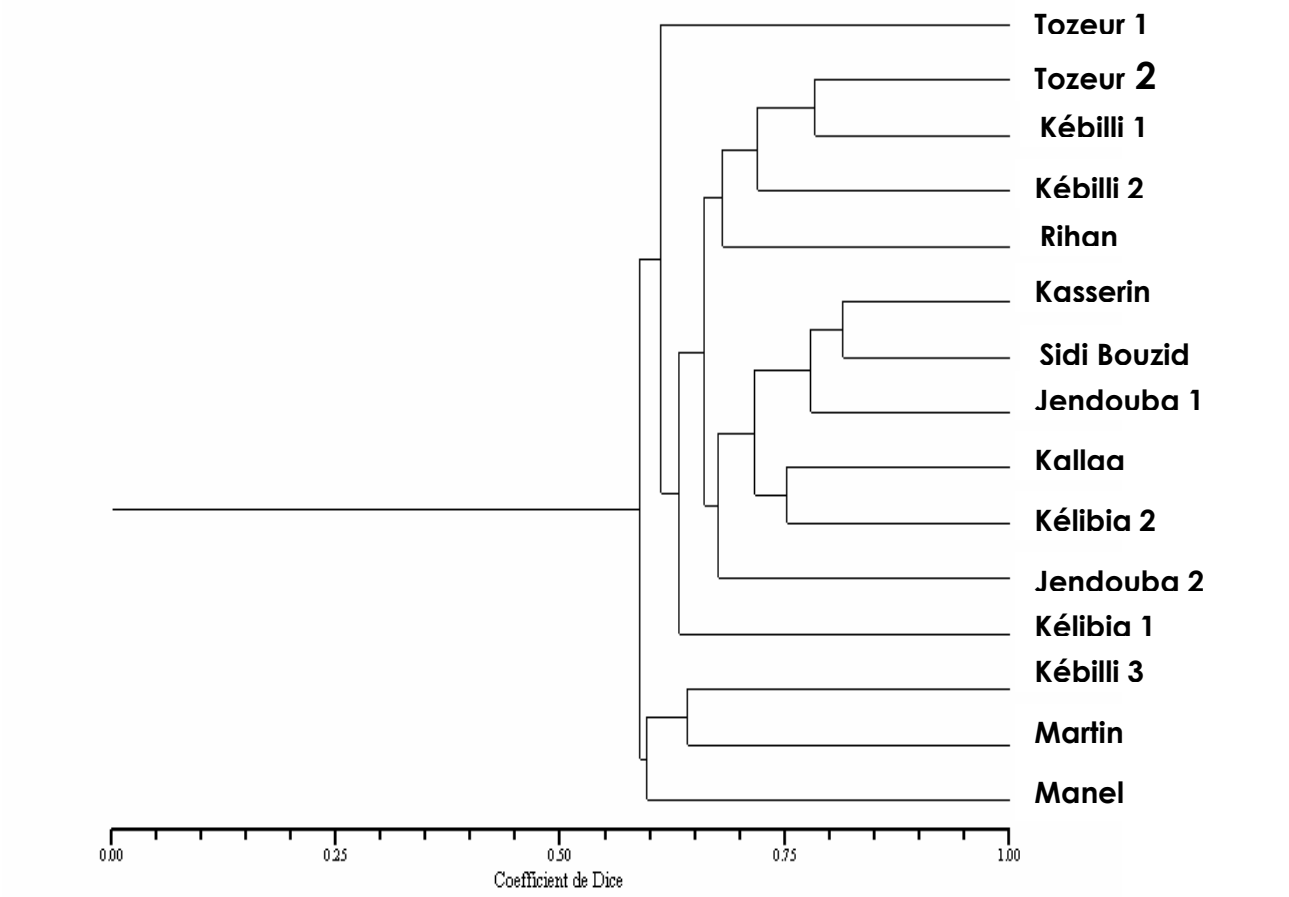

Figure 5. Dendrogram of the studied barley accessions, established by UPGMA method using the similarity matrix.

RAPD markers seemed to be effective to discriminate local barleys defined as accessions or populations geographically based (Yong et *al*., 2005). It is also a valuable tool for assessing genetic diversity levels. In our study, dendrogram obtained by RAPD markers classified the studied barley accessions according to, climatic stage and some morphological traits especially ear attitude, ear density and sterile spikelet attitude, which could be inherited independently from the environmental conditions.

4. Conclusion

In this study, distance matrices derived from RAPD markers and morpho-physiological data showed a low correlation (r = 0.14). This result is in agreement with those of Chia-Szu and Hsiao, (1999) working on *Lilium longiflorum* and reporting very low correlation *(r* = 0.035) between RAPD markers and morphological characters. However this result is in disagreement with those of Duarte et al,(1999) who found a correlation of 0.89 between the genetic distances obtained with RAPD and the distances of Mahalanobis indicating that the markers provide similar estimates of genetic divergence to those obtained using morpho-agronomical data on bean cultivars. This low correlation shows that there is a week association between molecular and physiological traits in these accessions. In other studies, Roldân-Ruiz et *al* ,(2001) working on perennial ryegrass found a correlation coefficient of 0.42 between STS markers and morphological traits methods. Mariç et *al*, (2004) studying hexaploid wheat cultivars, did not obtained a significant correlation between RAPD markers, morphological traits and coefficients of parentage. In the same way, Spooner et al,(2005*)* have obtained low correlation coefficient between potato genotypes by means of AFLP and morphological characters. On the other hand, Crochemore et al,(1998) working on 26 alfalfa population genetic structures found a global correlation coefficient of 0.51.

Hence, important consideration should be given to collection and conservation of local material for breeding, in order to maintain and preserve local barley germplasm from genetic erosion. Molecular study of the genetic fingerprints by RAPD markers allowed us to discover differences among barley ecotypes. This molecular tool could be used to supplement and clarify ambiguities in morpho-physiological studies. The good choice of primers to be used in this kind of study would enhance the efficiency of RAPD method.

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The ecology and distribution of Turkish Çarşakotu (*Paracaryum* (DC.) Boiss *spp.* (Boraginaceae)

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Abstract

The taxonomic revision of Turkish *Paracaryum* (DC.)Boiss. (Boraginaceae) has been carried out from 2005 to 2009. The distribution, phytogeographic element, habitat, altitude, flowering and fruiting time of *Paracaryum* species have been given and discussed. The Turkish name of this genus, that had no name before, has been suggested as çarşakotu.

Key words: Boraginaceae, Ecology, Paracaryum, Türkiye

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Türkiye Çarşakotlarının (*Paracaryum* (DC.) Boiss *spp.* (Boraginaceae) dağılışı ve ekolojisi

Özet

Türkiye'de yetişen *Paracaryum* (DC.) Boiss. (çarşakotu) cinsinin 2005-2009 yılları arasında taksonomik revizyonu geçekleştirilmiştir. Çarşakotu (Hodangiller) cinsinin türlerinin bulunduğu kareler, hangi bitki coğrafyası elementi olduğu, yetiştiği ortam, yetiştiği yükseklik, çiçeklenme ve meyvelenme zamanları, dünya yayılışları verilmiş ve ekolojik açıdan tartışılmıştır. Hiç Türkçe adı bulunmayan bu cinse çarşakotu adı önerilmiştir.

Anahtar kelimeler: Boraginaceae, Ekoloji, Paracaryum, Türkiye

1. Giriş

Yeryüzünde yaklaşık 223300 tohumlu bitki türü vardır (Scotland and Worthley, 2003). Türkiye'de ise 8988 tür (Güner et. al., 2000) ve daha sonra floraya eklenenlerle birlikte 9342 tür bulunmaktadır (Özhatay and Kültür, 2006; Özhatay et. al., 2009). Dolayısıyla dünyadaki yaklaşık her 24 tohumlu bitki türünden 1'i ülkemizde bulunmaktadır. Türkiye'nin en zengin ilk 10 familya arasına giren Boraginaceae'nin en büyük cinsleri arasında 3. sırada *Paracaryum* (DC.) Boiss. yer alır. *Paracaryum* cinsi Türkiye'de 28 tür, 1 alttür, 2 varyete toplam 31 taksonla yayılış göstermektedir (Mill, 1978; Yıldırımlı, 2000; Aytaç and Mill 2005; Koca, 2009).

Bu çalışmada Türkiye'nin bir çok bölgesinde yetişen *Paracaryum* cinsinin türleri, önerilen Türkçe adları ile yetiştiği coğrafik bölgeler, habitatlar ve yükseklikler arasındaki ilişki, elde edilen lokalite bilgileri ve arazi gözlemleri de kullanılarak verilmektedir. Şimdiye kadar *Paracaryum*'un hiç bilinmeyen Türkçe adının önerilmesi; türlerinin daha geniş bir biçimde yetişme ortamı ve yetişme yüksekliği bilgilerinin ortaya konması amaçlanmıştır.

2. Materyal ve yöntem

Paracaryum cinsinin Türkiye revizyonu ile ilgili olarak 2005-2009 yıllarında, Nisan ve Temmuz ayları arasında gerçekleştirilen arazi çalışmaları esnasında 127 adet *Paracaryum* populasyonuna ait yaklaşık 800 örnek toplanmış, bireylerin fotoğrafları ile birlikte habitat fotoğrafları da çekilmiştir. Toplanan örnekler herbaryum materyali haline getirilmiş, ayrıntılı morfolojik incelemeler sonucunda türlerin sınırları belirlenmiş ve herbaryum materyallerinin teşhisleri yapılmıştır. Tüm türlerin önerilen Türkçe adları ile birlikte Türkiye'de yayılış gösterdiği coğrafik bölgeler,

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hangi bitki coğrafyası elementi oldukları, habitatları, yetiştiği minimum ve maksimum yükseklik aralığı, çiçeklenme ve meyvelenme zamanları ile varsa dünyadaki yayılışlarının, görülebileceği bir tablo hazırlanmıştır. Tüm bu bilgiler arazi gözlemleri ile birlikte yorumlanarak verilmiştir. Türkiye'de *Paracaryum* cinsi altında sinonim görülen *Mattiastrum* cinsi bazı ülkelerin floralarında hala ayrı bir cins olarak değerlendirildiğinden tartışmalarda *Paracaryum* ve *Mattiastrum* birlikte ele alınmıştır.

3. Bulgular

Dört yıllık bir araştırma sonunda Türkiye'deki *Paracaryum* cinsinin türlerine ilişkin geniş, kapsamlı, yeni sistematik düzenlemeler, tür teşhis anahtarı, betimleri, tip örneklerinin bulunduğu yerler, Türkiye ve dünya yayılışları ve yorumları ortaya çıkarılmıştır. Bu çalışma sonunda elde edilen bulgularda cinsin türleri ve ekolojisi ile ilgili kısımları verilmiştir (Tablo 1). Çarşakotu cinsi ülkemizde 28 tür, 1 alttür, 2 varyete ile temsil edilmektedir (Mill, 1978).

4. Sonuçlar ve tartışma

Paracaryum dünyada Avrupa ve Orta Asya'da yayılışı olan bir cinstir. Avrupa'da, Yunanistan'da ve Kıbrıs'da 1 tür (*Mattiastrum lithospermifolium* olarak) yetişmekte olup (Ferguson, 1972) yoğun olarak Türkiye (28 tür) ve İran'da (17 *Paracaryum*, 25 *Mattiastrum*, toplam 42 tür) bulunur. Rusya'da 9 tür (hepsi *Paracaryum*), Suriye ve Filistin'de 3 tür (1 *Paracaryum*, 2 *Mattiastrum*), Çin'de ise 1 tür (*Mattiastrum*) yayılış göstermektedir (Shiskin, 1953; Mouterde, 1966; Rechinger, 1967; Shu, 1995).

Türkiye Florasında 23 taksonu İran-Turan bitki coğrafyası bölgesi elementi olarak gösterilmekte olan *Paracaryum* cinsinin (Mill, 1978) Türkiye'de Doğu, Güneydoğu, İç, Akdeniz, Karadeniz ve Ege bölgelerinde yetişmekte olduğu tespit edilmiştir. Tablo 2'de de görüleceği gibi Türkiye'deki çarşakotu üyelerinin dağılımı şöyledir: Doğu Anadolu'da 14 tür, İç Anadolu'da 11, Güneydoğu Anadolu 8, Akdeniz'de 6, Karadeniz'de 3 ve Ege bölgesinde 2 tür.

Tablo 2. Çarşakotu (*Paracaryum*) üyelerinin Türkiye'deki coğrafik bölgelere göre dağılımı.

Bölgeler	Yetişen tür sayısı
Doğu Anadolu	14
İç Anadolu	11
Güneydoğu Anadolu	8
Akdeniz	6
Karadeniz	3
Ege	2

Bir çok taksonunun Doğu, Güneydoğu ve İç Anadolu'da yetişmesi cinsin genel olarak Anadolu-Turan elementi olduğunu doğrulamaktadır. Aynı zamanda bu türlerin 10 tanesi Türkiye dışında da yetişmektedir. Bu bölgelerde yetişen türlerin en çok rastlanılan habitatları sırasıyla çarşak (yamaçta, eğimli alanlarda, hareketli taşlar arasında yetişen bitkilerin bulunduğu yerler) (Şekil 1), bozkır, serpantin, kayalık, taşlık, kalkerli alanlardır. Ekin, mısır tarlası, bağ, çayır kıyıları, meşe, alıç, çam, gürgen-ardıç, kavak açıklığı, killi ve kırmızı topraklı alanlar, marn, bazalt, volkanik metamorfik, andezit kayalıklar, taşlık yamaçlar, çakıllı nehir kıyısı, volkanik tüf, *Astragalus-Artemisia* birliği olan yerlerde de görülürler. Özellikle Doğu Anadolu'da çarşak, kayalık ve serpantin en çok görüldükleri habitatlar iken İç Anadolu ve Güneydoğu'da en çok bozkırda bulunurlar. Üç bölgede de rastlanılabilecek yükseklikler 650-2950 m'dir. Bu bölgelerdeki *Paracaryum* türlerinin çoğu ekolojik olarak çok iyi uyum sağlamış olup populasyonları yaygın ve populasyondaki birey sayısı boldur.

Tablo 1. Çarşakotu (*Paracaryum*) türlerinin önerilen Türkçe adı, Türkiye'de yetiştiği coğrafik bölgeler, bitki coğrafyası elementi, yetişme yerleri, yetişme yükseklikleri, çiçeklenme ve meyvelenme zamanı ile varsa dünya yayılışı.

Türler (Türkçe adları)	Yetiştiği bölgeler	Bitki coğrafyası bölgesi	Yetişme alanı	Yayılış yüksekliği (m)	Çiçeklenme zamanı (aylar)	Meyvelenme zamanı (aylar)	Dünya yayılışı
P. amani (Rech. fil.) R. Mill (Amanos çarşakotu)	Güneydoğu Anadolu	Akdeniz dağ elementi	daz, taşlık yamaçlar	1525-2300	6	6	endemik
P. ancyritanum Boiss. (Ankara çarşakotu)	İç, Doğu Anadolu, Karadeniz	An.-Tur. (İr.-Tur.)	bozkır, ekin tarlası kıyısı, tüf, mısır tarlası, kalkerli alanlar, meşe açıklıkları, erezyonlu yamaçlar, çakıllı nehir kıyısı	500-1650	5-6	6-7-8	endemik
P. artvinense R. Mill (Artvin çarşakotu)	Doğu Anadolu, Karadeniz	An.-Tur.	kayalık, volkanik kayalık, taşlık, killi yamaçlar, bozkır, çarşak	350-3000	5-6-7	6-7	endemik
P. aucheri (A.DC.) Boiss. (Ege çarşakotu)	Ege	Akdeniz dağ elementi	kayalık, çarşak, havacıva otu-sütleğen birliği	25-950	4	4- (5)	Ege Yunan adaları
P. calycinum Boiss. & Bal. (Bozkır çarşakotu)	İç Anadolu, Karadeniz	An.-Tur.	bozkır, kalkerli, kumlu alanlar, orman açıklıkları, meşelik, bağ kenarı	400-1700	4-5-6	5-6-7	endemik
P. cappadocicum Boiss. & Bal. (Kapadokya çarşakotu)	İç Anadolu	An.-Tur.	kavaklık açıklığı, kayalık	1050-1700	6	6-7	endemik
P. corymbiforme (DC.) Boiss. (Gümüşhane çarşakotu)	Doğu Anadolu	An.-Tur.	bozkır, meşe açıklığı, volkanik yamaç	1290-1900 (2800)	6-7	6-7-8	endemik
P. cristatum (Schreber) Boiss. subsp. *cristatum* (Anadolu çarşakotu)	Doğu, Güneydoğu Anadolu	An.-Tur.	bozkır, kayalık, serpantin, çayır kıyıları, meşelik açıklığı, tarla açıklığı, kalkerli alanlar, taşlık, volkanik yamaçlar,	1000-2900	(5)-6-7	6-7-(8)	endemik
P. cristatum (Schreber) Boiss. subsp. *carduchorum* R. Mill	Doğu, Güneydoğu Anadolu	An.-Tur.	bozkır, kayalık, kireçli alanlar, volkanik kayaçlar, çarşak	1500-2350	5-6-7	6-7	İran, Irak
P. erysimifolium Boiss.	Doğu Anadolu	An.-Tur.	bozkır, kayalık	900-1600	(5)-6	6-7	endemik

P. hedgei Aytaç & R. R. Mill (Toros mavisi çarşakotu)	İç Anadolu, Akdeniz	An.-Tur.	marn anakaya üzeri çayırlık, çam koruluğu, bozkır, karaçam-meşe-ardıç açıklığı, daz (alpinik bozkır), kalkerli yamaç	1000-2100	5-6	5-6	endemik
P. hirsutum (DC.) Boiss. (Tüylü çarşakotu)	Güneydoğu Anadolu	An.-Tur.	tarla kıyıları, meşe açıklığı, daz, çarşak, kayalık, bağ kıyısı	1000-1800	5-6	6-7	İran, Irak
P. incanum (Ledeb.) Boiss. (Ak çarşakotu)	İç, Doğu Anadolu	An.-Tur.	bozkır, andezit, tarlalar	650-1760	5-6-7	6-7-8	Rusya
P. kurdistanicum (Brand) R. Mill (Karacadag çarşakotu)	Güneydoğu Anadolu	An.-Tur.	bazalt taşlık ve kayalık	1250-1950	5-6	6	endemik
P. lamprocarpum Boiss.	Güneydoğu Anadolu	An.-Tur.	-	-	6	6	Suriye
P. laxiflorum Trautv. (Palandöken çarşakotu)	Doğu Anadolu	An.-Tur.	kayalık, çarşak, taşlık	1300-2350	6-7-8	7-8	Rusya
P. leptophyllum (A.DC.)Boiss.	Doğu Anadolu	An.-Tur.	bozkır, çarşak, jipsli kayalık	1300-1350	6-7	6-7	endemik
P. lithospermifolium (Lam.) Grande subsp. *cariense* (Boiss.) R. Mill var. *cariense* (Toros çarşakotu)	Ege, Akdeniz, İç Anadolu	Akdeniz dağ elementi	metamorfik yamaçlar, taşlık, kayalık, serpantin, çarşak, kireçli alanlar, karaçam açıklığı, daz	1030-3000	5-6-7-8	6-7-8- (9)	Yunanistan, Kıbrıs, Girit
P. lithospermifolium (Lam.) Grande subsp. *cariense* (Boiss.) R. Mill var. *erectum* R. Mill	Güneydoğu Anadolu	An.-Tur.	taşlık, bozkır, kireçli yamaçlar, meşe açıklığı, tarla açıklığı	1000-1500	5-6	5-6	endemik
longipes (Kayseri çarşakotu)	İç Anadolu	An.-Tur.	bozkır, taşlık, meşe-alıç açıklığı, kayalık, karaçam açıklığı	750-2000	5-6	6-7	endemik
*P. montbretii (*Riedl) R. Mill	Doğu Anadolu	An.-Tur.	taşlık	2245-2350	6-7	6-7	endemik
P. paphlagonicum (Bornm.) R. Mill (Çankırı çarşakotu)	İç Anadolu, Karadeniz	An.-Tur.	tarlalar ve kıyıları, bozkır, jipsli, kalkerli yamaç, orman altı, gürgen ve ardıç açıklığı, kırmızı toprak, serpantin	700-1300	5-6	6-7	endemik
P. polycarpum (Rech. fil.) R. Mill	Güneydoğu Anadolu	Akdeniz dağ elementi	bozkır, kalker, çarşak, daz	1830-2000	6-7	6-7	endemik
P. racemosum Schreber (Britten) var. *racemosum* (Mavi çarşakotu)	İç, Doğu Anadolu, Akdeniz	An.-Tur.	kalkerli alan, kayalık, bozkır, erozyonlu yamaçlar, jipsli alanlar, *Astragalus-Artemisia* birliği, volkanik tepeler, ekin açıklığı, sarıçam açıklığı, çarşak	900-2000	5-6-7	5-6-7	endemik

P. racemosum Schreber (Britten) var. *scabridum* (Rech. fil.) R. Mill (Köse çarşakotu)	Akdeniz	An.-Tur.	daz	1500-2100	6-7	6-7	endemik
P. reuteri Boiss. & Hausskn. (Daz çarşakotu)	Doğu, Güneydoğu, İç, Akdeniz	Akdeniz dağ elementi	kalkerli alanlar, daz, ardıç-meşe ormanı kalıntısı, kayalık, çarşak	1500-2800	6-7	6-7-8	endemik
P. rugulosum (DC.) Boiss.	İç, Doğu Anadolu	An.-Tur.	taşlık, kalkerli alanlar	1550-2200	3-5	3-5	İran, Arabistan, Pakistan
P. shepardii Post & Beauv. (Narin çarşakotu)	Akdeniz	Akdeniz dağ elementi	kayalık, daz	1280-2030	6	6- (7)	endemik
P. sintenisii Hausskn. ex Bornm. (Kuşyuvalı çarşakotu)	Doğu Anadolu	An.-Tur.	killi toprak, volkanik kayalık, çarşak, bozkır, taşlık	1000-1690	6-7	6-7	İran, Irak
P. stenolophum Boiss. (Boylu çarşakotu)	İç Anadolu	An.-Tur.	-	1250	6-7	6-7	endemik
P. strictum (C. Koch) Boiss. (Serpantin çarşakotu)	Doğu, Güneydoğu Anadolu	An.-Tur.	bozkır, kumlu bozkır, serpantin, kalkerli alanlar, taşlık, kayalık	950-2070	5-6-7	6-7	Rusya, İran, Irak

Şekil 1. Çarşakotunun (*Paracaryum*) en çok yayılış gösterdiği habitat olan çarşak (Kemaliye, Erzincan).

Akdeniz bölgesinde 6 tür yayılış göstermektedir. Bunlar, *P. aucheri* hariç, güneyde Toros dağlarının, Amanos dağlarının ve Ege bölgesinin genelde dazlarında (ağaçsız alpinik bölgelerinde) bulunmakta olup 1000-2800 m arasında yetişmektedir. Bu türler *P. racemosum* var. *scabridum, P. reuteri, P. polycarpum, P. amani, P. shepardii ve P. lithospermifolium* subsp. *cariense* var. *cariense*'dir. Bu türler alpinik bölgede yayılış göstermelerine bağlı olarak yatık-yükselici bir hal almış olup bitki boyları genelde 15-30 cm arasındadır. *P. lithospermifolium* subsp. *cariense* var. *cariense* aynı zamanda Avrupa'da da yetişmekte olan tek *Paracaryum* türüdür (Ferguson, 1972). Bu bölgedeki türlerin ağırlıklı olarak bulundukları habitatlar çarşak, daz, kayalık, taşlık, kalkerli alanlar, havacıva otu- sütleğen birliği, ardıç-meşe ormanı kalıntısı, karaçam açıklığı, metamorfik yamaçlardır. Tüm *Paracaryum* türleri arasında bir tek *P. aucheri* Ege bölgesinde, deniz kenarına kadar inmekte olup genel yükseklik dağılışı 25-950 m arasındadır. Bu tür, seçtiği habitatı bölgede seyrek olduğundan dolayı seyrek yayılışlı olmakla birlikte populasyonlarındaki birey sayıları boldur. Bir tek tipten bilinen ve tipi Amanosların dazında bulunan *P. racemosum* var. *scabridum* için Türkiye florasında Anadolu-Turan elementi denmesine rağmen bitkinin bulunduğu ortam Akdeniz bölgesine girmektedir. Buralarda bulunan relik Karadeniz elementlerinden dolayı Avrupa-Sibirya elementi olması da düşünülebilir. Bu ikilem içerisinde iken C4 İçel: Aslanköy, Cocakdere, Kıltır tepe, Katıyayla, daz, 2000-2100 m, 07.06.2003 lokalitesinden Muhittin Dinç (*MD.* 1663) tarafından toplanan bir örnek elimize ulaşmıştır. Bu örneğin *P. racemosum* var. *scabridum* olduğu anlaşılmıştır. İkinci olarak toplandığı yer Akdeniz bölgesine girmekle birlikte Torosların tepe noktaları Anadolu-Turan bitki coğrafyası bölgesi etkisi almaktadır. Dolayısıyla bu taksonun bitki coğrafyası bölgesinin An.-Tur. olarak kalması önerilir. Bu tartışmalı taksonların dışında kalan *P. shepardii, P. amani, P. reuteri, P. polycarpum* türleri yine Akdeniz dağ elementidir.

Karadeniz'de olup da İç Anadolu, Doğu Anadolu ile Karadeniz arasında geçiş bölgesinde yeralan türler *P. calycinum, P. ancyritanum, P. paphlagonicum* ve *P. artvinense*'dir. Bu türlerden *P. artvinense* dışındakiler Orta Karadeniz'in iç kısımlarında görülmektedir. En fazla 400 m'ye kadar inerler. Yaklaşık olarak 1000-1650 m arasında yayılırlar. *P. artvinense* ise Doğu Karadeniz'de 350 m'den 3000 m'ye kadar uzanan geniş bir yelpazede görülür. Bu bölgede yetişen türlerin en çok rastlanabileceği habitatlar kayalık, taşlık, killi, erezyonlu yamaçlar, mısır tarlası kıyısı, çakıllı nehir kenarı, çarşak, bozkır, kalkerli, volkanik kayalıklar, sarıçam açıklıklarıdır. Bu bölgede özelikle yüksek kesimlerdeki taksonlar ekolojik şartlara uyum sağlamış olup populasyonları boldur. Bu türlere Anadolu-Turan elementi demek uygundur.

Paracaryum cinsinin çiçeklenme ve meyvalanma dönemi her ne kadar lokalitelere ve kaynakçaya göre Nisan'dan Eylül'e kadar geniş bir zamanı kapsıyormuş gibi anlaşılsa da çiçekli ve meyveli olarak en çok rastlanılabilecek aylar Mayıs ve Haziran olarak tespit edilmiştir. Bu tespitler genel olarak yılın sıcak ya da soğuk geçmesi ile bir miktar sapma gösterebilir. Bir tek Ege bölgesinde yayılan ve Akdeniz elementi olan *P. aucheri* Nisan

ayında çiçeklenip meyvaya geçer. Diğer türlerin hepsi Mayıs hatta Mayıs ayının ikinci yarısında çiçeklenmektedir. Ancak yüksek kesimlerde yetişenler Haziran'da da çiçeklenebilir.

Araştırmanın başından beri de vurgulandığı üzere en çok yayılış gösterdiği yerlerden olan çarşak ve yamaçta yetişen populasyonlarda bu duruma uyum sağlamak amacıyla gövde yapısında bir farklılaşma söz konusu olmuştur (Şekil 2). Böyle bitkilerin gövdeleri ortamda tutunabilmek amacıyla yarıdikten yatık yükseliciye doğru bir değişiklik göstermektedir. Diğer habitatlardakilerin dış görünüşleri ise genelde diktir.

Diske doğru güçlüce kıvrık olan kuşyuvamsı meyveleri ile *Paracaryum* ve düz fındıkçık kanatlarına sahip meyveleri ile *Mattiastrum*, Boissier'den beri (1849) ayrılıp birleştirilmiş iki cinstir. Kuşyuvamsı fındıkçığa sahip türlerin hepsi (*P. strictum*, *P. sintenisii*, *P. hirsutum* ve *P. rugulosum*) Doğu ve Güneydoğu Anadolu'da yayılış göstermekte olup aynı zamanda ülkemizin dışında da yetişmektedir. Bu türlerin seçtiği habitatlar aynı bölgelerde bulunan diğer kuşyuvamsı olmayan *Paracaryum* türleri ile habitat, yükseklik, çiçeklenme ve meyvalanma zamanı bakımından bir fark göstermemektedir. Kuşyuvamsı fındıkçıklı türlerin en batıda toplandıkları nokta Pınarbaşı (Kayseri)'dir. Bunlar kuzeyde yükseklikle sınırlanmakla birlikte Rusya'ya kadar yayılmaktadır. Güney ve doğuda ise Suriye, İran, Afganistan'da da görülür. Ayrıca bu ülkelerde kuşyuvamsı fındıkçıklı olanların tür çeşitliliği de çok fazladır.

Paracaryum adı Yunanca'dan gelip para: yanında, nezdinde; karyon: ceviz anlamına gelmektedir (Akalın 1952). Kaynakça taramalarında *Paracaryum* cinsine verilen herhangi bir Türkçe isim tespit edilememiştir. Arazi çalışmaları esnasında özellikle çobanlar olmak üzere halka kullanımı, Türkçe adı, zehirli olup olmadığı, hayvan tarafından yenilip yenilmediği sorulmuş ve herhangi bir Türkçe adının ve kullanımının olmadığı saptanmıştır. Ayrıca çok fazla otlatmanın olduğu yerlerde bile bitki üzerinde yenik izine rastlanmamıştır. *Paracaryum* cinsine en çok yayılış gösterdiği habitattan esinlenilerek Türkçe adı olarak "çarşakotu" denmesi önerilmektedir.

Şekil 2. Yamaçta yetişen bir çarşakotu türünün genel görünüşü (*Paracaryum paphlagonicum, ADK* 2891, Atkaracalar- Çankırı).

Bu araştırma makalesi ile çarşakotunun Türkiye'de yayılış gösterdiği coğrafik bölgeler, hangi bitki coğrafyası elementi oldukları, habitatları, yetiştiği yükseklik aralığı, çiçeklenme ve meyvelenme zamanları belirtilmiş ve tartışılmıştır. Ayrıca bu cinsin Türkçe adının çarşakotu olması benimsenmiştir.

Teşekkür

"Türkiye'deki *Paracaryum* (*Boraginaceae*) Cinsinin Revizyonu" isimli 05 01 601 006 no'lu projeye verdiği destekten dolayı Hacettepe Üniversitesi Bilimsel Araştırmalar Birimine; bizimle çarşakotu örneğini paylaştığı için Doç. Dr. Muhittin Dinç'e teşekkür ederiz.

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A karyological investigation on the two varieties of *Galanthus fosteri* Baker (*Amaryllidaceae)*

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Abstract

In this study, the chromosome numbers and morphology of the populations of *Galanthus fosteri* Baker var. *fosteri* and *Galanthus fosteri* var. *antepensis* Zeybek and Sauer distrubuting in various geographic regions of Turkey have been investigated. In the karyological investigations, the structural polymorphizm (SAT-chromosome) have been established in the chromosomes of *G. fosteri* var. *fosteri* and *G. fosteri* var. *antepensis.* Although the diploid chromosome numbers (2n=24) of these varieties are similar, the chromosome morphology of their are significantly different.

Key words: *Galanthus fosteri*, Karyotype analysis, Amaryllidaceae

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Galanthus fosteri Baker (*Amaryllidaceae*)'nin iki varyetesi üzerinde karyolojik bir araştırma

Özet

Bu çalışmada, Türkiye'nin farklı coğrafik bölgelerinde yayılış gösteren *Galanthus fosteri* Baker var. *fosteri* and *Galanthus fosteri* var. *antepensis* Zeybek and Sauer populasyonlarının kromozom sayıları ve morfolojisi incelenmiştir. Karyolojik incelemelerde, *G. fosteri* var. *fosteri* and *G. fosteri* var. *antepensis* kromozomlarında yapısal polimorfizm (SAT-kromozom) tespit edilmiştir. Bu varyetelerin diploid kromozom sayısı (2n=24) aynı olmasına rağmen, onların kromozom morfolojileri önemli derecede farklıdır.

Anahtar Kelimeler: *Galanthus fosteri*, Karyotip analizi, Amaryllidaceae

1. Introduction

Galanthus L. (Snowdrops) is represented by many species in Anatolia, Caucasus, Thrace, East Mediterranean countries and in the vicinity of the Black Sea (Kamari, 1982; Zeybek, 1988). The species of *Galanthus* L. genus have important features because of their use as ornamental plant and including various alkoloid (galanthamin) in their bulbs. The galanthamin alkoloid was the first time isolated from the bulbs of *G. woronowii* Los. Today, galanthamin is used for treatment of some vessel diseases, poliomyelitis and skeleton muscles. The bulbs of some of the wide spread Turkish *Galanthus* species have been investigated pharmaceutically for their alkoloid content (Zeybek, 1983; 1988).

Galanthus fosteri var. *fosteri* and *Galanthus fosteri* var. *antepensis* are bulbous ephemeroid geophytes of this family (Figures 1 and 2). They are highly decorative in early spring species.

The karyological studies have revealed a polymorphizm among different karyotypes and SAT-chromosomes have been reported to be important in the variation (Zeybek, 1988; Zeybek and Sauer, 1994; Şenel et al., 2002). A valuable information has been put forward on the structure of chromosomes, importance of B-chromosomes and the origin of the species through the karyological studies carried out on the taxa of *Galanthus*, distributed around Russia, Caucasus and Black Sea (Sveshnikova, 1975; Sveshnikova and Grif, 1981; Zeybek and Sauer, 1994). In Bulgaria

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(Popova, 1972) and Greece (Kamari, 1982; Papanicolaou and Zacharof, 1983) karyological investigations on this genus have been made and descriptions of the new taxa have been given by evaluating the karyotypes cytotaxonomically (Kamari, 1982). Karyological investigations on *Galanthus* in Turkey populations have been made by Zeybek (1983), Zeybek and Sauer (1994) and Şenel et al. (2002). The karyological studies on plants which are valuable as economic and ornamental plants are very important. Also, these studies can be used in taxonomical studies on these species.

The aim of the present study is to determine the number and morphological properties of chromosomes in Turkey populations of the two varieties.

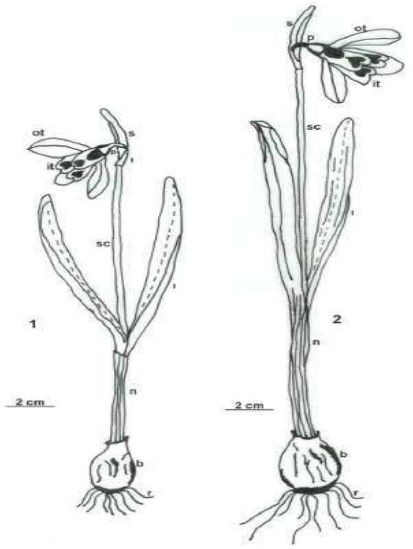
2. Materials and methods

The samples of *G. fosteri* var. *fosteri* have been collected from the localities listed below:

A5 Amasya: Akdağ, Doğantepe, Kayacık Village scrubs areas, 950 m, March 20, 2004, Kandemir, with the collection number 178 (Figure 3). (Karyotype analysis has been done the population in this localities)

A5 Amasya: Akdağ, Ziyaret Village, Alanoğlu site-Adatepe scrubs areas, 1450 m, March 23, 2004, Kandemir, with the collection number 179 (Figure 3).

A5 Amasya: Akdağ, Vermiş-Lokman Hekim Mausoleum, scrubs areas, 1000 m, March 23, 2004, Kandemir, with the collection number 180 (Figure 3).



Figures 1, 2. General appearences of *G. fosteri* var. *fosteri* and *G.fosteri* var. *antepensis* (r: root, b: bulb, n: neck, l: leaf, sc: scape, s: spatha, p: pedicel, ot: outher tepal, it: inner tepal)

The samples of *G. fosteri* var. *antepensis* have been collected from the localities listed below:

C6 Gaziantep: Bahçe, Acarobası Village scrubs areas, 1250 m, February 20, 2004, Kandemir, with the collection number 181 (Figure 3).

Somatic chromosomes have been studied from actively dividing root-tip cells obtained from natural populations. The chromosome counts and morphology have been carried out during the mitotic phase and processed according to the following squash technique (Ozkan et al., 2001; Şenel et al., 2002). The root-tips have been pretreated in α-monobromonapthalene solution for 14 h at 4°C and then fixed in acetic acid-alcohol (1:3). After washing in alcohol they have been hydrolyzed in 1N HCl for 10-12 minutes at 60°C in an oven. The root-tips have been stained with the leuco-basic fuchsin for 1 hour and squashed in 45 % acetic acid. Karyotype analysis has been performed according to the method described by Naranjo et al. (1986). Permanent slides for karyotype analysis for each variety have been prepared from at least ten well-spreaded metaphase cells. The photographs of the preparations have been taken with a Nicon microscope. The karyograms have been drawn from the metaphase. Measurements have been made on each pair of mitotic chromosomes.

3. Results

3.1. Galanthus fosteri var. *fosteri*: The chromosome number of this variety is 2n=24 (10M+8ST+6SM) (Figures 4 and 5). The karyotype of this variety consists of 5 pairs of median (M), 4 pairs of subterminal (ST) and 3 pairs of submedian (SM) chromosomes. The 1st, 2nd, 9th, 11th and 12th chromosomes are median, the 3th, 5th, 6th and 7th chromosomes are subterminal and the 4th, 8th and 10th chromosomes are submedian centromers (Figure 4 and Table 1). Satellite is present

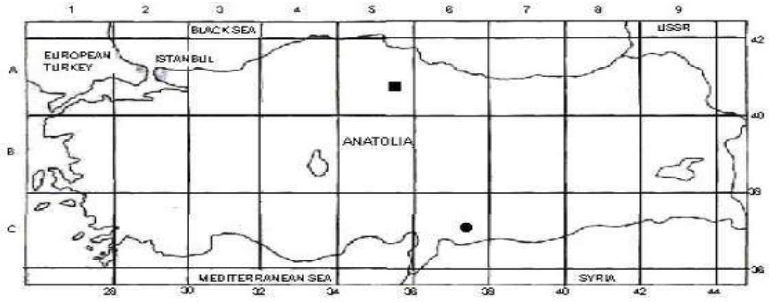


Figure 3. The distribution in Turkey. :*G. fosteri* var. *fosteri* , : *G fosteri* var. *antepensis*

on the short arm of the 5th chromosome of this variety. Chromosome lengths range from 5.5 to 22 µm. Longest arm is 12.5 µm and shortest arm is 2 µm. The lenght and arm ratio of each chromosome are presented in Table 1.

3.2. *Galanthus fosteri* var. *antepensis* : The chromosome number of this variety is 2n=24 (10M+10ST+4SM) (Figures 6 and 7). The karyotype of this variety consists of 5 pairs of median (M), 5 pairs of subterminal (ST) and 2 pairs of submedian (SM) chromosomes. The 1st, 8th, 10th, 11th and 12th chromosomes are median, the 2nd, 3th, 4th, 5th and 6th chromosomes are subterminal and the 7th and 9th chromosomes are submedian centromers (Figure 6 and Table 2). Satellite is present on the short arm of the 6th chromosome. Total chromosome lengths are about 5.5 to 20µm. Longest arm is 11.5 µm and shortest arm is 2 µm. The karyotype details, including chromosomes lenght and arm ratio, are shown Table 2.

Figure 4. Microphotograph of somatic metaphase chromosomes of *G. fosteri* var. *fosteri*

Table 1. The chromosome types, chromosome length and arm ratio of *G. fosteri* var. *fosteri*

Chromosome pairs	Total Length	Long arm length	Short arm lenght	Arm ratio	AT	Centromeric index I=(S/C) 100	Centromere position
1	22	11	11	1.		50	Medi
2	21	10.5	10.5	1.		50	Medi
3	15	12.5	2.5	1.		16	Subte
4	12.5	9	3.5	5.		28	Subm
5	11	8.5	2.5	2.		22	Subte
6	10	8	2	3.		20	Subte
7	9	7	2	4.		22	Subte
8	8.5	6	2.5	3.		29	Subm
9	7	3.5	3.5	3.		50	Medi
10	6.5	4	2.5	1.		38	Subm
11	6	3	3	1		50	Medi
12	5.5	3	2.5	1.		45	Medi

*: Satellite

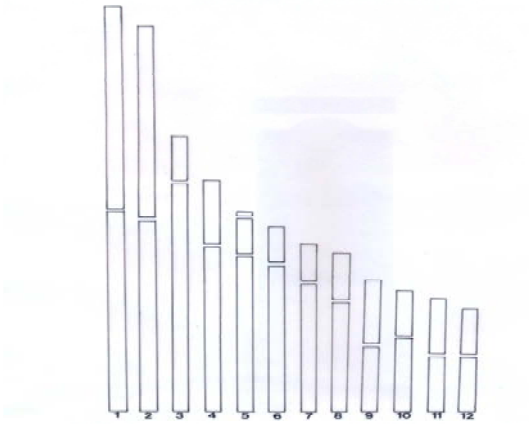


Figure 5. Idiogram of chromosome complement of *G.fosteri* var. *fosteri* at mitotic metaphase

Figure 6. Microphotograph of somatic metaphase chromosomes of *G. fosteri* var. *antepensis*

Table 2. The chromosome types, chromosome length and arm ratio of *G. fosteri* var. *antepensis*

Chromosome pairs	Total Length (C) µm	Long arm length (L) µm	Short arm lenght (S) µm	Arm ratio R=L/S	AT	Centromeric index I=(S/C) 100 µm	Centromere position
1	20	10	10	1.		50	Median
2	14.5	11.5	3	3.		20	Subter
3	12.5	9.5	3	3.		24	Subter
4	11.5	9.0	2.5	3.		21	Subter
5	10.5	8	2.5	3.		23	Subter
6	10	8	2	4.		20	Subter
7	9.5	7	2.5	2.		26	Subme
8	8	4	4	1.		50	Median
9	6.5	4	2.5	1.		38	Subme
10	6	3	3	1.		50	Median
11	6	3	3	1.		50	Median
12	5.5	3	2.5	1.		45	Median

4. Conclusions

Galanthus is a very ornamental genus and of potential medicinal value for its alkoloid content. They are formely widely distrubuted in Turkey but its area has been considerably reduced as a result of destruction of its primary habitats and through gathering of the flowers and bulbs (Zeybek, 1988; Ekim et al., 1991).

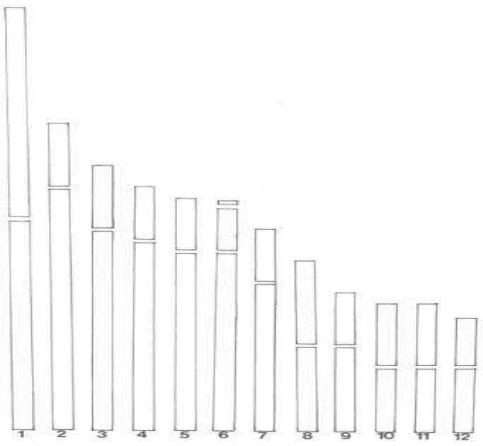


Figure 7. Idiogram of chromosome complement of *G. fosteri* var. *antepensis* at mitotic metaphase.

The essential *Galanthus* species growing in Turkey, i.e. *G. elwessi* Hooker fil., *G. ikariae* Baker, *G. nivalis* L. subsp. *cilicicus* (Baker) Gottlieb-Tannenhain, *G. fosteri* Baker and *G. gracilis* Celak are exported (Ekim et al.,,1991; Budnikov and Kricsfalusy, 1994; Kandemir et al., 1997).

The karyological study in this family has been attempted by a number of workers (Zeybek and Sauer, 1994; D'amato and Bianchi, 1999; Ito et al., 1999; Şenel et al.,2002). Although chromosome number of *G. fosteri* is given as 2n=24 in Flora of Turkey (Davis, 1984), chromosome numbers of these two varieties are not given. Also, the karyotypes of these varieties mentioned above have not been studied before in Turkey. In this paper, we have determined the chromosome number of these varieties as 2n= 24. The basic chromosome number of two varieties are x= 12. Ito et al. (1999) divided *Amaryllidaceae* into geographical clades according to their center of origin (namely The African Clade I, The African Clade II, The Cyrtanthus Clade, The American Clade, The Malaysia-Australian Clade, The Asian Clade and The Mediterranean Clade). In the Mediterrenean Clade comprises of three different tribes: *Pancratieae* (x=11), *Galantheae* (x= 7, 8,9, 11and 12) and *Narcisseae* (x= 7, 10 and 11) that includes a wide range of different basic chromosome numbers (Meerow, 1995). The genus of *Galanthus* L. distributed in Turkey and Caucasia are reported to have diploid with 2n=24 chromosomes number. Budbikov and Kricsfalusy (1994) and D'amato and Bianchi (1999) reported that *G. nivalis* showed 2n=24 chromosome number. Also, some species in Turkey and Caucasia are established to have different chromosome numbers (2n=24, 26, 48 ve 72)(Zeybek, 1983; Sveshnikova, 1975; Şenel et al., 2002). Although most of the *Galanthus* L. species in Caucasia is of the diploid form with 2n=24 chromosome, *G. lagodechianus* Kem-Nat. species is of the hexaploid form with 2n=72 chromosomes (Sveshnikova, 1975). Furthermore, diploid and tetraploid forms of *G. elwesii* subsp. *elwesii* have been observed in İzmir Yamanlar mountain, with 2n=24 chromosomes and Greece with 2n=48, respectively (Zeybek and Sauer, 1994). On the other hand, the diploid (2n=24) and triploid (2n=36) forms of *G. rizehensis* Stern (1956) have been obtained. In addition, it is reported by Şenel et al. (2002) that the chromosome number of *G. rizehensis* is as 2n= 26 in Turkey populations.

The karyological studies in *Galanthus* have revealed a polimorphism among different karyotypes SAT and accesory chromosomes (B- chromosomes) have been reported to be important in the variation (Zeybek, 1983; 1988; Zeybek and Sauer, 1994; Kamari, 1982; Şenel et al., 2002). In addition, D'amato and Bianchi (1999) reported that the occurence of accessory chromosomes is very common in *Galanthus.* In populations of *G. elwesii* in Rumania and Bulgaria, 0-3 B-chromosomes are obtained. In population of *G. gracilis, G. nivalis* subsp. *reginae-olgae, G. elwesii* subsp.*akmani* in Turkey 0-1B chromosomes are determined (Zeybek and Sauer, 1994). Also, in population of *G. nivalis* in the East Carpathians 0-1B are obtained (Budnikov and Kricsfalusy, 1994). In this study, the SAT chromosomes have been found whereas the accesory chromosomes have not been found in two varities.

Phylogenetic analyses of the genera *Leucojum* and *Galanthus* based on plastid (trnL-F and mat K) and nuclear (ITS) DNA sequences were done by Lledo' et al. (2004). The data was analysed separately and in combination, showing that the boundaries between the two genera are not appropriate. *Galanthus* is monophyletic but embedded in *Leucojum*. Also, DNA sequences are useful for comparing species and closely related genera. Similar chromosome morphology among the species of these genera is characteristic. Previous studies indicated that noncoding chloroplast DNA region, such as trnL-F, consistently yield low levels of variation. Briefly, it is necessary to analyse the plastid (trnL-F and matK) and nuclear (ITS) DNA sequences of the *Galanthus* species Mediterranean Clade to clarify the taxonomic states of two varieties.

The somatic chromosomes of two varieties of *G. fosteri* have been examined. There are some differences between the karyotypes of two varieties. These differences are total chromosome lengths, centromeric positions, arm ratio and centromeric index. number of these varieties as 2n= 24. *G. fosteri* var. *fosteri* and *G. fosteri* var. *antepensis* have 3 chromosome types. These types are classified as median centromeric, submedian centromeric and subterminal centromeric. The karyotype of *G. fosteri* var. *fosteri* consists of 5 pairs median, 4 pairs subterminal and 3 pairs

submedian centromeric chromosomes (Table 1). The karyotype of *G. fosteri* var. *antepensis* consists of 5 pairs median, 5 pairs subterminal and 2 pairs submedian centromeric chromosomes (Table 2). Also, some differences have been obtained in morphologic and anatomic properties of two varieties (Kandemir and Akçin, 2006). The morphological and anatomical differences between these two varieties are thought to be originated from the morphological structures of the chromosomes; for instance the differences of leaf apieces, spatha and pedicel length, the shapes of green spots in inner and outher surfaces of iner tepals, anther apieces, stigma and style properties, number of xylem arm in root anatomy, the thickness structure of cuticular layer in leaf anatomy, the number of cell layers in palizad and spongy parenchyma layers and stomatal index. The morphologic, anatomic and karyologic properties mentioned above are import in taxonomy of two varieties. Also, between these two varieties there are both geographical and reproduction isolation. Thus, their have been thought to be allopatric.

In sum, taking into account these differences, we are of the opinion that by changing the taxonomic status, these two varieties should be enhanced to subspeciescategory.

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Checklist of the cave Dwelling Invertebrates (Animalia) of Turkey

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Abstract

In this study, historical development of Turkish biospeleology is summarized with a checklist of cave dwelling Invertebrates of Turkey. After a review of the all available literature on the cave dwelling invertebrates fauna of Turkey, it was determined that 203 species have been reported. 29 of the species are from the phylum Mollusca, 5 species are from the subclassis Oligochaeta, 1 species is from the subclassis Hirudinea, 82 species are from the classis Arachnida, 1 genus and 19 species are from the classis Diplopoda, 1 genus and 4 species are from the classis Chilopoda, 42 species are from the classis Insecta and 21 species are from the subphylum Crustaceae. In these, 104 species are Anatolian endemics. In this checklist, published locality records are given in detail for all species.

Key Words: Biospeleology, Turkey, cave, checklist, Invertebrata

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Türkiye'nin mağara omurgasızlarının (Invertebrata: Animalia) kontrol listesi

Özet

Bu çalışmada; Türkiye'nin mağara omurgasızlarının kontrol listesi ile birlikte, Türk Biyospeleolojisinin tarihi gelişimi özetlenmiştir. Türkiye'nin mağara omurgasızları üzerine, kullanılabilir tüm literatürün gözden geçirilmesinden sonra, 203 türün rapor edildiği tespit edilmiştir. 29 tür Mollusca şubesinden, 5 tür Oligochaeta altsınıfından, 1 tür Hirudinea altsınıfından, 82 tür Arachnida, 19 tür Diplopoda, 1 cins ve 4 tür Chilopoda, 42 tür Insecta sınıfından ve 21 türde Crustaceae altşubesinden olup, bunlardan 104'ü Anadolu'ya endemik türlerdir. Kontrol listesi içerisinde, tüm türler için basılı mevki kayıtları detaylı olarak verilmiştir.

Anahtar kelimeler: Biyospeleoloji, Türkiye, mağara, Omurgasızlar

1. Giriş

Geçirmiş olduğu jeomorfolojik evrimin, karstlaşmaya olan etkilerinden dolayı sınırları içerisinde bir çok mağara ve yeraltı oluşumlarına ev sahipliği yapan Türkiye'nin speleolojik değerleri Nazik (1985) ve Buldur (1991) gibi çeşitli jeomorfologlar tarafından sistematik bir şekilde çalışılmıştır. Ne var ki bu değerlerin, biyospeleolojik yönden incelenmeleri neredeyse tamamen tesadüfi örneklemelere dayanmaktadır. Oysa yeraltı yaşamına uyum sağlamış canlıların örneklenmesi, kendilerinin (gelişmiş duyu organları, depigmentasyon sebebiyle ortama uyum, düşük populasyon yoğunluğu v.s.) ve yaşam ortamlarının sahip olduğu özel koşullardan dolayı (mutlak karanlık, ortamda sıklıkla bulunan yarık ve çatlaklar v.s.) çok fazla özen gerektirmektedir.

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Dünya'nın çeşitli ülkelerinde yeraltı yaşamına uyum sağlamış canlı faunasının belirlenmesine yönelik biyospeleolojik araştırmalara dair 20. yüzyılın başlarından literatür kayıtları bulunmaktadır (Packard, 1888). Türkiye mağaralarının faunistik açıdan incelenmesine yönelik ilk araştırma ise, 1865 yılında, Macarlı Miralay Dr. Abdullah Bey tarafından, Yarımburgaz Mağarası'nda (İstanbul) gerçekleştirilmiş ve bu bulgular 1867 yılında Fransa'da yayınlanmıştır (Erguvanlı, 1975).

20. yüzyıla gelindiğinde özellikle yabancı araştırmacıların çalışmaları hız kazanmış olsa da, bunlar mağara ve yeraltı sularının sistematik bir şekilde, amaca yönelik örneklenmesinden ziyade, Türkiye'den toplanan biyospeleolojik örneklerin yurtdışına götürülüp, orada uzmanlarına teşhis ettirilmesiyle gerçekleşen çalışmalardır. Bu hususta en büyük emek; Türkiye'ye gelmeden önce de, temel çalışma alanlarından bir tanesi, "Mağara canlılarının evrimsel biyolojisi" olan ve aynı konuda birçok makale sahibi Ord. Prof. Dr. Curt Kosswig'e aittir (Parzefal, 1983).

Kosswig'in bu çabaları sonucunda yayınlanan bir çok makale arasında; Verhoeff (1940, 1941 ve 1943), Jeannel (1947a, b), Beier (1949), Strouhal (1953a, b, 1963 ve 1971) ve Vandel (1980) en dikkat çekici olanlardır. Adı geçen yazarlardan Verhoeff, tesbih böcekleri (Isopoda; Oniscidea) ve kırkayakları (Diplopoda); Jeannel, kınkanatlıları (Insecta; Coleoptera); Beier, yalancı akrepleri (Arachnida; Pseudoscorpionida); Strouhal ve Vandel ise tesbih böcekleri (Isopoda; Oniscidea)'ni çalışmışlardır. *Mesoiulus kosswigi* Verhoeff, 1936 (Diplopoda; Julidae); *Kosswigia insularis* Jeannel, 1947 (Coleoptera; Carabidae); *Neobisium kosswigi* (Beier, 1949) (Pseudoscorpionida; Neobisiidae) ve *Trichonethes kosswigi* Strouhal, 1953 (Oniscidea; Trichoniscidae); Kosswig tarafından Anadolu mağaralarından toplanıp, adına ithaf edilen türlerden sadece birkaç tanesidir.

Kosswig'den sonra, bu kez sahneye İsveç'li karsinolog Knut Lindberg'in çıktığını görürüz. Lindberg; ilk kez, İstanbul Üniversitesinden bir zooloğun eşliğinde 10 Temmuz 1952'de Ilıksu mağarasında (Zonguldak) çalışmış, adı geçen mağarada, yatay bir nehrin ilk 150 metrelik kısmını keşfetmiş ve biyospeleolojik örneklemelerde bulunmuştur. Bu çalışmasının ardından, başta Zonguldak olmak üzere, Anadolu'daki bir çok mağara, yeraltı nehri, artezyen kuyuları gibi speleolojik alanlardan örneklemeler yapmıştır.

Türkiye seyahati sonrasını takip eden 10 yıllık süreç içerisinde Lindberg, topladığı örneklerden özellikle Copepoda (Crustacea) türlerini kendisi çalışmış (Lindberg, 1952a, b, c, 1953, 1954, 1955, 1957, 1958 ve 1960), farklı gruplardaki örnekleri ise uzmanlarına yollayarak değerlendirilmelerini sağlamıştır (Omodeo, 1955; Verrier, 1955; Vandel, 1957; Beauchamp, 1958; Roewer, 1959). Bu çalışmalar içerisinde, özellikle Alman araknolog Carl Friedrich Roewer'in, 1959 yılında yayınladığı "Die Araneae, Solifuga und Opiliones der Sammlungen des Herrn Dr. K. Lindberg aus Griecheland, Creta, Anatolien, Iran und Indien" adlı makalesi, Anadolu mağaralarının örümcek faunasının belirlenmesi konusunda çok önemli role sahiptir. Roewer; aynı adlı makalesinde, Türkiye mağaralarından 17 familyaya ait 37 tür kaydetmiştir (Şekil 4).

Lindberg'i takiben, 1960'lı yılların sonuna kadar, mağara ve yeraltı suları faunamızın keşfi yönünde bir durağanlık yaşanmış olsa da, bu süreçte Çağlar (1965), Strinati (1959) ve Osborn (1963) gibi araştırmacıların, her ne kadar mağara ekosistemlerinin daimi sakinlerinden olmasalar da, yarasalar (Chiroptera) üzerine yaptıkları çalışmalar dikkate değerdir. Yine Alman araknolog Wiehle (1963)'nin, Zonguldak Ereğlisi yakınlarındaki bir mağaradan *Carpathonesticus borutzkyi* Reimoser, 1930 (Araneae; Nesticidae)'yi kaydetmesi önemli bir veridir.

1960'lı yılların ikinci yarısından, günümüze kadar geçen yaklaşık elli yıllık süreçte; Anadolu'nun biyospeleolojik değerlerine, çoğunluğu Roma Üniversitesi kökenli İtalyan araştırmacıların ilgi gösterdiğini görmekteyiz (Şekil 5). Kronolojik olarak incelendiğinde; 1966 yılının Ağustos ayında, Roma Üniversitesi'nden Valerio Sbordoni'nin Anadolu'da gerçekleştirdiği biyospeleolojik arazi çalışması ilk olma özelliğindedir. Takip eden yıllarda Anadolu ve yakın çevresine; Augusto Vigna Taglianti, Paolo Marcello Brignoli, Achille Casale ve Marzio Zapparoli gibi, farklı dallardan bir çok ünlü zooloğun da katıldığı toplam 109 arazi çalışması gerçekleştirilmiş ve bu çalışmaların değerlendirilmesi sonucunda 197 bilimsel makale yayınlanmıştır (Sbordoni ve Vigna Taglianti, 1989; Vigna Taglianti ve Zapparoli, 2000). *Diplocephalus turcicus* Brignoli, 1972 (Araneae; Linypiidae); *Dina vignai* Minelli, 1978 (Hirudinea; Erpobdellidae); *Proasellus lykaonicus* Argano & Pesce, 1978 (Isopoda; Asellidae); *Parhadzia sbordonii* Vigna Taglianti, 1987 (Amphipoda; Hadziidae); *Harpolithobius vignatagliantii* Zapparoli, 1989 (Chilopoda; Lithobiidae) gibi farklı gruplardan hayvanlar, İtalyan araştırmacılar tarafından, yukarıda bahsedilen süreçte, ülkemiz mağara ve yeraltı sularından örneklenip, bilim dünyası için yeni olarak tanımlanan onlarca türden bazılarıdır.

2000'li yıllara gelindiğinde; üniversitelerimizin Biyoloji bölümlerinde, biyospeleoloji alanında dolaylı da olsa çeşitli yüksek lisans tez çalışmaları yapılmış (Selvi, 1999; Erkan, 2002; Paksuz, 2004) ve bazı araştırmacıların biyospeleolojik çalışmalara yöneldikleri gözlenmiştir. Bunların içerisinde; Yamaç ve arkadaşlarının (2005), mağara ortamından izole edilen aktinomiset izolatları üzerine yaptığı çalışmalar; Balık ve arkadaşlarının (2002), Yelköprü mağarası (Dikili; İzmir) ve yakın çevresinin sucul faunasını belirlemeye yönelik araştırmaları; Topçu ve Kunt (2005)'un, Türkiye'nin Mağara Örümceklerine dair verdikleri ilk kontrol listesi; Kunt ve arkadaşlarının (2008b), turizme açılmasından ötürü yoğun şekilde insan baskısında olan Dim mağarası (Alanya; Antalya)'nın omurgasız hayvan faunasını tespit çalışmaları anılması gerekenler arasındadır (Şekil 1).

Şekil 1. Fetrek mağarasında (Kemalpaşa, İzmir) biyospeleolojik incelemeler.

2. Materyal ve yöntem

Bu çalışmanın giriş kısmı; Kadir Boğaç Kunt ve Figen Kunt tarafından, 2008 senesinde Trabzon'da düzenlenen "19. Ulusal Biyoloji Kongresi" nde "Türkiye'de Biyospeleoloji ve Mağara Örümceklerine Yeni Bir Tür Kaydı" başlığı altında poster olarak sunulmuştur. Takip eden süreçte yazarlar, ülkemizde son yıllarda artış gösteren biyospeleolojik çalışmalara alt yapı sağlaması bakımından, mevcut literatürü derlemek ve biyospeleolojik değerlerin çoğunluğunu oluşturan mağara omurgasızlarına ait bir kontrol listesi oluşturmak ihtiyacı hissetmişlerdir. Bu amaçla 1865 senesinden günümüze kadar ülkemizden toplanan biyospeleolojik örneklerin değerlendirilmesi neticesinde yazılan makalelere ulaşılmaya çalışılmış ve bu makalelerdeki mevcut türler, güncel sistematikleri ve kayıt yerleri ile liste halinde verilmiştir. Sinonimlerin tespiti için bazı gruplarda yurtiçi ve yurtdışı uzmanların bilgisine başvurulmuştur. Tüm çabalarımıza rağmen yanıt alamadığımız durumlarda, ilgili türler orijinal metin içerisinde verilen isimleri ile anılmışlardır. Mevki tanımları ve mağara adları için de benzer durum söz konusudur. Anlamsız ve yetersiz oldukları ya da hiç verilmediklerini belirtmek etmek için **?** kullanılmıştır. Dağılışları sadece tanımlandıkları mağara ya da Anadolunun diğer mağaraları ile kısıtlı olanlar endemik olarak değerlendirilmiş ve liste içerisinde **[E]** ile gösterilmişlerdir. Yeraltı sularında yaşayan ve çoğunluğunu planktonik organizmaların oluşturduğu türlere ait veriler ise listeye dahil edilmemişlerdir.

Kontrol listesi incelendiğinde Anadolu mağaralarından kaydedilen toplam 200 omurgasız hayvan türünden, 104 tanesinin Türkiye endemiği olduğu görülmekte olup; bu oran hemen hemen %50'ye karşılık gelmektedir. Bununla birlikte, 202 türden bir kısmının trogloksen oldukları düşünülürse, mağara endemiklerinin oranı çok daha artmaktadır ki; bu rakamsal değer mağaralarımızın sahip oldukları biyoçeşitliliğin zenginliği açısından önemli bir veridir. İlgili literatür bilgisi bizlere Anadolu Mağaralarının sistematik bir şekilde araştırılmadığını; örneklemelerin genellikle tesadüfi olduğunu göstermektedir. Ayrıca kaydedilen bilhassa endemik türlerin zaman içerisindeki populasyon yoğunluklarına ve hatta akibetlerine dair bilgiler son derece azdır. Kunt ve arkadaşları, geçtiğimiz yıllarda Damlataş mağarasında (Alanya; Antalya) yaptıkları örnekleme çalışmaları süresince, tip yerleri adı geçen mağara olan *Cataleptoneta aesculapii* (Brignoli, 1968) (Araneae; Leptonetidae) ve *Discoptila beroni* Popov, 1974 (Orthoptera; Gryllidae) türlerine rastlamadıklarını belirtmişlerdir (Kunt vd., 2008b).

Mağara yaşamına uyum sağlamış canlılar, Tersiyer başlangıcında, Kuzey Amerika ve Avrasya'da yaşamını sürdüren epijen tropikal faunanın torunlarıdır. Günümüzde her iki bölgede de, tropikal faunaya rastlayabilmenin imkanı yoktur. Bu fauna elemanları ya yok olmuşlardır ya da modern tropikal bölgelere doğru göç etmişlerdir. Sadece toprağın derinliklerine ve mağaralara sığınan bazı türler, günümüze kadar gelebilmeyi başarabilmişler; bunlar da geçen jeolojik devirler süresince yapısal olarak bazı değişikliklere uğramışlardır. Bu özelliklerinden dolayı, ülkemizin sahip olduğu biyospeleolojik değerler, faunistik önemleri yanında, biyocoğrafik birer ajan olmaları sebebiyle de ön plana çıkmaktadırlar. Bununla birlikte, özetlemeye çalıştığımız biyospeleolojik geçmişimiz, Türk araştırmacılar tarafından bu bilim dalının ne denli ihmal edildiğini göstermektedir.

Biyospeleolojinin, üniversitelerimizin Biyoloji bölümlerinde temel ders olarak müfredata alınmasının; yüksek lisans ve doktora öğrencilerinin öğretim üyeleri tarafından biyospeleolojik çalışmalara yönlendirilmesinin, gelecek yıllarda bu bilim dalının ülkemizde gelişmesini sağlayacağına ve dolayısıyla Anadolu'nun biyocoğrafik konumu ve geçmişini daha iyi anlayabileceğimize dair ümidimizi muhafaza etmekteyiz.

3. Bulgular ve Tartışma

3.1. Tür Listesi

ŞUBE MOLLUSCA
Sınıf Gastropoda
Takım Basommatophora

Familya Lymnaeidae
Galba truncatula truncatula (Müller, 1774)
Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli Köyü, Ballıkaya Mağarası (Boettger, 1957).
Familya Planorbidae
Planorbis (Planorbis) planorbis (Linnaeus, 1758)
Türkiye mağaralarından kayıtlar: İstanbul İli, Yarımburgaz Mağarası (Boettger, 1957).

Takım Neritopsina

Familya Neritidae
Theodoxus anatolicus (Récluz, 1841) **[E]**
Türkiye mağaralarından kayıtlar: İstanbul İli, Yarımburgaz Mağarası (Boettger, 1957).

Takım Sorbeoconcha

Familya Hydrobiidae
Belgrandiella cavernica Boettger, 1957 **[E]**
Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, İnsırtı Mağarası (Boettger, 1957).
Pseudamnicola lindbergi Boettger, 1957 **[E]**
Türkiye mağaralarından kayıtlar: Kahramanmaraş İli, Elbistan İlçesi, Pınarbaşı Mağarası (Boettger, 1957).
Familya Pomatiidae
Pomatias costulatus (Ziegler)
Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, Kestaneci Köyü, **?** Mağarası (Strouhal, 1971).
Pomatias elegans (Müller, 1774)
Türkiye mağaralarından kayıtlar: Bursa İli, İnkaya Köyü, Suini Mağarası (Boettger, 1957).

Takım Stylommatophora

Familya Agriolimacidae
Deroceras thersites (Simroth, 1886)
Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, Kestaneci Köyü, **?** Mağarası (Strouhal, 1971).
Familya Clausiliidae
Dobatia goettingi (Brandt, 1961)
Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, Kestaneci Köyü, **?** Mağarası (Strouhal, 1971).
Elia (Acroeuxina) huebneri huebneri (Pfeiffer, 1848)
Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, Kestaneci Köyü, **?** Mağarası (Strouhal, 1971).
Familya Enidae
Zebrina kindermanni kindermanni (Pfeiffer, 1853)
Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, Kestaneci Köyü, **?** Mağarası (Strouhal, 1971).
Familya Ferussaciidae
Cecilioides tumulorum (Bourguignat, 1856)
Türkiye mağaralarından kayıtlar: Hatay İli, Belen İlçesi, Atik Yaylası, Kemikli Mağarası (Boettger, 1957).
Familya Hygromiidae
Monacha (Metatheba) samsunensis (Pfeiffer, 1868)
Türkiye mağaralarından kayıtlar: Kahramanmaraş İli, Elbistan İlçesi, Güvercinlik Köyü, Lor Mağarası (Boettger, 1957).
Xeropicta derbentina (Krynicki, 1836) **[E]**
Türkiye mağaralarından kayıtlar: Bursa İli, İnkaya Köyü, Kuşini Mağarası (Boettger, 1957).
Familya Limacidae
Limax flavus Linnaeus, 1758
Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, Kestaneci Köyü, **?** Mağarası (Strouhal, 1971).
Familya Pleurodiscidae
Pleurodiscus balmei erdeli (Roth)
Türkiye mağaralarından kayıtlar: Hatay İli, Harbiye İlçesi, Büyük Mağara; Hatay İli, Antakya İlçesi, Narlıca Mağarası (Boettger, 1957).
Familya Trigonochlamydidae
Drilolestes retowskii (Boettger, 1884)
Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, Kestaneci Köyü, **?** Mağarası (Strouhal, 1971).
Familya Zonitidae
Eopolita protensa tenerrima (Hesse, 1914)

Türkiye mağaralarından kayıtlar: Hatay İli, Antakya İlçesi, Narlıca Mağarası (Riedel, 1959).
Lindbergia karainensis Rähle & Riedel, 1987 **[E]**
Türkiye mağaralarından kayıtlar: Antalya İli, Döşemealtı İlçesi, Karain Mağarası (Rähle ve Riedel, 1987).
Oxychilus aequatum (Mousson)
Türkiye mağaralarından kayıtlar: Hatay İli, Antakya İlçesi, Narlıca Mağarası (Boettger, 1957).
Oxychilus deilus (Bourguignat, 1857)
Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, Kestaneci Köyü, **?** Mağarası (Strouhal, 1971).
Oxychilus camelinus (Bourguignat, 1852)
Türkiye mağaralarından kayıtlar: Hatay İli, Belen İlçesi, Atik Yaylası, **?** Mağarası (Boettger, 1957).
Oxychilus cyprius (Pfeiffer, 1847)
Türkiye mağaralarından kayıtlar: Hatay İli, Harbiye İlçesi, Büyük Mağara (Boettger, 1957; Riedel, 1959).
Oxychilus frondulosum (Mousson)
Türkiye mağaralarından kayıtlar: Bursa İli, İnkaya Village, Suini Mağarası (Boettger, 1957).
Oxychilus moussoni (Kobelt, 1878) **[E]**
Türkiye mağaralarından kayıtlar: İstanbul İli, Şile İlçesi, Tchihatcheff Mağarası (Riedel, 1959); Zonguldak İli, Ereğli İlçesi, Kestaneci Köyü, **?** Mağarası (Strouhal, 1971).
Vitrea diaphana (Studer, 1820)
Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, Kestaneci Köyü, **?** Mağarası (Strouhal, 1971).
Vitrea lodosi Riedel, 1984 **[E]**
Türkiye mağaralarından kayıtlar: Bursa İli, İnkaya Köyü, İnkaya Mağarası (Riedel, 1984).

Sınıf Bivalvia
Takım Veneroida

Familya Pisidiidae
Pisidium casertanum (Poli, 1791)
Türkiye mağaralarından kayıtlar: Niğde İli, **?** Mağarası (Boettger, 1957).
Pisidium subterraneum Shadin, 1932
Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, Kocaali Mağarası (Boettger, 1957).

ŞUBE ANNELIDA
Sınıf Cilitellata
Altsınıf Hirudinea

Familya Erpobdellidae
Dina vignai Minelli, 1978 **[E]**
Türkiye mağaralarından kayıtlar: Konya İli, Çamlık (Dalayman) Kasabası, Çocuk Attıkları Delik (Sket, 1986).

Altsınıf Oligochaeta

Familya Lumbricidae
Allolobophora handlirschi mahnerti (Zicsi, 1973)
Türkiye mağaralarından kayıtlar: Bursa İli, İnkaya Köyü, İnkaya Mağarası (Zicsi, 1973).
Aporrectodea caliginosa (Savigny, 1826)
Türkiye mağaralarından kayıtlar: Hatay İli, Antakya İlçesi, Narlıca Mağarası (Csuzdi vd., 2006)
Aporrectodea rosea (Savigny, 1826)
Türkiye mağaralarından kayıtlar: Konya İli, Beyşehir Gölü, Hacı Akif Adası, Hacı Akif Mağarası (Omoedo ve Rota, 1991).
Eisenia veneta (Rosa, 1886)
Türkiye mağaralarından kayıtlar: Antalya İli, Arif Mağarası (Csuzdi vd., 2006).
Eiseniella tetraedra (Savigny, 1826)
Türkiye mağaralarından kayıtlar: Antalya İli, Döşemealtı İlçesi, Kocain Mağarası; Hatay İli, Antakya İlçesi, Narlıca Mağarası; Bursa İli, Ayvaini Mağarası (Csuzdi vd., 2006).

ŞUBE ARTHROPODA
Sınıf Arachnida
Takım Amblypygi

Familya Charinidae
Charinus ioanniticus (Kritscher 1959)
Türkiye mağaralarından kayıtlar: Hatay İli, Samandağ İlçesi, Çevlik Köyü, Titus Tüneli **?** (Kovařík ve Vlasta, 1996).

Takım Araneae

Familya Agelenidae
Agelena labyrinthica (Clerck, 1757)
Türkiye mağaralarından kayıtlar: Mardin İli, Midyat İlçesi, Derömer Mağarası (Roewer, 1959).
Agelescape affinis (Kulczyński, 1911)
Türkiye mağaralarından kayıtlar: Hatay İli, Harbiye İlçesi, Büyük Mağara; Bitlis İli, Ahlat İlçesi, Sultan Seyit Mağarası (Roewer, 1959).
Lipocrea epeiroides (O.P. Cambridge, 1872)
Türkiye mağaralarından kayıtlar: Hatay İli, Hassa İlçesi, Hassa Mağarası (Kunt vd., 2010).
Malthonica anhela (Brignoli, 1972) **[E]**

Türkiye mağaralarından kayıtlar: Antalya İli, Döşemealtı İlçesi, Karain Mağarası (Brignoli, 1972; Brignoli, 1978b).
Malthonica ferruginea (Panzer, 1804)
Türkiye mağaralarından kayıtlar: Bursa İli, İnkaya Köyü, Suini Mağarası (Roewer, 1959).
Malthonica pagana C. L. Koch, 1840
Türkiye mağaralarından kayıtlar: Hatay İli, Antakya İlçesi, Narlıca Mağarası; Diyarbakır İli, Lice İlçesi, Korkha Mağarası (Roewer, 1959).
Tegenaria agnolettii Brignoli, 1978 **[E]**
Türkiye mağaralarından kayıtlar: Antalya İli, Döşemealtı İlçesi, Mustanini Mağarası (Brignoli, 1978b).
Tegenaria atrica C. L. Koch, 1843
Türkiye mağaralarından kayıtlar: Kayseri İli, Yeşilhisar İlçesi, Araplı Köyü, Harmankaya Mağarası (Roewer, 1959).
Tegenaria averni Brignoli, 1978 **[E]**
Türkiye mağaralarından kayıtlar: Mersin İli, Silifke İlçesi, Cennet Mağarası (Brignoli, 1978b).
Tegenaria domestica (Clerck, 1757)
Türkiye mağaralarından kayıtlar: Hatay İli, Antakya İlçesi, Narlıca Mağarası (Roewer, 1959).
Tegenaria elysii Brignoli, 1978 **[E]**
Türkiye mağaralarından kayıtlar: Mersin İli, Silifke İlçesi, Dilek Mağarası; Mersin İli, Silifke İlçesi, Cennet Mağarası (Brignoli, 1978b).
Tegenaria faniapollinis Brignoli, 1978 **[E]**
Türkiye mağaralarından kayıtlar: Hatay İli, Harbiye İlçesi, Harbiye Mağarası (Brignoli, 1978b).
Tegenaria forestieroi Brignoli, 1978 **[E]**
Türkiye mağaralarından kayıtlar: Karaman İli, Taşkale, Asarini Mağarası; Isparta İli, İnönü Mağarası; Antalya İli, Akseki İlçesi, Dikmen Mağarası; Konya İli, Seydişehir İlçesi, Ferzene Mağarası; Konya İli, Seydişehir İlçesi, Tınaztepe Mağarası; Çamlık (Dalayman) Kasabası, Körükini Mağarası; Konya İli, Hadim İlçesi, Suçıktığı Mağarası (Brignoli, 1978b).
Tegenaria karaman Brignoli, 1978 **[E]**
Türkiye mağaralarından kayıtlar: Konya İli, Seydişehir İlçesi, Ferzene Mağarası (Brignoli, 1978b).
Tegenaria melbae Brignoli, 1972
Türkiye mağaralarından kayıtlar: Diyarbakır İli, Lice İlçesi, Korkha Mağarası (Roewer, 1959).
Tegenaria percuriosa Brignoli, 1972 **[E]**
Türkiye mağaralarından kayıtlar: Isparta İli, Aksu İlçesi, Anamas Yaylası, Zindan Mağarası; Isparta İli, Barla İlçesi, Barla Mağarası; Konya İli, Beyşehir Gölü, Hacı Akif Adası, Hacı Akif Mağarası (Brignoli, 1972; Brignoli, 1978b); Isparta İli, Aksu İlçesi, Anamas Yaylası, Zindan Mağarası (Gasparo, 2007).

Familya Amaurobiidae

Coelotes atropos (Walckenaer, 1830)
Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, Ova köyü civarında bir mağara (Roewer, 1959).
Coelotes terrestris (Wider, 1834)
Türkiye mağaralarından kayıtlar: Bursa İli, İnkaya Köyü, Suini Mağarası (Roewer, 1959).

Familya Dysderidae

Dysdera crocata C.L. Koch, 1838
Türkiye mağaralarından kayıtlar: Hatay İli, Antakya İlçesi, Narlıca Mağarası (Roewer, 1959; Deeleman-Reinhold ve Deeleman, 1988).
Dysdera maurusia Thorell, 1873
Türkiye mağaralarından kayıtlar: Hatay İlçesi, Antakya İli, Narlıca Mağarası; Mardin İlçesi, Mardin yakınlarında bir mağara (Deeleman-Reinhold ve Deeleman, 1988).
Dysderocrates regina Deeleman-Reinhold, 1988 **[E]**
Türkiye mağaralarından kayıtlar: Antalya İli, Akseki İlçesi, Altınbeşik-Düdensuyu Mağarası; Konya İli, Gerikini Mağarası (Deeleman-Reinhold ve Deeleman, 1988).
Harpactea agnolettii Brignoli, 1978 **[E]**
Türkiye mağaralarından kayıtlar: Isparta İli, İnönü Mağarası (Brignoli, 1978b).
Harpactea galatica Brignoli, 1978 **[E]**
Türkiye mağaralarından kayıtlar: Yozgat İli, Kara Mağara (Brignoli, 1978a).
Harpactea isaurica Brignoli, 1978 **[E]**
Türkiye mağaralarından kayıtlar: Konya İli, Çamlık Kasabası, Körükini Mağarası (Brignoli, 1978a).
Harpactea pisidica Brignoli, 1978 **[E]**
Türkiye mağaralarından kayıtlar: Isparta İli, Eğirdir İlçesi, Anamas yakınlarında bir mağara (Brignoli, 1978b).
Harpactea sanctaeinsulae Brignoli, 1978 **[E]**
Türkiye mağaralarından kayıtlar: Konya İli, Beyşehir Gölü, Hacı Akif Adası, Hacı Akif Mağarası (Brignoli, 1978a).

Harpactea sbordoni Brignoli, 1978 **[E]**
Türkiye mağaralarından kayıtlar: Konya İli, Seydişehir İlçesi, Ferzene Mağarası (Brignoli, 1978a).
Harpactocrates troglophilus Brignoli, 1978 **[E]**
Türkiye mağaralarından kayıtlar: Isparta İli, Aksu İlçesi, Anamas Yaylası, Zindan Mağarası (Brignoli, 1978b).
Hygrocrates lycaoniae (Brignoli, 1978) **[E]**
Türkiye mağaralarından kayıtlar: Konya İli, Çamlık Kasabası, Körükini Mağarası (Brignoli, 1978a).

Familya Filistatidae

Filistata insidiatrix (Forskål, 1775)
Türkiye mağaralarından kayıtlar: Hatay İli, Antakya İlçesi, Suadiye, Mağaracık (Roewer, 1959).

Familya Gnaphosidae

Drassodes lutescens (C. L. Koch, 1839)
Türkiye mağaralarından kayıtlar: Kahramanmaraş İli, Alikaya Mağarası (Roewer, 1959).
Familya Leptonetidae
Cataleptoneta aesculapii (Brignoli, 1968) **[E]**
Türkiye mağaralarından kayıtlar: Antalya İli, Alanya İlçesi, Damlataş Mağarası (Brignoli, 1968; Brignoli, 1978b).
Cataleptoneta sbordonii (Brignoli, 1968) **[E]**
Türkiye mağaralarından kayıtlar: Burdur İli, İnsuyu Mağarası (Brignoli, 1968; Brignoli, 1978b); Antalya İli, Döşemealtı İlçesi, Yağca Köyü, Mustanini Mağarası (Brignoli, 1968; Brignoli, 1978b).
Familya Linyphiidae
Centromerus unicolor Roewer, 1959 **[E]**
Türkiye mağaralarından kayıtlar: Hatay İli, Antakya İlçesi, Narlıca Mağarası (Roewer, 1959).
Diplocephalus turcicus Brignoli, 1972
Türkiye mağaralarından kayıtlar: Burdur İli, İnsuyu Mağarası; Isparta İli, Aksu İlçesi, Anamas Yaylası, Zindan Mağarası; Konya İli, Beyşehir Gölü, Hacı Akif Adası, Hacı Akif Mağarası (Brignoli, 1972).
Gongylidium rufipes (Linnaeus, 1758)
Türkiye mağaralarından kayıtlar: Hatay İli, Antakya İlçesi, Narlıca Mağarası (Roewer, 1959).
Lepthyphantes leprosus (Ohlert, 1865)
Türkiye mağaralarından kayıtlar: Diyarbakır İli, Lice İlçesi, Korkha Mağarası; Bitlis İli, Ahlat İlçesi, Sultan Seyit Mağarası (Roewer, 1959).
Megalepthyphantes collinus (C. L. Koch, 1872)
Türkiye mağaralarından kayıtlar: Elazığ İli, Harput İlçesi, Buzluk Mağarası; Bitlis İli, Ahlat İlçesi, Sultan Seyit Mağarası; Bitlis İli, Adilcevaz İlçesi, Kon Mağarası (Roewer, 1959).
Palliduphantes bayrami Demir, Topçu & Seyyar, 2008 **[E]**
Türkiye mağaralarından kayıtlar: Karaman İli, Ermenek İlçesi, Manaspoli Mağarası (Demir vd., 2008)
Palliduphantes byzantinus (Fage, 1931) **[E]**
Türkiye mağaralarından kayıtlar: İstanbul İli, Yarımburgaz Mağarası (Fage, 1931); Bitlis İli, Adilcevaz İlçesi, Kon Mağarası (Roewer, 1959).
Troglohyphantes pisidicus Brignoli, 1971 **[E]**
Türkiye mağaralarından kayıtlar: Konya İli, Beyşehir Gölü, Hacı Akif Adası, Hacı Akif Mağarası (Brignoli, 1971).
Troglohyphantes karolianus Topçu, Türkeş & Seyyar, 2008 **[E]**
Türkiye mağaralarından kayıtlar: Konya İli, Beysehir İlçesi, Kurucaova Köyü, İnögü Mağarası (Topçu vd., 2008).
Familya Lycosidae
Hogna radiata (Latreille, 1817)
Türkiye mağaralarından kayıtlar: Yalova İli, Soğucak Köyü, Soğucak Mağarası (Roewer, 1959).
Pardosa agricola (Thorell, 1856)
Türkiye mağaralarından kayıtlar: Gaziantep İli, Arapdede Mağarası (Roewer, 1959).
Trochosa terricola Thorell, 1856
Türkiye mağaralarından kayıtlar: Bursa İli, İnkaya Köyü, Kuşini Mağarası (Roewer, 1959).
Familya Nesticidae Simon, 1894
Carpathonesticus borutzkyi Reimoser, 1930 **[E]**
Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, Ereğli civarında bir mağara (Wiehle, 1963); Zonguldak İli, Kapuz Mağarası (Brignoli, 1972); Eskişehir İli, Mihalıççık İlçesi, Gürleyik Köyü, Gürleyik Mağarası (Kunt vd., 2008c).
Nesticus cellulanus (Clerck, 1757)
Türkiye mağaralarından kayıtlar: Hatay İli, Antakya İlçesi, Narlıca Mağarası; Zonguldak İli, Ereğli İlçesi, Ilıksu Mağarası; Elazığ İli, Harput İlçesi, Buzluk Mağarası; Bitlis İli, Ahlat İlçesi, Sultan Seyit Mağarası (Roewer, 1959); Burdur İli, İnsuyu Mağarası; Gaziantep İli, İslahiye İlçesi, Köklü Köyü, Yapay bir mağara; Hatay İli, Antakya İlçesi, Narlıca Köyü, Karanlık mağara (Kunt vd., 2008c).
Nesticus eremita Simon, 1879
Türkiye mağaralarından kayıtlar: Antalya İli, Gazipaşa İlçesi, Beyrebucak Köyü, Yalandünya Mağarası; İzmir İli, Kemalpaşa İlçesi, Vişneli Köyü, Fetrek-1 Mağarası (Kunt vd., 2008c).
Familya Pholcidae
Holocnemus pluchei (Scopoli, 1763)
Türkiye mağaralarından kayıtlar: Elazığ İli, Harput İlçesi, Buzluk Mağarası; Kahramanmaraş İli, Elbistan İlçesi, Güvercinlik Köyü, Lor Mağarası (Roewer, 1959).
Hoplopholcus patrizii (Roewer, 1962) **[E]**
Türkiye mağaralarından kayıtlar: Antalya İli, Dağ Mağarası (Roewer 1962); Antalya İli, Döşemealtı İlçesi, Karain Mağarası (Brignoli, 1972).
Hoplopholcus labyrinthi (Kulczyński, 1903)
Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, Kestaneci Köyü, **?** Mağarası (Strouhal, 1971).
Pholcus opilionoides (Schrank, 1781)
Türkiye mağaralarından kayıtlar: Bursa İli, İnkaya Köyü, Suini Mağarası (Roewer, 1959).
Pholcus phalangioides (Fuesslin, 1775)
Türkiye mağaralarından kayıtlar: Hatay İli, Samandağ İlçesi, Mağaracık, Büyük Mağara; Diyarbakır İli, Lice İlçesi, Korkha Mağarası (Roewer, 1959).
Pholcus spasskyi Brignoli, 1978 **[E]**
Türkiye mağaralarından kayıtlar: Diyarbakır İli, Lice İlçesi, Korkha Mağarası (Brignoli, 1978a).

Familya Philodromidae
Philodromus collinus C.L. Koch, 1835
Türkiye mağaralarından kayıtlar: Bursa İli, İnkaya Köyü, Suini Mağarası; Hatay İli, Antakya İlçesi, Narlıca Mağarası (Roewer, 1959).
Philodromus histrio (Latreille, 1819)
Türkiye mağaralarından kayıtlar: Bitlis İli, Adilcevaz İlçesi, Kon Mağarası (Roewer, 1959).
Familya Phyxelididae
Phyxelida anatolica Griswold, 1990 **[E]**
Türkiye mağaralarından kayıtlar: Hatay İli, Samandağ İlçesi, Mağaracık Köyü, Büyük Mağara (Roewer, 1959).
Familya Salticidae
Carrhotus xanthogramma (Latreille, 1819)
Türkiye mağaralarından kayıtlar: Hatay İli, Antakya İlçesi, Narlıca Mağarası (Roewer, 1959).
Hasarius adansoni (Audouin, 1826)
Türkiye mağaralarından kayıtlar: Antalya İli, Alanya İlçesi, Dim Mağarası (Kunt vd., 2008b)
Familya Sicariidae
Loxosceles rufescens (Dufour, 1820)
Türkiye mağaralarından kayıtlar: Kahramanmaraş İli, Elbistan İlçesi, Culundu Mağarası (Roewer, 1959).
Familya Sparassidae
Eusparassus dufouri Simon, 1932
Türkiye mağaralarından kayıtlar: Osmaniye İli, Düziçi İlçesi, Haruniye Köyü, Sepulcrale Mağarası (Roewer, 1959).
Heteropoda variegata (Simon, 1874)
Türkiye mağaralarından kayıtlar: Adana İli, Pozantı İlçesi, Şekerpınar civarı, Akköprü Mağarası (Roewer, 1959).
Familya Tetragnathidae
Meta bourneti Simon, 1922
Türkiye mağaralarından kayıtlar: Yalova İli, I. ve II. Soğucak Mağarası; Bursa İli, İnkaya Köyü, Suini Mağarası (Roewer, 1959).
Meta menardi (Latreille, 1804)
Türkiye mağaralarından kayıtlar: Antalya İli, Alanya İlçesi, Dim Mağarası (Kunt vd., 2008b).
Metellina merianae (Scopoli, 1763)
Türkiye mağaralarından kayıtlar: Bursa İli, Ayvaini Mağarası; Hatay İli, Antakya İlçesi, Narlıca Mağarası (Roewer, 1959).
Pachygnatha degeeri Sundevall, 1830
Türkiye mağaralarından kayıtlar: Antalya İli, Dağ Mağarası (Roewer, 1962).
Familya Theraphosidae
Chaetopelma olivaceum (C. L. Koch, 1841)
Türkiye mağaralarından kayıtlar: Hatay İli, Samandağ İlçesi, Mağaracık Köyü, Büyük Mağara; Kahramanmaraş İli, Güvercinlik, Lor Mağarası (Roewer, 1959).
Familya Theridiidae
Latrodectus pallidus O.P. Cambridge, 1872
Türkiye mağaralarından kayıtlar: Kahramanmaraş İli, Afşin İlçesi, Göz Mağarası (Roewer, 1959).
Familya Thomisidae
Ozyptila rauda Simon, 1875
Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, İnsırtı, Ercole Mağarası (Cehennem Ağzı Mağaraları **?**) (Roewer, 1959).
Xysticus audax (Schrank, 1803)
Türkiye mağaralarından kayıtlar: Hatay İli, Antakya İlçesi, Atik yaylasında bir mağara (Roewer, 1959).
Familya Uloboridae
Uloborus plumipes Lucas, 1846
Türkiye mağaralarından kayıtlar: Hatay İli, Antakya İlçesi, Narlıca Mağarası (Roewer, 1959).

Takım Pseudoscorpiones

Familya Chernetidae
Lasiochernes turcicus Beier, 1949 **[E]**
Türkiye mağaralarından kayıtlar: Denizli İli, Acıpayam İlçesi, Dodurga Köyü, Dodurgalar Mağarası; Antalya İli, Döşemealtı İlçesi, Karain Mağarası (Beier, 1949; Beier, 1973); Konya İli, Beysehir İlçesi, Kurucaova Köyü, Asarini Mağarası (Mahnert, 1979).
Lasiochernes villosus Beier, 1957
Türkiye mağaralarından kayıtlar: Adana İli, Sinabuç Mağarası (Mahnert, 1979).
Familya Chthoniidae
Chthonius (*Chthonius*) *ischnocheles* (Hermann, 1804)
Türkiye mağaralarından kayıtlar: İstanbul İli, Yarımburgaz Mağarası (Beier, 1949).
Familya Neobisiidae
Neobisium (*Neobisium*) *agnolettii* Beier, 1973 **[E]**
Türkiye mağaralarından kayıtlar: Konya İli, Çamlık (Dalayman) Kasabası, Körükini Mağarası (Beier, 1973; Mahnert, 1979)
Neobisium (*Blothrus*) *hians* Mahnert, 1979 **[E]**
Türkiye mağaralarından kayıtlar: Antalya İli, Döşemealtı İlçesi, Kocain Mağarası (Inn Dag) (Mahnert, 1979; Kunt vd., 2008a)
Neobisium (*Blothrus*) *kosswigi* Beier, 1949 **[E]**
Türkiye mağaralarından kayıtlar: Konya İli, Beyşehir İlçesi, Beyşehir Gölü, Hacı Akif Adası, Hacı Akif Mağarası (Beier 1949; Mahnert 1979); Konya İli, Beyşehir İlçesi, Kurucaova Köyü, Asarini Mağarası (Mahnert, 1979); Burdur İli, İnsuyu Mağarası (Kunt vd., 2008a).

Neobisium (*Blothrus*) *sbordinii* Beier, 1973 **[E]**
Türkiye mağaralarından kayıtlar: Kahramanmaraş İli, Afşin İlçesi, Göz Mağarası (Beier, 1973).
Neobisium (*Ommatoblothrus*) *epirensis* Henderickx & Vets, 2000
Türkiye mağaralarından kayıtlar: Antalya İli, Alanya İlçesi, Dim Mağarası (Kunt vd., 2008b)
Roncus (*Parablothrus*) *parablothroides* Hadži, 1938
Türkiye mağaralarından kayıtlar: İstanbul İli, Yarımburgaz Mağarası (Beier, 1949); İstanbul İli, Şile İlçesi, Soflan Mağarası (Mahnert, 1979).

Takım Scorpiones

Familya Iuridae
Iurus kadleci Kovařík, Fet, Soleglad ve Yağmur, 2010 **[E]**
Türkiye mağaralarından kayıtlar: Antalya İli, Alanya İlçesi, Dim Mağarası (Kovařík vd., 2010)

Sınıf Diplopoda
Takım Callipodida

Familya Schizopetalidae
Acanthopetalum furculigerum furculigerum Verhoeff, 1901
Türkiye mağaralarından kayıtlar: İzmir İli, Selçuk İlçesi, Efes (Ephesos), Yedi Uyurlar Mağarası (Strasser, 1975).
Eurygyrus africanus (Attems, 1927) **[E]**
Türkiye mağaralarından kayıtlar: Hatay İli, Antakya İlçesi, Narlıca Mağarası (Hoffman ve Lohmander, 1964).
Eurygyrus bilselii (Verhoeff, 1940) **[E]**
Türkiye mağaralarından kayıtlar: Konya İli, Beyşehir Gölü, Hacı Akif Adası, Hacı Akif Mağarası; Burdur İli, İnsuyu Mağarası (Hoffman ve Lohmander, 1964); Mersin İli, Silifke İlçesi, Cennet Mağarası; Burdur İli, İnsuyu Mağarası (Hoffman, 1972); Konya İli, Beyşehir Gölü, Hacı Akif Adası, Hacı Akif Mağarası; Konya İli, Seydişehir İlçesi, Tınaztepe Mağarası; **?**, Eşekini Mağarası (Enghoff, 2006).
Eurygyrus ciliciensis (Verhoeff, 1898) **[E]**
Türkiye mağaralarından kayıtlar: Mersin İli, Tarsus İlçesi, Eshab-ı Kehf Mağarası (Hoffman ve Lohmander, 1964).
Eurygyrus rufolineatus C.L. Koch, 1847 **[E]**
Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, Kestaneci Köyü, **?** Mağarası (Strouhal, 1971); Konya İli, Çamlık (Dalayman) Kasabası, Körükini Mağarası (Enghoff, 2006).
Eurygyrus turcicus (Verhoeff, 1898)
Türkiye mağaralarından kayıtlar: **?**, Deve Mağarası (Lang, 1964).
Euxinopetalum dobatorum Hoffman, 1972 **[E]**
Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, İndere civarında bir mağara (Hoffman, 1972).

Takım Glomerida

Familya Trachysphaeridae
Trachysphaera rotundata (Lignau, 1911)
Türkiye mağaralarından kayıtlar: İstanbul İli, Yarımburgaz Mağarası (Verhoeff, 1941; Ceuca, 1975; Strasser, 1975).

Takım Julida

Familya Blaniulidae
Cibiniulus phlepsii (Verhoeff, 1897)
Türkiye mağaralarından kayıtlar: İstanbul İli, Şile İlçesi, Soflan Mağarası (Enghoff, 2006).
Nopoiulus anatolicus Lohmander, 1939 **[E]**
Türkiye mağaralarından kayıtlar: Hatay İli, Harbiye Köyü, Büyük Mağara (Lang, 1964).
Nopoiulus kochii (Gervais, 1847)
Türkiye mağaralarından kayıtlar: İstanbul İli, Yarımburgaz Mağarası (Ceuca, 1975; Strasser, 1975); Eskişehir İli, Günyüzü İlçesi, Yelinüstü Mağarası (Enghoff, 2006).
Familya Julidae
Mesoiulus ciliciensis Strasser, 1975 **[E]**
Türkiye mağaralarından kayıtlar: Mersin İli, Gülnar İlçesi, Karatepe Köyü, **?** Mağarası (Strasser, 1975); Mersin İli, Silifke İlçesi, Cennet & Cehennem Mağarası (Enghoff, 2006).
Mesoiulus kosswigi Verhoeff, 1936 **[E]**
Türkiye mağaralarından kayıtlar: İstanbul İli, Yarımburgaz Mağarası (Verhoeff, 1936; Lang, 1964; Ceuca, 1975; Strasser, 1975); İstanbul İli, Şile İlçesi, Soflan Mağarası (Enghoff, 2006).
Mesoiulus turcicus Verhoeff, 1898 **[E]**
Türkiye mağaralarından kayıtlar: **?**, Tchihatscheft Mağarası (Lang, 1964).

Takım Polydesmida

Familya Paradoxosomatidae
Tetrarthrosoma horticola (Attems, 1911)
Türkiye mağaralarından kayıtlar: Hatay İli, Antakya İlçesi, Narlıca Mağarası (Hoffman ve Lohmander, 1968).
Familya Polydesmidae
Polydesmus concordiae Verhoeff, 1941 **[E]**

Türkiye mağaralarından kayıtlar: İstanbul İli, Şile İlçesi, Soflan Mağarası (Enghoff, 2006).
Polydesmus mediterraneus Daday, 1889
Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, Amaçlar Mağarası (Hoffman ve Lohmander, 1968).
Familya Xystodesmidae
Melaphe apamea Hoffman & Lohmander, 1968 **[E]**
Türkiye mağaralarından kayıtlar: Denizli İli, Acıpayam İlçesi, Dodurga Köyü, Dodurgalar Mağarası (Hoffman ve Lohmander, 1968).
Melaphe castianeira Hoffman & Lohmander, 1968 **[E]**
Türkiye mağaralarından kayıtlar: Antalya İli, Döşemealtı İlçesi, Kocain Mağarası (Inn Dag) (Enghoff, 2006).

Sınıf Chilopoda
Takım Lithobiomorpha

Familya Lithobiidae
Harpolithobius vignatagliantii Zapparoli, 1989 **[E]**
Türkiye mağaralarından kayıtlar: Konya İli, Beyşehir Gölü, Hacı Akif Adası, Hacı Akif Mağarası (Zapparoli, 1989).
Lithobius sp.
Türkiye mağaralarından kayıtlar: İstanbul İli, Yarımburgaz Mağarası (Kosswig, 1952).
Lithobius agilis agilis C. L. Koch, 1847
Türkiye mağaralarından kayıtlar: Antalya İli, Döşemealtı İlçesi, Kocain Mağarası (Inn Dag) (Zapparoli, 1994); Antalya İli, Alanya İlçesi, Dim Mağarası (Kunt vd., 2008b).
Lithobius erythrocephalus erythrocephalus C. L. Koch, 1847
Türkiye mağaralarından kayıtlar: Konya İli, Beyşehir Gölü, Hacı Akif Adası, Hacı Akif Mağarası; Konya İli, Seydişehir İlçesi, Ferzene Mağarası (Zapparoli, 1994); Antalya İli, Alanya İlçesi, Dim Mağarası (Kunt vd., 2008b).
Lithobius viriatus Sseliwanoff, 1878
Türkiye mağaralarından kayıtlar: Ordu İli, Fatsa İlçesi, Kulak Köyü, Kulak Köyü civarında bir mağara (Zapparoli, 1994).

Sınıf Insecta
Takım Collembola

Familya Hypogastruridae
Hypogastrura sp.
Türkiye mağaralarından kayıtlar: İstanbul İli, Yarımburgaz Mağarası (Kosswig, 1952).

Takım Coleoptera

Familya Carabidae
Anillidius (*Troglocimmerites*) *byzantinus* Casale, Etonti & Giachino, 1991 **[E]**
Türkiye mağaralarından kayıtlar: İstanbul İli, Şile İlçesi, Kızılcaköy Mağarası (Casale vd., 1991).

Duvalius (*Duvalius*) *bruschii* Vigna Taglianti, 1999 **[E]**
Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, Oğlankız (İnsırtı 2) Mağarası (Casale ve Vigna Taglianti, 1999).
Karadeniziella omodeoi Casale & Giachino, 1989 **[E]**
Türkiye mağaralarından kayıtlar: Ordu İli, Fatsa İlçesi, Aybastı Vadisi, Kulak Köyü, Kulak Köyü civarında bir mağara (Casale ve Giachino, 1989).
Kosswigia insularis Jeannel, 1947 **[E]**
Türkiye mağaralarından kayıtlar: Konya İli, Beyşehir Gölü, Hacı Akif Adası, Hacı Akif Mağarası (Jeannel, 1947b).
Laemostenus (*Antisphodrus*) *agnolettii* Vigna Taglianti, 1999 **[E]**
Türkiye mağaralarından kayıtlar: Konya İli, Seydişehir İlçesi, Ferzene Mağarası (Casale ve Vigna Taglianti, 1999).
Laemostenus (*Antisphodrus*) *gasparoi* Casale, 2003 **[E]**
Türkiye mağaralarından kayıtlar: Antalya İli, Antalya-Kemer Otoyolu, Akyarlar Mağarası (Casale vd., 2003).
Laemostenus (*Antisphodrus*) *guzelolukensis* Lassalle, 1997 **[E]**
Türkiye mağaralarından kayıtlar: Mersin İli, Silifke İlçesi, Cennet Mağarası; Astım Mağarası (Casale ve Vigna Taglianti, 1999).
Laemostenus (*Antisphodrus*) *kestelensis* Casale, Felix & Muilwijk, 2003 **[E]**
Türkiye mağaralarından kayıtlar: Burdur İli, Bucak İlçesi [7 km batı-kuzeybatısı (WNW)], İncirhanın 1 km batısı, Yarasa Mağarası; Burdur İli, Bucak İlçesi [2 km batı-kuzeybatısı (WNW)], Sefer Yitiği Mağarası (Casale vd., 2003).
Laemostenus (*Antisphodrus*) *longicornis* Casale, 1988 **[E]**
Türkiye mağaralarından kayıtlar: Antalya İli, Akseki İlçesi, Demirci Dükkanları Mağarası (Casale ve Vigna Taglianti, 1999).
Laemostenus (*Antisphodrus*) *patrizii* Vigna Taglianti, 1999 **[E]**
Türkiye mağaralarından kayıtlar: Antalya İli, Döşemealtı İlçesi, Yağca Köyü, Mustanini Mağarası; Antalya İli, Döşemealtı İlçesi, Kocain Mağarası (Inn Dag); Antalya İli, Döşemealtı İlçesi, Karain Mağarası (Casale ve Vigna Taglianti, 1999).
Laemostenus (*Antisphodrus*) *zoiai* Casale & Vigna Taglianti, 1999 **[E]**
Türkiye mağaralarından kayıtlar: Mersin İli, Anamur İlçesi, Kösen Bürkü Mağarası (Casale ve Vigna Taglianti, 1999).
Pontodytes cavazzutii Casale & Giachino, 1989 **[E]**
Türkiye mağaralarından kayıtlar: Ordu İli, Fatsa İlçesi, Aybastı Vadisi, Kulak Köyü (Casale ve Giachino, 1989).
Sbordoniella indagi Vigna Taglianti, 1980 **[E]**
Türkiye mağaralarından kayıtlar: Antalya İli, Döşemealtı İlçesi, Kocain Mağarası (Inn Dag) (Casale ve Vigna Taglianti, 1999).
Familya Cholevidae
Catops arifensis Giachino & Vailati, 2000 **[E]**
Türkiye mağaralarından kayıtlar: Antalya İli, Elmalı İlçesi, Arif Köyü, Arif Mağarası (Giachino ve Vailati, 2000).
Choleva bertiae Giachino & Vailati, 2000 **[E]**

Türkiye mağaralarından kayıtlar: Isparta İli, Aksu İlçesi, Anamas Yaylası, Zindan Mağarası; Antalya İli, Akseki'nin 24 km. güneyinde bir mağara (Giachino ve Vailati, 2000).
Choleva casalei Giachino & Vailati, 2000 **[E]**
Türkiye mağaralarından kayıtlar: Antalya İli, Akseki'nin 24 km. güneyinde bir mağara (Giachino ve Vailati, 2000).
Choleva cavazzutii Giachino, 1990 **[E]**
Türkiye mağaralarından kayıtlar: Sivas İli, İmranlı İlçesi, **?** Mağarası (Giachino, 1990).
Catops fuscus fuscus (Panzer, 1794)
Türkiye mağaralarından kayıtlar: Kastamonu İli, Küre İlçesi, Küre'nin güneyinde bir mağara (Giachino ve Vailati, 2000).
Catops fuliginosus fuliginosus Erichson, 1837
Türkiye mağaralarından kayıtlar: Kastamonu İli, Devrekani İlçesi, Devrekani Mağarası; İstanbul İli, Şile İlçesi, Kay Mağarası (Giachino ve Vailati, 2000).
Catops giganteus Breit, 1913 **[E]**
Türkiye mağaralarından kayıtlar: Antalya İli, Elmalı İlçesi, Arif Köyü, Arif Mağarası (Giachino, 1990); Mersin İli, Bolkar M., Gümüş **?**, Kükü Mağarası (Giachino ve Vailati, 2000).
Catops nigricans (Spence, 1815) **[E]**
Türkiye mağaralarından kayıtlar: Kastamonu İli, Devrekani İlçesi, Devrekani Mağarası (Giachino ve Vailati, 2000).
Choleva etontii Giachino & Vailati, 2000 **[E]**
Türkiye mağaralarından kayıtlar: İstanbul İli, Şile İlçesi, Satzmal & Kay Mağarası (Giachino ve Vailati, 2000).
Choleva (*Cholevopsis*) *major turcica* Coiffait, 1959 **[E]**
Türkiye mağaralarından kayıtlar: Burdur İli, Kapaklı Köyü, Zeybekini Mağarası (Giachino, 1990).
Eocatops cavazzutii Giachino & Vailati, 2000 **[E]**
Türkiye mağaralarından kayıtlar: Sivas İli, İmranlı İlçesi, **?** Mağarası (Giachino ve Vailati, 2000).
Huetheriella maximiliani Jeannel, 1934 **[E]**
Türkiye mağaralarından kayıtlar: Konya: Seydişehir, Ferzene Mağarası (Jeannel, 1934); Antalya İli, Susuz **?**, Güvercin Taşı Deliği Mağarası (Casale ve Giachino, 1990).
Huetheriella notenboomi Casale & Giachino, 1990 **[E]**
Türkiye mağaralarından kayıtlar: Antalya İli, Akseki İlçesi, Değirmenlik Köyü, Sakal Tutan Düdeni (Giachino ve Vailati, 2000).
Sciodrepoides watsoni (Spence, 1815)
Türkiye mağaralarından kayıtlar: Ordu İli, Fatsa İlçesi, Kulak Köyü (Giachino, 1990); İstanbul İli, Şile İlçesi, Kay Mağarası (Giachino ve Vailati 2000).

Familya Histeridae
Spelaeacritus anophthalmus Jeannel 1934 **[E]**
Türkiye mağaralarından kayıtlar: Konya İli, Seydişehir İlçesi, Ferzene Mağarası (Jeannel, 1934)

Familya Leiodidae
Cavazzutiella taurica Casale & Giachino, 1985 **[E]**
Türkiye mağaralarından kayıtlar: Antalya İli, Elmalı İlçesi, Arif Köyü, Arif Mağarası (Casale ve Giachino, 1985).
Pisidiella kosswigi Jeannel, 1947 **[E]**
Türkiye mağaralarından kayıtlar: Konya İli, Beyşehir Gölü, Hacı Akif Adası, Hacı Akif Mağarası (Jeannel, 1947b).

Familya Staphylinidae
Atheta lindbergiana Scheerpeltz 1958 **[E]**
Türkiye mağaralarından kayıtlar: Elazığ İli, Merkez İlçe, Buzluk Mağarası (Scheerpeltz, 1958)
Atheta surda Likovsky 1984 **[E]**
Türkiye mağaralarından kayıtlar: Bitlis İli, Ahlat İlçesi, Sultan Seyit Mağarası (Scheerpeltz, 1958).
Deleaster dichrous (Gravenhorst, 1802)
Türkiye mağaralarından kayıtlar: Konya İli, Çamlık (Dalayman) Kasabası, Körükini Mağarası (Bordoni, 1978).
Quedius magarasiensis Bordoni 1978 **[E]**
Türkiye mağaralarından kayıtlar: Isparta İli, Anamas Dağı, Zindan Mağarası (Bordoni, 1978; Herman, 2001).
Quedius weiratheri Gridelli, 1938
Türkiye mağaralarından kayıtlar: Konya İli, Çamlık (Dalayman) Kasabası, Körük Mağarası (Bordoni, 1978); Konya İli, Seydişehir İlçesi, Ferzene Mağarası (Bordoni, 1978); Konya İli, Seydişehir İlçesi, Tınaztepe Mağarası (Gridelli, 1938; Bordoni, 1978; Coiffait, 1978; Herman, 2001).

Takım Diptera
Alttakım Brachycera
Üstfamilya Hippoboscoidea

Familya Nycteribiidae
Nycteribia sp.
Türkiye mağaralarından kayıtlar: İstanbul İli, Yarımburgaz Mağarası (Kosswig, 1952).

Takım Orthoptera

Familya Gryllidae
Ovaliptila beroni Popov, 1974 **[E]**
Türkiye mağaralarından kayıtlar: Mersin İli, Gülnar İlçesi; Antalya İli, Alanya İlçesi, Damlataş Mağarası (Popov, 1974); Antalya İli, Alanya İlçesi, Dim Mağarası (Kunt vd., 2008b).

Familya Rhaphidophoridae
Troglophilus adamovici Us, 1974 **[E]**

Türkiye mağaralarından kayıtlar: Isparta, Aksu İlçesi, Anamas Yaylası, Zindan Mağarası; Konya İli, Beyşehir İlçesi, Derebucak Köyü, Bıçakcı Mağarası; Konya İli, Çamlık (Dalayman) Kasabası, Balatini Mağarası; Konya İli, Çamlık (Dalayman) Kasabası, Körükini Mağarası; Konya İli, Seydişehir İlçesi, Ferzene Mağarası; Konya İli, Seydişehir İlçesi, Tınaztepe Mağarası (Us, 1974; Rampini ve Russo, 2003).

Troglophilus bicakcii Rampini & di Russo 2003 **[E]**

Türkiye mağaralarından kayıtlar: Konya İli, Beyşehir İlçesi, Derebucak Köyü, Bıçakcı Mağarası; Konya İli, Çamlık (Dalayman) Kasabası, Balatini Mağarası; Antalya İli, Akseki İlçesi, Kuyucak Köyü, Subaşı Mağarası (Rampini ve Russo, 2003); Antalya İli, Alanya İlçesi, Dim Mağarası (Kunt vd., 2008b).

Troglophilus escalerai Bolivar, 1899 **[E]**

Türkiye mağaralarından kayıtlar: Konya İli, Seydişehir İlçesi, Ferzene Mağarası; Kahramanmaraş İli, Yenicekale İlçesi, Yenicekale civarında bir mağara (Us, 1974; Rampini ve Russo, 2003).

Troglophilus gajaci Us, 1974 **[E]**

Türkiye mağaralarından kayıtlar: Mersin İli, Silifke İlçesi, Cennet Mağarası (Us, 1974; Rampini ve Russo, 2003).

Takım Zygentoma

Familya Nicoletiidae

Coletinia longissima Mendes, 1988 **[E]**

Türkiye mağaralarından kayıtlar: Mersin İli, Silifke İlçesi, Cennet Mağarası; Astım Mağarası (Mendes, 1988).

Altşube Crustacea
Sınıf Malacostraca
Takım Amphipoda

Familya Gammaridae

Gammarus ustaoglui Özbek & Güloğlu, 2005 **[E]**

Türkiye mağaralarından kayıtlar: Mersin İli, Anamur İlçesi, Sugözü Köyü, Taşeli Yaylası, Peynirlikönü Mağarası (Özbek ve Güloğlu, 2005).

Familya Hadziidae

Parhadzia sbordonii Vigna Taglianti, 1988 **[E]**

Türkiye mağaralarından kayıtlar: Antalya İli, Döşemealtı İlçesi, Yağca Köyü, Mustanini Mağarası (Vigna Taglianti, 1988).

Takım Decapoda

Familya Potamidae

Potamon ibericum tauricum (Czerniavsky, 1884)

Türkiye mağaralarından kayıtlar: İzmir İli, Dikili İlçesi, Yelköprü Mağarası (Balık vd., 2002).

Takım Isopoda
Alttakım Asellota

Familya Asellidae

Asellus (Asellus) aquaticus (Linneaus, 1758)

Türkiye mağaralarından kayıtlar: Burdur İli, İnsuyu Mağarası (Henry vd., 1986).

Proasellus lykaonicus Argano & Pesce, 1978

Türkiye mağaralarından kayıtlar: Konya İli, Çamlık Kasabası, Körükini Mağarası (Henry vd.,1986).

Alttakım Oniscidea

Familya Cylisticidae

Cylisticus convexus (De Geer, 1778)

Türkiye mağaralarından kayıtlar: Yalova İli, Soğucak Mağarası; Isparta, Aksu İlçesi, Anamas Yaylası, Zindan Mağarası (Verhoeff, 1943; Strouhal, 1953b).

Cylisticus dobati Strouhal, 1971 **[E]**

Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, Kestaneci Köyü, **?** Mağarası (Strouhal, 1971).

Cylisticus mechthildae Strouhal, 1971 **[E]**

Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, Kestaneci Köyü, **?** Mağarası (Strouhal, 1971).

Familya Ligiidae

Ligidium assimile Strouhal, 1971 **[E]**

Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, Hoca Ali Mağarası (Strouhal, 1971).

Ligidium riparum Verhoeff, 1943 **[E]**

Türkiye mağaralarından kayıtlar: Bursa İli, İnkaya Köyü, İnkaya Mağarası (Verhoeff, 1943).

Familya Trichoniscidae

Anatoliscus longicornis Verhoeff, 1949 **[E]**

Türkiye mağaralarından kayıtlar: Isparta İli, Uluborlu İlçesi, İnsan yapımı bir mağara (Verhoeff, 1943).

Chasmatoniscus oculatus Strouhal, 1971 **[E]**

Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, Kestaneci Köyü, **?** Mağarası (Strouhal, 1971).

Haplophthalmus bituberculatus Strouhal, 1963 **[E]**

Türkiye mağaralarından kayıtlar: Mersin İli, Erdemli İlçesi, Kızkalesi Kasabası (Korykos), Bir düden **?** (Strouhal, 1963).
Haplophthalmus danicus tauricus Frankenberger, 1950
Türkiye mağaralarından kayıtlar: Hatay İli, Antakya İlçesi, Narlıca Mağarası (Strouhal, 1963).
Haplophthalmus stygivagus Verhoeff, 1936
Türkiye mağaralarından kayıtlar: İstanbul İli, Yarımburgaz Mağarası (Verhoeff, 1943; Strouhal, 1963).
Kosswigius delattini Verhoeff, 1941 **[E]**
Türkiye mağaralarından kayıtlar: Bursa İli, İnkaya Köyü, İnkaya Mağarası (Verhoeff, 1943).
Trichonethes kosswigi Strouhal, 1953 **[E]**
Türkiye mağaralarından kayıtlar: Denizli İli, Acıpayam İlçesi, Dodurga Köyü, Dodurgalar Mağarası; Isparta İli, Aksu İlçesi, Anamas Yaylası, Zindan Mağarası (Strouhal, 1953a).
Trichoniscus heracleotis Strouhal, 1971 **[E]**
Türkiye mağaralarından kayıtlar: Zonguldak İli, Ereğli İlçesi, Kestaneci Köyü, **?** Mağarası (Strouhal, 1971).
Turkonethes albus Verhoeff, 1943 **[E]**
Türkiye mağaralarından kayıtlar: Yalova İli, Soğucak Mağarası (Verhoeff, 1943).

Turkonethes solifugus Verhoeff, 1943 **[E]**
Türkiye mağaralarından kayıtlar: Bursa İli, İnkaya Köyü, İnkaya Mağarası (Verhoeff, 1943).

Sınıf Maxillopoda
Takım Cyclopoida

Familya Cyclopidae
Eucyclops serrulatus (Fischer, 1851)
Türkiye mağaralarından kayıtlar: Burdur İli, İnsuyu Mağarası (Pesce, 1992).

Teşekkür

Bu çalışma Türk speleolojisinin gelişimine sağladıkları önemli katkılardan dolayı Ord. Prof. Dr. Curt Kosswig (1903-1982), Dr. Paolo Marcello Brignoli (1942-1986) ve Dr. Temuçin Aygen (1921-2003)'in aziz hatıralarına adanmıştır. Makalenin kaynak toplama ve yazım sürecinde sağladığı maddi ve manevi katkılardan dolayı Figen Kunt (Ankara, Türkiye)'a; mağara ekosistemlerinin korunması çalışmaları için böylesi bir kontrol listesinin varlığının gerekliliği hususunu bizlere telkin eden ve arazi çalışmalarımız için lojistik destek sağlayan Doğa Koruma ve Milli Parklar Genel Müdürlüğü, Mağara Araştırma Birimi'nden Dr. Selim Erdoğan'a (Ankara, Türkiye); sağladıkları makaleler ve yüreklendirici mesajlarından ötürü Bülent Erdem (İstanbul, Türkiye), Dr. Augusto Vigna-Taglianti (Roma, İtalya), Dr. Achile Casale (Sassari, İtalya), Dr. Marzio Zapparoli (Viterbo, İtalya), Dr. Mauro Rampini (Roma, İtalya), Dr. Claudio Di Russo (Roma, İtalya), Dr. Boris Sket (Ljubljana, Slovenya), Dr. Bernard Hausdorf (Hamburg, Almanya), Dr. Spyros Sfenthourakis (Patras, Yunanistan), Dr. Christo Deltshev (Sofia, Bulgaristan), Dr. Alexi Popov (Sofia, Bulgaristan), Yüksek Orman Mühendisi Meriç Çakır (İstanbul, Türkiye), Dr. Herdem Aslan Cihangir (Çanakkale, Türkiye) ve Dr. Alper Doğan (İzmir, Türkiye)'a teşekkür ederiz.

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Morphological and anatomical properties of the genus *Crithopsis* (Poaceae) in Turkey

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Abstract

C. delileana (Schult.) Roshev., the only member of the genus *Crithopsis* is taxonomically revised on the basis of herbarium materials, field observations, and laboratory examination. Ninety accessions belonging to 18 populations of *C. delileana* were subjected to Principal Component Analysis in order to determine the variability and the structure of its natural populations of based on morphology. The results of statistical analysis showed that the variability among the populations does not permit to distinguish any intra-specific categories. In addition to the statistical analysis, emended and updated description along with a distribution map of this species and the vegetative anatomical characters are also given.

Key words *Crithopsis delileana*, morphological variability, distribution, anatomy, Turkey.

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Türkiye'de bulunan *Crithopsis* (Poaceae) cinsinin morfolojik ve anatomik özellikleri

Özet

Crithopsis cinsinin tek üyesi olan, *C. delileana* (Schult.) Roshev., herbaryum materyalleri, arazi gözlemleri ve laboratuar incelemelerine dayanılarak taksonomik olarak revize edildi. *C. delileana'nın* 18 populasyonuna ait 90 birey, *C. delileana* populasyonlarının morfolojik açıdan yapısını ve çeşitliliğini belirlemek amacıyla, Temel Bileşen analizinde kullanıldı. İstatistiksel analizin sonuçları göstermiştir ki; populasyonlar arasındaki varyasyonlar tür içi bir taksonun ayrılmasına izin vermemektedir. İstatistiksel analize ek olarak, güncellenmiş ve genişletilmiş tür tanımı aynı zamanda bu türün dağılım haritası ve vejetatif anatomik karakterleri de verilmiştir.

Anahtar Kelimeler: *Crithopsis delileana*, morfolojik çeşitlilik, dağılım, anatomi, Türkiye.

1. Introduction

C. delileana (Schult.) Roshev., is the only member of the genus *Crithopsis* Jaub. & Spach (Poaceae; Triticeae). Its distribution extends from western Afghanistan and Baluchistan to Morocco (Frederiksen, 1993). Löve (1984) proposed that it carries the K genome. Sakamoto and Muramatsu (1965) were the first to report its chromosome number as 2n = 14. This number was confirmed by Sakamoto (1973) and Frederiksen (1993) on the bases of the different populations collected from Syria, Iraq, Crete, Greece, and Palestine.

With respect to their common morphological feature, sharing similar spike morphology (2-3 spikelets per node), the diploid genera *Crithopsis*, *Taeniatherum* Nevski and *Psathyrostachys* Nevski, and *Hordeum* L. have been considered rather closely related (Frederiksen and Seberg, 1992; Bothmer et al., 1995).

In the Flora of Turkey, Melderis (1985) recognized one species in the genus named as *C. delileana*. According to this account, *C. delileana* was confined to South Anatolia where it was recorded from three locations.

In spite of the several studies done on the tribe Triticeae in the literature (Schwendener, 1890; Metcalfe, 1960; Watson and Dallwitz, 1992; Terrel and Peterson, 1993; Xu and Zhou, 2008), there was a limited number of studies

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based on the anatomy of the genus *Crithopsis*.

This is the sixth paper from the series: Taxonomic revision of the tribe Triticeae Dumort. in Turkey which is funded by TÜBİTAK TBAG. Former five, have been accomplished on the taxonomy, palynology and anatomy of certain genera found in tribe Triticeae in Turkey by the authors (Cabi and Doğan, 2009; Cabi et al., 2009; Özler et al., 2009; Başer et al 2009; Cabi et al., 2010). Doğan (1988, 1991, 1992, and 1997) was also carried out extensive taxonomical studies on the genera of the tribe Aveneae, Agrostideae, Phalarideae and Phleeae in Turkey.

In this paper, in an attempt to revise the genus *Crithopsis* in Turkey, a detailed account of morphological, ecological and anatomical features of the genus *Crithopsis* is given.

2. Material and methods

Since 2006, as a part of a revisional study of the tribe *Triticeae* Dumort. in Turkey, the authors have carried out extensive field studies and collected a large number of specimens of the genus *Crithopsis.* The specimens were first carefully pressed and dried using the standard techniques for field and laboratory analysis given by Davis and Heywood (1973). Morphological measurements were made on fresh and herbarium material with the use of Leica L2 Stereomicroscope and Leica Application Suite software package. During measurements largest specimen and complete spike on each specimen is chosen and measured. Measurements of the spikelets and florets were accomplished on the spikelets dissected from the middle part of spike. Each population sample constitutes minimum ten plants. The material was deposited in the Plant Systematic and Biodiversity Laboratory in the Department of Biological Sciences Middle East Technical University.

For statistical analysis, the population samples were analyzed with respect to 10 numerical characters (Table 1). Each Operational Taxonomic Unit (OTU) scored in this study, was chosen from the most complete and largest spikes on each sheath. The initial character set was established by reviewing published keys. This set was amended, after examination of material collected from the field and also herbarium specimens from major herbaria, to include additional characters that appeared to be taxonomically important and to exclude characters that were invariant among the specimens. This resulted in selection of 10 characters (Table 1) which were scored on all OTU's Inter and Intra population variability was characterized using arithmetic means, minimum and maximum values, and Principal component analysis-PCA (Sneath and Sokal, 1973) The PCA analysis was carried out with the use of the software package MVSP version 3.1 (Kovach, 1999). PCA was performed using Gower's (1971) General Similarity Index so as to generate a distance matrix. This distance matrix was used for PCA analysis with the help UPGMA algorithm. The advantage of Gower's coefficient is the allowing the presence of a mixture of all variable types and tolerates missing values as well (Mason et al., 2005).

For anatomical studies some of the freshly obtained materials were preserved in 70% ethyl alcohol solutions. After the fixation in formalin-acetic acid-alcohol (F.A.A.) solution for 48 hours, the fixative was removed by distilled water. Then the specimens were dehydrated before embedding. They were embedded into paraffin and sectioned by applying the Johansen's (1944) paraffin sectioning method. The sections were stained by Safranine and mounted by Entellan. Observations were acquired by using Euromex FE 2025 microscope and photographed by using Euromex CMEX DC.1300 camera.

Table 1. Quantitative characters used in Principal Component Analysis (PCA)

1. CLe. Culm length (cm)
2. LbLe. Leaf blade length (cm)
3. LbWi. Leaf blade width (mm)
4. SLe. Spike length (cm)
5. RhILe. Rhachis internodes length (mm)
6. LLe. Body of lemma length (mm)
7. AofLL. Awn of lemma length (mm)
8. GLe. Glume length (mm)
9. NSps. Number of spikelets at each node
10. FnSp. Florets number at each spikelet
11. GVn. Glume vein number

3. Results and discussion

3.1. Morphology

It should be noted that the populations belonging to *C. delileana* do not show any differentiation with respect to their geographical distribution. Quantitative characters used to construct scatter diagram (Figure 1) show great variation. Culm length and glume length are the most variable characters among the studied characters. The observations and measurements showed that culm length may show variability even among the representatives of the

same populations collected at different times (Figure 1).

Principal Component Analysis. The first two principal components accounted for 75.48%, 20.131% respectively, of the total variance. Culm, lemma and glume lengths contributed most of the first and second axis. The projection of the OTU's onto the first two components (Figure 2) revealed any strongly defined groups among the OTU's.

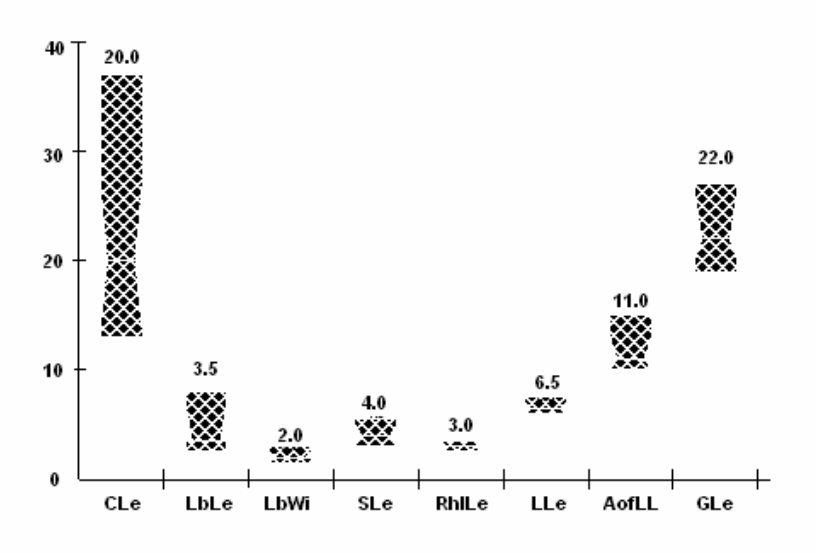

Figure 1. Box plot graph of the quantitative characters.

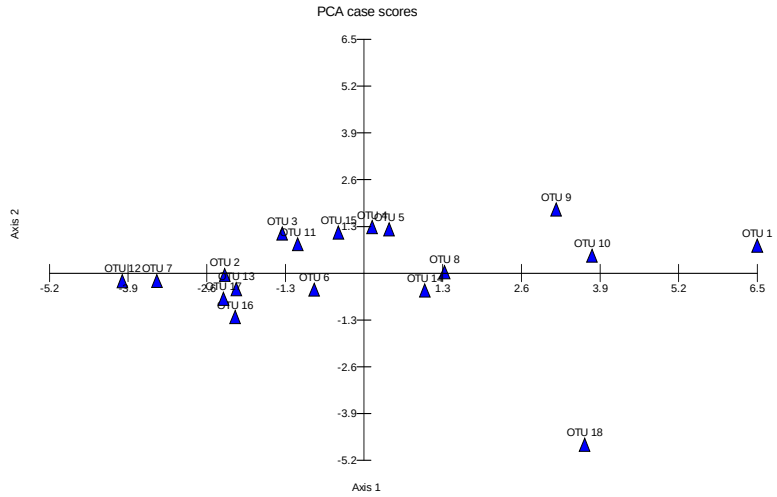

Figure 2. Principal Component Analysis (PCA)-scatter diagram of specimens from 18 populations of *C. delileana*

Crithopsis Jaub. & Spach

Annual. Culms herbaceous, slightly geniculate at base then ascending or strongly decumbent. Culm nodes glabrous. Leaves linear acuminate; flat or becoming folded towards apex. Auricles present, falcate shaped. Ligule membranous. Inflorescence a dense spike consisting of fully fragile rachis segments. Rachis segments densely and rigidly pilose on margins. Spikelets in pairs at each rachis node, with 2 florets, the lower floret bisexual, the upper one rudimentary; rachilla disarticulating below florets. Spikelets distinctly longer than adjacent internodes, about > 4x length. Glumes coriaceous, strap-shaped, longer than florets, scabrid. Lemma of fertile floret oblong-lanceolate, flattened dorsally, scabrid, often slightly verrucose below, scabrid and ± hirsute above, gradually tapering into flattened, scabrid awn. Palea two keeled, ciliate on the keels. Caryopsis adherent to palea and lemma, longitudionally grooved, dorsiventrally compressed, oblong-eliptic in outline, hairy at apex; hilum long linear. Endosperm flinty. – A monotypic genus.

The name of *Crithopsis* was originated from the Greek *krithe* (barley) and *opsis* (appearance-from the fancied resemblance of the inflorescence to the barley ear) (Bor, 1968).

C. delileana (Schult.) Roshev., Zlaki 319 (1937). Syn: *Elymus geniculatus* Delile, Fl. Egypt 30, t. 13 f. 1 (1812) non Curtis (1790); *E. delileanus* Schult., Syst. Veg. ed. 15, 2 Mant. 424 (1824); *Crithopsis rhachitrichus* Jaub. & Spach, I11. Pl. Or. 4: 30, t. 321 (1851). Ic: Fl. Iraq 9: t. 77 (1968).

Culms 6.5-49 cm long with 2-3 glabrous nodes, usually fasciculate, geniculate at base. Leaf blades 2.5-8 x 1.5-3 mm broad, scabrid, sparsely pilose, leaves are becoming folded towards apex. Spike to 3.5 cm (excl. awns). Glumes equaling, 17-25 mm long (incl. awns), gradually tapering into an awn, longer than the adjacent lemmas, narrow, up to 0.5 mm wide; subulate; scabrid or shortly pilose especially on nerves, 3-5 nerved. Lemmas of fertile florets 5.5-7.5 mm, with awn 6-12.5 mm long, wider than glumes (up to 1.2 mm wide), sparsely pilose. Palea as long as or slightly shorter than body of lemmas, membranous, two keeled without cleft at apex, ciliate on keels. Anthers are short up to 1 mm long. Caryopsis up to 5 mm long.

Chromosome number x=7, 2n=14. diploid. Genomic symbol **K** (Genome designations as recommended by the International Triticeae Consortium; http://herbarium.usu.edu/Triticeae/genmsymb.htm)**.**

Fl. 4-5. Sandy, calcareous soils, arid steppe, 11-1003 m.

Type: [Egypt] â Alexandrie dans les champs d'orge, entre le lac Mareotis et la mer, iii 1800, *Delile* (holo. MPU).

Examined specimens: S. Anatolia, C4 Mersin:, Silifke, Mersin to Tarsus, 11 m, 36° 20.357' N 33°54.892' E, 01 May 2008, *E.Cabi* 2751 **(new record for C4 grid square). C6 Gaziantep**: Doğanpınar to Karkamış, Arıkdere village gravestone, 2 km to Akçaköy, 439 m, 36°49.394' N 37°50.692' E, 21 Apr 2007, *E.Cabi* 1757. **C6 Hatay**: Reyhanlı, around Cilvegözü village, 265 m, 36°14.878' N 36°37.889' E, 03 May 2008, *E.Cabi* 2805. **C6 Kilis**: Islahiye to Kilis, after Musabeyli, 478 m, 36°48.452' N 36°59.992' E, 21 Apr 2007, *E.Cabi* 1747. **C6 Adıyaman**: Besni, Çakırhöyük district, 610 m, 37°33'22" N 37°48'33" E, 20 May 2007, *E.Cabi* 2154. **C7 Urfa**: Ceylanpınar State Farm, Çevri mainroad, 478 m, 36°58.254' N 39°38.642' E, 22 May 2007, *E.Cabi* 2232. **Urfa**: Ceylanpınar State Farm, South of Horozviran, 471 m, arid environments, 36°51.904' N 39°34.410' E, 22 May 2007, *E.Cabi* 2229. **Urfa:** Urfa to Akçakale, 8 km to Büyükhan, 600 m, 37°04.618' N 38°50.550' E, 22 Apr 2007, *E.Cabi* 1790. **Urfa**: Birecik to Urfa, 20 km before to Urfa, calcareous steppes, 654 m, 37°05.093' N 38°36.606' E, 22 Apr 2007, *E.Cabi* 1785, **Urfa**: 3 km before Birecik hydroelectric power station, 379 m, 37°03.537' N 37°55.870' E, 22 Apr 2007, *E.Cabi* 1770, **Urfa**: Ceylanpınar State Farm, Güzelyat area, N of Avea base station, *E.Cabi* 1871, **Urfa**: Ceylanpınar State Farm, 8 km from Yassıtepe gendarme station to Büyükyıldız, 442 m, 36°42.806' N 39°32.928' E, 23 Apr 2007, *E.Cabi* 1868, **Urfa**: Ceylanpınar State Farm, Kazıktepe sheep enterprise, 419 m, 36°48.927' N 39°51.270' E, 23 Apr 2007, *E.Cabi* 1852, **Urfa**: Ceylanpınar State Farm, Gökçayır cattle enterprise, 417 m, 36°48.927' N 39°51.270' E, 23 Apr 2007, *E.Cabi* 1845, **Urfa**: Urfa to Antep, 5 km from Urfa, 661 m, 37°03.113' N 38°14.411' E, 23 Apr 2006, *E.Cabi* 113, **Urfa**: Suruç to Birecik, 750 m, roadsides, 37°03.286' N 38°07.992' E, 29 Apr 2006, *E.Cabi* 244, **Urfa**: Ceylanpınar State Farm, Gökçayır işletmesi, 384 m, 36°49.080' N 39°57.227' E, 23 Apr 2007, *E.Cabi* 1823, **Urfa**: Viransehir to Urfa, 66 km before Urfa, 627 m, 37°13'34" N 39°26'21" E, 22 May 2007, *E.Cabi* 2220, **C8 Mardin**: around train station, 666 m, 37° 17'10" N 40°44'06" E, 23 May 2007, *E.Cabi* 2289, **Mardin**: S. of Gercüş, 1003 m, 37°33'52" N 41°22'35" E, 23 May 2007, *E.Cabi* 2295 **(new record for C8 grid square)** (Figure 3).

General Distribution: Crete, Cyprus, Syria, Palestine, Jordan, Egypt, Iraq, Iran, Libya.

Phytogeography: Multi regional (Holoarctic and Paleotropical, Tethyan, African, Mediterranean, Saharo Sindian, Ir.-Tur. element).

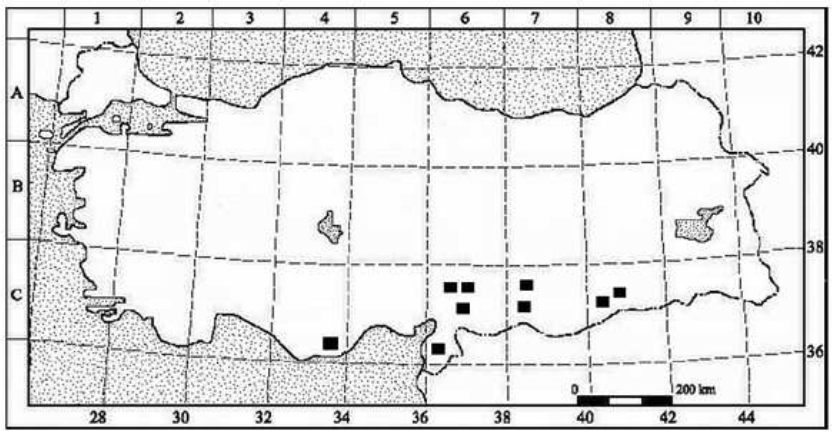

Figure 3. Updated geographic distribution of *C. delileana*

3.2. Ecology

The genus *Crithopsis* is a typical representative of Sakamoto's (1982) Mediterranean group in the Triticeae, comprising Mediterranean central Asiatic genera such as *Heteranthelium*, *Aegilops*. The members of this genus are confined to Mediterranean central Asiatic region with a climate of hot, dry summers and winter rainfall, changing inland to drier continental with cold winters.

In Turkey the distribution is confined to the eastern parts of South Anatolia. Its distribution range especially extends from C4 to C8 grid squares. Annual habit of this genus is an advantageous life strategy with seasonal rainfall. The seeds of this genus go into the dormancy periods to survive during the hot summers.

C. delileana grows on sandy arid areas, pastures, roadsides, edges of cultivated lands. Other species grow within the habitats of *C. delileana* are *Cynosurus cristatus* L., *Taeniatherum caput-medusae* (L.) Nevski, *Hordeum spontaneum* K.Koch, *H. murinum* L., *Aegilops geniculata* Roth, *Ae. crassa* Boiss., *Ae. tauschii* Coss., *Echinaria capitata* (L.) Desf., *Cynosurus echinatus* L.

The genus is a typical lowland genus with just only one accession from 1000 m. The general altitudinal distribution of the genus varies from 11 m (the accession gathered from Mersin) to 1003 m (the accession gathered from Mardin, Gercüş). During the revisional study of the tribe *Triticeae* throughout the Turkey, two new records for the grid squares C4 and C8 were found.

The threat category of *C. delileana* was assessed as vulnerable (VU) in Turkish Red Data Book (Ekim *et al.* 2000). According to the recent field surveys conducted by us, although the species is distributed more than 10 locations, the populations of *C. delileana* are still vulnerable to grazing activity of the sheeps and cattle. Distribution area is affected by anthropogenic factors such as habitat degradation and overgrazing. The effects of overgrazing seems to be so high especially due to the dry and hot summers (IUCN 2001; Criteria B and C).

Figure 4. *C. delileana* in its native habitat

3.3. Vegetative Anatomy

The transverse sections of the stem, root and leaf and its surface view are shown in Fig. 5. As seen in Fig. 5A, the bulliform cells of the leaf sections are not readily distinguishable. Also the mesophyll, including irregularly shaped cells with large intercellular cavities, is not differentiated into palisade and spongy parenchyma. The arrangement of sclerenchyma around the vascular bundles seems to be in different dispositions. There are adaxial and abaxial strands but, around the differentiated central vascular bundle there are both adaxial and abaxial girders, both of which are I-shaped.

The circular vascular bundles are of nearly the same sizes except the central vascular bundle which is the largest, and there seems to be double bundle sheathes around it. The outer sheath is parenchymatic, however, the inner one, which is not completely surrounded by the outer one, is sclerenchymatic. Metcalfe (1960) indicated that stomata of the leaves of Gramineae family can be distinguished according to their subsidiary cells. From this point of view, *C. delileana* has the stomata with two parallel subsidiary cells (Fig. 5D). The leaf surfaces also include papillae, prickles and macro hairs (Fig. 5B). Long cells have clearly thick and markedly sinuous walls with only one short cell between them.

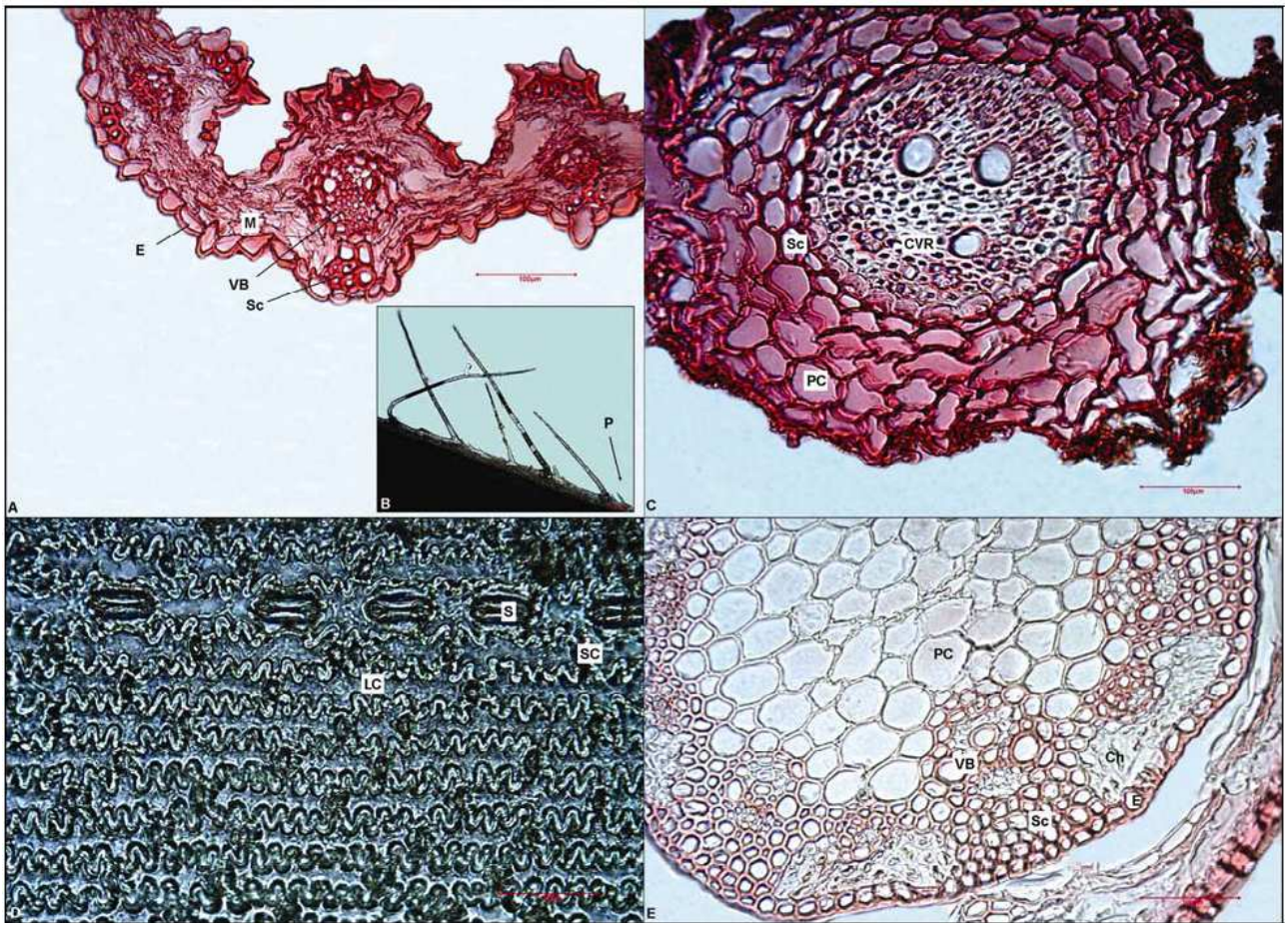

Figure 5. Sections of vegetative organs of *C. delileana* **A.** Transverse section of the leaf **B.** Hairs of the upper side of the leaf **C.** Transverse section of the root **D.** Surface view of the lower side of the leaf **E.** Transverse section of the stem

Ch: Cholerenchyma, **C.V.R.:** Central Vascular Region**, E:** Epidermis, **L.C.:** Long cell, **M:** Mesophyl **P:** Pricle, **P.C.:** Parenchymatous cells **, S:** Stomata , **SC:** Short Cell, **Sc:** Sclerenchyma, **VB:** Vascular Bundle

Stem transverse sections show that the vascular strands arise in a band of a circle, including the smaller and the larger bundles (Fig. 5E). These vascular bundles are connected to each other with sclerenchyma. However, only the larger bundles connect to the glabrous epidermis by sclerenchymatic girders separating the near columns of assimilatory tissue, called as chlorenchyma. The inner ground tissue of the large cells has thick cell walls, getting thinner towards the centre of the stem. These are parenchymatous cells that completely cover the middle region of the stem.

Transverse sections of grass roots show the same general type of anatomy (Metcalfe, 1960). Epidermis subtended by a single layer of large cells (Fig. 5.C). Beneath the ring of epidermis, there is a broad multilayered cortex, including 4-6 layers of parenchymatous cells. The inner part of the cortex is made up of a single layered of sclerenchymatous cells. The endodermis is readily distinguishable with its thick walled and U-shaped cells. The central vascular tissue marked by conspicuously large metaxylem vessels and small strands of phloem alternating with them.

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The Flora of the İnegöl Mountain (Gümüşhacıköy/Amasya, Turkey)

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Abstract

In this article, the floristical characteristics of Inegöl Mountain are given and the vascular plant species growing there are documented. The İnegöl mountain belongs to A5 square according to the Davis' grid system relating to the floristic aspect.Approximately 1700 plant samples were collected and identified from the İnegöl mountain between 2005-2008. After the identification studies, 291 genera and 661 species and subspecies taxa belonging to the 71 families were determined. 103 items (15,6 %) Euro-Siberian, 99 items (15,0 %) Iranian-Turanian, 43 items (6,5 %) Mediterranian region are the floristic elements of 661 species and subspecies taxa identified in the research area. The rest 418 items (63 %) are the elements of one or more unknown floristic regions. The first 5 families which contain the most taxa are listed below according to the distribution of taxa relating to the families in the research area. They are *Compositae* 87 (13,2 %) taxa, *Leguminosae* 69 (10.4 %) taxa, *Labiatae* 60 (9.1 %) taxa, *Cruciferae* 41(6.2 %) taxa and *Boraginaceae* 34 (5.1 %) taxa. 77 plants (11.65 %) in the reseach area are endemic.

Key words: Flora, İnegöl Mountain, Gümüşhacıköy, Amasya, Turkey

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İnegöl Dağı (Gümüşhacıköy-Amasya, Türkiye) Florası

Özet

Bu çalışmada İnegöl Dağı (Gümüşhacıköy-Amasya) ve çevresinin florası araştırılmıştır. İnegöl Dağı floristik açıdan Davis'in Grid sistemine göre A5 karesi içerisine girer. İnegöl Dağından 2005-2008 yılları arasında yaklaşık 1700 bitki örneği toplanarak teşhis edilmiştir. Teşhis çalışmaları sonucunda 71 familyaya ait 291 cins ve 661 tür ve tür altı taksona ulaşılmıştır. Araştırma alanında tespit edilen 661 tür ve tür altı taksondan; 103 tanesi (% 15,6) Avrupa-Sibirya, 99 tanesi (% 15,0) İran-Turan, 43 tanesi de (% 6,5) Akdeniz floristik bölgesi elementidir. Geriye kalan 418 tanesi (% 63) ise birden fazla bölgeli ya da floristik bölgesi bilinmeyendir. Araştırma alanındaki taksonların familyalara dağılımına göre en fazla takson içeren ilk 5 familya şu şekilde sıralanmaktadır. *Compositae* 87 (%13,2) takson, *Leguminosae* 69 (%10,4) takson, *Labiatae* 60 (%9,1) takson, *Cruciferae* 41(%6.2) takson, *Boraginaceae* 34 (%5.1) takson şeklindedir. Araştırma alanında bulunan bitkilerden 77 (% 11.65) tanesi endemiktir.

Anahtar kelimeler: Flora, İnegöl Dağı, Gümüşhacıköy, Amasya, Türkiye

1. Giriş

İnegöl Dağları, Karadeniz Bölgesi'nin Orta Karadeniz Bölümü'nün iç kesimlerinde yer almaktadır. İdari bakımdan Amasya ve Çorum illeri sınırları içinde yer alan İnegöl Dağı üzerinde hem daimi, hem de geçici kır yerleşim birimleri bulunur. İlçe merkezi durumundaki büyük yerleşim merkezleri daha çok İnegöl Dağı'nın çevresinde bulunan alanlarda toplanmıştır. İnegöl Dağı'nın doğusunda Gümüşhacıköy-Amasya, batısında Osmancık-Çorum ve güneyinde Hamamözü-Amasya ilçeleri bulunmaktadır (Şekil 1).

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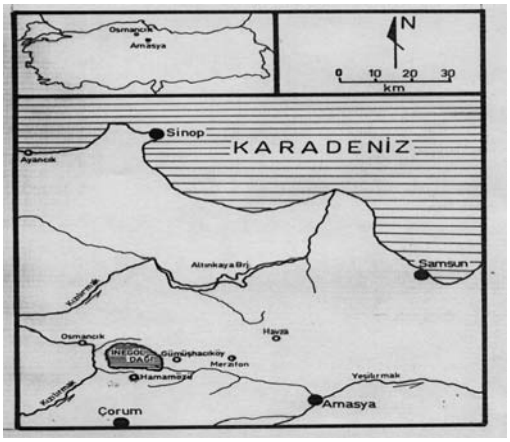


Şekil 1 Araştırma alanının coğrafi konumu

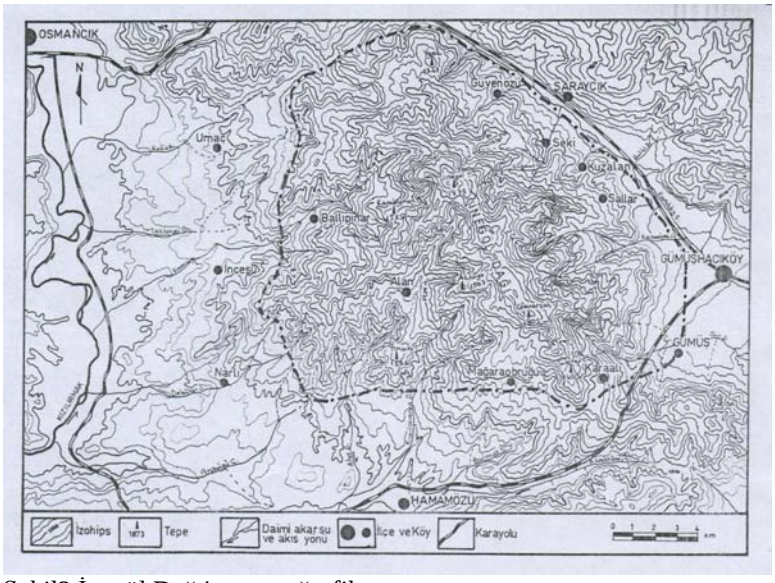
Araştırma alanının yer aldığı, Gümüşhacıköy ilçesi, 40.53 enlem ve 35.13 boylamları arasında yer almakta olup deniz seviyesinden yüksekliği 770 m.dir.Osmancık ilçesi ise 40.58 enlem ve 34.48 boylamları arasında yer almakta olup deniz seviyesinden yüksekliği 410 m.dir. Araştırma alanı olarak seçilen İnegöl Dağı, Amasya il merkezinin batısında olup, Amasya ve Çorum illeri sınırındadır. Davis'in Grid sistemine göre A5 karesi içerisine girer.

Araştırma alanı, doğu yüzünde Gümüş kasabası ve İmirler, Kılınçarslan, Karaali köyleri, batısında Güvenözü ve Çampınarı köyleri, güneyinde Alan ve Arpaderesi köyleri, kuzeyinde ise Sallar, Sekü, Kuzalan, Bacakoğlu köyleri ile sınırlandırılmıştır.

Ayrıca araştırma alanının farklı yer ve yükseltilerinde yaz mevsiminde yaylacılık yapılmaktadır. Bunlardan başlıcaları İnegöl, Çampınarı, Kırca, Çökek, Sarıçam, Bentler, Yılanoğlu, Güvenözü, Kuzpınarı, Damlaca yaylaları olarak sayılabilir. Araştırma alanındaki belli başlı tepeler ise İnegöl (Bey) tepe (1873 m), Gavurçalı tepe (1802 m), Karaburun tepe (1525 m), Akkaya tepe (1507 m), Çaltepe tepe(1453 m), Yanık tepe (1247 m.) olarak sıralanabilir.

Araştırma alanının daimi akış gösteren tek deresi " Hamamözü çayı", İnegöl dağından doğarak Kızıl ırmağa karışır(Şekil 2). Araştırma alanı olarak seçilen "İnegöl Dağı" coğrafik olarak İç Anadolu ve Orta Karadeniz Bölgeleri arasında, bitki coğrafyası bakımından ise Avrupa-Sibirya ile İran-Turan floristik bölgeleri arasında bir geçiş bölgesinde yer almaktadır. Bunun gibi 1985'te ve 1990'da Kılınç'ın İç Anadolu Batı Karadeniz, 1994'te Karaer'in İç Anadolu-Orta ve Doğu Karadeniz geçiş alanlarında ve 2001'de Cansaran ve Aydoğdu ile 2005'de Korkmaz ve arkadaşlarının İç Anadolu ve Orta Karadeniz Bölgeleri geçiş alanlarında çalışmaları vardır. Bu araştırmalar dikkate alındığında; bu tip geçiş alanları bir yandan Karadeniz'in nemli, diğer yandan İç Anadolu'nun kurak ikliminin etkisi altında bulunması sebebiyle her iki bölgeye ait bitki türlerini de içermektedir. Ayrıca son yıllarda, Alpınar 1979a, Peker 1988, Ketenoğlu ve ark. 1994, Özen ve Kılınç 1995, Kılınç 1985, 1990, Cansaran ve Aydoğdu 1998, Cansaran 2002, Korkmaz ve ark.2005, Celep ve ark.2006, Yücel 2005, Cansaran ve ark.2007a, araştırma alanımıza yakın yörelerden bilimsel amaçlı olarak bitki örnekleri toplamışlardır. Geçiş bölgeleri gerek vejetasyon, gerekse flora ve bitki coğrafyası bakımından oldukça ilginç özellikler göstermektedir. Ayrıca bugüne kadar "İnegöl Dağı"nın flora ve vejetasyonu ile ilgili olarak lokal ve ayrıntılı bir çalışma yapılmamıştır. İşte bu özelliklerinden hareketle "İnegöl Dağı" araştırma alanı olarak seçilmiştir.

Litolojik ve tektonik faktörler, araştırma alanının bugünkü jeomorfolojik özelliklerinin ortaya çıkmasında önemli rol oynamışlardır. Nitekim tektonik olaylar İnegöl Dağı ve çevresindeki Gümüşhacıköy, Osmancık ve Hamamözü depresyonlarının oluşumunda belirleyici olmuştur. Farklı direnç ve yapıdaki kayaçlar birbirine göre yüksek ve alçak alanların oluşmasında etkili olmuştur. Yine kireç taşı ve mermerlere bağlı olarak karstik şekiller ortaya çıkmıştır (Çoban ve Aylar 2006). Araştırma alanının temelini Ilgaz masifine ait kayaçlar oluşturur. Bu kayaçlar paleozoik yaşlı fillit, kuvarsit, yeşil şist ve mermerlerdir. Bunlardan fillit, kuvarsit ve yeşil şistler alanın kuzeyinde Sallar ve Güvenözü köyleri arasında, mermer ise güneyde Mağaraobruğu ve Alan köyleri arasında adeseler halinde bulunurlar. Alanda Mesozoik, Alt Kretase yaşlı şist, gre ve konglomera, Üst Kretase yaşlı kalker, andezit ve greli şist fasiyesi ile temsil edilir. Alt Kretase yaşlı şist gre ve konglomeradan oluşan seri alanın kuzeyinde Güvenözü köyü batısında yayılır. Üst Kretase kalkerleri alanın güneydoğusunda ve kuzeybatısında bulunurlar (Blumenthal, 1948 – Ketin, 1962). Kalker formasyonlar, İnegöl Dağı'nın zirvesini teşkil eden Çal tepe, Gavurçalı tepe, Akkaya tepe ve İnegöl tepe gibi alanları kuzeybatı-güneydoğu istikametinde geçerek, muhtemelen alanın dışında da devam etmektedir (Erer, 1983).



Şekil2 İnegöl Dağı'nın topoğrafik yapısı

Araştırma alanında iklim, topoğrafya ve ana madde farklılıkları nedeniyle çeşitli büyük toprak grupları oluşmuştur. Büyük toprak gruplarının yanısıra, toprak örtüsünden yoksun bazı arazi tipleri de (çıplak kaya ve molozlar) görülmektedir.

Araştırma alanında görülen başlıca toprak grupları Kahverengi Orman toprakları, Kahverengi topraklar, Kestanerengi topraklar, Alüviyal topraklar, Kolüvyal topraklar şeklindedir.

Gümüşhacıköy ilçesinde, iklim İç Anadolu'nun karasal iklimi ile Karadeniz iklimi arasında geçiş teşkil eder. Yağışlar yağmur şeklinde olup, yüksek seviyelerde kar şeklindedir. Bölgede hakim rüzgarlar kuzey-güney doğrultusunda esmektedir. Araştırma alanının iklimi Gümüşhacıköy, Merzifon ve Osmancık meteoroloji istasyonlarının iklim verilerinden, bölgenin en yüksek kesimi olan İnegöl Tepe'nin eteklerinin(1800 m.) iklimi ise enterpolasyonla hesaplanan verilerden yararlanılarak değerlendirilmiştir.

Çizelge 1. Yıllık yağışın mevsimlere dağılışı ve yağış rejim tipleri

İSTASYONLAR	MEVSİMLER									YAĞIŞ REJİM TİPLERİ
	KIŞ		İLKBAHAR		YAZ		SONBAHAR		YILLIK	
	mm	%	mm	%	mm	%	mm	%	mm/m	
GÜMÜŞHACIKÖY (770 m)	123	24.4	164.6	32.7	117.4	22.7	100.7	20.2	505.7	İ.K.Y.S. Geçiş iklimlerinin yağış rejimleri 1. tipi
İNEGÖL DAĞI (1800 m)	262.05	24.68	303.65	28.6	256.45	24.14	239.75	22.58	1062	İ.K.Y.S. Geçiş iklimlerinin yağış rejimleri 1. tipi
OSMANCIK (410 m)	97.6	25	131.7	33.7	81.3	20.81	80.3	20.55	390.9	İ.K.Y.S. Geçiş iklimlerinin yağış rejimleri 1. tipi
Merzifon (755 m)	105.3	27	137.6	35	71.2	18	77.0	20	385.5	İ.K.S.Y. Doğu Akdeniz yağış rejimi 2.tipi

Gümüşhacıköy meteoroloji istasyonunun (40.53 Kuzey Enlemi-770 m) verilerine göre, yıllık ortalama sıcaklık 10.2 °C'dir. Merzifon meteoroloji istasyonunun (40.52 Kuzey Enlemi-755 m) verilerine göre, yıllık ortalama sıcaklık 11.5 °C'dir. Osmancık meteoroloji istasyonunda (40.58 Kuzey Enlemi-410 m) ise yıllık ortalama sıcaklık 13.7 °C'dir.

İnegöl Dağı'nda 1800 m. için enterpolasyonla hesaplanmıştır. Buna göre yıllık ortalama sıcaklık 5-6 °C civarındadır.

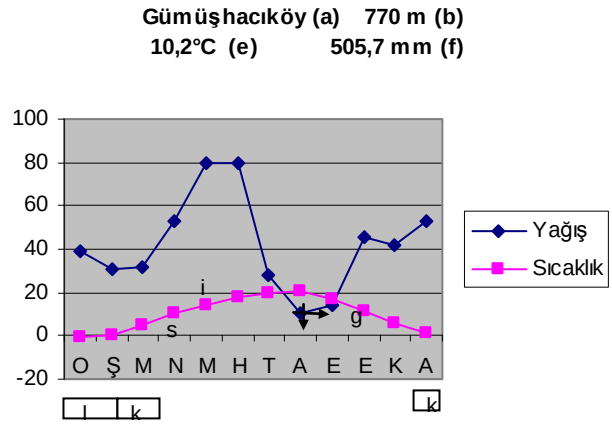
Araştırma alanındaki yükseklik farklılıkları (850-1875) hem sıcaklık ve yağış değerlerinde farklılıklara yol açmakta hem de bitki örtüsünün çeşitlenmesine neden olmaktadır.

Araştırma alanının iklimi Erinç'in (1965) yağış etkenliği, (Im=P/Tom; Im:Yağış etkenliği, P:Yıllık yağış, Tom: Yıllık ortalama sıcaklık) ve De Martonne'nun (1923) kuraklık indisi, (I=P/T+10, I:Kuraklık İndisi, P:Yıllık yağış miktarı (mm), T:Yıllık ortalama sıcaklık) formülleri ile değerlendirilmiştir.

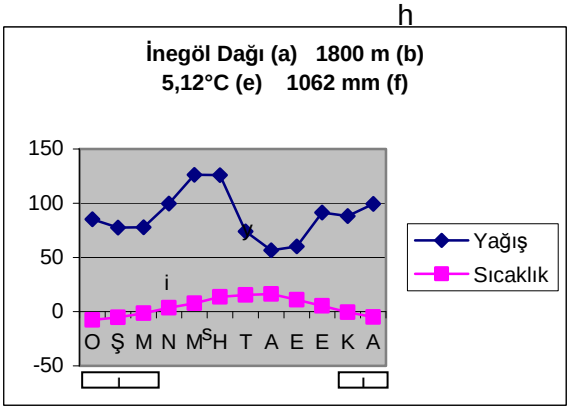
Buna göre araştırma alanında, Erinç'in yağış etkenliği indisine göre Osmancık ve Merzifon'da "Yarı Kurak", Gümüşhacıköy de "Yarı Nemli" iklim hakimdir. Bölgede bulunan meteoroloji istasyonlarının Walter (1956) metodu ile sıcaklık ve yağış değerlerine göre Gümüşhacıköy ve İnegöl Dağının iklim diyagramları incelendiğinde (Şekil 3-4) kuraklığın Gümüşhacıköy istasyonunda 7-8. aylarda daha fazla olduğu görülmektedir. Ayrıca Gümüşhacıköy'de 1-2. aylar mutlak donlu aylardır. 3. ve 12. aylarda muhtemel donlu aylardır. Gümüşhacıköy istasyon verileri kullanılarak enterpolasyonla hesaplanan İnegöl Dağı'nın 1800 metre yüksekliği için sıcaklık ve iklim değerlerine göre çizilen iklim diyagramlarına bakıldığında ise kurak devreye rastlanılmamaktadır. Enterpolasyonla elde edilen sıcaklık değerleri incelendiğinde ise 1.,3. ve 11.ve 12. aylarda İnegöl Dağı'nın 1800 metre yüksekliği mutlak donlu aylardır.

Çizelge 2. İklim diyagramlarında kullanılan kısaltmalar

	Ölçüm yapan istasyonun adı		Muhtemel donlu aylar
	Ölçüm yapan istasyonun yükseltisi		Mutlak donlu aylar
	Sıcaklık rasat süresi		En soğuk ayın en düşük sıcaklık ortalaması
	Yağış rasat süresi		Mutlak minimum sıcaklık
	Yıllık ortalama sıcaklık		En sıcak ayın en yüksek sıcaklık ortalaması
	Yıllık ortalama yağış		Mutlak maksimum sıcaklık
	Kuraklık süresi		Sıcaklık eğrisi
	Kuraklık Şiddeti		Yağış eğrisi
	Nemli mevsim		



Şekil 3. Gümüşhacıköy meteroloji istasyonuna ait iklim diyagramı



Şekil 4. Gümüşhacıköy meteroloji istasyonu verilerine göre enterpolasyonla elde edilen değerler için İnegöl Dağı'na ait iklim diyagramı

Sonuç olarak araştırma alanının İç Anadolu ve Orta Karadeniz bölgeleri arasında geçiş durumunda bulunması nedeniyle bölgenin iklim bakımından yorumlanması oldukça zor olmaktadır. Bu nedenle fitocoğrafik bölgeler bakımından olduğu gibi, çalışma alanında iklim bakımından da bir geçiş söz konusudur.

2. Materyal ve yöntem

Araştırmanın materyalini, 2005-2008 yılları arasında uygun vejetasyon dönemlerinde toplanan bitki örnekleri oluşturmaktadır. Bitki örnekleri, yöntemine uygun olarak en az üçer adet olmak üzere; üzerinde çiçek, meyve, yaprak ve kök gibi organları ile toplanmaya özen gösterilmiştir. Toplanan bitki örnekleri yöntemine uygun olarak preslenip, kurutularak herbaryum materyali haline getirilmiştir. Bu örnekler henüz kurulma aşamasında olan Amasya Üniversitesi Eğitim Fakültesi Herbaryumu (AEFH)'nda muhafaza edilmektir. Bitkilerin teşhisinde Davis (1965-1988), Boissier (1867- 1888), Güner ve arkadaşları (2000), Dalcı (1986), Duran ve Duman (2002), Cansaran ve Aydoğdu (1998, 2002), Korkmaz ve ark (2005) ile Amasya Üniversitesi Eğitim Fakültesi Herbaryumu (AEFH)'ndan yararlanıldı. Teşhisinde güçlükle karşılaşılan bazı bitki örnekleri konu ile ilgili uzmanların yardımları ile teşhis edildi. Çalışma sahasının floristik açıdan değerlendirilmesinde Cansaran vd., 2007b ve Yıldırım vd., 2007 çalışmalarından da faydalanılmıştır. Araştırma alanının florası Davis'in (1965–1988) Türkiye Florası adlı eserindeki sıralamaya göre düzenlendi. Bitki örneklerinin hayat formları, hangi bölgenin elementi oldukları ve endemizim durumları örneklerle birlikte verildi. Ayrıca floristik bulgular yakın bölgelerde yapılmış çalışmalar ile karşılaştırılarak değerlendirildi. Araştırma bölgesinin iklim özelliklerini açıklayabilmek için bölgede bulunan meteoroloji istasyonlarına ait veriler, Meteoroloji İşleri Genel Müdürlüğü Bilgi İşlem Dairesi Başkanlığı "Sıcaklık ve Yağış Değerleri Bülteni" (1984) ve "Osmancık ve Gümüşhacıköy Meteoroloji İstasyonları Yayımlanmamış Döküm Cetvelleri"nden temin edildi (Meteroloji Genel Müdürlüğü 2006).

Alanı karakterize eden iklim diyagramları çizilirken ve yöredeki iklim katları belirlenirken aşağıdaki kaynaklardan yararlanılmıştır. "Klimatoloji Tatbikatı" (Ardel ve ark.1969), "Karadeniz Bölgesinin İklim Özellikleri" (Akıncı 1991), "Türkiye İklimi" (Koçman 1993), "Umumi Klimatoloji ve İklim Çalışmaları" (Dönmez 1979), "Bitki Ekolojisi ve Bitki Sosyolojisi Uygulamaları" (Kılınç ve ark.2006). Alanın topoğrafik haritasının çiziminde ise Orman Genel Müdürlüğü Türkiye Orman Haritası kullanılmıştır.

Araştırma alanındaki toprak grupları "Çorum İli Arazi Varlığı" (Köyhizmetleri Genel Müdürlüğü 1994), "Amasya İli Arazi Varlığı" (Köyhizmetleri Genel Müdürlüğü 1991), ve "Yeşilırmak Havzası Toprakları" (Köyişleri Bakanlığı 1975), isimli kaynaklardan faydalanılarak belirlenmiştir.

Araştırma alanındaki jeolojik yapı; Maden Tetkik Arama Enstitüsü'nün yayınlamış olduğu çeşitli raporlardan (MTA GenelMüdürlüğü 1967, 1980, 1982a, 1989) ve "Amasya Doğu Yöresinin Jeolojisi" (Haznedar 1989) ile "Amasya Yöresinin Jeolojisi" (Alp 1972) kaynaklarından yararlanılarak hazırlanmıştır.

Tüm taksonlar Davis'in Grid sistemine göre "A5: Amasya" karesi içindedir, tekrardan kaçınmak amacıyla bu bilgi tüm taksonlar için ayrı ayrı yazılmamıştır. Ayrıca tüm taksonlar "Yıldırım" tarafından toplanmış olup, bitki listesi verilirken toplayıcı ismi belirtilmemiş sadece toplayıcı numaraları yazılmıştır. Floristik listede kullanılan "kısaltmalar" ve "lokaliteler" (Çizelge 3-4) aşağıda verilmiştir:

Çizelge 3 Floristik listedeki kısaltmalar

VU-Zarar görebilir	G: Geofit
LR-Az Tehdit Altında	Th: Terofit
a-(cd) Koruma Önlemi Gerektiren	Vp: Vasküler Parazit
b-(nt) Tehdit Altına Girebilir	H: Hemikriptofit
c-(Ic) En Az Endişe Verici	Ph: Fanerofit
DD-Veri Yetersiz	Ch: Kamefit

Çizelge 4 Lokalitelerin Kısaltmaları

Lokalite No	(L) Lokalite
L1	Sultançayırı ile Gümüş kasabası arası, yol kenarı, kayalık habitat, 1300 m., 30.05.2005
L2	İnegöl tepe etekleri, *Juniperus* çalılıkları, 1750 m., 30.05.2005
L3	Güvenözü köyü üstleri, *P.nigra* ormanı açıklıkları, 1100 m., 30.05.2005
L4	Hamamözü ilçesi ile Alan köyü arası, yol kenarı, 1100m., 30.05.2005
L6	Gümüş kasabası ile Sultançayırı arası, yol kenarı kayalık habitat, 1350m., 10.06.2005
L7	Gümüş kasabası ile Sultançayırı arası, yol kenarı kayalık habitat, 1500m., 10.06.2005
L8	Sallar köyü üstü şeyhin düzü mevkii, *Quercus* çalılıkları altı, 1200m., 19.06.2006
L9	Gümüş kasabası üstü Kabalı dere mevki, açık alanlar, 950m., 28.06.2006
L10	Sultançayırı ile Gümüş kasabası arası, yol kenarı, kayalık habitat, 1150 m., 28.06.2005
L11	Sultançayırı ile Gümüş kasabası arası, yol kenarı, kayalık habitat, 1400 m., 10.06.2005
L12	Sultançayırı ile Gümüş kasabası arası, yol kenarı, kayalık habitat, 1500 m., 28.06.2005
L14	Beytepe civarı, *Juniperus* çalılıkları altı, 1700 m., 28.06.2005
L15	Beytepe ile Sallar köyü arası, yol kenarı, 1550m., 28.06.2006
L16	Sallar köyü üstleri, yol kenarı, 1100m., 28.06.2005
L17	Bacakoğlu köyü üstü, yol kenarı, 900 m., 11.08.2005
L19	Bacakoğlu köyü üstü, yol kenarı, nemli habitat, 1200 m., 11.08.2005

Çizelge 4. Devam ediyor

L20 Kırca yaylaları mevkii, yol kenarı, 1500 m., 11.08.2005
L21 Bacakoğlu köyü ile Bacakoğlu yaylası arası, 1250 m., 11.08.2005
L22 Kırca yaylaları üstü, stebik alanlar, 1650 m., 11.08.2005
L23 Başpınar nahiyesi üstleri, yol kenarı, 800 m., 11.08.2005
L24 Sultançayırı ile Gümüş kasabası arası, yol kenarı, kayalık habitat,1600 m., 12.08.2005
L26 Sultançayırı ile Gümüş kasabası arası, yol kenarı, kayalık habitat, 1350 m., 12.08.2005
L27 Beytepe ile Sallar köyü arası, yol kenarı, nemli habitat, 1400 m., 12.08.2005
L28 Sultançayırı ve İnegöl tepe civarı, 1650m., 14.08.2005
L29 İmirler köyü ile İmirler yaylası arası, yol kenarı, 1250 m., 14.08.2005
L30 Bacakoğlu köyü ile Bacakoğlu yaylası arası, yol kenarı, 1100 m.,14.08.2005
L31 Güvenözü köyü yaylası civarı, 1400m., 14.08.2005
L32 Bacakoğlu köyü ile Kırca yaylası arası, yol kenarı, 1300 m., 28.08.2005
L35 Sultançayırı ile Gümüş kasabası arası, yol kenarı, kayalık habitat, 1450 m., 09.09.2005
L36 Beytepe mevkii, yol kenarı, 1650 m., 09.09.2005
L38 Sultançayırı ile Gümüş kasabası arası, yol kenarı, kayalık habitat, 1500 m., 23.09.2005
L39 Karaali köyünün güneyi tepeler, kayalık habitat, 1100 m., 03.03.2006
L40 Sultançayırı ile Gümüş kasabası arası, yol kenarı, 1200 m., 03.03.2006, Yıldırım 2225
L41 Güvenözü köyü üstleri, *P.nigra* ormanı, 1100 m., 18.03.2006
L42 Karaali köyü üstü Maltepe etekleri, kayalık step ve çalı altı habitat, 31.03.2006
L43 Gümüş kasabası ile Karaali köyü arası, yol kenarı, 900 m., 31.03.2006
L45 Gümüş kasabası ile Sultançayırı arası, yol kenarı kayalık habitat, 1100m., 31.03.2006
L46 Güvenözü köyü ile İstanbul asfaltı arası, yol kenarı, *Quercus* ormanı altı, 1000 m., 14.04.2006
L47 Güvenözü köyü üstleri, *P.nigra* ormanı açıklıkları, 1200 m., 14.04.2006
L48 Beytepe ile Sallar köyü arası, yol kenarı, 1500 m., 14.04.2006
L49 Gümüş kasabası üstü Kabalı dere mevki, korunmuş step, 900m., 29.04.2006
L50 Gümüş kasabası ile Sultançayırı arası, yol kenarı ve *Astragalus* çalılıkları altı,1500m., 29.04.2006
L51 Sultançayırı ile Gümüş kasabası arası, yol kenarı, kayalık habitat, 1550 m., 29.04.2006
L52 Sallar köyü üstü Beydamı mevki, kayalık habitat, 1500m., 29.04.2006
L53 Beytepe ile Sallar köyü arası, yol kenarı, orman altları, 1200 m., 29.04.2006
L54 Sekü köyü içi, dere kenarı, nemli habitat, 1000 m., 06.05.2006
L55 Bacakoğlu köyü üstleri,kayalık habitat,1000m.,06.05.2006
L56 Beytepe ile Sallar köyü arası, yol kenarı kayalık habitat, 1400m.., 06.05.2006
L57 Güvenözü köyü ile İstanbul asfaltı arası, yol kenarı, 850m., 06.05.2006
L58 Güvenözü köyü üstleri, *P.nigra* ormanı açıklıkları, 1100 m., 06.05.2006
L59 Gümüş kasabası üzeri Kabalı dere mevkii, korunmuş step, 900 m., 20.05.2006
L60 Sultançayırı ile Gümüş kasabası arası, yol kenarı, kayalık habitat, 1100 m., 20.05.2006
L61 Sultançayırı ve İnegöl tepe civarı, 1650m., 20.05.2006
L62 Karaali köyü güneyi Karagöz-Maltepe civarları, kayalık habitat,1400m., 20.05.2006
L63 Gümüş kasabası ile Sultançayırı arası, yol kenarı kayalık habitat *Astragalus* çalılıkları çevresi, 1600m., 01.06.2006
L64 Sultançayırı civarı, nemli habitat, 1600m., 01.06.2006
L65 Sultançayırı ile Gümüş kasabası arası, yol kenarı, kayalık habitat, 1550 m., 01.06.2006
L66 Sultançayırı ile Gümüş kasabası arası, yol kenarı, kayalık habitat, 1200 m., 01.06.2006
L67 Gümüş kasabası üstü Kabalı dere mevki, korunmuş step, 900 m., 01.06.2006
L68 Alan köyü ile Alan yaylası arası, dere vadisi, 1500m., 01.06.2006
L69 Hamamözü ilçesi ile Alan köyü arası, yol kenarı, 1200m., 01.06.2006
L70 Beytepe ile Sallar köyü arası, yol kenarı, 1150 m., 10.06.2006
L71 Beytepe ile Sallar köyü arası, yol kenarı, 1400 m., 10.06.2006
L72 Güvenözü köyü üstleri, *P.nigra* ormanı açıklıkları, 1100 m., 10.06.2006
L73 Beytepe ile Sallar köyü arası, yol kenarı *Fagus* ormanı altı, 1450m., 10.06.2006
L74 Güvenözü köyü ile İstanbul asfaltı arası, Quercus çalılıkları, 900m., 10.06.2006
L75 İnegöl Tepe çevresi, *Juniperus communis* birliği altı, 1800m., 10.06.2006
L76 Sallar köyü üstü Beydamı mevki, *Fagus* ormanı altı, 1650m., 10.06.2006
L77 İmirler köyü ile İmirler yaylası arası, çalı altları, 1500 m., 19.06.2006
L78 İmirler köyü ile İmirler yaylası arası, yol kenarı, çalılıklar çevresi, 1500 m., 19.06.2006
L79 Sultançayırı ile Gümüş kasabası arası, yol kenarı, kayalık habitat, 1600 m., 19.06.2006
L80 İnegöl tepe ile Alan köyü arası, yol kenarı, orman altı ve açıklıkları, 1650 m., 19.06.2006
L81 Karaali köyü güneyi tepeler, kayalık habitat, 1250m., 19.06.2006
L82 Gümüş kasabası üstü Kabalı dere mevki, korunmuş step, 900m., 19.06.2006
L83 Sultançayırı ile Gümüş kasabası arası, yol kenarı, kayalık habitat, 1300 m., 19.06.2006
L84 Karaali köyü güneyi Karagöz-Maltepe civarları, kayalık habitat, 1400m., 19.06.2006
L85 Bacakoğlu köyü ile Bacakoğlu yaylası arası, yol kenarı, *Carpinus* çalılıkları altı, 1400 m., 20.06.2006
L86 Güvenözü köyü yaylası ile Çampınar köyü yaylası arası, *P.nigra* ormanı altı ve çevresi, 1350 m., 20.06.2006
L87 Bacakoğlu köyü üstü Cüneytdede mevkii, *Fagus* ormanı altı, 1450 m., 20.06.2006
L88 Güvenözü köyü üstleri, *P.nigra* ormanı açıklıkları, 1100 m., 20.06.2006
L90 Bacakoğlu köyü ile Bacakoğlu yaylası arası, yolkenarı, 1350m., 20.06.2006
L91 Beytepe ile Sallar köyü arası, yol kenarı çalı altları, 1150m., 27.06.2006
L92 Beytepe ile Sallar köyü arası, yol kenarı, 1450 m., *Fagus* ormanı altı, 27.06.2006
L93 Beytepe ile Sallar köyü arası, yol kenarı kayalık habitat, 1500m.., 27.06.2006
L94 İnegöl Tepe çevresi, *Astragalus* çalılıkları altı, 1750m., 27.06.2006
L95 Alan köyü ile Alan yaylası arası, yol kenarı, orman açıklıkları, 1550 m., 04.07.2006
L96 Gümüş kasabası ile Sultançayırı arası, yol kenarı kayalık habitat, 1250m., 04.07.2006
L97 Sultançayırı ile Gümüş kasabası arası, yol kenarı, kayalık habitat, 1600 m., 04.07.2006

Çizelge 4. Devam ediyor

L98	Sultançayırı ile Sallar köyü yaylası arası, dere kenarı, nemli habitat, 1650 m., 04.07.2006
L99	Gümüş kasabası üstü Kabalı dere mevki, korunmuş step, 900m., 04.07.2006,
L100	Sultançayırı ile Gümüş kasabası arası, yol kenarı, kayalık habitat, 1450 m., 04.07.2006
L101	Güvenözü köyü ile İstanbul asfaltı arası, yol kenarı, 900 m., 10.07.2006
L102	Güvenözü köyü yaylaları çevresi, *Pinus nigra* ormanı altları, 1400 m., 10.07.2006
L103	Çampınar köyü üstleri, orman altı, nemli habitat,1250m.,10.07.2006
L104	Bacakoğlu köyü üstü, yol kenarı, 1200 m., 10.07.2006
L105	Beytepe ile Sallar köyü arası, yol kenarı kayalık habitat, 1400m.., 16.07.2006
L106	Sultançayırı ile Gümüş kasabası arası, yol kenarı, kayalık habitat, 1650 m., 16.07.2006
L108	Karaali köyü güneyi Karagöz-Maltepe civarları, kayalık habitat, 1400m., 23.07.2006
L109	Beytepe ile Sallar köyü arası, yol kenarı, 1300 m., 28.07.2006
L110	Beytepe mevkii, yol kenarı, 1600 m., 28.07.2006
L111	Sultançayırı ile Gümüş kasabası arası, yol kenarı, kayalık habitat, 1300 m., 28.07.2006
L112	Güvenözü köyü ile İstanbul asfaltı arası, 950m., 17.08.2006
L113	Güvenözü köyü üstleri, *P.nigra* ormanı açıklıkları, 1100 m., 17.08.2006
L115	Gümüş kasabası ile Sultançayırı arası, yol kenarı kayalık habitat, 1200m., 23.08.2006
L119	Sultançayırı ile Gümüş kasabası arası, yol kenarı, 1200 m., 07.09.2006
L120	Ovacık köyünün doğusu, çalılıklar, 1150 m., 07.09.2006
L121	Sultançayırı ile Gümüş kasabası arası, yol kenarı, 1300 m., 20.09.2006
L123	Sultançayırı ile Gümüş kasabası arası, yol kenarı, 1200 m., 27.09.2007
L124	Sultançayırı ile Gümüş kasabası arası, yol kenarı, 1600 m., 27.09.2007
L127	Gümüş kasabası üstü Kabalı dere mevki, korunmuş step, 900m., 25.04.2008
L129	Gümüş kasabası üstü Kabalı dere mevki, açık alanlar, 1000m., 10.06.2008
L130	İnegöl tepe ile Alan köyü arası, yol kenarı, *P.sylvestris* ormanı altı, 1750 m., 10.06.2008
L131	Güvenözü köyü ile Güvenözü yaylası arası, yol kenarı, 1225 m., 10.06.2008
L132	Beytepe ile Sallar köyü arası, yol kenarı kayalık habitat, 1400m., 10.06.2008
L133	Gümüş kasabası üstü Kabalı dere mevki, açık alanlar, 1000m.., 21.06.2008
L134	Güvenözü köyü ile İstanbul asfaltı arası, *Quercus* çalılıkları, 1000m., 21.06.2008
L135	Beytepe ile Sallar köyü arası, yol kenarı *Quercus* çalılıkları altı, 1400m., 21.06.2008
L136	Bacakoğlu köyü üstü Cüneytdede mevkii, *Fagus* ormanı altları, 1500 m., 04.07.2008
L137	Çökek yaylası mevkii, *Pinus sylvestris* ormanı altları, 1500 m., 04.07.2008
L138	Güvenözü Köyü üstü, *Pinus nigra* ormanı altları, 1160 m., 04.07.2008
L139	Çökek yaylası mevkii, *Pinus sylvestris* ormanı altları, 1580 m., 04.07.2008
L140	Gümüş kasabası üstü Kabalı dere mevki, açık alanlar, 1100m., 04.07.2008
L141	Beytepe ile Sallar köyü arası, *Fagus* ormanı altı, 1600 m., 04.07.2008
L142	Güvenözü Köyü ile Güvenözü Yaylası arası, çalı altları, 1300 m., 04.07.2008

3. Bulgular

Araştırma Alanında Bulunan Bitkilerin Listesi (Floristik Liste)

PTERIDOPHYTA
EQUISETACEAE
Equisetum arvense L. L103, 3405, H.
POLYPODIACEAE
Polypodium vulgare L. subsp. ***vulgare*** L. L55, 2322, H.

SPERMATOPHYTA
GYMNOSPERMAE
PINACEAE
Pinus sylvestris L. L61, 2369, Ph. ***Pinus nigra*** Arn. subsp. ***pallasiana*** (Lamb.) Holmboe L16, 2002, Ph.
CUPRESSACEAE
Juniperus communis subsp. ***alpina*** (Sm.) Celak. L28, 2160, Ph. ***Juniperus oxycedrus*** L. subsp. ***oxycedrus*** L74, 2575 ***Juniperus foetidissima*** Willd. L84, 2802, Ph. ***Juniperus excelsa*** Bieb. L108,3296, Ph.
EPHEDRACEAE
Ephedra major Host. L62, 2395, Ch.

ANGIOSPERMAE
DICOTYLEDONES
RANUNCULACEAE
Nigella orientalis L. L99, 3179, H. ***Nigella segetalis*** Bieb. L96, 3104, H. ***Nigella arvensis*** L. var. ***glauca*** Boiss. L9, 1838, T. ***Delphinium peregrinum*** L. L99, 3175, T. ***Delphinium venulosum*** Boiss. L69, 2489, Ir.-Tur. Element, Endemik, LR (Ic), T. ***Consolida orientalis*** (Gay) Schröd. L9, 1842, Ir.-Tur. Element, T. ***Clematis vitalba*** L. L112, 3368, Ph. ***Adonis aestivalis*** L. subsp. ***aestivalis*** L140, 3484, T. ***Adonis flammea*** Jacq. L49, 2286, T. ***Ranunculus brutius*** Ten. L73, 2556, Euro-Sib. Element, H. ***Ranunculus repens*** L. L90, 2872, Ch.
Ranunculus kotschyi Boiss. L91, 2991, H. ***Ranunculus constantinopolitanus*** (DC) d'Urv. L68, 2468, H.

Ranunculus oxyspermus Willd. L75, 2622, H. ***Ranunculus argyreus*** Boiss. L52, 2314, H. 25. ***Ranunculus rumelicus*** Griseb. L76, 2641, E.Medit Element, H. ***Ranunculus muricatus*** L. L4, 1771, T. ***Ranunculus arvensis*** L. L6, 1784, T. ***Ceratocephalus falcatus*** (L.) Pers. L45, 2240, T.

BERBERIDACEAE

Berberis vulgaris L. L115, 3393, Ph. ***Berberis crataegina*** DC. L28, 2151, Ph.

PAPAVERACEAE

Chelodonium majus L. L16, 2004, Euro-Sib. Element, H. ***Papaver rhoaes*** L. L9, 1845, T. ***Papaver argemone*** L. L49, 2293, T. ***Corydalis solida***(L) Sw. subsp. ***solida*** L42, 2229, G. ***Fumaria officinalis*** L. L49, 2290, T. ***Fumaria asephala*** Boiss. L59, 2349, Ir.-Tur. Element, T.

CRUCIFERAE

Crambe tataria Sebeök, Dissert. *var.* ***tataria*** Ic. L93, 3024, H. ***Rapistrum rugosum*** (L.) All. L9, 1840, T.
Conringia perfoliata (C.A.Mey.) Bush. L61, 2363, T. ***Cardaria draba*** (L.) Desv. L67, 2458, H. ***Aethionema armenum*** Boiss. L69, 2479, Ir.-Tur. Element, H. ***Thlaspi perfoliatum*** L. L46, 2250, T. ***Capsella bursa-pastoris*** (L.) Medik L94, 3071, T. ***Euclıdıum syriacum*** (L.) R. Br. L68, 2472, T. ***Fibigia eriocarpa*** (DC) Boiss. L50, 2299, H. ***Alyssum dasycarpum*** Steph.ex Willd. L91, 2906, T. ***Alyssum hirsutum*** Bieb. L50, 2300, T.***Alyssum repens*** Baumg. var. ***trichostachyum*** L57, 2335, H. ***Alyssum praecox*** Boiss.& Bal. var. ***praecox*** L9,1854, Endemik, LR (Ic), Ch.
Alyssum sibiricum Willd. L6, 1788, H. ***Alyssum murale*** Waldst.& Kit. var. **m*urale*** L74, 2597, Ch. ***Clypeola jonthlaspi*** L. L47, 2252, T. ***Draba rigida*** Willd. *var.****rigida*** L56, 2325, Endemik., LR (Ic), H. ***Draba muralis*** L.
L52, 2312, T. ***Erophila verna*** (L.) Chevall. subsp.***verna*** L46, 2244, T. ***Arabis caucasica*** Willd. subsp. ***caucasica***
L56, 2330, H. ***Arabis sagittata*** (Bertol) DC. L17, 2038, H. ***Arabis abietina*** Bornm. L47, 2262, Euxine(mt.) Element, Endemik, VU, H. **Turritis laxa** (Sibth.& Sm.) Hayek L136, 3477, T. ***Barbarea vulgaris*** R. Br. L64, 2404, H.
Cardamine bulbifera (L.) Crantz L136, 3478, Euro–Sib. Element, H. ***Aubrieta canescens*** (Boiss.) Bornm. subsp. ***canescens L7***, 1804, Endemik, LR (Ic), H. ***Hesperis bicuspidata*** (Willd.) Poiret. L68, 2471, H. ***Hesperis buschiana*** Tzvelev. L65, 2415, Endemik, LR (nt), H. ***Erysimum cuspidatum*** (Bieb.) DC. L81, 2726, H. ***Erysimum leptophyllum*** (Bieb.) Andrz. L81, 2725, H. ***Erysimum eginense*** Hausskn. L8, 1823, Endemik, VU, H. ***Erysimum smyrnaeum*** Boiss.& Bal. L10, 1150m., 1869, H. ***Erysimum graecum*** Boiss.& Heldr. L6, 1785, H. ***Alliaria petiolata*** (Bieb) Cav.& Grande L15, 1979, T. ***Sisymbrium officinale*** (L.) Scop. L109, 3337, T. ***Sisymbrium altissimum*** L. L15, 1978, T. ***Sisymbrium orientale*** L. L96, 3120, T. ***Sisymbrium loeselii*** L. L82, 2738, T. 75. ***Descurainıa sophia*** (L.) Webb ex Prantl. L69, 2486, T. ***Arabidopsis thaliana*** (L.) Heynhold. L56, 2324, T. ***Camelina rumelica*** Vel. L62, 2386, T.

RESEDACEAE

Reseda lutea L.var. ***lutea*** L16, 2010, H. ***Reseda luteola*** L. L101, 3191, H.

CISTACEAE

Helianthemum nummularium (L.) Miller. subsp. ***nummularium.*** L91, 2998, Ch. ***Helianthemum nummularium*** (L.) Miller. subsp. ***lycaonicum*** **C**oode &Cullen. L47, 2266, Endemik, LR (Ic), Ch. ***Helianthemum canum*** (L.) Baumg.**Group a**. Boiss. L84, 2794, H.
Helianthemum canum (L.) Baumg.**Group d**. Boiss. L12, 1954, H.
Helianthemum salicifolium (L.) Miller. L103, 3269,T.

VIOLACEAE

Viola odorata L. L76, 2644, H. ***Viola suavis*** Bieb. L45, 2238, H. ***Viola sieheana*** Becker L7, 1816, H. ***Viola kitaibeliana*** Roem.& Schult. L47, 2256, T.

POLYGALACEAE

Polygala pruinosa Boiss. *subsp.* ***pruinosa*** L62, 2394, H. ***Polygala anatolica*** Boiss.& Heldr. L72, 2543, H. ***Polygala monspeliaca*** L. L81, 2714, Medit.Element, T.

CARYOPHYLLACEAE

Arenaria ledebouriana Fenzl.var.***ledebouriana*** L63, 2401, 3248, Endemik, LR (Ic), H. ***Minuartia hirsuta*** (Bieb.) Hand. L7, 1805, H. ***Minuartia multinervis*** (Boiss.) Bornm. L129, 3457, Ir.- Tur.Element, T. ***Minuartia micrantha*** Schischk. L6, 1799, H.
Minuartia corymbulosa (Boiss.& Bal.) Mc Neil.var.***corymbulosa*** L10, 1877, Ir.-Tur. Element, Endemik, LR (nt), H. ***Minuartia subtilis*** (Fenzl.) Hand. L105, 3234, Ir.-Tur. Element, T. ***Stelleria media*** (L.) Vill. subsp. ***media*** L50, 2303, T. ***Stellaria holestea*** L. L53, 2318, Euro-Sib. Element, H. ***Cerastium diffusum*** Pers. L86, 2840, T. ***Holosteum umbellatum*** L.var. ***glutinosum*** (Bieb) Gay. L51, 2308, T. ***Telephium imperati*** L. subsp. ***orientale*** (Boiss.) Nyman. L129, 3454, H. ***Dianthus liboschitzianus*** Ser. L97, 3149, H. ***Dianthus balansae*** Boiss. L75, 2618, Endemik, LR (Ic), H. ***Dianthus zonatus*** Fenzl. var. ***aristatus*** (Boiss) Reeve. L24, 2100, Ch. ***Dianthus carthusianorum*** L. L102, 3218, Ch. ***Petrorhagia prolifera*** (L.) Ball & Heywood. L10, 1881, T. ***Velezia rigida*** L. L133, 3464, T. ***Saponaria glutinosa*** Bieb. L72, 2514, H. ***Saponaria prostrata*** Willd. subsp. ***prostrata*** L74, 2596, Ir.-Tur. Element, Endemik, LR (Ic), H. ***Silene italica*** (L.) Pers. L14, 1971, H. ***Silene capitellata*** Boiss. L84, 2797, Endemik, LR (Ic), H. ***Silene otites*** (L.) Wibel. L108, 3313, H. ***Silene spergulifolia*** (Desf.) Bieb. L10, 1901, Ir.-Tur. Element, H. ***Silene supina*** Bieb. subsp. ***pruinosa*** (Boiss.) Chowdh. L96, 3121, H. ***Silene thymifolia*** Sibth & Sm. L104, 3417, Ch.
Silene vulgaris (Moench) Garcke.var. ***vulgaris*** L67, 2443, H. ***Silene vulgaris*** (Moench) Garcke.var. ***commutata*** (Guss.) Coode & Cullen. L103, 3404, H. ***Silene compacta*** Fischer. L17, 2017, H. ***Silene alba*** (Miller) Krause subsp. ***eriocalycina*** (Boiss.) Walters. L9, 1841, H.

ILLECEBRACEAE

Herniaria incana Lam. L129, 3469, H. ***Paronychia kurdica*** Boiss. subsp. ***kurdica*** var. ***kurdica*** L91, 2887, H.

POLYGONACEAE

Rumex acetosella L. L10, 1878, H.

CHENOPODIACEAE

Chenopodium foliosum (Moench) Aschers. L15, 1999, T.

GUTTIFERAE

Hypericum lydium Boiss. L84, 2798, H. ***Hypericum scabrum*** L. L75, 2636, Ir.-Tur. Element, H. ***Hypericum venustum*** Fenzl. L4, 1774, H. ***Hypericum montbretii*** Spach. L85, 2819, 2873, H. ***Hypericum orientale*** L. L91, 2962, H. 130. ***Hypericum origanifolium*** Willd. L66, 2436, H. ***Hypericum perforatum*** L. L99, 3172, H.

MALVACEAE

Alcea apterocarpa (Fenzl.) Boiss. L10, 1883, Ir.-Tur. Element, Endemik, LR (Ic), H.

LINACEAE

Linum nodiflorum L. L81, 2704, Medit. Element, T. ***Linum hirsutum*** L. subsp.***pseudoanatolicum*** Davis. L101, 3188, Ir.-Tur. Element, Endemik, LR (Ic), H.

GERANIACEAE

Geranium lucidum L. L7, 1814, T. ***Geranium rotundifolium*** L. L80, 2695, T. ***Geranium pusillum*** Burm. L73, 2561, T. ***Geranium tuberosum*** L. subsp. ***tuberosum*** L75, 2638, G. ***Geranium macrostylum*** Boiss. L70, 2506, E.Medit(mt.) Element, H. ***Geranium pyrenaicum*** Burm. L78, 2664, H. ***Erodium ciconium*** (L.) L'Herit. L79, 2689, T. ***Erodium amanum*** Boiss. & Kotschy. L36, 2197, Ir.-Tur. Element, Endemik, LR (Ic), H. ***Erodium cicutarium*** (L.)L'Herit. *subsp.****cicutarium*** L49, 2289, T. ***Erodium acaule*** (L.) Becherer & Thell. L46, 2242, H.

ACERACEAE

Acer tataricum L. L70, 2495, Ph. ***Acer campestre*** L. subsp. ***campestre*** L85, 2809, Ph. ***Acer campestre*** L. subsp. ***leiocarpum*** (Opiz) Pax. L73, 2550, Euro-Sib. Element, Ph. ***Acer hyrcanum*** Fisch & Mey. subsp. ***hyrcanum*** L83, 2785, Ph.

RHAMNACEAE

***Palirus spina*-christi** Miller. L23, 2096, Ph.

ANACARDIACEAE

69. *Rhus* L.

Rhus coriaria L. L101, 3194, Ph.

LEGUMINOSAE

Chamaecytisus supinus (L.) Link. L91, 3009, Euro-Sib. Element, Ch. ***Chamaecytisus austriacus*** (L.) Link. L91, 2923, Euro-Sib. Element, Ch. ***Chamaecytisus pygmaeus*** (Willd.) Rothm. L74, 2587, Euro-Sib. Element, Ch. ***Genista tinctoria*** L. L88, 2862, Euro-Sib. Element, Ch. ***Genista albida*** Willd. L62, 2397, Ch. ***Argyrolobium biebersteinii*** Ball. L138, 3482, H. ***Colutea cilicica*** Boiss. L74, 2581, Ph. ***Astragalus amasiensis*** Freyn. L47, 2268, H. ***Astragalus densifolius*** Lam. subsp. ***amasiensis*** L7, 1813, Ir.-Tur. Element, Endemik, LR (Ic), H. ***Astragalus leucothrix*** Freyn & Bornm. L66, 2434, Ir.-Tur. Element, Endemik, LR (Ic), Ch. ***Astragalus pseudocaspius*** Fischer. L115, 3382, Ch. 162. ***Astragalus microcephalus*** *Willd*. L83, 2765, Ir.-Tur. Element, Ch. ***Astragalus tokatensis*** Fischer. L29, 2163, Ir.-Tur. Element, Endemik, LR (Ic), Ch. ***Astragalus barba-jovis*** DC.var. ***barba-jovis*** L31, 2178, Ch. 165. ***Astragalus barba-jovis*** DC.var. ***candicans*** Sirj. L27, 2110, Ir.-Tur. Element, Ch. ***Astragalus micropterus*** Fischer. L103, 3271, Ir.-Tur. Element, Endemik, LR (Ic), Ch. ***Astragalus strictispinsis*** Boiss. L38, 2212, Endemik, LR (nt), Ch. ***Astragalus baibutensis*** Bunge. L99, 3184, Ir.-Tur. Element, Endemik, LR (Ic), Ch. ***Astragalus anthylloides*** Lam. L47, 2269, Ir.-Tur. Element, H. ***Astragalus ponticus*** Pall. L85 2804, H. ***Astragalus strigillosus*** Bunge. L6, 1780, Ir.-Tur. Element, H. ***Astragalus karamasicus*** Boiss & Ball. L65, 2409, Ir.-Tur. Element, Endemik, LR (Ic), H. ***Astragalus onobrychis*** L. L69, 2485, H. ***Astragalus angustifolius*** Lam. subsp. ***angustifolius*** var. ***Angustifolius*** L28, 2161, Ch. ***Oxytropis fominii*** Grossh. L103, 3398, Ir.-Tur. Element, H. ***Psoralea bituminosa*** L. L74, 2579, H. ***Vicia cracca*** L. subsp.***cracca*** L72, 2545, Euro-Sib. Element, H. ***Vicia cracca*** L. subsp.***tenuifolia*** (Roth) Gaudin. L72, 2528, H. ***Vicia cracca*** L. subsp. ***stenophylla*** Vel. L72, 2535, H. ***Vicia villosa*** Roth. subsp.***villosa*** L78 2666, T. ***Vicia ervillia*** (L.) Willd. L85 2822, T. ***Vicia noena*** Reuter ex Boiss. var. ***neona*** L67, 2449, Ir.-Tur. Element, T. ***Vicia sativa*** L. subsp. ***sativa*** L69, 2478, T. ***Lathyrus aureus*** (Stev.) Brandza. L90, 2871, Euxine Element, H. ***Lathyrus tukhtensis*** Czecz. L91, 2981, Endemik, LR (Ic), H. ***Lathyrus pratensis*** L. L103, 3407, H. ***Lathyrus laxiflorus*** (Desf.) O.Kuntze. subsp. ***laxiflorus*** L73, 2551, H. ***Lathyrus czeczottianus*** Bassler. L1, 1757, Endemik, LR (Ic), H. ***Lathyrus roseus*** Stev. L70, 2496, Hyrcano-Euxine Element., H. ***Lathyrus inconspicuus*** L. L66, 2440, T. ***Lathyrus cicera*** L. L74, 2581, T. ***Lathyrus aphaca*** L.var. **b*iflorus*** Post. L95, 3094, T. ***Ononis spinosa*** L. subsp. ***leiosperma*** (Biss.) Sirj. L17, 2053, Ch. ***Trifolium repens*** L.var. ***repens*** L77, 2660, H. ***Trifolium campestre*** Schreb. L137, 3481, T. ***Trifolium pratense*** L.var. ***pratense*** L102, 3210, H. ***Trifolium medium*** L.var. ***medium*** L91, 2928, H. ***Trifolium ochroleucum*** Huds. L70, 2507, H. ***Trifolium pannonicum*** Jacq. subsp. ***elongatum*** (Willd.) Zoh. L72, 2549, Endemik, LR (Ic), H. ***Trifolium hirtum*** All. L74, 2592, Medit Element., T. ***Trifolium arvense*** L. *var*. ***arvense*** L74, 2589, T. ***Trifolium purpureum*** Lois.var. ***purpureum*** L77, 2659, T. ***Melilotus officinalis*** (L.) Desr. L90, 2870, T. ***Melilotus alba*** Desr. L74, 2582, T. ***Medicago x varia*** Martyn. L109, 3331, H. ***Medicago falcata*** L. L102, 3216, H. ***Medicago minima*** (L.) Bart.var. ***minima*** L66, 2437, T. ***Dorycnium graecum*** (L.) Ser. L10, 1913, Ch. ***Dorycnium pentaphyllum*** Scop. subsp. ***herbaceum*** (Vill.) Rouy. L74, 2580, Ch. ***Dorycnium pentaphyllum*** Scop. subsp. ***anatolicum*** (Boiss.) Gams. L102, 3215, Ch. ***Lotus corniculatus*** L. var. ***corniculatus*** L138, 3486,T. ***Anthyllis vulneraria*** L. subsp. **b*oissieri*** (Sag.) Bornm. L102, 3221, Ch. ***Coronilla emerus*** L. subsp. ***emeroides*** (Biss. & Sprun) Uhrova. L74, 2590, Ph ***Coronilla orientalis*** Miller.var. ***orientalis*** L20, 2077, H. ***Coronilla varia*** L. subsp.***varia*** L73, 2559, H. ***Hedysarum varium*** Willd. L73, 2598, Ir.-Tur. Element, H. ***Onobrychis armena*** Boiss. L103, 3309, Endemik, LR (Ic), H. ***Onobrychis oxyodonta*** Boiss. L88, 2859, H. ***Onobrychis tournefortii*** (Willd.) Desv. L9, 1848, Endemik, LR (Ic), H.

ROSACEAE

Prunus spinosa L. L38, 2218, Euro-Sib. Element, Ph. ***Prunus divericata*** Ledeb. subsp.***divericata*** L28, 2154, Ph. ***Cerasus incana*** (Palas) Spach. L120, 3434, Ir.Tur.Element, Ph. ***Cerasus avium*** (L.) Moench. L131, 3459, Ph. ***Amygdalus communis*** L. L127, 3450, Ph. ***Filipendula vulgaris*** Moench. L81, 2707, Euro-Sib. Element, H. ***Rubus discolor*** Weihe & Nees. L17, 2024, Ch. ***Rubus canescens*** DC.var. ***canescens*** L10, 1886, Ch. ***Rubus canescens*** DC.var. ***glabratus*** (Godron) Davis & Meikle. L109, 3338, Euro-Sib. Element, Ch. ***Rubus hirtus*** Waldst. L115, 3394, Ch. ***Potentilla argentea*** L. L97, 3155, H. ***Potentilla recta*** L.Group B L100, 3186, H. ***Potentilla supina*** L. L91, 2965, H. ***Potentilla erecta*** (L.) Rauschel. L73, 2552, H. ***Potentilla micrantha*** Ramond ex DC. L52, 2313, H. ***Fragaria vesca*** L. L136, 3479, H. ***Geum urbanum*** L. L91, 2965, Euro-Sib. Element, H. ***Sanguisorba minor*** Scop. subsp.***muricata*** (Spach) Briq. L6, 1790, H. ***Alchemilla mollis*** (Buser) Rothm. L98, 3162, H. ***Rosa pulverulenta*** Bieb. L38, 2220, Ch. ***Rosa horrida*** Fischer. L38, 2206, Ph. ***Rosa canina*** L. L10, 1914, Ph. ***Rosa dumalis*** Bechst.var. **b*oissieri*.** L28, 2147, Ch.

Cotonaster nummularia Fisch. L121, 3437, Ph. ***Pyracantha coccinea*** Roemer L17, 2021, Ph. ***Crataegus tanacetifolia*** (Lam.) Pers. L121, 3433,3435, Endemik, LR (Ic), Ph. ***Crataegus bornmuelleri*** Zabel. L121, 3439, Ph.
Crataegus orientalis Palas ex Bieb.var. ***orientalis*** L121, 3440, Ph. ***Crataegus orientalis*** Palas ex Bieb.var. ***obtusata*** L121, 3436, Ph. ***Crataegus szovitsii*** Pojark. L121, 3438, Ir.-Tur. Element?, Ph. ***Crataegus aronia*** (L.) Bosc.ex DC.var. ***aronia*** L123, 3441, Ph. ***Crataegus monogyna*** Jacq. subsp. ***monogyna*** L123, 3442, Ph. ***Crataegus microphylla*** C.Koch L115, 3380, Hyrcano-Euxine Element, Ph. ***Sorbus umbellata*** (Desf.) Fritsch.var. ***umbellata***
L119, 3425, Ph. ***Sorbus umbellata*** (Desf.) Fritsch.var. ***cretica*** (Lindl.) Schneider. L72, 2527, Ph. ***Sorbus torminalis*** (L.) Crantz.var. ***torminalis*** L81, 2736, Ph. ***Malus slyvestris*** Miller. subsp. ***orientalis*** (A.Uglitzkich) Browicz.var. ***orientalis*** L120, 3428, Ph.

LYTHRACEAE

Lythrum salicaria L. L19, 2064, Euro-Sib. Element, H.

ONOGRACEAE

Epilobium angustifolium L. L17, 2048, H. ***Epilobium hirsutum*** L. L19, 2062, 2065, H. ***Epilobium montanum*** L. L17, 2032, Euro-Sib. Element, H. ***Epilobium lanceolatum*** Seb.& Mauri L91, 2927, H. ***Epilobium tetragonium*** L. subsp. ***lamyi*** (F.W.Schultz) Nyman. L95, 3127, Euro-Sib. Element, H.

DATISCACEAE

Datısca cannabina L. L32, 2190, H.

CRASSULACEAE

Sedum acre L L97, 3157, Ch. ***Sedum album*** L. L96, 3126, Ch. ***Sedum hispanicum*** L. var. ***hispanicum*** L94, 3082, T. ***Sedum pallidum*** Bieb. var. **bitynicum** (Biss.) Chamberlain L10, 1892, H. ***Sempervivum brevipilum*** Muirhead. L108, 3294 Endemik, LR (nt), Ch.

SAXIFRAGACEAE

Saxifraga rotundifolia L. L92, 2935, Euro-Sib. Element, H. ***Saxifraga cymbalaria*** L.var. ***cymbalaria*** L93, 3048, T.

UMBELLIFERAE

Eryngium campastre L. var. ***virens*** Link L123, 3445, H. ***Chaerophyllum byzantinum*** Boiss. L77, 2674, Euxine Element, H. ***Anthriscus nemorosa*** (Bieb.) Sprengel. L68, 2467, H. ***Scaligeria tripartita*** (Kalen.) Tamamsch. L91, 2942, Euxine Element, H. ***Foeniculum vulgare*** Miller. L103, 3277, H. ***Anethum graveolens*** L. L67, 2447, T.
Bupleurum sulphureum Boiss.& Ball. L96, 3109, Ir.-Tur. Element, Endemik, LR (Ic), T. ***Trinia scabra*** Boiss.& Noe L94, 3076, Ir.-Tur. Element, H. ***Peucedanum ruthenicum*** Bieb. L113, 3371, H. ***Malabalia secacul*** Banks & Sol. L82, 2742, H. ***Heracleum platytaenium*** Boiss. L90, 2869, Euxine Element?, Endemik, LR (Ic), H. ***Laserpitium hispidum*** Bieb. L17, 2057, H. ***Torilis arvensis*** (Huds.) Link. subsp. ***arvensis*** L67, 2459, T. ***Torilis leptophylla*** (L.) Reichb. L91, 2896, T. ***Astrodaucus orientalis*** (L.) Drude & Prantl. L101, 3206, Ir.-Tur. Element?, T. ***Caucalis platycarpus*** L. L59, 2350, T. ***Turgenia latifolia*** (L.) Hoffm. L27, 2012, T. ***Artedia squamata*** L. L9, 1839, T.

CORNACEAE

Cornus mas L. L30, 2165, Euro-Sib. Element, Ph.

CAPRIFOLIACEAE

.***Sambucus ebulus*** L. L104, 3414, Euro-Sib. Element, H. ***Sambucus nigra*** L. L31, 2172, Euro-Sib. Element, Ph.
Viburnum lantana L. L12, 1950, Euro-Sib. Element, Ph. ***Lonicera caucasica*** Pallas. subsp. ***orientalis*** L72, 2534, Endemik, LR (Ic), Ch. ***Lonicera etrusca*** Santi. var. ***etrusca*** L103, 3291, Medit Element, Ph.

VALERIANACEAE

Valeriana dioscoridis Sm. L55, 2323, E.Medit Element, H. ***Centranthus longiflorus*** Stev. subsp. ***longiflorus*** L72, 2512, Ir.-Tur. Element, Ch. ***Valerianella pumila***(L.)DC. L62, 2383, T. ***Valerianella vesicaria*** (L.) Moench. L129, 3468, T.

MORINACEAE

Morina persica L. L24, 2101, Ir.-Tur. Element, H.

DIPSACACEAE

Dipsacus laciniatus L. L17, 2014, H. ***Scabiosa columbaria*** L. subsp. ***columbaria*** var. ***columbaria*** L103, 3315, H. ***Scabiosa argentea*** L. L103, 3314, H. ***Scabiosa micrantha*** Desf. L102, 3213, T. ***Scabiosa rotata*** Bieb. L10, 1865, Ir.-Tur. Element, T. ***Pterocephalus plumosus*** (L.) Coulter. L10, 1872, T.

COMPOSITAE

Inula salicina L. L86, 2836, Euro-Sib. Element, H. ***Inula ensifolia*** L. L108, 3311, Euro-Sib. Element, H. ***Inula oculus-christii*** L. L111, 3356, Euro-Sib. Element?, H. ***Inula britannica*** L. L111, 3301, Euro-Sib. Element?, H. ***Inula montbretiana*** DC. L111, 3312, Ir.-Tur. Element, H. ***Helichrysum graveolens*** (Bieb.) Sweet. L93, 3060, H ***Helichrysum plicatum*** DC. subsp. ***plicatum*** L20, 2071, H. ***Helichrysum arenarium*** (L.) Moench. subsp. ***aucheri*** (Boiss.) Davis& Kupicha. L94, 3091, Ir.-Tur. Element, Endemik, LR (Ic), H ***Filago eriocephala*** Guss. L133, 3461, E.Medit.Element, T. ***Logfia arvensis*** (L.) Holub. L10, 1861, T. ***Aster alpinus*** L. L97, 3151, T. ***Bellis perennis*** L. L47, 2260, Euro-Sib. Element, H. ***Doronicum orientale*** Hoffm. L46, 2249, H. 319. ***Senecio mollis*** Willd. L83, 2753, 2766, 2777, Ir.-Tur. Element?, H. ***Senecio pseudo-orientalis*** Schisckin. L15, 1974, Ir.-Tur. Element, H. ***Senecio vernalis*** Waldst. & Kit. L49, 2283, T. ***Tussilago farfara*** L. L43, 2234, Euro-Sib. Element, G. ***Petasites hybridus*** (L.) Gaertner. L54, 2320, Euro-Sib. Element, H. ***Anthemis cretica*** L. subsp. ***pontica*** (Willd.) Grierson. L6, 1789, H. ***Anthemis cretica*** L. subsp. ***tenuiloba*** (DC.) Grierson. L81, 2712, H. ***Anthemis cretica*** L. subsp. ***candiscans*** (Boiss.) Grierson. L91, 2925, H. ***Anthemis tinctoria*** L.var. ***tinctoria*** L74, 2591, H. ***Achillea phrygia*** Boiss.& Ball. L83, 2774, Ir.-Tur. Element, Endemik, LR (Ic),H. ***Achillea*** **millefolium** L. subsp. ***millefolium*** L11, 1937, Euro-Sib. Element, H.
Achillea **millefolium** L. subsp. ***pannonica*** (Scheele) Hayek. L74, 2615, Euro-Sib. Element, H. ***Achillea coarctata*** Poir. L17, 2031, H. ***Achillea biebersteinii*** Afan. L27, 2107, Ir.-Tur. Element, H. ***Tanacetum poterifolium*** (Ledeb.) Grierson. L72, 2519, Euxine Element, H. ***Tanacetum parthenium*** (L.) Schultz Bip. L77, 2671, H. ***Tripleurospermum oreades*** (Boiss.) Rech.var. oreades L47, 2270, H. ***Artemisia absinthium*** L. L15, 1989, Ch. ***Cirsium osseticum*** (Adams.) Petrak L113, 3375, H. ***Cirsium vulgare*** (Savi.) Ten. L105, 3273, H. ***Cirsium hypoleucum*** D.C. L85 2813, Euxine Element, H. ***Cirsium pseudopersonata*** Boiss.& Ball subsp. ***pseudopersonata*** L91, 2952, Euxine Element, H. ***Cirsium arvense*** (L.) Scop. subsp. ***arvense*** L102, 3220, H. ***Cirsium arvense*** (L.) Scop. subsp. ***vestitum*** (Wimmer &Grab.) Petrak. L20, 2079, H. ***Picnomon acarna*** (L.) Cass. Gümüş kasabası üstü Kabalı dere

mevki, açık alanlar, 1000m., 01.07.2008, 3476, E. Medit Element, T. ***Ptilostemon afer*** (Jacq.) Greuter subsp. ***eburneus*** Greuter. L132, 3460, Endemik, LR (Ic), H. ***Carduus tmoleus*** Boiss. L71, 2508, H. ***Carduus nutans*** L. ***nutans sensu-lato*** L77, 2653, H. ***Carduus acanthoides*** L. subsp. ***acanthoides*** L17, 2030, Euro-Sib. Element, H. ***Carduus pycnocephalus*** L. subsp. ***albidus*** (Bieb.) Kazmi. L66, 2432, T. ***Centaurae virgata*** Lam.**GroupA** L101, 3208, H. ***Centaurae virgata*** Lam. **GroupB**. L17, 2054, H. ***Centaurea solsitalis*** L. subsp. ***solsitalis*** L99, 3181, T. ***Centaurea iberica*** Trev.ex Sprengel. L28, 2149, T. ***Centaurea urvillei*** DC. subsp. ***urvillei*** L103, 3247, Medit Element, H. ***Centaurea urvillei*** DC. subsp. ***stepposa*** L91, 2895, Ir.-Tur. Element, H. ***Centaurea carduiformis*** DC. subsp. ***carduiformis*** L101, 3203, H. ***Centaurea pichleri*** Boiss. subsp. ***pichleri*** L6, 1782, H. ***Centaurea triumfettii*** All.Group A L6, 1781, H. ***Centaurea triumfettii*** All.Group B L72, 2529, H. ***Centaurea depressa*** Bieb. L69, 2483, T. ***Centaurea cankiriense*** A.Duran & H.Duman L103, 3310, Endemik, DD, H. ***Crupina crupinastrum*** (Moris) Vis. L74, 2572, T. ***Carthamus lanatus*** L. L108, 3286, T. ***Carthamus dentatus*** Vahl.
L115, 3381, T. ***Xeranthemum annuum*** L. L17, 2043, T. ***Echinops ritro*** L. L111, 3359, H. ***Echinops galaticus*** Freyn. L17, 2033, Euxine Element, H. ***Scolymus hispanicus*** L. L112, 3360, Medit Element, H. ***Cichorium intybus*** L. L9, 1853, H. ***Scorzonera tomentosa*** L. L108, 3308, Ir.-Tur. Element, Endemik, LR (Ic), H. ***Tragopogon longirostris*** Bich. ex Schultz var. ***abbreviatus*** Boiss. L57, 2340, H. ***Tragopogon coloratus*** C.A.Meyer L74, 2568, Ir.-Tur. Element, H. ***Tragopogon buphthalmoides*** (DC.) Boiss.var. **b*uphthalmoides*** L86, 2824, H. ***Leontodon hispidus*** L.var.***hispidus***
L72, 2516 ***Leontodon hispidus*** L.var. ***glabratus*** (W.Koch)Bisch, H. L109, 3330 ***Reichardia glauca*** Matthews. L101, 3195, Ir.Tur.Element, H. ***Pilosella hoppeana*** (Schultes) C.H. &F.W.Schultz subsp. ***pilisquama*** (NP.) Sell & West. L38, 2209/A, H. ***Pilosella hoppeana*** (Schultes) C.H. &F.W.Schultz subsp. ***troica*** (Zahn) P.D.Sell & West. L38, 2209/B, H. ***Pilosella pilosolloides*** (Vill.) Sojak subsp. ***pilosolloides*** L15, 1998, H. ***Mulgedium tataricum*** (L.)DC. L95, 3136, H. ***Lactuca seriola*** L. L35, 2195, Euro-Sib. Element, H. ***Scariola viminea*** (L.) F.W.Schmidt. L115, 3391, H. ***Scariola orientalis*** (Boiss.) Sojak L108, 3307, Ir.-Tur. Element, H. ***Lapsana communis*** L. subsp. ***alpina*** (Boiss.& Bal.) Sel. L27, 2125, Euxine(mt.)Element, H. ***Lapsana communis*** L. subsp. ***intermedia*** (Bieb.) Hayek L27, 2122, H.
Taraxacum serotinum (Waldst & Kit.) Poiret. L15, 1973, H. ***Taraxacum scaturiginosum*** G.Hagl. L46, 2241, H. ***Taraxacum buttleri*** Van Soest. L35, 2194, H. ***Chondrilla juncea*** L.var. ***juncea*** L27, 2114, H. ***Crepis macropus*** Boiss.& Heldr. L113, 3369, Ir.-Tur. Element, Endemik, LR (Ic), H. ***Crepis pulchra*** L. L108, 3279, T. ***Crepis foetida*** L. subsp. ***foetida*** L49, 2288, T. ***Crepis foetida*** L. subsp. ***rhoeadifolia*** (Bieb.) Celak L9, 1850, T.

CAMPANULACEAE

177. *Campanula* L.

Campanula latifolia L. L95, 3137, Euro-Sib. Element, H. ***Campanula rapunculoides*** L. subsp. ***rapunculoides***
L91, 3023, Euro-Sib. Element, T. ***Campanula rapunculoides*** L. subsp. ***cardifolia*** (C.Koch) Damboldt. L102, 3212, H. ***Campanula glomerata*** L. subsp. ***hispida*** (Witasek)Hayek L102, 3223, Euro-Sib. Element, H. ***Campanula psilostachya*** Boiss.& Kotschy. L93, 3052, E.Medit Element, Endemik, LR (nt), H. ***Campanula olympica*** Boiss. L74, 2571, Euxine Element, H. ***Campanula rapunculus*** L. var. ***lambertiana*** (A.DC.) Boiss. L87, 2855, Euro-Sib. Element, H. ***Asyneuma amplexicaule*** (Willd.) Hand.-Mazz. subsp. ***amplexicaule*** var. ***amplexicaule*** L102, 3209, H. ***Asyneuma limonifolium*** (L.) Janchen subsp. ***limonifolium*** L103, 3228, H. ***Asyneuma limonifolium*** (L.) Janchen subsp. ***pestalozzae*** (Boiss.) Damboldt L102, 3224, Endemik, LR (Ic), H. ***Asyneuma rigidum*** (Willd.) Grossh. subsp. ***rigidum***
L81, 2733, Ir.-Tur. Element, H. ***Asyneuma virgatum*** (Labill.) Bornm. subsp. ***virgatum*** L10, 1891, H. ***Legousia falcata*** (Ten.) Fritsch. L88, 2520, Medit Element, T. ***Legousia speculum-veneris*** (L.) Chaix. L70, 2493,
Medit Element, T. ***Legousia pentagonia*** (L.) Thellung. L91, 2920, T.

PRIMULACEAE

Primula vulgaris Huds. subsp. ***vulgaris*** L47, 2252, Euro-Sib. Element, Ch. ***Androsace maxima*** L. L48, 2275, T.
Cyclamen coum Miler *var*. ***coum*** L76, 2643, G. ***Lysimachia verticillaris*** Sprengel. L85, 2820, Hyrcano-Euxine Element, H. ***Anagallis foemina*** Miller. L83, 2771, Medit Element, T.

OLEACEAE

Jasminium fruticans L. L108, 3283, Medit Element, Ph.

APOCYNACEAE

Vinca herbaceae Waldst. & Kit. L61, 2359, Ch.

ASCLEPIADACEAE

Vincetoxicum fuscatum(Hornem.) Reichb. subsp. ***boissieri*** (Kusn.) Browiez. L77, 2687, Ir.-Tur. Element, Endemik, LR (Ic), H.

CONVOLVULACEAE

Convolvulus aucheri Choisy. L66, 2435, E.Medit Element, H. ***Convolvulus cantabrica*** L. L83, 2757, Ch. ***Convolvulus lineatus*** L. L8, 1829, H. ***Convolvulus holosericeus*** Bieb. subsp. ***macrocalycinus*** Hausskn.& Bornm. L74, 2595, Ir.-Tur. Element, Endemik, LR (nt), H. ***Convolvulus assyricus*** Griseb. L1, 1755, Ir.-Tur. Element, Endemik, LR (Ic), Ch. ***Convolvulus cataonicus*** Boiss.& Hausskn. L81, 2715, Ir.-Tur. Element, Endemik, LR (Ic), Ch. ***Convolvulus arvensis*** L. L91, 2924, H.

CUSCUTACEAE

Cuscuta epithymum (L.) L. var. ***epithymum*** L102, 3225/B, Vp. ***Cuscuta approximata*** Babington var. ***approximata*** L69, 2480, Vp.

BORAGINACEAE

Heliotropium eurapaeum L. L9, 1856, T. ***Heliotropium suaveolens*** Bieb. L27, 2116, E.Medit Element?, T.
Lappula barbata (Bieb.) Gürke. L27, 2109, Ir.-Tur. Element, H. ***Lappula microcarpa*** (Ledeb.) Gürke & Prantl. L10, 1903, Ir.-Tur. Element, H. ***Lappula squarrosa*** (Retz.) Dumort. L83, 2751, H. ***Myosotis ramosissima*** Rochel ex Schultes subsp. ***ramosissima*** L68, 2463, T. ***Myosotis arvensis*** (L.) Hill. subsp.***arvensis*** L75, 2637, T. ***Myosotis alpestris*** F.W.Schmidt. L77, 2657, H. ***Myosotis litospermifolia***(Willd.)Hornem. L80 2692, H. ***Myosotis sicula*** Guss. L62, 2398, T. ***Paracaryum ancyritanum*** Boiss. L10, 1868, Ir.-Tur. Element, Endemik, LR (Ic), H. ***Paracaryum paphlagonicum*** (Bornm.) R.Mill L74, 2614, Ir.-Tur. Element, Endemik, LR (cd), H. ***Cynoglossom officinale*** L. L74, 2610, Euro-Sib. Element, H. ***Cynoglossom creticum*** Miller. L6, 1793, H. ***Cynoglossom montanum*** L. L1,1759, Euro-Sib. Element, H. ***Buglossoides arvensis*** (L.) Johnston L51, 2305, T. ***Neatostema apulum*** (L.) Johnston L47, 2261, Medit Element, T. ***Echium italicum*** L. L9, 1847, Medit Element?, H. ***Echium vulgare*** L. L16, 2008, Euro-Sib. Element, H. ***Echium plantagineum*** L. L72, 2521, Medit Element, T. ***Onosma sericeum*** Willd. L9, 1849, Ir.-Tur. Element, H.

Onosma isauricum Boiss & Heldr. L6, 1777, Ir.-Tur. Element, Endemik, LR (Ic), H. ***Onosma bracteusum*** Hausskn. & Bornm. L63, 2403, Ir.-Tur. Element, Endemik, LR (Ic), Ch. ***Onosma bourgaei*** Boiss. L56, 2326, Ir.-Tur. Element, H. ***Onosma alba roseum*** Fisch.& Mey. subsp. ***alba roseum*** var. ***alba roseum*** L7, 1817, Ir.-Tur. Element, H.
Onosma aucheranum DC. L6, 1778, E.Medit Element, H. ***Onosma roussaei*** DC. L75, 2629, Ir.-Tur. Element, H. ***Onosma armenum*** DC. L65, 2411, Endemik, LR (Ic), H. ***Cerinthe minor*** L. subsp. ***auriculata*** (Ten.) Domac.
L91, 2903, H. ***Anchusa leptophylla*** Roemer & Schultes subsp. ***leptophylla*** L59, 2346, H. ***Anchusa leptophylla*** Roemer & Schultes subsp. ***incana*** (Ledeb.) Chamb. L67, 2451, Ir.-Tur. Element, Endemik, LR (Ic),H. ***Anchusa azurea*** Miller var. ***azurea*** L57, 2336, H. ***Anchusa strigosa*** Labill. L82, 2740, H. ***Alkanna orientalis*** (L.) Boiss. var. ***orientalis*** L1, 1758, Ir.-Tur. Element, H.

SOLANACEAE

Atropa bellodona L. L16, 2005, Euro-Sib. Element, H. ***Hyocyamus niger*** L. L15, 1994, T.

SCROPHULARIACEAE

Verbascum ponticum (Boiss.) O.Kuntze. L30 2169, Euxine Element, Endemik, LR (cd), H. ***Verbascum oreophilum*** C.Koch. var. ***oreophilum*** L72, 2537, Ir.-Tur. Element, H. ***Verbascum macrocarpum*** Boiss. L75, 2627, Ir.-Tur.Element, H. ***Verbascum spectabile*** Bieb.var. ***spectabile*** L84, 2792, Euxine Element, H. ***Verbascum pyramidatum*** Bieb. L10, 1893, Hyrcano-Euxine Element, H. ***Verbascum georgicum*** Bentham. L84, 2793, Ir.-Tur. Element, H. ***Verbascum krauseanum*** Murb. L9, 1852, Ir.-Tur. Element, Endemik, LR (nt), H. ***Verbascum varians*** Freyn & Sint.var. ***varians*** L93, 3053, H. ***Verbascum lasianthum*** Boiss. ex Bentham L22, 2086, H. ***Verbascum songaricum*** Schrenk ex Fisch.& Mey. subsp. ***subdecurrens*** Hub.- Mor. L15, 2001, Ir.-Tur. Element, Endemik, LR (Ic), H. ***Verbascum cheiranthifolium*** Boiss. var. ***cherianthifolium*** L88, 2863, H. ***Verbascum cheiranthifolium*** Boiss. var. ***asperulum*** (Boiss.) Murb., L101,
3197, Endemik, LR (Ic), H. ***Scrophularia scopolii*** (Hoppe ex) Pers.var. ***scopolii*** L73, 2557, H. ***Scrophularia canina*** L. subsp. **b*icolor*** (Sm.) Greuter L67, 2456, E.Medit Element, H. ***Linaria genistifolia*** (L.) Miller subsp. ***genistifolia*** L136, 3480, H. ***Linaria genistifolia*** (L.) Miller subsp. ***linifolia*** (Boiss.) Davis L74, 2599, H. ***Linaria grandiflora*** Desf.
L17, 2015, Ir.-Tur. Element, H. ***Linaria corifolia*** Desf. L12, 1944, Ir.-Tur. Element, Endemik, LR (Ic), H. ***Digitalis ferruginea*** L. subsp. ***ferruginea*** L17, 2035, Euro-Sib. Element, H. ***Digitalis lamarckii*** Ivan. L83, 2779, Ir.-Tur. Element, Endemik, LR (Ic), H. ***Veronica verna*** L. L62, 2379, Euro-Sib. Element, T. ***Veronica polita*** Fries. L47, 2253, T. ***Veronica anagallis-aquatica*** L. L64, 2405, H. ***Veronica jacquinii*** Baumg L49, 2294, Euro-Sib. Element, H. ***Veronica multifida*** L. L6, 1802, Endemik, LR (Ic), H. ***Melampyrum arvense*** L.var.***arvense*** L3, 1764/B, Euro-Sib. Element, T. ***Parentucellia latifolia*** (L.) Caruel. subsp. ***latifolia*** L139, 3483, Medit Element, T. ***Pedicularis comosa*** L.var. ***sibthorpii*** (Boiss.) Boiss. L62, 2393, H. ***Pedicularis comosa*** L.var. ***acmodonta*** (Boiss.) Boiss. L3, 1764/A, H.

OROBANCHACEAE

Orobanche ramosa L. L91, 3022, Vp. ***Orobanche coelestis*** (Reuter) G. Beck. L10, 1889, Vp. ***Orobanche purpurea*** Jacq. L83, 2758, Vp. ***Orobanche grisebachii*** Reuter. L110, 3346, E. Medit Element, Vp. ***Orobanche minor*** Sm. L96, 3142, Vp. ***Orobanche lutea*** Baumg. L3, 1765, Vp.

GLOBULARIACEAE

Globularia trichosantha Fisch. & Mey. L62, 2400, H.

VERBENACEAE

Verbena officinalis L. L101, 3193, H.

LABIATAE

Ajuga orientalis L. L3, 1762, H. ***Ajuga chamaepitys*** (L.) Schreber subsp. ***chia*** (Schreber) Arcangeli var. ***chia*** L129, 3467, H. ***Teucrium orientale*** L.var. ***orientale*** L10, 1857, Ir.- Tur. Element, H. ***Teucrium orientale*** L.var. ***puberulens*** T.Ekim L82, 2747, Ir.-Tur. Element, H. ***Teucrium chamaedrys*** L. subsp. ***chamaedrys*** L9, 1834, Ch. ***Teucrium polium*** L. L91, 2884, H. ***Scutellaria salviifoliae*** (Boiss.) Edmondson. L96, 3115, Endemik, LR (Ic), H. ***Scutellaria orientalis*** L. subsp. ***pinnatifida*** Edmondson. L6, 1783, Ch. ***Phlomis pungens*** Willd.var. ***hirta***.Velen. L108, 3319, H.
Phlomis russeliana (Sims) Bentham. L95, 3130, Euxine (mt.) Element, Endemik, LR (Ic), H. ***Phlomis armeniaca*** Willd. L96, 3169, Ir.-Tur. Element, Endemik, LR (Ic), H. ***Lamium amplexicaule*** L. L6, 1801, Euro- Sib. Element, T.
Lamıum purpureum L.var. ***purpureum*** L7, 1807, T. ***Lamium album*** L. L7,1806, Euro- Sib. Element, H. ***Wiedemannia orientalis*** Fisch & Mey. L95, 3096, 3099, Ir.- Tur. Element, Endemik, LR (Ic), T. ***Marrubium vulgare*** L. L11, 1927, H. ***Marrubium parviflorum*** Fisch & Mey. subsp. ***parviflorum*** L10, 1899, Ir.- Tur. Element, H. ***Marrubium heterodon*** (Bentham) Boiss.& Bal. L22, 2085,2087, E.Medit. Element, Endemik, LR (Ic), H. ***Marrubium globosum*** Montbret & Aucher ex Bentham. subsp. ***globosum*** L83, 2769, 2772, Ir.- Tur. Element, Endemik, LR (Ic), Ch. ***Marrubium astracanicum*** Jacq. subsp. ***astracanicum*** L77, 2647, Ch. ***Sideritis montana*** L. subsp.***remota*** (d'Urv.) P.W. Ball ex Heywood. L10, 1908, E. Medit. Element, T. ***Sideritis amasiaca*** Bornm. L26, 2103, Endemik, LR (nt), H. ***Stachys huber-morathii*** Bhattachharjee L142, 3488, Endemik, VU, H. ***Stachys byzantina*** C.Koch. L10, 1863, Euro- Sib. Element, H. ***Stachys sylvatica*** L. L105, 3243, H. ***Stachys lavandulifolia*** Vahl.var. ***lavandulifolia*** L65, 2416, Ir.-Tur. Element, H. ***Stachys iberica*** Bieb. subsp. ***stenostachya*** (Boiss.) Rech. L10, 1858, Ir.- Tur. Element, H. ***Stachys annua*** (L.) L. subsp. ***annua*** *var*. ***annua*** L59, 2352, T. ***Stachys annua*** (L.) L. subsp. ***annua*** *var*. ***lycaonica*** Bhattacharjee. L9, 1843, Ir.- Tur. Element, T. ***Nepeta italica*** L. L11, 1929, H. ***Nepeta cataria*** L. L27, 2123, Euro- Sib. Element, H. ***Nepeta nuda*** L. subsp. ***albiflora*** (Boiss.) Gams. L7,1810, H. ***Prunella vulgaris*** L. L103, 3230, Euro- Sib. Element, H. ***Prunella laciniata*** (L.) L. L98, 3163, Euro-Sib. Element, H. ***Origanum vulgare*** L. subsp. ***hirtum*** (Link) Ietswaart. L103, 3232, E.Medit. Element, H. ***Origanum vulgare*** L. subsp.***viride*** (Boiss.) Hayek. L96, 3116, H. ***Origanum vulgare*** L. subsp. ***vulgare*** L101, 3192, Euro- Sib. Element, H. ***Satureja wiedemanniana*** (Lallem) Velen. L103, 3297, Endemik, LR (Ic), Ch. ***Clinopodium vulgare*** L. subsp. ***vulgare*** L94, 3081, H. ***Clinopodium vulgare*** L. subsp. ***arundanum*** (Boiss.) Nyman. L95, 3135, H. ***Clinopodium umbrosum*** (Bieb.) C.Koch. L17, 2013, H. ***Acinos rotundifolius*** Pers. L15, 1992, T. ***Thymus leucotrichus*** Hal.var. ***leucotrichus*** L10, 1871, E. Medit. Element, Ch. ***Thymus sipyleus*** Boiss. subsp. ***rosulans*** (Borbas) Jalas L10, 1870, Ch. ***Thymus leucostomus*** Hausskn. var. ***leucostomus*** L11, 1935, Ch. ***Thymus praecox*** Opiz subsp. ***skorpilii*** (Velen) Jalas var. ***skorpilii*** L83, 2760, Ch. ***Thymus longicaulis*** C.Presl subsp. ***longicaulis*** var. ***longicaulis*** L75, 2630, Ch. ***Mentha pulegium*** (Miller) DC. L19, 2063, H. ***Mentha longifolia*** (L.) Hudson subsp. ***typhoides*** (Briq) Harley. var. ***typhoides*** **L103**, 3400, H. ***Ziziphora capitata*** L. L10, 1907, Ir.- Tur. Element, T. ***Salvia tomentosa*** Miller. L95, 3092, H. ***Salvia syriaca*** L. L65, 2414, Ir.- Tur. Element, H. ***Salvia viridis*** L. L4,1768, Medit. Element, T. ***Salvia hypargeia*** Fisch &

Mey. L83, 2756, Ir.- Tur. Element, Endemik, LR (Ic), H. ***Salvia sclarea*** L. L74, 2602, H. ***Salvia aethiopis*** L. L71, 2511, H. ***Salvia glutinosa*** L. L82, 2744, Hyrcano – Euxine Element, H. ***Salvia virgata*** Jacq. L96, 3123, H. ***Salvia verticillata*** L. subsp. ***verticillata*** L9, 1837, Euro- Sib. Element, H. ***Salvia verticillata*** L. subsp. ***amasiaca*** (Freyn & Bornm.) Bornm. L10, 1874, Ir.- Tur. Element, H.

PLUMBAGINACEAE

Plumbago europara L. L115, 3396, Euro-Sib. Element, H. ***Acantholimon acerosum*** (Willd.) Boiss.var. ***acerosum*** L96, 3168, Ir.-Tur. Element, Ch. ***Acantholimon glamaceum***(Jaub.& Spach) Boiss. L24, 2098, Ir.- Tur. Element, Ch.
Acantholimon ulucinum (Willd. Ex Schultes) Boiss. subsp. ***lycaonicum*** (Boiss. & Heldr.) Bokhari & Edmondson L97, 3156, Ir.-Tur. Element?, Ch.

PLANTAGINACEAE

Plantago lanceolata L. L129, 3455, H.

THYMELAEACEAE

Daphne pontica L. L79, 2688, Euxine Element, Ch.

SANTALACEAE

Thesium arvense Horvatovszky. L134, 3471, Euro- Sib. Element, H.

LORANTHACEAE

Viscum album L. subsp. ***austriacum*** (Wiesb.) Vollman. L41, 2228, Vp.

ARISTOLOCHIACEAE

Aristolochia maurorum L. L127, 3449, Ir.–Tur. Element, H.

EUPHORBIACEAE

Euphorbia herniariifolia Willd.var. ***herniariifolia*** L60, 2358, H. ***Euphorbia herniariifolia*** Willd.var. ***glaberrima*** Hal. L56, 2331, H. ***Euphorbia myrsinites*** L. L45, 2237, H. ***Euphorbia rigida*** Bieb. L46, 2246, 2341, Medit Element, H. ***Euphorbia seguieriana*** Necker subsp. ***seguieriana*** L83, 2778, Euro–Sib. Element, H.

URTICACEAE

Urtica dioica L. L85, 2812, Euro–Sib. Element, H.

FAGACEAE

Fagus orientalis Lipsky. L15, 1997, Euro–Sib. Element, Ph. ***Quercus robur*** L. subsp. ***robur*** L91, 3006, Euro–Sib. Element, Ph. ***Quercus hartwissiana*** Steven. L91, 2968, Ph. ***Quercus macranthera*** Fisch. Et Mey. subsp. ***syspirensis*** (C.Koch.) Menitsky. L112, 3367, Ph. ***Quercus petraea*** (Mattuschka) Lieb. subsp.***petraea*** L111, 3352, Ph. ***Quercus petraea*** (Mattuschka) Lieb. subsp.***iberica*** (Steven ex Bieb.) Krassilin. L91, 2943, Ph. ***Quercus infectoria*** Oliver. subsp. ***boissieri*** (Reuter) O.Schwarz. L83, 2787, Ph. ***Quercus pubescens*** Willd. L102, 3225, Ph. ***Quercus virgilliana*** Ten. L28, 2152, Ph. ***Quercus cerris*** L. var. ***cerris*** L74, 2586, Ph.

CORYLACEAE

Carpinus betulus L. L85 2823, Euro–Sib. Element, Ph. ***Carpinus orientalis*** Miller. L111, 3351, Ph. ***Corylus avellana*** L.var. ***avellana*** L113, 3374, Euro–Sib. Element, Ph.

SALICACEAE

Salix alba L. L85, 2818, Euro–Sib. Element, Ph. ***Populus tremula*** L. L28, 2153, Euro–Sib. Element, Ph. ***Populus nigra*** L. subsp. ***nigra*** L77, 2650, Ph.

RUBIACEAE

Crucianella gilanica Trin. subsp. ***pontica*** (Ehrend.) Ehrend. L10, 1864, Euxine Element, H. ***Asperula involucrata*** Wahlenb. L15, 1987, Euxine Element, H. ***Asperula arvensis*** L. L49, 2295, Medit. Element, T. ***Galium verum*** L. subsp. ***glabrescens*** Ehrend. L102, 3225, Ir.–Tur. Element, H. ***Galium album*** Miller subsp. ***prusense*** (C.Koch)Ehrend. & Krendl L98, 3160, H. ***Galium fissurense*** Ehrend. & Schönb. L15, 1987, Euxine Element, Endemik, LR (Ic), H. ***Galium incanum*** Sm. subsp. ***incanum*** L94, 3072, E. Medit. Element, H. 596. ***Galium incanum*** Sm. subsp. ***elatius*** (Boiss.) Ehrend. L94, 3079, Ir.- Tur. Element, H. ***Galium spurium*** L. subsp. ***spurium*** L73, 2555, Euro–Sib. Element, T. ***Galium tricornutum*** Dandy L91, 2939, Medit. Element, T. ***Galium tenuissimum*** Bieb. subsp. ***trichophorum*** (Kar. & Kir.) Ehrend. L91, 2961, Ir.–Tur. Element, T. ***Callipeltis cucullaria*** (L.) Steven L74, 2606, Ir.–Tur. Element, T. ***Cruciata laevipes*** Opiz. L75, 2632, H. ***Cruciata taurica*** (Palas ex Willd.) Ehrend. L49, 2284, Ir.–Tur. Element, H.

ANGIOSPERMAE

MONOCOTYLEDONES

ARACEAE

Arum euxinum R.Mill. L79, 2686, Euxine Element, Endemik, LR (Ic), G.

LILIACEAE

Polygonatum orientale Desf. L87, 2852, Euxine Element?, G. ***Asphodelus aestivus*** Brot. L68, 2470, G. ***Allium paniculatum*** L. subsp.***paniculatum*** L103, 3281, Medit Element, G. ***Allium atroviolaceum*** Boiss. L72, 2515, G. ***Allium scorodoprasum*** L. subsp. ***rotundum*** (L.) Stearn. L74, 2569, Euro- Sib. Element, G. ***Allium scorodoprasum*** L. subsp.***jajlae*** (Vved.) Stearn L82, 2749, Euxine Element, G. ***Scilla bifolia*** L. L48, 2276, Medit. Element, G. ***Ornithogalum oligophyllum*** E.D.Clark L49, 2282, G. ***Ornitagalum platyphyllum*** Boiss. L83, 2781, Ir.–Tur. Element, G. ***Ornitagalum ortophyllum*** Ten. L77, 2672, G. ***Muscari armeniacum*** Leichtlin ex Baker.L62, 2384, G.
Muscari neglectum Guss. L46, 2251, G. ***Muscari bourgaei*** Baker L51, 2310, Medit (mt.) Element, Endemik, LR (Ic), G. ***Gagae granatellii*** (Parl.) Parl. L39, 2224, Medit Element, G. ***Gagae villosa*** (Bieb.)Duby var. ***villosa*** L47, 2255, Medit Element?, G. ***Colchicum falcifolium*** Stapf L40, 2226, Ir.–Tur. Element, G.

AMARYLLIDACEAE

Sternbergia colchiciflora Waldst.& Kit. L124, 3444, G.

IRIDACEAE

Iris kerneriana Ascherson & Sint.ex Baker. L72, 2544, Euro–Sib. Element, Endemik, LR (Ic), G. ***Crocus ancyrensis*** (Herbert) Maw. L40, Ir.-Tur. Element, Endemik, LR (Ic), G. ***Crocus speciosus*** Bieb. subsp. ***ilgazensis*** Mathew. L124, 3443, Euro-Sib. Element, Endemik, LR (nt), G. ***Gladiolus atroviolaceus*** Boiss. L69, 2490, Ir.–Tur. Element, G.

ORCHIDACEAE

Cephalanthera rubra (L.) L.C.M. Richard L103, 3401, G. ***Cephalanthera damasonium*** (Miller) Druce. L87, 2851, Euro–Sib. Element, G. ***Orchis tridentata*** Scop. L103, 3403, G. ***Orchis pallens*** L. L2, 1761, Euro–Sib. Element?, G. ***Dactylorhiza romana*** (Seb.) Soo. subsp. ***romana*** L130, 3458, Medit Element, G. ***Dactylorhiza saccifera***(Brong.) Soo. L103, 3402, E. Medit. Element, G. ***Dactylorhiza osmanica*** (KL) Soo.var. ***osmanica*** L58, 2342, Ir.–Tur. Element? Endemik, LR (Ic), G.

CYPERACEAE

Carex spicata Hudson. L86, 2500, 2844, Euro–Sib. Element, H. ***Carex divisa*** Hudson. L46, 2245, Euro–Sib. Element, H.

GRAMINEAE

Bracypodium sylvaticum (Hudson) P. Beauv. L81, 2710, H. ***Elymus repens*** (L.) Gould subsp. ***elongatiformis*** (Drobov) Melderis. L134, 3470, H. ***Aegilops triuncialis*** L. L67, 2445, T. ***Aegilops geniculata*** Roth. L67, 2453, Medit. Element, T. ***Hordeum murinum*** L. subsp. ***glaucum*** (Steudel) Tzvelev L67, 2444, T. ***Hordeum bulbosum*** L. L67, 2455, G. ***Taeniatherum caput-medusae*** (L.) Nevski subsp. ***crinitum*** (Schreb.) Melderis L133, 3474, T. ***Bromus tectorium*** L. L141, 3485, T. ***Bromus sterilis*** L. L67, 2454, T ***Bromus cappadocicus*** Boiss.& Bal. subsp. ***sclerophyllus*** (Boiss.) P.M.Smith. L83, 2761, Ir.–Tur. Element, Endemik, LR (Ic), H. ***Helictotrichon argaeum*** (Boiss.) Parsa. L7, 1820, Ir.-Tur. Element, Endemik, LR (Ic), H. ***Trisetum flavescens*** (L.) P. Beauv. L86, 2827, Euro–Sib. Element, H. ***Koeleria cristata*** (L.) Pers. L74, 2605, H. ***Calamagrostis epigejos*** (L.) Roth. L21, 2082, Euro–Sib. Element, H. ***Alopecurus aequalis*** Sobol. L77, 2662, T. ***Phleum exaratum*** Hochst.ex Griseb. subsp. ***exaratum*** L10, 1898, E. Medit. Element, T. ***Festuca jeanpertii*** (St.-Yves) F.Markgraf apud Hayek subsp. ***jeanpertii*** L129, 3466, H. ***Poa trivialis*** L. L72, 2525, H. ***Poa pratensis*** L. L65, 2417, H. ***Poa bulbosa*** L. L65, 2418, H. ***Eremopoa persica*** (Trin.) Roshev. L135, 3473, T. ***Dactylis glomerata*** L. subsp. ***hispanica*** (Roth) Nyman. L81, 2709, H. ***Briza media*** L. L134, 3472, H. ***Melica uniflora*** Retz. L87, 2853, Euro–Sib. Element, H. ***Melica ciliata*** L. subsp. ***ciliata*** L99, 3180, H. ***Stipa holosericea*** Trin. L133, 3463, H. ***Chrysopogon gryllus*** (L.) Trin. subsp. ***gryllus*** L133, 3465, H. ***Bothriochloa ischaemum*** (L.) Keng. L133, 3462, H.

4.Sonuçlar ve tartışma

4.1. Araştırma alanının florası ile ilgili bulgular

İnegöl Dağı'ndan 2005-2008 yılları arasında mart- kasım aylarında yaklaşık 1700 bitki örneği toplanarak teşhis edilmiştir. Teşhis çalışmaları sonucunda 71 familyaya ait 291 cins ve 661 tür ve tür altı taksona ulaşılmıştır. Bu taksonlardan 2 familyaya ait 2 cins ve bu cinslere ait 2 takson Pteridophyta şubesine aittir. Geriye kalan 69 familya, 289 cins ve 659 takson ise Spermatophyta şubesine aittir. Bunlardan 3 familya, 3 cins ve 7 takson Gymnospermae sınıfına, 66 familya, 286 cins ve 661, tür ve tür altı takson ise Angiospermae sınıfına aittir (Çizelge 5)

Çizelge 5. İnegöl Dağı bitkilerinin sınıflandırma kategorilerine göre dağılımı

	Pteridophyta	Spermatophyta			
		Gymnospermae	Angiospermae		
			Dicotyledones	Monocotyledones	TOPLAM
Familya	2	3	60	6	71
Cins	2	3	249	37	291
Tür ve türaltı takson	2	7	593	59	661

Araştırma alanında tespit edilen 661 tür ve türaltı taksondan; 103 tanesi (% 15.6) Avrupa-Sibirya, 99 tanesi (% 15.0) İran-Turan, 43tanesi de (% 6.5) Akdeniz floristik bölgesi elementidir. Geriye kalan 418 tanesi (% 63) ise birden fazla bölgeli ya da floristik bölgesi bilinmeyendir (Şekil 6)

Çizelge 6. İnegöl Dağı bitkilerinin floristik bölgelere göre dağılımı

Floristik Bölgeler	Takson Sayısı	%
Avrıpa-Sibirya	103	15,60
İran-Turan	99	15,60
Akdeniz	43	6,50
Birden Fazla Bölgeli	418	63,00

Araştırma alanındaki taksonların familyalara dağılımına göre en fazla takson içeren ilk 5 familya şu şekilde sıralanmaktadır. Compositae 87 (%13.2) takson, Leguminosae 69 (%10.4) takson, LABİATAE 60 (%9.1) takson, Cruciferae 41 (%6.2) takson, Boraginaceae 34 (%5.1) takson şeklindedir (Şekil 7).

Çizelge 7. Araştırma alanındaki taksonların familyalara ve cinslere dağılımı

Familya	Takson Sayısı	%	Cins	Takson Sayısı
Compositae	87	13,2	Astragalus	17
Leguminosae	69	10,4	Verbascum-Centaurea	12
Labiatae	60	9,1	Silene-Salvia	10
Cruciferae	41	6,2	Ranunculus-Quercus-Lathyrus-Trifolium	9
Boraginaceae	34	5,1	Creatagus-Onosma-Galium	8
Diğerleri	370	56		

Araştırma alanındaki tür ve türaltı taksonların cinslere dağılımına göre en fazla takson içeren cinsler şu şekilde sıralanmaktadır. Astragalus (17), Verbascum-Centaurea (12), Silene-Salvia (10), Ranunculus-Quercus-Lathyrus-Trifolium (9), Creatagus-Onosma-Galium (8) şeklindedir.

Araştırma alanında tespit edilen taksonların Raunkier hayat formlarına göre dağılımları şu şekildedir. Fanerofitler 59 (% 8.93), Kamefitler 61 (% 9.23), Hemikriptofitler 363 (% 54.94), Geofitler 34 (% 51.4), Terofitler 135 (% 20.40), Vasküler parazitler 9 (% 1.36) taksondan oluşmaktadır (Çizelge 8).

Çizelge 8. Araştırma alanında tespit edilen taksonların Raunkier hayat formlarına göre dağılımları

Hayat formları	Takson Sayısı	Yüzdesi (%)
Fanerofitler (Ph)	59	8,93
Kamefitler (Ch)	61	9,23
Hemikriptofitler (H)	363	54,94
Geofitler (G)	34	5,14
Terofitler (T)	135	20,4
Vasküler par. (Vp)	9	1,36

Araştırma alanında bulunan bitkilerden 77 (% 11.65) tanesi endemiktir. Endemik bitkilerin "Türkiye Bitkilerinin Kırmızı Kitabı 2000"'e göre tehlike kategorileri belirlenmiştir. Buna göre taksonlardan, 3'ü zarar görebilir (VU), 2 si koruma önlemi gerektiren (cd), 9'u tehdit altına girebilir (nt), 62' si en az endişe verici (Ic), 1'i veri yetersiz (DD) katagorisindedir (Çizelge 9)

Raunkier hayat formlarına göre İnegöl Dağı endemik bitkilerinin; % 1,3' ü Fanerofit (Ph), 18.2'si Kamefit (Ch), 68.8'i Hemikriptofit (H), 7.8'i Geofit (G), 3.9'u Terofit (T) dir.

Endemik bitkilerin floristik bölgelere göre % olarak dağılımları ise şu şekildedir. İran-Turan % 49.4, Avrupa-Sibirya % 13.0, Akdeniz % 1.3, Floristik bölgesi bilinmeyenler ise % 36.3 tür.

Çizelge 9. Endemik bitkilerin IUCN Red Data Book kategorilerine göre gruplandırılması

TEHLİKE KATEGORİLERİ	Takson Sayısı	Yüzdesi
EX-Tükenmiş	-	-
EW-Doğada tükenmiş	-	-
CR-Çok tehlikede	-	-
EN-Tehlikede	-	-
VU-Zarar görebilir	3	3,9
LR-Az Tehdit Altında		
a-(cd) Koruma Önlemi Gerektiren	2	2,6
b-(nt) Tehdit Altına Girebilir	9	11.7
c-(Ic) En Az Endişe Verici	62	80.5
DD-Veri Yetersiz	1	1,3
NE-Değerlendirilemeyen	-	-
TOPLAM	77	100

4.2 Araştırma alanındaki bulguların yakın bölgelerde yapılan bazı çalışmalarla karşılaştırılması

Araştırma alanına yakın bölgelerde yapılmış olan 9 farklı floristik çalışma ile İnegöl Dağ'ında elde ettiğimiz bulgular farklı açılardan karşılaştırılmıştır.

Bulgular çizelgeler şeklinde verilmiştir. Buna göre yapılan çalışmalarda en fazla familya içeren çalışma 96 familya ile Akdağ çalışmasıdır. Bunu sırası ile Kuşpınar tepe 86, Kıbrıs köyü 81, Tavşan dağı 77, Vermiş-Yuvacık Köyleri ve Amasya Kalesi Arası 75, Aşağı Tersakan Vadisi 74, İnegöl dağı 71, Eğerli dağı 70, Hacıkadın vadisi 63, Amasya-Yozgat-Çorum Arası 61, Direkli-Yassıçal-Abacı Arası 56, Çakır dağı 36 familya ile izlemektedir (Çizelge 4.2.1).

Cins sayısı bakımından 424 cins ile yine Akdağ çalışması en fazla cinse sahiptir. Bunu sırası ile Kıbrıs köyü 343, Kuşpınar tepe 313, Tavşan dağı 307, Aşağı Tersakan Vadisi 301, Eğerli dağı 298, Amasya-Yozgat-Çorum Arası 296, İnegöl dağı 291, Vermiş-Yuvacık Köyleri ve Amasya Kalesi Arası 287, Hacıkadın vadisi 258, Direkli-Yassıçal-Abacı Arası 221, Çakır dağı 131 izlemektedir (Çizelge 10).

Çizelge 10. Araştırma alanı ve yakın bölgelerde yapılan floristik araştırmalarda toplam; familya, cins, tür ve türaltı takson sayıları

No	Araştırma Adı	Familya Sayısı	Cins Sayısı	Tür ve türaltı takson Sayısı
1	**İnegöl dağı (Yıldırım ve Kılınç 2009)**	**71**	**291**	**661**
2	Akdağ (Alpınar 1979a)	96	424	887
3	Kuşpınar tepe (Peker 1988)	86	313	488
4	Amasya-Yozgat-Çorum Arası (Ketenoğlu ve ark. 1994)	61	296	536
5	Vermiş-Yuvacık Köyleri ve Amasya Kalesi Arası (Cansaran ve Aydoğdu 1998)	75	287	420
6	Eğerli dağı (Cansaran 2002)	70	298	650
7	Tavşan dağı (Korkmaz ve ark.2005)	77	307	594
8	Aşağı Tersakan Vadisi (Celep ve ark.2006)	74	301	457
9	Çakır dağı (Yücel 2005)	36	131	195
10	Direkli-Yassıçal-Abacı Arası (Cansaran ve ark.2007a)	56	221	379
11	Hacıkadın vadisi (Yeşilyurt ve ark.2008)	63	258	480
12	Kıbrıs köyü (Aslan ve Vural 2009)	81	343	628

Tür ve tür altı takson sayısı bakımından incelendiğinde ise Akdağ 887 takson içermektedir. Bunu sırası ile İnegöl dağı 661, Eğerli dağı 650, Kıbrıs köyü 628, Tavşan dağı 594, Amasya-Yozgat-Çorum Arası 536, Kuşpınar tepe 488,Hacıkadın vadisi 480, Aşağı Tersakan Vadisi 457, Vermiş-Yuvacık Köyleri ve Amasya Kalesi Arası 420, Direkli-Yassıçal-Abacı Arası 379 ve Çakır dağı 195 taksonla izlemektedir (Şekil 11). Araştırma alanımıza en yakın bölge olan Eğerli dağı ile Tavşan dağının bulguları İnegöl dağından elde edilen bulgulara benzerlik göstermektedir.

Çizelge 11. Araştırma alanına yakın bölgelerde yapılan floristik araştırmalardaki taksonların fitocoğrafik bölgelere dağılımları

No	Araştırma Adı	Ir.- Tur.	Avr.- Si.	Akdeniz
1	**İnegöl dağı (Yıldırım ve Kılınç 2009)**	**99 (%15)**	**103 (%15.6)**	**43 (%6.5)**
2	Akdağ (Alpınar 1979a)	-	-	-
3	Kuşpınar tepe (Peker 1988)	43 (%8.98)	51 (%10.64)	45 (%9.39)
4	Amasya-Yozgat-Çorum Arası (Ketenoğlu ve ark. 1994)	100 (%18.65)	71 (%13.25)	41 (%7.65)
5	Vermiş-Yuvacık Köyleri ve Amasya Kalesi Arası (Cansaran ve Aydoğdu 1998)	70 (%15.71)	31 (%7.38)	40 (%9.52)
6	Eğerli dağı (Cansaran 2002)	102 (%15.69)	97 (%14.92)	46 (%7.07)
7	Tavşan dağı (Korkmaz ve ark.2005)	71 (%11.95)	141 (%23.73)	30 (%5.04)
8	Aşağı Tersakan Vadisi (Celep ve ark.2006)	77 (%16.8)	39 (%8.5)	35 (%7.6)
9	Çakır dağı (Yücel 2005)	23 (%11.79)	12 (%6.15)	10 (%5.12)
10	Direkli-Yassıçal-Abacı Arası (Cansaran ve ark.2007a)	51 (%13.4)	45 (%11.8)	35 (%9.2)
11	Hacıkadın vadisi (Yeşilyurt ve ark.2008)	89 (%18,5)	45 (%9,3)	43 (%8,9)
12	Kıbrıs köyü (Aslan ve Vural 2009)	124 (%19,74)	66 (10,5)	51(%8,12)

Fitocoğrafik dağılımlar incelendiğinde araştırma alanındaki taksonların dağılımı; Avrupa-Sibirya elementlerinin (% 15.6), Ir.-Tur. bölgesi elementlerin (% 15), Akdeniz elementlerinin ise (% 6.5) olduğu görülmektedir. Avrupa-Sibirya ve İran-Turan elementlerinin bulunuş yüzdelerinin birbirine çok yakın olması araştırma alanının bu iki bölge arasında geçiş bölgesi olmasından kaynaklanmaktadır.

Benzer durum farklı araştırmacılar tarafından yapılan Kuşpınar tepe'nin florası, Eğerli dağının florası, Direkli-Yassıçal-Abacı Arası'nın florası çalışmalarında da görülmektedir. Bunların dışında Karadeniz'in sahil kesimlerine daha yakın olan Tavşan dağında Avrupa-Sibirya elementlerinin bulunma yüzdesi diğer bölgelerin elementlerine göre çok daha yüksektir. Daha iç kesimlerde kalan Çakır dağı, Kıbrıs köyü, Hacıkadın vadisi, Aşağı Tersakan Vadisi, Vermiş-Yuvacık Köyleri ve Amasya Kalesi Arası, Amasya-Yozgat-Çorum Arası çalışmalarında ise İran-Turan Bölge elementlerinin % oranları yüksektir.

Araştırma alanının endemizm yüzdesi 11.65'tir. Diğer araştırmalara bakıldığında % 6.89'luk değer ile en düşük endemizm yüzdesi ile Kuşpınar tepe'de yapılan çalışma görülmektedir. En yüksek endemizm yüzdesi ise 12.30 değeri ile Eğerli dağında yapılan çalışmada tespit edilmiştir. Diğer araştırmaların yüzdesi ise; Akdağ 7.0, Amasya-Yozgat-Çorum Arası 7.09, Vermiş-Yuvacık Köyleri ve Amasya Kalesi Arası 11.0, Tavşan dağı 10.94, Kıbrıs köyü 10,67, Hacıkadın vadisi 9,3, Aşağı Tersakan Vadisi 10.94, Çakır dağı 9.23, Direkli-Yassıçal-Abacı Arası 11.6 şeklindedir (Çizelge 12).

Çizelge 12. Araştırma alanına yakın bölgelerde yapılan floristik araştırmalardaki endemik taksonların dağılımları

No	Araştırma Adı	Sayı	%
1	**İnegöl dağı (Yıldırım ve Kılınç 2009)**	**77**	**11,65**
2	Akdağ (Alpınar 1979a)	62	7,0
3	Kuşpınar tepe (Peker 1988)	33	6,89
4	Amasya-Yozgat-Çorum Arası (Ketenoğlu ve ark. 1994)	38	7,09
5	Vermiş-Yuvacık Köyleri ve Amasya Kalesi Arası (Cansaran ve Aydoğdu 1998)	46	11,0
6	Eğerli dağı (Cansaran 2002)	80	12,30
7	Tavşan dağı(Korkmaz ve ark.2005)	65	10,94
8	Aşağı Tersakan Vadisi (Celep ve ark.2006)	50	10,94
9	Çakır dağı (Yücel 2005)	18	9,23
10	Direkli-Yassıçal-Abacı Arası (Cansaran ve ark.2007a)	44	11,6
11	Hacıkadın vadisi (Yeşilyurt ve ark.2008)	45	9,3
12	Kıbrıs köyü (Aslan ve Vural 2009)	67	10,67

Araştırma alanında tesbit edilen taksonların familyalara dağılımına bakıldığında ilk üç familya sırası ile *Compositae*: 84 (%13,4), *Leguminosae*: 66 (%10,5), *Labiatae*: 58 (%9,3) şeklinde sıralanmaktadır. Diğer çalışmalardan Kuşpınar tepe (Peker 1988), Tavşan dağı (Korkmaz ve ark.2005), Aşağı Tersakan Vadisi (Celep ve ark.2006), Çakır dağı (Yücel 2005), Direkli-Yassıçal-Abacı Arası (Cansaran ve ark.2007a) çalışmalarıda ilk üç familyanın sıralanışı ile İnegöl dağının bulgularına benzerlik göstermektedir. Bu aynı zamanda Türkiye Florası (Davis 1965-1988) bulgularınada benzerdir. Diğer çalışmalarda ise ilk üç familya; Amasya-Yozgat-Çorum Arası (Ketenoğlu ve ark. 1994); *Leguminosae*: 85 (% 15.85), *Compositae*: 82 (% 15.29), *Poaceae*: 39 (% 7.27), Vermiş-Yuvacık Köyleri ve Amasya Kalesi Arası (Cans. ve Aydoğdu 1998); *Compositae*: 46 (% 11.1), *Labiatae*: 38 (% 9.2), *Leguminosae*: 33 (% 8.0), Eğerli dağı (Cansaran 2002); *Compositae*: 78 (% 12.6), *Leguminosae*: 77 (% 12.4), *Poaceae*: 42 (% 6.7), Hacıkadın vadisi (Yeşilyurt ve ark.2008); *Compositae:55 (%11,4),Leguminosae: 49 (%10.2),Labiatae: 38 (%7,9),* Kıbrıs köyü (Aslan ve Vural 2009); *Compositae: 87 (% 13,85),Leguminosae: 53 (% 8,44),Poaceae: 47 (% 7,48)* şeklindedir (Çizelge 12).

Araştırma alanında en fazla tür içeren ilk üç cins sırası ile; *Astragalus* (17), *Verbascum* (12), *Centaurea* (12) dir. Diğer araştırmalarda ise bu sıralama ve cinslerin içerdiği tür sayıları şu şekildedir.

Kuşpınar tepe (Peker 1988); *Astragalus* (10), *Vicia-Trifolium-Ranunculus* (7), *Geranium-Alyssum* (6), Amasya-Yozgat-Çorum Arası (Ketenoğlu ve ark. 1994); *Astragalus* (29), *Trifolium* (12), *Silene-Lathyrus* (7), Vermiş-Yuvacık Köyleri ve Amasya Kalesi Arası (Cansaran ve Aydoğdu 1998); *Astragalus* (10), *Salvia* (9), *Convolvulus–Euphorbia-Silene–Verbascum* (5), Eğerli dağı (Cansaran 2002); *Astragalus* (23), *Silene–Lathyrus* (10), *Trifolium–Galium–Onosma–Salvia* (8), Tavşan dağı (Korkmaz ve ark.2005); *Veronica* (13), *Salvia–Alyssum* (11), *Centaurea* (10), Aşağı Tersakan Vadisi (Celep ve ark.2006); *Astragalus-Alyssum* (7), *Vicia-Salvia* (6), *Centaurea* (5), Çakır dağı (Yücel 2005); *Astragalus-Centaurea* (6), *Ornithogalum-Onobrychis* (4), *Dianthus* (3), Direkli-Yassıçal-Abacı Arası (Cansaran ve ark.2007a), *Astragalus-Silene* (8), C*entaurea* (7), *Lathyrus* (6), Hacıkadın vadisi (Yeşilyurt ve ark.2008), *Trifolium(10),* Alyssum (9), Ranunculus (8), Kıbrıs köyü (Aslan ve Vural 2009), Salvia (11), Astragalus (9), Silene (8) şeklindedir (Çizelge 13).

Çizelge 13. En büyük ilk 3 familya ve ilk 3 cinse göre araştırma alanına yakın bölgelerde yapılan floristik çalışmaların karşılaştırılması

Araştırma Alanı	**En büyük 3 familya (tür sayısı / tür yüzdesi)**	**En büyük 3 cins (tür sayısı)**
İnegöl dağı (Yıldırım ve Kılınç 2009)	***Compositae*:84 (%13.4)** ***Leguminosae*: 66 (%10.5)** ***Labiatae*: 58 (%9.3)**	****Astragalus* (17)** ****Verbascum* (12)** ****Centaurea* (12)**
Akdağ (Alpınar 1979a)	-	-
Kuşpınar tepe (Peker 1988)	*Compositae*: 58 (% 12.1) *Leguminosae*: 54 (% 11.3) *Labiatae*: 33 (% 6.9)	* *Astragalus* (10) **Vicia-Trifolium-Ranunculus* (7) **Geranium-Alyssum* (6)
Amasya-Yozgat-Çorum Arası (Ketenoğlu ve ark. 1994)	*Leguminosae*: 85 (%15.85) *Compositae*: 82 (%15.29) *Poaceae*: 39 (%7.27)	* *Astragalus* (29) * *Trifolium* (12) **Silene-Lathyrus* (7)
Vermiş-Yuvacık Köyleri ve Amasya Kalesi Arası (Cans. ve Aydoğdu 1998)	*Compositae*: 46 (% 11.1) *Labiatae*: 38 (% 9.2) *Leguminosae*: 33 (% 8.0)	**Astragalus* (10) **Salvia* (9) **Convolvulus.–Euphorbia- Silene–Verbascum* (5)
Eğerli dağı (Cansaran 2002)	*Compositae*: 78 (%12.6) *Leguminosae*: 77 (% 12.4) *Poaceae:* 42 (% 6.7)	**Astragalus* (23) **Silene–Lathyrus* (10) **Trifolium–Galium–Onosma- Salvia* (8)
Tavşan dağı (Korkmaz ve ark.2005)	*Compositae*: 78 (% 12.9) *Leguminosae* : 56 (% 9.2) *Labiatae*: 53 (% 8.8)	**Veronica* (13) **Salvia–Alyssum* (11) **Centaurea* (10)
Aşağı Tersakan Vadisi (Celep ve ark.2006)	*Compositae*: 56 (% 12.2) *Leguminosae*: 42 (% 9.2) *Labiatae*: 35 (% 7.6)	* *Astragalus-Alyssum* (7) * *Vicia-Salvia* (6) * *Centaurea* (5)
Çakır dağı (Yücel 2005)	*Compositae*: 33 (%16.92) *Leguminosae*: 27 (%13.84) *Labiatae*: 17 (% 8.71)	**Astragalus-Centaurea* (6) **Ornithogalum-Onobrychis* (4) * *Dianthus* (3)
Direkli-Yassıçal-Abacı Arası (Cansaran ve ark.2007a)	*Compositae*: 47 (% 12.6) *Leguminosae*: 38 (% 10.2) *Labiatae*: 36 (% 9.7)	**Astragalus-Silene* (8) **Centaurea* (7) * *Lathyrus* (6)
Hacıkadın vadisi (Yeşilyurt ve ark.2008)	*Compositae:*55 (% 11,4) *Leguminosae:* 49 (% 10.2) *Labiatae:* 38 (%7,9)	* *Trifolium(10)* * Alyssum (9) * Ranunculus (8)
Kıbrıs köyü (Aslan ve Vural 2009)	*Compositae:* 87 (% 13,85) *Leguminosae:* 53 (% 8,44) *Poaceae:* 47 (% 7,48)	* Salvia (11) * Astragalus (9) * Silene (8)

Teşekkür

Bu araştırma 2006–2009 yılları arasında Ondokuz Mayıs Üniversitesi Bilimsel Araştırmalar Fonunun (F419 nolu Proje) desteği ile gerçekleştirilmiştir. Desteklerinden dolayı Ondokuz Mayıs Üniversitesi Bilimsel Araştırmalar Fonuna teşekkür ederiz.

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A new record for the Flora of Turkey: *Anchusa aegyptiaca* (L) A. DC. (Boraginaceae)

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Abstract

Anchusa aegyptiaca (L) DC., was collected during a field trip to the around Cennet-Cehennem (Silifke, Mersin province) caverns. It is reported for the first known locality of *A. aegyptiaca* for the Flora of Turkey.

Key words: *Anchusa*, Boraginaceae, New record, Turkey

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Türkiye Florası için yeni bir kayıt*: Anchusa aegyptiaca* (L) DC. (Boraginaceae)

Özet

Anchusa aegyptiaca (L) DC., Cennet-Cehennem (Silifke, Mersin) mağaraları civarına düzenlenen arazi çalışması esnasında toplandı. Bu lokalite Türkiye florası için *A. aegyptiaca*' nın bilinen ilk lokalitesi olarak kaydedildi.

Anahtar kelimeler: *Anchusa*, Boraginaceae, Yeni kayıt, Türkiye

1. Introduction

Anchusa L. is one of the major genera of the tribe Boragineae, a group of 15 genera and *c* . 170 taxa native to the temperate and subtropical areas of the Old World. It is morphologically characterized by bracteate cymes, hypocrateriform corollas with a long tube, spreading limb and faucal scales at the throat, and by strophiolate mericarpids with ventral attachment to a planar gynobase. When delimited in a narrow sense, it includes 27–30 species mainly distributed in the Mediterranean basin and Middle East with only three disjunct members, one in the Ethiopian-West Arabian highlands (*A. affinis* R.Br.) and two in South Africa (*A. capensis* Thunb. and *A. riparia* DC.) (Selvi & Bigazzi, 2003).

The Genus *Anchusa* in Turkey was revised by D.F. Chamberlain (1978) in *Flora of Turkey and the East Aegean Islands*, volume 6, in which he recognized 15 species, and 1 doubtful species. He mentioned that the *A. aegyptiaca* only found the *Khalki, Rodhos and Salakos* islands. *Anchusa barrelieri* (All.) Vitman var. *orientalis* Guşul. was reduced to synonymy under *Cynoglottis chetikiana* Vural & Kit Tan subsp. *paphlagonica* (Hausskn. ex Bornm.) Vural & Kit Tan (Vural & Tan, 1988). So, total number of *Anchusa* species was reduced 14.

2. Materials and methods

In late Spring 2009, during a botanical trip to the Cennet-Cehennem (Silifke, Mersin provinces), the authors collected interesting flowering and fruiting specimens of *Anchusa*. These specimens were identified as *A. aegyptiaca* (L) DC. according to Flora of Turkey and the East Aegean Islands (Chamberlain, 1979), Flora Europaea (Chater, 1972), Flora Hellenica (Strid,Tan eds., 1997), Flora Aegea (Rechinger, 1943), Flora of Syria, Palestine and Sinai (Post, 1932), Student's Flora of Egypt (Tackholm, 1974), Conspectus Florae Graecae (de Halácsy, 1902), Flora Iranica (Riedl, 1967),

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Flora SSSR (Popov, 1953), Prodromus Florea Peninsulae Balcanicae (Hayek, 1927) and Revision of genus *Anchusa* (Boraginaceae-Boragineae) in Greece (Selvi & Bigazzi, 2003).

As a result of this new record of *A. aegyptiaca*, the total number of *Anchusa* species in Turkey increased to 15.

3. Results and discussion

A. aegyptiaca (L) DC., Prodr. 10: 48 1(846) (Figure 1, 2)

Syn.: *Lycopsis aegyptiaca* L., *Sp. Pl.* 138 (1753).
Asperugo aegyptiaca L., *Sp. Pl.* ed. 2: 198 (1763).
Anchusa flava Forssk., *Fl. Aegypt.-Arab*. 40 (1775).
Anchusa verrucosa Lam., Encycl. 1:504 (1783).

Annual herbs. Indumentum hispid-strigose with dense, short, hairs and stout trichomes inserted on prominent basal tubercle of whitish colour. Stems 30–55 cm, decumbent to ascending, branched from the base. Lower cauline Leaves 28–63 × 10–19 mm, oblanceolate to oblong-ovate, obtuse, with denticulate or erose-dentate margins. Inflorescence with leafy cymes; pedicels 2–3 mm in flower, to 15 mm in fruit; bracts leaf-like, exceeding calyx. Calyx 4–5 mm in flower, 7–8 mm in fruit, divided almost to the base into linear-lanceolate lobes. Corolla sligtly zygomorphic, pale to cream yellow, with tube c. 4 mm, straight, slightly shorter than calyx; limb 4–6 mm in diameter, often slightly obliquous, subrotate, with 5 slightly unequal lobes; Stamens inserted in the lower half of the tube near the middle, two higher than the other three; style included. Faucal scales exserted, yellowish-white hairy and curved outwards. Nutlets 2–3 × 4–5 mm, with a sub-vertical, acute beak and a thick basal ring; coat surface strongly reticulate-rugose, yellowish-white . *Fl. 3–5 : Opening area between limestone rocks.*

Locality and Habitat: C5: Mersin, Silifke, around Cennet-Cehennem caverns, opening area between limestone rocks. N: 36º 26' 32", E: 034º 06' 46", 53 m, 16.04.2009, *H. Yıldırım* 1534 (EGE).

Figure 1. *A. aegyptiaca* A) habit and habitat, B) flower

A. aegyptiaca is distribution on the Egypt, Iran, Iraq, Syria, Palestine, Israel, Jordan, Tunisia, Saudi Arabia, Cyprus, Crete, western Aegean islands (Dokos, Salamis), eastern Aegean Islands (Rodhos, Kassos, Karpathos, Khalki, Tilos), Cyclades (Astipalea, Sifnos, Thira).

No clear locality was given in Med-checklist Vol. 1 (Greuter *et al*., 1984) though it was indicated Asiatic Turkey (An) a distribution area of *A. aegyptiaca*. Although Flora of Turkey Vol. 10 (Davis *et al*., 1988) , Flora of Turkey Vol. 11(Güner *et al*., 2000) and Check-List of Additional Taxa to the Supplement Flora of Turkey I-II-III-IV (Özhatay *et al*., 1994, 1996, 2004, 2009) were published after Med-checklist Vol. 1 (Greuter *et al*., 1984), no data about *A. aegyptiaca* distribution in Turkey was found in these references.

A. aegyptiaca was not previously recorded in Turkey up to date. It was found in a narrow area at around Cennet-Cehennem **(**Korykos, Korykion-Antron) caverns by us. Finally, this locality is first known locality of *A. aegyptiaca* for Flora of Turkey.

A. aegyptiaca is clearly different from other *Anchusa* species. It can be easily distinguished from other *Anchusa* species by the following features. Indumentum stout trichomes inserted on prominent basal tubercle, Corolla pale to cream yellow. Nutlets sub-vertical and acute beak, calyx divided almost to the base.

Figure 2. *A. aegyptiaca* A) habit, B) flower, C) nutlet D) indumentum of leaves

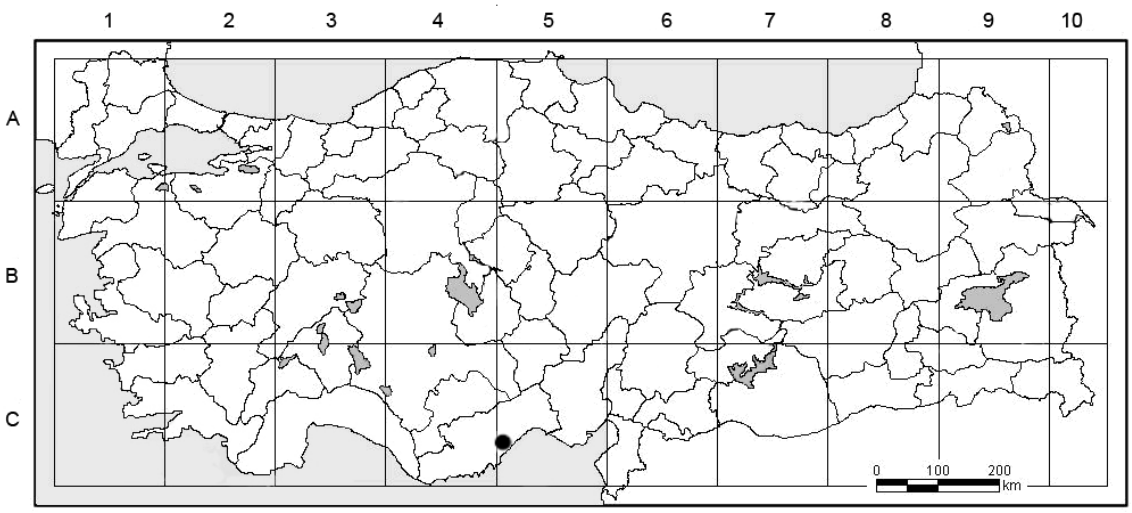

Figure 3. Distribution map of A. *aegyptiaca* (●) in Turkey

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The Bryophyte Flora of Babadağ (Denizli/Turkey)

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Abstract

The bryophyte flora of Babadağ (Denizli), a floristically important mountain of Western Anatolia with a high number of endemic flowering plant taxa, was investigated between 2003 and 2006. After the identification of approximately 2500 bryophyte taxa collected from the research area, total 213 moss taxa belonging to 24 families and 78 genera, 24 liverwort taxa belonging to 17 families and 19 genera and one hornwort species are reported from the study area. Twenty-five moss taxa and one liverwort species are reported for the first time from C11 qrid-square in the system adopted by Henderson (1961).

Key words: Bryophyte, Babadag Flora, Bryogeography, West Anatolia, Turkey.

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Yarı kurak bölgelerde bozuk ekosistemlerin yeniden kazınılmasında uygun fidan, ağaç tipi ve dikim mevsiminin belirlenmesi

Özet

Bu çalışmada, çok sayıda endemik çiçekli bitki taksonu içeren Batı Anadolu' nun önemli bir dağı olan, Babadağ' ın (Denizli) bryofit florası 2003 – 2006 yılları arasında araştırılmıştır. Çalışma alanından toplanan yaklaşık 2500 bryofit taksonun teşhisi sonucunda, toplam 24 familya, 78 cins'e ait 213 karayosunu taksonu, 17 familya, 19 cins'e ait 24 ciğerotu taksonu ve sadece 1 boynuzlu ciğerotu türünün alanda yayılış gösterdiği belirlenmiştir. Teşhis edilen bryofitler içinde ciğerotlarından 1, karayosunlarından ise 25 takson Henderson (1961) kareleme sistemine göre C11 karesi için yeni kayıt olarak bulunmuştur.

Anahtar kelimeler: Bryofitler, Babadağ Flora, Bryocoğrafya, Batı Anadolu, Türkiye

1. Introduction

Studies on the bryophyte flora of Turkey focused on the Black Sea region, the western and southern part of the country. To date, nearly thirty of them have been deal with the bryoflora of the West Anatolia in Turkey, e.g., Walther (1967, 1970, 1975, 1979), Walther and Leblebici (1969), Leblebici (1974), Çetin (1988), Yayıntaş and Iwatsuki (1988), Gökler and Öztürk (1991), Gökler (1992,1993 a,b), Çetin (1993), Tonguç and Yayıntaş (1996), Kürschner and Parolly (1999), Yayıntaş and Tonguç (2001), Özenoğlu (2001), Gökler (2001), Özenoğlu and Gökler (2002), Erdağ (2002), Kürschner (2004) and Özenoğlu et al. (2007). In spite of these investigations, important parts of the area are still bryologically poorly known such as the Aydın Mountains, major parts of the Menteşe Mountains and most of the mountain ranges around Denizli province (florulas of these mountains are in preparation by the authors).

There is still an obvious need to conduct further field work in the western part of Turkey in order to contribute to the knowledge of the Mediterranean bryophyte diversity.

This study aims to provide such a mosaic stone in giving an annotated species inventory from a highly diverse area.

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1.1 The study area

The study area is located between 37° 54´ N latitude, 28° 41´ E longitude and 37° 37´ N latitude, 29° 12´ E longitude. Although main parts of the study area is located in Denizli province, the small northwesten part extends to province Aydın (Figure 1).

The main summits of Babadağ are Babadağ (2300 m), Sarıbıçak Tepe (2220 m), Evran Tepe (2100 m), Akdağ (2200m), Karababa Tepesi (2100 m), Göktepe (1850 m) and Ortaca Tepe (1750 m). Steep valleys, mostly cut into the North side of the mountain, increase the habitat and climatic diversity of the area.

Although there are many streams during winter and early spring, only Yeşildere Stream, İsrail Stream (Seyme), Dandalaz Stream and Altındere (Gebere Stream) are permanently flowing during the long and dry summer period. With the exception of Dandalaz Stream, all are situated in the northern parts of Babadağ.

Maquis dominates the deforested areas at lower altitudes. *Pinus brutia* Ten. forms well developed forests all around the study area mostly N, E and NW slopes of the mountain between 250 and 1000 (1200) m. From 1200 – 1400 m on, it is replaced by *P. nigra* subsp. *caramanica* (Loudon) Rehder. Higher up, Juniper forests and thorn cushion communities are seen as mixed formations between 1400 - 1600 m. After this zone pure thorn–cushion vegetation prevails.

The main annual precipitation in the area is around 500 mm/y (464 mm/y in Babadağ County and 658 mm/y in Tavas County), reflecting the typically long summer drought from May to October. During the mild winter most of the annual precipitation falls (MGM, 2005).

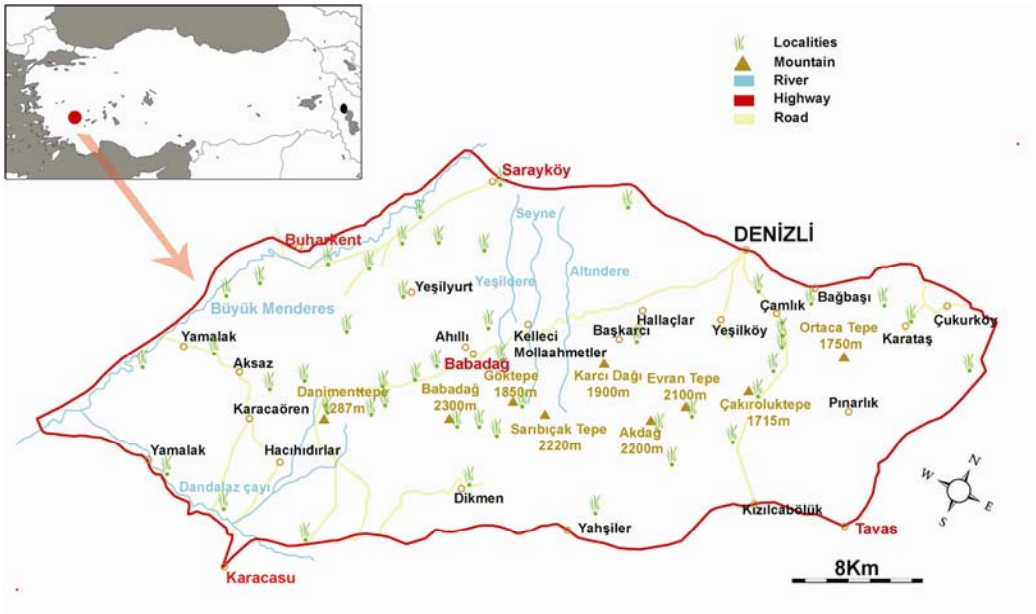

Figure 1. The map of study area

2. Materials and methods

The bryophyte flora of Babadağ (Denizli/Turkey), one of the important mountains of Western Turkey, has been investigated. Nearly 2500 bryophyte specimens were collected from 51 different localities in different seasons between 2003 and 2006 and identified with the relevant floras and monographs (Smith, 2004; Nyholm, 1981; Frahm and Frey, 1983; Crum and Anderson, 1981; Arnell, 1981; Paton, 1997; Zander, 1978, 1993; Heyn and Herrnstadt, 2004; Pedrotti, 2001; Nyholm, 1986; Cano et al. 1993; Cano et al. 2005; Greven, 1995; Muñoz, 1999; Hofmann, 1998; Jimenez et al., 2005 etc.).

Moss taxa are listed to generic level in adopting the taxonomy and nomenclature of the checklist of Hill et. al (2006), which in respects of higher taxonomical ranks is based on the system by Goffinet and Buck (2004). The treatment of hornworts and liverworts follows Grolle (1983). The recorded specific and subspecific taxa are listed alphabetically. For each taxon, only one collector number was given to avoid repetition in the floristic list but the same plants collected from different localities were indicated (loc. 1,2,3..). Asterisks indicate new records for square C11 (Henderson, 1961) (*) and records for bryoflora of Turkey (#). All specimens are deposited in AYDN (Herbarium of Adnan Menderes University, Aydın, Turkey).

Collection localities are presented in the following list with their coordinates (as far as available), altitudes and a brief site ecological note.
Collector and identifying author abbreviations used in the text and appendix are AERD. (Adnan ERDAĞ), MKIR. (Mesut KIRMACI), OZ. (Hatice ÖZENOĞLU)

2.1. List of Collection localities

1. **Başoluk –Yaylatepe (Babadağ),** N 37º 41´, E 28º 56´, Alt. 1600 m., *Pinus nigra* - *Juniperus* spp. mixed forest, 10 viii 2003.
2. **Akdağ summit**, N 37º 42´, E 028º 57´, Alt. 2100 m., pure thorn–cushion vegetation, 03 ix 2003.
3. **Gökbel (Babadağ) Mountain**, Alt. 1600 m., *Pinus nigra* forest, 03 ix 2003.
4. **Zeytin high plateu (upper part of Çamlık, Denizli),** Alt. 1300 m., *Pinus nigra* forest, 23 xi 2003.
5. **Çakıroluk Tepe (Denizli),** Alt. 1200 m., *Pinus nigra* forest, 23 xi 2003.
6. **Between Çamlık and Çakıroluk Tepe (Denizli),** N 37º 41´, E 29º 15´, Alt. 1200 m., near stream, *Platanus orientalis* L. dominates, 23 xi 2003.
7. **Upper part of Çamlık (Denizli),** N 37º 41´, E 29º 20´, Alt. 1100 m., steep valley, Maquis dominates, *Daphne* sp., *Pistacia* sp., *Juniperus sp*., 23 xi 2003.
8. **Köprü area (upper part of Çamlık, Denizli),** Alt. 1000 m., steep valley, *Juglans regia* L., 23 xi 2003.
9. **East of Babadağ summit,** N 37º 44´, E 29º 55´, Alt. 1850 m., *Pinus nigra* forest, 01 v 2004.
10. **Mollaahmetler village (Babadağ),** N 37º 46´, E 28º 56', Alt. 1400 m., *Pinus nigra* forest, 01 v 2004.
11. **Yeşilköy Valley, Şelale area (Denizli),** Alt. 600 m., according to high moisture, *Castenae sativa* Mill., *Styrax officinalis* L., *Arbutus unedo* L., *Ficus carica* L., *Juglans regia* L. and *Corylus avellana* L. constitute general vegetation, 04 vi 2004.
12. **Çakıroluk Tepe (Denizli),** N 37º 41´, E 29º 02´, Alt. 1600 m., *Juniperus* sp., *Pinus nigra* mixed forest, 04 vi 2004.
13. **Between Çamlık and Çakıroluk Tepe (Denizli),** N 37º 41´, E 29º 50´, Alt. 1250 m., *Pinus brutia* and *Pinus nigra* mixed forest, 04 vi 2004.
14. **Between Çamlık and Çakıroluk Tepe (10 km to Denizli),** N 37º 41´, E 29º 05´, Alt. 1000 m., *Pinus brutia* forest, 04 vi 2004.
15. **Between Çamlık and Çakıroluk Tepe (5 km to Denizli),** N 37º 42´, E 29º 04´, Alt. 800 m., *Pinus brutia* forest, 04 vi 2004.
16. **Between Yamalak Town and Aksaz village (Aydın),** Alt. 340 m., *Pinus brutia* forest and Maquis, 06 viii 2004.
17. **Between Aksaz village and Sarayköy (Aydın),** N 37º 51´, E 28º 44´, Alt. 900 m., *Pinus brutia* forest, 06 viii 2004.
18. **Kovanlı Mountain and Azılar Gediği (Aksaz / Aydın),** N 37º 51´, E 28º 43´, Alt. 990 m., *Quercus* spp. and *Pinus brutia* mixed forest, 06 viii 2004.
19. **Sarayköy - Yeşilyurt, Ketenlik Stream,** N 37º 50´, E 28º 45´, Alt. 850 m., along stream *Platanus orientalis* dominates, *Quercus coccifera* L., *Q. infectoria* ssp. *boisseri* (Reuter) O. Schwarz., *Cistus salvifolius* L. and *Styrax officinalis* are other plants, 07 viii 2004.
20. **Taşoluk (Babadağ),** N 37º 50´, E 28º 46´, Alt. 820 m., there are a lot of small streams, *Platanus orientalis* dominates, 07 viii 2004.
21. **Babadağ – Karacasu road; 30 km to Karacasu,** N 37º 50´, E 28º 47´, Alt. 800 m., *Pinus brutia* forest, 07 viii 2004.
22. **Taşdelen Tepe (Babadağ),** N 37º 48´, E 28º 46´, Alt. 1220 m., *Pinus nigra* forest, 07 viii 2004.
23. **Taşoluk Plateau (Babadağ),** N 37º 47´, E 28º 47´, Alt. 1340 m., *Pinus nigra* forest, 07 viii 2004.
24. **Dokuzçam area (Babadağ – Karacasu road; 17 km to Karacasu),** N 37º 48´, E 28º 45´, Alt. 1460 m., *Pinus nigra* forest, 07 viii 2004.
25. **Dikmen Village (Karacasu),** N 37º 43´, E 28º 49´, Alt. 1010 m., deforested area, destroyed maquis, 10 viii 2004.
26. **Dikmen Tepe (Karacasu),** N 37º 42´, E 028º 50´, Alt. 1400 m., *Quercus* spp. mixed forest, 10 viii 2004.
27. **Babadağ summit,** Alt. 2300 m., pure thorn–cushion vegetation, 10 viii 2004.
28. **Saçma Tepe (Karacasu),** Alt. 1800 m., *Pinus nigra*, *Juniperus excelsa* Bieb., *J. oxycedrus* L. and *J. foetidissima* Wild. mixed forest, 10 viii 2004.
29. **Dandalaz River (near Karacasu),** Alt. 450 m., along stream *Platanus orientalis* dominates, 11 viii 2004.
30. **Danişment-Göktepe (Babadağ),** N 37º 48´, E 028º 44´, Alt. 1250 m., *Pinus nigra* forest, 11 viii 2004.
31. **Taşdelen fountain,** N 37º 48´, E 028º 46´, Alt. 1350 m., *Pinus nigra* forest, 13 viii 2004.
32. **Taşoluk Plateau (Babadağ),** N 37º 47´, E 028º 47´, Alt.1200 m., *Pinus nigra* and *Pinus brutia* mixed forest, 13 viii 2004.
33. **Kızılcabölük – Evran Tepe,** N 37º 41´, E 029º 00´, Alt. 1550 m., *Pinus nigra* forest, 15 iv 2005.

34. **Between Yenice and Karacasu (Aydın),** N 37º 46´, E 028º 36´, Alt. 400 m., *Pinus brutia* forest and maquis (*Quercus coccifera, Cistus creticus* L., *Jasminium fruticans* L., *Cercis siliquastrum* L.), 21 v 2005.
35. **Denizli, Bağbaşı (Northwest of Babadağ),** N 37º 43´, E 029º 07´, Alt. 700 m., destroyed maquis, 07 vii 2005.
36. **Babadağ - Karataş forest office (Southeast of Babadağ),** N 37º 41´, E 029º 10´, Alt. 900 m., *Pinus brutia* forest, 08 vii 2005.
37. **East of Babadağ (Denizli-Tavas highway),** N 37º 42´, E 029º 12´, Alt. 720 m., *Pinus brutia* plantation, 08 vii 2005.
38. **Between Denizli-Aydın, Erenköy village (North of Babadağ),** N 37º 50´, E 029º 00´, Alt. 400 m., cultivated area, weak plant cover, 09 vii 2005.
39. **Between Denizli-Aydın, Hacı Eyüplü village (North of Babadağ),** N 37º 50´, E 029º 8´, Alt. 360 m., agriculture area, weak plant cover, 10 vii 2005.
40. **Denizli – Sarayköy (on Sarayköy - Babadağ highway),** N 37º 54´, E 028º 54´, Alt. 160 m., agriculture area, 10 vii 2005.
41. **Between Sarayköy and Babadağ (9 km to Babadağ),** N 37º 50´, E 028º 53´, Alt. 320 m., *Pinus brutia* forest, 12 vii 2005.
42. **Babadağ District, Kos Stream,** Alt. 1000 m., *Pinus brutia* forest, along stream *Platanus orientalis* dominated, 12 vii 2005.
43. **Between Babadağ and Sarayköy (10 km to Sarayköy),** N 37º 50´, E 028º 52´, Alt. 330 m., *Pinus brutia* forest and maquis, 12 vii 2005.
44. **Denizli-Aydın highway (50 km to Aydın),** N 37º 57´, E 028º 47´, Alt. 160 m., agriculture area, 12 vii 2005.
45. **Babadağ District, Darıyeri locality,** Alt. 1900 m., upper part of tree zone (Pure thorn–cushion vegetation), 20 iii 2006.
46. **Denizli – Babadağ – Karacasu highway, west of Babadağ, between Başaran and Yenice Village,** Alt. 200 m., agriculture area and *Olea europaea* L. Plantation, 23 iii 2006.
47. **Aydın, Aksaz Village,** N 37º 55´, E 028º 39´, Alt. 120 m., agriculture area, 30 iv 2006.
48. **Aydın, field of Gencelli Village,** Alt. 120 m., agricultural area, 30 iv 2006.
49. **Denizli – Babadağ cross road,** N 37º 54´, E 028º 56´, Alt 180 m., agriculture area, 30 iv 2006.
50. **Denizli, Çamlık,** Alt. 450 m., *Pinus brutia* forest, 30 iv 2006.
51. **Between Aydın and Buharkent,** N 37º 57´, E 028º 43´, Alt.140 m., agriculture area, 30 iv 2006.

3. Results and discussion

3.1 Floristic Inventory

ANTHOCEROTOPHYTA
ANTHOCEROTACEAE
Phaeoceros laevis (L.) Prosk.
Loc: 25, 51, on soil, 0-500 m, MKIR 2201
MARCHANTIOPHYTA SPHAEROCARPACEAE
Sphaerocarpos texanus Austin
Loc: 46,47,49,50,51, on soil, Alt. 0-500 m, MKIR 3733
TARGIONIACEAE
Targionia hypophylla L.
Loc: 8, on soil and soil-covered rock, Alt. 500-1500 m, MKIR 1555
AYTONIACEAE
Reboulia hemisphaerica (L.) Raddi
Loc: 8,9,11,19,27,28, on soil and rock, Alt. 0-2000 m, MKIR 2086
Preissia quadrata (Scop.) Nees
Loc: 9,35, on rocks and soil-covered rock, Alt. 500-2000 m, Det: ERD & MKIR, MKIR 1633
CONOCEPHALACEAE
Conocephalum conicum (L.) Dumort.
Loc: 9,11,19,23, on soil and soil-covered rock, Alt. 500-2000 m, MKIR 1631
LUNULARIACEAE
Lunularia cruciata (L.) Dumort. ex Lindb.
Loc: 25, on soil and rocks, Alt. 0-2000 m, MKIR 2234
MARCHANTIACEAE
Marchantia polymorpha L.
Loc: 19,23, on moist soil and rocks, Alt. 0 – 500 m, MKIR 2163
CORSINIACEAE
Corsinia coriandrina (Spreng.) Lindb.
Loc: 46, on soil and epiphytic, Alt. 0-1000 m, MKIR 3723
OXYMITRACEAE
Oxymitra incrassata (Brotero) Sérgio & Sim-Sim

Loc: 9, on soil, Alt. 1500-2000 m, MKIR 1673
RICCIACEAE
Riccia sorocarpa Bisch.
Loc: 46, on soil, Alt. 500, MKIR 3723 d
METZGERIACEAE
Metzgeria furcata (L.) Dumort.
Loc: 11, on rocks, Alt. 1000, MKIR 1733b
ANEURACEAE
Aneura pinguis (L.) Dumort.
Loc: 23, epilithic-on soil, Alt. 0-1000, MKIR 2162
PELLIACEAE
Pellia endiviifolia (Dicks.) Dumort.
Loc: 9,23,25, epilithic- on soil - soil-covered rock, Alt. between: 500-1500, MKIR 1638
Pellia epiphylla (L.) Corda
Loc: 19,30, epilithic - on soil - soil-covered rock, Alt. 500-1500, MKIR 2333
CODONIACEAE
Fossombronia husnotii Corb.
Loc: 46, on soil, Alt. 0-500, MKIR 3723a
Petalophyllum ralfsii (Wils.) Nees & Gottsche
Loc: 46, on soil - soil-covered rock, Alt. 0-500, MKIR 3723c
JUNGERMANNIACEAE
Jungermannia atrovirens Dumort.
Loc: 9, epilithic, Alt. 1500-2000, MKIR 1615b
Jungermannia gracillima Sm.
Loc: 9, epilithic, Alt. 1500-2000, MKIR 1609
CEPHALOZIELLACEAE
Cephaloziella divaricata (Sm.) Schiffn.
Loc: 10, epilithic, Alt. 0-1000, MKIR1709b
FRULLANIACEAE
Frullania dilatata (L.) Dumort.
Loc: 11, epiphytic, Alt. 500-1000, Det: ÖZ & MKIR, MKIR 1723b
PORELLACEAE
Porella cordaeana (Huebener) Moore
Loc: 8,25, epilithic - epiphytic - soil-covered rock, Alt. 1000-1500, MKIR 2205
* *Porella obtusata* (Taylor) Trevis.
Loc: 35, epilithic, Alt. 500-1000, MKIR 3198
Porella pinnata L.
Loc: 9, epilithic - epiphytic - soil-covered rock, Alt. 1500-2000, MKIR 1662
Porella platyphylla (L.) Pfeiff.
Loc:8,11,35, epilithic - epiphytic- on soil - soil-covered rock, Alt. 500-2000, MKIR 3195b

BRYOPHYTA
POLYTRICHACEAE
**Atrichum undulatum* (Hedw.) P. Beauv.
Loc: 45, on soil, Alt. *ca* : 1000-1500, MKIR 3682
Pogonatum urnigerum (Hedw.) P. Beauv.
Loc: 9, epilithic, Alt. 1500-2000, MKIR 1640b
Polytrichum piliferum Hedw.
Loc: 11, on soil, Alt. 500-1000, MKIR 1727
TIMMIACEAE
**Timmia megapolitana* Hedw.
Loc:28, epilithic, Alt. 1500-2000, MKIR 2310b
ENCALYPTACEAE
Encalypta rhaptocarpa Schwägr.
Loc: 28, epilithic, Alt. 500-2000, MKIR 2269
Encalypta streptocarpa Hedw.
Loc: 6,8,9,33, epilithic - soil-covered rock, Alt. 500-2000, MKIR 2394
Encalypta vulgaris var. *mutica* Brid.
Loc: 51,52, soil-covered rock, Alt. 0-500, MKIR 3808
Encalypta vulgaris Hedw. var. *vulgaris*
Loc: 1,2,9,13,15,16,17,19,28,33,35,36, epilithic - on soil - soil-covered rock, Alt. 0-2300, MKIR 3798
FUNARIACEAE
Entostodon convexus (Supruce) Brugués
Loc: 9, on soil, Alt. 0-500, MKIR 1676
Entostodon pulchellus (H. Philib.) Brugués
Loc: 9,46, on soil, Alt. 0-500, MKIR 1605b
Funaria hygrometrica Hedw.

Loc: 8,9,10,17,34,35,40,46,47,49,50, on soil - soil-covered rock, Alt. 0-2000, MKIR 3162
**Physcomitrium pyriforme* (Hedw.) Bruch & Schimp.
Loc: 51, on soil, Alt. 0-500, MKIR 3749
GRIMMIACEAE
Grimmia anodon Bruch & Schimp.
Loc: 9,28, epilithic, Alt. 1000-2000, MKIR 1677
Grimmia decipiens (Schultz) Lindb.
Loc: 8, epilithic, Alt. 1000-1500, MKIR 1774
Grimmia dissimulata E. Maier
Loc: 36, epilithic, Alt. 500-1500, MKIR 3213
Grimmia funalis (Schwägr.) Bruch & Schimp.
Loc: 16,19, epilithic, Alt. 0-1500 , MKIR 2084
Grimmia hartmanii Schimp.
Loc: 30, epilithic, Alt. 1000-1500, MKIR 2015
Grimmia laevigata (Brid.) Brid.
Loc: 3,4,9,11,13,18,21,22,26,36,37, epilithic, Alt. 500-2000, MKIR 1730
Grimmia lisae De Not.
Loc: 4,7,8,1,15,16,17,21,22,25,30,35, epilithic - soil-covered rock, Alt. 0-1500, MKIR 3199
Grimmia nutans Bruch
Loc: 25, epilithic Alt. 1000-1500, MKIR 2190
Grimmia orbicularis Bruch ex Wilson
Loc: 30,34,36,37,39, epilithic, Alt. 0-2000, MKIR 3577
Grimmia ovalis (Hedw.) Lindb.
Loc: 9,1,17,18,22, epilithic, Alt. 500-2000, MKIR 2370
Grimmia pulvinata (Hedw.) Sm.
Loc: 1,4,8,9,15,16,17,19,21,22,23,24,25,26,28,31,32,33,34,35,37,39,41,42, epilithic - epiphytic - on soil, Alt. 0-2000, MKIR 2380
Grimmia trichophylla Grev.
Loc: 6,7,11,15,16,17,19,21,23,25,30, epilithic - on soil - soil-covered rock, Alt. 0-1500, MKIR 2343
Schistidium apocarpum (Hedw.) Bruch & Schimp.
Loc: 1,9,19,35,36, epilithic, Alt. 500-2000, MKIR 3225
**Schistidium helveticum* (Schkuhr) Deguchi
Loc: 9, epilithic, Alt. 1500-2000,MKIR 1625
**Schistidium pruinosum* (Wilson ex Schimp.) G. Roth
Loc: 15, on soil, Alt. 1000-1500, MKIR 1784b
Schistidium rivulare (Brid.) Podp.
Loc: 7,9,25,28, epilithic - on soil - soil-covered rock, Alt. 500-2000, MKIR 2388
FISSIDENTACEAE
Fissidens adianthoides Hedw.
Loc: 8,9,11, on soil - soil-covered rock, Alt. 500-2000, MKIR 1684
Fissidens pusillus (Wilson) Milde
Loc: 25,29, epilithic, Alt. 1000-1500, MKIR 2221
**Fissidens rufulus* Bruch & Schimp.
Loc: 34, epilithic - on soil, Alt. 0-500, MKIR 2596
Fissidens taxifolius Hedw.
Loc: 8 epilithic, Alt. 1000-1500, MKIR 1562
DITRICHACEAE
Ceratodon conicus (Hampe) Lindb.
Loc: 9,43, soil-covered rock, Alt. 1500-2000, MKIR 2172
Ceratodon purpureus (Hedw.) Brid.
Loc: 9,16,23,24,25,28,36,40,43,44, epilithic - on soil - soil-covered rock, Alt. 0-1500, MKIR 2305
Cheilothela chloropus (Brid.) Broth.
Loc: 21,22,44, on soil - epilithic, Alt. 0-1000 , MKIR 2132
Distichium capillaceum (Hedw.) Bruch & Schimp. var. *capillaceum*
Loc: 1,6,8,9,15,28,30, epilithic - soil-covered rock, Alt. 500-2000, MKIR 3809
Distichium capillaceum (Hedw.) Bruch & Schimp. var. *compactum* (Huebener) Dalla Torre & Sarnth.
Loc: 1,9,28, epilithic - soil-covered rock, Alt. 1000-2000, MKIR 2289
Dicranoweisia cirrata (Hedw.) Lindb.
Loc: 1,11,17, epilithic - on soil - soil-covered rock, Alt. 500-1500, MKIR 3165
DICRANACEAE
Dicranella heteromalla (Hedw.) Schimp.
Loc:23, soil-covered rock, Alt. 1000-1500, MKIR 2164
Dicranella howei Renauld & Cardot
Loc: 20,35, on soil, Alt. 500-1500, MKIR 3171b
**Dicranella subulata* (Hedw.) Schimp.
Loc: 35, epilithic, Alt. 500-1000, MKIR 3203
Dicranella varia (Hedw.) Schimp.
Loc: 43, on soil - soil-covered rock, Alt. 1000-2000, MKIR 3667a

Dicranum scoparium Hedw.
Loc: 9, on soil, Alt. 1500-2000, MKIR 1619b
MKIR 2010
POTTIACEAE
Timmiella anomala (Bruch & Schimp.) Limpr.
Loc: 9,44, epilithic, Alt. 500-1000, MKIR 3678
Timmiella barbuloides (Brid.) Mönk.
Loc: 35, soil-covered rock, Alt. 500-1000, MKIR 3181
Eucladium verticillatum (With.) Bruch & Schimp.
Loc: 8,9,11,42, epilithic, Alt. 500-2000, MKIR 1736
Gymnostomum aeruginosum Sm.
Loc: 9,11,12, epilithic, Alt. 500-1500, MKIR 1725
Hymenostylium recurvirostrum (Hedw.) Dixon
Loc: 17,19,25, epilithic, Alt. 500-1500, MKIR 2232
Pleurochaete squarrosa (Brid.) Lindb.
Loc: 7,13,16,18,19,36,39,41, epilithic - on soil - soil-covered rock, Alt. 0-1500, MKIR 2064
Tortella fragilis (Hook. & Wilson) Limpr.
Loc: 11,25, epilithic, Alt. 500-1000, MKIR 1745b
Tortella inclinata (R. Hedw.) Limpr.
Loc: 28, epilithic, Alt. 500-2000, MKIR 1992
Tortella inflexa (Bruch) Broth.
Loc: 16, soil-covered rock, Alt. 0-1500, MKIR 2282b
Tortella tortuosa (Hedw.) Limpr.
Loc: 1,2,4,7,8,11,12,13,14,17,18,19,24,25,28,33,35,36,37, epilithic - soil-covered rock - on soil, Alt. 500-2300, MKIR 3211
Trichostomum brachydontium Bruch
Loc: 9,11, epilithic, Alt. 500-2000, MKIR 1626
Trichostomum crispulum Bruch
Loc: 7,8,9,11,16,35,42, epilithic - on soil - soil-covered rock, Alt. 0-2000, MKIR 1687
Weissia condensa (Voit) Lindb.
Loc: 5,19, soil-covered rock, Alt. 1500-2000, MKIR 3467
Weissia controversa Hedw.
Loc: 4,19,28, epilithic, Alt. 500-2000, MKIR 1494
**Acaulon muticum* (Hedw.) Müll. Hal.
Loc: 50, on soil, Alt. 0-500, MKIR 3745
Aloina aloides (Koch ex Schultz) Kindb.
Loc: 40,43,44,46,47, on soil, Alt. 0-1000, MKIR 3671
Aloina ambigua (Bruch & Schimp.) Limpr.
Loc: 40,44, on soil, Alt. 1000-1500, MKIR 3637
**Barbula bolleana* (Müll. Hal.) Broth.
Loc: 29, epilithic, Alt. 500-1500, MKIR 2328b
Barbula convoluta Hedw. var. *convoluta*
Loc: 9,11,15,17,19, soil-covered rock, Alt. 0-500, MKIR 1755
Barbula convoluta var. *sardoa* Schimp.
Loc: 7,17, epilithic, Alt. 1000-2000, MKIR 2026
Barbula unguiculata Hedw.
Loc: 9,12,16,17,19,28,36,38,46, epilithic - on soil - soil-covered rock, Alt. 0-2000, MKIR 2290
Bryoerythrophyllum recurvirostrum (Hedw.) P. C. Chen
Loc: 25, epilithic - soil-covered rock Alt. 500-2000, MKIR 2197c
Crossidium squamiferum (Viv.) Jur. var. *pottioideum* (De Not.) Mönk.
Loc: 1,34, epilithic, Alt. 0-500, MKIR 2616
Crossidium squamiferum (Viv.) Jur. var. *squamiferum*
Loc: 12,16,18,34,35,36,39,41,43,44, epilithic - on soil - soil-covered rock, Alt. 0-2000, MKIR 3576
Didymodon acutus (Brid.) K. Saito
Loc: 13,38,39, on soil, Alt. 500-1000, MKIR 3581
**Didymodon australasiae* (Hook. & Grev.) R. H. Zander
Loc: 35, soil-covered rock, Alt. 500-1000, MKIR 3182b
Didymodon fallax (Hedw.) R. H. Zander
Loc: 17, epilithic - epiphytic, Alt. 500-1500, MKIR 2164
Didymodon ferrugineus (Schimp. ex Besch.) M. O. Hill
Loc: 17, soil-covered rock, Alt. 500-1000, MKIR 2003
**Didymodon glaucus* Ryan
Loc: 36 on soil, Alt. 500-1000, MKIR 3220
Didymodon insulanus (De Not.) M. O. Hill
Loc: 9,13,17,19,25,30,39,42, epilithic - epiphytic, Alt. 500-1500 , MKIR 1774
Didymodon luridus Spreng.
Loc: 1,7,9,16,17,19,21,22,26,28,34,35,36,38,39,43, epilithic - on soil - soil-covered rock, Alt. 0-1500, MKIR 1524
Didymodon rigidulus Hedw.

Loc: 19,26, epilithic - soil-covered rock, Alt. 500-2000, MKIR 2317
Didymodon sinuosus (Mitt.) Delogne
Loc: 11,36,42, epilithic - on soil, Alt. 500-2300, MKIR 3219
Didymodon spadiceus (Mitt.) Limpr.
Loc: 25,34, epilithic - on soil, Alt. 0-1500, MKIR 2606
Didymodon tophaceus (Brid.) Lisa
Loc: 11,16,17,19,20,24,28,36, epilithic - epiphytic - on soil, Alt. 0-1500, MKIR 3214
Didymodon vinealis (Brid.) R. H. Zander
Loc: 1,9,16,17,19,21,25,38,43, epilithic - epiphytic - on soil - soil-covered rock, Alt. 0-2000, MKIR 3573
**Microbryum davallianum* (Sm.) R. H. Zander
Loc: 16, on soil, Alt. 0-500, MKIR 3727b
Microbryum floerkeanum (F. Weber & D. Mohr) Schimp.
Loc: 49, on soil, Alt. 0-500, MKIR 3732b
Microbryum starckeanum (Hedw.) R. H. Zander
Loc: 46,47, on soil, Alt. 0-500, MKIR 3734
Phascum cuspidatum Hedw. var. *cuspidatum*
Loc: 46,47,49,50, on soil, Alt. 0-500, MKIR 3746
Phascum cuspidatum Hedw. var. *piliferum* (Hedw.) Hook. & Taylor
Loc: 46,50, on soil, Alt. 0-1000, MKIR 3725
Pseudocrossidium hornschuchianum (Schultz) R. H. Zander
Loc: 16,23, epilithic - on soil, Alt. 0-2000, MKIR 1963
Pseudocrossidium revolutum (Brid.) R. H. Zander
Loc: 4,15,16,20,25, epilithic - on soil - soil-covered rock, Alt. 0-1500, MKIR 1792
**Pterygoneurum ovatum* (Hedw.) Dixon
Loc: 1,47, on soil, Alt. 0-2000, MKIR 3807
**Syntrichia calcicola* J. J. Amann
Loc: 2,4,21,25, epilithic, Alt. 1000-2300, MKIR 3816
**Syntrichia caninervis* Mitt. var. *caninervis*
Loc: 24,28, 52, epilithic, soil-covered rock, Alt. 1500-2000, MKIR 2279
* *Syntrichia caninervis* Mitt. var. *gypsophila* (J. J. Amann ex G. Roth) Ochyra
Loc: 33, epilithic, Alt. 500-2000, MKIR 2286
Syntrichia caninervis Mitt. var. *pseudodesertorum* (Vondr.) M.T.Gallego
Loc: 28 epilithic, Alt. 500-2000, MKIR 2279
Syntrichia handelii (Schiffn.) S. Agnew & Vondr.
Loc: 7,2,28, epilithic - Epiphytic, Alt. 1000-2000, MKIR 2296
Syntrichia montana Nees
Loc: 7,12,17,18,19,22,25,28,35,36,37,38, epilithic - epiphytic - soil-covered rock, Alt. 500-2000, MKIR 2144a
Syntrichia laevipila Brid.
Loc: 7,12, epiphytic, Alt. 0-1500, MKIR 1765
Syntrichia norvegica F. Weber
Loc: 28, soil-covered rock, Alt. 1500-2000, MKIR 2273c
Syntrichia papillosissima (Copp.) Loeske
Loc: 1,4,7,9,12,18,25,30, epilithic - on soil, Alt. 1000-2300, MKIR 1763
Syntrichia princeps (De Not.) Mitt.
Loc: 1,6,7,15,16,17,19,21,22,25,31,35, epiphytic - epilithic - on soil, Alt. 0-1500, MKIR 1540
Syntrichia ruralis (Hedw.) F. Weber & D. Mohr var. *ruraliformis* (Besch.) Delogne
Loc: 9,15, epilithic - on soil, Alt. 1000-2000, MKIR 1796
Syntrichia ruralis (Hedw.) F. Weber & D. Mohr
Loc: 1,2,4,8,9,12,22,28,33,36, epilithic - epiphytic - on soil, Alt. 500-2300, MKIR 2390
Syntrichia subpapillosissima (Bizot & R. B. Pierrot ex W. A. Kramer) M. T. Gallego & J. Guerra
Loc: 4,28,35,37, epilithic, Alt. 500-2000, MKIR 3201
Syntrichia virescens (De Not.) Ochyra
Loc: 3,4,9,28,35, epilithic - epiphytic, Alt. 0-2000, MKIR 1467
Tortula atrovirens (Sm.) Lindb.
Loc: 36,39,43, epilithic - on soil - soil-covered rock, Alt. 500-2000, MKIR 3221
Tortula brevissima Schiffn.
Loc: 44, epilithic, Alt. 500-1000, MKIR 3679
Tortula canescens Mont.
Loc: 44, on soil, Alt. 500-1000, MKIR 3740
Tortula hoppeana (Schultz.) Ochyra
Loc: 35,43, epilithic - soil-covered rock, Alt. 500-2000, MKIR 3174
Tortula inermis (Brid.) Mont.
Loc: 16,37, soil-covered rock, Alt. 0-1500, MKIR 3146
Tortula lanceolata R. H. Zander
Loc: 49, on soil, Alt. 0-500, MKIR 3740
Tortula muralis var. *aestiva* Brid. ex Hedw.
Loc: 28,32,34,42,44, epilithic, Alt. 500-2000, MKIR 2257

Tortula muralis Hedw. var *muralis*
Loc: 1,8,11,16,19,25,29, epilithic - on soil, Alt. 0-2000, MKIR 2324
Tortula truncata (Hedw.) Mitt.
Loc:6,46,50, on soil, Alt. 1000-1500, MKIR 1511
Tortula subulata Hedw.
Loc: 1,4,9,11,15,19,22,23,25,28,29,30,31,32,33,34,35,36,37,42, epilithic - epiphytic - on soil, Alt. 0-2000, MKIR 2335
Tortula vahliana (Schultz) Mont.
Loc: 6,40, on soil, Alt. 500-1500, MKIR 1514
ORTHOTRICH ACEAE
Orthotrichum affine Schrad. ex Brid.
Loc: 2,4,8,9,11,12,17,18,19,24,30,31,43, epiphytic, Alt. 500-2000, MKIR 3663
Orthotrichum anomalum Hedw.
Loc: 4,11,19, epilithic - epiphytic, Alt. 500-1500, MKIR 1708
Orthotrichum cupulatum Hoffm. ex Brid. var. *bistratosum* Schiffn.
Loc: 5, epilithic Alt. 500-1000, MKIR 2783
Orthotrichum cupulatum Hoffm. ex Brid. var. *cupulatum*
Loc: 1,17,19,22,25,30,33,35,36,37,38, epilithic - epiphytic - on soil, Alt. 500-2000, MKIR 2011
Orthotrichum diaphanum Schrad. ex Brid.
Loc: 2,3,5,16,17,19,25,34,36,40,43,50, epiphytic, Alt. 0-1500, MKIR 3632
Orthotrichum lyellii Hook. & Taylor
Loc: 1,18,26,50, epiphytic, Alt. 0-1500, MKIR 2236
Orthotrichum macrocephalum F. Lara, Garilleti & Mazimpaka
Loc: 3,5,18,21,34,50, epiphytic, Alt. 0-1500, MKIR 1462
Orthotrichum pallens Bruch ex Brid.
Loc: 8,19,30,31, epilithic - epiphytic, Alt. 500-2000, MKIR 2363b
Orthotrichum pumilum Sw. ex Anon.
Loc: 2,3,4,8,12,16,19,21,22,24,25,28,30,31,34,50, epiphytic, Alt. 0-1500, MKIR 2316
Orthotrichum rupestre subsp. *franzonianum* (De Not.) Mönk.
Loc: 30,31, epiphytic, Alt. 500-2000, MKIR 2379
Orthotrichum rupestre Schleich. ex Schwägr. subsp. *rupestre*
Loc: 1,4,7,8,9,11,17,18,19,22,26,28,30, epilithic - epiphytic, Alt. 500-2000, MKIR 2349
Orthotrichum rupestre subsp. *sturmii* (Hoppe & Hornsch.) Boulay
Loc: 33, epilithic, Alt. 1500-2000, MKIR 2385
**#Orthotrichum scanicum* Grönvall
Loc: 19,21, epiphytic, Alt. 500-1000, MKIR 2117d
Orthotrichum speciosum Nees
Loc: 2,4,7,12,17,18,19,21,26,29,30,33,36, epiphytic, Alt. 500-2000, MKIR 1455
Orthotrichum striatum Hedw.
Loc: 4,5,6,7,12,19,24,28,30, epiphytic, Alt. 500-2000, MKIR 2178
Orthotrichum tenellum Bruch ex Brid.
Loc: 19, epiphytic, Alt. 500-1000, MKIR 2068d
#Orthotrichum tortidontium F. Lara, Garilleti & Mazimpaka
Loc: 28 epiphytic, Alt. 1000-2000, MKIR 2315
Orthotrichum urnigerum Myrin
Loc: 21, epiphytic, Alt. 500-1000, MKIR 2115
**Ulota hutchinsiae* (Sm.) Hammar
Loc: 9,12, epiphytic, Alt. 1500-2000, MKIR 1771
Zygodon viridissimus (Dicks.) Brid.
Loc: 4, epiphytic, Alt. 500-1000, MKIR 1503
HEDWIGIACEAE
Hedwigia stellata Hedenäs
Loc: 10,11,12, epilithic, Alt. 500-1500, MKIR 1703a
BARTRAMIACEAE
Anacolia webbii (Mont.) Schimp.
Loc: 9,30, on soil - soil-covered rock, Alt. 500-1500, MKIR 2342
Bartramia pomiformis Hedw.
Loc: 23,31, on soil - soil-covered rock, Alt. 1000-1500, MKIR 2376
Bartramia stricta Brid.
Loc: 9,19,22,25,30,35,36, epilithic - on soil - soil-covered rock, Alt. 500-2000, MKIR 3226
Philonotis caespitosa Jur.
Loc: 23, epilithic - on soil, Alt. 1000-1500, MKIR 2166a
BRYACEAE
#Bryum algovicum Sendtn. ex Müll. Hal.
Loc: 34, on soil, Alt. 0-500, MKIR 2607
Bryum alpinum Huds. ex With.
Loc: 30, epilithic - on soil - soil-covered rock, Alt. 1000-1500, MKIR 2345
Bryum argenteum Hedw. var. *argenteum*

Loc: 1,16,22,28,31,35, epilithic - on soil, Alt. 500-2000, MKIR 2252
Bryum argenteum var. *lanatum* (P. Beauv.) Hampe
Loc: 11, epilithic - on soil, Alt. 1000-2000, MKIR 2336
Bryum caespiticium Hedw.
Loc: 1,7,28,30,31,33,38, epilithic - on soil - soil-covered rock, Alt. 0-2000, MKIR 1495
Bryum canariense Brid.
Loc: 7,17,18, on soil, Alt. 1000-1500, MKIR 2045
Bryum capillare Hedw.
Loc: 1,4,6,15,17,19,21,22,28,30,35, epilithic - epiphytic - on soil, Alt. 500-1500, MKIR 2137
Bryum dichotomum Hedw.
Loc: 35, epiphytic - on soil, Alt. 500-1000, MKIR 3160
Bryum elegans Nees
Loc: 11, epilithic, Alt. 1500-2000, MKIR 3312
Bryum gemmilucens R. Wilczek & Demaret
Loc: 49, on soil, Alt. 0-500, MKIR 3739
Bryum imbricatum (Schwägr.) Bruch & Schimp.
Loc: 4,9,18,19,22,24,28,30, epilithic - on soil, Alt. 1000-2000, MKIR 1617
Bryum mildeanum Jur.
Loc: 9, on soil, Alt. 1500-2000, MKIR 1607
**Bryum moravicum* Podp.
Loc: 8,11,18, epiphytic, Alt. 500-2000, MKIR 2258a
Bryum pseudotriquetrum (Hedw.) P. Gaertn. et al. var. *pseudotriquetrum*
Loc: 9,25,34, epilithic - on soil - soil-covered rock, Alt. 0-2000, MKIR 2188
Bryum pseudotriquetrum var. *bimum* (Schreb.) Lilj.
Loc: 19, on soil, Alt. 500-1000, MKIR 2081
Bryum torquescens Bruch & Schimp.
Loc: 8, on soil, Alt. 1000-1500, MKIR 1552
Epipterygium tozeri (Grev.) Lindb.
Loc: 34,40, epilithic - on soil, Alt. 0-1000, MKIR 2598
Pohlia cruda (Hedw.) Lindb.
Loc: 9,19,28,33, epilithic - on soil - soil-covered rock, Alt. 500-2000, MKIR 2396
Pohlia elongata Hedw.
Loc: 9,31, on soil, Alt. 500-2000, MKIR 1657
Pohlia melanodon (Brid.) A. J. Shaw
Loc: 19,42, on soil, Alt. 500-1000, MKIR 3651
Pohlia wahlenbergii (F. Weber & D. Mohr) A. L. Andrews var. *calcarea* (Warnst.) E. F. Warb.
Loc: 25, on soil, Alt. 1000-1500, MKIR 2216
Pohlia wahlenbergii (F. Weber & D. Mohr) A. L. Andrews *wahlenbergii*
Loc: 10,17,19,23,28,49, epilithic - on soil, Alt. 0-1500, MKIR 3743
PLAGIOMNIACEAE
**Plagiomnium elatum* (Bruch & Schimp.) T. J. Kop.
Loc: 42, on soil, Alt. 500-1000, MKIR 3654b
**Plagiomnium rostratum* (Schrad.) T. J. Kop.
Loc: 42, on soil, Alt. 500-1000, MKIR 3653a
Plagiomnium undulatum (Hedw.) T. J. Kop.
Loc: 9,19,23, epilithic - on soil, Alt. 500-2000, MKIR 2165a
AULACOMNIACEAE
Aulacomnium androgynum (Hedw.) Schwägr.
Loc: 19, on soil - soil-covered rock, Alt. 500-2000, MKIR 2075b
AMBLYSTEGIACEAE
Amblystegium serpens (Hedw.) Schimp.
Loc: 16,25,28, epilithic - on soil, Alt. 500-2000, MKIR 2249
Hygroamblystegium tenax (Hedw.) Jenn.
Loc: 9, epilithic, Alt. 1000-1500, MKIR 2354
Leptodictyum riparium (Hedw.) Warnst.
Loc: 7,36, epiphytic, Alt. 500-1500, MKIR 3236
Palustriella commutata (Hedw.) Ochyra
Loc: 9,11,19,25, epilithic - on soil, Alt. 500-2000, MKIR 1608
LESKEACEAE
Pseudoleskeella catenulata (Brid. ex Schrad.) Kindb.
Loc: 28, epiphytic, Alt. 0-500, MKIR 2284a
BRACHYTHECIACEAE
Scorpiurium circinatum (Bruch) M. Fleisch. & Loeske
Loc: 23, epilithic, Alt. 1000-1500, MKIR 2165b
Scorpiurium sendtneri (Schimp.) M. Fleisch.
Loc: 11,16,34, epilithic - epiphytic - soil-covered rock, Alt. 0-2000, MKIR 2599
Platyhypnidium riparioides (Hedw.) Dixon

Loc: 9,19,23,30, epilithic, Alt. 500-1500, MKIR 3662
Rhynchostegium megapolitanum (Blandow ex F. Weber & D. Mohr) Schimp.
Loc: 40, on soil, Alt. 500-1000, MKIR 3639
Rhynchostegium murale (Hedw.) Schimp.
Loc: 23, soil-covered rock, Alt. 1000-1500, MKIR 2174
Rhynchostegiella litorea (De Not.) Limpr.
Loc: 7, on soil, Alt. 500-1000, MKIR 1528c
Rhynchostegiella tenella (Dicks.) Limpr.
Loc: 2,4,7,8,20,33, epilithic - on soil, Alt. 500-2000, MKIR 2406
Rhynchostegiella teneriffae (Mont.) Dirkse & Bouman
Loc: 17, on soil, Alt. 500-1000, MKIR 2001
Cirriphyllum piliferum (Hedw.) Grout
Loc: 17,19, epilithic - on soil, Alt. 0-1000, MKIR 2000
Oxyrrhynchium schleicheri (R. Hedw.) Röll
Loc: 17,19,29, epilithic, Alt. 500-1500, MKIR 2328
Oxyrrhynchium hians (Hedw.) Loeske
Loc: 19,41, on soil, Alt. 0-1000, MKIR 3661
Oxyrrhynchium speciosum (Brid.) Warnst.
Loc: 29,40 on soil Alt. 0-1000, MKIR 3638
Kindbergia praelonga (Hedw.) Ochyra
Loc: 19, epilithic, Alt. 0-500, MKIR 1970
Sciuro-hypnum plumosum (Hedw.) Ignatov & Huttunen
Loc: 24, on soil, Alt. 500-1500, MKIR 2183
Sciuro-hypnum reflexum (Starke) Ignatov & Huttunen
Loc: 28 epilithic, Alt. 1500-2000, MKIR 2273b
Brachythecium glareosum (Bruch ex Spruce) Schimp.
Loc: 8, epilithic, Alt. 500-2000, MKIR 1548
**Brachythecium mildeanum* (Schimp.) Schimp.
Loc: 9, epilithic, Alt. 1500-2000, MKIR 1607
Brachythecium rivulare Schimp.
Loc: 20,42, epilithic - epiphytic - on soil, Alt. 0-1500, MKIR 2112
Brachythecium rutabulum (Hedw.) Schimp.
Loc: 19, on soil, Alt. 500-1000, MKIR 2078
Brachythecium salebrosum (Hoffm. ex F. Weber & D. Mohr) Schimp.
Loc: 17,18, epilithic, Alt. 500-1500, MKIR 2014
Scleropodium cespitans (Wilson ex Müll. Hal.) L. F. Koch
Loc: 21, on soil, Alt. 500-1000, MKIR 2118
Scleropodium touretii (Brid.) L. F. Koch
Loc: 23, epilithic, Alt. 500-1500, MKIR 2197
Eurhynchiastrum pulchellum (Hedw.) Ignatov & Huttunen
Loc: 9,20,23,29,30,42, epilithic - on soil, Alt. 500-2000, MKIR 3656
Brachytheciastrum velutinum (Hedw.) Ignatov & Huttunen
Loc: 1,6,12,15,17,21,28,33, epilithic - epiphytic - on soil - soil-covered rock, Alt. 500-2000, MKIR 2404
Homalothecium aureum (Spruce) H. Rob.
Loc: 9, on soil, Alt. 500-2000, MKIR 2033
Homalothecium lutescens (Hedw.) H. Rob.
Loc: 1,8, on soil, Alt. 1000-1500, MKIR 1554
Homalothecium philippeanum (Spruce) Schimp.
Loc: 28, epilithic, Alt. 1500-2000, MKIR 2280
Homalothecium sericeum (Hedw.) Schimp.
Loc: 1,4,7,9,10,12,16,17,21,22,25,28,30, epilithic - epiphytic - on soil - soil-covered rock, Alt. 500-2000, MKIR 3592
FABRONIACAE
Fabronia pusilla Raddi
Loc: 4,35,37, epilithic - epiphytic, Alt. 500-1000, MKIR 3194
HYPNACEAE
Calliergonella cuspidata (Hedw.) Loeske
Loc: 19, epilithic, Alt. 500-1000, MKIR 2105
Ctenidium molluscum (Hedw.) Mitt.
Loc: 8,9, epilithic - on soil, Alt. 1000-2000, MKIR 1569
**Hypnum andoi* A. J. E. Sm.
Loc: 19, on soil, Alt. 500-1000, MKIR 2080
Hypnum cupressiforme Hedw. *cupressiforme*
Loc: 8,11,17,28,35, epilithic - epiphytic - on soil, Alt. 500-1500, MKIR 2032
Hypnum cupressiforme var. *lacunosum* Brid.
Loc: 1, epilithic - epiphytic, Alt. 500-2000, MKIR 1664
Hypnum cupressiforme var. *resupinatum* (Taylor) Schimp.
Loc: 1,9, epilithic - epiphytic, Alt. 1000-1500, MKIR 1667b

**Hypnum revolutum* (Mitt.) Lindb.
Loc: 28, epilithic, Alt. 1000-2000, MKIR 2292
PTERGYNANDRACEAE
Habrodon perpusillus (De Not) Lindb.
Loc: 1,12, epiphytic, Alt. 500-1000, MKIR 1761
Ptergynandrum filiforme Hedw.
Loc: 1,9, epiphytic, Alt. 1000-2000, MKIR 1669a
LEUCODONTACEAE
Leucodon sciuroides (Hedw.) Schwägr.var.*sciuroides*
Loc: 1,4,17,20,22,25,28,30,36, epilithic - epiphytic - on soil, Alt. 500-1500, MKIR 2017
Leucodon sciuroides var. *morensis* (Schwägr.) De Not.
Loc: 38,22, epilithic, Alt. 500-1500, MKIR 2158
Antitrichia californica Sull.
Loc: 11,19,30, epilithic - epiphytic, Alt. 500-1500, MKIR 2361
Antitrichia curtipendula (Hedw.) Brid.
Loc: 9, epilithic - on soil, Alt. 1500-2000, MKIR 1695
Pterogonium gracile (Hedw.) Sm.
Loc: 4,8,9,11,18,24,35, epilithic, Alt. 500-2000, MKIR 1697
NECKERACEAE
Neckera menziesii Drumm.
Loc: 30, epilithic, Alt. 1000-1500, MKIR 2359
LEMBOPHYLLACEAE
Isothecium alopecuroides (Lam. ex Dubois) Isov.
Loc: 19, epilithic - epiphytic, Alt. 500-1500, MKIR 2067
**#Isothecium myosuroides* var. *brachythecioides* (Dixon) Braithw.
Loc: 8,19,23, epiphytic - on soil, Alt. 500-1500, MKIR 2096

3.2. General remarks:

As a result of the identification of approximately 2500 specimens, 213 moss species belonging to 24 families and 78 genera, 24 liverwort species belonging to 17 families and 19 genera and one hornwort species have been found in the area. Among these bryophytes, one liverwort and 25 moss taxa represent new records for the C11 square according to Henderson (1961) grid system. The *Porellaceae* (5 taxa belonging to 2 genera) is the richest family in species number among the hepatics. *Porella* L. is the genus with most species (4 taxa). *Pottiaceae* (70 taxa belonging to 20 genera), *Grimmiaceae* (16 taxa belonging to 2 genera), *Bryaceae* (22 taxa belonging to 3 genera), *Orthotrichaceae* (21 taxa belonging to 3 genera) and *Brachytheciaceae* (28 taxa belonging to 13 genera) are the species rich families and they constitute 71.6% of the flora (157 taxa) as an expected result due to climatic conditions. *Aulocomniaceae, Timmiaceae, Hedwigiaceae, Neckeraceae, Fabroniaceae* and *Thuidiaceae* are monotypically represented families in the area.

The study area can be considered an important reserve for the species of the genus *Orthotrichum*, because 18 of 29 Turkish taxa are growing here (Papp and Sabovljevic, 2003; Erdağ and Kürschner, 2002; Erdağ et al., 2004; Kürschner and Erdağ, 2005). In spite of attractive communities dominated by members of the genus in the area, there are no bryosociological studies in the mountain (as a deficiency of Turkish bryology that focused mainly on floristic studies in general).

In the recent years, rising demand of dried plants in flower markets has caused an extensive harvesting of bryophytes. In our study area, northern slopes have plentiful bryophyte mats suitable for bryophyte harvesting activities. Fortunately, we have no observation about this activity which is very common in the most of the remaining mountains in western Anatolia.

3.3 Taxonomical remarks:

Orthotrichum cupulatum Hoffm. ex Brid. var. *bistratosum* Schiffn. (Schiffner, 1913) and *Grimmia nutans* Bruch (Müller, 1829) were described from Turkey in the early 19th century. The latter (figure 2) was also collected from Meteora (Greece) and described as a new species (*G. meteorae*) by Townsend in 1989. Greven (1995) has compared two collections and found that *G. meteorae* is a synonym of *G. nutans*, a neglected taxon during 160 years. *G. nutans was* collected from Babadağ after 175 years of the first collection from İzmir,Turkey in 1829. It should be emphasized that *Orthotrichum cupulatum* var. *bistratosum* has been known only from its type locality (Schiffner, 1913) and from Spain (Guerra, 1985) (figure 3). This taxon was also collected from Babadağ and Honaz Mountain (Kırmacı and Erdağ, 2009) 91 years later. Additionally, more recently recorded taxa for Turkey such as *Orthotrichum tortidontium* F. Lara, Garilleti and Mazimpaka (Mazimpaka et al., 2000), *O. scanicum* (Erdağ et al., 2004), *Bryum algovicum* (Yayıntaş Tonguç, 2001) and *Isothecium myosuroides* var. *brachythecioides* (Dixon) Braithw. (Uyar and Çetin, 2004) were also collected from the study area.

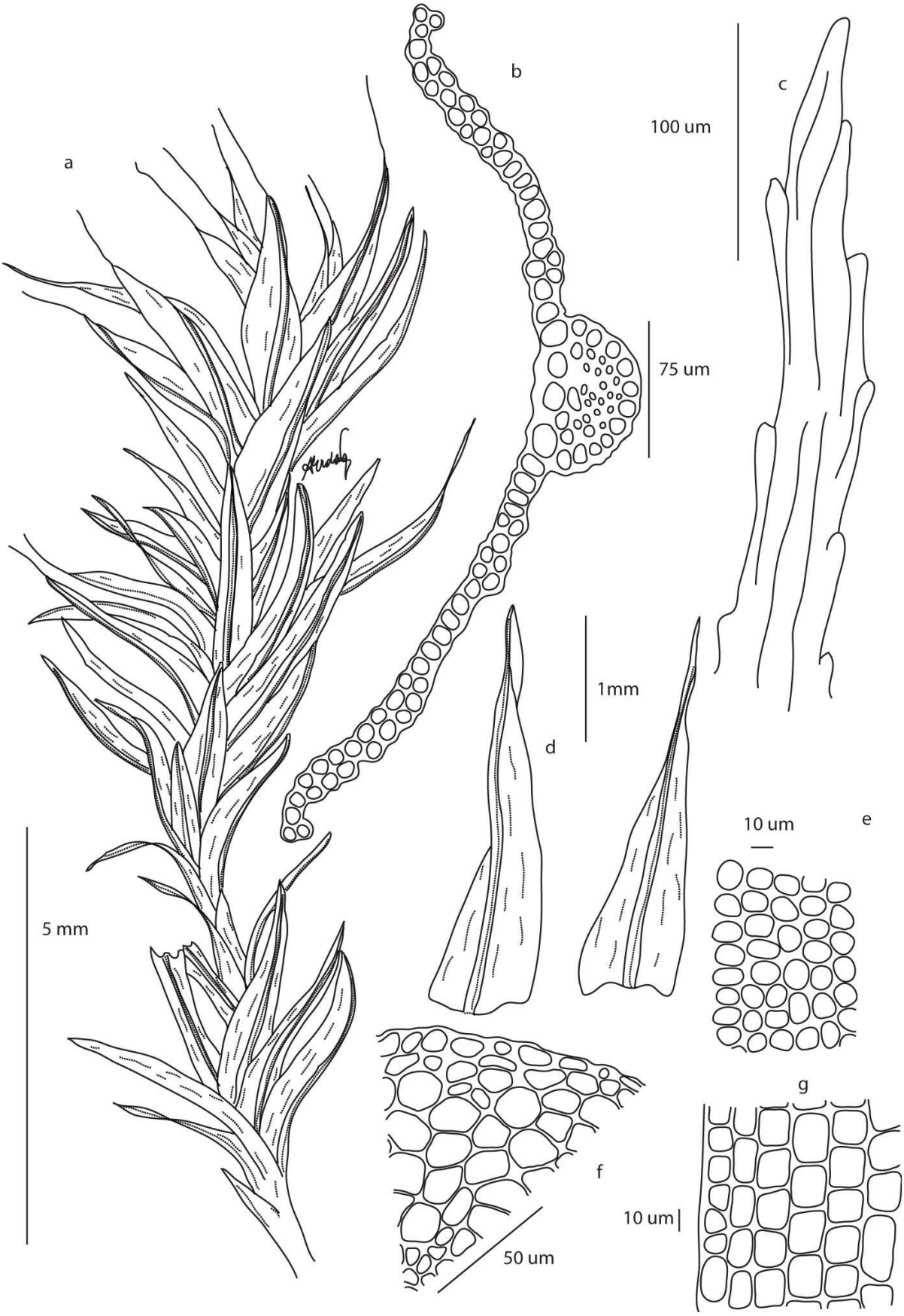

Figure 2

Grimmia nutans **a.** Habit (wet); **b.** Leaf cross section ; **c.** Hair point; **d.** Leaves; **e.** Mid – leaf cells; **f.** Cross section of stem; **g.** Basal leaf cells (Mkır 2190)

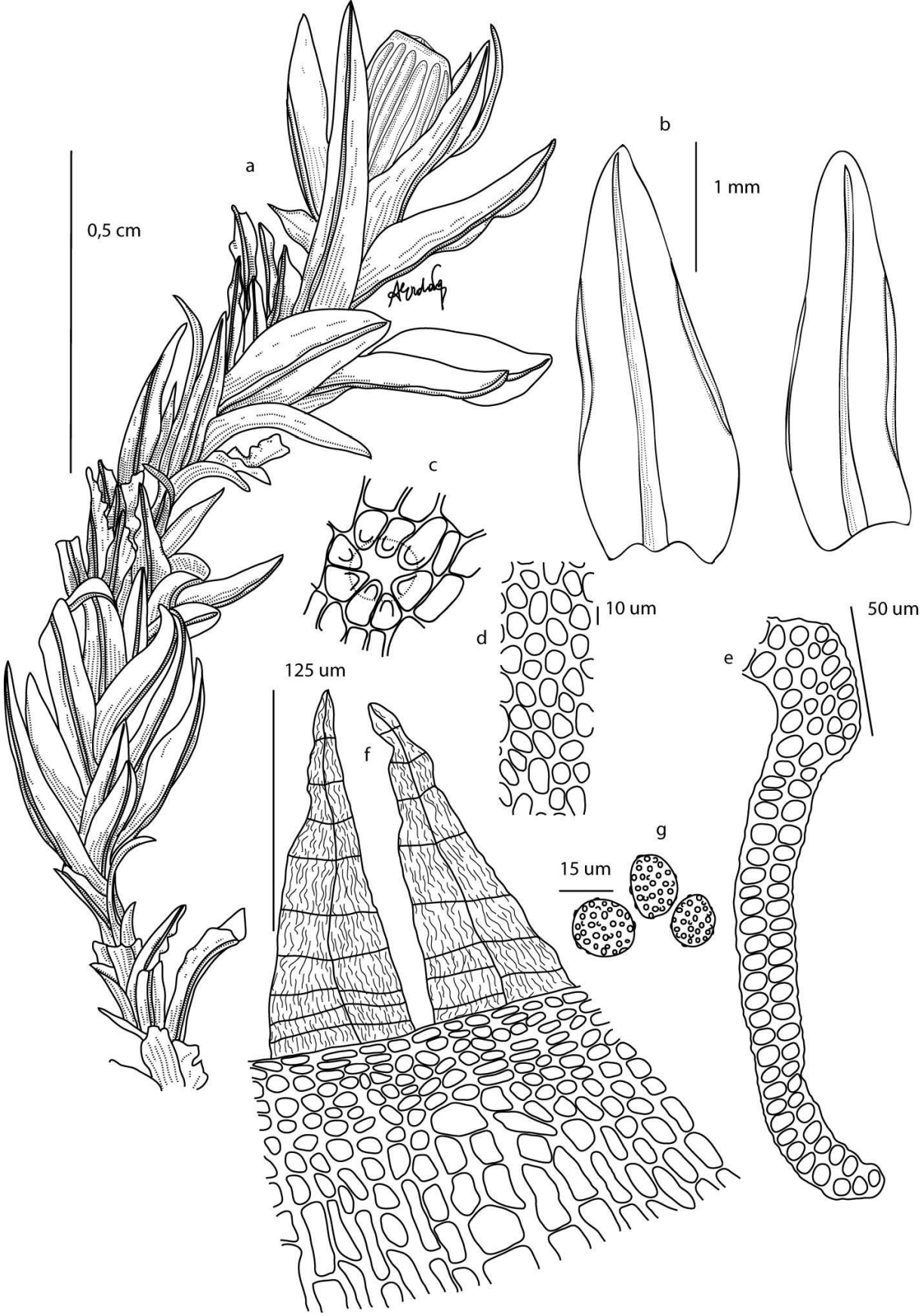

Figure 3: ***Orthotrichum cupulatum*** var. ***bistratosum*** **a.** Habit (wet); **b.** Leaves; **c.** Stoma; **d.** Mid – leaf cels; **e.** Leaf cross section; **f.** Peristome; **g.** Spores (Mkır 2783b)

Orthotrichum scanicum Gronvall was evaluated as a threatened species in the Red list of world bryophytes which was prepared by International Union for Conservation of Nature (IUCN) SSC Bryophyte specialist group. The population is suspected to have declined by at least 20% over the last 15 years (three generations), because host trees have been cut and air pollution has lowered the vitality of this species. It therefore meets the IUCN criteria for "vulnerable". Fortunately, it was recently found in some additional European countries and Turkey (Portugal, Vieira et al. 2004; Spain, Cano et al. 2004; Czech Republic, Kucera and Vana, 2003; Greece, Lara et al. 2003; Turkey, Erdağ et

al. 2004). Now, it can be regarded as a Mediterranean rather than a Nordic species and its threatened status becomes obsolete after these new findings.

Phascum cuspidatum Schreb. ex Hedw. var. *arcuatum* Herrnst. & Heyn has been only recorded from Israel in 1991 (figure 4). Its diagnostic character is the curved seta which is equal or longer than the capsule. This taxon morphologically resembles *P. cuspidatum* var. *piliferum* (Hedw.) Hook. & Taylor and *P. cuspidatum* var. *curvisetum* (Dicks.) Nees & Hornsch. However *P. cuspidatum* var. *piliferum* has straight seta and the latter has curved seta but seta is shorter than capsule. Similarly, *Didymodon validus* (=*D. acutus* var. *valida* or *D. acutus* f. *valida*) has been defined a distinct taxon in some floras (e.g., Kucera and Vana, 2003). The taxonomical status of these two taxa remains unclear and we did not include them in the list. Tortula *subulata* var. *graeffii* Warnst. and *T. subulata* var. *subinermis* (Bruch & Schimp.) Wilson were also evaluated as synonyms of *T. subulata* by Cano et. al. (2005). Indeed, it is not easy to distinguish these varieties using the diagnostic characters in all cases, because intermediate individuals cause identification problems, thus we also did not list these varieties separately. We followed the taxonomical approaches of Cano et al. (2005) for these taxa.

Figure 4: ***Phascum cuspidatum*** var. ***arcuatum*** **A.** Habit (dry) **B.** Habit (wet) (Mkır 3732)

The present study is a part of the on going research on the bryophyte flora of the Caria region of south-west Anatolia, which will be available in near future by the authors. In terms of species number of the flora (nearly ¼ of the total Turkish bryoflora), Babadag can be considered as one of the bryologically most important areas of the country especially for xerophytic bryophytes.

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Aquatic Coleoptera fauna of Çorum and Yozgat Provinces (Turkey)

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Abstract

Aquatic beetles in the families Gyrinidae, Haliplidae, Noteridae, Dytiscidae, Helophoridae and Hydrophilidae were sampled at the Çorum and Yozgat provinces in Central Anatolian from 2006 through 2009. 61 species of water beetles were recorded in Çorum province and 15 species in Yozgat province. 56 species appeared to be new for Çorum and 14 for Yozgat. Of these beetles 13 species are here recorded for the first time from the Central Anatolian region. The known ranges of these species are expanded by the new findings.

Key words: Aquatic Coleoptera, fauna, Çorum, Yozgat, Turkey

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Çorum ve Yozgat illeri (Türkiye) Sucul kınkanatlı faunası

Özet

2006-2009 yılları arasında İç Anadolu Bölgesinde yer alan Çorum ve Yozgat illerinde sucul kınkanatlı (Gyrinidae, Haliplidae, Noteridae, Dytiscidae, Helophoridae ve Hydrophilidae) faunası araştırılmıştır. Çorum ilinde 61, Yozgat ilinde ise 15 sucul kınkanatlı türü kaydedilmiştir. Çorum ilinden 56 tür, Yozgat ilinden 14 tür ilk kez kaydedilmiştir. Bu türlerden 13'ü İç Anadolu Bölgesi için yeni kayıttır. Yeni bulgularla birlikte bu türlerin yayılış alanı genişlemiştir.

Anahtar kelimeler: Sucul Coleoptera, fauna, Çorum, Yozgat, Türkiye

1. Introduction

Çorum and Yozgat provinces are located in the Central Anatolia of Turkey. The aquatic Coleoptera fauna of these provinces are scarcely known. Nine species of aquatic beetles have been recorded from the studied region previously, shown in the Table 1.

2. Materials and methods

All samples were collected from Central Anatolian Region in the years 2006-2009. The samples were collected from spring water areas, with a sieve, ladle or water-net having a 1 mm mesh size. The beetles were killed with 70% alcohol and in the laboratory cleaned of debris with a small paintbrush. The aedeagophore was dissected under a stereo-microscope and left in 10% KOH solution for about 1–2 hours. Materials have been deposited in the Zoological Museum of Gazi University (=ZMGU), Ankara, Turkey and Zoological Museum, Atatürk University, Erzurum, Turkey. The aim of this study was to make contributions to Turkish aquatic beetles fauna.

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Table 1. Literature records of the research area

Species list	Çorum	Yozgat	Literature
Agabus biguttatus (Olivier, 1795)	x		Guéorguiev, 1981; Darılmaz and Kıyak, 2009
Deronectes parvicollis (Schaum, 1864)	x		Guéorguiev, 1981; Fery and Hosseinie, 1998; Darılmaz and Kıyak, 2009
Scarodytes halensis halensis (Fabricius, 1787)	x		Guéorguiev, 1981; Darılmaz and Kıyak, 2009
Hygrotus lernaeus (Schaum, 1857)	x		Guéorguiev, 1981; Darılmaz and Kıyak, 2009
Laccobius obscuratus aegaeus Gentili, 1974		x	Gentili, 2000
Laccobius simulatrix d'Orchymont, 1932		x	Gentili, 2000
Laccobius sipylus d'Orchymont, 1939		x	Gentili, 2000
Laccobius syriacus Guillebeau, 1896		x	Gentili, 2000
Laccobius gracilis gracilis Motschulsky, 1855		x	Darılmaz and Kıyak, 2010

3. Results

Family Gyrinidae

Aulonogyrus concinnus (Klug, 1834)

Materials: Çorum: 1 ex. Hatap (stream), 40°23'N 34°48'E, 866 m. 05.08.2007.
Remarks: New for Çorum.

Gyrinus substriatus Stephens, 1828

Materials: Çorum: 12 ex. Türkler village (stream), 40°38'N 34°52'E, 956 m. 01.07.2006; 5 ex. Sıklık boğazı, 40°35'N 35°02'E, 1097 m. 28.07.2006; 25 ex. Boğazönü village, 40°19'N 34°49'E, 1182 m. 07.07.2007; 4 ex. Hatap (stream), 40°23'N 34°48'E, 866 m. 09.09.2007; 8. ex. Boğazönü village, 40°19'N 34°49'E, 1182 m. 03.07.2008; 27 ex. Küçük Keşlik village, 40°15'N 34°55'E, 1028 m. 01.09.2009. **Yozgat:** 12 ex. Çayıralan, Kaynarpınar, 39°18'N 35°50'E, 1379 m. 18.07.2006; 26 ex. Çayıralan, Karalı Boğazı, 39°18'N 35°50'E, 1350 m. 24.07.2006.
Remarks: New for Çorum and Yozgat.

Family Haliplidae

Haliplus lineatocollis (Marsham, 1802)

Materials: Çorum: 2 ex. Sıklık boğazı, 40°35'N 35°02'E, 1097 m. 28.07.2006; 1 ex. Boğazönü village, 40°19'N 34°49'E, 1182 m. 05.08.2007; 1 ex. Hatap (stream), 40°23'N 34°48'E, 866 m. 09.09.2007. **Yozgat:** 2 ex. Çayıralan, Derekemal village, Örenlice, 39°21'N 35°43'E, 1603 m. 23.07.2006.
Remarks: This species is a new record fauna of the Central Anatolian region and also new for Çorum and Yozgat.

Peltodytes caesus (Duftschmid, 1805)

Materials: Çorum: 4 ex. near the H.Ü. Faculty of Arts & Sciences, 40°34'N 34°55'E, 795 m. 01.04.2006; 2 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 04.06.2006; 3 ex. near the H.Ü. Faculty of Arts & Sciences, 40°34'N 34°55'E, 795 m. 14.06. 2006; **Yozgat:** 7 ex. Çayıralan, Derekemal village, Örenlice, 39°21'N 35°43'E, 1603 m. 23.07.2006.
Remarks: New for Çorum and Yozgat.

Family Noteridae

Noterus clavicornis (De Geer, 1774)

Materials: Çorum: 2 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 01.03.2006; 1 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 04.06.2006; 2 ex. Sarılık bridge, small stream, 40°23'N 35°04'E, 28.07.2007.
Remarks: New for Çorum.

Family Dytiscidae

Agabus biguttatus (Olivier, 1795)

Materials: Çorum: 8 ex. İskilip road 12.Km, 40°34'N 34°48'E, 946 m. 01.06.2008; 4 ex. Türkler village (stream), 40°38'N 34°52'E, 956 m. 04.06.2006; 5 ex. Türkler village (stream), 40°38'N 34°52'E, 956 m. 29.07.2006; 3 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 16.11.2006; 2 ex. Boğazönü village, 40°19'N 34°49'E, 1182 m. 03.07.2008.
Remarks: New for Çorum.

***Agabus bipustulatus* (Linnaeus, 1767)**

Materials: Çorum: 1 ex. Türkler village (stream), 40°38'N 34°52'E, 956 m. 04.06.2006; 5 ex. Çatak (national park), 40°41'N 34°18'E, 1388 m. 04.06.2006; 8 ex. near the H.Ü. Faculty of Arts & Sciences, 40°34'N 34°55'E, 795 m. 14.06.2006; 4 ex. Türkler village (stream), 40°38'N 34°52'E, 956 m. 01.07.2006; 2 ex. Göcenovacığı village (small lake), 40°20'N 34°50'E, 1307 m. 21.07.2007; 11 ex. Sarılık bridge-small stream, 40°23'N 35°04'E, 28.07.2007; 1 ex. Çatak village, 40°41'N 34°50'E, 1192 m. 15.05.2008; 1 ex. Küçük Keşlik village, 40°15'N 34°55'E, 1028 m. 01.09.2009; 1 ex. Küçük Keşlik village, 40°15'N 34°55'E, 1028 m. 07.11.2009; 2 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 16.11.2009; 3 ex. Beydilli village (marsh), 40°37'N 34°53' E, 872 m. 18.11.2009. **Yozgat:** 1 ex. Çayıralan, Kaynarpınar, 39°18'N 35°50'E, 1379 m. 18.07.2006; 1 ex. Çayıralan, Karalı Boğazı, 39°18'N 35°50'E, 1350 m. 22.07.2006; 1 ex. Çayıralan (Atılan Pınar), 39°18'N 35°44'E, 1500 m. 27.07.2006.
Remarks: New for Çorum and Yozgat.

***Agabus conspersus* (Marsham, 1802)**

Materials: Çorum: 5 ex. Çatak (national park), 40°41'N 34°18'E, 1388 m. 04.06.2006; 3 ex. near the H.Ü. Faculty of Arts & Sciences, 40°34'N 34°55'E, 795 m. 14.06.2006; 1 ex. Türkler village (stream), 40°38'N 34°52'E, 956 m. 01.07.2006; 6 ex. Sarılık bridge- small stream, 40°23'N 35°04'E, 28.07.2007; 1 ex. Çatak village, 40°41'N 34°50'E, 1192 m. 15.05.2008.
Remarks: New for Çorum.

***Agabus guttatus guttatus* (Paykull, 1798)**

Materials: Çorum: 12 ex. Çatak (national park), 40°41'N 34°18'E, 1388 m. 10.07.2006; 8 ex. İskilip road 12.Km, 40°34'N 34°48'E, 946 m. 0106.2008.
Remarks: New for Çorum.

***Agabus labiatus* (Brahm, 1790)**

Materials: Çorum: 1 ex. İskilip road 12.Km, 40°34'N 34°48'E, 946 m. 01.06.2008.
Remarks: This species is a new record fauna of the Central Anatolian region and also new for Çorum.

***Agabus nebulosus* (Forster, 1771)**

Materials: Çorum: 2 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 04.06.2006; 2 ex. Çatak (national park), 40°41'N 34°18'E, 1388 m. 10.07.2006.
Remarks: New for Çorum.

***Agabus paludosus* (Fabricius, 1801)**

Materials: Yozgat: 9 ex. Çayıralan, Karalı Boğazı, 39°18'N 35°50'E, 1350 m. 22.07.2006.
Remarks: New for Yozgat.

***Ilybius fuliginosus fuliginosus* (Fabricius, 1792)**

Materials: Çorum: 1 ex. Türkler village (stream), 40°38'N 34°52'E, 956 m. 04.06.2006; 1 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 04.06.2006; 1 ex. Türkler village (stream), 40°38'N 34°52'E, 956 m. 01.07.2006; 3 ex. Sarılık bridge, small stream, 40°23'N 35°04'E, 28.07.2007; 1 ex. Boğazönü village (bridge), 40°19'N 34°18'E, 18.08.2007; 4 ex. Kayı village (stream), 40°24'N 35°00'E, 1305 m. 25.08.2007. **Yozgat:** 5 ex. Çayıralan, Kaynarpınar, 39°18'N 35°50'E, 1379 m. 18.07.2006; 4 ex. Çayıralan, Karalı Boğazı, 39°18'N 35°50'E, 1350 m. 22.07.2006; 9 ex. Çayıralan, Derekemal village, Örenlice, 39°21'N 35°43'E, 1603 m. 23.07.2006; 12 ex. Çayıralan, Karalı Boğazı, 39°18'N 35°50'E, 1350 m. 24.07.2006.
Remarks: New for Çorum and Yozgat.

***Platambus lunulatus* (Fischer von Waldheim, 1829)**

Materials: Çorum: 2 ex. Sıklık boğazı, 40°35'N 35°02'E, 1097 m. 28.07.2006; 53 ex. Hatap (stream), 40°23'N 34 48'E, 866 m. 05.08.2007; 10 ex. Boğazönü village (bridge), 40°19'N 34°18'E, 18.08.2007; 13 ex. Hatap (stream), 40°23'N 34°48'E, 866 m. 09.09.2007; 3 ex. Boğazönü village, 40°19'N 34°49'E, 1182 m. 09.09.2007. **Yozgat:** 13 ex. Çayıralan, Hacet Pınarı, 39°16'N 35°43'E, 1779 m. 18.07.2006; 21 ex. Çayıralan, Kaynarpınar, 39°18'N 35°50'E, 1379 m. 18.07.2006; 1 ex. Çayıralan, Karalı Boğazı, 39°18'N 35°50'E, 1350 m. 22.07.2006; 1 ex. Çayıralan, Derekemal village, Örenlice, 39°21'N 35°43'E, 1603 m. 23.07.2006; 2 ex. Çayıralan, Karalı Boğazı, 39°18'N 35°50'E, 1350 m. 24.07.2006.
Remarks: New for Çorum and Yozgat.

***Platambus maculatus* (Linnaeus, 1758)**

Materials: Çorum: 1 ex. Türkler village (stream), 40°38'N 34°52'E, 956 m. 01.07.2006; 25 ex. Hatap (stream), 40°23'N 34°48'E, 866 m. 05.08.2007; 6 ex. Boğazönü village (bridge), 40°19'N 34°18'E, 18.08.2007; 5 ex. Hatap (stream), 40°23'N 34°48'E, 866 m. 09.09.2007; 1 ex. Boğazönü village, 40°19'N 34°49'E, 1182 m. 26.04.2008,

Remarks: New for Çorum.

***Colymbetes fuscus* (Linnaeus, 1758)**

Materials: Çorum: 1 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 04.06.2006; 1 ex. Küçük Keşlik village, 40°15'N 34°55'E, 1028 m. 01.09.2009; 2 ex. Küçük Keşlik village, 40°15'N 34°55'E, 1028 m. 07.11.2009; 3 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 16.11.2009; 7 ex. Beydilli village (marsh), 40°37'N 34°53'E, 872 m. 18.11.2009.
Remarks: New for Çorum.

***Rhantus suturalis* (W.S. MacLeay, 1825)**

Materials: Çorum: 1 ex. Sarılık bridge, small stream, 40°23'N 35°04'E, 28.07.07; 2 ex. Kayı village (stream), 40°24'N 35°00'E, 1305 m. 25.08.07,
Remarks: New for Çorum.

***Cybister lateralimarginalis torquatus* (Fischer von Waldheim, 1829)**

Materials: Çorum: 1 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 04.06.2006.
Remarks: New for Çorum.

***Dytiscus marginalis marginalis* Linnaeus, 1758**

Materials: Çorum: 1 ex. Çatak (national park), 40°41'N 34°18'E, 1388 m. 04.06.2006; 3 ex. Boğazönü village (bridge), 40°19'N 34°18'E, 18.08.2007; 9 ex. Küçük Keşlik village, 40°15'N 34°55'E, 1028 m. 07.11.2009; 1 ex. Beydilli village (marsh), 40°37'N 34°53'E, 872 m. 18.11.2009.
Remarks: New for Çorum.

***Hydaticus transversalis laevisculptus* Zaitzev, 1910**

Materials: Çorum: 1 ex. Türkler village (stream), 40°38'N 34°52'E, 956 m. 04.06.2006.
Remarks: This species is a new record fauna of the Central Anatolian region and also new for Çorum.

***Hydroglyphus geminus* (Fabricius, 1792)**

Materials: Çorum: 7 ex. near the H.Ü. Faculty of Arts & Sciences, 40°34'N 34°55'E, 795 m. 01.04.2006; 3 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 01.05.2006; 3 ex. Beydilli village (marsh), 40°37'N 34°53'E, 872 m. 04.06.2006; 1 ex. Boğazönü village, 40°19'N 34°49'E, 1182 m. 05.08.2007. **Yozgat:** 2 ex. Çayıralan, Derekemal village, Örenlice, 39°21'N 35°43'E, 1603 m. 23.07.2006.
Remarks: New for Çorum and Yozgat.

***Deronectes parvicollis* (Schaum, 1864)**

Materials: Çorum: 1 ex. Hatap (stream), 40°23'N 34°48'E, 866 m. 03.07.2008.
Remarks: New for Çorum.

***Graptodytes sedilloti phrygius* Guignot, 1942**

Materials: Çorum: 1 ex. Türkler village (stream), 40°38'N 34°52'E, 956 m. 04.06.2006.
Remarks: New for Çorum.

***Hydroporus palustris* (Linnaeus, 1761)**

Materials: Çorum: 7 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 01.03.2006; 1 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 01.05.2006; 8 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 04.06.2006; 6 ex. Göcenovacığı village (small lake), 40°20'N 34°50'E, 1307 m. 21.07.2007; 2 ex. Sarılık bridge, small stream, 40°23'N 35°04'E, 28.07.2007. **Yozgat:** 3 ex. Çayıralan, Karalı Boğazı, 39°18'N 35°50'E, 1350 m. 24.07.2006.
Remarks: This species is a new record fauna of the Central Anatolian region and also new for Çorum and Yozgat.

***Hydroporus planus* (Fabricius, 1782)**

Materials: Çorum: 1 ex. Sarılık bridge, small stream, 40°23'N 35 04'E, 12.28.2007; 2 ex. Hatap (stream), 40°23'N 34°48'E, 866 m. 03.07.2008.
Remarks: This species is a new record fauna of the Central Anatolian region and also new for Çorum.

***Hydroporus marginatus* (Duftschmid, 1805)**

Materials: Çorum: 1 ex. near the H.Ü. Faculty of Arts & Sciences, 40°34'N 34°55'E, 795 m. 01.04.2006; 15 ex. near the H.Ü. Faculty of Arts & Sciences, 40°34'N 34°55'E, 795 m. 14.06. 2006; 6 ex. Çatak (national park), 40°41'N 34°18'E, 1388 m. 29.07.2006.
Remarks: New for Çorum.

***Nebrioporus stearinus suavis* (Sharp, 1882)**

Materials: Çorum: 2 ex. Hatap (stream), 40°23'N 34°48'E, 866 m. 09.09.2007.
Remarks: New for Çorum.

***Scarodytes halensis halensis* (Fabricius, 1787)**

Materials: Çorum: 1 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 01.05.2006; 1 ex. Türkler village (stream), 40°38'N 34°52'E, 956 m. 04.06.2006; 15 ex. Sıklık boğazı, 40°35'N 35°02'E, 1097 m. 28.07.2006; 2 ex. Türkler village (stream), 40°38'N 34°52'E, 956 m. 05.08.2006; 28 ex. Göcenovacığı village (small lake), 40°20'N 34°50'E, 1307 m. 21.07.2007; 3 ex. Boğazönü village, 40°19'N 34°49'E, 1182 m. 05.08.2007; 6 ex. Hatap (stream), 40°23'N 34°48'E, 866 m. 05.08.2007; 1 ex. Sarılık bridge, small stream, 40°23'N 35°04'E, 25.08.2007; 5 ex. Boğazönü village, 40°19'N 34°49'E, 1182 m. 09.09.2007; 14 ex. Hatap (stream), 40°23'N 34°48'E, 866 m.09.09.2007; 12 ex. Küçük Keşlik village, 40°15'N 34°55'E, 1028 m. 01.09.2009. **Yozgat:** 3 ex. Çayıralan, Karalı Boğazı, 39°18'N 35°50'E, 1350 m. 22.07.2006; 3 ex. Çayıralan, Derekemal village, Örenlice, 39°21'N 35°43'E, 1603 m. 23.07.2006; 1 ex. Çayıralan, Karalı Boğazı, 39°18'N 35°50'E, 1350 m. 24.07.2006.
Remarks: New for Çorum.

***Hygrotus inaequalis* (Fabricius, 1777)**

Materials: Çorum: 6 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 01.05.2006; 1 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 04.06.2006.
Remarks: New for Çorum.

***Hygrotus impressopunctatus* (Schaller, 1783)**

Materials: Çorum: 1 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 01.03.2006.
Remarks: New for Çorum.

***Hyphydrus ovatus* (Linnaeus, 1761)**

Materials: Çorum: 1 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 04.06.2006.
Remarks: New for Çorum.

***Laccophilus hyalinus hyalinus* (De Geer, 1774)**

Materials: Çorum: 3 ex. Kadıkırı village (stream), 40°28'N 34°52'E, 07.07.2007; 1 ex. Sarılık bridge, small stream, 40°23'N 35°04'E, 25.08.2007; 1 ex. Hatap (stream), 40°23'N 34°48'E, 866 m. 09.09.2007.
Remarks: New for Çorum.

***Laccophilus minutus* (Linnaeus, 1758)**

Materials: Çorum: 24 ex. near the H.Ü. Faculty of Arts & Sciences, 40°34'N 34°55'E, 795 m. 01.04.2006; 9 ex. Beydilli village (marsh), 40°37'N 34°53'E, 872 m. 04.06.2006; 1 ex. Türkler village (stream), 40°38'N 34°52'E, 956 m. 04.06.2006; 5 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m 04.06.2006; 1 ex. Türkler village (stream), 40°38'N 34°52'E, 956 m. 29.07.2006; 1 ex. Seydim (Seydim Lake), 40°33'N 34°44'E, 1106 m. 29.07.2006; 1 ex. Şekerbey village, 40°28'N 34°59'E, 899 m. 16.06.2007; 13 ex. Sarılık bridge, small stream, 40°23'N 35°04'E, 25.08.2007; 5 ex. Gökçepınar village (small lake), 40°22'N 35°08'E; 25.08.2007; 1 ex. Küçük Keşlik village, 40°15'N 34°55'E, 1028 m. 01.09.2009. **Yozgat:** 1 ex. Çayıralan, Karalı Boğazı, 39°18'N 35°50'E, 1350 m. 24.07.2006.
Remarks: New for Çorum and Yozgat.

***Laccophilus poecilus* Klug, 1834**

Materials: Çorum: 1 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 04.08.08.
Remarks: New for Çorum.

Family Helophoridae

***Helophorus arvernicus* Mulsant, 1846**

Materials: Çorum: 7 ex. Centrum, Hacıbey, 40°36'N 34°35'E, 532 m, 03.06.2008; 12 ex. Alaca, Seherhacı, 40°09'N 34°33'E, 973 m, 02.06.2007; 9 ex. Çapraşık, 40°10'N 35°05'E, 1027 m, 01.06.2007; 8 ex. Mecitözü, Elvançelebi, 40°35'N 35°08'E, 491 m, 03.06.2008; 13 ex. Sungurlu, Tüpçüköy, 40°17'N 34°15'E, 730 m, 02.06.2007.
Remarks: This species is a new record fauna of the Central Anatolian region and also new for Çorum.

***Helophorus aquaticus* (Linnaeus, 1758)**

Materials: Çorum: 1 ex. near the H.Ü. Faculty of Arts & Sciences, 40°34'N 34°55'E, 795 m. 01.06.2006; 15 ex. Çatak (national park), 40°41'N 34°18'E, 1388 m. 04.06.2006; 1 ex. Boğazönü village, 40°19'N 34°49'E, 1182 m. 26.04.2008; 5 ex. Centrum, 40°34'N 34°26'E, 1053 m, 02.06.2007; 8 ex. Alaca, Seherhacı, 40°09'N 34°33'E, 973 m, 02.06.2007; 10 ex. İskilip, Kayıbeli pass, 40°47'N 34°37'E, 1261 m, 03.06.2008; 5 ex. Laçin, Mescitli, 40°46'N 34°56'E, 567 m,

05.05.2008; 10 ex. Mecitözü, Elvançelebi, 40°35'N 35°08'E, 491 m, 03.06.2008; 7 ex. Osmaniye, 40°41'N 34°54'E, 1109 m, 05.05.2008; 4 ex. Sungurlu, Yilce, 40°24N 34°16E, 731 m, 26.07.2007.
Remarks: New for Çorum.

***Helophorus micans* (Faldermann, 1835)**

Materials: Çorum: 7 ex. Sungurlu, Tüpçüköy, 40°17'N 34°15'E, 730m, 02.06.2007.
Remarks: New for Çorum.

***Helophorus syriacus* Kuwert, 1885**

Materials: Çorum: 5 ex. Beydilli village (marsh), 40°37'N 34°53'E, 872 m. 04.06.2006; 5 ex. near the H.Ü. Faculty of Arts & Sciences, 40°34'N 34°55'E, 795 m. 14.06. 2006.
Remarks: This species is a new record fauna of the Central Anatolian region and also new for Çorum.

***Helophorus brevipalpis brevipalpis* Bedel, 1881**

Materials: Çorum : 15 ex. Beydilli village (marsh), 40°37'N 34°53'E, 872 m. 04.06.2006; 37 ex. near the H.Ü. Faculty of Arts & Sciences, 40°34'N 34°55'E, 795 m. 14.06. 2006; 5 ex. Centrum, 40°34'N 34°26'E, 1053 m, 02.06.2007; 11 ex. Alaca, Seherhacı, 40°09'N 34°33'E, 973 m, 02.06.2007; 7 ex. Avutmuş, 40°10'N 35°02'E, 1027 m, 01.06.2007; 6 ex. Çapraşık, 40°10'N 35°05'E, 1027 m, 01.06.2007; 11 ex. Kayabaşı, Tuğulu, 40°26'N 34°20'E, 731 m, 02.06.2007; 8 ex. Mecitözü, Boyacı, 40°26'N 35°16'E, 865 m, 28.06.2007; 4 ex. Elvançelebi, 40°35'N 35°08'E, 491 m, 03.06.2008; 12 ex. Sungurlu, 40°07'N 34°31'E, 858 m, 02.06.2007; 9 ex. Tüpçüköy, 40°17'N 34°15'E, 730 m, 02.06.2007; 9 ex. Yilce, 40°24'N 34°16'E, 731 m, 26.07.2007.
Remarks: New for Çorum.

***Helophorus daedalus* d'Orchymont, 1932**

Materials: Çorum: 6 ex. Oğuzlar, Ağaççam, 40°48'N 34°40'E, 966 m, 27.06.2007.
Remarks: New for Çorum.

***Helophorus discrepans* Rey, 1885**

Materials: Çorum: 5 ex. Centrum, 40°34'N 34°46'E, 1018 m, 27.06.2007; 6 ex. Sungurlu, Tüpçüköy, 40°11'N 34°19'E, 793 m, 02.06.2007; 8 ex. Alaca, Seherhacı, 40°09'N 34°33'E, 973 m, 02.06.2007; 19 ex. Çapraşık, 40°10'N 35°05'E, 1027 m, 01.06.2007. **Yozgat:** 3 ex. Çayıralan, Derekemal village, Örenlice, 39° 21' N 35° 43' E, 1603m. 23.07.2006.
Remarks: New for Çorum and Yozgat.

***Helophorus flavipes* Fabricius, 1792**

Materials: Çorum: 1 ex. Sarılık bridge, small stream, 40°23'N 35°04'E, 28.07.2007; 2 ex. Mecitözü, Elvançelebi, 40°35'N 35°08'E, 491 m, 03.06.2008.
Remarks: This species is a new record fauna of the Central Anatolian region and also new for Çorum.

***Helophorus fulgidicollis* Motschulsky, 1860**

Materials: Çorum: 7 ex. Mecitözü, Elvançelebi, 40°35'N 35°08'E, 491 m, 03.06.2008; 5 ex. Sungurlu, Yilce, 40°24'N 34°16'E, 731 m, 26.07.2007.
Remarks: This species is a new record fauna of the Central Anatolian region and also new for Çorum.

***Helophorus griseus* Herbst, 1793**

Materials: Çorum: 8 ex. Centrum, Hacıbey, 40°36'N 34°35'E, 532 m, 03.06.2008; 7 ex. Laçin, Narlıçay, 40°49'N 34°52'E, 450 m, 27.06.2007.
Remarks: New for Çorum.

***Helophorus lewisi* Angus, 1985**

Materials: Çorum: 3 ex. Beydilli village (marsh), 40°37'N 34°53'E, 872 m. 04.06.2006.
Remarks: This species is a new record fauna of the Central Anatolian region and also new for Çorum.

***Helophorus obscurus* Mulsant, 1844**

Materials: Çorum: 7 ex. Alaca, Seherhacı, 40°09'N 34°33'E, 973 m, 02.06.2007; 6 ex. Sungurlu, Yilce, 40°24'N 34°16'E, 731 m, 26.07.2007.
Remarks: This species is a new record fauna of the Central Anatolian region and also new for Çorum.

***Helophorus strigifrons* Thomson, 1868**

Materials: Çorum: 5 ex. Centrum, Hacıbey, 40°36'N 34°35'E, 532 m, 03.06.2008; 6 ex. Sungurlu, Tüpçüköy, 40°17'N 34°15'E, 730 m, 02.06.2007.
Remarks: New for Çorum.

***Helophorus terminassianae* Angus, 1984**
Materials: Çorum: 3 ex. Sungurlu, 40°07'N 34°31'E, 858 m, 02.06.2007.
Remarks: New for Çorum.

Family Hydrophilidae

***Anacaena limbata* (Fabricius, 1792)**
Materials: Çorum: 1 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 01.09.2006. **Yozgat:** 2 ex. Çayıralan, Kaynarpınar, 39°18'N 35°50'E, 1379 m. 18.07.2006; 12 ex. Çayıralan, Karalı Boğazı, 39°18'N 35°50'E, 1350 m. 24.07.2006.
Remarks: New for Çorum and Yozgat

***Paracymus relaxus* Rey, 1884**
Materials: Çorum: 1 ex. Centrum, Tuğulu, Kayabaşı, 40°26'N 34°20'E, 731 m, 02.06.2007.
Remarks: This species is a new record fauna of the Central Anatolian region and also new for Çorum.

***Enochrus fuscipennis* (Thomson, 1884)**
Materials: Çorum: 4 ex. near the H.Ü. Faculty of Arts & Sciences, 40°34'N 34°55'E, 795 m. 01.06.2006; 2 ex. Türkler village (stream), 40°38'N 34°52'E, 956 m. 04.06.2006; 12 ex. near the H.Ü. Faculty of Arts & Sciences, 40°34'N 34°55'E, 795 m.14.06.2006; 4 ex. Türkler village (stream), 40°38'N 34°52'E, 956 m. 01.07.2006; 6 ex. Sarılık bridge, small stream, 40°23'N 35°04'E, 28.07.2007.
Remarks: New for Çorum.

***Berosus spinosus* (Steven, 1808)**
Materials: Çorum: 1 ex. Laçin, Narlıçay, 40°49'N 34°52'E, 450 m, 27.06.2007.
Remarks: New for Çorum.

***Helochares lividus* (Forster, 1771)**
Materials: Çorum: 5 ex. Centrum, 40°34'N 34°46'E, 1018 m, 27.06.2007; 1 ex. Oğuzlar, Ağaççam, 40°48'N 34°40'E, 966 m, 27.06.2007.
Remarks: New for Çorum.

***Helochares punctatus* Sharp, 1869**
Materials: Çorum: 11 ex. near the H.Ü. Faculty of Arts & Sciences, 40°34'N 34°55'E, 795 m. 01.06.2006; 1 ex. Türkler village (stream), 40°38'N 34°52'E, 956 m. 04.06.2006.
Remarks: This species is a new record fauna of the Central Anatolian region and also new for Çorum.

***Hydrobius fuscipes* (Linnaeus, 1758)**
Materials: Çorum: 1 ex. Gölünyazı lake, 40°41'N 34°54'E, 1103 m. 04.06.2006; 4 ex. Osmaniye, 40°41'N 34°54'E, 1109 m, 05.05.2008.
Remarks: New for Çorum.

***Hydrophilus piceus* (Linnaeus, 1758)**
Materials: Çorum: 1 ex. near the H.Ü. Faculty of Arts & Sciences, 40°34'N 34°55'E, 795 m. 14.06.2006.
Remarks: New for Çorum.

***Laccobius bipunctatus* (Fabricius, 1775)**
Materials: Çorum: 3 ex. Boğazönü village, 40°19'N 34°49'E, 1182 m. 05.08.2007; 1 ex. Hatap (stream), 40°23'N 34°48'E, 866 m.26.04.2008; 3 ex. Hatap (stream), 40°23'N 34°48'E, 866 m.03.07.2008.
Remarks: New for Çorum.

***Laccobius simulatrix* d'Orchymont, 1932**
Materials: Çorum: 3 ex. Boğazönü village, 40°19'N 34°49'E, 1182 m. 26.04.2008; 8 ex. Centrum, 40°34'N 34°26'E, 1053 m, 02.06.2007; 7 ex. Mecitözü, Elvançelebi, 40°35'N 35°08'E, 491 m, 03.06.2008; 6 ex. Boyacı, 40°26'N 35°16'E, 865 m, 28.06.2007; 5 ex. Oğuzlar, Ağaççam, 40°48'N 34°40'E, 966 m, 27.06.2007; 3 ex. Osmaniye, 40°41'N 34°54'E, 1109 m, 05.05.2008. **Yozgat:** 2 ex. Çökerek, Kadışehir, 40°01'N 35°44'E, 1211 m, 01.06.2007.
Remarks: New for Yozgat

***Laccobius syriacus* Guillebeau, 1896**
Materials: Çorum: 42 ex. Beydilli village (marsh), 40°37'N 34°53'E, 872 m. 04.06.2006; 8 ex. Türkler village (stream), 40°38'N 34°52'E, 956 m. 29.07.2006; 5 ex. Centrum, 40°35'N 34°43'E, 1026 m, 01.07.2007; 8 ex. Hacıbey,

40°36'N 34°35'E, 532 m, 03.06.2008; 8 ex. Alaca, Seherhacı, 40°09'N 34°33'E, 973 m, 02.06.2007; 7 ex. Çapraşık, 40°10'N 35°05'E, 1027 m, 01.06.2007; 10 ex. Kayabaşı, Tuğulu, 40°26'N 34°20'E, 731 m, 02.06.2007; 10 ex. Mecitözü, Boyacı, 40°26'N 35°16'E, 865 m, 28.06.2007; 6 ex. Oğuzlar, Ağaççam, 40°48'N 34°40'E, 966 m, 27.06.2007; 5 ex. Sungurlu, Tüpçüköy, 40°11'N 34°19'E, 793 m, 02.06.2007; 6 ex. Tuğulu, 40°17'N 34°15'E, 730 m, 02.06.2007.

***Laccobius obscuratus aegaeus* Gentili, 1974**

Materials: Çorum: 1 ex. Çatak (national park), 40°41'N 34°18'E, 1388 m. 04.06.2006; 2 ex. Çatak (national park), 40°41'N 34°18'E, 1388 m. 29.07.2006; 5 ex. Mecitözü, Boyacı, 40°26'N 35°16'E, 865 m, 28.06.2007; 3 ex. Ortaköy, Selimbey, 40°17'N 35°53'E, 765 m, 02.06.2007.

***Laccobius gracilis gracilis* Motschulsky, 1855**

Materials: Çorum: 5 ex. Sungurlu, Tuğulu, 40°17'N 34°15'E, 730 m, 02.06.2007. **Yozgat:** 1 ex. Çayıralan, Derekemal village, Örenlice, 39°21'N 35°43'E, 1603 m. 23.07.2006.
Remarks: New for Yozgat.

***Coelostoma orbiculare* (Fabricius, 1775)**

Materials: Çorum: 1 ex. Centrum, 40°34'N 34°46'E, 1018 m, 27.06.2007.
Remarks: New for Çorum.

4. Conclusions

In different habitats of Çorum and Yozgat Provinces, 62 species belonging to 6 families were recorded. Of these, *Haliplus lineatocollis*, *Agabus labiatus*, *Hydaticus transversalis laevisculptus*, *Hydroporus palustris*, *Hydroporus planus*, *Helophorus arvernicus*, *Helophorus syriacus*, *Helophorus flavipes*, *Helophorus fulgidicollis*, *Helophorus lewisi*, *Helophorus obscurus*, *Paracymus relaxus* and *Helochares punctatus* are new records for the aquatic coleoptera fauna of Central Anatolian region. Furthermore, 56 species are new record only for Çorum and 14 for Yozgat. Although the water beetle fauna of Turkey is now better known, more studies are required to better understand the overall distribution.

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Contributions of the ethnobotanical ınvestigation carried out ın Amasya dıstrıct of Turkey (Amasya-Center, Bağlarüstü, Boğaköy and Vermiş villages; Yassıçal and Ziyaret towns)

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Abstract

In this study a field investigation done before in Amasya - Turkey (Amasya-Center, Bağlarüstü, Boğaköy and Vermiş villages; Yassıçal and Ziyaret towns) was evaluated. The aim of the ethnobotany research carried out between September 2004 and March 2006 was to determine the knowledge on plants for various purposes in Turkey (Black Sea Region / Amasya-Center, Bağlarüstü, Boğaköy and Vermiş villages; Yassıçal and Ziyaret towns) with the support of the Turkish Academy of Sciences (TUBA). A team of 2 worked periodically for total 30 days (20 days in villages and towns, 10 days in Amasya-Center). During this period 50 local people were interviewed and 350 plant samples were collected. 12 of these endemic to Turkey and total 257 taxa were determined. Although there were some overlapping uses (especially between food and medicinal plants) 127 plants were used for food, 93 for medicinal purpose, 12 as fuel, 16 as animal feed and 60 for hand-crafts, as well as 49 plant species useful for diverse purposes. From the area 407 recipes were collected for diverse uses. The obtained data were transferred into the database of "Kültür-Kitap" programme of the Turkish Academy of Science (TUBA) Turkey's Cultural Inventory Project. Furthermore, the results were published as a report in the TUBA Cultural Inventory Journal. The results in the mentioned report were discussed and evaluated in the current study and some new ethnobotany data have been put forward.

Key words: Turkey, Black Sea Region, Amasya, Ethnobotanical contributions

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Türkiye'nin Amasya yöresinde (Amasya-Merkez, Bağlarüstü, Boğaköy ve Vermiş Köyleri, Yassıçal ve Ziyaret Kasabaları) gerçekleştirilmiş olan bir etnobotanik araştırmaya katkılar

Özet

Bu çalışmada Türkiye'nin Amasya yöresinde (Amasya-Merkez, Bağlarüstü, Boğaköy ve Vermiş Köyleri, Yassıçal ve Ziyaret Kasabaları) daha önce yapılmış olan bir etnobotanik alan araştırması değerlendirilmiştir. Amasya merkez ilçe, Bağlarüstü, Boğaköy ve Vermiş köyleri; Yassıçal ve Ziyaret beldelerinde halkın değişik alanlardaki bitki bilgisini belirlemeye yönelik etnobotanik çalışmaları, Eylül 2004 - Mart 2006 tarihleri arasında Türkiye Bilimler Akademisinin (TÜBA) destekleriyle sürdürülmüştür. 2 kişilik bir ekiple aralıklı olarak toplam 30 gün (20 gün köylerde ve beldelerde, 10 gün merkez ilçede) çalışılmış, 50 kaynak kişi ile görüşülmüş, 350 bitki örneği toplanmıştır. Bu örneklerden 12'si Türkiye'ye endemik olmak üzere toplam 257 takson belirlenmiştir. Özellikle gıda bitkileri ile tıbbi bitkiler arasında bazı örtüşen türler olmakla birlikte 127 gıda, 93 ilaç, 12 yakacak, 16 yem, 60 el sanatları alanındaki kullanımın yanı sıra 49 bitki türünün de farklı alanlarda yararlı oldukları saptanmıştır. Alandan farklı bitki kullanımlarına ilişkin 407 kullanım biçimi (reçetesi) derlenmiştir. Elde edilen bulgular Türkiye Bilimler Akademisinin Türkiye Kültür Envanteri Projesi kapsamındaki "Kültür-Kitap" veritabanına da aktarılmıştır. Ayrıca, sonuçlar TÜBA Kültür Envanteri Dergisinde bir rapor halinde yayımlanmıştır ki şu anki çalışma ile bahsedilen raporun sonuçları tartışılarak değerlendirilmiş ve bu raporun sonuçlarına birtakım katkılarda bulunulmuştur.

Anahtar Kelimeler: Türkiye, Karadeniz Bölgesi, Amasya, Etnobotanik Katkılar

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1. Introduction

Ethnobotanic studies which could be defined shortly as the influence between humans and plants consist of valuable information gained through try and error methods and it reached us through the generations (Yıldırımlı, 2004). With the evaluated study, carried out in Bağlarüstü, Boğaköy and Vermiş villages, Ziyaret and Yassıçal towns, in Amasya Center in Black Sea region between the dates of September 2004 and March 2005, how the plants are used by local people tried to be determined. For instance, they use them for feeding, curing humans and animals, producing paint, against evil eye, decoration and as fence plant, for animal feeding and as fuel. Thus, a part of potential of folklore in Amasya was determined.

Turkey is situated in the temperate zone and has the richest flora among the western pale arctic countries. It also attracts attention with its high endemism rate in the Turkish flora (34.4 %). Nearly one third of the flowering plants and ferns that grows naturally in Turkey (10.765) are endemic (3022). In the temperate zone, except the isolated islands and tropical countries, the high rate of endemism is not seen in any other countries (Özhatay et al., 2003). As can be seen, Turkey is very rich in terms of floristic structure. However, there are not enough studies in ethnobotany field.

Amasya province has a 7500 year old history (Anonymous, 2002). 13 different civilizations existed in the city (Anonymous, 2003). The earliest ethnobotanic study in the field is done by Alpınar (Alpınar, 1979). There are also studies by Fujita et al. (Fujita et al., 1995), Ezer and Mumcu Arısan (Ezer and Arısan-Mumcu, 2006), Cansaran, Kaya and Yıldırım (Cansaran et al., 2007a). In the regions close to Amasya, there are some other studies, too (Sezik et al., 1992; Dönmez, 2000; Ertuğ, 2000; Sezik et al., 2001; Vural and Karavelioğulları, 1997 etc.).

The altitude of the places where this study was done was measured by altimeter. Accordingly, Amasya is 412 m., Yassıçal 1050 m., Vermiş 1100 m., Boğakoy 700 m., Bağlarüstü 750 m., Ziyaret is 500 m. Amasya province is in the Middle Black Sea Region on the borders of Northern and Central Anatolia (Baytop and Alpınar, 1980). Amasya is in the middle part of Black Sea region, but since it does not have an access to the Sea, it has Central Anatolia socioeconomic and cultural features. The location of the province is between 35.00 and 36.30 eastern longitude and 40.15 and 41.02 northern latitude. Yeşilırmak divided mountain ranges into two sides by creating wide valleys. The highest point is Akdağ with 2062 m. Amasya takes place within A5/A6 in the Grid system in Turkey (Davis, 1965-1985). In Figure 1, the map showing the topographic structure of the study field was included. Amasya, which is in the southern part of Black Sea region, has a harsher climate compared to other Black Sea provinces. However, compared to other provinces, it is considered dry. Within the province, rain fall decreases from north to south (Anonymous, 1991). In Amasya, a transition climate is dominant. Also, the geology, topographic and orographic structure of the regions is effective on the climate of the province. According to Emberger, in Amasya semi-dry Mediterranean climate with an extremely cold winter is dominant (Akman, 1990).

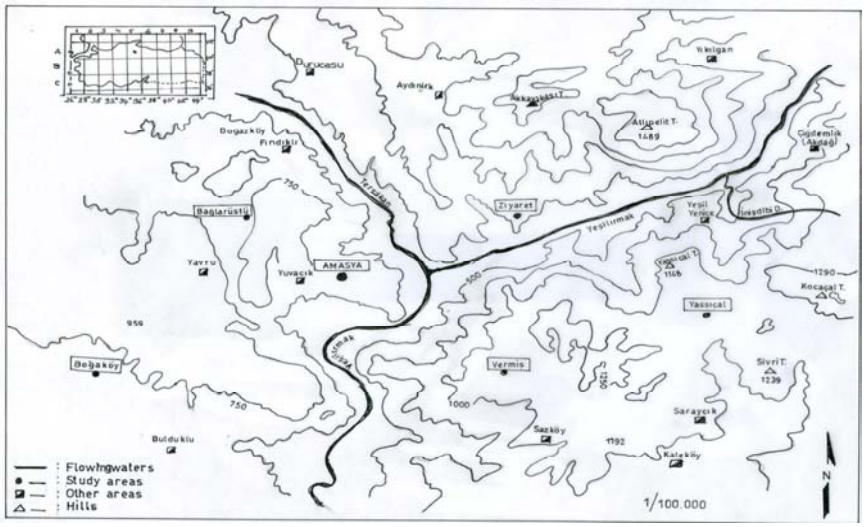

Figure 1. Topographic map of the study area

In Amasya, mostly, floristic studies have been carried out (Ketenoğlu et al., 1994; Cansaran and Aydoğdu, 1998; Cansaran, 2002; Cansaran et al., 2007b; Korkmaz et al., 2005; Celep et al., 2006 etc.). There are also some vegetation studies, some have been completed and some are ongoing (Ketenoğlu et al., 1994; Cansaran and Aydoğdu, 2001 etc.).

In terms of the structure of the study area, it took its shape at mesozoic in the second period and tertiary in the third period. There are also areas belonging to the last mesozoic period, which consists of hard and soft calcareous and chalky parts. In the study area, the alluvions (sand, stones, clay), sedimentary belonging to the third period (calcareous,

marl., clay stone etc), sedimentary belonging to the pre-third period (especially calcareous) and crystal rock masses (granite, serpentine, andesite, basalt etc) have been placed (Anonymous, 1986).

The chestnut coloured soils are commonly seen in the study area. Furthermore, colluvial and alluvial soils are rarely seen in the area. The massive soil groups in the area are occurred with the effect of topographic, vegetation and the main soil in a period under certain climate and they have certain profile characters (Anonymous, 1970).

2. Material and Method

The ethnobotanic field investigation evaluated in this current study was carried out in the Middle Black Sea region (Amasya-Center, Bağlarüstü, Boğaköy and Vermiş villages; Yassıçal and Ziyaret towns) in Turkey. Field study was done between September 2004 and March 2006. 50 informants were interviewed and 350 plants were collected. The ages of the informants range from 35 to 65 and most of them (4/5) were woman. The villages were visited three times in the spring, in the summer and in the fall, and the villages were visited only once in the winter. "Turkish Flora" (Davis, 1965-1985; Davis et al., 1988; Güner et al., 2000) was used for determination of the plants. The plants are kept in the Faculty of Education in Amasya University.

In the investigation evaluated and contributed with current study, by asking questions it is determined how certain plants are used and whether they have local names. Question form contains the location of the plant, its Latin name, local name, which purposes it is used for, which part is used and how it is used. Question form also has interview date, name of the village or town, and the person who answered the questions. Later, the information collected in groups such as food, medicine, animal feeding and handicrafts were sorted out. For the usages codes of the plants, the pilot project carried out in Buldan (Denizli) was taken as a base (Ertuğ et al., 2004) (Table 1). The parts of plants used were also given in Table 2. Later, the plants were listed alphabetically given in the "results" (Table 3). The Flora of Turkey (Davis, 1965-1985; Davis et al., 1988; Güner et al., 2000) were utilized in the identification of the specimens. Experts were consulted for some controversial cases. When the authors of the plant takson were being written, "Authors of Plant Names" was used (Brummit and Powell, 1992). Endemic plants in the field were given by checking from Red Data Book of Turkish Plants (Ekim et al., 2000). If there are various usages of a certain plants, all of them were listed. Local names of the plants that are not used in the region were also given since there are not enough information about the local names of the plants. Above mentioned ethnobotanic field study (Cansaran and Kaya, 2006) is the basis of current investigation. In current investigation, the data in field study report (Tablo 3) were evaluated and new data were added to these results.

Table 1. Plant groups / usage (plants usage codes)

I. Food Plants	**II. Plants Used For Medical purpose**	**III. Plants Used For Fuel**	**IV. Plants Used As Animal Food**	**V. Plants Used For Handycrafts**	**VII. Other Useful Plants**	**VII. Plants Acccepted As Useful/ Harmful**
Those used as food **01**	For human treatment **01**	_	_	Those used for painting **01**	Plants used for roof cover, balconies, camelia and fence **01**	Harmful plants **01**
Those whose leaves and shoots are edible	For animal treatment **02**	_	_	Straw knitting- **02**	Those used for oil source (dapphne) **02**	Those signify another beneficial plants **02**
Those whose roots and bodies are edible	_	_	_	For making basket **03**	Tar- **03**	Those that are not liked and eaten by animals **03**
Those whose knobs are edible	_	_	_	Brom **04**	Adhesive- **04**	Those known as poisonous or believed to be poisonous **04**
Those whose fruits and seeds are edible	_	_	_	Woodwork (containers, spoons, staff, toys, pipes, musical instruments) **05**	Anesthetics, sedatives- **05**	Those lilked with their scent **05**
Mushroom	_	_	_	Beads **06**	Amulet, charm, incense **06**	Plants with an odor and named because of this qulaity **06**

Table 1. Continue

Those whose flowers are edible	_	_	_	Charm against evil eye **07**	Those used for bird and fish hunting **07**	Those according how they look **07**
Those used as drinks **02**	_	_	_	Other (rope, handles, souvenirs etc) **08**	Decorative plants **08**	Those named according where the grow commonly**08**
Those used as spice, sweeteners **03**	_	_	_	_	Used for shade **09**	Other (seasonal signs) **09**
Those used for medicine **04**	_	_	_	_	Insect repellers **10**	_
Snacks **05**	_	_	_	_	Against mold and fungus **11**	_
Gum **06**	_	_	_	_	Soap **12**	
Others (yeast-plant esence) **07**	_	_	_	_	Plants that bees use for honey **13**	_
_	_	_	_	_	Used against erosion **14**	_
_	_	_	_	_	Using to clean and dry Water **15**	_
_	_	_	_	_	Social usages (child plays, decoration) **16**	_
_	_	_	_	_	Wind blockers **17**	_
_	_	_	_	_	Other (incubation, insemination) **18**	_

Table 2. Plants used parts

A	whole plant	
B	roots	
C	body under the soil	**Ca** knob body
		Cb rizom
		Cc bulb
		Cd hard bulb
D	body	
E	leaves-shoots	
F	flowers	
G	fruits	
H	seeds	
I	other	**Ia** Essence
		Ib Shell
		Ic Latex
		Id Resinous
		Ie Cone
		If Tar
K	Fungus	

3. Results

At the end of the evaluated field study done between September 2004 and March 2006, 407 recipes were collected. 257 taxa were evaluated by adding the plants which are not used but have local names (Table 3). Of the total 257 plants evaluated, 211 were natural and 46 were cultural plants. Of the plants evaluated, 13 were from Mediterranean, 17 were from Euro-Siberian, 14 were from Irano-Turanian phytogeographic region. Although there are plants used in more than one field, here are the number of plants according to fields they are used: Food (127), Medicine (93), Fuel (12) Animal food (16), Handy crafts (60), Other useful plants (22), beneficial/ harmful plants (27), those who are not used, but have local names (21). 4.66 % of all the plants were endemic. Since one cannot determine how endemic plants are used anywhere else in the world, it is important to know how these plants are used not only for cultural history but also for preservation if needed (Ertuğ et al., 2004).

Table 3. The list of the plants determined in Amasya (Amasya Center, Baglarustu (Moramil), Bogakoy and Vermis Villages; Ziyaret and Yassical Towns)

Inventory no.	Family	Genus / Species	Local name	Locality	Used plant part	Usage codes	Specimen no.	Endemism and phytogeographic region
1	Divisio: ASCOMYCOTA	*Morchella sp.*	kuzu göbeği	1, 6	K	I01	4242	-
2	Divisio: BASIDIOMYCOTA	**Agaricus sp.*	kültür mantarı	6	K	I01		-
3	Sınıf: ASCOLICHENES	*Parmelia sp.*	taş (şeytan) kınası	5, 6	L	V01	4288-B	-
4	EQUISETACEAE	*Equisetum ramosissimum* Desf.	kırk kilit/ sazak	6	A	II01	4201	-
5	AMARANTHACEAE	*Amaranthus retroflexus* L.	karagöz pancarı/ kara sirkem/ karagöz otu/ kara pancar	2, 3, 5, 6	E	I01	3429	-
6	ANACARDIACEAE	*Pistacia terebinthus* L. ssp. *palaestina* (Boiss.)Engl.	sakızlık ağacı/ çetene/ menengüç	4, 6	G	I05, II01	3303	E. Medit El.
					D	V08		
					E	V01		
7		*Rhus coriaria* L.	tetre/ sumak	2, 3	G	II02	4202	-
8	APIACEAE	*Anethum graveolens* L.	dere otu/ ırazdane	2, 6	E	I01,I03	4203	-
9		*Bifora radians* M. Bieb.	kins otu/ madenüs otu/ kötü ot/ acı ot/ kişmirim otu	5, 6	E	I03	3316	-
					A	VII06		
10		*Bupleurum rotundifolium* L.	tavuk götü/ gıcır	1	E	I01	4115	-
11		*Caucalis platycarpos* L.	telli kara pıtırak	2	A	IV,V04	4139	-
12		*Conium maculatum* L.	baldıran/ baldırgan	1, 2, 3, 6	A	VII04	3420	-
13		*Eryngium campestre* L. var. *virens* Link	sütlü diken/ kuşkonmaz otu	5,6	B	I01	4204	-
14		*Heracleum platytaenium* Boiss.	hava otu/ hava çaluğu otu	1,3,6	E	II01	4205	End./ Öksin El.
					G	V08		
15		**Petroselinum crispum* (Mill.) A.W.Hill	madenüs/ maydanoz	1, 4, 5, 6	E	I01, II01		-
16		*Turgenia latifolia* (L.) H. Hoffm.	karapıtırak	2	A	IV	4133	-
17	ARACEAE	*Arum euxinum* R.B. Mill.	minik/ nünük/ gavur pancarı	1, 3, 4	E	I01	4206	-
					A	II01		
18	ASTERACEAE	*Achillea biebersteinii* Afan.	hava otu/ civan perçemi/ kesik otu	6	E, F	II01	3351	Ir.-Tur. El.
					F (kuru)	V08		
19		*Achillea millefolium* L. ssp. *pannonica* (Scheele) Hayek	harıca ot/ civan perçemi/ hezeran	2, 3, 6	A	VII04	4150	-
					F (kuru)	V08		
20		*Achillea setacea* Waldst.&Kit.	civan perçemi/ hezeran	2, 3, 6	F (kuru)	V08	4207	Euro.-Sib. El.
21		*Bellis perennis* L.	papatya	1	F	II01	4208	Euro.-Sib. El.
22		*Calendula arvensis* L.	-	6	F	VI08	4293	-
23		*Carduus nutans* L. sensu lato	peygamber düğmesi	6	F, H	II01	4126	-
24		*Carduus pycnocephalus* L. ssp. *albidus* (M.Bieb.) Kazmi	dikencik	1, 2, 5	E	I01	3418	-

25		*Centaurea virgata* Lam. Group A	barama otu	6	A	V04, VI18	4122	-
26		*Chondrilla juncea* L. var. *juncea*	sakız otu	1,6	Ic	I06, II01	3283	-
27		*Cichorium intybus* L.	sakızlık otu/ eşek sakızı/ yabani hindiba/ yer sakızı/ ayakçak otu	3, 5, 6	Ic	I06	4209	-
					A	VII09, II01		
28		*Cirsium arvense* Scop. ssp. *vestitum* (Wimm.&Grab.)Petr.	dikencik/ köy göçüren	1,2,5	A	VII01	3414	-
					E	I01		
29		**Helianthus annuus* L.	ayçiçeği	5	H	I01		-
					A (kuru)	III		
30		**Helianthus tuberosus* L.	yer elması	3, 6	Ca	I01, II01		-
31		*Helichrysum plicatum* DC. ssp. *plicatum*	yayla çiçeği/ arı çiçeği/ yılan çiçeği/ altın çiçek/ ölmez çiçek/ pire çiçeği	2, 3, 6	F	II01	3384	-
32		*Lactuca serriola* L.	badik otu/ ayakçak otu/ kibrit otu	5, 6	E	IV, VII09	3444	Euro.-Sib. El.
33		*Matricaria chamomilla* L. var. *recutita* (L.) Grierson	koyun gözü	1, 2	E	I02, II01, II02	3386	-
					A	V01, VII03		
34		*Picris strigosa* M.Bieb.	sütlücan	1	E	I01	3439	Ir.-Tur. El.
					A	IV		
35		*Reichardia glauca* Matthews	acı ot	3	A	VII04	3441	Ir.-Tur. El.
36		*Scorzonera cana* (C.A.Mey.) H.Hoffm. var. *radicosa* (Boiss.) D.F.Chamb.	tekel/ tekelcan	1, 4, 5, 6	E	I01	3451-B	-
37		*Scorzonera mollis* M. Bieb. ssp. *szowitzii* (DC) D.F.Chamb.	geçi ciciği	1	Ca	I01	3383	-
38		*Tanacetum balsaminata* L. ssp. *balsaminata*	mesmelek	6	E	I03	3284	-
39		*Taraxacum officinale*Weber	karahindiba/ eşek sakızı	5, 6	E	I01	4210	-
					Ic	I06		
					A	II01		
40		*Tragopogon longirostris* Bisch. Ex Sch. Bip. var. *abbreviatus* Boiss.	yemlik	2, 4, 5, 6	E	I01	3406	-
41		*Xeranthemum annuum* L.	-	6	F	VI08	4211	-
42	BERBERIDACEAE	*Berberis vulgaris* L.	hanım tuzluğu	1, 6	G	II01	4212	-
					B	V01		
43		*Leontice leontopetalum* L. ssp. *leontopetalum*	çakıldak/ cingit bardağı	1	G	VI16	3331	-
44	BORAGINACEAE	*Anchusa leptophylla* Roem.&Schultes ssp.*incana* Ledeb.	-	4	F	V01	3304-A	End./Ir.-Tur. El.?

45		*Anchusa leptophylla* Roem.&Schultes ssp. *leptophylla*	sığır dili	2	E	I01	4143	-
46		*Anchusa strigosa* Labill.	dikencik	1, 2, 5	E	I01	3328	-
47		*Anchusa undulata* L. ssp. *hybrida* (Ten.) Coutinho	-	4	F	V01	3304-B	Medit. El.
48		*Buglossoides arvensis* (L.) I.M.Johnst.	karerüş	2	E	I01	3397	-
49		*Echium italicum* L.	hava civa	6	B	II01	3353	Medit. El
50		*Nonea caspica* (Willd.) G. Don.	dana dili	6	E	I01	4213	Ir.-Tur. El.
51	BRASSICACEAE	**Brassica oleracea* L. var. *oleracea*	kelem/ lahana	5, 6	E	I01, II01, II02		-
52		*Capsella bursa-pastoris* (L.) Medik.	kuş ekmeği	1, 2, 4, 5, 6	E	I01	3290	-
53		*Descurainia sophia* (L.) Webb ex Prantl	kıl namzan	2	A	V04	4134	-
54		**Eruca sativa* Mill.	roka	6	E	I01		-
55		**Lepidium sativum* L. ssp. *sativum*	tere	6	E	I01		-
56		*Neslia apiculata* Fisch.	gıcır otu/ tarla gıcırı/ gıcır tavuk	1, 3, 5	E	I01	3325	-
57		*Sinapis arvensis* L.	namzan	2, 3, 4, 5, 6	E A	I01 VII04	3244	-
58	BUXACEAE	**Buxus sempervirens* L.	şimşir	6	D	V05		Euro.-Sib. El.
59	CAMPANULACEAE	*Asyneuma limonifolium* (L.) Janch. ssp. *pestalozzae* (Boiss.) Damboldt	-	3	A	V04	4214	End.
60	CANNABACEAE	*Humulus lupulus* L.	maya otu	4,6	F	I07	4197	Euro.-Sib. El.
61	CAPPARACEAE	*Capparis ovata* Desf. var. *herbacea* (Willd.) D. Zohary	gebere	6	F	I01	4215	-
62	CAPRIFOLIACEAE	*Lonicera etrusca* Santi var. *etrusca*	hanımeli	4, 6	F	I01, VII05	4292	Medit. El.
63	CARYOPHYLLACEAE	*Cerastium brachypetalum* Pers. ssp. *roeseri* (Boiss.&Heldr.) Nyman	Tavşan topuğu, tavşan ekmeği	2, 6	E	I01	3296	-
64		*Cerastium dichotomum* L. ssp. *dichotomum*	dingilcük	2	E	I01	3403	-
65		*Holosteum umbellatum* L. var. *tenerrimum* (Boiss.) Gay.	erişte	1, 6	E	I01	4216	-
66		*Saponaria officinalis* L.	sabun otu/ köpürük otu	1, 2, 6	E, F	VI12	4289	-
67		*Silene alba* (Mill.) Krause ssp. *eriocalycina* (Boiss.) Walters	kurt kulağı	2, 6	E G	I01 VI16	3299	-
68		*Silene vulgaris* (Moench) Garcke	tavuk gıcırı/ gıcır tavuk/	2, 6	E	I01	3436	-

		var. *vulgaris*	kıncıl					
69		*Stellaria media* Vill. ssp. *media* (L.) Vill.	yılancık/ kaz otu/ kaz ayağı/ cincilim/ yer yayıltısı	1, 2, 4, 5, 6	E	I01	3302	-
70	CHENOPODIACEAE	**Atriplex hortensis* L.	hayat süpürgesi	5, 6	A	V04	3281	-
71		**Beta vulgaris* L. provar. *altissima* (Döll) J. Helm	kocabaş/ şeker pancarı	2, 5, 6	E B	I01 I01, II01, VI16		-
72		*Chenopodium album* L. ssp. *album var. album*	sirkem/ tatlı sirkem/ ak sirkem	2, 3, 5, 6	E	I01	3427	-
73		*Chenopodium murale* L.	altığrız	1	E	I01	3342	
74	CONVOLVULACEAE	*Convolvulus arvensis* L.	şarmaşık otu/ dana şarmışavı/ dana otu/ şarmuşağuk	3, 6	E	I01, II01	4151	-
75	CORYLACEAE	*Carpinus betulus* L.	gürgen	3, 6	D	III, V08	4217	Euro.-Sib. El.
76		*Carpinus orientalis* Mill. ssp. *orientalis*	meşe	2,3,6	D	III, V08	4218	-
77		*Corylus colurna* L.	fındık	4	G D	II01 III V03	4219	Euro.-Sib. El
78	CUCURBITACEAE	*Bryonia alba* L.	ilingür	1, 6	E	I01	3338	Euro.-Sib. El
79		**Cucumis sativus* L.	salatalık/ hıyar	6	G Ia	I01 II01		-
80		**Cucurbita pepo* L.	kabak	5, 6	G H	I01 II01		-
81		*Ecballium elaterium* (L.) A. Rich.	it hıyarı/ it kavunu/ yabani kavun	4, 6	Ia	II01	4220	-
82		**Momordica charantia* L.	kudret narı	6	G H	II01 VII09		-
83	CUPRESSACEAE	**Cupressus sempervirens* L.	selvi	6	Ie	II01, V08		-
84		*Juniperus oxycedrus* L. ssp. *oxycedrus*	ardıç	3, 6	Ie	II01	4221	-
85	CYPERACEAE	*Cyperus rotundus* L.	topalak otu	6	B	II01	4194	-
86	DIPSACACEAE	*Dipsacus laciniatus* L.	-	1, 3	F	V08	4222	-
87		*Scabiosa rotata* M. Bieb.	-	3	A	V04	4223	Ir.-Tur. El.
88	ELAEAGNACEAE	**Elaeagnus angustifolia* L.	iğde	1, 4, 6	D F G	V07 VII05 I05		-
89	EUPHORBIACEAE	*Andrachne telephioides* L.	boncuk otu	6	G	V06	4224	-
90		*Euphorbia cardiophylla* Boiss. & Heldr.	sütleğen/ acı ot/ sütlaç otu	4, 6	Ic A	II01 VII04	4228	End.
91		*Euphorbia rigida* M. Bieb.	sütleğen/ acı ot/ sütlaç otu	1, 6	Ic A	II01 VII04	4227	Medit. El.
92	FABACEAE	*Astragalus angustifolius* Lam. ssp. *pungens* (Willd.) Hayek	geven	2, 6	A	IV, V08	4226	-

93		*Astragalus pseudocaspius* Fisch.	geven	2, 6	A	IV, V08	4225-A	-
94		▲*Cassia angustifolia* Vahl.	sinameki	4, 5, 6	E	II01		-
95		*Colutea cilicica* Boiss. & Bal.	patlangaç	3, 5, 6	G	VI16	4225-B	-
96		*Medicago minima (L.) Bartal. var. minima*	yabani yonca/ kara yonca/ ikçil otu	5	A	II02, IV	3412	-
97		*Medicago sativa L. ssp. sativa*	efek/ kara yonca	5	A	IV, VII04	3413	-
98		*Robinia pseudoacacia* L.	akasya	6	G	I01	4290	-
					F	I01		
99		* *Vicia anatolica* Turril	fiğ	1	A	IV	3335	Ir.-Tur. El.
100		*Vicia bithynica* L.	Şaban paklası	2	E	I01	4144	-
101		*Vicia cracca* L. ssp. *stenophylla* Vell.	kuş pasılı/ dağ yoncası/ yalancı yonca	5	H	I05	3447	-
					A	IV		
102		*Vicia narbonensis* L. var. *narbonensis*	pasıl/ paklava otu/ yabani bakla/ yılan yastığı	1, 2, 5	E	I01	3407	-
					H	I05		
103		*Vicia sativa* L. *ssp. incisa* (M.Bieb.)Archibald var. *cordata* (Wulfen ex Hoppe) Archibald	-	1	A	IV	4123	-
104	FAGACEAE	*Quercus cerris* L. var. *cerris*	pelit	2, 3, 4	G	I05, VI16	4229	-
					D	III		
					E, G	V01		
					E	VI18		
105		*Quercus pubescens* Willd.	pelit	2, 3, 4	G	I05, VI16	4231	-
					D	III		
					E, G	V01		
					E	VI18		
106	HYPERICACEAE	*Hypericum perforatum* L.	kantoron otu	6	E, F	II01	3352	-
107	GERANIACEAE	*Erodium ciconium* (L.)L'Hér.	keklik tırnağı	6	E	I01	3349	-
108		*Erodium cicutarium* (L.)L'Hér. ssp. *cicutarium*	leylek burnu	6	E	I01	4230	-
109		*Geranium macrostylum* Boiss.	dedaban/ dere daban/ deli daban/ deve tabanı	1, 2, 3, 5	Ca	I01	3368	E. Medit. (mt.) El.
110		*Geranium pusillum* Burm.	gelin parmağı	6	E	I01	3348	-
111		*Geranium rotundifolium* L.	yüzük kaşı	1, 2, 4, 6	E	I01	3287	-
112		**Pelargonium zonale*	sardunya	6	F	VI10		-
113	IRIDACEAE	*Crocus ancyrensis* (Herbert) Maw	sarıçiğdem	1, 2, 3, 5	Cd	I01	3294	End. / Ir.-Tur. E.l.
114		*Crocus reticulatus* Steven ex Adams ssp. *reticulatus*	çiğdem	1, 2, 3, 5	Cd	I01	4233	-
115		*Iris galatica* Siehe	nevruz/ menevşe	6	Ca	I01	4234	End./ Ir.-Tur. E.l.
					F	I01		
116		*Iris histrioides*	nevruz/	2, 3	Ca	I01	4232	End. / Euxine

		(Wilson) Arnott	menevşe		F	I01		El.
117	JUGLANDACEAE	* *Juglans regia* L.	ceviz	5, 6	H	I05, II01		-
						II01		
					G	III		
					E, G	V01		
					D	V05		
118	LAMIACEAE	*Lamium purpureum* L. var. *purpureum*	ballık/ bal mumu/ ballı baba/ balluhan/ göğen gözü	1, 6	E	I01	3289	Euro.-Sib. El.
119		*Melissa officinalis* L. ssp. *officinalis*	oğul otu/ kör ısırgan/ limon otu	1, 3, 6	E	II01	4235	-
120		*Mentha longifolia* (L.) Huds. ssp. *longifolia*	su nanesi	2, 3	E	I03	4236	Medit. El.
121		**Mentha suaveolens* Ehrh.	nane	4, 5, 6	E	I03		-
					A	II01		
122		*Nepeta italica* L	adaçayı	6	F	I02	4239	-
123		**Ocimum basilicum* L.	reyhan/ fesleğen/ irehan	4, 6	E	I03	3277	-
					F	VI10		
124		*Salvia candidissima* Vahl. ssp. *occidentalis* Hedge	ellik otu	2, 5	E	VI18	4145	Ir.-Tur. El.?
125		*Salvia sclarea* L.	ellik otu	2, 5	E	VI18	4238	-
126		*Salvia tomentosa* Mill.	ellik otu	2, 5	E	VI18	3425	Medit. El.
127		*Salvia verticillata* L. ssp. *amasiaca* (Freyn&Bornm.) Bornm.	ellik otu	2, 5	E	VI18	4147	Ir.-Tur. El.?
128		*Salvia virgata* Jacq.	ellik otu	2, 5	E	VI18	4146	-
129		*Satureja hortensis* L.	kekik	2, 3	E	I03	4240	-
					E, F	II01		
130		*Satureja wiedemanniana* (Lallem.) Velen.	kekik	1, 2, 3	E	I03	4199	End.
					E, F	II01		
131		*Sideritis dichotoma* Huter	tüylü adaçayı	1, 6	F	I02	4241	End.
					E, F	II01		
132		*Teucrium polium* L.	harman otu/ karın ağrısı otu/ mayasıl otu	1, 6	F	II01	3320	-
133		*Thymbra spicata* L. var. *spicata*	karabaş kekiği	2, 3, 6	E,F	II01	4243	E.Medit.El.
134		*Thymus sipyleus* Boiss. *ssp. rosulans* (Borbas) Jalas	kekik otu	1, 2, 6	E	I03	4248	-
					E, F	I02, II01, II02		
135		*Wiedemannia orientalis* Fisch.&C.A.Mey.	emzik otu/ emecek/ ballık/ balcık/bal otu	1, 2, 5	F	I01	4237	End./ Ir.- Tur. El.
136	LILIACEAE	**Allium cepa* L.	soğan	2, 5, 6	Cc, E	I01		-
					Cc	II01		
					Cc	V01		
137		**Allium sativum* L.	sarımsak	5	H	I01, II01		-
138		*Asparagus officinalis* L.	menevcer/ kuşkonmaz	1, 4, 5, 6	E	I01	3265	-

139		*Muscari armeniacum* Leichtlin ex Baker	horoz ibiği/ karga pabucu/ it sarımsağı/ karga sarımsağı	5, 6	F	V01	4244	-
					A	VII04		
140		*Muscari bourgaei* Baker	horoz ibiği/ karga pabucu/ it sarımsağı/ karga sarımsağı	5, 6	F	V01	4245	End. / Medit. El.
					A	VII04		
141		*Muscari neglectum* Guss.	horoz ibiği/ karga pabucu/ it sarımsağı/ karga sarımsağı	5, 6	F	V01	4246	-
					A	VII04		
142		*Ornithogalum oligophyllum* E.D. Clarke	sabun otu	4	E	VI12	4247	-
143		*Ornithogalum sphaerocarpum* A. Kern	sabun otu	4	E	VI12	4252	-
144	LINACEAE	**Linum bienne* Mill.	sağrek/ seyrek/ zeyrek/ susam	4, 5, 6	H	I01, II01	4109	Medit. El.
145	LORANTHACEAE	*Viscum album* L. ssp. *album*	gökçe otu/ ökse otu	4, 6	E, G	II01	4249	-
146	MALVACEAE	*Alcea pallida* Waldst.&Kit.	gül hatmi/ fatmagül	6	E, F	II01	4251	-
147		**Hibiscus esculentus*	bamya	5	G	II01,I01		-
148		*Malva neglecta* Wallr.	kömeç/ ebemgümeci	1, 2, 3, 4, 5, 6	E	I01	3389	-
					E, B	II01		
149		*Malva sylvestris* L.	kömeç/ ebemgümeci	1, 2, 3, 4, 5, 6	E	I01	4253	-
					E, B	II01		
150	MORACEAE	**Ficus carica* L. ssp. *carica*	incir	5, 6	Ic	II01		-
					D	V05		
					G	I01		
151		**Morus alba* L.	beyaz dut	2, 6	G	I01		-
					E	I01		
					D	V05		
152		**Morus nigra* L.	kara dut	1, 2, 6	G	I01, II01		-
					E	I01		
					D	V05		
153	OLEACEAE	*Jasminum frutians* L.	at otu	6	G	II02	4121	Medit. El.
154		▲*Olea europaea* L. var. *sylvestris* (Mill.) Lehr	zeytin	2, 5, 6	G	I01		-
					G, H	II01		
155		*Phillyrea latifolia* L.	gökçe ağaç/ göğce ağacı	6	D	V04	3285	Medit. El.
156	ONAGRACACEAE	*Epilobium angustifolium* L.	yakı otu	1, 2, 3	F	II01	4250	-
157	ORCHIDACEAE	*Orchis palustris* Jacq.	salep otu	3, 6	Ca	II01	4254	-
158	PAPAVERACEAE	*Fumaria asepala* Boiss.	cıvık ot	5, 6	E,F	II01	4131	-
159		*Fumaria officinalis* L.	-	5, 6	E,F	II01	3312	-
160		*Papaver lacerum* Popov	lale/ gelincik/ gelin eli	2, 5, 6	F	I01	3408	-
					A	VII06		
161		*Papaver rhoeas* L.	lale/ gelincik/ gelin eli	2, 5, 6	F	I01	4255	-
					A	VII06		

162		*Papaver somniferum* L.	afein/ haşhaş/ hakkaş	5	H	II01, I01		-
					G	V01		
163	PINACEAE	*Pinus brutia* Ten.	kızılçam	2, 3	Id	I06	4267	-
					E	II01		
					D, E, Ie	III		
					Ie	V08		
					D	V05		
164		*Pinus nigra* Arn. ssp. *pallasiana* (Lamb.) Holmboe	karaçam	2, 3, 6	Id	I06	4260	-
					E	II01		
					D, E, Ie	III		
					Ie	V08		
					D	V05		
165		*Pinus sylvestris* L.	sarıçam	2, 3, 6	Id	I06	4264	-
					E	II01		
					D, E, Ie	III		
					Ie	V08		
					D	V05		
166		*Pinus pinea* L.	fıstık çamı	2, 3	Id	I06	4256	-
					E	II01		
					D, E, Ie	III		
					Ie	V08		
					D	V05		
					H	I01		
167	PLANTAGINACEAE	*Plantago lanceolata* L.	demra otu	1, 5, 6	E	I01	3280	-
					B	II01		
168		*Plantago major* L. ssp. *major*	sinir otu/ bağ yaprağı/ siğilli yaprak/ çiban otu/ bahar otu	2, 4, 6	E	I01, II01	3398	-
169	PLUMBAGINACEAE	*Acantholimon acerosum* (Willd.) Boiss. var. *acerosum*	erkek geven	2, 6	A	IV	4266	Ir.- Tur. El.
					F	VI08		
170	POACEAE	*Avena fatua* L. var. *fatua*	yabani yulaf/ piç yulaf	5	A	II02, IV	4130	-
171		**Avena sativa* L.	kara yulaf	3	A	IV	3246	-
172		*Chrysopogon gryllus* (L.) Trin. ssp. *gryllus*	damat süpürgesi	6	A	V04	4257	-
173		**Coix lacryma-jobi* L.	tespih otu	6	H	V06	4196 (	-
174		*Hordeum murinum* (L.) ssp. *glaucum* (Steud.) Tzvelev	avrum otu	5, 6	A	IV	4265	-
175		**Hordeum vulgare* L.	arpa	5	A	III, IV	3445	-
					H	II01		
176		* *Secale cereale* L. var. *cereale*	çavdar	2	A	IV	4128	-
177		*Sorghum halepense* (L.) Pers. var. *halepense*	kelem ayrığı	4	A	VII04	3282	-
178		*Stipa ehrenbergiana* Trin.&Rupr.	-	2, 6	H	VI08	4258	-
179		**Triticum aestivum* L.	buğday	1, 3, 5	H	I01	3245	-
					A	III		
					D	V05		

180		**Zea mays* L.	mısır	5, 6	G, D	II01		-
					G	I05, V08		
					D	V02, V08		
					H	VI06		
181	POLYGONACEAE	*Polygonum convolvulus* L.	yeme şarmışavı/ şarmuşak	2	E	I01	4138	-
182		*Polygonum arenastrum* Bor.	kara madımak	2, 5, 6	E	I01	3422	-
183		*Polygonum cognatum* Meisn.	madımak	1, 2, 3, 4	E	I01	3424	-
184		*Rumex acetosella* L.	eğşi kulak/eşkicük	2	E	I01,II01	4259	-
185		*Rumex angustifolius* Campd. ssp. *angustifolius*	efelik/efelek	1, 2, 3, 4, 6	E	I01	4156	-
186		*Rumex patientia* L.	efelik/efelek	1, 2, 3, 4, 6	E	I01	3387	-
187		*Rumex scutatus* L.	kuzu kulağı/eşkicük/ ekşimik	2, 3, 4	E	I01,II01	3401	-
188	PORTULACACEAE	*Portulaca oleracea* L. ssp. *oleracea*	pirpirim/ semiz otu	1, 5, 6	E	I01	4263	-
189	PRIMULACEAE	*Cyclamen coum* Mill. var. *coum*	ağurşak/ağşak/ kızıl avşak	4, 6	Ca	II01	4261	-
190	PUNICACEAE	**Punica granatum* L.	nar	6	F	II01		-
					G	I01		
191	RANUNCULACEAE	*Adonis aestivalis* L. ssp. *aestivalis*	arap saçı	2	A	V04	3392	-
192		*Adonis flammea* Jacq.	arap saçı	1	E	I01	3451-A	-
193		*Nigella arvensis* var. *glauca*	çörek otu	1, 6	H	I01	4269	-
194		*Ranunculus arvensis* L.	sarı pıtırak	2, 3, 4, 6	A	II01	3402	-
195	RHAMNACEAE	*Paliurus spina-christi* Mill.	çaltı dikeni	1, 5, 6	G	II01, VI16, V08	4268	-
196		**Zizyphus jujuba* Mill.	innap	6	G	I01, II01		-
					F	VII05		
197	ROSACEAE	*Amygdalus communis* L.	badem/çağla	2, 3, 5, 6	G,H	I05	4271	-
198		**Cerasus avium*	kiraz	5, 6	G	I01		-
					G	II01		
199		*Cerasus mahaleb* (L.) Mill. var. *mahaleb*	endülüs/mahlep	2, 3, 6	G	II01	4272	-
200		*Cerasus prostrata* (Lab.) Ser. var. *prostrata*	davşan elması	3, 4, 6	G	I01	3300	-
201		*Crataegus monogyna* Jacq. ssp. *monogyna*	yemişen	1, 2, 5, 6	G	I01	4280	-
202		*Crataegus orientalis* Pall. ex M. Bieb var. *orientalis*	aluç	2, 3	G	I01, II01	3262	-
					G, D	I02		
203		**Cydonia oblonga* Mill.	ayva/ hayva	4, 5, 6	F	I01		-
					G	I01		
					E	I02,		

						V01		
					E,H	II01		
					D	V05		
204		**Malus communis* H.J. Lam	Amsya elması/ misket/Amasya misketi	4, 5, 6	G	I01		-
					G, H	II01		
					D	V08		
205		*Malus sylvestris* Mill. ssp. *orientalis* var. *orientalis* (A. Uglitzkich) Browicz	acuk/ piç elma/ yabani elma	2, 3	G	I01, II02	4262	-
206		**Persica vulgaris* Mill.	şeftali	6	G	I01		-
					E	II02		
207		*Prunus divaricata* Ledeb. ssp. *ursina* (Kotschy) Browicz	çalkı otu/ çıtırdak	1	D	V04	3332	-
208		*Pyracantha coccinea* Roem.	ebembükü	1, 3	G	I01	4281	-
209		*Pyrus amygdaliformis* var. *lanceolata* Diap.	çördük	1, 2	G	I01	4270	-
210		**Pyrus communis* L. ssp. *communis*	armut	5	D	V08		-
					G	I01		
211		*Pyrus elaeagnifolia* Pall. ssp. *elaeagnifolia*	ahlat	1, 2	G	I01, II01	4282	-
212		*Rosa canina* L.	kuşburnu/ yabani gül	1, 2, 5, 6	F	I01	4273	-
					G	I01, I02, II01		
213		*Rosa foetida* J. Herrm.	sarı kuşburnu	5	F	I01	3314	Ir.-Tur. El.
214		*Rubus canescens* DC. var. *canescens*	karamuk/ kızamık/ böğürtlen	1, 2, 5	G	I01	4279	-
					B, D	II01		
215		*Rubus sanctus* Schreb.	karamuk/ kızamık/ böğürtlen	1, 2, 5	G	I01	4274	-
					B, D	II01		
216		**Sorbus domestica* L.	üvez	1, 6	G	I01		Euro.- Sib. El.
					E, G	II01		
217	RUBIACEAE	*Galium spurium* L. ssp. *spurium*	yapışkan ot/ boya otu/ boya çili	3, 4, 5, 6	A	V01	3410	Euro.- Sib. El.
218		*Galium verum* L. ssp. *verum*	boya otu	4, 5, 6	A	V01	3305	-
219	RUTACEAE	*Ruta montana* (L.) L.	hava otu/ humma otu	6	A	II01	4120	-
					F	V08		
220	SALICACEAE	*Salix alba* L.	söğüt	6	E	II01	4283	Euro.- Sib. El.
					D	VII09, V05 ,V08, V03		
221	SCROPHULARIACEAE	*Veronica polita* Fr.	llgancık/ urgancık/ cüce bağırsağı	2, 5, 6	E	I01	3288	-
222	SIMAROUBACEAE	*Ailanthus altissima* (Mill.) Swingle	mundar ağaç	5, 6	A	VII06	4278	-
					D	V05		
223	SOLANACEAE	*Hyoscyamus niger* L.	diş otu	4, 6	G, H	II01	4277	-
224		*Lycium*	ak çalu/ mor	1, 5	G	I01	3318	End./ Ir.- Tur.

		anatolicum A. Baytop&R.B. Mill.	tiken					El.
225		**Solanum melongena* L.	badılcan/ patlıcan	4, 5, 6	G	I01, II01		-
226		*Solanum nigrum* L. ssp. *nigrum*	it üzümü	5	A	VII09	4106	-
227		**Solanum tuberosum* L.	patates	4, 5, 6	Ca	I01, II01		-
228	STYRACACEAE	**Styrax officinalis* L.	tespih ağacı	6	H	V06		-
229	THEACEAE	▲*Camellia sinensis* (L.) O. Kuntze	çay	6	E	II01		-
230	TILIACEAE	*Tilia rubra* (DC.) ssp. *caucasica* (Rupr.) V. Engl.	ıhlamur	2, 4, 6	F	I02, II01	4284	Euxine El.
231	ULMACEAE	*Celtis caucasica* Willd.	daum ağacı/ doğum ağacı	1, 5, 6	G G, D D	I01 V07 V05	3275	-
232		*Ulmus minor* Mill. ssp. *minor*	kara ağaç	5, 6	D	V04, V08	4275	-
233	URTICACEAE	*Urtica dioica* L.	ısırgan/ dalağan	1, 2, 3, 4, 5, 6	E E,H	I01 II01	3388	Euro.- Sib. El
234	VITACEAE	**Vitis sylvestris* Gmelin	asma/ devek/ bağ/ üzüm	1, 2, 6	G E Ib	I01 I01 VI06		-
235	ZYGOPHYLLACEAE	*Peganum harmala* L.	üzerlik otu/ yüzerlik otu/ güzellik otu	5, 6	H A	II01, V07 VI06	4276	-
236		*Tribulus terrestris* L.	çoban çökerten	6	A	II01	4285	-
237	APIACEAE	• *Scandix iberica* M. Bieb.	çubuk otu				3419	-
238	ASTERACEAE	•*Arctium minus* (Hill) Bernh. ssp. *pubens* (Bab.) A'renes	kaba döşşeği				3417	Euro.- Sib. El
239		•*Centaurea iberica* Trev. ex Sprengel	eşek dikeni/ kara diken				3385	-
240		•*Centaurea solsitialis* L. ssp. *solsitialis*	alagöz dikeni				4294	-
241		•*Xanthium spinosum* L.	sarı diken				3449	-
242		•*Xanthium strumarium* L. ssp. *strumarium*	domuz pıtırağı				4295	-
243	BRASSICACEAE	•*Cardaria draba* (L.) Desv. ssp. *draba*	eşek teresi				3341	-
244		• *Sisymbrium orientale* L.	namzan				3322	-
245	CARYOPHYLLACEAE	•*Vaccaria pyramidata* Medik. var. *grandiflora* (Fisch. ex DC.) Cullen	gıcır				4114-A	-
246	CUSCUTACEAE	•*Cuscuta sp.*	İlembeç/ verem otu				4291	…
247	FABACEAE	•*Coronilla scorpioides* (L.) Koch	ikçil otu				4135	-
248		•*Glycyrrhiza glabra* L. var.	biyan				4287	-

		glandulifera (Waldst. Et Kit.) Boiss.						
249		•*Medicagoxvaria* Martyn	sarı yonca/ kayışkıran				4149	-
250		•*Melilotus officinalis* (L.) Desr.	ikçil otu				4155	-
251		•*Trifolium pratense* L. var. *pratense*	ikçil otu				4148	-
252	PAPAVERACEAE	•*Glaucium grandiflorum* Boiss. et Huet var. *grandiflorum*	lale				3432	-
253	POACEAE	•*Bromus tectorum* L.	pisik otu				4127	-
254	PRIMULACEAE	•*Anagallis arvensis* L. var. *caerulea* (L.) Gouan	dağ irehanı				4137	-
255	RANUNCULACEAE	•*Consolida orientalis* (Gay) Schröd.	gelin çiçeği				4288-A	-
256	RESEDACEAE	•*Reseda lutea* L. var. *lutea*	eşek turpu				3329	-
257	SOLANACEAE	•*Datura stramonium* L.	eşek kestanesi				4286	-

Note: "•": Those who have local names but not used, "*": Cultural plants, "▲": Plants who are not grown in the study field but used. All the plants that are not marked with "*" and "▲" (Including those marked with "•") are natural plants / This is the list for the places plants are found: 1: Bağlarüstü village (Moramil), 2: Yassıçal town (Ebemi), 3: Vermiş village, 4: Ziyaret town, 5: Boğaköy village, 6: Amasya (Center).

According to the results of ethnobotany field research above mentioned, 127 of the plants were found in the study field are used as food. 34 of these are cultural plants. 7 of the plants used as food are endemic. 3 of these are geofyte (*Crocus ancyrensis*, *Iris galatica* and *Iris histrioides*). *Crocus ancyrensis* has been consumed as raw bulbs and *Iris galatica* and *Iris histrioides* have been consumed as raw bulbs and petals. In the case of another endemic species (*Wiedemannia orientalis*) the nectars under the petals have been consumed. The fruits of *Lycium anatolicum* is consumed by local people and *Sideritis dichotoma* is used as tea. *Satureja wiedemanniana* is used as spices. The most commonly used plant as food is called "pancar" and sold in the markets in the months of September-October and March-April. Some of these plants are consumed by itself and some of them are mixed and consumed that way. Local people consume shoots and leaves of 59 plants, roots of 2 plant, bulbs of 8 plants, fruits and seeds of 42 plants, flowers of 11 plants. 7 of the plants are used as tea, 9 of them are used as spice, 8 of them are used for appetizers, 7 of them are used as gum and 1 of them is used as starter. In the field, two mushroms are used as food.

Amasya is an important place since the first akrabazin and the first surgery book was written here (Alpınar, 1979). It was observed that 93 of the plants in the study field are used for alternative medication. Of these, 65 were natural and 28 were agricultural plants. 4 of the plants used for medical purposes are endemic. These are *Heracleum platytaenium* (in the case of sunshock, the leaves of the plant are boiled in the water and this water is used for bath), *Satureja wiedemanniana* (it is used as tea for cold), *Sideritis dichotoma* (it is uses as tea for cold), *Euphorbia cardiophylla* (it is used for verruca). Most of the plants used for folk medicine is used as tea, sometimes they are used as creme (for instance, *Echium italicum*). In the study regions (in Bağlarüstü, Boğaköy and Vermiş villages; Ziyaret and

Yassıçal towns; Amasya Center), the examples of the plants which cure the diseases can be also given as follows:

Hemorrhoid: *Ficus carica* ssp. *carica*, *Malva sylvestris*, *Achillea biebersteinii*, *Cupressus sempervirens*, *Solanum melongena*, *Teucrium polium*, *Paliurus spina–christi* etc.

Inflammation: *Petroselinum crispum*, *Sorbus domestica*, *Plantago major* ssp. *major* .

Nephritis: *Hypericum perforatum*, *Helichrysum plicatum* ssp. *plicatum*, *Equisetum ramosissimum*, *Petroselinum crispum*, *Zea mays*.

Cholesterol: *Juglans regia*, *Fumaria officinalis*, *Malus communis*, *Urtica dioica*, *Tribulus terrestris*.

Heart disease: *Crataegus orientalis* var. *orientalis*, *Melissa officinalis* ssp. *officinalis*, *Berberis vulgaris*, *Tribulus terrestris* (çoban çökerten), *Pistacia terebinthus* ssp. *palaestina*, *Allium sativum*.

Cold and cough: *Cydonia oblonga*, *Sideritis dichotoma*, *Satureja wiedemanniana*, *Taraxacum officinale*, *Rumex scutatus*.

Gastritis and gastric ulser: *Convolvulus arvensis*, *Hypericum perforatum*, *Momardica charantia*.

Diarrhea: *Pyrus elaeagnifolia* ssp. *elaeagnifolia*, *Rosa canina*, *Solanum tuberosum* (patates), *Sorbus domestica*.

Constipation: *Malva sp*., *Hibiscus esculentus*, *Cassia angustifolia*.
Intestinal parasite: *Cucurbita pepo*, *Beta vulgaris* provar. *altissima* .
Diabetes mellitus: *Punica granatum*, *Zizphus jujuba*, *Urtica dioica*, *Helianthus tuberosus*, *Juniperus oxycedrus* ssp. *oxycedrus*, *Taraxacum officinale*, *Pinus sp.*
Cancer: *Urtica dioica*, *Epilobium angustifolium* (especially for prostrate cancer), *Momardica charantia* (especially for intestine cancer).
Sinusitis: *Ecballium elaterium.*

Besides these, in the study areas the plants whose parts are used for different purposes are found among both natural and wild plants. The examples can be given below:

Achillea biebersteini (kesik otu): Against hemorrhoid, urethra inflammation and gynecological diseases; as antiseptic.
Alcea pallida (fatmagül): For respiratory system diseases (bronchitis, asthma) and coughing; against sunstroke and tonsillit.
Carduus nutans (peygamber düğmesi): Against hemorrhoid and diarrhea
Plantago major ssp. *major* (bağ yaprağı): For development of furuncles; vasodilator; regulating nerve system; to prevent inflammation.
Peganum harmala (üzerlik,güzellik): For hemorrhoid and varix; as making sleppy.
Ecballium elaterium (yabani kavun): For treating sinusitis and jaundice; against rheumatism.
Urtica dioica (ısırgan): For preventing calcify of articulation, lumbago and hernia; against coughing; decreasing cholesterol and diabetes; for treating urethra inflammation; against coming out of hair and eczema.
Crataegus orientalis var. *orientalis* (aluç): Against to calcify, rheumatism and arteriosclerosis.
Juniperus oxycedrus ssp. *oxycedrus* (ardıç): Against diabetes, tuberculosis and stomach diseases.
Matricaria chamomilla var. *recutita* (koyun gözü): Losing weight; pain killer; preventing coming out of hair.
Teucrium polium (harman otu): Against hemorrhoid; as a pain killer.
Thymus sipyleus ssp. *rosulans* (kekik otu): Against abdominal ache and catching cold.
Malus communis (misket: Amasya elması): For preventing coughing; treating burnt place caused by hot water. Its vinegar used for losing weight and vasodilator.
Cupressus sempervirens (selvi): Against hemorrhoid and aphtha.
Ficus carica ssp. *carica* (incir) : Against hemorrhoid and verruca.
Linum bienne (sağrek): For development of furuncles; against swollen place and spraining.
Allium cepa (soğan): For development of furuncles; against colding.
Allium sativum (sarımsak): Tension regulator; decreasing cholesterol; treating ear inflammation and ache; against bronchitis.
Juglans regia (ceviz): Against eczema; preventing of coming out of hair; decreasing cholesterol.
Sorbus domestica (üvez): Against diarrhea, urethra inflammation and renal stone.
Petroselinum crispum (madenüs): Against urethra inflammation; for losing weight; preventing abdominal ache; diurethic.
Brassica oleracea var. *oleracea* (kelem): For development of furuncles; against bronchitis.
Tilia rubra ssp. *caucasica* (ıhlamur): For preventing to cold; against tooth inflammation.
Momardica charantia (kudret narı): For stomach ulcer, colon cancer, sunburne and rheumatism.
Cerasus avium (kiraz): As a sedative and pain killer; preventing urethra inflammation; for losing weight.

It was determined that in Amasya 12 plants are used as fuel. 4 of these are cultural plants. *Quercus pubescens* and *Quercus cerris* var. c*erris* are called "pelit" and used as fuel. This is at the top of the list of the plants used as fuel. Of the fuel plants, *Carpinus orientalis* ssp. o*rientalis* and *Carpinus betulus* are called "meşe" (*Fagus orientalis* is not grown in the study area but it is also called by local people as "gürgen"). Furthermore; the inner shells of hazelnut and walnut are used as igniter. Other igniters in the field are from various pine trees ("karaçam, sarıçam, kızılçam, fıstık çamı") and especially their parts that consist of gums such as stems ("çıra"), cones and leaves. In addition to these, pine woods are used as fuel. Other than these trees, wheat, barley and sunflower are used as fuel after their seeds are taken.

It was deterrmined that 16 plants are used for animal feeding. Four of these, namely *Avena sativa, Secale cereale* var. *cereale*, *Hordeum vulgare,* and *Vicia anatolica* are cultural plants. The uses of thorny plants *Acantholimon acerosum* var. *acerosum*, *Astragalus pseudocaspius* and *Astragalus angustifolius* ssp. *pungens* are quite interesting. Of these three plants, the thorns are burned when they are fresh or dry. Then, the plant is crushed and mixed with straw and is given to animals. It is stated by the local people that these plants are quite oily. Leaves of *Lactuca serriola* are given to baby goose the plant is called "baby goose plant". Other than these, *Avena fatua* var. *fatua*, *Vicia cracca* ssp. *stenophylla*, *Hordeum murinum* ssp. *glaucum*, *Caucalis platycarpos*, *Turgenia latifolia*, *Medicago minima* var. *minima* and *Medicago sativa* ssp. *sativa* are used animal food in the study area.

Among the handicrafts that are made by using plants paint, mat and basket, brom, woodwork (toys and musical instrumants), beads, charm against the evil eye, various handhold and souveniers can be counted. 60 plants are used for this purpose and 17 of them are cultural plants. 3 of these plants (*Heracleum platytaenium, Anchusa leptophylla* ssp. *incana, Muscari bourgaei*) are endemic.

Other than these basic uses of the plants there are some social and singular usages in the study area. Some of these are *Peganum harmala*, *Vitis sylvestris* and *Zea mays* (to make incence against evil eye), *Silene alba* ssp. *eriocalycina*, *Leontice leontopetalum* ssp. *leontopetalum* and *Coluta cilicica* (children use for play), *Bifora radians* and *Ailanthus altissima* (known with its odor), *Elaeagnus angustifolia*, *Lonicera etrusca* var. *etrusca* and *Zizyphus jujuba* (liked with their aroma). Another interesting thing determined in the study field is that "*Salvia sp.*" known as "adaçayı" in Turkish (Karabacak et al., 2009) and used to obtain tea is used for different purposes with a name "ellik otu" to handle agricultural equipment.

4. Conclusions and discussion

The tables summarizing the results of the evaluated field study were provided (Table 4, 5, 6).

Table 4. Data related to the results of the study

Number of specimens	350
Number of identified species	257
Number of useful species	236
Number of species that are not used but names are determined	21
Number of endemics	12

Table 5. Number of usages of the species in various categories

Categories	Native species	Cultivars	Total
Edible	93	34	127
Medicinals	65	28	93
Fuel	8	4	12
Fodder	12	4	16
Handicrafts	43	17	60
Others	41	8	49
Plants whose usages were not determined	21	-	21

Table 6. Categorization of food plants acoording to how they are used

	Native species	Cultivars	Total
Root	1	1	1
Bulb	6	2	8
Leaves and shoots	51	8	59
Fruits and seeds	29	13	42
Mushrooms	1	1	2
Flowers	10	1	11
Tea plants	6	1	7
Spices	7	2	9
Appetizers	5	3	8
Gum	7	-	7
Starter	1	-	1

407 recipes were collected in the evaluated study that conducted in the forementioned field. Of the 257 plants determined, 211 were natural and 46 were cultural. Although there are overlaps among the plants used for medical and food purposes, there are two class mushrooms, 1 class lichens, and 87 class seedy plants totaling to 257 takson, it was determined that 127 plants are used for food, 93 for medicine, 12 for fuel, 16 for animal food, 60 for handycrafts, and 49 for various purposes. The names of the 21 plants which are named in the region but are not used were added to the end of main inventory list. Of the 257 plants, 12 (4.66 %) are endemic to Turkey. All of the endemic plants used in the

study are in "LR (Ic)" danger category (LR-Lower risk, Ic-Least concern) (Ekim et al., 2000). That is to say, the endemic plants in the region don't need protection and they are not endangered species.

The earliest study carried out in Amasya region is by Alpınar in 1979 (Alpınar, 1979). This study was conducted in Akdağ and its surrounding villages and in Amasya Center. In this study, the local usage of 36 plants and 60 plants with local names specific to Amasya were determined. There is also another study by Fujita et al. which covers Middle Black Sea including Amasya and Western Black Sea region too (Fujita et al., 1995). In this study, plants collected from Amasya center (Amasya Castle, Beldağ and Yuvaköy villages) and Taşova town (Destek) were evaluated with the help of local people. Another study done in Amasya is by Ezer and Mumcu-Arısan (Ezer and Mumcu-Arısan, 2006). Researchers in this study determined that in Merzifon (Amasya) 35 plant and 4 animal species and 1 inorganic and 3 animal resources are used form medical purposes. Another study done in Amasya region was carried out by Cansaran et al. This study was done in Ovabaşı, Akpınar, Güllüce and Köseler villages (Gümüşhacıköy/Amasya) (Cansaran et al., 2007a) and with the evaluation of 170 plant samples it was determined that 59 of them are used for food, 14 for medicine, 6 for fuel, 7 for animal food, 20 for handicrafts and 18 for various purposes. In addition to these, 136 recipes for various plants were collected.

Traditional plant knowledge can change within the time. However, ethnobotanic studies are important in terms of reflecting the culture of the regions. There have been only five ethnobotanic studies (including this evaluated study) in Amasya so far and three of them are only for medical usages (Alpınar, 1979; Ezer and Mumcu-Arısan, 2006; Fujita et al., 1995). There are common plants used for the same purpose in these studies (For example, *Ecballium elaterium* (L.) A. Rich. is used against sinusite, *Urtica dioica* L. is used for stomach problems, *Plantago major* L. subsp. *major* / is used against abscess). In addition to this, in three studies the medical usages of different plants or different medical usages of the same plants were seen. In two other studies carried out in Amasya, not only medical usages but also other usages of plants were examined (Cansaran and Kaya, 2006; Cansaran et al., 2007a). In both of these studies, using plants as foods were commonly observed. This situation signifies that local people consume them as food. In both studies, medical usage comes right after the usage of the plants as food.

As a result, in Turkey where there is an abundant variety in terms of plants and one third of the plants are endemic, carrying out ethnobotanic studies and determining the local cultures are extremely important. Recording how local people use the plants, preparing an inventory and offering for the use of masses are extremely important both for us and for the generation to come. With this study, the ethnobotanic wealth of a certain region in Amasya which is in Middle Black Sea Region (Turkey) is determined.

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An investigation on determining the most suitable nitrogen and zinc fertilizer doses for the main crops of Sorghum-Sudangrass Hybrids (*Sorghum bicolor* X *Sorghum sudanense*) in the Çukurova Region (Turkey)

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Abstract

This study was carried out in order to determine the most suitable nitrogen and zinc fertilizer doses for the main crops of sorghum-sudangrass hybrids in the Çukurova Region during 2001-2002 at Çukurova Agricultural Research Institution. Grazer cultivar of Sorghum-Sudangrass hybrids and as pure fertilizer doses 0, 7, 14, 18, 24 kg/da nitrogen and 0, 0.5, 1.0 kg/da zinc were used in the study. As a result of this research, while the highest total fresh yield was obtained with 5722.97 kg/da value from N18-Zn0 treatment, the lowest total fresh yield was obtained with 4415.00 kg/da value from N0-Zn0 treatment. While the highest total dry matter yield was obtained with 1602.87 kg/da value from N14-Zn1 treatment, the lowest total dry matter yield was obtained with 1185.88 kg/da value from N0-Zn0.5 treatment. In general, the effect of nitrogen and zinc treatments on the fresh and dry matter yield was found to be significant. While the highest crude protein yield was obtained with 5498.085 kd/da value from N18-Zn0 treatment, the lowest crude protein yield was obtained with 4030.665 kg/da value from N0-Zn0.5 treatment. In general, N and Zn application increased crude protein yield. While the ADF rate was obtained with % 47.560 values from N7-Zn1 treatment, the lowest ADF rate was obtained with % 44.525 values from N0-Zn0.5 treatment. The rate of increasing Zinc ration caused maturation, low protein and high ADF contents.

Key words: Sorghum-Sudangrass Hybrids, Nitrogen, Zinc, Yield

1. Introduction

Turkey's total land area is 783,577 km^2, of which 759,752 km^2 are in Asia and 23,825 km^2 in Europe. The population was 65,311,000 in 2000. The agricultural population is declining year by year. While half of the population was involved in agriculture in 1983, this is now 34 % (22,205,740) (SIS-State Institute of Statistics, SPO - State Planning Organization, 1994)

Turkey has favorable conditions for animal husbandry. Traditionally most farmers in many parts of Turkey are involved in raising a few cattle, some small ruminants and poultry to meet their domestic needs.

There are 20 indigenous cattle breeds, 17 sheep breeds and 5 goat breeds (Akman et all, 2000). The ruminant population in 2001 was 10,686,000 heads of cattle and buffalos, and 33,994,000 heads of sheep and goats (SIS, 2002 a,b).

Most of the cattle are still raised under traditional management approaches based mainly on extensive grazing, and receiving poor quality feed, particularly in winter, and in most cases very little animal husbandary care except for vaccination. Similarly a high proportion of small ruminants is raised under traditional systems. Since 1990, the number of small ruminants has decreased, while cattle numbers are stays almost stable. This indicates a structural change in the livestock sector through a move to more intensive systems.

Quality forage sorghum silage is a useful feed for dairy and beef cattle, but it is lower in feeding value than well-cured, well-matured corn silage. The farmers' main interest in growing sorghum for silage is to produce a high dry matter yield with a low water requirement. (Extending Livestock Feed Supplies, 2003).

Sudangrass and sorghum-sudangrass hybrids provide excellent temporary pasture. Seeding in late May or early

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June will provide three to four times grazing. They can also be harvested for hay or silage. Total yields generally increase with delaying harvesting time from vegetative stage through boot, flower and dough stages; however, protein concentration decreases.

The hybrids offer increased vigor and higher forage yields, a particular advantage is silage and hay when they are harvested for.

Increased feeding frequency of low fiber, high grain diets increases milk fat levels. Cows require a minimum acid detergent fiber (ADF) level of 19 to 21 % of dry matter in the ration. Maintain total neutral detergent fiber (NDF) intake above 26 % of the total ration dry matter. Below these levels, cows are at an increased risk for acidosis, feed intake fluctuations, laminitis, and rapid and extensive body condition loss especially in early lactation. Protein Feeding Guidelines: Generally, dietary crude protein level affects milk yield but not milk protein percent, unless the diet is deficient in crude protein. Normal changes in dietary protein ranges do not consistently affect milk fat percentage. Theoretically, insufficient amounts of rumen-degradable protein might result in decreased milk fat percentage if the concentration of ammonia in the rumen does not support the optimal digestion of fiber and microbial growth. The crude protein requirement for a 612.35 kg cow producing 3.6 % milk fat ranges from 14.0 % of total dry matter (TDM) for 22.68 kg of milk to 18.0 % TDM for 45.36 kg of milk. Depending on the stage and level of production, the recommended level of undegradable protein ranges from 32 % to 38 % of crude protein. Keep soluble protein between 30 to 32 % of crude protein, or about half of the degradable protein intake level. It is essential to meet the cow's requirement for both crude protein and rumen undegradable protein to avoid a negative impact on dry matter intake and fiber digestibility (Looper, 2001).

Crude protein in the present study is at the level permissible for optimal feed intake and rumen function considering the IVDMD of 61% DM. (Abdulrazak et all, 2000)

Sudangrass and sorghum-sudangrass crosses require adequate nitrogen fertilization to ensure maximum yield. Phosphorous, potassium and other nutrients may also be needed by the crop (Parker et all, 2004)

Adequate levels of nitrogen (N), phosphorous (P) and potassium (K) are important if good growth rates are to be achieved. Forage sorghum is sensitive to zinc deficiency and to some extent manganese and sulphur deficiencies. To prevent micro-nutrient deficiency, trace elements should be applied three to five weeks after emergence as a foliar treatment, based on plant tissue test results.

Development of methods to adjust N rates in relation to the amount of N supplied by indigenous soil resources. As a result, N fertilizer recommendations are typically made for districts or regions with the implicit assumption that soil N supply is relatively uniform within these domains.

Recent work has shown the importance of root-induced changes in the rhizosphere for solubilizing Zn and increasing its plant uptake.

The efficiency of utilization of N by maize and sorghum (defined as grain yield per unit N uptake) varies under different climatic, soil, and management conditions (Fischer, 1998).

Nitrogen is the most limiting nutrient for grain sorghum and forage sorghum production. Adequate soil fertility is one of the requirements for profitable grain and forage sorghum production. N is the most yield-limiting nutrient, unless high N fertilizer rates or manure applied to the previous crop have left high residual NO_3-N levels in the soil. P is the next most limiting nutrient, while Zn and Fe also may be limiting in some soils.

Zn deficiencies are common on soils where the subsoil is exposed, or on soils with high levels of free lime. Zn availability decreases with increasing soil pH, and most Zn deficiencies are reported on soils with pH levels higher than 7.0. Incorporation of manure in eroded soils may correct Zn deficiencies, as well as improve soil structure.

Zn is involved in the necessary functions of plant growth. It helps produce auxins, a growth-promoting substance that controls growth of shoots. Zn also forms enzyme systems, which regulate plant life.

Because of its high insolubility and immobility in the soil, zinc should be applied under the subsoil with a starter fertilizer or by root zone handing.

This study was carried out in order to determine the most suitable nitrogen and zinc fertilizer doses at sorghum-sudangrass hybrids in the Çukurova Region.

2. Material and methods

This study was carried out in order to determine the most suitable N and Zn fertilizer doses at the main crops sorghum-sudangrass hybrids in the Çukurova Region during 2001-2002 at Çukurova Agricultural Research Institution. Grazer cultivar of Sorghum-Sudangrass hybrids was used as crop material and pure fertilizer doses 0, 7, 14, 18, 24 kg/da N and 0, 0.5, 1.0 kg/da Zn nutrient doses in this study.

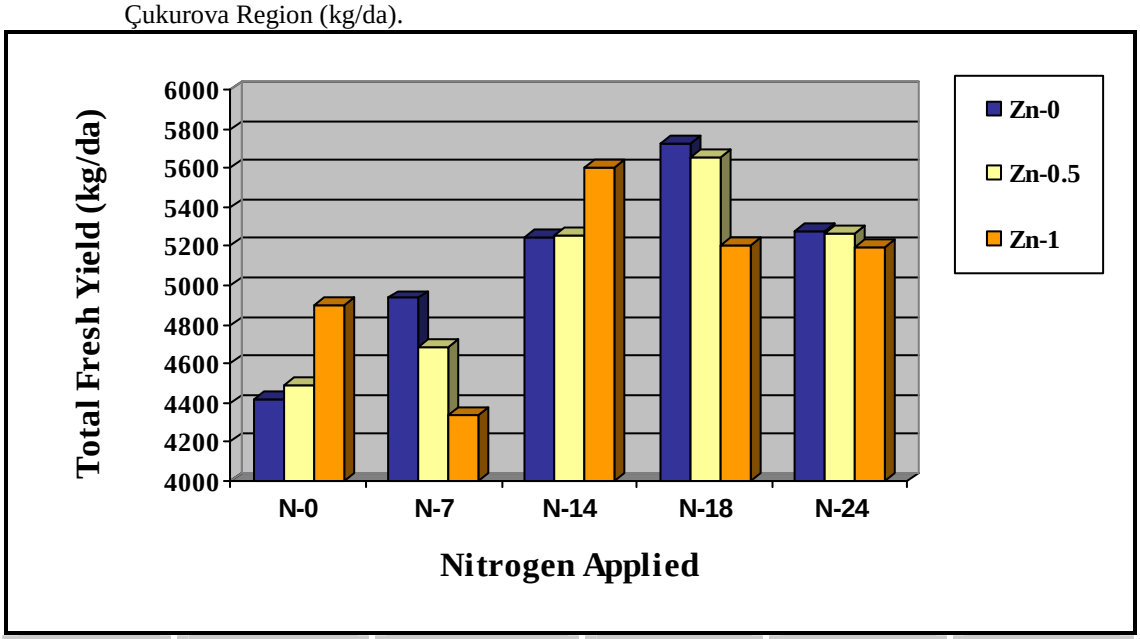
The trial was split-split plot block design with three replication. In the trial cuttings form main parcels,nitrogen doses form sub parcels, and zinc doses form sub-sub parcels. The plants were established in plots of 2.8 x 5 m and each parcel was planted in 4 rows at 0.75 m spacing.

Samples were taken randomly from the three replicates at the vegetative stage dried and stored until analysed. The dried samples were ground to pass through a 2 mm screen and analysed for acid detergent fibre (ADF), nitrogen (Kjeldahl method). Acid detergent fiber was measured by the methods described by Van Soest (1967).

3. Results and discussion

Total Fresh Yield obtained from Different N and Zn Fertilizer Doses at Sorghum-Sudangrass Hybrids in the Çukurova Region are presented in figure 1.

Figure 1. Total Fresh Yield from Applied Different N and Zn Fertilizer Doses at Sorghum-Sudangrass Hybrids in the Çukurova Region (kg/da).



	N-0	N-7	N-14	N-18	N-24
Zn-0	**4415,00**	4933,25	5248,67	**5722,97**	5271,35
Zn-0.5	4486,45	4686,42	5258,67	5649,13	5261,97
Zn-1	4897,58	4334,85	5604,70	5204,70	5192,85

According to results given in figure 1, in general, nitrogen application increased total fresh yields but not after 18 kg/da N doses. According to work by Johnston (2000), N fertilizer has significantly increased yield in the past few decades as compared to any other agricultural input. Smith et al (1990) reported that corn and sorghum yield would have dropped by 41 and 19%, respectively, without N fertilizer application. This increasing total fresh yield with N application up to N-18 application and then, increasing N application caused to a reduction total fresh yield.

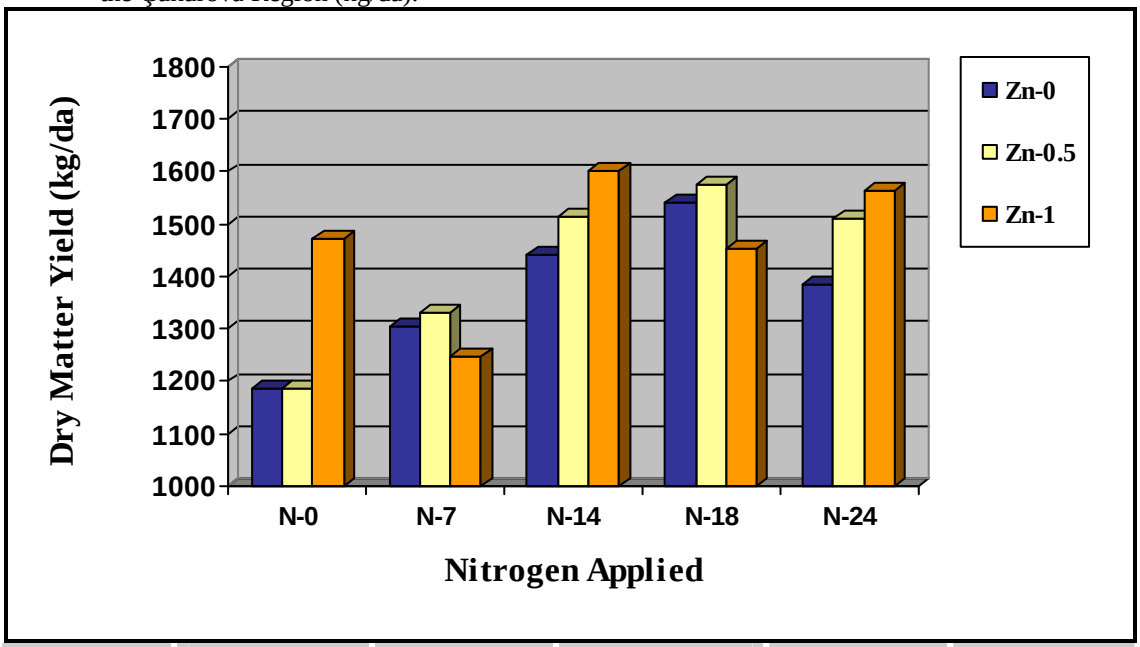
No signification differences in total fresh yield were observed in Zn application. However, especially N-0 and N-14 application together Zn application increased total fresh yield. In addition, while the highest total fresh yield was obtained with 5722.97 values from N-18, Zn-0 application, the lowest total fresh yield was obtained with 4415.00 values from N-0, Zn-0 application.

Total Dry Matter Yield obtained from Different N and Zn Fertilizer Doses at Sorghum-Sudangrass Hybrids in the Çukurova Region are shown in figure 2.

In regard to figure 2, nitrogen application had a positive impact on dry matter yield but this impact was not as effective as total fresh yield. Zn application had the most efficient impact on dry matter yield especially at the application of Zn-0.5.

In addition to, while the greatest dry matter yields occurred with 1602.87 values from application of N-14 and Zn-1, the littlest dry matter yields occurred with 1185.88 values from application of N-0 and Zn-0.5.

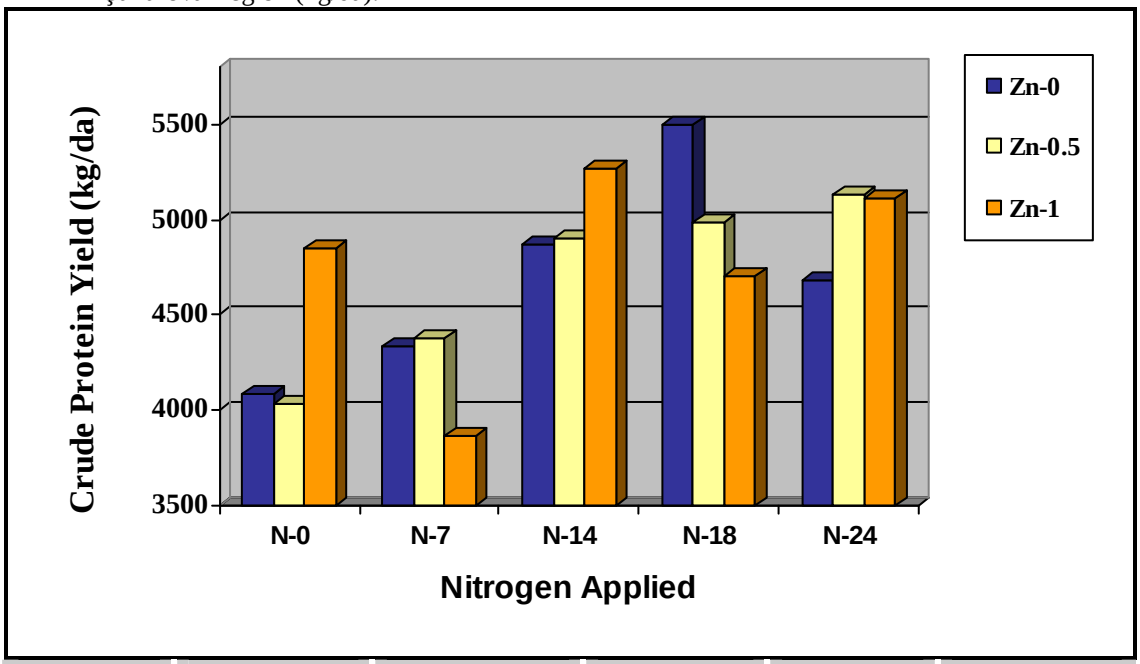
Figure 2. Total Dry Matter Yield from Applied Different N and Zn Fertilizer Doses at Sorghum-Sudangrass Hybrids in the Çukurova Region (kg/da).



	N-0	N-7	N-14	N-18	N-24
Zn-0	1188,42	1306,22	1440,88	1542,52	1385,88
Zn-0.5	**1185,88**	1331,63	1513,50	1575,03	1510,57
Zn-1	1471,98	1245,88	**1602,87**	1453,48	1563,30

Crude Protein Yield obtained from Different Nitrogen and Zinc Fertilizer Doses at Sorghum-Sudangrass Hybrids in the Çukurova Region are shown in figure 3.

Figure 3. Crude Protein Yield from Applied Different N and Zn Fertilizer Doses at Sorghum-Sudangrass Hybrids in the Çukurova Region (kg/da).



	N-0	N-7	N-14	N-18	N-24
Zn-0	4084,670	4336,835	4872,670	**5498,085**	4680,750
Zn-0.5	**4030,665**	4377,830	4902,500	4988,915	5135,165
Zn-1	4848,330	3866,585	5264,835	4698,500	5112,080

According to results given in figure 3, in general, N application increased crude protein yield. This increasing crude protein yield with N application up to N-18 application and then, increasing N application caused a very little reduction of crude protein yield. N is normally used by plants for chlorophyll and protein production, which in turn is used in formation of new plant cells (Pall et all, 1996).

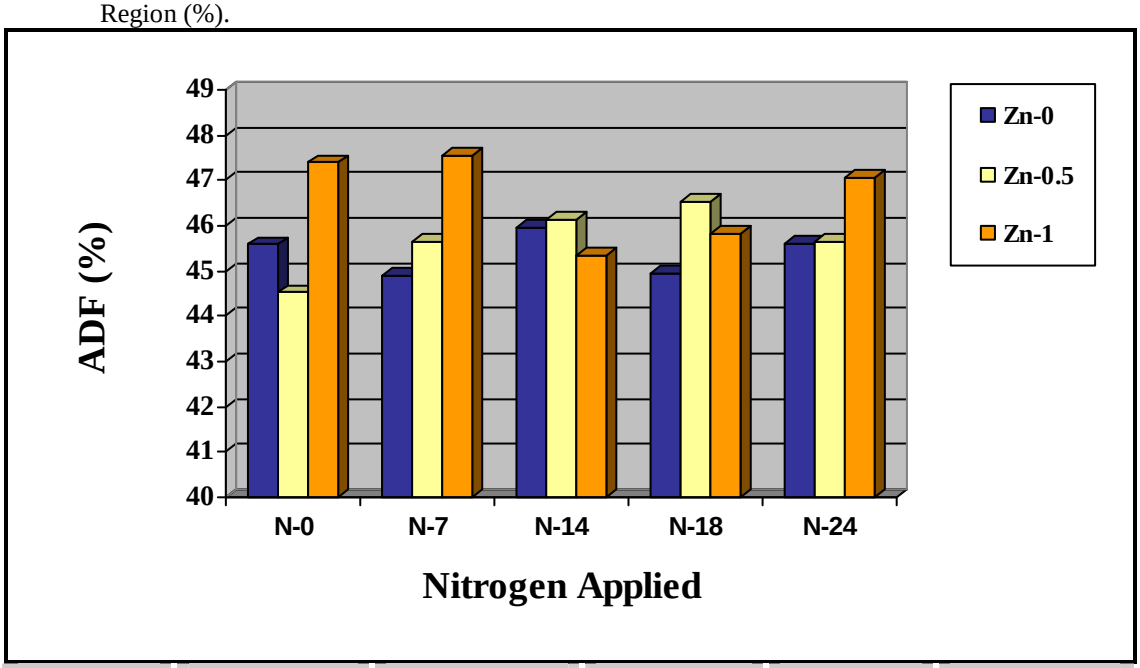
Zn application had the most efficient impact on crude protein yield. Especially at the application of Zn-1 with N-0 and N-14 caused the most efficient impact on crude protein yield.

Generally, according to work by Madibela and Modiakgotla (2004), CP content is positively correlated with quality. In other words, high-protein forages generally are high-quality forages. CP content is positively correlated to energy content of forages. High-protein forages generally are more digestible and provide more energy per pound than low-protein forages.

In addition to, while the greatest crude protein yields occurred with 5498.085 kg/da value from application of N-18 and Zn-0, the littlest crude protein yields occurred with 4030.665 kg/da value from application of N-0 and Zn-0.5.

ADF Rate obtained from Different Nitrogen and Zinc Fertilizer Doses at Sorghum-Sudangrass Hybrids in the Çukurova Region are shown in figure 4.

Figure 4. ADF Rate from Applied Different N and Zn Fertilizer Doses at Sorghum-Sudangrass Hybrids in the Çukurova Region (%).



	N-0	N-7	N-14	N-18	N-24
Zn-0	45,580	44,910	45,950	44,950	45,590
Zn-0.5	**44,525**	45,635	46,135	46,510	45,660
Zn-1	47,390	**47,560**	45,350	45,830	47,070

In regard to figure 4, in generally, N application had a no positive impact on ADF rate, but Zn application had the most efficient impact on ADF rate. Especially at the application of Zn-1 caused the most efficient impact on ADF rate. Weiss et al (1999) reported that fiber content of forages is inversely related to quality. Forages with high concentrations of fiber generally will support less milk production than will low-fiber forages. Plant fiber is composed largely of cellulose and hemi cellulose.

Fiber content and energy content are closely related since almost all laboratories use fiber (either ADF or NDF) to estimate available energy. Concentration of fiber is negatively related to quality because forages with high concentrations of fiber contain less available energy and are consumed in lesser amounts by cows than are forages with low amounts of fiber.

In addition to, while the greatest ADF rate occurred with % 47.560 values from application of N-7 and Zn-1, the littlest ADF rate occurred with % 44.525 values from application of N-0 and Zn-0.5.

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A new distribution area of *Asperula daphneola* (Rubiaceae) in Western Turkey and it's new recommended IUCN threat category

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Abstract

The *Asperula daphneola* O. Schwarz is a local endemic species in West Anatolia. It has been classified within VU (vulnerable) category of IUCN from Ekim at al. (2000). Until now, *A. daphneola* has been known from the single locality (Nif Mountain). A new distribution area of this species was found out by authors of this article in 2009 at Mahmut Mountain, above Armutlu in the province İzmir. This species disclosed distribution 1350 m altitude on limestone rock. A taxonomic description, the illustrations and of the *A. daphneola* which gathered from Mahmut Mountain are given. Our studies led us to recommend it as CR B1ab(iii)+2ab(ii,iii), according to the 2001 IUCN categories.

Key words: A new distribution area, Rubiaceae, Asperula, İzmir, Mahmut Mountain

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Özet

Asperula daphneola O. Schwarz Batı-Anadolu'ya ait lokal bir endemik türdür. Ekim ve ark. (2000) tarafından IUCN kategorilerinden VU (duyarlı) kategorisi içerisinde sınıflandırılmıştır. *A. daphneola* şimdiye kadar sadece tek (Nif Dağı) lokaliteden bilinmekteydi. Bu türün yeni bir yayılış alanı makalenin yazarları tarafından 2009 yılında İzmir ili, Armutlu yukarısı, Mahmut Dağı'nda bulunmuştur. Bu tür, 1350m yükseklikte kalker kaya üzerinde yayılış göstermektedir. Mahmut Dağı'nda toplanan *A. daphneola* örneklerine ait taksonomik bir betimi ve resimleri verilmiştir. Çalışmalarımız sonucunda tür, IUCN (2001) kriterlerine göre CR B1ab(iii)+2ab(ii,iii), olarak önerilmiştir.

Anahtar kelimeler: *Yeni bir yayılış alanı, Rubiaceae, Asperula, İzmir, Mahmut Dağı*

1. Giriş

Asperula, bünyesinde başka cinslerden üyeleri de barındırabilen, homojen olmayan bir cinstir. Dünyada yaklaşık olarak 100-150 kadar tür ile temsil edilir. Cinsin gen merkezi Akdeniz fitocoğrafik bölgesi ve Güney-Batı Asya'dır. Bu cinsin en karakteristik ve diğer yakın cinslerden farklı kılan özelliklerinin başında çiçek yapılarıdır. *Galium* cinsinden ayıran en temel özellik çiçek tüpünün boyudur. Bu cinse ilişkin ilk anlamlı taksonomik çalışma Scopoli (1771) tarafından yapılmıştır. Scopoli, Linnaean'ın *Asperula* cinsi içerisine koyduğu tüm taksonları (*A. arvensis* hariç) *Galium* cinsine transfer etmiş ve bu durumda *A. arvensis*, *Asperula* cinsine ait tip örneği olarak atanmıştır (Ehrendorfen ve Schönbeck-Temesy 1982).

Asperula cinsi Türkiye'de toplamda 51 takson içerir. Bunlardan 25 tanesi endemiktir. Toplamda 6 seksiyona ayrılmıştır. Bunlar; *Cruciana, Oppositifoliae, Cynanchicae, Glabelle, Asperula* ve *Thliphthisa* seksiyonlarıdır. *Asperula daphneola* bu seksiyonlardan *Cynanchicae* altında yer alır ve 1934 yılında O. Schwarz tarafından İzmir ili, Kemalpaşa-Nif Dağı'nda keşfedilip bilim dünyasına tanıtılmıştır. *Asperula daphneola* aynı seksiyonda yer alan ve Yunanistan'da yayılış gösteren *A. pulvinaris* (Boiss.) Heldr. ex Boiss. ve *A. icarica* Ehrend. & Schonb ile yakın akrabadır. Bu üç türün yayılış alanları olasılıkla son buzul devrinden kopuş göstermiştir (Verdier, 1963). Bu üç yakın türden yalnızca *A.*

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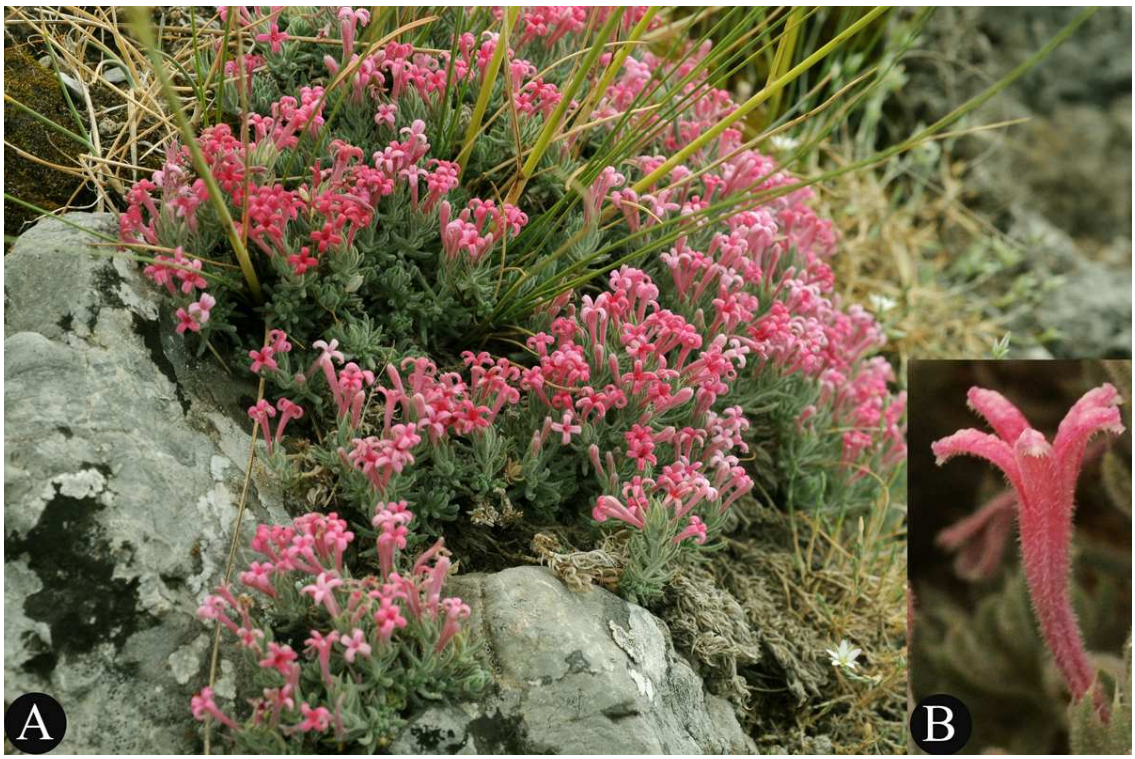
daphneola, Red Data Book of Turkish Plants (Ekim ve ark., 2000)'a göre IUCN tehlike kategorilerinden "duyarlı" (VU) kategorisinde yer alır. Bu tür üzerinde Gücel ve Seçmen (2009) tarafından populasyon düzeyindeki yapılan ayrıntılı çalışmalar sonucunda IUCN (2001)'e göre "CR B2ab(ii)+(iii)" kategorisinde olması önerilmiştir.

Şuana kadar sadece tek lokaliteden bilinen ve toplamda 2,6 km^2'lik bir alanda yayılış gösteren Türkiye'nin lokal bir endemiği olan *A. daphneola*'ya ait yeni bir lokalite 2009 yılında makalenin yazarları tarafından bulunmuştur. Benzer şekilde Türkiye florasında tek lokaliteden bilinip, son yıllarda gerçekleştirilen floristik çalışmalar sonucunda *Teucrium paederotoides* Boiss. et. Hausskn (Özuslu ve Öztekin, 2008) ve *Flueggea anatolica* Gemici (Ok ve Avşar, 2009) örneklerinde de olduğu gibi türlere ait yeni populasyonlar tespit edilmekte ve yayılış alanları genişletilmektedir. Bu tarz çalışmalar ile bulunan yeni lokaliteler türlerin tehlike kategorilerinin yeniden belirlenmesinde önem arz etmektedir.

2. Materyal ve yöntem

Bu çalışmanın materyalini *Asperula daphneola'*ya ait örnekler oluşturmaktadır. 26 Mayıs 2009'da İzmir, Armutlu yukarısı, Mahmut Dağı'na düzenlenen bir arazi çalışması esnasında toplanan bazı *Asperula* örnekleri, Türkiye Florası'na (Ehrendorfen ve Schönbeck-Temesy 1982) göre teşhis edilmiş ve teşhis sonucunda *A. daphneola'*ya ait örnekler oldukları saptanmıştır (Şekil 1, 2). Toplanan *Asperula* örnekleri, Ege Üniversitesi Herbaryumu'nda (EGE) bulunan *A. daphneola'* ya ait örnekler ile de karşılaştırılmıştır.

Arazi çalışmaları esnasında toplanan örnekler Ege Üniversitesi Herbaryumu (EGE) koleksiyonuna dahil edilmiştir (Şekil 2).

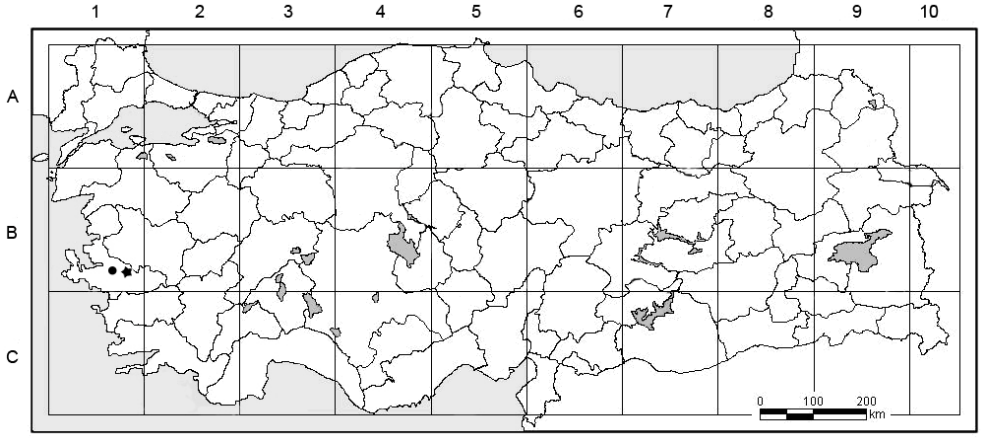


Şekil 1. *A. daphneola'*nın (İzmir-Mahmut Dağı) A−Genel görünüşü B−Korollası.

Sekil 2. *A. daphneola*'ya ait Mahmut Dağı'nda toplanan herbaryum örneklerine ait; A−Genel görünüşü, B−Üst gövde yaprakları, C−Ovaryum, D−Korolla'ları.

3. Bulgular

Asperula daphneola'ya ait yeni lokalite, Nif Dağı'na oldukça yakın bir mesafede, B1 İzmir: Armutlu yukarısı Mahmut Dağı, kuzey yamacı, 1350 m yükseklikte kalker kaya üzerinde tespit edilmiştir. Populasyon yaklaşık olarak 200 m^2 büyüklüğünde ve ergin birey sayısı 126 olarak sayılmıştır (Şekil 3).



Şekil 3. *A. daphneola*'nın (●)Türkiye Florası'ndaki ve(⛫) Tespit ettiğimiz yeni yayılış alanları.

A. daphneola'ya ait Mahmut Dağı'nda bulunan populasyonda toplanan örnekler üzerinde yapılan ölçümler sonucunda hazırladığımız taksonomik betim aşağıda verilmiştir.

Alçak boylu, grimsi yeşil, yastık formunda, çok yıllık. 5−25 cm çapında kümeler halinde. Gövde; çok sayıda, 1−3 cm boyunda yükselici veya dik dallı, dört köşeli, hispid tüylü. Yapraklar ± imbrikat dizilimli; taban yaprakları 3−4 × 0.6−0.8 mm, lanseolat ya da oblong, uçta kısa-sivri bir çıkıntı ile son bulur, ± tüysüz; orta ve üst yapraklar, linear, 7−10 × 1 mm, 0.5−1mm boyunda zarımsı kılçıklı, kenarlardan geriye dönük veya değil, yoğun hispid tüylü. Çiçekler

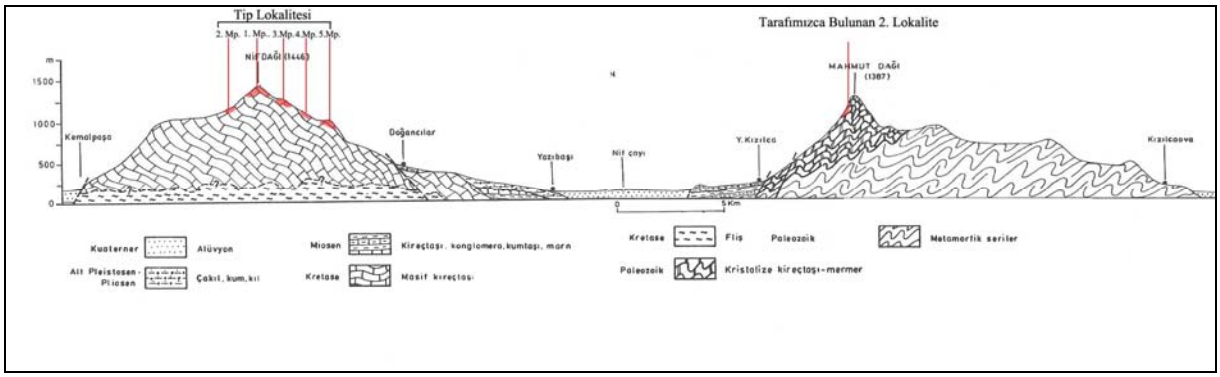
yapraksı brakte koltuklarında 2−4 adet; brakteler, koralla boyunun 2/3' ü kadar. Kaliks bulunmaz. Korolla soluk pembeden parlak pembeye kadar, 10−12mm, dar infundibular şekilli, dış yüzeyi hispid, loblar 2−2.5 mm, oblong dan lanseolat-oblong'a kadar, uçta zarımsı kısa bir çıkıntı ile son bulur. Ovaryum hispid tüylü. Çiçeklenme 5. ve 6. aylar.

Tür Mahmut Dağı üzerinde kristalize kalker-mermer anakaya üzerinde yayılış gösterirken, Nif Dağı'nda kalker ana kayadan kökenli topraklar üzerinde yayılışa sahiptir.

4. Sonuçlar ve tartışma

İzmir il sınırları içinde bugüne kadar sadece Nif Dağı'ndan bilinen lokal endemik bir tür olan *A. daphneola*'nın ikinci bir lokalitesi, bu alana çok yakın komşu bir dağ olan Mahmut Dağı'nda bulunmuştur. Mahmut Dağı, İzmir il sınırları içerisinde doğu-batı yönünde uzanan Bozdağ'lar serisinin en batı ucunu oluşturmaktadır. Bozdağ'lar serisi doğudan batıya doğru Karadağ, Bozdağ (2159 m), Keldağ (1372 m), Çatma Dağı, Çal Dağı (1407 m), Mahmut Dağı (1378 m) şeklinde devam eder ve Mahmut Dağı ötesinde, muhtemelen Orta/üst Miosen'de gelişen Karabel Neojen çukuru ile ve Nif Dağı'ndan ayrılır, (Koçman, 1989). Mahmut, Nif Dağı arası mesafe kuş uçuşu yaklaşık 20 km' dir (Şekil 4).

Gücel ve Seçmen (2009) tarafından gerçekleştirilen ve türün koruma biyolojisi ile çalışmada temelde türe ait üreme başarısının düşük olduğu belirlenmiştir. Populasyon büyüklüğü ve yayılım alanının ise İzmir ili, Kemalpaşa ilçesi, Nif Dağı'nı oluşturan tepelerde 5 meta populasyondan oluştuğu belirtilmiştir (Şekil 4). Türün yayılış yüksekliği 1350-1500 m'ler arasındadır ve toplamda 2,6 km^2'lik bir alanda yaklaşık 7956 birey ile temsil edilmektedir. Türün yayılış alanı içerisinde parçalı bir yayılım göstermesi pek çok yüksek dağ taksonunda gözlemlenen bir özelliktir. Nif Dağı'nda yer alan 5 meta populasyonun alan büyüklükleri ve populasyonlardaki birey sayılarına bakılacak olursa; Nif zirve 1.5 km, 1786 birey, Alaca tepe 0.4 km^2, 888 birey, Ayrıca Tepe 0.4 km^2, 2652 birey, Bölme tepe 0.1 km^2, 1750 birey, Nif Dağı batı zirvesi 0.2 km^2, 880 bireydir. Tarafımızdan eklenen bu yeni lokalite (populasyon) ile türün yayılış alanı 2,8 km^2 ye, birey sayısı 8082'ye yükselmiştir.



Şekil 4. Nif ve Mahmut Dağları jeolojik kesiti (Koçman, 1989) ve *A. daphneola* populasyonları (Mp.: meta populasyon).

Ancak belirlenen bu yeni lokalitade yer alan populasyonun oldukça küçük bir alanda (yaklaşık 200 m^2) yayılış göstermesi ve ergin birey sayısının (126 birey) oluşu bu populasyonun sürekliliği açısından sorunlu olacağını düşündürmektedir. Mahmut Dağı eteklerinde yer alan Yukarı Kızılca, Aşağı Kızılca, Armutlu ve Dereköy yerleşkelerinde özellikle küçükbaş hayvancılık yapılıyor olması bu populasyonun risk olasılığını arttırmaktadır. Mahmut Dağı zirveye yakın olan populasyonu tehdit eden bir diğer faktör ise, bitkinin habitatını oluşturan kristalize kalker-mermer anakayanın iklimsel parametrelere bağlı olarak parçalanması ve habitat genelinde yoğun erezyonun gözleniyor olmasıdır. Bu durumun, ergin bireylerin tutunmasını güçleştirmesi ve buna bağlı olarak, yakın gelecekte populasyonda birey kayıplarına sebep olması kaçınılmazdır.

Bu güne kadar tek lokaliteden bilinen bir tür olan *A. daphneola* adına yeni bir lokalite bulunmuş olması önemlidir. Ancak bu yeni populasyon bitkinin belirlenmiş toplam ergin birey sayısının ancak %1,5'lik kısmını oluşturmaktadır, %98,5'lik bölüm bitkinin tip lokalitesi olan Nif Dağı'ndadır. Nif populasyonunda oluşacak ani bir tahribat türün gen havuzunda büyük ve geri dönüşü olmayan kayıplara sebep olacaktır. Nif populasyonu üzerindeki tehditler Gücel ve Seçmen (2009) tarafından özellikle zirvede yer alan yangın gözetleme kulesi çevresindeki yapılaşma, alan kullanımı, radyo vericileri ve bunlara bağlı alan tahribatları ile bölgeye ulaşmak için açılan yollar olarak özetlenmiştir. Ayrıca bölgede yoğun otlatma faaliyetleri de mevcuttur. Bu yönü ile antropojenik etkinin yoğun oluşu türün geleceğini büyük oranda tehlikeye sokmaktadır.

Gucel ve Seçmen (2009) tarafından IUCN 2001 kriterlerine göre bitkinin risk sınıfı CR B2ab(ii)+(iii) olarak belirlenmiştir. Bu kriter bitkinin 10 km^2'den (<10 km^2) az gerçek yayılım alanına sahip olması, tek lokaliteden bilinmesi (a), giderek azalan yayılış alanı (b(ii)) ve habitat kalitesi (b(iii)) sebebi ile verilmiştir. Eklenen bu yeni lokalite ve yayılış alanı bitkinin CR kategorisinde yer almasına bir engel oluşturmamakla beraber, lokalite sayısının artışı ve

buna bağlı olarak potansiyel yayılım sahası alt kategorisinin ortaya çıkması sebebi ile türün tehlike kategorisi CR B1ab(iii)+2ab(ii,iii), olarak yeniden belirlenmiştir.

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Causal interpretation of vegetation along Nullah Korang (Islamabad, Pakistan) using multivariate techniques

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Abstract

In pursuit of elaborating the prevailing vegetation type in (Nullah Karang, Islamabad) area, phytosociology has several environmental constraints that have been overcome by statistical techniques. Vegetation was analyzed using multivariate technique along a wastewater channel (Nullah Korang) with an aim to (i) identify the prevailing vegetation type, (ii) to what extent, the existing plant species growing along Nullah Korang are in natural grouping, and (iii) causal interpretation of the existing plant communities. Field observations were recorded using quadrat method using 1m x 1m sized quadrat. Raw data was tabulated in excel spreadsheet and later on analyzed using PC-ORD for the classification and ordination analysis in which the two-way indicator species analysis (TWINSPAN) and Deterended correspondence analysis (DCA) was applied. Presently growing vegetation communities particularly *Cynodon dactylon* and *Carthamus oxyacantha* species are best adapted to prevailing environmental conditions. Three major plant communities identified in the results showed grouping of those species that share common characteristics in terms of life form and habit. It was predicted that present situation of vegetation composition will sustain in further provided no drastic environmental change or highly competitive exotic plant species intrude in the study area.

Key words: Phytosociology, multivariate technique, DCA

1. Introduction

The human impact has been a major dominating factor in affecting different aspects of earth environment. In last two centuries this impact on the earth and its resources has increased at an unprecedented rate (Bayliss and Owen, 1990). The interactions between the environment and human activities are complex, important and poorly understood. However, human activities are continuously modifying the physical, chemical and biological composition of the environment. Vegetation is a general term for the plant life of a region; it refers to the ground cover life forms, structure, spatial extent or any other specific botanical or geographic characteristics. Vegetation supports critical functions in the biosphere.

Species are not uniformly distributed over the earth. Diversity varies greatly from place to place. Different environmental factors influence the distribution of species. On a local scale on the land, the kinds of species change with soils and with changes in the topographic characteristics of slope, aspect (the direction the slope faces), elevation and relation to drainage basin (Botkin and Keller, 1995).

The analysis of species–environment relationship has always been a central issue in ecology (Antoine and Niklaus, 2000). For over a century, ecologists have attempted to determine the factors that control plant species distribution and variation in vegetation composition (Glenn *et al*., 2002). In a similar studies plant communities were sampled in the lower reaches of the Tarim River, Xinjiang. The results showed that there are 23 species belonging to 21 genera in 11 families, most of which have low occurrence frequency in quadrats. Quantitative classification (TWINSPAN) and ordination (CCA) methods were used to study the distribution patterns of 23 plant species in 19 sites in this valley. TWINSPAN results showed that the plant communities in the middle reaches of the Tarim River could be divided into 3 groups and the sampling sites could be divided into 7 types in 3 groups (Zhang *et al*., 2006). Classification of vegetation Farasan Islands using TWIN SPAN technique resulted in recognition of seven community types associated with seven different habitat types. These communities were dominated or co-dominated by 13

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perennial species; 87 associate species were recorded in the study area with chamaephytes dominating the life-form spectrum. Canonical Correspondence analysis indicated that organic carbon, soil moisture, silt, electrical conductivity and calcium carbonate were the major edaphic gradient controlling the distribution of plant communities on Farasan Islands (El-Demerdash, 1996).

Nullah Kurang is a stream of polluted water passing through Khanna Dak, Islamabad. It was contaminated by chemicals and heavy metals .Waste water from BaniGala, Bhara Kahu, Malpur and Noorpur Shahan Flows into Rawal Lake. Rawal Lake empties into Nullah Korang. From there the streams continue its way and flows along the left side of Islamabad Highway. The objective of present study was to classify the vegetation along the sides of Nullah Korang, Islamabad.

2. Material and method

The vegetation sampling was conducted from March 2008 to June 2008. The site was visited several times during this period. Unidentified plants in the field were collected and identified. Nomenclature of plants follows that of ''Flora of Pakistan'' (Stewart, 1972). Based on the usual observations of vegetation structure, which comprises mostly of herbs and grasses the quadrat size of 1m x 1m was selected. The accessible drain is 1.5 km long. Samples were taken from both sides of drain. A total of 20 quadrats were taken for herbs and grasses. Sample no. 1-10 belongs to Site A (Left side of Nullah Korang) and Sample no. 11-20 belongs to Site B (Right side of Nullah Korang). Cover was estimated as a percentage (Kent and Coker, 1992). Vegetation was analyzed using classification and ordination methods such as the Two-Way INdicator SPecies Analysis (TWINSPAN) and Deterended Correspondence Analysis (DCA).

3. Results

The vegetation at site A was dominated by *Cynodon dactylon, Carthamus oxyacantha, Zizypus jujuba, Ricinus communis, Achyranthes aspera, Poa aratica, Parthenium hysterophorus, Euphorbia helioscopia,* and *Capsella bursa-pastoris.*The diagnostic species of site B were *Euphorbia helioscopia, Rumex nepalensis, Parthenium hysterophorus, Achyranthes aspera, Cynodon dactylon, Artemisia scoparia*and, *Carthamus oxyacantha.* Due to lack of statistical analysis, understanding the structure of plant species is associated with considerable mistakes, therefore, vegetation of the study area was classified using DCA analysis. All the default settings of the computer program PC-ORD for windows version 5 were used for DCA. These results clearly indicated that vegetation of whole study area into two major communities, which were further divided into sub-communities. Each community was named after the leading dominant species. Each community differs from the others in its environmental attributes.

Communities identified by DCA along site A.

At site A, following major plant species groups were identified figure 1.

1. *Carthamus oxyacantha, Achyranthes aspera, Broussonetia papyrifera*.
2. *Parthenium hysterophorus, Artemisia scoparia, Plantago major Cynodon dactylon, Rumex nepalensis, Capsella bursa-pastoris.*
3. *Poa aratica, Taraxacum officinale, Phalaris minor* community.

3.1. *Carthamus oxyacantha, Achyranthes aspera, Broussonetia papyrifera*.

The species present in this group includes *Carthamus oxyacantha, Broussonetia papyrifera* and *Achyranthes aspera*. Diagnostic species of this group was *Carthamus oxyacautha,* which had a cover value of 25%. *Achyranthes aspera* was the co-dominant species, having a cover value of 16%.Both of these species are herbs. *Broussonetia papyrifera* was the only tree species in this group and was the least occurring species of the group.

3.2. Parthenium hysterophorus, Artemisia scoparia, Plantago major.

The species present in this group were *Parthenium hysterophorus, Artemisia scoparia* and *Plantago major*. *Parthenium hysterophorus* of family Asteraceae is the dominant species in this group, with a cover value of 11%. *Artemisia scoparia,* with a cover value of 8% was the co-dominant species. The least occurring species in this group was *Plantago major,* which had a cover value of only 4%. Destructive human activities result in low species count at this side.

3.3. *Cynodon dactylon, Rumex nepalensis, Capsella bursa-pastoris.*

The diagnostic species of the group was *Cynodon dactylon* of family Poaceae with the cover value of 19.7 %. *Cynodon dactylon* occurs on almost all soil types. It was common in disturbed areas such as gardens, roadsides, overgrazed, trampled areas, uncultivated lands, localities with high levels of nitrogen, and is often found in moist sites

along rivers (Martin et al., 1951). *Capsella bursa-pastoris* was co-dominant species in the group. It had a cover value of 11%. *Rumex nepalensis*, had a cover value of 8% is least occurring species of the group.

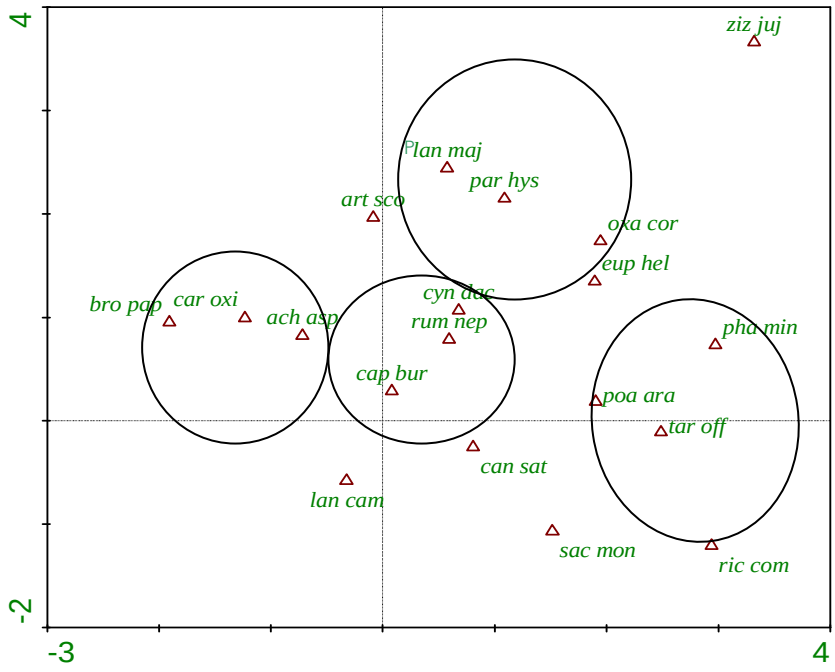

Figure 1. Scattered diagram showing grouping of species at site A

3.4. *Poa aratica, Taraxacum officinale, Phalaris minor.*

Poa aratica, with a cover value of 13% was the dominant species of this group. The co-dominant species of this group was *Taraxacum officinale*, with a cover value of 6%. *Phalaris minor* was the least occurring species of this group. It had a cover value of only 4%.At the site A only four groups, each comprising of three species were identified by DCA. There are very few species found in these groups. Low species count was due human anthropogenic activities at this site. Land had been cleared for agricultural purposes at this side. These practices resulted in destruction of natured flora at this site.

Communities identified by DCA along site B.

At site B, following major plant species groups were identified figure 2.

- *Achyranthes aspera, Anagallis arvensis* community.
- *Euphorbia helioscopia, Cannabis sativa* community.
- *Rumex nepalensis, Lantana camara community.*
- *Cynodon dactylon, Lantana camara* community.

3.5 *Achyranthes aspera, Anagallis arvensis* community

The species present in this community were *Achranthes aspera, Anagallas arvensis* and *Polygonum plebejum*. The community was named after dominant species. The dominant species of the group was *Achranthus aspera*, with a cover value of 18%. *Anagallis arvensis* had a cover value of 8% and was the co- dominant species. *Polygonum plebejum*, with a 6% cover value was the least occurring species.

3.6. *Euphorbia helioscopia, Cannabis sativa* community

This community was dominated by *Euphorbia helioscopia*, with a cover value of 16%. *Cannabis sativa*, with a cover value of 8% was the co- dominant species of the community. The other species recorded in the groups were *Zizypus jujuba*, 4% and *Hytopogon contlathus*.

3.7. *Rumex nepalensis, Lantana camara* community

This community was characterized by three species. *Rumex nepalensis* had the largest cover value, 11%, so it was the dominant species of community. The other species of the group were *Capsella bursa-pastoris* (9%) and *Lantana camara*, with a cover value of 6% was the least occurring species of the group.

3.8. *Cynodon dactylon, Lantana camara* community

Cynodon dactylon of family Poaceae, the most dominant species of the group. It has a cover value of 27%. *Plantago major* was the co- dominant species of the group. It had a cover value of 6%. The other species of the group were *Chenopodium alba*, *Dalbergia sissoo*, *Riccinus communis* and *Saccharum munja*.

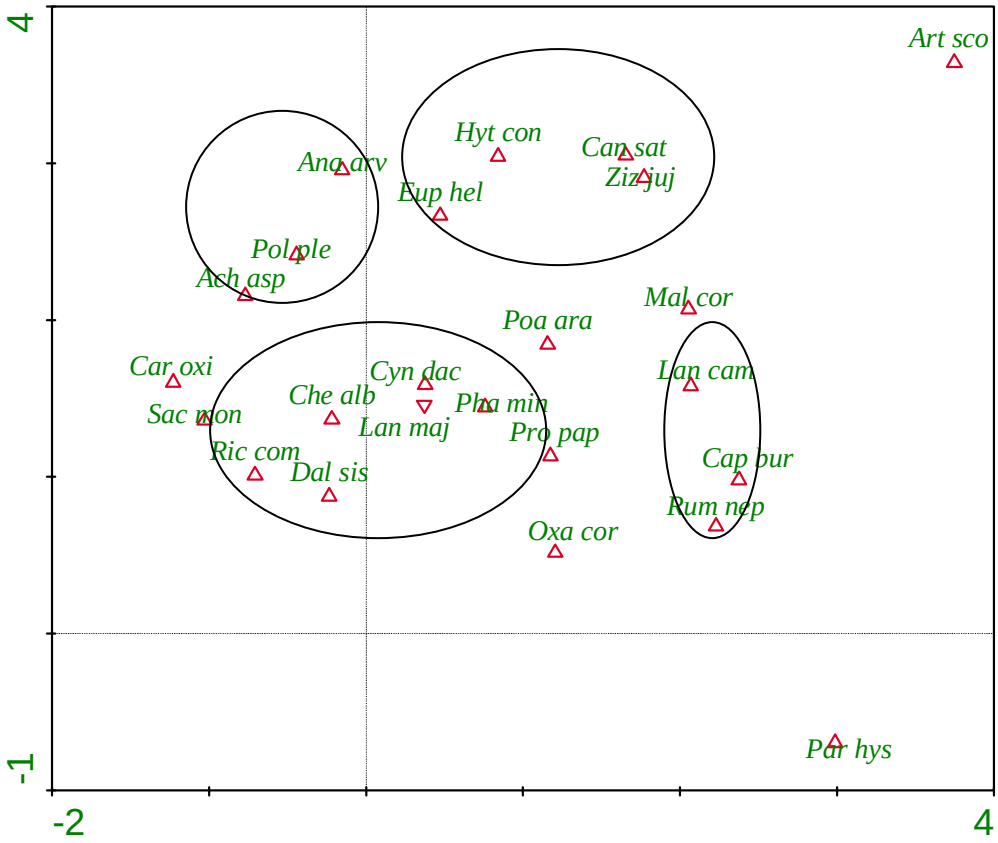

Figure 2. A Scattered diagram showing grouping of species at site B

4. Conclusions and Discussion

In the present study, an overall low species count was observed due to urbanization effects and human anthropogenic activities in the study area. Although 20 quadrats were recorded at both sides of Nullah Korang (A and B), but less number of species indicate that plant diversity is on decline, reflecting an important indicators of quality of life (Knops *et al*., 1999). Prediction of distribution of species requires good survey data as well as knowledge of environmental factors (Le Duc *et al*., 1992), therefore, vegetation along Nullah Korang not only showed few dominant species comprising the associations and distinct communities, but our results also showed some trends of habitat fragmentation. Our effort in this study was to include all plants, the habitats in which they are found, their interactions with each other and with other organisms. This has enabled us to highlight important trends of vegetation composition as species composition is strongly influenced with their surroundings and the genetic differences between them (Knops et al., 1999). Species are not uniformly distributed over the earth. Diversity varies greatly from place to place (Botkin and Keller, 1995). As a whole our study is based on the results of field quadrats observation where only 25 species were recorded. Usually this norm is followed in similar type of studies where vegetation in the filed is analyzed directly from quadrat method and then synthetic information was derived through raw data by arranging the quadrats in proper order (Cillers and Bredenkamp, 1999). At site A, *Cynodon dactylon* with a cover value of 38% was the most dominant species. *Carthamus oxiacantha* was the co-dominant species at this site. It had a cover value of 25%. At site B, *Cynodon dactylon* was the most dominant species. The persistent dominance of *Cynodon dactylon* on both the sites can be explained on the basis plant habit as this grass species tend to be herbaceous and requires relatively more soil moisture to grow. As this study was conducted along Nullah Korang therefore, availability of soil moisture was adequat and no limitation factor of that kind has existed in the study area and hence naturally favoured the colonization of this grass species persistently in site A and B. Due to this reason probably it constituted a cover value of 28%. On the other hand *Euphorbia helioscopia* having a cover value of 16% was the co-dominant species. A major factor in the appearance of these two species as dominant one and co-dominant may seem to be the similarity of habit and life form as both were herbaceous. In addition to that, grouping of plant species as revealed in DCA biplots further strongly

support this evidence that plant sharing the same ecological requirements have been found in close vicinity. Wilson et al. (1998) gave a similar illustration that small scale vegetation dynamics evolve where common characteristics among plants led them to grow in close vicinity. The study though based on small scale but it seems to be influenced by several characteristics and this has been reported that regional scale vegetation dynamics is generally influenced by several characteristics of biotic and abiotic origin (Noe and Zedler, 2001). In a similar study carried out by Ahmad et al (2009) and lu *et al*. (2006) multivariate techniques was used to classify vegetation and discover a correlation with environmental variables.

The Nullah Korang has a continuous water flow maintained throughout the year. However, in rainy season, particularly in monsoon, the amount of water overflows at certain spot thus making the adjacent soil under water. This makes an interesting condition to cause variations among new colonizing annual species. The communities grouped in TWINSPAN revealed this fact as most of the annual species were naturally grouped. Such trends are highlighted in other studies as well (Wilson et al., 1998) and temporal variation in vegetation composition can be explained better on such trend (Le Duc et al., 1992). Ahmad (2007) classifies the wild medicinal flora of (M-2) Pakistan on the basis of their medicinal importance. In conclusion, it seems that present conditions will remain sustainable provided no outside disturbance influence the vegetation to change. Furthermore, the environmental conditions of areas along Nullah Korang will remain supportive and favour the dominance of currently growing plant species so long as any exotic intruder successfully colonize the area and outperform other species in competition.

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Myriophyllum spicatum (Spiked water-milfoil) as a biomonitor of heavy metal pollution in Porsuk Stream/Turkey

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Abstract

In this study, heavy metal (Fe^{+2}, Cd^{+2}, Ni^{+2}, Pb^{+2} and Zn^{+2}) pollution in Porsuk Stream was aimed to biomonitorized by *Myriophyllum spicatum* (Spiked water-milfoil, Eurasian water milfoil) which is hydrophilic macrophyte. Furthermore, usability of Spiked water-milfoil as absorbent was investigated for clean up the heavy metal polluted area. Toward determined aims; total eigth sampling area were determined from Porsuk Stream origin to Eskişehir city line and investigation was concentrated on these areas. In this study, we determined that ordinarily 20.4-209.7, 20.5-740 and 40.5-988.5 ppm iron (Fe^{+2}); 0.5- 7, 0.5-2 and 0.5-3 ppm cadmium (Cd^{+2}); 85-1006, 27-204.5 and 28.5-312.5 ppm nickel (Ni^{+2}); 16-404 ppm, 13-302,5 and 1-235 ppm lead (Pb^{+2}) and also 18-589, 60-235.5 and 110-465.5 ppm zinc (Zn^{+2}) in base mud, stem and leaves. When all data considered, heavy metal pollution above permitted rates was observed in Porsuk stream. We determined that, Spiked water-milfoil absorb heavy metals and can use for clean up polluted water.

Key words: *Myriophyllum spicatum*, Biomonitor, Heavy Metal, Water Pollution, Porsuk Stream

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Porsuk çayında ağır metal kirlilik düzeylerinin *Myriophyllum spicatum* (Başaklı Sucivanperçemi) bitkisi ile biyomonitörlenmesi

Özet

Bu çalışmada, Porsuk Çayındaki ağır metal (Fe^{+2}, Cd^{+2}, Ni^{+2}, Pb^{+2} ve Zn^{+2}) kirliliği, sucul bir makrofit olan *Myriophyllum spicatum* (Başaklı sucivanperçemi, Avrasya sucivanperçemi**)** bitkisi ile biyomonitörlenmesi amaçlanmıştır. Ayrıca, ortamdan ağır metal kirliliğinin temizlenmesinde Başaklı sucivanperçemi'nin absorbant olarak kullanılabilirliği araştırılmıştır. Belirlenen amaçlar doğrultusunda; Porsuk Çayı'nın kaynağından, Eskişehir ili çıkışına kadar toplam sekiz örnekleme noktası belirlenmiş ve çalışmalar bu noktalarda yoğunlaşmıştır. Dip çamuru örneklerinde demir (Fe^{+2}) 20,4-209,7 ppm, bitkinin gövde örneklerinde 20,5-740 ppm ve yaprak örneklerinde 40,5-988,5 ppm arasında; kadmiyum (Cd^{+2}) dip çamurunda; 0,5-7 ppm, bitkinin gövde örneklerinde 0,5-2 ppm ve yaprak örneklerinde 0,5-3 ppm arasında; nikel (Ni^{+2}) dip çamurunda 85-1006 ppm, bitkinin gövde örneklerinde 27-204,5 ppm ve yaprak örneklerinde 28,5-312,5 ppm arasında; kurşun (Pb^{+2}) dip çamurunda 16-404 ppm, bitkinin gövde örneklerinde 13-302,5 ppm ve yaprak örneklerinde 1-235 ppm arasında; çinko (Zn^{+2}) dip çamurunda 18-589 ppm, bitkinin gövde örneklerinde 60-235,5 ppm ve yaprak örneklerinde 110-465,5 ppm arasında olduğu tespit edilmiştir. Elde edilen sonuçlar topluca değerlendirildiğinde, Porsuk çayında izin verilebilir sınır değerlerin üzerinde bir ağır metal kirliliğinin olduğu görülmektedir. Ayrıca Başaklı sucivanperçemi bitkisinin ağır metalleri absorbe ettiği ve kirli su ortamlarının temizlenmesinde kullanılabilecek nitelikte olduğu belirlenmiştir.

Anahtar Kelimeler: *Myriophyllum spicatum*, Biyomonitor, Ağır Metal, Su Kirliliği, Porsuk Çayı

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1. Giriş

Hızlı kentleşme, sanayi atıklarının kimyasal olarak arıtılmadan su sistemlerine verilmesi, tarım alanlarında yaygın ve aşırı miktarda pestisit kullanımı su kaynaklarının kirlenmesine neden olmuştur. Bu durum öncelikle tatlı su ekosistemlerinin ve dolaylı olarak da kirletilmiş suyu kullanan tarım alanları başta olmak üzere diğer ekosistemlerin bozulması sonucunu gündeme getirmiştir. Yıllar boyunca birçok ülkede olduğu gibi ülkemizin çevresel politikaları da bu problemlere kalıcı çözümler üretmeyi başaramamıştır (Kılıç vd., 2009).

Porsuk Çayı, Murat Dağı'nın eteklerinden çıkarak öncelikle Kütahya ve sonrasında da Eskişehir ilini geçerek Sakarya Nehrine ulaşmaktadır. Porsuk Çayı Sakarya Nehrine dökülünceye kadar birçok yerleşim yeri, sanayi ve tarım alanlarından geçmektedir. Evsel ve sanayi atıkları, tarım alanlarındaki uygulamaları ve yağmur suları ile diğer kirletici unsurların Porsuk Çayına ulaşması neticesinde su kalitesi giderek bozulmaktadır. Bu çayın suları tarım alanlarında sulama amacıyla, arıtılarak şehir ve sanayide su ihtiyacını karşılamada kullanılmaktadır.

Su ekosistemlerinde özellikle de tatlı su kaynaklarında, ağır metal miktarlarının yüksek olması gerek sucul organizmaların gerekse de insanların hayatlarını olumsuz yönde etkileyerek potansiyel bir tehlike oluşturmaktadır. Endüstriyel veya kentsel atık suları ile kirlenmiş akarsu ve göllerin tarımsal amaçla kullanılması sonucunda, topraklarda önemli düzeyde iz element ve ağır metal birikimi olduğu bilinmektedir. Canlı sisteme giren ağır metaller, besin zinciri ile bir organizmadan diğerine taşınarak canlı sistemlerde yüksek konsantrasyonlara ulaşmakta ve zararlarını yıllarca sürdürebilmektedir. Ağır metallerden kaynaklı kirlilik araştırmaları son dönemde birçok araştırıcıya konu oluşturmuştur (Yücel vd., 2008; Çavuşoğlu vd., 2009).

Karasal sistemlerde ağır metal kirlilik düzeylerinin belirlenmesinde çeşitli bitkiler kullanılmaktadır (Bereket ve Yücel, 1990**;** Öztürk vd., 1994; Yücel, 1996; Öztürk vd., 2005; Gücel vd, 2009; Çelik vd., 2010). Benzer şekilde sucul bitkiler su kalitesinin arttırılması ve suda ağır metaller ile diğer kirleticilerin araştırılmasında monitör olarak kullanılmaktadırlar. Su içinde yaşayan makrofitlerin göllerdeki su kalitesi ve biyolojik yapı üzerinde büyük etkileri bulunmaktadır (Carpenter ve Lodge, 1986). Bazı sucul bitki türleri ağır metalleri bünyelerinde biriktirerek toplayabilmektedirler. Bu özelliklerinden dolayı sucul bitkilerin, ağır metallerin atık sulardan uzaklaştırılmasında bir yöntem olarak kullanılmaktadır (Lacher and Smith, 2002, Kuyucak ve Volesky, 1989). Biyolojik metodlar, sulu solüsyonlardan ağır metallerin kurtarılması ve uzaklaştırılmasında ucuz ve en etkin uygulamalardan biridir (Hashim ve Chu, 2003; Yan ve Viraraghavan, 2003; Sawidis ve ark., 1995). Yapılan bu çalışmalar sucul bitkiler kullanılarak sediment ve sulardaki ağır metal kirliliğinin temizlenebileceğini göstermesi bakımından önemlidir.

Başaklı sucivanperçemi (*Myriophyllum spicatum*), Avrupa, Asya ve Kuzey Afrika'da yayılış gösteren, tamamı su içinde olan, genellikle 0,5-4,57 m derinliğindeki sığ sularda yaşayan yerli bir bitkidir. Su içinde çok dallı bir yapıya sahip olup, 90 cm ile 3 m derinliğine kadar uzayabilmektedir (Aiken et al., 1979). Bitki bu özelliğinden dolayı birçok bitki ve balık türünün yaşaması için uygun bir ortam hazırlar. Başaklı sucivanperçemi; sucul, çok yıllık, su içerisinde serbest yüzebilen veya rizomlu otsu bir bitkidir. Yapraklar bir halkada 4 adet ve yaklaşık olarak 1,5-2,7 cm uzunluğunda ve çoğunlukla internodyumlardan daha kısadırlar. Brakteler basit, çiçeklerden kısa ve 5 adet, erkek çiçekteki petaller 2-2,5 mm kırmızımsı renktedir. Meyva fındıksı ve 4 karpellidir (Seçmen ve Leblebici, 1997). Bu bitki ülkemizde Tekirdağ'dan Mardin'e kadar; genelde göller, sulama kanalları ve yavaş akan derelerde yetişmektedir.

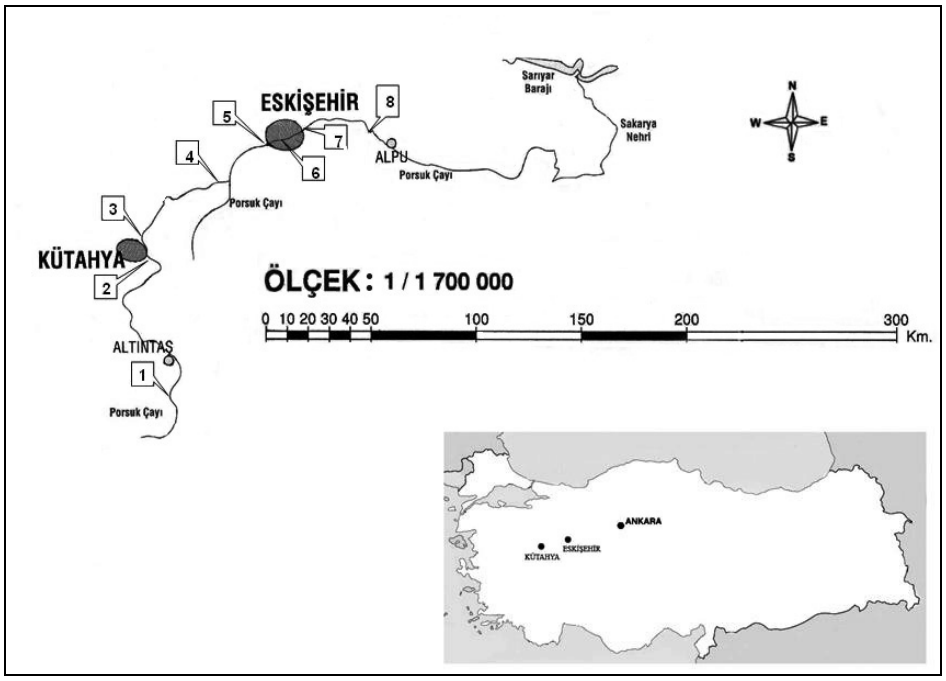
Porsuk çayında kirlilik düzeylerinin belirlenmesine yönelik bazı hayvan ve bitki türlerinin kullanılabilirliliğine ilişkin çalışmalar bulunmaktadır (Saleh and Zeytinoğlu, 2001; Yücel vd., 1995). Ancak Porsuk Çayında ağır metal kirliliğinin biyomonitörlenmesinde Başaklı sucivanperçemi'nin kullanıldığına ilişkin bir çalışma bulunmamaktadır.

Bu çalışmada, Porsuk Çayındaki ağır metal (Fe^{+2}, Cd^{+2}, Ni^{+2}, Pb^{+2} ve Zn^{+2}) kirliliğini belirlemede, sucul bir makrofit olan Başaklı sucivanperçemi bitkisinin biyoindikatör olarak kullanılması amaçlanmıştır. Ayrıca ortamdan ağır metal kirliliğinin temizlenmesinde Başaklı sucivanperçemi'nin absorbant olarak kullanılabilirliği araştırılmıştır.

2. Materyal ve yöntem

Belirlenen amaçlar doğrultusunda; Porsuk Çayı araştırma alanı, Başaklı Sucivanperçeminin gövde ve yaprakları araştırma materyali olarak seçilmiştir. Porsuk Çayı boyunca kayda değer uzaklıklarda yaygın olarak yetişiyor olması, örneklerin kolay bulunabilir ve tekrarlanabilir olması, gerektiğinde gelişiminin hızlı ve yetiştirilmesinin kolay olması gibi nedenler, bu bitkisinin çalışma materyali olarak seçilmesinde etken olmuştur.

Araştırmada Porsuk Çayı'nın kaynağından, Eskişehir ili çıkışına kadar toplam sekiz örnekleme noktası belirlenmiş ve çalışmalar bu noktalarda yoğunlaşmıştır (Şekil 1). Örnekleme noktaları; Porsuk Çayı üzerinde Adaköy'den başlayarak, Kütahya girişi olarak Ağaçköy'den, Kütahya çıkışından, Porsuk Barajı girişinden, Eskişehir giriş olarak Orman Fidanlığından, Eskişehir merkez olarak Şeker Mahallesi ve Arıtma Tesislerine girmeden ve son olarak da Eskişehir çıkışı Alpu girişinden seçilmiştir (Tablo 1).



Şekil 1. Porsuk Çayı üzerinde seçilen örnekleme noktaları
Figure 1. Chosen sample areas on Porsuk River

Tablo 1. Porsuk Çayı üzerinde seçilen örnekleme noktaları ve bunların kaynağa uzaklıkları
Table 1. Chosen sample areas on Porsuk River and distances to origin

Örnekleme		Mesafe (km)	Kirlilik Kaynakları
No:	**Yeri:**		
1)	Adaköy, Murat Dağı etekleri	12	tarımsal (gübre, pestisit)
2)	Ağaçköy, Kütahya giriş	32	tarımsal, evsel
3)	Kütahya çıkış	58	tarımsal, evsel, sanayi
4)	Porsuk Barajı giriş	70	tarımsal (gübre, pestisit)
5)	Eskişehir girişi, Orman Fidanlığı	114	tarımsal, evsel
6)	Köprübaşı, Eskişehir	129	tarımsal, evsel
7)	Çevre yolu, Eskişehir	136	tarımsal, evsel, sanayi
8)	Alpu, Eskişehir çıkış	157	tarımsal, evsel, sanayi

Dip çamuru ve bitki örnekleri aynı noktalardan ve su içinden alınmıştır. Araziden getirilen dip çamuru örnekleri laboratuvarda toz ve kimyasal etkilerden uzak bölgelerde hava kurusu haline getirilmiştir.

Düzgün büyüme gösteren sağlıklı bireylere ait çok genç yada çok yaşlı olmayan yaprak örnekleri toplanarak yıkanmıştır. Daha sonra kurumaları sağlanan örnekler ve 0.1 mm elekten elenerek analizlere hazır hale getirilmiştir.

Bitki gövde ve yaprak örnekleri ile dip çamuru örneklerinin kimyasal analizlerinde yaş yakma yöntemi kullanılmıştır (Halvin and Soltanpour, 1980). Ağır metal analizleri Perkin Elmer Optical Emission Spectrometer Optima 4300 DV cihazında yapılmıştır.

Dip çamuru ve bitki örneklerinin kimyasal analizlere hazırlanması ve yaş yakma işlemleri Anadolu Üniversitesi Fen fakültesi Biyoloji Bölümün Bitki Ekolojisi Laboratuvarında, Optical Emission Spectrometer'deki okumalar ise Eskişehir Orman Toprakları ve Ekoloji Araştırma Enstitüsünde yapılmıştır.

Elde edilen sonuçlar değerlendirilmesinde "SPSS 10.0" istatistik paket programı ve Microsoft Excel 2003 programı kullanılmıştır.

3. Bulgular

Belirlenen amaçlar doğrultusunda Porsuk Çayı üzeride seçilen sekiz örnekleme noktasından alınan; Başaklı sucivanperçemi bitkisinin gövdesi ve yaprakları ile dip çamuru örneklerinde ağır metal kirlilik düzeyleri belirlenerek aşağıda verilmiştir.

3.1. Demir (Fe^{+2}) kirliliği ilişkileri

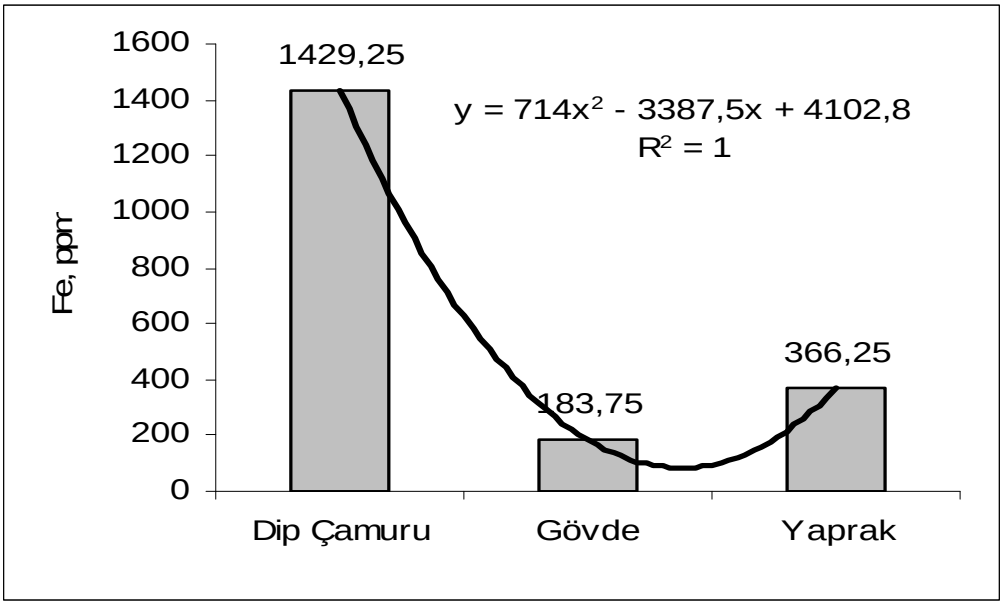
Örnekleme noktalarından alınan bitkinin gövde ve yaprakları ile dip çamuru örneklerinde saptanan demir (Fe^{+2}) miktarlarının birbirlerinden farklı olduğu ve bu farkın istatistiksel olarak $p \leq 0,05$ düzeyinde anlamlı olduğu bulunmuştur (Tablo 2). Bitki yapraklarında bulunan demir miktarı ise, gövdede bulunan demir miktarından daha fazla olduğu görülmektedir.

Tablo 2. Başaklı sucivanperçemi'nin gövdesi, yaprakları ve dip çamurunda demir (Fe^{+2}) kirliliği ilişki düzeyleri
Table 2. Correlation degrees of iron (Fe^{+2}) pollution and Spiked water-milfoil's stem, leaves and base mud

	Eşleştirilmiş Farklar		T	df	Sig. (2-tailed)
	Ortalama	Std. Hata Ortalaması			
Dip çamuru-Gövde	1245,5	141,79	8,784	7	0*
Dip çamuru-Yaprak	1063	144,12	7,376	7	0*
Gövde-Yaprak	-182,5	48,19	-3,787	7	0,007*

* $p \leq 0,05$

Başaklı sucivanperçemi'nin gövdesi, yaprakları ve dip çamurunda bulunan demir miktarları arasında istatistiksel olarak; ikinci derece bir denklemle ifade edilebilen bir ilişki bulunmuştur (Şekil 2). Buna göre dip çamurundaki demir miktarının artışına bağlı olarak bitkide bulunan demir miktarı da artış göstermektedir. Bu sonuca göre ortamdaki demir kirliliği, bitki tarafından da önemli ölçüde temizlenmektedir.



Şekil 2. Başaklı sucivanperçemi'nin gövde ve yaprakları ile dip çamurunda demir (Fe^{+2}) kirliliği dağılımı ve ilişki modeli
Figure 2. Distribution of iron (Fe^{+2}) pollution in Spiked water-milfoil's stem, leaves and base mud and correlation model

Dip çamuru örneklerinde saptanan demir miktarları ile kaynaktan uzaklık arasında istatistiksel olarak pozitif yönlü $p \leq 0,05$ düzeyinde bir ilişki bulunmuştur (Tablo 3). Ancak gövde ile yaprak örneklerinde ölçülen demir değerleri ile kaynaktan uzaklık arasında istatiksel bakımdan anlamlı bir ilişki bulunamamıştır. Porsuk barajı girişinde oldukça yüksek ölçülen demir kirlilik düzeyleri baraj çıkışında düşmüştür. Buna göre barajda demirin bir kısmı organizmalar bir kısmı da sedimentler tarafından tutulmaktadır.

Belirlenen 8 örnekleme noktasından alınan bitkinin gövdesi ile dip çamuru örneklerinde saptanan demir miktarları ile kaynaktan uzaklık arasında istatistiksel olarak pozitif yönlü bir ilişki bulunmuştur (Tablo 3). Ancak yaprak örneklerinde ölçülen demir değerleri ile kaynaktan uzaklık arasındaki ilişki anlamlı bulunmamıştır.

Tablo 3. Dip çamuru, Başaklı sucivanperçemi'nin gövdesi ve yaprağında ölçülen demir (Fe^{+2}) değerleri ile kaynaktan uzaklık ilişkisi

Table 3. Correlation between distance of origin and measured iron (Fe^{+2}) pollution in Spiked water-milfoil's stem, leaves.

Mesafe (Km)	**Materyal**	**Sabit D_0**	**Regresyon Katsayısı (D_1)**	**Kararlılık Katsayısı (R^2)**	**Standart Hata (St)**
12-70	Dip çamuru	87,899	22,316	0,923*	220,678
70-152	Dip çamuru	-1853,682	25,986	0,851*	1038,554
12-70	Gövde	150,403	2,505	0,766*	47,572
70-152	Gövde	-1947,080	16,835	0,965**	307,163
12-70	Yaprak	219,134	-1,105	0,023	246,094
70-152	Yaprak	57,104	3,155	0,020	2081,132

***** 0,05 düzeyinde anlamlı bir ilişki; ****** 0,01 düzeyinde anlamlı bir ilişki

3.2. Kadmiyum (Cd^{+2}) kirliliği ilişkisi

Elde edilen veriler topluca değerlendirildiğinde bitkinin gövdesi, yaprakları ve dip çamurunda bulunan kadmiyum (Cd^{+2}) konsantrasyonlarının birbirlerinden farklı olduğu ve bunun istatistiksel olarak anlamlı olduğu bulunmuştur (Tablo 4). Buna göre ortamdaki kadmiyum kirliliği dip çamurunda yoğunlaşırken, bitki tarafından da önemli ölçüde alındığı anlaşılmaktadır. Ancak yaprakta bulunan kadmiyum birikimi gövdede bulunan miktardan daha fazla olmakla birlikte aralarındaki ilişki istatiksel bakımdan anlamlı bulunmamıştır. Buna göre kadmiyum bitkinin gövde ve yaprakları tarafından yaklaşık birbirine yakın oranlarda biriktirilmektedir.

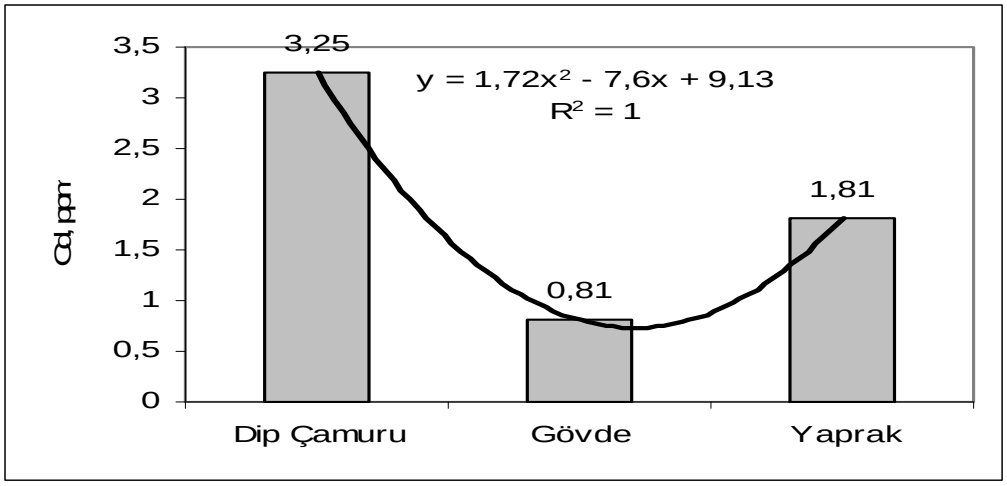
Tablo 4. Başaklı sucivanperçemi'nin gövde ve yaprakları ile dip çamurunda kadmiyum (Cd^{+2}) kirliliği ilişki düzeyleri

Table 4. Correlation degrees of cadmium (Cd^{+2}) pollution and Spiked water-milfoil's stem, leaves and base mud

	Eşleştirilmiş	Farklar	t	df	Sig.
	Ortalama	Std. Hata Ortalaması			(2-tailed)
Dip çamuru-Gövde	2,44	0,59	4,108	7	0,005*
Dip çamuru-Yaprak	-180,5	32,04	-5,633	7	0,001*
Gövde-Yaprak	-1	0,66	-1,512	7	0,174

* $p \leq 0,05$

Tüm örnek alanlardan elde edilen veriler topluca değerlendirildiğinde bitkinin gövdesi, yaprakları ve dip çamurunda bulunan kadmiyum miktarları arasında, istatistiksel olarak; ikinci derece bir denklemle ifade edilebilen bir ilişki bulunmuştur (Şekil 3). Buna göre dip çamurundaki kadmiyum miktarına bağlı olarak, bitkide bulunan kadmiyum miktarı da artış göstermektedir.



Şekil 3. Başaklı sucivanperçemi'nin gövdesi, yaprakları ve dip çamurunda bulunan kadmiyum (Cd^{+2}) kirliliği dağılımı ve ilişki modeli

Figure 3. Distribution of cadmium (Cd^{+2}) pollution in Spiked water-milfoil's stem, leaves and base mud and correlation model

Örnekleme noktalarından toplanan dip çamuru, bitkinin gövde ve yaprak örneklerinde ölçülen kadmiyum değerleri ile kaynaktan uzaklık arasında istatistiksel olarak anlamlı bir ilişki bulunmamaktadır (Tablo 5).

Tablo 5. Dip çamuru, Başaklı sucivanperçemi'nin gövde ve yaprağında ölçülen kadmiyum (Cd^{+2}) değerleri ile kaynaktan uzaklık ilişkisi
Table 5. Correlation between distance of origin and measured cadmium (Cd^{+2}) pollution in Spiked water-milfoil's stem, leaves.

Mesafe (Km)	**Materyal**	**Sabit D_0**	**Regresyon Katsayısı (D_1)**	**Kararlılık Katsayısı (R^2)**	**Standart Hata (St)**
12-70	Dip çamuru	2,997	0,041	0,229	2,266
70-152	Dip çamuru	1,345	0,002	0,001	5,914
12-70	Gövde	1,157	-0,001	0,001	0,988
70-152	Gövde	-0,984	0,012	0,736	0,685
12-70	Yaprak	1,672	-0,010	0,046	1,532
70-152	Yaprak	2,873	-0,013	0,035	6,555

***** 0,05 düzeyinde anlamlı bir ilişki; ****** 0,01 düzeyinde anlamlı bir ilişki

3.3. Nikel (Ni^{+2}) kirliliği ilişkisi

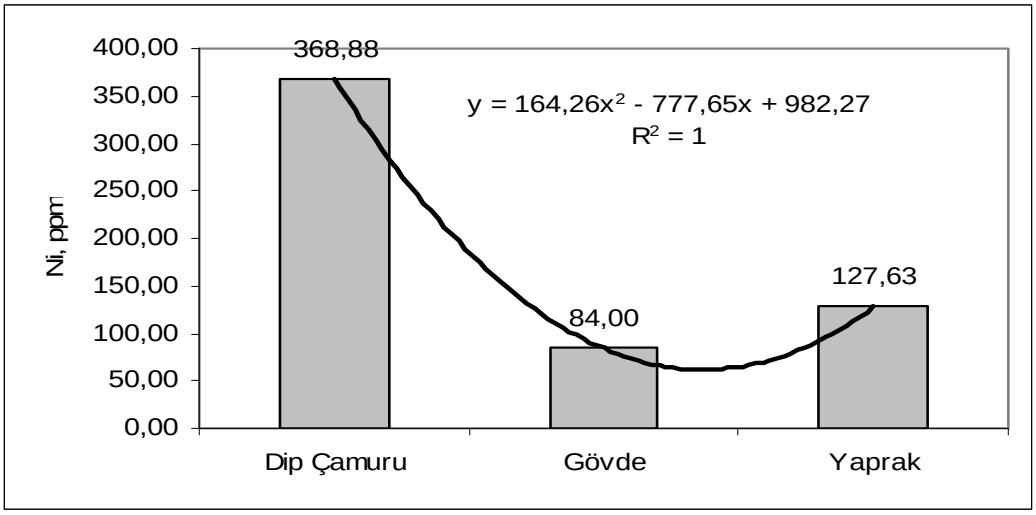
Bitkinin gövde ve yaprakları ile Porsuk Çayının dip çamurunda saptanan nikel miktarlarının birbirlerinden farklı olduğu ve bunun istatistiksel olarak $p \leq 0,05$ düzeyinde anlamlı olduğu bulunmuştur (Tablo 6). Ortamdaki nikel kirliliği dip çamurunda daha fazla olup, bitki tarafından önemli ölçüde absorbe edildiği görülmektedir. Ayrıca bitki yapraklarında tutulan nikel miktarının gövdede tutulan miktardan daha fazla olduğu ve bunun istatistiksel bakımdan önemli olduğu bulunmuştur.

Tablo 6. Başaklı sucivanperçemi'nin gövdesi, yaprakları ve dip çamurunda nikel (Ni^{+2}) kirliliği ilişki düzeyleri
Table 6. Correlation degrees of nickel (Ni^{+2}) pollution and Spiked water-milfoil's stem, leaves and base mud

	Eşleştirilmiş Farklar		t	df	Sig. (2-tailed)
	Ortalama	Std. Hata Ortalaması			
Dip çamuru-Gövde	284,88	86,85	3,28	7	0,013*
Dip çamuru-Yaprak	241,25	93,17	2,589	7	0,036*
Gövde-Yaprak	-43,63	16,66	-2,618	7	0,035*

* $p \leq 0,05$

Başaklı Sucivanperçemi'nin gövdesi, yaprakları ve dip çamurunda belirlenen nikel miktarları arasında istatistiksel olarak; anlamlı, bir ilişki bulunmuştur (Şekil 4). Buna göre dip çamurundaki nikel miktarının artmasına bağlı olarak bitkide bulunan nikel miktarı da artış göstermektedir.



Şekil 4. Başaklı sucivanperçemi'nin gövdesi, yaprakları ve dip çamurunda bulunan nikel (Ni^{+2}) kirliliği dağılımı ve ilişki modeli

Figure 4. Distribution of nickel (Ni^{+2}) pollution in Spiked water-milfoil's stem, leaves and base mud and correlation model

Çalışma alanlarından toplanan bitkinin gövde örnekleri ile aynı örnekleme noktalarından alınan dip çamuru örneklerinde saptanan nikel miktarları ile kaynaktan uzaklık arasında istatistiksel olarak pozitif yönlü $p \leq 0,05$ düzeyinde anlamlı bir ilişki bulunmuştur (Tablo 7). Ancak bitkinin yaprak örneklerinde ölçülen nikel değerleri ile kaynaktan uzaklık arasında istatistiksel olarak anlamlı bir ilişki bulunamamıştır.

Tablo 7. Dip çamuru, Başaklı sucivanperçemi'nin gövde ve yaprağında ölçülen nikel (Ni^{+2}) değerleri ile kaynaktan uzaklık ilişkisi

Table 7. Correlation between distance of origin and measured nickel (Ni^{+2}) pollution in Spiked water-milfoil's stem, leaves.

Mesafe (Km)	**Materyal**	**Sabit D_0**	**Regresyon Katsayısı (D_1)**	**Kararlılık Katsayısı (R^2)**	**Standart Hata (St)**
12-70	Dip çamuru	15,824	5,016	0,932*	46,590
70-152	Dip çamuru	-1992,155	18,458	0,845*	694,526
12-70	Gövde	10,783	0,996	0,945*	8,254
70-152	Gövde	-459,192	4,277	0,935*	107,213
12-70	Yaprak	77,553	-0,109	0,003	69,020
70-152	Yaprak	82,634	0,741	0,020	493,505

***** 0,05 düzeyinde anlamlı bir ilişki

3.4. Kurşun (Pb^{+2}) kirliliği ilişkisi

Bitkinin gövdesi, yaprakları ve dip çamurunda bulunan; kurşun (Pb^{+2}) kirliliği dip çamurunda yoğunlaşırken, bitki gövde ve yaprakları tarafından da belli ölçüde alındığı görülmektedir. Ancak bitkinin gövdesi, yaprakları ve dip çamurunda bulunan kurşun birikimleri birbirlerinden farklı olmakla birlikte, aralarındaki bu fark istatiksel bakımdan önemli bulunmamıştır (Tablo 8).

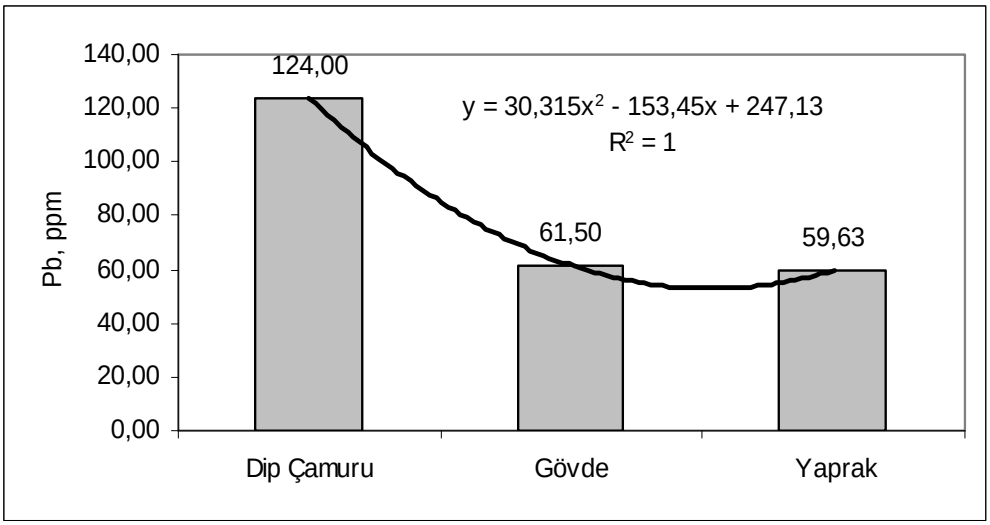
Tablo 8. Başaklı sucivanperçemi'nin gövdesi, yaprakları ve dip çamurunda kurşun (Pb^{+2}) kirliliği ilişki düzeyleri

Table 8. Correlation degrees of lead (Pb^{+2}) pollution and Spiked water-milfoil's stem, leaves and base mud

	Eşleştirilmiş Farklar		t	df	Sig. (2-tailed)
	Ortalama	Std. Hata Ortalaması			
Dip çamuru-Gövde	62,5	36,77	1,7	7	0,133
Dip çamuru-Yaprak	64,38	44,13	1,459	7	0,188
Gövde-Yaprak	1,88	10,8	0,174	7	0,867

* $p \leq 0,05$

Bitkinin gövdesi, yaprakları ve dip çamurunda saptanan kurşun miktarları arasında istatistiksel olarak; ikinci derece bir denklemle ifade edilebilen anlamlı bir ilişki bulunmuştur (Şekil 5). Buna göre dip çamurundaki kurşun miktarının artmasına bağlı olarak bitkide bulunan kurşun miktarı da artış göstermektedir.



Şekil 5. Başaklı sucivanperçemi'nin gövdesi, yaprakları ve dip çamurunda kurşun (Pb^{+2}) kirliliği dağılımı ve ilişki modeli

Figure 5. Distribution of lead (Pb^{+2}) pollution in Spiked water-milfoil's stem, leaves and base mud and correlation model

Belirlenen örnekleme noktalarından toplanan bitkinin gövde ve yaprak örnekleri ile aynı örnekleme noktalarından alınan dip çamuru örneklerinde saptanan kurşun miktarları ile kaynaktan uzaklık arasında istatistiksel olarak pozitif yönlü $p \leq 0,05$ düzeyinde anlamlı bir ilişki bulunmuştur (Tablo 9).

Tablo 9. Başaklı Sucivanperçemi'nin gövde, yaprak ve dip çamurunda ölçülen kurşun (Pb^{+2}) değerleri ile kaynaktan uzaklık ilişkisi

Table 9. Correlation between distance from origin and measured lead (Pb^{+2}) pollution in Spiked water-milfoil's stem, leaves.

Mesafe (Km)	**Materyal**	**Sabit D_0**	**Regresyon Katsayısı (D_1)**	**Kararlılık Katsayısı (R^2)**	**Standart Hata (St)**
12-70	Dip çamuru	-84,126	7,073	0,984**	31,128
70-152	Dip çamuru	-127,283	1,476	0,718*	88,135
12-70	Gövde	-91,510	5,643	0,908*	61,525
70-152	Gövde	-155,345	1,542	0,771*	80,217
12-70	Yaprak	-62,359	4,383	0,969*	26,829
70-152	Yaprak	-161,210	1,502	0,896*	48,676

***** 0,05 düzeyinde anlamlı bir ilişki; ****** 0,01 düzeyinde anlamlı bir ilişki

3.5. Çinko (Zn^{+2}) kirliliği ilişkisi

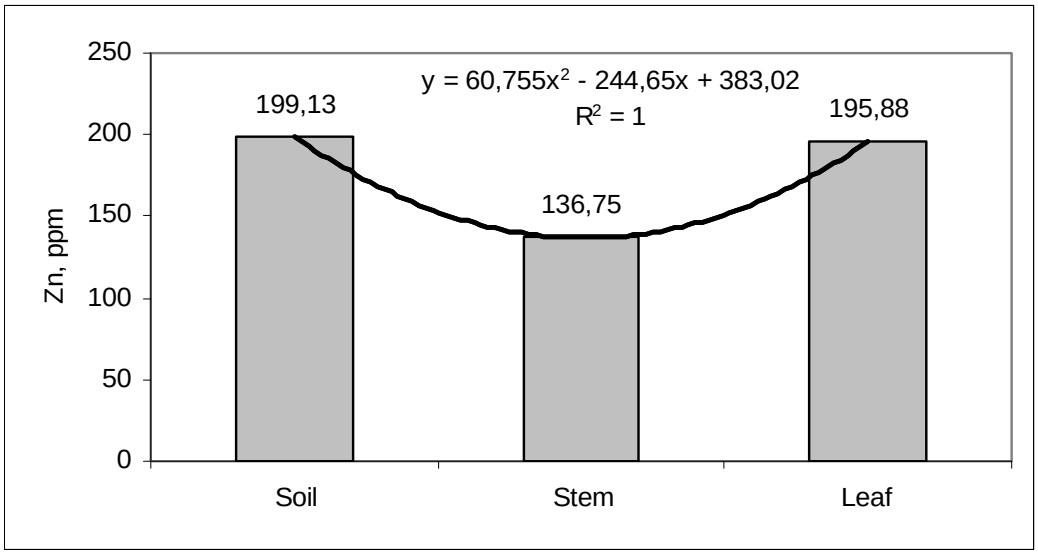
Çinko kirliliği dip çamurunda yoğunlaşırken, bitki gövde ve yaprakları tarafından da önemli ölçüde alınmaktadır. Özellikle yapraklarda bulunan çinko (Zn^{+2}) birikimi, dip çamurundaki miktara yakındır. Bitkinin gövdesi, yaprakları ve dip çamurunda bulunan Zn^{+2} birikimleri arasında az bir fark olmakla birlikte, aralarındaki fark istatiksel bakımdan önemli bulunmamıştır (Tablo 10).

Tablo 10. Başaklı sucivanperçemi'nin gövdesi, yaprakları ve dip çamurunda çinko (Zn^{+2}) kirliliği ilişki düzeyleri
Table 10. Correlation degrees of zinc (Zn^{+2}) pollution and Spiked water-milfoil's stem, leaves and base mud

	Eşleştirilmiş Farklar		t	df	Sig. (2-tailed)
	Ortalama	Std. Hata Ortalaması			
Dip çamuru-Gövde	62,38	56,83	1,098	7	0,309
Dip çamuru-Yaprak	3,25	68,15	0,048	7	0,963
Gövde-Yaprak	-59,13	34,27	-1,725	7	0,128

* $p \leq 0,05$

Bitkinin gövdesi, yaprakları ve dip çamurunda bulunan Zn^{+2} miktarları arasında istatistiksel olarak; ikinci derece bir denklemle ifade edilebilen bir ilişki bulunmuştur (Şekil 6). Buna göre dip çamurundaki Zn^{+2}, bitki tarafından yoğun bir şekilde absorbe edilmektedir.



Şekil 6. Başaklı sucivanperçemi'nin gövdesi, yaprakları ve dip çamurunda çinko (Zn^{+2}) kirliliği dağılımı ve ilişki modeli
Figure 6. Distribution of zinc (Zn^{+2}) pollution in Spiked water-milfoil's stem, leaves and base mud and correlation model

Belirlenen örnekleme noktalarından toplanan Başaklı Sucivanperçemi'nin gövde ve yaprak örnekleri ile aynı örnekleme noktalarından alınan dip çamuru örneklerinde saptanan Zn^{+2} miktarları ile kaynaktan uzaklık arasında istatistiksel olarak pozitif yönlü $p \leq 0,05$ düzeyinde anlamlı bir ilişki bulunmuştur (Tablo 11).

Tablo 11. Dip çamuru, Başaklı sucivanperçemi'nin gövde ve yaprakta ölçülen çinko (Zn^{+2}) değerleri ile kaynaktan uzaklık ilişkisi
Table 11. Correlation between distance from origin and measured zinc (Zn^{+2}) pollution in Spiked water-milfoil's stem, leaves.

Mesafe (Km)	**Materyal**	**Sabit D_0**	**Regresyon Katsayısı (D_1)**	**Kararlılık Katsayısı (R^2)**	**Standart Hata (St)**
12-70	Dip çamuru	-121,520	9,605	0,925*	94,187
70-152	Dip çamuru	-498,768	4,519	0,999**	15,381
12-70	Gövde	27,002	2,674	0,731*	55,643
70-152	Gövde	-274,964	2,844	0,899*	90,888
12-70	Yaprak	108,754	1,939	0,748*	38,638
70-152	Yaprak	-864,435	8,123	0,805*	381,007

***** 0,05 düzeyinde anlamlı bir ilişki; ****** 0,01 düzeyinde anlamlı bir ilişki

4.Tartışma ve sonuçlar

Porsuk Çayında ağır metal kirliliğinin saptanması amacıyla Başaklı Sucivanperçemi (*Myriophyllum spicatum*) gövde ve yaprakları biyomonitör olarak kullanılmıştır. Aynı noktalardan dip çamuru örnekleri de alınarak kimyasal analize tabi tutulmuştur. Ayrıca kaynaktan uzaklaştıkça elde edilen veriler ile mesafe arasında istatistiksel olarak anlamlı bir ilişkinin olup olmadığı da araştırılmıştır.

Porsuk çayında kirli bölgelerden alınan *Rana ridibunda* kan örneklerinde mikronükleus oluşumunda bir artış olduğu ve bunun endüstriyel ve tarımsal kirlenmenin organizmalar üzerinde klastojenik etkiler gösterdiği, dolayısıyle bölgede yaşayan insan topluluğu üzerinde de benzer etkilerin olabileceği bildirilmektedir (Saleh and Zeytinoğlu, 2001).

Yapılan bir diğer çalışmada ise ağır metal kirliliğini saptamak amacı ile biyoindikatör olarak *Phragmites australis* ve *Sparganium erectum* yaprakları kullanılmış ve Porsuk çayında ağır metal (Cd, Zn, Cu, Pb) kirlilik düzeylerinin kabul edilebilir sınırların çok üzerinde olduğu bulunmuştur (Yücel vd., 1995).

Güney-Batı Polonya'da yapılan benzer bir çalışmalarda, *Potamogeton pectinatus* ve *Myriophyllum spicatum*'un ağır metal içeriği araştırılmış ve *M. spicatum*'da Cd^{+2} miktarı 7.1-8.8 mg/kg, Ni^{+2} miktarı 18-19 mg/kg, Pb^{+2} miktarı 469-850 mg/kg ve Zn^{+2} miktarı 313-315 mg/kg; *Potamogeton pectinatus*'da Cd^{+2} miktarı 1.1-1.5 mg/kg, Ni^{+2} miktarı 57-59 mg/kg, Pb^{+2} miktarı 151-237 mg/kg ve Zn^{+2} miktarı 246-272 mg/kg olarak bulunmuştur (Samecka-Cymerman ve Kempers, 2004). Bu çalışma sonuçları ile Polanya'da ölçülen değerler karşılaştırıldığında; Porsuk Çayında, bitkide bulunan Cd^{+2} miktarının daha düşük, Ni^{+2}, Pb^{+2} ve Zn^{+2} miktarlarının daha yüksek olduğu görülmektedir.

Sıvacı vd.(2004), *Myriophyllum spicatum* ve *M. triphyllum* türleri kullanılarak ağır metallerden kadmiyumun ortamdan uzaklaştırılmasını incelemiş ve bu türlerin ağır metallerin uzaklaştırılmasına katkıda bulunabileceğini bildirmişlerdir. Yapılan bir diğer araştırma da ise; *Myriophyllum spicatum* bitkisinin maksimum adsorbsiyon kapasitesini; Cu^{+2} için 10.37 mg/g, Zn^{+2} için 15.59 mg/g ve Pb^{+2} için 46.49 mg/g olarak tespit edilmiştir (Keskinkan vd., 2003).

Toprakta izin verilebilir sınır demir (Fe^{+2}) değeri 50 mg/kg olarak; bitkide izin verilebilir demir sınır değerleri ise 50-150 mg/kg arasında olduğu bildirilmektedir (Fergusson, 1990; Baumbach, 1996; Boşgelmez vd., 2001; Romheld and Marschner, 1991).

Bu çalışmada; dip çamuru örneklerinde ölçülen demir değerleri; 20,4-2097 ppm arasında, Başaklı Sucivanperçemi gövde örneklerinde 20,5-740 ppm ve yaprak örneklerinde 40,5-988,5 ppm arasında tespit edilmiştir. Elde edilen veriler izin verilen sınır değerler ile karşılaştırıldığında, Porsuk çayında, bitkide izin verilen sınır değerler üzerinde ve yoğun bir demir kirliliği olduğu görülmektedir. Kaynaktan uzaklaştıkça dip çamuru ve bitkinin gövde örneklerinde ölçülen demir değerlerinde artış olduğu, elde edilen veriler ile mesafe arasında istatistiksel olarak $p \leq 0,05$ düzeyinde anlamlı bir ilişki bulunduğu belirlenmiştir. Başaklı Sucivanperçemi yaprak örneklerinde ölçülen demir değerleri ile kaynaktan uzaklık arasında ise istatistiksel olarak anlamlı bir ilişki bulunmamaktadır.

Toprakta izin verilebilir sınır kadmiyum (Cd^{+2}) değerleri 1-3 mg/kg arasında olmaktadır (Anonim, 1986; Fergusson, 1990; Baumbach, 1996; Boşgelmez et al., 2001; Romheld ve Marschner, 1991). Bitkide izin verilebilir kadmiyum sınır değerleri ise 0,03-3 mg/kg arasındadır (Markert,1994; Bergman,1983; Ross,1994; Fergusson, 1990; Baumbach, 1996; Boşgelmez et al., 2001; Romheld ve Marschner, 1991).

Bu çalışmada; dip çamuru örneklerinde ölçülen kadmiyum değerleri; 0,5-7 ppm arasında, Başaklı Sucivanperçemi bitkisinin gövde örneklerinde 0,5-2 ppm arasında ve yaprak örneklerinde 0,5-3 ppm arasında olduğu tespit edilmiştir. Ölçülen değerler doğrultusunda; Kütahya giriş, Kütahya çıkış ve Porsuk Barajı girişinden alınan dip çamuru örneklerinde kadmiyum kirliliğinin sınır değerlerin üzerinde olduğu tespit edilmiştir. Porsuk barajına kadar göreceli olarak artan kadmiyum miktarının, baraj çıkışından itibaren daha düşük sevilerde olduğu görülmektedir. Bu da kadmiyumun bir şekilde barajda tutulduğunu göstermektedir. Bitkinin gövde ve yaprak örneklerinde ölçülen kadmiyum değerleri ise izin verilebilir sınır değerlerin üzerine çıkmadığı görülmüştür. Tüm sonuçlar kaynaktan uzaklık bakımından değerlendirildiğinde; dip çamuru, bitkinin gövde ve yaprak örneklerinde ölçülen kadmiyumun değerleri ile kaynaktan uzaklık arasında istatistiksel olarak anlamlı bir ilişki bulunamamıştır.

Toprakta izin verilebilir sınır nikel değerleri 30-75 mg/kg olmaktadır (Anonim, 1986; Baumbach, 1996; Boşgelmez vd, 2001; Romheld ve Marschner, 1991). Bitkide izin verilebilir Ni^{+2} limit değerleri 25-40 mg/kg arasında olmaktadır (Fergusson, 1990; Baumbach, 1996; Romheld ve Marschner, 1991).

Bu çalışmada; dip çamuru örneklerinde ölçülen nikel (Ni^{+2}) değerleri; 85-1006 ppm arasında, Başaklı Sucivanperçemi'nin gövde örneklerinde 27-204,5 ppm arasında ve yaprak örneklerinde 28,5-312,5 ppm arasında tespit edilmiştir. Elde edilen sonuçlar karşılaştırıldığında, dip çamurunda ölçülen değerlerin izin verilebilir sınır değerden yaklaşık 13 kat; bitki örneklerinde ölçülen nikel miktarının ise 7 kat daha fazla olduğu görülmektedir. Buna göre porsuk çayında yoğun bir şekilde nikel kirliliği olduğu ve bazı önlemler alınmasının zorunlu olduğu açıkça görülmektedir. Kaynaktan uzaklaştıkça dip çamuru ve bitkinin gövde örneklerinde ölçülen nikel değerlerinde artış olduğu, elde edilen veriler ile mesafe arasında istatistiksel olarak $p \leq 0,05$ düzeyinde anlamlı bir ilişki bulunduğu belirlenmiştir. Bitkinin yaprak örneklerinde ölçülen nikel değerleri ile kaynaktan uzaklık arasında ise istatistiksel olarak anlamlı bir ilişki bulunamamıştır.

Toprakta izin verilebilir sınır kurşun değerleri 50-100 mg/kg olarak (Anonim, 1986; Fergusson, 1990; Boşgelmez vd., 2001; Romheld ve Marschner, 1991); bitkide izin verilebilir kurşun sınır değerleri ise 1 ppm olarak bildirilmiştir (Markert, 1994; Bergman, 1983).

Bu çalışmada; dip çamuru örneklerinde ölçülen kurşun (Pb^{+2}) değerleri; 16-404 ppm arasında, Başaklı Sucivanperçemi'nin gövde örneklerinde 13-302,5 ppm arasında ve yaprak örneklerinde 1-235 ppm arasında tespit edilmiştir. Bitkinin gövde ve yaprak örneklerinin kimyasal analizi sonucunda elde edilen değerler izin verilebilir sınır değerlerin oldukça üzerinde bulunmuştur. Elde edilen sonuçlar karşılaştırıldığında, dip çamurunda ölçülen kurşun miktarının izin verilebilir sınır değerden yaklaşık 4 kat; bitki örneklerinde ölçülen kurşun miktarının ise 302 kat daha fazla olduğu görülmektedir. Su kaynağından uzaklık ile; dip çamuru ve Bitkinin gövde ve yaprak örneklerinde ölçülen kurşun değerleri arasında istatistiksel olarak pozitif yönde $p \leq 0,05$ düzeyinde anlamlı bir ilişki bulunduğu belirlenmiştir. Buna göre kaynaktan uzaklaştıkça kurşun kirliliği de artmaktadır.

Toprakta izin verilebilir sınır çinko değerleri 150-300 mg/kg (Anonim, 1986; Fergusson, 1990; Baumbach, 1996; Boşgelmez vd., 2001; Romheld ve Marschner, 1991); bitkide izin verilebilir çinko limit değerleri 80-200 mg/kg arasında olması gerektiği bildirilmektedir (Fergusson, 1990; Baumbach, 1996; Boşgelmez vd., 2001; Romheld ve Marschner, 1991).

Bu çalışmada; dip çamuru örneklerinde ölçülen çinko (Zn^{+2}) değerleri; 18-589 ppm arasında, Başaklı Sucivanperçemi'nin gövde örneklerinde 60-235,5 ppm arasında ve yaprak örneklerinde 110-465,5 ppm arasında tespit edilmiştir. Kütahya çıkış ve Porsuk Barajından alınan dip çamuru ve bitkinin gövde örneklerinde, Kütahya giriş, Kütahya çıkış, Porsuk Barajı ve Eskişehir çıkıştan alınan bitkinin yaprak örneklerinde ölçülen çinko değerleri izin verilebilir sınır değerlerin üzerinde bulunmuştur. Elde edilen sonuçlar karşılaştırıldığında, dip çamurunda ölçülen çinko miktarının izin verilebilir sınır değerden yaklaşık 1,9 kat; bitki örneklerinde ölçülen çinko miktarının ise 2,3 kat daha fazla olduğu görülmektedir.

Su kaynağından uzaklaştıkça dip çamuru ve bitkinin gövde ve yaprak örneklerinde ölçülen çinko değerleri arasında istatistiksel olarak pozitif yönde $p \leq 0,05$ düzeyinde anlamlı bir ilişki olduğu belirlenmiştir. Bu sonuca göre Porsuk çayının kaynağından uzaklaştıkça çinko kirliliği de artmaktadır.

Kıta içi su kaynaklarının su kalite kriterlerine göre Porsuk çayı; Ağaçköy Regülatöründen Kütahya Belediyesi Atık Su Arıtma Tesislerine kadar **1. sınıf** (**temiz su**) **fosfor açısından 2. sınıf**, daha sonra birçok parametreler açısından **4. sınıf (çok kirlenmiş su)** yani hiçbir amaçla kullanılmaması gerekli su durumuna gelmekte ve bu şekilde Porsuk Barajı rezervuarına girmekte; Porsuk Baraj çıkışında ise Amonyak ve Fosfor bakımından ancak **3. sınıfa** düşmekte; Eskişehir Bölümünde ise Eskişehir Büyükşehir Belediyesi Evsel Atıkların hemen öncesinde **temiz (2. sınıf)** olan değerler, Eskişehir Şeker Fabrikaları ve Eskişehir Belediyesi Evsel Atıklarından hemen sonra **çok kirlenmiş (4. sınıf)** değerlere ulaşmaktadır (Anonim, 2008). Bu sonuçlara göre Porsuk çayı bir çok parametre açısından çok kirlenmiş **(4. Sınıf)** su kalitesinde olup hiçbir amaçla kullanılmaması gerekli su durumunda olmasına karşın tarımsal amaçlı kullanılmasının yanı sıra, Eskişehir'in içme-kullanma suyu olarak kullanılıyor olması insan sağlı açısından önemli risk oluşturmaktadır.

Yapılan bu araştırma sonucunda elde edilen sonuçlar topluca değerlendirildiğinde, Porsuk çayında izin verilebilir sınır değerlerin üzerinde bir ağır metal kirliliğinin olduğu saptanmıştır. Ayrıca Başaklı Sucivanperçemi (*Myriophyllum spicatum*) bitkisinin ağır metalleri absorbe ettiği ve kirli su ortamlarının temizlenmesinde kullanılabilecek özelliklere sahip olduğu belirlenmiştir.

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Artificial ecosystems for wastewaters treatment under Mediterranean conditions (Morocco)

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Abstract

The use of well-designed and high efficient extensive wastewater technologies can provide subsequent economic advantages (low-cost investment and cheaper operational costs) and can contribute to protecting the environment and ensuring safe water resources (reuse of treated wastewater). Following the progressive experimentations led under Mediterranean climate (MHEA® Experimental Centre in M'Diq, NW of Morocco), the methodological and technological process of Hierarchised Mosaics of Artificial Ecosystems (MHEA®) permitted to identify multi-ecosystemic plants for urban-wastewaters treatment, passing the traditional extensive-plants efficiencies. Results obtained during the optimization period permit to provide the structure of several MHEA® technologies adapted to the South Mediterranean socio-economic and environmental context, respecting a net treatment area of 2 m^2 PE^{-1}, a total load of 5 000 PE ha^{-1} and a retention time of 15 days. The valorisation possibilities of waters treated (23 m^3 PE^{-1} an^{-1}), sludge (57 kg of dry weight PE^{-1} $year^{-1}$) and aerial biomass of macrophytes under the Mediterranean climate constitute a significant economic input for these technologies.

Key words: Artificial ecosystem, wastewaters treatment, macrophytes, Morocco.

1. Introduction

Wastewaters reuse is an important mobilization way of non-conventional water resources, since about 50 % of Moroccan population would reach absolute water scarcity (500 m^3 $person^{-1}$ $year^{-1}$) in 2 020 (Anonymous, 2000). Besides, the quasi-totality of domestic and industrial wastewaters is evacuated in natural habitats without adequate treatment, and about 80 % of wastewaters treatment plants achieved by the local communities are out of use through, among others, lack of maintenance, managers training and specific allocations (Anonymous, 2000). The current urbanisation of Moroccan Mediterranean coast urbanisation is due to rural depopulation and development of tourist infrastructure (Anonymous, 2000). The wastewaters are evacuated in this area without treatment and often reused in market gardening.

Effective and cheaper systems of wastewater treatment constitute a fundamental aim for the local authorities. The use of well-designed and high efficient extensive wastewater technologies, especially for medium-sized conurbations and towns, can provide subsequent economic advantages (low-cost investment and cheaper operational costs) and can contribute to protecting the environment and ensuring safe water resources (re-use of treated wastewater). Nevertheless, experimental-data deficiency under the Mediterranean climate (North of Morocco) doesn't enable applications of these technologies. The MHEA® (Mosaic Hierarchised of Artificial Ecosystems) project has been achieved in M'Diq (NW of Morocco) through the channel of the Intergovernmental Agency of French-speaking countries (Walloon Region-Morocco) in order to develop wastewater-treatment systems adapted to the local climatic and socio-economic contexts.

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2. Material and method

The comparative experimental-protocol (1998/2000) and the optimization one (2001/2003) were carried out in order to assess the purification efficiency of the main types of ecosystems and to propose MHEA® systems for wastewaters treatment in tourist or agricultural areas. Comparison of treatment efficiency of different ecosystems categories (aquatic, semi-aquatic and terrestrial) aimed to research purification systems using percolation in third level. Treatment systems using percolation in second and third levels showed a particular interest in tertiary purification and disinfection (Ezzahri *et al.*, 2001; Radoux *et al.*, 2003; Ezzahri, 2005).

Eight treatment systems are experimented under the same circumstances of climate, load and flow, during the second experimental-protocol, permitted the design of efficient treatment-systems in order to protect the quality of coastal water (summer tourism and fishing) or to reuse wastewater after purification (agricultural areas). The two optimised treatment-systems, presented in this paper (Table 1), collect raw wastewater from the wastewater sewerage system in the city of M'Diq (hydraulic load = 1 183 L day^{-1}). The net treatment area is 2 m^2 Person $Equivalent^{-1}$ (0.8 m^2 PE^{-1} in level I, 0.6 m^2 PE^{-1} in level II and 0.6 m^2 PE^{-1} in level III). Monitoring of treatment efficiencies of tested systems is based on the analysis of physico-chemical (SS, COD, TN, TP) and biological (faecal coliforms, faecal streptococci, helminths) wastewater parameters of instantaneous or combined sampling every 14 days, i.e. 26 analysis campaigns per year.

The plant species used in this experimentation are selected for application in wastewater treatment, among other wetland species from the North of Morocco, based on studies of their ecology, development (biomass and macronutrients retention), regeneration and socio-economy (Ennabili *et al.*, 1996, 1998; Ennabili & Gharnit, 2003; Ennabili 2008).

Table 1. Characteristics of treatment systems for agricultural context (A) and tourist one (T).

Treatment	Level	Ecosystem	Macrophyte	Area (m^2)	Water circulation	Retention time (day)
System "A"	I	aquatic	-	18	translation	9
	II	terrestrial	-	2	percolation	3
	III	terrestrial	*Salix purpurea*	2	percolation	3
System "T"	I	aquatic	-	18	translation	9
	II	terrestrial	*Phragmites australis*	2	percolation	3
	III	terrestrial	*Phragmites australis*	2	percolation	3

3. Results

Considering the treatment net-area of 2 m^2 PE^{-1}, the global SS-retention by the treatment systems "A" and "B" reaches respectively 98 % and 100 %. Outflow SS-concentration averages 6 mg L^{-1} and 1 mg L^{-1} in the same order (Figure 1). Concerning COD-retention average (Figure 2), the treatment efficiency attains 95 % in the treatment system "A" with a mean concentration from 19 to 29 mg O_2 L^{-1}. These results are similar to those obtained by using the treatment system "T" (97 % and 19 mg O_2 L^{-1}).

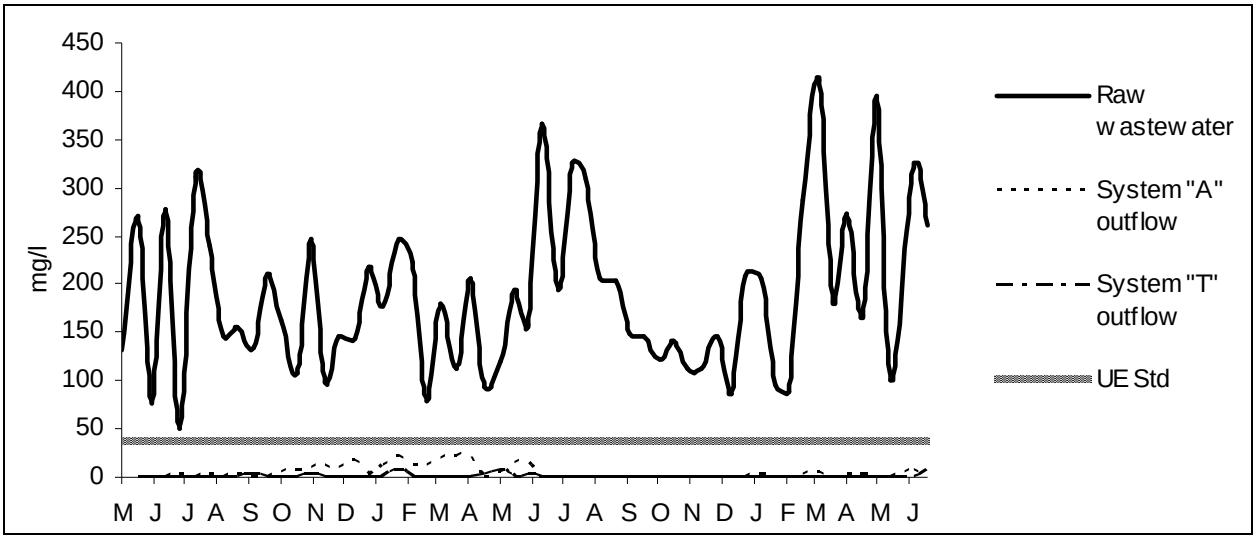

Figure 1. Concentration of suspended solids (SS).

The concentration of treatment-system "A" outflow means 12 mg N L^{-1}, corresponding to removal rate of 75 %. Nevertheless, N-concentration increases during the second year of experimentation and attains 26 mg N L^{-1}. While the mean N-retention obtained by the treatment system "T" gets to 88 % with an average of outflow N-concentration of 7 mg N L^{-1} (Figure 3). The treatment system "A", using percolation through soil at levels II and III, retains an average of 96 % of P-load and the outflow P-concentration not exceeds 1 mg P L^{-1}. Whereas mean P-removal by treatment system "T" reaches 98 % with an outflow concentration not passing 0.5 mg P L^{-1} (average = 0.2 mg P L^{-1}) (Figure 4).

The treatment system "A" guarantees removal ranges of 5.5 $\log_{10}$ units for FC and 5.2 $\log_{10}$ units for FS, with the mean concentrations of 50 CFU/100 ml for FC and 100 CFU/100 ml for FS (Figures 5 and 6), and <1 helminths egg/L. The disinfection rates obtained by the treatment system "T" are similar to those of previous system (5.8 $\log_{10}$ units for FC and 5.2 $\log_{10}$ units for FS) with an outflow mean-contamination of 18 CFU/100 ml for FC, 30 CFU/100 ml for FS and <1 helminths egg/L) (Figures 5 and 6).

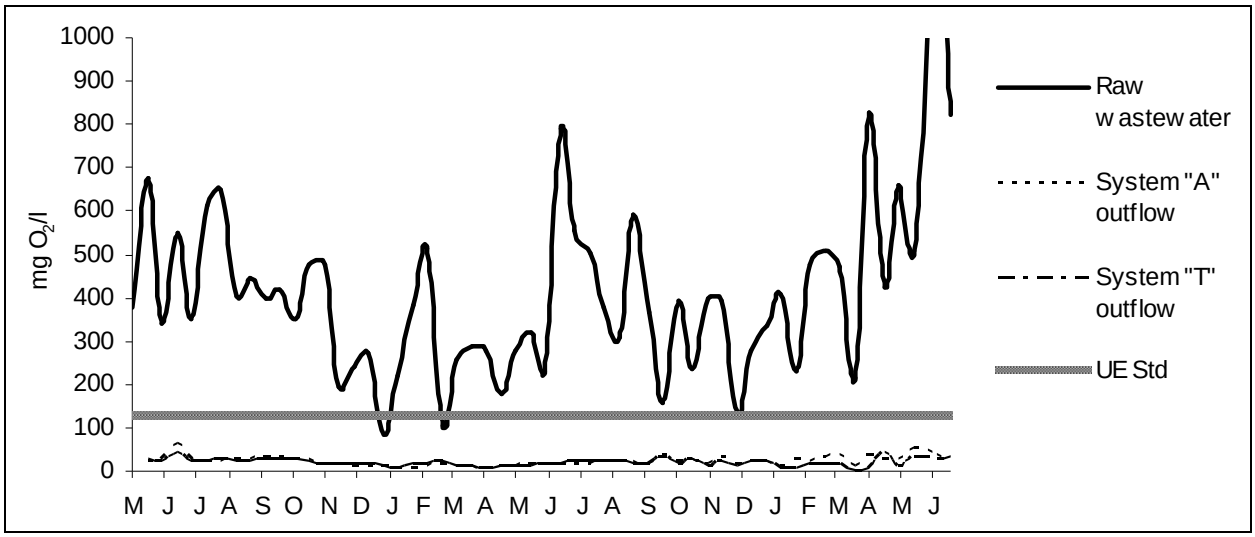

Figure 2. Concentration of COD (chemical oxygen demand).

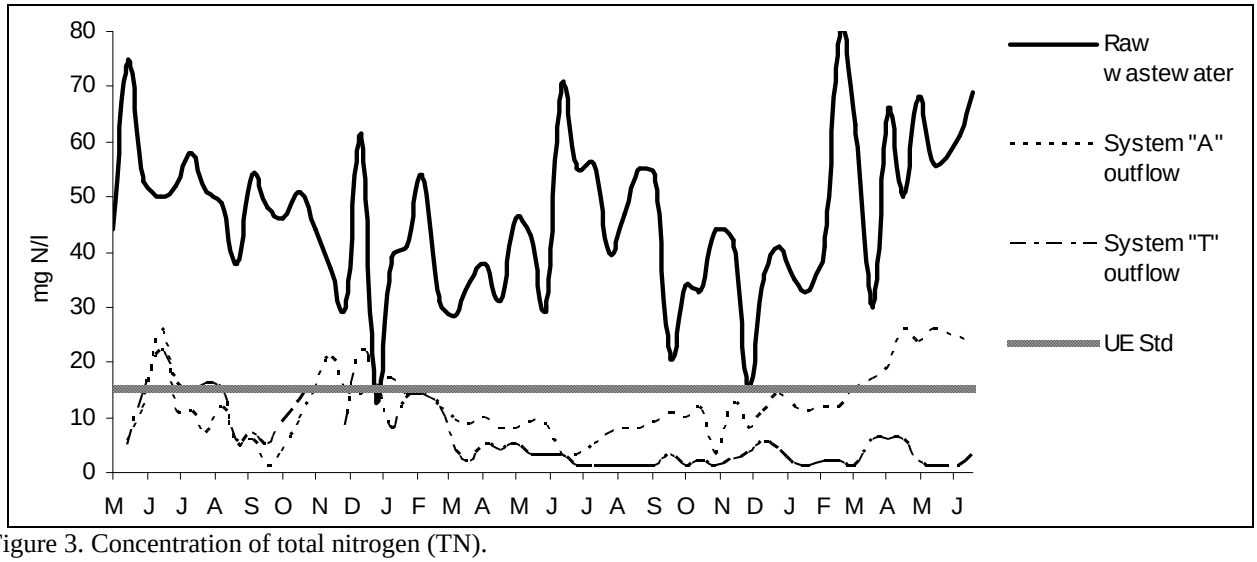

Figure 3. Concentration of total nitrogen (TN).

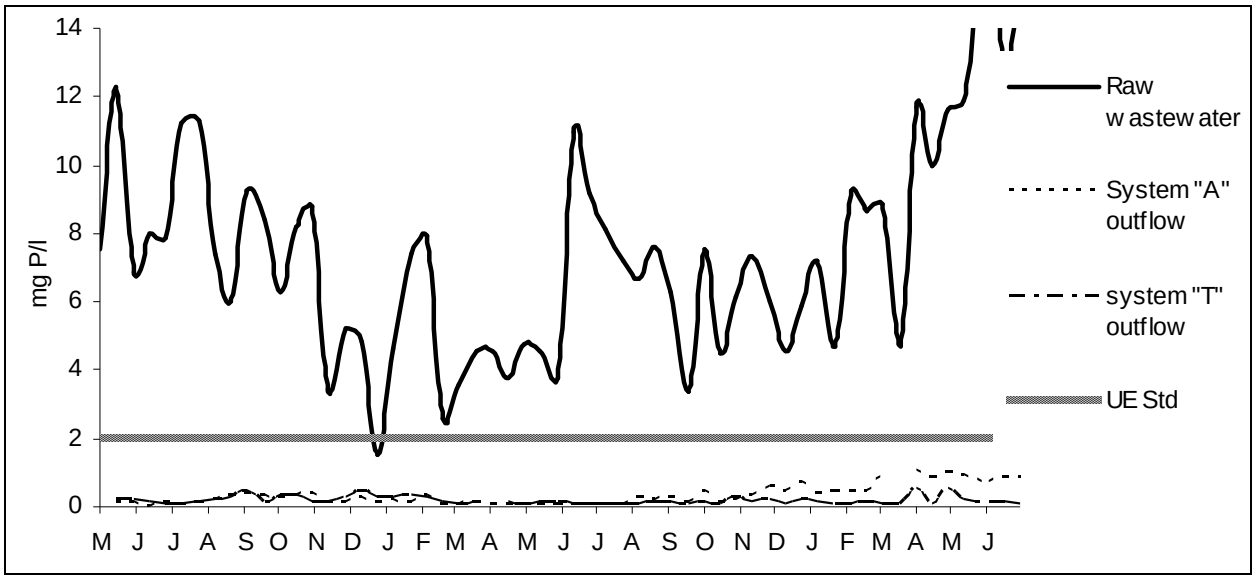

Figure 4. Concentration of total phosphorus (TP).

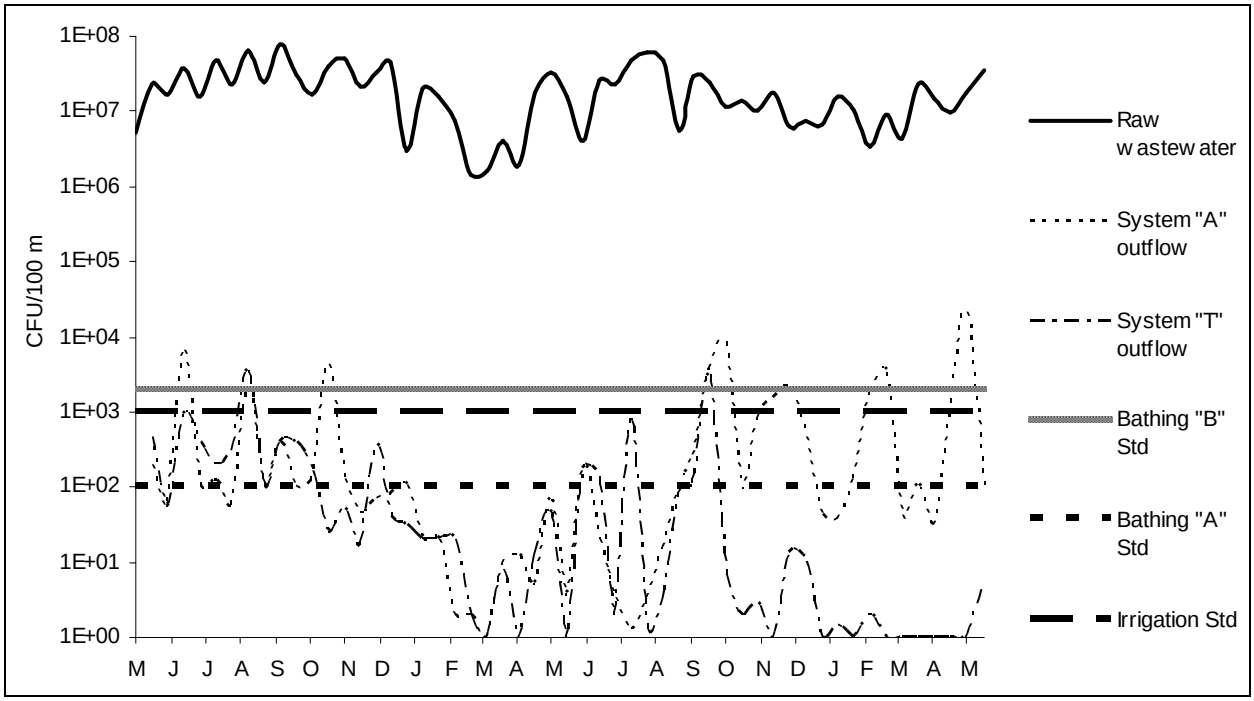

Figure 5. Number of faecal coliforms (FC).

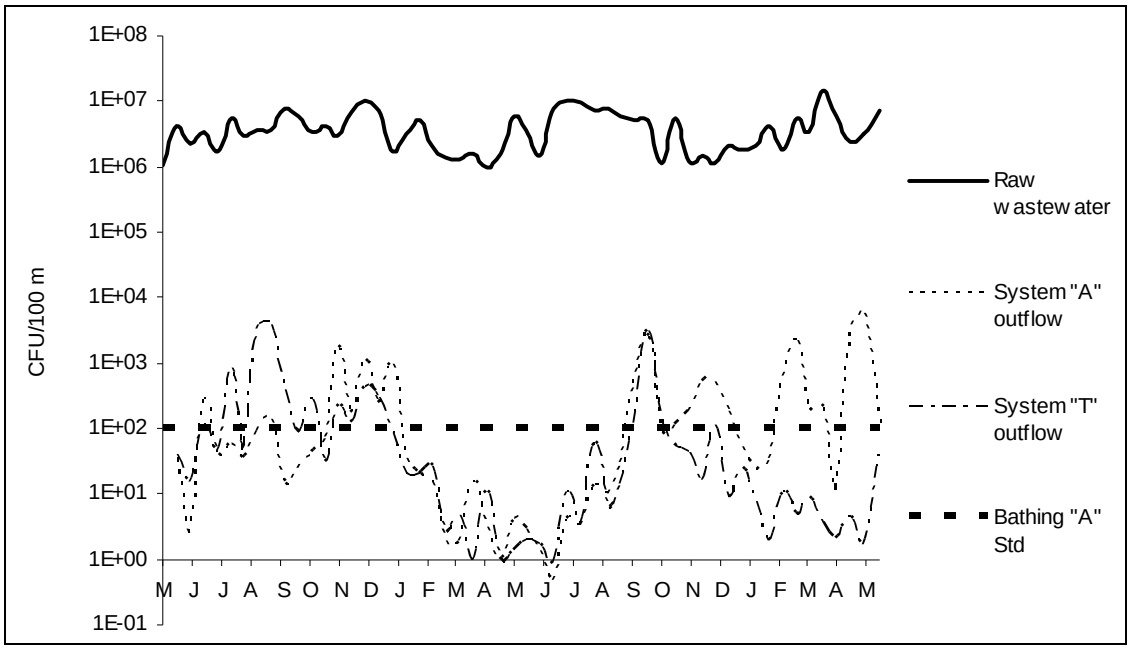

Figure 6. Number of faecal streptococci (FS).

The daily evapotranspiration in treatment system "A" averages 25 mm (80 % of treated flow, corresponding to 23 m^3 PE^{-1} $year^{-1}$), vs. 43 mm and a low outflow mean-volume of 50 % (not exceed 28 % and often without outflow from level III in summer) in treatment system "T".

4. Conclusions and discussion

Outflow SS-concentration averages respect the E.U. 91/271 standard of 35 mg L^{-1} and removal rate (90 %). The COD-retention efficiency guaranties also the E.U. standard of 125 mg O_2 L^{-1}. According to the tertiary treatment, N-concentration increases during the second year of experimentation in the system "A", which accords with advantage-reuse of treated wastewater in agriculture, and is distinctly less than the E.U. of 15 mg N L^{-1} in the system "T". The P-removal of both of experimented systems honours the E.U. standard of 2 mg P L^{-1}. The excellent results obtained by the treatment system "T" underline its particular interest in tourist areas.

The microbiological quality of treated wastewater from the system "A" agrees generally with the Moroccan standard allowing market-gardening irrigation (1 000 CFU/100 ml for FC). This treatment system is especially interesting for parasites retention and respect also the Moroccan standard sanctioning irrigation without restriction (<1 000 FC/100 ml and <1 helminths egg/L). The treatment system "T" guaranties for the most part the Moroccan standard bathing waters, range "A" (2 000 FC/100 ml and 100 FS/100 ml). In tourist areas (NO of Morocco), excellent results were underlined for all treatment parameters studied when using *Arundo donax* based treatment MHEA®-system. The obtained results will be published subsequently.

The treatment system "A" provides high volumes of treated wastewater and stills in keeping with agriculture requirements (high disinfection rates but low N and P removal rates). Whereas, the treatment system "T" is harmoniously recommended for seaside protection thanks to high average-daily-evapotranspiration and a low outflow mean-volume.

Experimental application of these MHEA® systems in wastewater treatment could generate annually 90 tons of dry matter ha^{-1} of macrophytes biomass, locally required for multiple uses. The financial product of macrophytes used in wastewater treatment is estimated in natural habitats to 80 341.00 MAD ha^{-1} $year^{-1}$(Ennabili 1999). It constitutes a significant economic input (17 MAD PE^{-1}) for their exploitation cost (about 8.50 MAD PE^{-1} for macrophytes harvesting and evacuation). Furthermore, the MEHA® treatment systems produce experimentally 57 kg of dry sludge PE^{-1} $year^{-1}$. Treated sludge could be advantageously used in agriculture sine its production (15 tons of dry sludge ha^{-1}) corresponds to fertilizing supply of 160 Kg N ha^{-1} and 60 Kg P ha^{-1}.

On an experimental scale, the main routine-measures concern (i) aerial-biomasses harvesting and evacuation, (ii) regular unclogging of unplanted terrestrial-ecosystems (4-6 times yearly), and/or (iii) sludge evacuation by pumping (1 time each 5 years). These operations would be validated on a pilot scale for any full-size application of treatment MHEA®-systems (Radoux, 1996), and are compatible with the socio-economic context of medium-sized conurbations and towns in N of Morocco.

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A new record for the Flora of Turkey: *Geranium macrorrhizum* L. (Geraniaceae)

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Abstract

Geranium macrorrhizum L. was collected during a fieldwork around Kapıdağ Peninsula (Erdek, Balıkesir province) in May 2008, is added as a new record for the Flora of Turkey. It's diagnostic characters, description and detailed pictures are given. The geographical distribution in Turkey of the new record is mapped.

Key words: Geranium, Geraniaceae, New record, Kapıdağ Peninsula, Turkey

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Türkiye Florası için yeni bir kayıt: *Geranium macrorrhizum* L. (Geraniaceae)

Özet

Geranium macrorrhizum L., 2008 Mayıs ayında Kapıdağ Yarımadası (Erdek, Balıkesir ili) civarına düzenlenen bir arazi çalışması esnasında toplandı ve Türkiye Florası için yeni bir kayıt olarak eklenmiştir. Onun tanımlayıcı karakterleri, betimi ve ayrıntılı resimleri verilmiştir. Yeni kayıdın Türkiye'de ki coğrafik yayılışı haritalandırılmıştır.

Anahtar kelimeler: Geranium, Geraniaceae, Yeni kayıt, Kapıdağ Yarımadası, Türkiye

1. Introduction

The genus *Geranium* L., belongs to the tribe *Geranieae* of family Geraniaceae (Boissier, 1867; Edgeworth, Hook, 1974; Melchior, 1964) and comprises about 350 species distributed in temperate and tropical alpine regions in the world (Lawrence, 1951; Porter, 1959; Willis, 1973, Aedo et al. 2005). The genus was monographied by Knuth (1912). Some taxa are valuable for ornamental and medicinal uses (Thomas, 1960). *Geranium* has been divided into three subgenera, 14 sections and 20 informal groups (Yeo, 2001). *Geranium* is divided into the subgenera *Geranium*, *Erodioidea* and *Robertium* (Yeo, 2001; Aedo *et al.* 1998, 2002).

Since the genus *Geranium* has been revised by Davis (1966) for the Flora of Turkey, some other new taxa, such as *Geranium davisianum* Peşmen, Güner, *G. sibiricum* L., *G. cinereum* subsp. *subcaulescens* var. *pisidicum* Peşmen, Güner, *G. platypetalum* var. *albipetalum* Fisch, Demirkuş; *G. chelikii* Kit Tan, Yıldız and *G. kalenderianum* İlçim, Behçet (Davis at al. 1988, Güner at al. 2000, İlçim, Behçet 2006) have been added to the Flora of Turkey. Totally 37 species, 10 subspecies and 9 variety have been recorded for the Flora of Turkey up to date. In this paper, *Geranium macrorrhizum* L. were added as a new record of *Geranium* species for Flora of Turkey. With this new record, the total number of *Geranium* species known from Turkey rise to 38.

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2. Materials and methods

During fieldwork for *"The study on fitosociological and fitoecological aspects of Kapıdağ Peninsula (Erdek-Balıkesir)"* Project in 2006 to 2009, some interesting specimens of *Geranium* was collected by first author in May 2008. These specimens were identified as *Geranium macrorrhizum* L. according to Flora of Turkey and the East Aegean Islands (Davis at all, 1966, 1988), Turkey and the East Aegean Islands (Supplement) (Güner, 2000.), Flora Europaea (Webb, Ferguson, 1968), Flora Orientalis (Boissier,1867), Prodromus Florea Peninsulae Balcanicae (Hayek 1927), Flora der Südalpen (Pitschmann&Reisigl, 1965), Illustrierte Flora von Mittel-Europa (Hegi, 1975), Flora of the USSR (Shishkin, 1949), Flora Bulgarica, Supplementum I (Velenowsky I, 1898). Consequently, *Geranium macrorrhizum* L. was described and illustrated a new record by authors for the Flora of Turkey.

3. Results and discussion

Geranium macrorrhizum L., *Sp. Pl* 680 (1753) (Figure 1, 2)

Perennial, with stout, elongated, 6 - 13 mm wide, cylindrical, horizontal rhizome. Stem 20 - 60 cm, erect. Leaves orbicular, 7 - 17 cm wide, divided for 4/3 of the radius into 5 - 7 obovate, pinnatifid lobes; segments obtuse but conspicuously mucronate, glandular-pubescent. Petiole 5 - 55 mm. Inflorescence with 2 - 7 flowers in a corymb or umbel, densely short and long glandular-pubescent. Bracts 2, 2 - 4 mm. Pedicel 11 - 27 mm. Sepals erect, 5 - 7 mm, ovate with longitudinally 3-nerved, long aristate at apex, greenish to reddish, densely glandular-pubescent. Petals *c.* 15 mm, obovate to spathulate, entire, patent or deflexed, dull purplish-red limb, glabrous. Stamens 22 - 26 mm; filaments reddish, curved at apex; anther reddish; pollen yellowish. Style up to 40 mm, reddish. Mericarps glabrous to slightly pubescent, transversely rugose. Flowering and fruting in May and June.

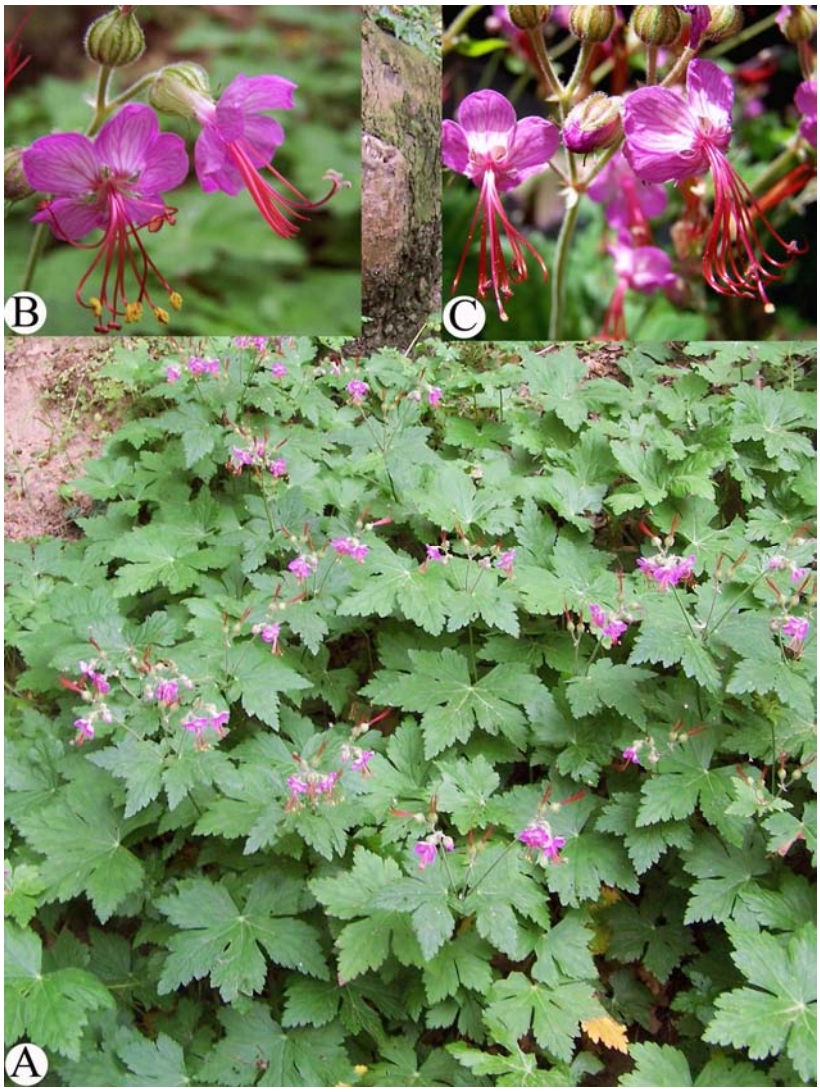

Figure 1. *G. macrorrhizum* A) Habit, B - C) Flowers.

B1: Balıkesir: Erdek, Kapıdağ Peninsula (Figure. 3), slopes, shady and wet areas, meadows and especially under *Castanea sativa*, *Carpinus betulus*, *Fagus orientalis*, *Platanus orientalis* and *Tilia tomentosa* groups, on brown forest soils where on the granite and granodiorite main rocks, 200 - 650 m, 27.05.2008, H. Öner 646. The plant specimens are deposited in Ege University Herbarium (EGE) (Figure 2).

The associated species with *G. macrorhizum* include; *Achillea grandiflora, Alliaria petiolata, Arbutus unedo, Cardamine bulbifera, Corylus avellana, Crataegus monogyna, Daphne pontica, Doronicum orientalis, Festuca slyvaticum, Fritillaria pinardii Geum urbanum, Helleborus orientalis, Hypericum calycinum, Laurus nobilis, Mespilus germanica, Phillyrea latifolia, Primula vulgaris Polygonatum multiflorum, Quercus coccifera, Q. infectoria* subsp *infectoria, Rosa canina, Rubus canescens, R. discolor, R. idaeus, Ruscus hypoglossum, Silene vulgaris, Sytrax officinalis, Trachystemon orientalis, Vicia cracca* and *Viola sieheana.*

G. macrorrhizum is naturally distribution on the Balkan Peninsula, S., E. Carpathians, S. Alps, Appennini mountains (Italy). Cultivated elsewhere for ornament and often naturalized (Albania, Austria, France, Greece, Italy, Jugoslavia, Romania, Belgium, Britain, Germany, Crimea and middle-upper Black sea countries) (Webb and Ferguson, 1968) . It was not previously recorded in Turkey. It was found in a narrow area around Kapıdağ Peninsula (Erdek-Balıkesir) firstly.

Figure 2. *G. macrorrhizum* A) Habit, B) Calyx, C) Mericarps, D) Basal leaf, E) Style, stamens and calyx.

G. macrorrhizum is clearly different from other *Geranium* species in Turkey. It can be easily distinguished from other *Geranium* species by the following features. Rhizome (horizontally, elongated, 6-13 mm wide), leaves wide and lobes (7 - 17 cm wide, divided for 4/3 of the radius into 5 - 7 obovate pinnatifid lobes), stamens length (22 - 26 mm) and style length (up to 40 mm).

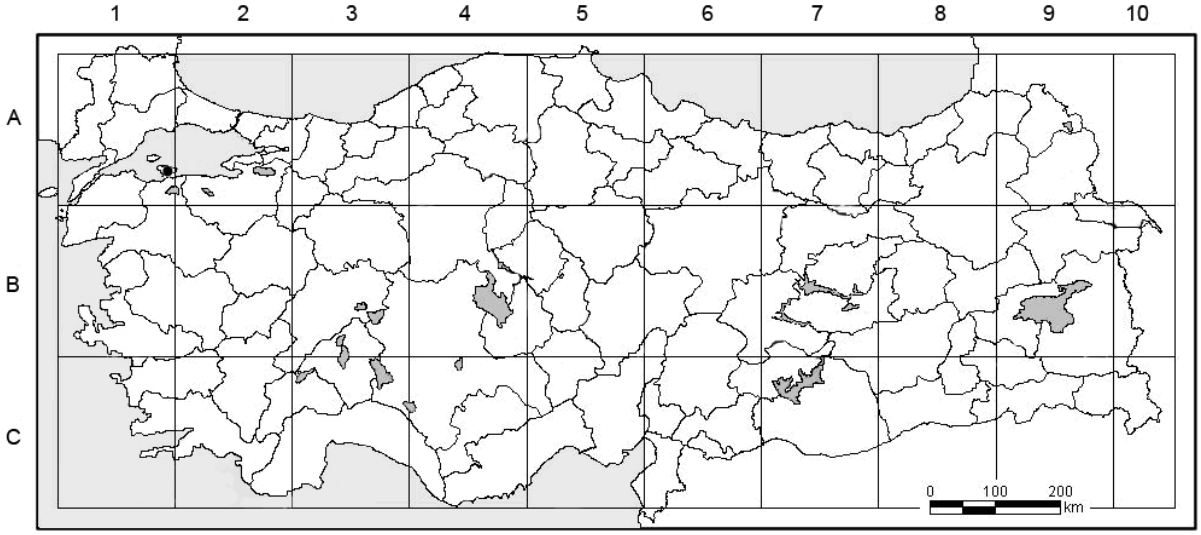

Figure 3. Distribution map of (●)*G. macrorrhizum* in Turkey

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Varieties and chorology of *Convolvulus oleifolius* Desr. (Convolvulaceae) in Turkey

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Abstract

In this study, two varieties of *C. oleifolius* recorded in flora of Turkey, which were determined to distribute in our country. As a result of the identifications made by taking into account of the specimens collected during the field studies and the herbarium specimens, it is determined *C. oleifolius* var. *oleifolius* and *C. oleifolius* var. *deserti* distribute in our country. Descriptions of taxa, illustrative drawings and distributions are given in the study and polen characters of both taxa were examined by light microscope and SEM.

Key words: Chorology, Convolvulaceae, *Convolvulus oleifolius*, Turkey

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Convolvulus oleifolius Desr. (Convolvulaceae)'un Türkiye'deki varyeteleri ve korolojisi

Özet

Bu çalışmada, Türkiye Florasında kayıtlı olan *C. oleifolius*'un, ülkemizde yayılış gösterdiği belirlenen iki varyetesi sunulmuştur. Arazi çalışmaları sırasında toplanan örnekler ile herbaryum örnekleri göz önüne alınarak yapılan teşhisler sonucunda, ülkemizde *C. oleifolius* var. *oleifolius* ve *C. oleifolius* var. *deserti*'nin yayılış gösterdiği tespit edilmiştir. Çalışmada taksonlara ait betimlemeler, tanımlayıcı çizimler ve yayılış alanları verilmiş, her iki taksonun polen karakterleri ışık mikroskobu ve SEM ile incelenmiştir.

Anahtar kelimeler: Convolvulaceae, *Convolvulus oleifolius*, Koroloji, Türkiye

1. Introduction

The family Convolvulaceae (bindweed family) is a family of herbaceous and woody, climbing or trailing vines, shrubs and trees. It is represented throughout temperate and tropical regions of the world, and has a wide range of habitats (Heywood, 1985). It consists of 58 genera and approximately 2000 species, with the genus *Convolvulus* L. comprising some 250 species throughout the world (Staples and Yang, 1998). The genus *Convolvulus* was revised by Parris (1978) in the 'Flora of Turkey and the East Aegean Islands' and one species was subsequently described (Davis *et al*. 1988). According to Flora of Turkey, belong to 33 species (36 taxa) of genus *Convolvulus* were distributed in Turkey.

C. oleifolius Desr. is a woody based perennials, shrublets or shrubs and distributing rocky and stony slopes, macchie areas, phrygana and sand dunes near the sea in Aegean and Mediterranean regions in Turkey. *C. oleifolius* is distribute in Aegean Islands, Cyprus, Egypt, Greece, Libya, Malta, North Africa, Palestine, Sicily and West Syria outside of Turkey. Three variety of this species, *C. oleifolius* Desr. var. *oleifolius*, *C. oleifolius* Desr. var. *deserti* Pamp. and *C. oleifolius* Desr. var. *pumilius* Pamp., are in Flora of Cyprus. According to Flora of Cyprus these varieties distinguished from each other especially with habit and leaves; *C. oleifolius* var. *oleifolius* is spreading subshrubs, leaves numerous and oblanceolate; *C. oleifolius* var. *deserti* is rigid, broom-like, usually erect and much branched shrubs and the branches often leafless towards the base, leaves narrowly linear (Meikle, 1985).

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These varieties were incorporated in Med-checklist which was published by Greuter *et al.* (1986). Similarly, *C. oleifolius* var. *oleifolius*, *C. oleifolius* var. *deserti* and *C. oleifolius* var. *pumilius* taxa weren't indicated as synonymous of this species (Greuter, 1986). Numerous specimens of *C. oleifolius* were collected during the field trips of "Taxonomical Studies on genus *Convolvulus* L. (Convolvulaceae) in Turkey" project. It is approved that the specimens of *C. oleifolius* are evaluate as two different variety which are *C. oleifolius* var. *oleifolius* and *C. oleifolius* var. *deserti* according to results of field observations, morphological and palynological studies. In the present study, morphological description of *C. oleifolius*, descriptions which show the differences between two varieties, identification key, palynological features and distribution map of the taxa are presented.

2. Materials and methods

During the field trips in West and Southwest Anatolia for Revision of Turkish *Convolvulus*, we collected some interesting specimens thought to belong to *C. oleifolius* According to 'Flora of Turkey' (Parris, 1978), *C. oleifolius* distributed in B1, C1 and C2 squares in Turkey, but the varieties of this species weren't mentioned. Therefore, they couldn't be identified by using 'Flora of Turkey'. Then specimens were crosschecked with various *Convolvulus* accounts given in the relevant literature, the 'Flora of Cyprus' (Meikle, 1985), 'Flora Europaea' (Stace, 1972), 'Flora Iranica' (Rechinger, 1979), 'Flora of Syria, Palestine and Sinai' (Post, 1932), Nouvelle Flore du Liban et de la Surie (Mouterde, 1986), Karamanoğlu (1964) and Sa'ad (1967). These specimens which belong to different varieties of *C. oleifolius* were determined by use of the 'Flora of Cyprus' (Meikle, 1985).

The pollen morphologies of *C. oleifolius* var. *oleifolius* and *C. oleifolius* var. *deserti* were examined by means of light microscope (LM) and SEM. For LM, the pollen grains were first treated with 96% alcohol to remove oily substances, and then embedded in glycerin jelly stained with basic fuchsine (Wodehouse, 1935). In LM studies the following parameters were measured: polar axis (P), equatorial axis (E), exine and intine thickness. The measured pollen diameters were based on 50 samples. To examine the exine sculpture in detail, scanning electron microscopy (SEM) was also used. For SEM study, the pollen was first treated with 70% alcohol and then dried before mounting on stubs with gold. The photomicrographs were taken with Zeiss LEO-1430 Electron Microscopes. In this study, the terminology of Punt *et al.* (2007) was used.

This study was based on the herbarium materials deposited in GAZI, HUB, ANK, ISTE, ISTF and on the plants collected in the field and deposited in the herbarium of AKDU (Herbarium of the Biology Department of Akdeniz University).

3. Results and discussions

Convolvulus oleifolius Desr. in Lam., Encycl. 3:552 (1789)

Type: Levant, probably form Crete (Parris, 1978).

The following description of the species was based on the specimens collected from B1, C1, C2 and C3 squares in Turkey.

Woody-based, perennials, shrublets or shrubs. Stem 10–50 cm, prostrate, erect or ascending, silvery-silky indumentum. Leaves linear, oblanceolate or oblanceolate-sphatulate, 10–60 x 1.5–7 mm, acute or obtuse, attenuate at the base, adpressed-sericeous; occasionally sparsely pilose at the base; the basal leaves resemble to the cauline leaves, sometimes dense clustered and imbricate at the base of stem, sometimes semi-amplexicaule and scarious margin at the base. Inflorescence axillary and terminal, solitary or 2–8 flowered cymes (especially dichasia); pedicel 0.5–4 mm or wanting; peduncle 5–60 mm. Bracts similar the cauline leaves, 6–15 x 0.5–1 mm, adpressed-sericeous sometimes with sparsely soft and spreading hairs. Bracteoles linear, 3–20 x 0.2–1 mm, longer than pedicel. Sepals erect at flowering and fruiting period; outer sepals elliptic-lanceolate to obovoid-lanceolate, 8–12 x 2.5–4.5 mm, long acuminate to caudate, scattered villose, usually black dotted. Middle sepal elliptic-lanceolate, 8–11.5 x 3–5 mm, long acuminate to caudate, with the right and the left half unequal, one half membranous towards margin; the membranous part glabrous or glabrescent. Inner sepals elliptic-lanceolate to obovoid-lanceolate, 8–11x 3–5 mm, long acuminate to caudate, with the both half membranous towards margin; the membranous part glabrous or glabrescent. Corolla pale pink or rose pink, 15–25 mm long, with hairy bands on the outside; petals pubescent at the apex. Stamens unequal, 9.5–14 mm long; filaments entire at margin; anthers oblong with retuse apex, 2.5–3 mm long. Ovary ovoid-conical, 1.5–2 x 1–1.5 mm, hairy, surrounded by a glabrous disc at the base; style 5–6 mm, hairy; stigma lobes filiform, 5.5–6 mm. Capsule ovoid to conical, 4–5 x 3–5 mm, glabrescent towards base, hairy above, bilocular, 2– or 4– seeded; seeds ovoid, 3–3.5 x 2–3 mm, densely hairy. Flowering time April-June. (in Turkey).

General Distribution: Aegean Islands, Cyprus, Egypt, Greece, Libya, Malta, North Africa, Palestine, Sicily, west Syria, Turkey.

Habitat: Macchie, phrygana, stony, sandy, limestone and dry rocky slopes, under *Pinus brutia* and sand dunes, from sea-level to 250 m.

The following key can be used for distinguishing two varieties of *C. oleifolius* in Turkey:

1. Rigid, broom-like branched, usually erect, shrublets or shrubs, leaves dense clustered at the base of stem…… var. *deserti*
1. Prostrate or ascending, woody based perennials, stem branched from the base, leaves scattered on the stem……..……..var. *oleifolius*

C. oleifolius Desr. var. ***oleifolius*** (Figure. 1)

Type: 'vient du Levant & est cultivée au Jardin du Roi' (P).

Woody-based, perennials. Stem 10–50 cm high, prostrate or ascending, branched from the base, adpressed- sericeous. Leaves oblanceolate to oblanceolate-sphatulate, numerous and scattered on the stem. Inflorescence axillary and terminal, solitary or 2–3 flowered dichasia. Outer sepals elliptic-lanceolate with green acuminate apex, 9–10.5 x 3–4.5 mm, scattered villose. Corolla pale pink, 20–25 mm long. Filaments 8-11 mm long; anthers oblong, 3 mm long. Ovary ovoid, 1.5–2 x 1–1.5 mm, hairy; style 5–5.5 mm long, hairy; stigma lobes 6 mm long.

Specimens examined: **C3 Antalya:** Finike, 5 km from Finike to Demre, dry rocky slopes, macchie, 47 m, 12.v.2009, C. Aykurt (2429), N. Kemaloğlu (AKDU). **Antalya:** Finike, 5 km from Finike to Demre, dry rocky slopes, macchie, 47 m, 28.iv.2010, C. Aykurt (2957), N. Kemaloğlu (AKDU). **Antalya:** Between Finike and Demre, macchie, 50 m, 02.v.1979, H. Peşmen (4569), A. Güner (GAZI).

C. oleifolius Desr. var. ***deserti*** Pamp. in Archivio Bot., 12: 41 (1936) (Fig.1)

Type: Libya, Cyrenaica.

Rigid, broom-like, much branched shrublets or shrubs. Stem 10–50 cm, erect or ascending, adpressed-sericeous. Leaves linear, oblanceolate or oblanceolate-sphatulate and dense clustered at the base of stem; the branches sometimes leafless towards the base. Inflorescence axillary and terminal, solitary or 3–8 flowered cymes (often dichasia). Outer sepals elliptic-lanceolate with long, green acuminate apex, 8–12 x 2.5–3 mm, long and scattered villose. Corolla white, pale pink, or rose pink, 15–20 mm long. Filaments 7–11 mm long; anthers oblong, 2.5-3 mm long. Ovary ovoid, 2 x 1.5 mm, hairy; style 5.5–6 mm long, hairy; stigma lobes 5.5–6 mm long.

Specimens examined: **B1 İzmir:** Çeşme, Harbor district, phrygana, dry rocky hillside, 4 m, 13.v.2008, C. Aykurt (1950), N. Kemaloğlu (AKDU). **C1: Muğla:** Datça, 44 km from Marmaris to Datça, stony slopes, 80 m, 26.v.2008, C. Aykurt (2041), N. Kemaloğlu (AKDU). Muğla: Datça, between Marmaris and Datça, under *Pinus brutia*, 30 m, 1.vi.2009, N 36.76203 E 27 88094, C. Aykurt (2631), N. Kemaloğlu (AKDU). Muğla: Datça, Gebekum shore, sand dunes, 5 m, 2.vi.2009, C. Aykurt (2637), N. Kemaloğlu (AKDU). Muğla: Datça, Gebekum, under *Pinus brutia*, sandy slopes, 16 m, 2.vi.2009, C. Aykurt (2638), N. Kemaloğlu (AKDU). C1 Muğla: Datça, Gebekum, sea shores, 0-10 m, 10.v.2001, H. Duman 8534 (GAZI). **C2**: **Muğla:** Marmaris, between Datça and Marmaris, 33 km to Marmaris, slopes, 50 m, 2.vi.2009, C. Aykurt (2639), N. Kemaloğlu. (AKDU). **C3 Antalya:** Finike, 7 km from Finike to Demre, dry rocky slopes, 40 m, 28.iv.2010, C. Aykurt (2955), N. Kemaloğlu (AKDU). **Antalya:** Finike, 12 km from Finike to Demre, dry rocky slopes, 40 m, 28.iv.2010, C. Aykurt (2956), N. Kemaloğlu (AKDU).

A detailed comparison of the *C. oleifolius* var. *oleifolius* and *C. oleifolius* var. *deserti* given in the Table 1 and the geographical distributions of the two varieties are mapped in Figure 2.

Table 1. Comparison of some diagnostic morphological characters of *C. oleifolius* var. *oleifolius* and *C. oleifolius* var. *deserti*

	C. oleifolius var. *oleifolius*	*C. oleifolius* var. *deserti*
Habit	Prostrate or ascending, woody based perennials, 10–50 cm	Rigid, broom-like, erect or ascending much branched shrublets or shrubs, 10–50 cm
Leaves	Leaves numerous and scattered on the stem	Leaves dense clustered at the base of stem, the branches sometimes leafless towards the base
Inflorescence	Inflorescence axillary and terminal, solitary or 2–3 flowered cymes	Inflorescence axillary and terminal, solitary or 3–8 flowered cymes
Outer sepals	9–10.5 x 3–4.5 mm	8–12 x 2.5–3 mm

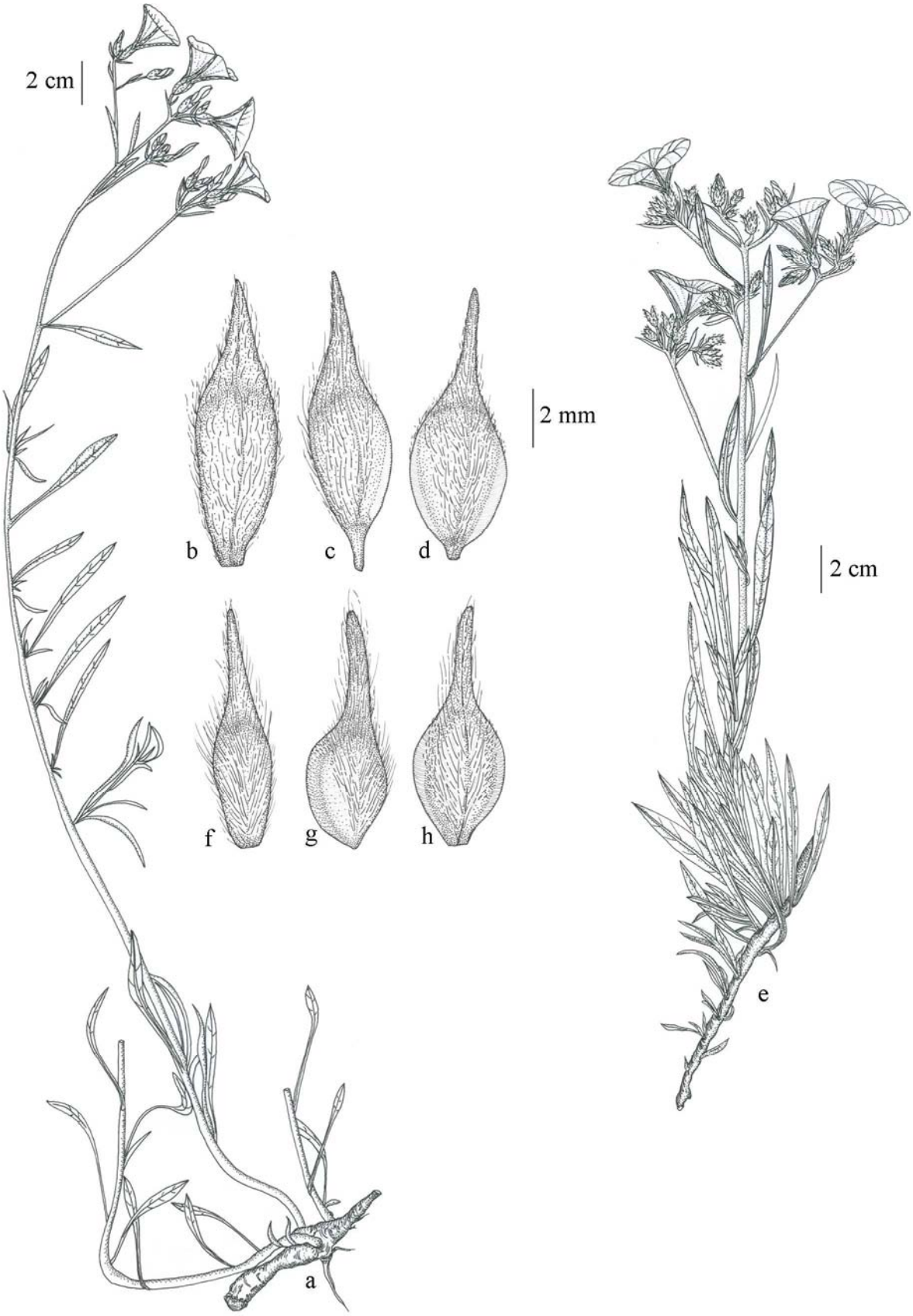

Figure 1. *C. oleifolius* var. *oleifolius*: a: Habit; b, c, d: Outer, middle, inner sepals; C. *oleifolius* var. *deserti*: e: Habit; f, g, h: Outer, middle, inner sepals.

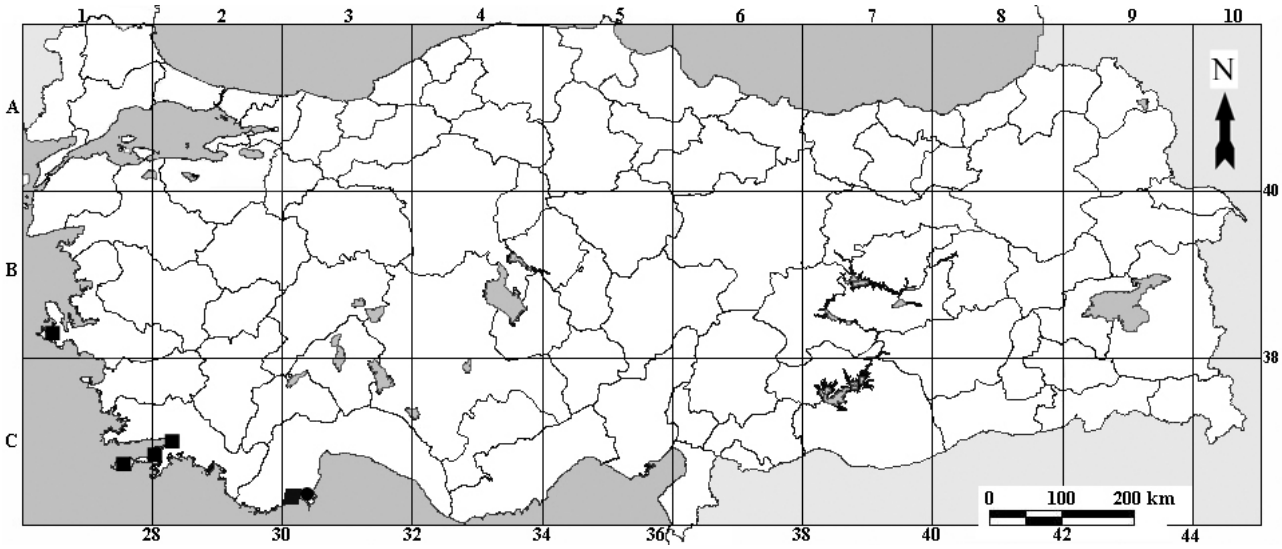

Figure. 2. Distribution of *C. oleifolius* var. *oleifolius* (●) and *C. oleifolius* var. *deserti* (■) in Turkey

Pollen Morphology

According to LM (Figure 3) and SEM (Figure 4-5) investigations, the pollen grains of *C. oleifolius* var. *oleifolius* and *C. oleifolius* var. *deserti* are tri- or tetracolpate, are large in size (51-100 µm). The pollen shapes (based on P/E ratio) are oblate-spheroidal to spheroidal and the ornamentation is microechinate-perforate; perforations are approximately circular, dense, distinct and irregularly distributed (specimens *C. Aykurt 2429* and *C. Aykurt 2638*). The main palynological features of the examined *C. oleifolius* var. *oleifolius* and *C. oleifolius* var. *deserti* are summarized in Table 2.

Table 2. Pollen characteristics of *C. oleifolius* var. *oleifolius* and *C. oleifolius* var. *deserti*

Taxa	Shape	P/E	P (µm)			E (µm)			Exine (µm)	Intine (µm)	Ornamentation
			M	SD	V	M	SD	V			
C. oleifolius var. *oleifolius*	oblate-spheroidal to spheroidal	0,95	69,30	±2.61	64.57–75.85	73.08	±1.98	69.7–77.9	1,02–2.05	1,02	microechinate-perforate
C. oleifolius var. *deserti*	oblate-spheroidal to spheroidal	0.98	57,91	±1,82	54,32–61,5	58,91	±1,74	56,37–62,52	1,02–2.05	1,02–1.54	microechinate-perforate

[Abbreviations: P – Polar axis, E – equatorial axis, M – mean value, SD – standard deviation, V – variation].

These results show that the pollen grains of *C. oleifolius* var. *oleifolius* and *C. oleifolius* var. *deserti* are mainly morphologically similar. The pollen grains of *C. oleifolius* var. *oleifolius* are distinguished by *C. oleifolius* var. *deserti*, which are usually tetracolpate and larger. Lewis and Oliver (1965) studied the pollen grains of the genus *Convolvulus*. They described the *Convolvulus* pollen grains as 3- or rarely 4-zonocolpate and prolate to subspheroidal. Our results are similar to the earlier studies (Menemen and Jury, 2002; Tellería and Daners, 2003; Lewis and Oliver, 1965).

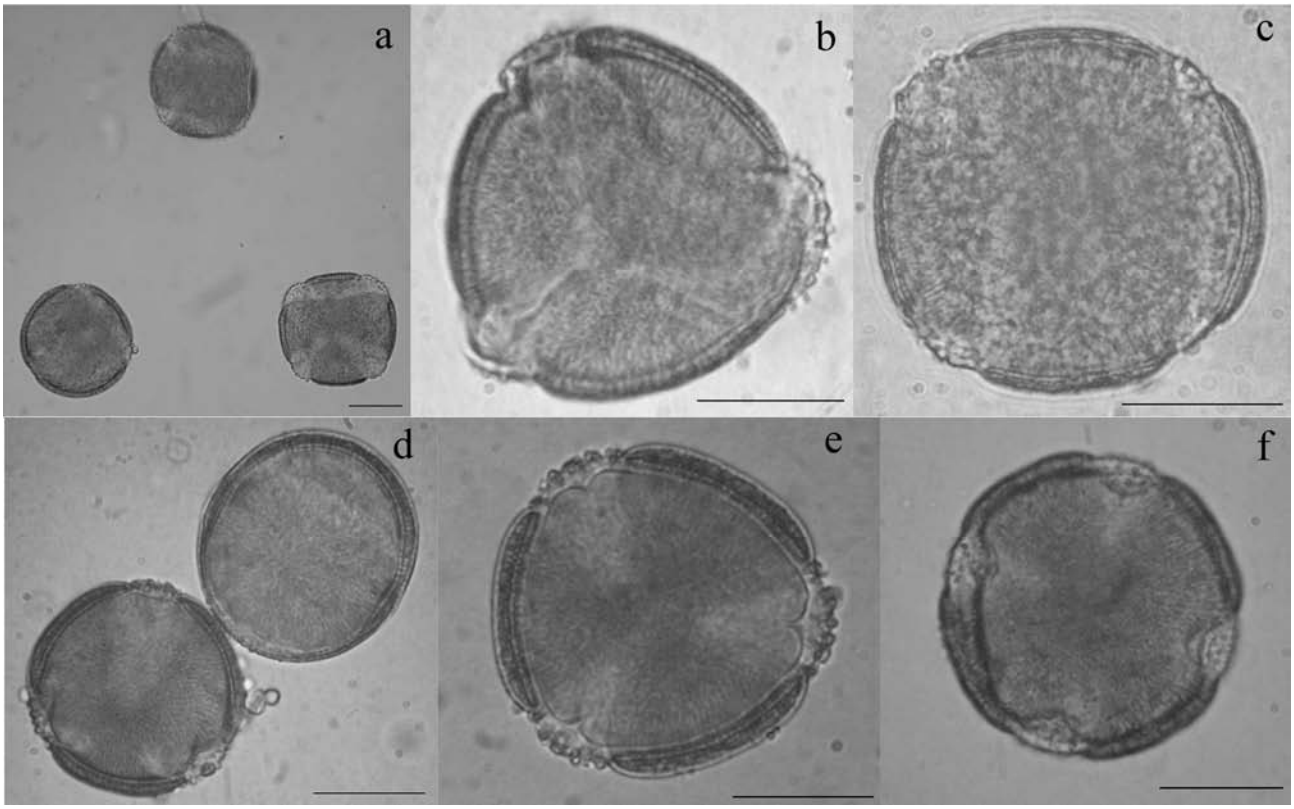

Figure 3. LM photographs of the pollen grains of *C. oleifolius* var. *oleifolius* and *C. oleifolius* var. *deserti*: a-b-c: *C. oleifolius* var. *oleifolius*; d-e-f: *C. oleifolius* var. *deserti* (bars = 30 µm).

It is approved that the specimens of *C. oleifolius* are evaluate as two different variety which are *C. oleifolius* var. *oleifolius* and *C. oleifolius* var. *deserti* according to results of field observations, morphological and palynological studies. Because, the specimens belonging these two varieties clearly separated from the each other with especially habit and leaf characters like it was specified in Flora of Cyprus. *C. oleifolius* var. *oleifolius* is a prostrate or ascending woody based perennials; leaves scattered on stem and not clustered at the base of stem. On the other hand, C. *oleifolius* var. *deserti* is a usually erect, rigid and broom-like branched shrublets or scrubs; leaves imbricate and dense clustered at the base of stem.

During the field trips, it is determined that both *C. oleifolius* var. *oleifolius* and *C. oleifolius* var. *deserti* are distributed on rocky places and macchie between Finike and Demre (Antalya) in Mediterrenean Region; but only *C. oleifolius* var. *deserti* among both varieties is distributed on stony and rocky slopes, macchie, phrygana, under *Pinus brutia* forests and sandy dunes around Çeşme (İzmir), Datça, Marmaris (Muğla) in Aegean Region. *C. oleifolius* var. *oleifolius* wasn't observed in the suitable habitats or places where *C. oleifolius* var. *deserti* was collected in the Aegean Region. It is possible to say that the individuals belonging both varieties have distributed simpatrically between Finike and Demre.

Flora of Turkey records of *C. oleifolius*:

Bl Izmir: nr Urla, *Kegel* (EGE 12678). CI Izmir: Kuşadasi, s.l., *Hub.-Mor.* 17530; ibid., 15 m, *Sorger* 65-9-52! Cl/2 Muğla: Marmaris to Datça, 25-30 km from Hisarönü, 250 m, *Dudley* (*D.* 35421)!

During field studies, specimens of *C. oleifolius* collected between Datça and Marmaris, were identified as *C. oleifolius* var. *deserti.* Although field studies were performed also around Urla and Kuşadası, any *C. oleifolius* species weren't met.

In Turkey, a great number of specimens of *Convolvulus* in large herbaria such as GAZI, HUB, ANK, ISTE, ISTF were examined. Specimens which are defined to belong to this species weren't met during herbarium studies. Only two different specimens of *C. oleifolius* were met. One of them was collected from Gebekum (Datça, Muğla) by Hayri Duman, one of the esteemed botanists of Turkey, and was considered under the name of *C. oleifolius* var. *deserti* within our study; and the other one was collected from the macchie area between Finike and Demre (Antalya) by deceased botanist Prof. Dr. Hasan Peşmen, and was considered under the name of *C.oleifolius* var. *oleifolius* within our study.

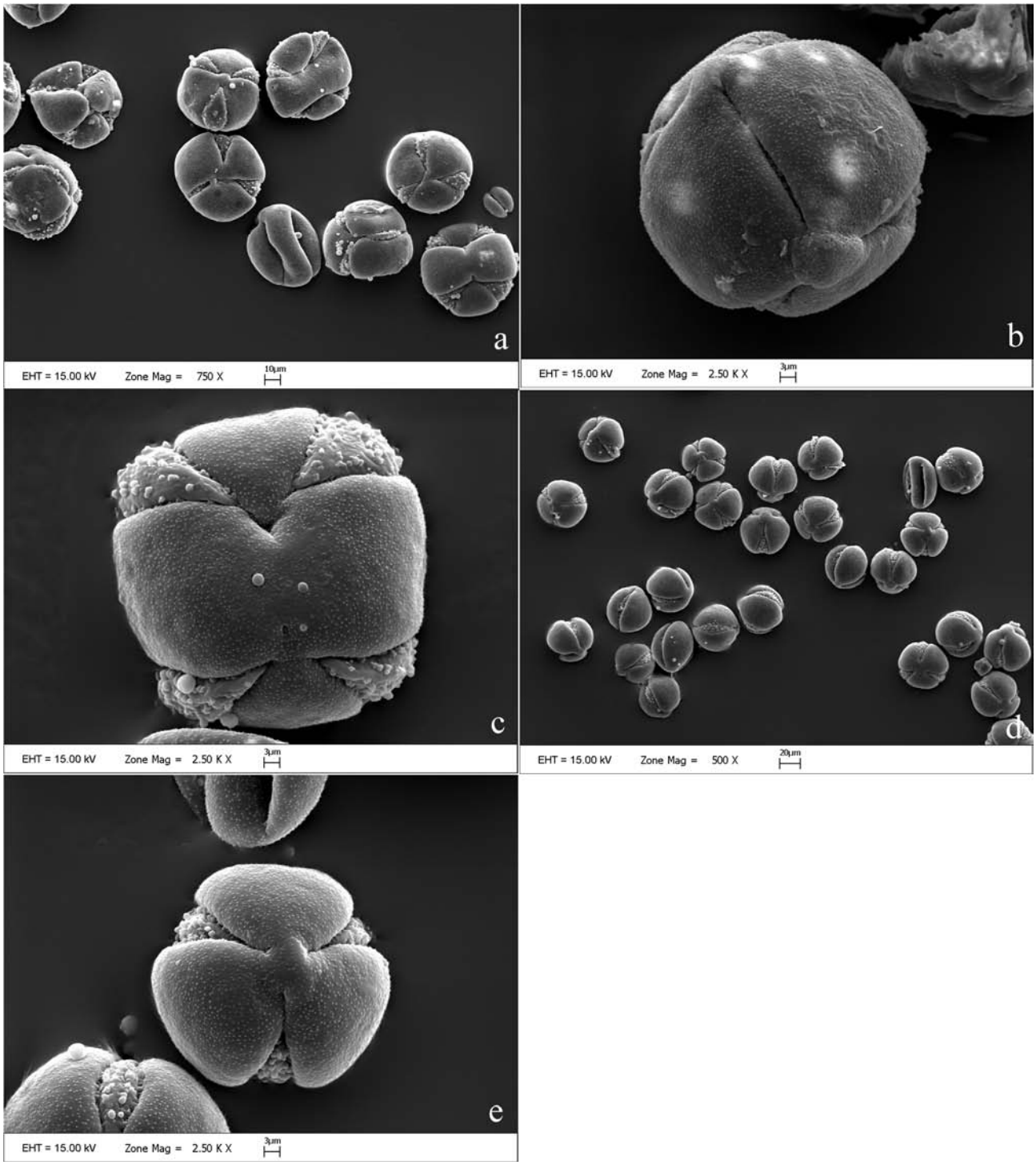

Figure 4. SEM photographs of the pollen grains of *C. oleifolius* var. *oleifolius* and *C. oleifolius* var. *deserti*: a-b-c: *C. oleifolius* var. *oleifolius*; d-e: *C. oleifolius* var. *deserti*.

Acknowledgements

The specimens were collected during the "Taxonomical Studies on genus *Convolvulus* L. (Convolvulaceae) in Turkey". The project is funded by Akdeniz University Scientific Research Projects Unit (Project Number 2007.03.0121.006). We are grateful to the Akdeniz University Scientific Research Projects Unit for their financial support.

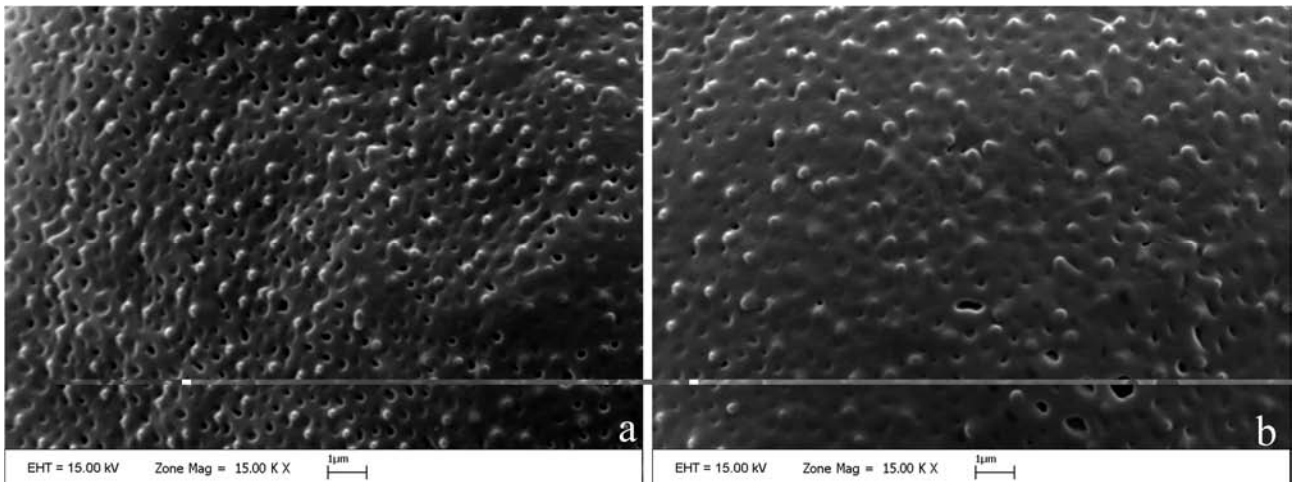

Figure 5. SEM photographs of the pollen surfaces of *C. oleifolius* var. *oleifolius* and *C. oleifolius* var. *deserti*: a: *C. oleifolius* var. *oleifolius*; b: *C. oleifolius* var. *deserti*.

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Morphological, karyological and ecological features of halophytic endemic *Sphaerophysa kotschyana* Boiss. (Fabaceae) in Turkey

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Abstract

Morphological, karyological and ecological features of halophytic endemic *Sphaerophysa kotschyana* are investigated based on the specimens collected from Tuz Lake environs. The expanded morphological description and illustration of this species is given. This study shows that the somatic chromosome number is 2n=14+0-2B. The pollen grains are prolate, 3-zonocolporate, medium in size, with suprareticulate ornamentation according to the results of SEM studies. Seeds are reniform, the sizes range between 3.5 mm and 4.0 mm in length and width. The seed surface has irregular granules. The karyogram, ideogram, and SEM photos of the pollen and seed surface are presented. In addition, the habitat of its and accompanied species are given as well.

Key words: Ecology, Karyology, Morphology, *Sphaerophysa kotschyana*

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Türkiye'de Halofitik Endemik *Sphaerophysa kotschyana* Boiss. (Fabaceae)'nın Morfolojik, Karyolojik ve Ekolojik Özellikleri

Özet

Tuz Gölü ve çevresinden toplanmış bir halofitik endemik olan *Sphaerophysa kotschyana*'nın morfolojik, karyolojik ve ekolojik özellikleri incelenmiştir. Genişletilmiş morfolojik deskripsiyonu ve görüntüleri verilmiştir. Bu çalışmada somatik kromozom sayısının 2n=14+0-2B olduğu görülmüştür. SEM çalışmalarına göre polen taneleri prolate, 3-zonokolpate, orta büyüklükte ve suprareticulate ornemantasyonludur. Tohumlar reniform, ebatları 3.5 mm uzunluğunda ve 4.0 mm genişliktedir. Tohum yüzeyi düzensiz granüllüdür. Karyogram, idiyogram, polen ve tohum yüzeyinin SEM'de çekilmiş görüntüleri sunulmuştur. Bunlara ilave olarak, türün habitatı ve birlikte bulunduğu türler hakkında bilgi verilmiştir.

Anahtar kelimeler: Ekoloji, Karyoloji, Morfoloji, *Sphaerophysa kotschyana*

1. Introduction

Turkey occurring in warm climate zone is distinguished from many countries situating its environments by the plant diversity. The number of plants distributed in Turkey is nearly those in Europe. The plant taxa in Turkey have reached to 12.000 by recently discovered new taxa. The richness of Turkish Flora is based on geographic, climatic, topographic and edaphic factors. These factors bring about the plant formation diversity and infraspecific variation. Turkey is also one of the richest countries in world with respect to endemism. The number of endemic taxa is more than 3000 and endemism ratio is 34.4% (Erik and Tarıkahya 2004; Avcı 2005; Özhatay et al. 2005).

The genus *Sphaerophysa* DC. was distributed in Middle and Central Asia, from South Siberia to North China, West Caucasia and Anatolia. This genus is represented two species in the world. These are *Sphaerophysa kotschyana*

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Boiss. and *S. salsula* DC. (Polhill and Raven 1981). The first of these, *S. salsula*, grows in Iran, Russia, Azerbaijan and Syria, while *S. kotschyana* is endemic to Central Anatolia (Aytaç and Ekim 1996). According the Bern Convention, *S. kotschyana* is in under absolute preservation plant list (CITES 2008). There are a few studies on the genus *Sphaerophysa* as (Chamberlain 1970; Shiskin 1971; Aytaç and Ekim 1996).

True halophytes are plants that able to live under elevated salinities, but also vary in their salt content from slight to brackish to medium to severe to above seawater salinity. In general 2.500-3.000 species of halophytes are found in the world. Nearly 700 species are distributed in the Mediterranean climatic zone (Güvensen et al. 2006).

The ecosystem of which occur in the Tuz Lake and its surrounding is one of the halophyte steppe habitat and watering area where rarely important biological richness of Turkey has accommodate. Both in the South and in the Southwestern part of the Tuz Lake, there exists exceptional area that includes salty and fresh water marsh. There are 35 local endemic plants species which grows especially around Tuz Lake and its surrounding. In Central Anatolia vegetation are dry in summer season except for some perennial and halophyte plants. Most of the halophyte plants are C4 plants and their photosynthesis and growing is very fast. Halophyte plants can adapt to living and maintain growing up in the hardest ecological conditions such as: hot and cold weathers, drought, dryness, saltiness, mineral deficiency and high radiation. The halophyte plants that growing around the Tuz Lake basin shows considerable variation depends on the salt density of the soil. The variation of the edaphic features that the populations of different plants cause to be organized and the population confined like isobaric lines on a map. An observation from far away, halophyte and xerophyte zone plants can easily distinguish the higher areas around the Tuz Lake.

Sphaerophysa kotschyana is closely related to *S. salsula*. It mainly differs from *S. salsula* because it has stipules 2-9 mm long (not c. 2 mm), calyx 5-7 mm long (not 4-5 mm), corolla purplish-pink to violet (not red), ovary glabrous (not short appressed hairs, seeds 3.5-4 mm long (not c. 1.5 mm) (Davis 1970; Shiskin 1971).

In this study, *S. kotschyana* which naturally grows in surrounding of the Tuz Lake were investigated as morphological description, ecological features, pollen and seed micromorphologies and karyology.

2. Materials and methods

Plant samples were collected from Tuz Lake environs. The specimens are dried according to standard herbarium techniques and stored at Selcuk University Education Faculty Herbarium. The collecting locality of the species as follows; morphology and pollen; B4 Konya: Tuz Lake, between Gölyazı-Tersakan, 945 m, 27.05. 2006, roadsides, field margins, 38º35.821'N, 33º07.170'E, *A.Duran 7149* (S.Ü. Education Fac. Herb.); morphology; Konya: Cihanbeyli, between Gölyazı-Tuz Lake, c. 15. km, 922 m, 12.06.2006, 38º32.389'N, 33º20.418'E, salt steppe, *A.Duran*, observation; morphology, seed and karyology; Aksaray: Eskil, 930 m, 30.04.2006, 38º24.319'N, 33º24.543'E, *A.Duran 7135* (S.Ü. Education Fac. Herb.); morphology; Ankara: Sereflikoçhisar, Kaldırım Tuzlası, 910 m, 27.05.2006, salt steppe, *A.Duran*, observation.

These specimens are used for morphological and palynological studies. For the morphological studies, at least ten specimens are investigated, and morphological description of the species was expanded. Palynological investigations are made by both light microscope and scanning electron microscope. For light microscope studies, the pollen slides were prepared according to the Wodehouse technique (Woodehouse 1935). Pollen grains are dissected from herbarium specimens and placed on a clean microscope slides. Glycerin-gelatin with basic fuchsine was placed on pollen and allowed to melt and mixed by a clean pin to get scattered pollen grains. All measurements are determined on at least thirty pollen grains. The pollen grains are also directly placed on prepared stubs and covered with gold for SEM studies. Photographs are taken with SEM. Pollen terminology follows in literature (Erdtman 1960; Punt et al. 1994).

The seeds are examined and photographed under SEM like the pollen. Mitotic chromosome preparations were prepared from root meristems obtained from germinating seeds. Root tips pretreated for 16 h in α-monobromonaphthalene at 4°C, fixed in 3:1 absolute alcohol-glacial acetic acid, then the root tips were hydrolyzed with 1 N HCl for 3 minutes at 60°C an overnight and stained 2% aceto-orcein for 2h at room temperature. Stained root tips were squashed in a drop of 45% acetic acid and permanent slides were made by mounting in Depex. At least 20 counts from seven to ten individuals were made to verify the observations. We examined slides under Olympus BX–50 Photomicroscope using an oil immersion objective (100X). Photographs were taken with the same microscope. The karyogram and ideogram were prepared with measurements taken on enlarged micrographs of five well spread metaphase plates. Chromosome measurement and karyotype were calculated with Bs200Pro Image Analysis Software. Ideogram of species was arranged in order of decreasing length.

3. Results

3.1. Sphaerophysa kotschyana Boiss. (Figures 1- 2).

3.2. Description

Perennial herbs. Plant 20-30 cm tall, ± erect, ± sparsely adpressed bifurcate hairs. Stems slightly striate, 2-3 mm diam. below, densely branched at base or middle part. Leaves alternate, imparipinnate; leaflets 4-8 paired, cuneate-oblong, apex truncate, 5-15 x 2-6.5 mm. Stipules paired, adnate, triangular-lanceolate, membraneceous at margins, 2-9 x 0.5-3 mm, gradually decreasing in size upwards, sparsely bifurcate hairs. Peduncles quadrangular, 5-11 cm. Inflorescence axillary, raceme, 5-12 flowered. Flowers pedicellate. Pedicels 2-5 mm, bracteates, 1-2 mm. Bracteoles sparsely hairy, 0.5-1 mm. Calyx campanulate, 5-7 mm long, sparsely pubescent especially at mouth outside and inside, teeth subequal, triangular ovate to lanceolate, acute 1.5-2.5 mm long. Corolla generally purplish-pink to violet, 15-20 mm. Standard flabellate, 1.3-1.7 x 1.4-1.6 cm; wings oblanceolate, 1.5-1.6 x 0.45-0.55 cm; carina clawed, 1.4-1.8 cm long; claw 0.9-1.2 cm long, with 1-2 mm long auricles at base; limb narrow, 4-5 mm long. Stamens diadelphous. Ovary glabrous. Ripe fruit strongly inflated, indehiscent, oblong-ellipsoid, membranous with 10-12 mm stipe and curved 6-7 mm long style, conspicuously parallel veined. Veins branched, dark green arising from the sture. Seeds 5-8, asymmetric reniform, 3.5-4 x 3.5-4 mm, ± smooth, dark brown (Stearn 1996).

Figure 1. Habitus of *Sphaerophysa kotschyana*

Figure 2. Mature fruits of *Sphaerophysa kotschyana*

3.3. Seed characteristics

The seeds of *Sphaerophysa kotschyana* are asymmetric reniform, on the average, 3.5-4.0 mm long and wide, with an outgrowth about the middle of the sinus. The seed surface is irregular ornamentation Figures 3-4. Epicuticular wax was observed on the surface layer of the seed coat. In microphotographs, its surface features are randomly granulate to slightly roughened.

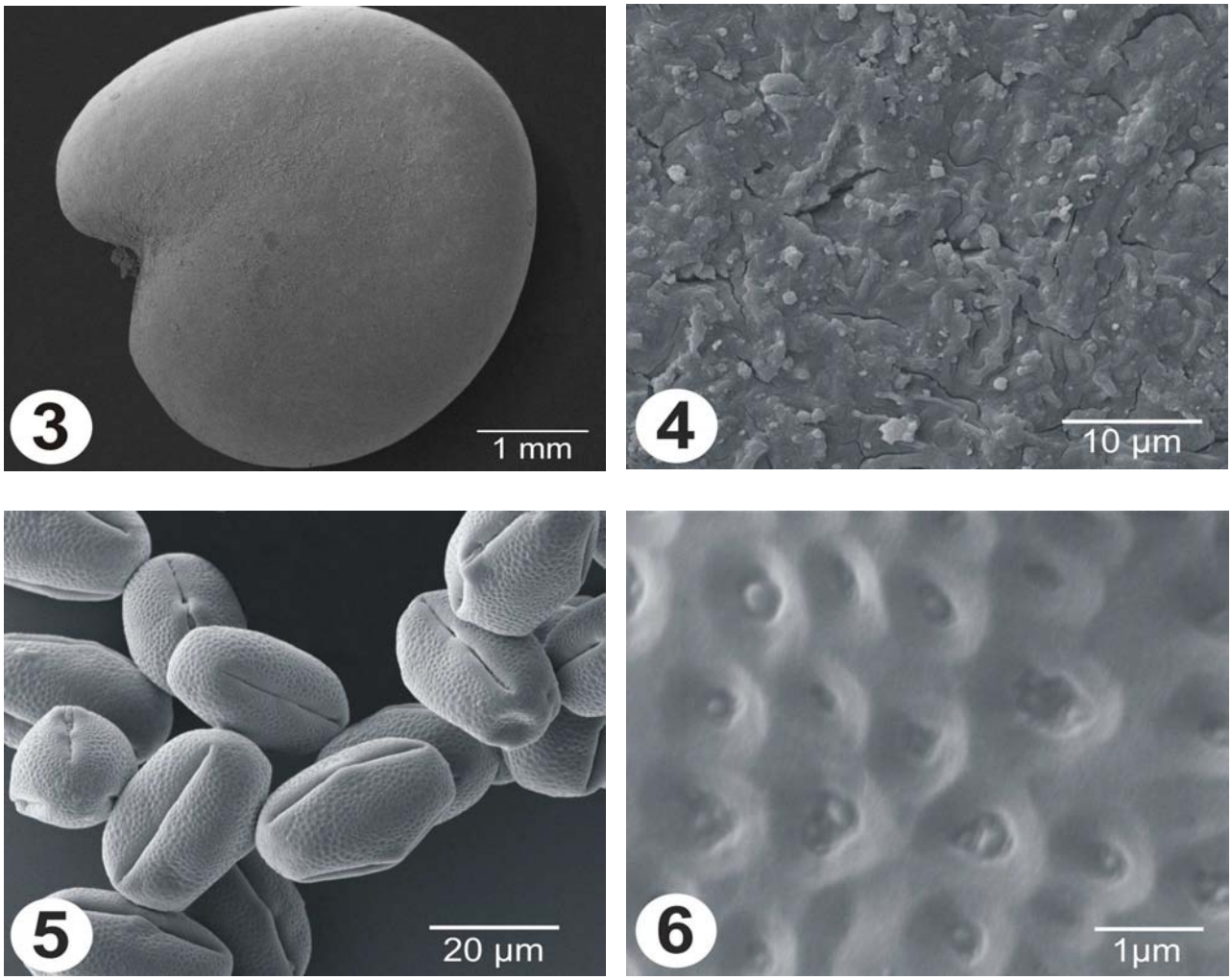

Figure 3-6. SEM micrographs of the seed coat surfaces and the pollen grains of *Sphaerophysa kotschyana*. Seed: (3) general shape, (4) seed coat surface; pollen grains: (5) general view, (6) wall detail

3.4. Pollen morphology

The pollen of *Sphaerophysa kotschyana* are monad, medium sized, 3-zonocolporate. Polar axis (P) is between 27-30 µm, equatorial axis (E) 16-19 µm and P/E ratio 1.52-1.66. In the equatorial view, the shape of pollen grain is prolate. The pollen is triangular-obtuse-convex to circular in polar view. The exine thickness is between 1.30-1.45 µm. The exine ornamentation is suprareticulate Figures 5-6.

3.5. Karyological features

The chromosome number and morphology of *Sphaerophysa kotschyana* has been studied for the first time. The somatic chromosome number of the species was determined to be 2n=14+0-2B (Figure 7). The basic chromosome number for this species is x=7. The total chromosome length is between 1.33-2.22 µm. The total length of the haploid set is 11.83 µm. In addition to somatic number, homologous chromosome pairs were also determined through total length of each chromosome for each slide. However, it was impossible to determine the position of centromers and karyotype formula, because the chromosomes of this species invariable very small. The ideogram and karyogram are given in Figures 8-9.

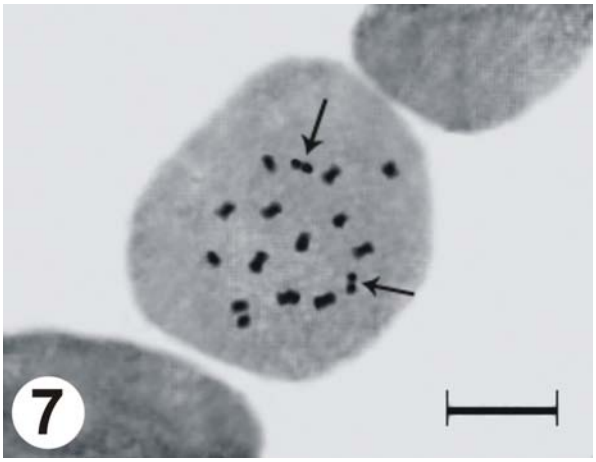

Figure 7. Metaphase chromosomes of *Sphaerophysa kotschyana* Bar: 5 µm.

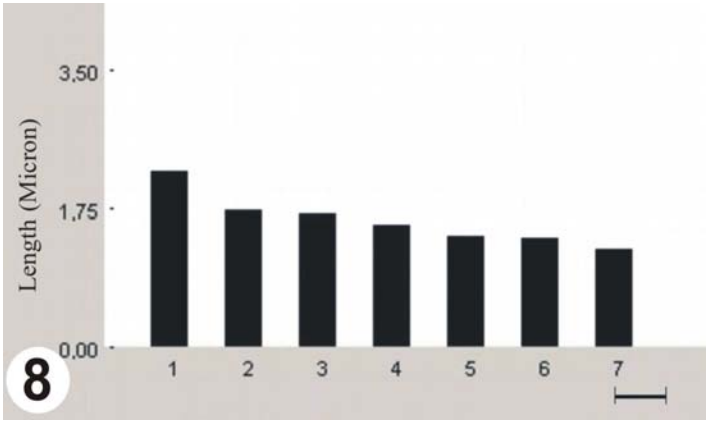

Figure 8. Ideogram of *Sphaerophysa kotschyana*

Figure 9. Karyogram of *Sphaerophysa kotschyana*

3.6. Ecology

Sphaerophysa kotschyana an endemic species of Turkey and Irano-Turanian element. It grows on salty marsh and salty steppe in mainly Central Anatolia. The species found growing with *S. kotschyana* include *Frankeria hirsuta* L., *Leymus cappadocicus* (Boiss. & Bal.) Melderis, *Halimione portulacoides* (L.) Allen, *Panderia pilosa* Fisch. & C.A.Mey., *Camphorosma monspeliaca* L., *Ferula halophila* Peşmen, *Achillea wilhemsi* C.Koch., *Centaurea drabifolia* Sm., *Limonium iconicum* (Boiss. & Heldr.) O.Kuntze, *Limonium anatolicum* Hedge, *Astragalus ovalis* Boiss. & Bal., *Anthemis fumariifolia* Boiss., *Scorzonera hieraciifolia* Hayek, *Centaurea bornmulleri* Hausskn. ex Bornm., *Aeluropus littoralis* (Gouan) Parl., *Prangos meliocarpoides* Boiss. The geographical distribution map of *Sphaerophysa kotschyana* is given Fig. 10.

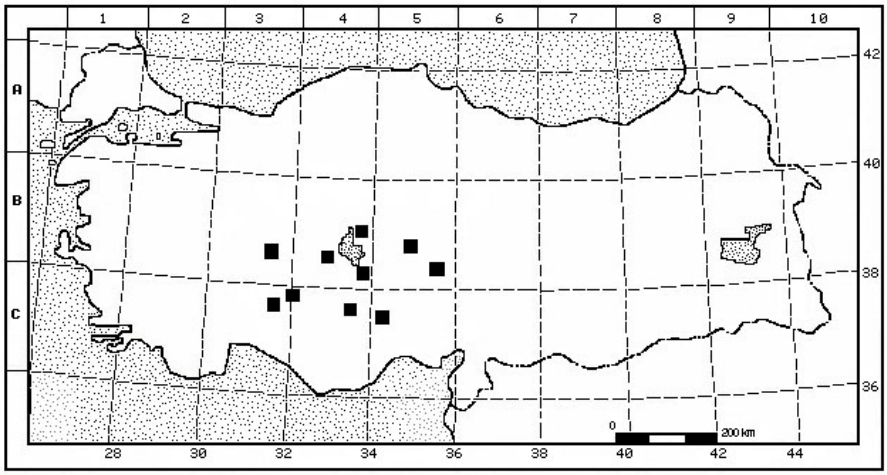

Figure 10. The geographical distribution map of *Sphaerophysa kotschyana*

3.7. Status

The *Sphaerophysa kotschyana* species placed in VU (Vulnerable) status (Ekim et al. 1989). Nevertheless, the places where it grows are small areas of 100 m^2 or less. The great majority of such areas are in use as agricultural land. It seems that *S. kotschyana* is adapted in such areas. For these reasons, it would be correct to change the status of the plant Vulnerable to the" lower risk near threatened (Lrnt) category of IUCN (IUCN 1994; Aytaç and Ekim 1996). Now, It should be graded as Near Threatened (NT) (IUCN, 2001), because of its local distribution and rather a small population size.

3.8. Economic use

In Turkey the great majority of members of the family Fabaceae are used as animal fodder. But there is no record of *Sphaerophysa kotschyana* used (Aytaç and Ekim 1996). The *S. salsula* is one of the widely cultivated plants in U.S.A. This species is using as a medical plant and erosion control. Roots are used for the preparation of medicaments used in gynaecology (Hanelt 2001).

4. Discussion

Sphaerophysa kotschyana, known in the Flora of Turkey from only one locality, has now been represented from ten separate and widely-scattered areas. The following are the collection sites: Afyon, Sultandağı; Ankara, Şereflikoçhisar; Kayseri, Everek; Kayseri, Develi; Denizli, Çardak; Afyon, Dazkırı; Konya, Aslım marhes; Konya, Ereğli; Konya, Cihanbeyli; Aksaray, Eskil. The geographical distribution of the *S. kotschyana* is mapped (Fig. 10). *S. kotschyana* grows in salt marshes, salt steppe, and in fields which are within such areas (Aytaç and Ekim 1996).

Sphaerophysa kotschyana was introduced to science world by Edmond Boissier in 1872 (Chamberlain 1970). But the description of this species is very insufficient. Its description was emended with field observation and herbarium materials. But also seed morphology features and mature fruit, seed characteristics which were unknown in Flora of Turkey are described in the present study. Ripe fruits are strongly inflated, oblong-ellipsoid, membranous, with 10-12 mm stipe and curved, with 6-7 mm style, with conspicuously parallel veined. The veins are branched and dark green. Seeds number are 5-8, asymmetric reniform, 3.5-4 x 3.5-4 mm, ± smooth and dark brown.

The seeds and pollen of *S. kotschyana* are examined by SEM, and its seed surface has irregular ornamentation. The pollen characteristics are monad, 3-zonocolpate, and the shape of pollen grain is prolate and the exine ornamentation is suprareticulate.

The somatic chromosome number of *S. kotschyana* was determined to be 2n=14+0-2B. The basic chromosome number for this species is x=7. The total chromosome length is between 1.33-2.22 µm. The total length of the haploid set is 11.83 µm. The morphological characters of the genus *Sphaerophysa* are similar with the genus *Colutea* L. The diploid chromosome number of *Colutea* was reported 2n=16, the basic chromosome number for this species is x=8 (Slade 1953). The diploid chromosome number of *S. kotschyana* 2n=14+0-2B, the basic chromosome number for this species is x=7 and differentiated from the genus *Colutea*.

In this scope of study, we discussed the ecological properties of *Sphaerophysa kotschyana* that are naturally grown in the Tuz Lake basin. Besides, in this study determined the karyological properties and the micromorphologies pollen and seed of the *S. kotschyana*.

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The flora of Kaş Plateau and its surroundings (Anamur – Mersin/Turkey)

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Abstract

This research has been made to determine the flora of Kaş Plateau and its surroundings (Anamur - Mersin). The research area is in the C4 square according to the grid system. As a result of the examination of 840 plants specimens which were collected from the research area between 2006-2008, 470 taxa that belong to 73 families and 279 genera have been determined. In the research area the number of endemic taxa is 62 (13.2%). The phytogeographic region of plants in this area are represented as follows; Mediterranean 33.6%, Irano-Turanian 10.2%, Euro-Siberian 4.3%.

Key words: Flora, Kaş Plateau, Anamur, Mersin, Turkey

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Kaş Yaylası ve çevresinin (Anamur - Mersin) florası

Özet

Bu araştırma Kaş Yaylası ve çevresinin (Anamur - Mersin) florasını tespit etmek için yapılmıştır. Araştırma alanı kareleme sistemine göre C4 karesi içerisindedir. Çalışma alanından 2006-2008 yılları arasında toplanan 840 bitki örneğinin değerlendirilmesi sonucu 73 familyaya ait 470 takson ve 279 cins tespit edilmiştir. Çalışma alanındaki endemik takson sayısı 62 (% 13.2)'dir. Bitkilerin fitocoğrafik bölgelere göre dağılımları şöyledir: Akdeniz elementi % 33.6, İran-Turan elementi % 10.2, Avrupa-Sibirya elementi % 4.3'dür.

Anahtar kelimeler: Flora, Kaş Yaylası, Anamur, Mersin, Türkiye

1. Introduction

The research area locate in Anamur-Ermenek highway 42nd kilometers north of the district of Anamur and is in square C4, according to the grid system used in the Flora of Turkey (Davis, 1965-1985). The study area is situated between 32°52'36" / 32°55'44" E longitude and between 36°09'94" / 36°14'80" N latitude. The region is located in the south of Teketaşı Hill, in the north of Sülmen Hill and Ormancık, in the east of Kınalı Hill and in the west of Narağacı and Tombul Hill (Figure 1). The altitude of the area ranges from 150 m to 1675 m.

There have been no previous studies on the flora of the Kaş Plateau. This area was selected for the research because it was not thoroughly studied and has some interesting characteristics, in terms of both flora and phytogeography. The research area has a mediterranean climate. According to Emberger the precipitation-temperature coefficient (Q) is 67.4 (Akman, 1990). According to this value Anamur is in mediterranean climate less rainfall and take part in bioclimatic zone where winter is very cold. Annual mean temperature is 19.2 °C. The maximum mean temperature (M) is 33.5 °C. The minimum mean temperature (m) is 5.8 °C (Table 1). Annual rainfall is about 965.6 mm and the seasonal precipitation regime is winter, autumn, spring and summer (MIM, 2002). The ombrothermic diagram shows dry and rainy months (Figure 2). As geological structure area is located between Alanya and Aladağ massifs (units). The tectonic unit is represented by pre-permian age calcshists, chloroschists, crystalized limestones (Yapıcı et

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al., 2003). The most common soil type in the research area is the red podzolic soil (Doğu Akdeniz havzası toprakları, 1974).

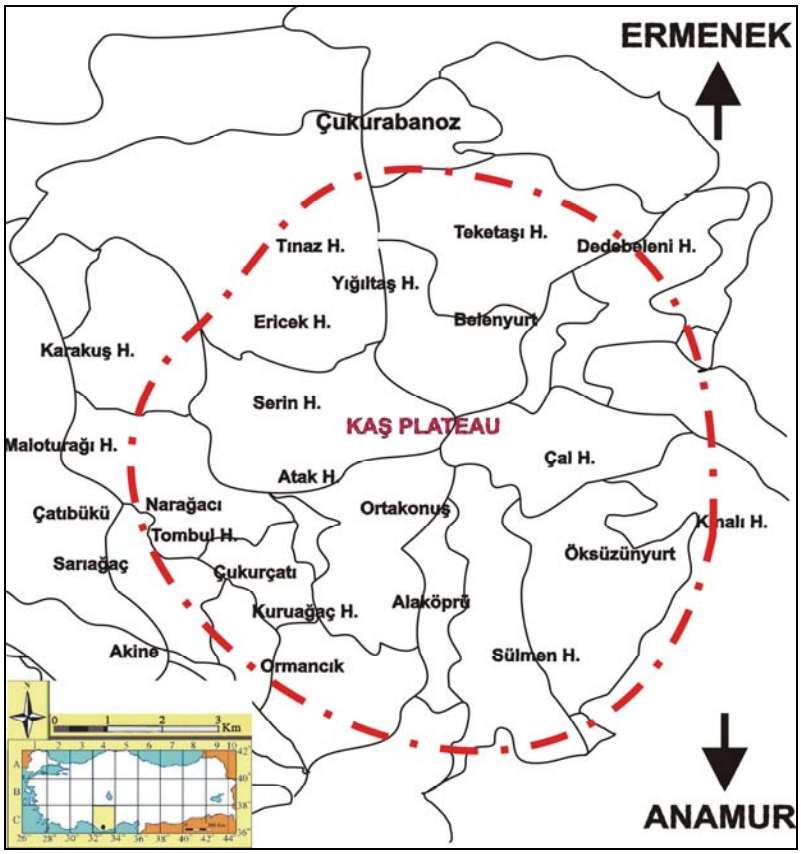

Figure 1. Map of the study area.

Table 1. Monthly – annual rainfall (mm) and temperature (°C) values of Anamur.

ANAMUR	OBSERVATION PERIOD	MONTHS												ANNUAL
		1	2	3	4	5	6	7	8	9	10	11	12	
Rainfall (mm)	55	199.4	150.1	102.6	46.7	24.8	4.7	0.3	0.7	7.4	75.4	124.4	229.1	965.6
Avr. Temp. (°C)	55	11.4	11.5	13.4	16.8	20.7	24.9	27.9	28.0	25.1	21.0	16.5	13.0	19.2
Max. Avr. Temp. (°C)	55	22.5	23.2	27.5	33.3	37.5	41.0	42.0	44.2	39.5	36.6	30.3	24.6	33.5
Min. Avr. Temp. (°C)	55	-1.4	-4.7	-0.7	3.4	8.6	12.2	16.2	15.8	10.8	8.0	2.3	0.7	5.9

2. Materials and methods

During fieldwork conducted between 2006 and 2008, 840 plant specimens were collected in the study area. The collected plant specimens were dried according to herbarium techniques, numbered and deposited in KNYA herbarium collection. The majority of the specimens were identified with the help of The Flora of Turkey and The East Aegean Islands (Davis, 1965-1985; Davis et al., 1988; Güner et al., 2000). Some of the identifications were checked in Flora Europaea (Tutin et al., 1964-1980), Flora Hellenica (Strid and Tan, 1997), Flora Iberica (Talavera, 1999) and Flora Iranica (Rechinger, 1965-1977). The herbarium of KNYA was used to check the specimens. All taxa in the floristic list are given according to the order in the Flora of Turkey (Davis, 1965-1985). The floristic elements are listed in the results. In the results, every species is represented with the following details: family and taxon name, authors of the species, geographical locations, habitats, altitudes, collection dates and collector numbers. In addition, endemism, IUCN threat categories (Ekim et al., 2000; IUCN, 2001), their phytogeographical regions and the life forms are given. The phytogeographical regions of the taxa were evaluated according to Flora of Turkey (Davis, 1965-1985; Davis et al.,

1988). Grid square and city name are not mentioned for each location because the study area is completely within the C4 Anamur (Mersin). Author abbreviations of plant names are given according to Brummitt and Powell (1992). The wild taxa were compared with floras of neighbouring areas (Sümbül and Erik, 1988a-1988b-1990a-1990b; Ertuğrul et al., 2002, Everest and Rauss, 2004, Düzenli and Çakan, 2001).

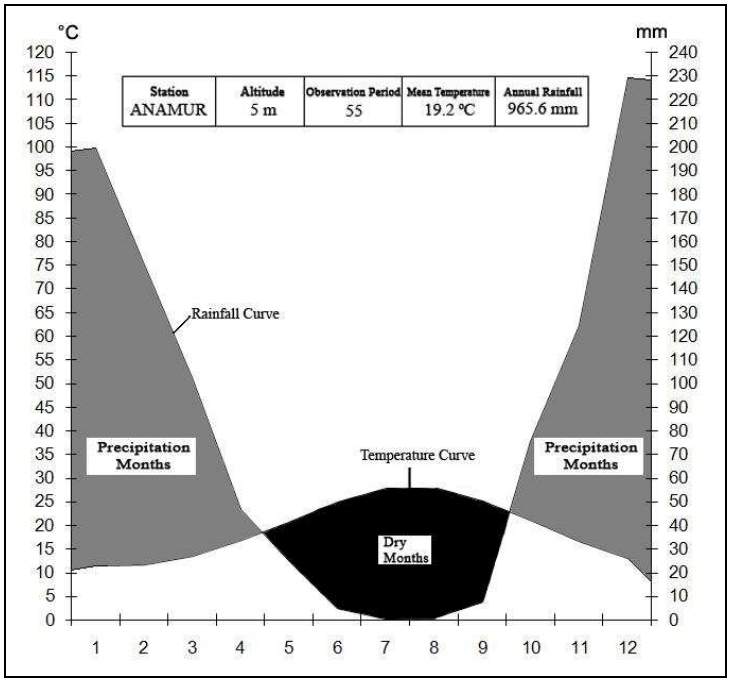

Figure 2. Ombrothermic diagrams of Anamur.

2.1. Abbreviations

The abbreviations used in the text and in the floristic list are as follows: Medit.: Mediterranean element; Ir.-Tur.: Irano - Turanian element; Euro-Sib.: Euro-Siberian element; EN: Endangered; VU: Vulnerable; NT: Near threatened; LC: Least concern; H.: Hill; Th.: Therophyte; Hcrp.: Hemicryptophyte; Msph.: Mesophanerophyte; Mcph.: Microphanerophyte; Nph.: Nanophanerophyte; Crp.: Cryptophyte; Ch.: Chamaephyte; Vp.: Vascular parasite.

2.2. Vegetation

Forest, rocky and lower mountain steppe are the main vegetation types in the study area. In the study area, forest vegetation is characterised. Forest vegetation includes *Pinus brutia* Ten., *Abies cilicia* (Ant. & Kotschy) Carr. subsp. *isaurica* Coode & Cullen and *Cedrus libani* A. Rich. *Sedum album* L., *Umbilicus horizontalis* (Guss.) DC. subsp. *horizontalis*, *Micromeria myrtifolia* Boiss. & Hohen., *Thymus revolutus* Celak., *Paronychia argentea* Lam. var. *argentea*, *Ceterach officinarum* DC., *Pelargonium endlicherianum* Fenzl, *Valeriana dioscoridis* Sm., *Corydalis solida* (L.) Swartz subsp. *solida*, *Centaurea cheirolepidoides* Wagenitz, *Campanula glomerata* L. subsp. *hispida* (Witasek) Hayek and *Stachys lavandulifolia* Vahl var. *lavandulifolia* are commonly found in the rocky parts of the research area. Lower mountain steppe vegetation includes *Thlaspi ochroleucum* Boiss. & Heldr., *Arabis androsacea* Fenzl., *Barbarea minor* C.Koch var. *robusta* Coode & Cullen, *Astragalus oxytropifolius* Boiss., *A. angustifolius* Lam. subsp. *angustifolius* var. *angustifolius*, *A. hirsutus* Vahl and *Phlomis armeniaca* Willd.

3. Results

The Floristic List

PTERIDOPHYTA

EQUISETACEAE

Equisetum ramosissimum Desf.
Near Alaköprü, stream edge, 550 m, 18.05.2008, Yıldıztugay 1966.
Widespread, Crp.

ASPLENIACEAE

Ceterach officinarum DC.
Kaş Plateau, near Deliktaş Cave, rocky places, 1500 m, 05.04.2007, Yıldıztugay 1409.
Medit., Crp.

ASPIDIACEAE

Dryopteris filix-mas (L.) Schott
Anamur – Ermenek main road, 18. km, in *Pinus* forest, 550 m, 17.05.2007, Yıldıztugay 1665.
Crp.

SPERMATOPHYTA
GYMNOSPERMAE
PINACEAE

Abies cilicia (Ant. & Kotschy) Carr. subsp. **isaurica** Coode & Cullen
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2030.
Endemic, LC, Medit., Msph.

Cedrus libani A. Rich.
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2032.
Medit., Msph.

Pinus brutia Ten.
Near Alaköprü, stony places, 550 m, 28.10.2008, Yıldıztugay 2100.
Medit., Msph.

CUPRESSACEAE

Juniperus drupacea Lab.
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2031.
Mcph.

J. oxycedrus L. subsp. **oxycedrus**
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2064.
Widespread, Mcph.

J. excelsa M.Bieb. subsp. **excelsa**
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2033.
Widespread, Mcph.

EPHEDRACEAE

Ephedra major Host
Atak Hill, stony places, 1450 m, 28.10.2008, Yıldıztugay 2085.
Ch.

ANGIOSPERMAE
DICOTYLEDONAE

RANUNCULACEAE

Nigella arvensis L. var. **tauricola** P.H.Davis
Anamur – Ermenek main road, 20. km, roadsides, 570 m, 18.06.2008, Yıldıztugay 2050.
Th.

Caltha polypetala Hochst. ex Lorent
Near Alaköprü, damp places, 550 m, 01.03.2007, Yıldıztugay 1324.
Hcrp.

Anemone blanda Schott & Kotschy
Kaş Plateau, near Deliktaş Cave, rocky places, 1500 m, 01.03.2007, Yıldıztugay 1351.
Crp.

A. coronaria L.
Near Alaköprü, stony places, 550 m, 01.03.2007, Yıldıztugay 1305.
Medit., Crp.

Adonis flammea Jacq.
Kuruağaç Hill, stony places, 300 m, 01.03.2007, Yıldıztugay 1680.
Widespread, Th.

Ranunculus velutinus Ten.
Near Alaköprü, damp places, 550 m, 01.03.2007, Yıldıztugay 1337.
Medit., Hcrp.

R. lanuginosus L.
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1978.
Euro-Sib., Hcrp.

R. cadmicus Boiss.
Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1929.
Crp.

R. millefolius Banks & Sol. subsp. **millefolius**
Near Alaköprü, stony and damp places, 550 m, 07.04.2008, Yıldıztugay 1794.
Crp.

R. isthmicus Boiss. subsp. **isthmicus**
Anamur – Ermenek main road, Sevgi Water Park crossroads, stony places, 155 m, 06.04.2007, Yıldıztugay 1447.
Crp.

R. arvensis L.
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1702.
Widespread, Th.

Ceratocephalus testiculatus (Crantz) Roth
Kaş Plateau, rocky places, 1670 m, 07.04.2008, Yıldıztugay 1823.
Th.

BERBERIDACEAE

Berberis crataegina DC.
Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1947.
Ir.-Tur., Nph.

PAPAVERACEAE

Glaucium leiocarpum Boiss.
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1979.
Widespread, Hcrp.

Roemeria hybrida (L.) DC. subsp. **hybrida**
Near Ortakonuş, stony places, 700 m, 18.06.2008, Yıldıztugay 2065.
Widespread, Th.

Papaver rhoeas L.
Anamur – Ermenek main road, Sevgi Water Park crossroads, roadsides, 155 m, 06.04.2007, Yıldıztugay 1446.
Widespread, Th.

Hypecoum imberbe Sibth. & Sm.
Serin Hill, open places, 1500 m, 04.03.2008, Yıldıztugay 1779.
Widespread, Th.

H. pendulum L.
Tombul Hill, stony places, 650 m, 08.04.2007, Yıldıztugay 1554.
Widespread, Th.

Corydalis solida (L.) Swartz subsp. **solida**
Kaş Plateau, Deliktaş Cave around, rocky places, 1500 m, 05.04.2007, Yıldıztugay 1413.
Crp.

Fumaria capreolata L.
Near Alaköprü, stony places, 550 m, 01.03.2007, Yıldıztugay 1315.
Th.

F. officinalis L.
Near Alaköprü, damp places, 550 m, 01.03.2007, Yıldıztugay 1328.
Th.

BRASSICACEAE

Raphanus raphanistrum L.
Near Alaköprü, damp places, 550 m, 01.03.2007, Yıldıztugay 1326.
Th.

Conringia grandiflora Boiss. & Heldr.
Yığıltaş Hill, in *Pinus* forest, 1600 m, 07.04.2007, Yıldıztugay 1498.
Endemic, LC, Medit., Hcrp.

Cardaria draba (L.) Desv. subsp. **chalepensis** (L.) O.E.Schulz
Kaş Plateau, rocky places, 1600 m, 17.05.2007, Yıldıztugay 1681.
Widespread, Hcrp.

Isatis tinctoria L. subsp. **tomentella** (Boiss.) P.H.Davis
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1723.
Hcrp.

Iberis attica Jord.
Anamur – Ermenek main road, 25. km, in *Pinus* forest, 670 m, 17.05.2007, Yıldıztugay 1661.
Hcrp.

Thlaspi perfoliatum L.
Kaş Plateau, near Deliktaş Cave, rocky places, 1500 m, 05.04.2007, Yıldıztugay 1405.
Widespread, Th.

T. ochroleucum Boiss. & Heldr.
Kaş Plateau, stony places, 1670 m, 07.04.2008, Yıldıztugay 1825.

Hcrp.
Capsella bursa-pastoris (L.) Medik.
Kaş Plateau, roadside, 1670 m, 06.04.2007, Yıldıztugay 1427.
Widespread, Th.
Fibigia eriocarpa (DC.) Boiss.
Kaş Plateau, stony places, 1675 m, 17.05.2007, Yıldıztugay 1729.
Widespread, Hcrp.
Alyssum dasycarpum Steph. ex Willd.
Anamur – Ermenek main road, Sevgi Water Park crossroads, stony places, 160 m, 07.04.2008, Yıldıztugay 1796.
Widespread, Th.
A. minus (L.) Rothm. var. **minus**
Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1941.
Widespread, Th.
A. mouradicum Boiss. & Bal.
Kaş Plateau, rocky places, 1600 m, 17.05.2007, Yıldıztugay 1699.
Hcrp.
Clypeola jonthlaspi L.
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 740 m, 07.04.2008, Yıldıztugay 1820.
Widespread, Th.
C. ciliata Boiss.
Kaş Plateau, stony places, 1675 m, 17.05.2007, Yıldıztugay 1717.
Endemic, EN, Th.
Draba muralis L.
Anamur – Ermenek main road, Karabahşişler Village entrance, roadsides, 150 m, 01.03.2007, Yıldıztugay 1355.
Th.
Erophila verna (L.) Chevall. subsp. **verna**
Kaş Plateau, near Deliktaş Cave, rocky places, 1500 m, 05.04.2007, Yıldıztugay 1403.
Th.
Arabis androsacea Fenzl.
Kaş Plateau, rocky places, 1670 m, 07.04.2008, Yıldıztugay 1826; Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1930.
Endemic, LC, Hcrp.
A. deflexa Boiss.
Kaş Plateau, rocky places, 1600 m, 17.05.2007, Yıldıztugay 1697.
Medit., Hcrp.
A. ionocalyx Boiss.
Anamur – Ermenek main road, 24. km, in *Pinus* forest, 650 m, 07.04.2008, Yıldıztugay 1813.
Medit., Hcrp.
A. caucasica Willd. subsp. **caucasica**
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1977-1980.
Widespread, Hcrp.
A. nova Vill.
Anamur – Ermenek main road, 35. km, rocky places, 1450 m, 05.04.2007, Yıldıztugay 1415.
Th.
A. verna (L.) DC.
Anamur – Ermenek main road, 24. km, in *Pinus* forest, 650 m, 07.04.2008, Yıldıztugay 1818.
Th.
A. aucheri Boiss.
Güney Bahşişler Village, Kesme Hill, stony places, 230 m, 06.04.2007, Yıldıztugay 1457.
Th.
Turritis laxa (Sibth.& Sm.) Hayek
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1721.
Hcrp.
Nasturtium officinale R.Br.
Anamur – Ermenek main road, 21. km, roadside, 580 m, 07.04.2008, Yıldıztugay 1803.
Widespread, Hcrp.
Barbarea minor C.Koch var. **robusta** Coode & Cullen
Kaş Plateau, rocky places, 1670 m, 07.04.2008, Yıldıztugay 1827.
Hcrp.
Cardamine graeca L.
Near Alaköprü, stony places, 550 m, 01.03.2007, Yıldıztugay 1307-1316.
Th.
C. hirsuta L.
Anamur – Ermenek main road, Karabahşişler Village entrance, roadsides, 150 m, 01.03.2007, Yıldıztugay 1354.
Th.
Malcolmia chia (L.) DC.
Anamur – Ermenek main road, Sevgi Water Park crossroads, roadsides, 155 m, 01.03.2007, Yıldıztugay 1378.
Medit., Th.
Erysimum diffusum Ehrh.
Anamur – Ermenek main road, Sevgi Water Park crossroads, roadsides, 155 m, 01.03.2007, Yıldıztugay 1366.
Euro-Sib., Hcrp.
Sisymbrium officinale (L.) Scop.
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1958.
Widespread, Th.

CAPPARACEAE

Capparis spinosa L. var. **spinosa**
Near Alaköprü, in *Pinus* forest, 540 m, 18.08.2008, Yıldıztugay 2074.
Nph.

RESEDACEAE

Reseda lutea L. var. **lutea**
Near Alaköprü, roadsides, 540 m, 18.08.2008, Yıldıztugay1997.
Widespread, Hcrp.

CISTACEAE

Cistus creticus L.
Near Alaköprü, in *Pinus* forest, 540 m, 01.03.2007, Yıldıztugay 1397.
Medit., Nph.
C. salviifolius L.
Anamur – Ermenek main road, 26. km, roadsides, 740 m, 09.04.2007, Yıldıztugay 1599.
Nph.
Helianthemum salicifolium (L.) Mill.
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 740 m, 07.04.2008, Yıldıztugay 1816.
Th.
Fumana arabica (L.) Spach var. **arabica**
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1669.
Hcrp.
Tuberaria guttata (L.) Fourr. var. **plantaginea** (Willd.) Gross.
Near Alaköprü, meadows, 550 m, 01.03.2007, Yıldıztugay 1309.
Th.

VIOLACEAE

Viola modesta Fenzl.
Kaş Plateau, near Deliktaş Cave, rocky places, 1500 m, 05.04.2007, Yıldıztugay 1407.
Th.
V. pentadactyla Fenzl
Kaş Plateau, rocky places, 1670 m, 07.04.2008, Yıldıztugay 1822.
Th.
V. kitaibeliana Roem. & Schult.
Kaş Plateau, under forest, 1600 m, 17.05.2007, Yıldıztugay 1678.
Th.

PORTULACACEAE

Portulaca oleracea L.
Kaş Plateau, field edge, 1580 m, 28.10.2008, Yıldıztugay 2081.
Th.

CARYOPHYLLACEAE

Arenaria pamphylica Boiss. & Heldr. subsp. **pamphylica** var. **turcica** McNeill
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2014.
Endemic, VU, Th.
A. pamphylica Boiss. & Heldr. subsp. **alpestris** (McNeill) McNeill
Kaş Plateau, rocky places, 1600 m, 17.05.2007, Yıldıztugay 1679.
Endemic, LC, Medit., Th.
A. macrosepala Boiss.
Near Alaköprü, stony places, 550 m, 01.03.2007, Yıldıztugay 1308.
Th.
Minuartia hamata (Hausskn.) Mattf.
Kaş Plateau, rocky places, 1600 m, 17.05.2007, Yıldıztugay 1685.
Medit., Th.
M. mesogitana (Boiss.) Hand. –Mazz. subsp. **mesogitana**
Anamur – Ermenek main road, Ormancık Village around, stony places, 250 m, 01.03.2007, Yıldıztugay 1340.
Medit., Th.

M. mesogitana (Boiss.) Hand.-Mazz. subsp. **kotschyana** (Boiss.) McNeill
Anamur – Ermenek main road, Sevgi Water Park crossroads, roadsides, 155 m, 01.03.2007, Yıldıztugay 1363.
Th.
M. hybrida (Vill.) Schischk subsp. **hybrida**
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1632.
Th.
M. mediterranea (Ledeb.) K.Maly
Anamur – Ermenek main road, 32. km, rocky places, 1450 m, 05.04.2007, Yıldıztugay 1419.
Medit., Th.
Stellaria media (L.) Vill. subsp. **postii** Holmboe
Near Alaköprü, stony and damp places, 550 m, 01.03.2007, Yıldıztugay 1313.
Th.
S. cilicica Boiss. & Ball.
Anamur – Ermenek main road, 32. km, rocky places, 1450 m, 05.04.2007, Yıldıztugay 1478.
Th.
Cerastium anomalum Waldst. & Kit.
Anamur – Ermenek main road, 21. km, rocky places, 580 m, 07.04.2008, Yıldıztugay 1808.
Th.
C. dichotomum L. subsp. **dichotomum**
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1707.
Th.
C. dichotomum L. subsp. **inflatum** (Link) Cullen
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1711.
Th.
C. glomeratum Thuill.
Anamur – Ermenek main road, Sevgi Water Park crossroads, stony places, 155 m, 06.04.2007, Yıldıztugay 1422.
Th.
C. brachypetalum Pers. subsp. **roeseri** (Boiss. & Heldr.) Nyman
Kaş Plateau, stony places, 1575 m, 09.04.2008, Yıldıztugay 1872.
Medit., Th.
C. illyricum Ard. subsp. **comatum** (Desv.) P.D.Sell & Whitehead
Anamur – Ermenek main road, 32. km, rocky places, 1450 m, 05.04.2007, Yıldıztugay 1420.
Medit., Th.
Holosteum umbellatum L. var. **umbellatum**
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 740 m, 07.04.2008, Yıldıztugay 1819.
Th.
Spergularia marina (L.) Gris.
Anamur – Ermenek main road, Sevgi Water Park crossroads, roadsides, 155 m, 01.03.2007, Yıldıztugay 1360.
Widespread, Th.
Telephium imperati L. subsp. **orientale** (Boiss.) Nyman
Kaş Plateau, roadsides, 1600 m, 17.05.2007, Yıldıztugay 1720.
Hcrp.
Dianthus leucophaeus Sibth. & Sm. var. **patens** Reever
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2020.
Hcrp.
Petrorhagia velutina (Guss.) Ball & Heywood
Anamur – Ermenek main road, Sevgi Water Park crossroads, stony places, 155 m, 01.03.2007, Yıldıztugay 1367.
Hcrp.
Velezia rigida L.
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 1981.
Medit., Th.
V. pseudorigida Hub.-Mor.
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1672.
Endemic, VU, Medit., Th.
Silene cappadocica Boiss. & Heldr.
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2018.
Ir.-Tur., Hcrp.
S. spergulifolia (Desf.) M.Bieb.
Kaş Plateau, rocky places, 1600 m, 17.05.2007, Yıldıztugay 1696.
Hcrp.
S. vulgaris (Moench) Garcke var. **vulgaris**
Güney Bahşişler Village, Kesme Hill, stony places, 230 m, 06.04.2007, Yıldıztugay 1460.
Hcrp.
S. balansae Boiss.
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2037.
Endemic, EN, Ir.-Tur., Hcrp.
S. rigidula Sibth. & Sm.
Anamur – Ermenek main road, Ormancık Village around, stony places, 250 m, 01.03.2007, Yıldıztugay 1339.
Medit., Hcrp.
S. aegyptiaca (L.fil.) subsp. **aegyptiaca**
Anamur – Ermenek main road, 32. km, rocky places, 1450 m, 05.04.2007, Yıldıztugay 1417; Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1703.
Th.
S. behen L.
Near Alaköprü, stony places, 550 m, 01.03.2007, Yıldıztugay 1319.
Th.
S. dichotoma Ehrh. subsp. **euxina** (Rupr.) Coode & Cullen
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 2007.
Euro-Sib., Hcrp.
S. pompeiopolitana Gay ex Boiss.
Anamur – Ermenek main road, 21. km, in *Pinus* forest, 580 m, 17.05.2007, Yıldıztugay 1649.
Endemic, VU, Medit., Th.
S. gallica L.
Kaş Plateau, near Deliktaş Cave, rocky places, 1500 m, 01.03.2007, Yıldıztugay 1349.
Th.
S. conoidea L.
Sevgi Water Park around, in *Pinus* forest, 265 m, 06.04.2007, Yıldıztugay 1471.
Th.
Agrostemma githago L.
Anamur – Ermenek main road, Sevgi Water Park crossroads, roadsides, 155 m, 06.04.2007, Yıldıztugay 1424.
Th.

ILLECEBRACEAE

Herniaria incana Lam.
Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1944.
Hcrp.
Paronychia argentea Lam. var. **argentea**
Kaş Plateau, rocky places, 1575 m, 08.04.2007, Yıldıztugay 1530.
Medit., Hcrp.

POLYGONACEAE

Polygonum salebrosum Coode & Cullen
Kaş Plateau, stony places, 1605 m, 28.10.2008, Yıldıztugay 2090.
Endemic, LC, Hcrp.
Rumex acetosella L.
Kaş Plateau, roadsides, 1570 m, 17.05.2008, Yıldıztugay 1907.
Hcrp.

TAMARICACEAE

Tamarix parviflora DC.
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1731.
Medit., Mcph.

HYPERICACEAE

Hypericum lanuginosum Lam. var. **lanuginosum**
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 1988.
Hcrp.
H. lanuginosum Lam. var. **scabrellum** (Boiss.) Robson
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1629.
Endemic, LC, Medit., Hcrp.
H. olympicum L. subsp. **olympicum**
Near Alaköprü, in *Pinus* forest, 540 m, 10.08.2008, Yıldıztugay 2069.
Medit., Hcrp.
H. polyphyllum Boiss. & Bal. subsp. **lycium** Robson & Hub.-Mor.
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1602.
Endemic, LC, Medit., Hcrp.

MALVACEAE

Alcea pallida Waldst. & Kit.
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1617.
Ch.

LINACEAE

Linum nodiflorum L.
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1673.
Medit., Th.
L. strictum L. var. **strictum**

Anamur – Ermenek main road, 21. km, in *Pinus* forest, 580 m, 17.05.2007, Yıldıztugay 1650.
Th.
L. bienne Mill.
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1674.
Medit., Hcrp.

GERANIACEAE

Geranium lucidum L.
Near Alaköprü, damp places, 550 m, 01.03.2007, Yıldıztugay 1318.
Th.
G. purpureum Vill
Sevgi Water Park around, in *Pinus* forest, 265 m, 06.04.2007, Yıldıztugay 1472.
Th.
G. rotundifolium L.
Near Alaköprü, damp places, 550 m, 01.03.2007, Yıldıztugay 1321.
Th.
G. molle L. subsp. **molle**
Anamur – Ermenek main road, Sevgi Water Park crossroads, roadsides, 160 m, 07.04.2008, Yıldıztugay 1799.
Th.
G. stepporum P.H.Davis
Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1945.
Ir.-Tur., Crp.
Erodium moschatum (L.) L'Herit.
Near Alaköprü, stony and damp places, 550 m, 01.03.2007, Yıldıztugay 1310.
Medit., Th.
E. acaule (L.) Bech. & Thell.
Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1932.
Th.
Pelargonium endlicherianum Fenzl
Kaş Plateau, rocky places, 1605 m, 17.06.2008, Yıldıztugay 2011.
Hcrp.

OXALIDACEAE

Oxalis corniculata L.
Near Alaköprü, stony places, 550 m, 01.03.2007, Yıldıztugay 1317.
Th.

VITACEAE

Vitis vinifera L.
Kaş Plateau, field edge, 1570 m, 18.06.2008, Yıldıztugay 2102.
Mcph.

RHAMNACEAE

Paliurus spina-christi Mill.
Near Alaköprü, stony places, 550 m, 18.05.2008, Yıldıztugay 1920.
Ch.

ANACARDIACEAE

Cotinus coggyria Scop.
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 07.04.2007, Yıldıztugay 1504.
Ch.
Rhus coriaria L.
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 1987.
Medit., Ch.
Pistacia terebinthus L. subsp. **palaestina** (Boiss.) Engl.
Kaş Plateau, stony places, 1610 m, 18.06.2008, Yıldıztugay 2053.
Medit., Mcph.

FABACEAE

Cercis siliquastrum L. subsp. **siliquastrum**
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 1996.
Mcph.
Acacia retinoides Schlecht.
Near Alaköprü, roadsides, 540 m, 18.08.2008, Yıldıztugay 2079.
Medit., Mcph.
Genista acanthoclada DC.
Near Alaköprü, roadsides, 540 m, 108.04.2007, Yıldıztugay 1549.
Medit., Ch.
Spartium junceum L.
Kaş Plateau, stony places, 1610 m, 17.05.2007, Yıldıztugay 1732.
Medit., Nph.
Lupinus angustifolius L. subsp. **angustifolius**
Anamur – Ermenek main road, Sevgi Water Park crossroads, stony places, 155 m, 06.04.2007, Yıldıztugay 1431.
Hcrp.
Robinia pseudoacacia L.
Ovabaşı Village, roadsides, 230 m, 07.04.2007, Yıldıztugay 1502.
Mcph.
Colutea cilicica Boiss. & Bal.
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 1990.
Widespread, Nph.
Astragalus oxytropifolius Boiss.
Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1928.
Endemic, LC, Ir.-Tur., Hcrp.
A. depressus L.
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1733.
Hcrp.
A. condensatus Ledeb.
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2024.
Endemic, LC, Ir.-Tur., Hcrp.
A. anthylloides Lam.
Kaş Plateau, rocky places, 1600 m, 17.05.2007, Yıldıztugay 1689.
Endemic, Ir.-Tur., Hcrp.
A. odoratus Lam.
Ovabaşı Village, roadsides, 230 m, 07.04.2007, Yıldıztugay 1484.
Hcrp.
A. hirsutus Vahl
Kaş Plateau, rocky places, 1600 m, 17.05.2007, Yıldıztugay 1687.
Endemic, LC, Hcrp.
A. angustifolius Lam. subsp. **angustifolius** var. **angustifolius**
Kaş Plateau, under *Abies*, 1600 m, 17.05.2007, Yıldıztugay 1677.
Ch.
Vicia cracca L. subsp. **cracca**
Anamur – Ermenek main road, 21. km, in *Pinus* forest, 580 m, 17.05.2007, Yıldıztugay 1652.
Euro-Sib., Hcrp.
V. cracca L. subsp. **stenophylla** Vel.
Anamur – Ermenek main road, Sevgi Water Park crossroads, stony places, 155 m, 06.04.2007, Yıldıztugay 1428.
Widespread, Hcrp.
V. cypria Kotschy ex Unger & Kotschy
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1706.
Th.
V. pubescens (DC.) Link.
Kaş Plateau, rocky places, 1670 m, 07.04.2008, Yıldıztugay 1834.
Medit., Th.
V. hybrida L.
Near Alaköprü, stony places, 550 m, 01.03.2007, Yıldıztugay 1329.
Medit., Th.
V. lathyroides L.
Anamur – Ermenek main road, 21. km, rocky places, 580 m, 07.04.2008, Yıldıztugay 1806.
Th.
V. sativa L. subsp. **nigra** (L.) Ehrh. var. **nigra**
Anamur – Ermenek main road, 21. km, stony places, 580 m, 08.04.2007, Yıldıztugay 1553.
Th.
V. narbonensis L. var. **narbonensis**
Ovabaşı Village, field edge, 230 m, 07.04.2007, Yıldıztugay 1483.
Th.
Lathyrus pratensis L.
Güney Bahşişler Village, Kesme Hill, stony places, 230 m, 06.04.2007, Yıldıztugay 1452.
Euro-Sib., Hcrp.
L. tuberosus L.
Anamur – Ermenek main road, 21. km, in *Pinus* forest, 580 m, 17.05.2007, Yıldıztugay 1639.
Euro-Sib., Crp.
L. cicera L.
Anamur – Ermenek main road, 21. km, in *Pinus* forest, 580 m, 17.05.2007, Yıldıztugay 1637.
Th.
L. sativus L.
Anamur – Ermenek main road, Sevgi Water Park crossroads, stony places, 160 m, 07.04.2008, Yıldıztugay 1801.

Widespread, Th.
L. stenophyllus Boiss. & Heldr.
Güney Bahşişler Village, Kesme Hill, stony places, 230 m, 06.04.2007, Yıldıztugay 1453.
Medit., Th.
Pisum sativum L. subsp. **sativum** var. **sativum**
Ovabaşı Village, field edge, 230 m, 07.04.2007, Yıldıztugay 1467.
Th.
Trifolium repens L. var. **macrorrhizum** (Boiss.) Boiss.
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1714.
Hcrp.
T. speciosum Willd.
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1710.
Medit., Th.
T. campestre Schreb.
Sevgi Water Park around, in *Pinus* forest, 265 m, 06.04.2007, Yıldıztugay 1470.
Widespread, Th.
T. spumosum L.
Anamur – Ermenek main road, Sevgi Water Park crossroads, stony places, 155 m, 06.04.2007, Yıldıztugay 1432.
Medit., Th.
T. fragiferum L. subsp. **fragiferum**
Anamur – Ermenek main road, Sevgi Water Park crossroads, roadsides, 155 m, 01.03.2007, Yıldıztugay 1369.
Hcrp.
T. purpureum Lois. var. **pamphylicum** (Boiss. & Heldr.) Zoh.
Anamur – Ermenek main road, Sevgi Water Park crossroads, roadsides, 155 m, 06.04.2007, Yıldıztugay 1582.
Medit., Th.
Melilotus officinalis (L.) Desr.
Anamur – Ermenek main road, Sevgi Water Park crossroads, roadsides, 155 m, 06.04.2007, Yıldıztugay 1544.
Widespread, Th.
M. alba Desr.
Anamur – Ermenek main road, 28. km, roadsides, 750 m, 17.05.2007, Yıldıztugay 1690.
Widespread, Th.
Trigonella brachycarpa (Fisch.) Moris
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1713.
Ir.-Tur., Th.
T. spruneriana Boiss. var. **spruneriana**
Anamur – Ermenek main road, Sevgi Water Park crossroads, stony places, 155 m, 06.04.2007, Yıldıztugay 1439.
Ir.-Tur., Th.
T. spruneriana Boiss. var. **sibthorpii** (Boiss.) Hub.–Mor.
Kaş Plateau, rocky places, 1600 m, 17.05.2007, Yıldıztugay 1694.
Medit., Th.
T. cylindracea Desv.
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1712.
Medit., Th.
T. crassipes Boiss.
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1716.
Ir.-Tur., Th.
T. cariensis Boiss.
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1663.
Medit., Th.
Medicago coronata (L.) Bart.
Near Alaköprü, damp places, 550 m, 01.03.2007, Yıldıztugay 1346.
Medit., Th.
M. minima (L.) Bart. var. **minima**
Near Alaköprü, roadsides, 550 m, 09.04.2007, Yıldıztugay 1592.
Widespread, Th.
M. polymorpha L. subsp. **polymorpha**
Ovabaşı Village, roadsides, 230 m, 07.04.2007, Yıldıztugay 1482.
Th.
Dorycnium pentaphyllum Scop. subsp. **haussknechtii** (Boiss.) Gams
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 1983.
Endemic, LC, Ir.-Tur., Hcrp.
Lotus ornithopodioides L.
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 08.04.2007, Yıldıztugay 1540.
Medit., Hcrp.
L. aegaeus (Gris.) Boiss.
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2025.
Ir.-Tur., Hcrp.
Anthyllis tetraphylla L.
Kaş Plateau, stony places, 1605 m, 07.04.2007, Yıldıztugay 1496.
Medit., Th.
Securigera securidaca (L.) Degen & Dörf.
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1666.
Th.
Coronilla parviflora Willd.
Anamur – Ermenek main road, 21. km, in *Pinus* forest, 580 m, 17.05.2007, Yıldıztugay 1639.
Medit., Th.
C. grandiflora Boiss.
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1608.
Endemic, LC, Medit., Hcrp.
Ornithopus compressus L.
Kaş Plateau, rocky places, 1670 m, 07.04.2008, Yıldıztugay 1835.
Medit., Th.
Onobrychis montana DC. subsp. **cadmea** (Boiss.) P.W.Ball
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1624.
Widespread, Hcrp.
O. armena Boiss. & Huet
Near Alaköprü, stony places, 550 m, 09.04.2007, Yıldıztugay 1568.
Endemic, LC, Widespread, Hcrp.
O. oxyodonta Boiss.
Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1953.
Widespread, Hcrp.
Ebenus laguroides Boiss. var. **cilicica** (Boiss.) Bornm.
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2012.
Endemic, LC, Ir.-Tur., Hcrp.
Bituminaria bituminosa (L.) C.H.Stirt.
Kaş Plateau, stony places, 1605 m, 07.04.2007, Yıldıztugay 1490.
Ch.

ROSACEAE

Prunus x domestica L.
Kaş Plateau, roadsides, 1605 m, 17.06.2008, Yıldıztugay 2034.
Mcph.
Rubus sanctus Schreb.
Near Alaköprü, under forest, 550 m, 10.08.2008, Yıldıztugay 2062.
Widespread, Ch.
Potentilla kotschyana Fenzl
Kaş Plateau, rocky places, 1600 m, 17.05.2007, Yıldıztugay 1693.
Medit., Hcrp.
P. aurea L. subsp. **chrysocraspeda** (Lehm.) Nyman
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1971.
Hcrp.
Sanguisorba minor Scop. subsp. **muricata** (Spach) Briq.
Ovabaşı Village, roadsides, 230 m, 07.04.2007, Yıldıztugay 1481.
Widespread, Hcrp.
Crataegus orientalis Pall. ex M.Bieb. var. **orientalis**
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1993.
Widespread, Mcph.

MYRTACEAE

Myrtus communis L. subsp. **communis**
Anamur – Ermenek main road, Sevgi Water Park around, stony places, 210 m, 28.10.2008, Yıldıztugay 2097.
Mcph.
Eucalyptus camaldulensis Dehnh.
Anamur – Ermenek main road, Sevgi Water Park crossroads, roadsides, 155 m, 06.04.2007, Yıldıztugay 1426.
Msph.

PUNICACEAE

Punica granatum L.
Anamur – Ermenek main road, Sevgi Water Park crossroads, roadsides, 160 m, 17.06.2008, Yıldıztugay 1994.
Mcph.

CRASSULACEAE

Umbilicus horizontalis (Guss.) DC. subsp. **horizontalis**
Kaş Plateau, rocky places, 1670 m, 07.04.2008, Yıldıztugay 1833.
Hcrp.
Sedum album L.
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2019.
Hcrp.

APIACEAE

Eryngium creticum Lam.
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2035.
Medit., Hcrp.
Lagoecia cuminoides L.

Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1609.
Medit., Th.
Scandix pecten-veneris L.
Near Alaköprü, stony places, 550 m, 01.03.2007, Yıldıztugay 1327.
Widespread, Th.
S. australis L. subsp. **grandiflora** (L.) Thell.
Anamur – Ermenek main road, Sevgi Water Park crossroads, roadsides, 160 m, 07.04.2008, Yıldıztugay 1797.
Th.
Bunium microcarpum (Boiss.) Freyn subsp. **microcarpum**
Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1950.
Medit., Crp.
Bupleurum rotundifolium L.
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1667.
Th.
Ferula communis L. subsp. **communis**
Kaş Plateau, stony places, 1575 m, 07.04.2007, Yıldıztugay 1514.
Medit., Hcrp.
F. lycia Boiss.
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2028.
Endemic, LC, Ir.-Tur., Hcrp.
Tordylium aegaeum Runem.
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 2000.
Medit., Th.
Ainsworthia trachycarpa Boiss.
Anamur – Ermenek main road, Sevgi Water Park crossroads, stony places, 155 m, 06.04.2007, Yıldıztugay 1430.
Medit., Th.
Torilis arvensis (Huds.) Link subsp. **elongata** (Hoffm. & Link) Cannon.
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 1984.
Medit., Th.
T. japonica (Houtt.) DC.
Sevgi Water Park around, in *Pinus* forest, 265 m, 06.04.2007, Yıldıztugay 1479.
Th.
T. ucranica Spreng.
Near Alaköprü, stony places, 550 m, 07.04.2007, Yıldıztugay 1493.
Th.
Caucalis platycarpos L.
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1614.
Th.
Turgenia latifolia (L.) Hoffm.
Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1951.
Widespread, Th.
Daucus carota L.
Anamur – Ermenek main road, 26. km, stony places, 600 m, 17.06.2008, Yıldıztugay 1998 10.08.2008, Yıldıztugay 2060. Hcrp.

VALERIANACEAE

Valeriana dioscoridis Sm.
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1709.
Medit., Hcrp.
Valerianella locusta (L.) Laterr.
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 740 m, 07.04.2008, Yıldıztugay 1811.
Euro-Sib., Th.
V. coronata (L.) DC.
Kaş Plateau, rocky places, 1675 m, 08.04.2007, Yıldıztugay 1562.
Widespread, Th.

DIPSACACEAE

Scabiosa atropurpurea L. subsp. **maritima** (L.) Arc.
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 1991.
Hcrp.
S. hispidula Boiss.
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1613.
Th.
S. reuteriana Boiss.
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1607.
Endemic, LC, Medit., Th.
Pterocephalus plumosus (L.) Coult.
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1967.
Widespread, Th.

ASTERACEAE

Bidens tripartita L.
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1657.
Widespread, Hcrp.
Pallenis spinosa (L.) Cass.
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1654.
Medit., Th.
Helichrysum pamphylicum P.H.Davis & Kubicha
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 2008.
Endemic, Medit., Hcrp.
Filago eriocephala Guss.
Anamur – Ermenek main road, 21. km, in *Pinus* forest, 580 m, 17.05.2007, Yıldıztugay 1647.
Th.
Logfia gallica (L.) Cosson & Germ.
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 2002.
Th.
Erigeron acer L. **acer**
Ovabaşı Village, roadsides, 230 m, 09.04.2008, Yıldıztugay 1848.
Widespread, Hcrp.
Bellis perennis L.
Ovabaşı Village, in *Pinus* forest, 230 m, 420 m, 07.04.2007, Yıldıztugay 1511.
Euro-Sib., Hcrp.
Senecio tauricolus Matthews
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2036.
Endemic, Ir.-Tur., Hcrp.
S. vernalis Waldst. & Kit.
Near Alaköprü, roadsides, 550 m, 09.04.2008, Yıldıztugay 1879.
Widespread, Th.
Calendula officinalis L.
Near Alaköprü, stony places, 550 m, 01.03.2007, Yıldıztugay 1336.
Th.
Anthemis pestalozzae Boiss.
Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1939.
Endemic, LC, Medit., Th.
Achillea wilhelmsii C.Koch
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1969.
Ir.-Tur., Hcrp.
Chrysanthemum segetum L.
Near Alaköprü, stony places, 550 m, 01.03.2007, Yıldıztugay 1314.
Medit., Th.
Gundelia tournefortii L. var. **tournefortii**
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1735.
Hcrp.
Onopordum acanthium L.
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1690.
Hcrp.
Cirsium ligulare Boiss.
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1622.
Hcrp.
C. vulgare (Savi) Ten.
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1957.
Hcrp.
C. arvense (L.) Scop. subsp. **vestitum** (Wimm. & Grab.) Petr.
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1659.
Hcrp.
Lamyropsis cynaroides (Lam.) Dittrich
Anamur – Ermenek main road, 21. km, in *Pinus* forest, 580 m, 17.05.2007, Yıldıztugay 1638.
Medit., Hcrp.
Carduus nutans L. subsp. **nutans** sensu lato
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1737.
Widespread, Hcrp.
Centaurea cheirolepidoides Wagenitz
Kaş Plateau, rocky places, 1605 m, 17.06.2008, Yıldıztugay 2063.
Endemic, EN, Medit., Hcrp.
C. babylonica (L.) L.

Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 1986.
Medit., Hcrp.
C. solstitialis L. subsp. subsp. **pyracantha** (Boiss.) Wagenitz
Anamur – Ermenek main road, 28. km, roadsides, 750 m, 01.07.2007, Yıldıztugay 1754.
Endemic, LC, Medit., Th.
C. urvillei DC. subsp. **armata** Wagenitz
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1664.
Medit., Hcrp.
C. pichleri Boiss. subsp. **extrarosularis** (Hayek & Siehe) Wagenitz
Kaş Plateau, rocky places, 1600 m, 17.05.2007, Yıldıztugay 1691.
Endemic, LC, Hcrp.
Cnicus benedictus L. var. **kotschyi** Boiss.
Anamur – Ermenek main road, Sevgi Water Park crossroads, stony places, 160 m, 07.04.2008, Yıldıztugay 1791.
Widespread, Th.
Carthamus dentatus Vahl
Near Alaköprü, in *Pinus* forest, 540 m, 18.08.2008, Yıldıztugay 2077.
Widespread, Hcrp.
Xeranthemum longipapposum Fisch. & C.A.Mey.
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 1995.
Ir.-Tur., Th.
Chardinia orientalis (L.) O.Kuntze
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1728.
Ir.-Tur., Th.
Cichorium glandulosum Boiss. & Huet.
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1628.
Ir.-Tur., Hcrp.
Scorzonera cana (C.A. Mey.) Hoffm. var. **cana**
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1715.
Widespread, Hcrp.
S. mollis M.Bieb. subsp. **szowitzii** (DC.) Chamb.
Kaş Plateau, rocky places, 1600 m, 17.05.2007, Yıldıztugay 1695.
Ir.-Tur., Hcrp.
Tragopogon longirostris Bisch. ex Sch.Bip. var. **longirostris**
Anamur – Ermenek main road, Sevgi Water Park crossroads, roadsides, 155 m, 06.04.2007, Yıldıztugay 1434.
Hcrp.
T. dubius Scop.
Anamur – Ermenek main road, 21. km, in *Pinus* forest, 580 m, 17.05.2007, Yıldıztugay 1640.
Hcrp.
Picris pauciflora Willd.
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1619.
Medit., Hcrp.
P. cyprica Lack
Anamur – Ermenek main road, Sevgi Water Park crossroads, under forest, 160 m, 07.04.2007, Yıldıztugay 1500.
Medit., Th.
Urospermum picroides (L.) F.W.Schmidt
Anamur – Ermenek main road, Sevgi Water Park crossroads, stony places, 155 m, 06.04.2007, Yıldıztugay 1429.
Medit., Th.
Sonchus asper (L.) Hill subsp. **glaucescens** (Jordan) Ball
Near Alaköprü, damp places, 550 m, 01.03.2007, Yıldıztugay 1331.
Th.
Pilosella x auriculoides (F.A.Lang) Sell & West
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2017.
Crp.
Lactuca serriola L.
Near Alaköprü, in *Pinus* forest, 540 m, 18.08.2008, Yıldıztugay 2075.
Hcrp.
Taraxacum syriacum Boiss.
Kaş Plateau, stony places, 1605 m, 18.08.2008, Yıldıztugay 2071.
Ir.-Tur., Hcrp.
T. officinale Weber
Anamur – Ermenek main road, 26. km, roadsides, 740 m, 07.04.2008, Yıldıztugay 1815.
Hcrp.
Chondrilla juncea L. var. **juncea**
Near Alaköprü, in *Pinus* forest, 540 m, 18.08.2008, Yıldıztugay 2076.
Widespread, Hcrp.
Crepis reuterana Boiss. subsp. **reuterana**
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 1992.
Medit., Hcrp.
C. pulchra L. subsp. **pulchra**
Near Alaköprü, stony places, 550 m, 01.03.2007, Yıldıztugay 1322.
Widespread, Th.
C. sancta (L.) Babc.
Anamur – Ermenek main road, Sevgi Water Park crossroads, roadsides, 155 m, 01.03.2007, Yıldıztugay 1362.
Widespread, Th.
C. micrantha Czer.
Near Alaköprü, stony places, 550 m, 01.03.2007, Yıldıztugay 1335.
Widespread, Th.
C. neglecta L.
Anamur – Ermenek main road, 21. km, in *Pinus* forest, 580 m, 17.05.2007, Yıldıztugay 1633.
Th.
C. vesicaria L.
Anamur – Ermenek main road, Sevgi Water Park crossroads, stony places, 160 m, 07.04.2008, Yıldıztugay 1793.
Medit., Th.

CAMPANULACEAE

Campanula lyrata Lam. subsp. **lyrata**
Anamur – Ermenek main road, 21. km, rocky places, 580 m, 17.05.2007, Yıldıztugay 1643.
Endemic, LC, Hcrp.
C. glomerata L. subsp. **hispida** (Witasek) Hayek
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1976.
Hcrp.
C. involucrata Aucher ex A.DC.
Kaş Plateau, rocky places, 1600 m, 17.05.2007, Yıldıztugay 1692.
Ir.-Tur., Hcrp.
C. stricta L. var. **libanotica** (A.DC.) Boiss.
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2013.
Medit., Hcrp.
C. drabifolia Sm.
Güney Bahşişler Village to Sevgi Water Park, in *Pinus* forest, 260 m, 06.04.2007, Yıldıztugay 1463.
Th.
Asyneuma linifolium (Boiss. & Heldr.) Bornm. subsp. **linifolium**
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2026.
Endemic, LC, Medit., Hcrp.
Michauxia campanuloides L'Herit ex Aiton
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 2009.
Medit., Hcrp.
Legousia falcata (Ten.) Fritsch
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1671.
Medit., Th.
L. speculum-veneris (L.) Chaix
Sevgi Water Park around, in *Pinus* forest, 265 m, 06.04.2007, Yıldıztugay 1468.
Medit., Th.

ERICACEAE

Erica manipuliflora Salisb.
Sevgi Water Park around, in *Pinus* forest, 265 m, 07.04.2007, Yıldıztugay 1509.
Medit., Ch.

PRIMULACEAE

Androsace maxima L.
Kaş Plateau, near Deliktaş Cave, rocky places, 1500 m, 05.04.2007, Yıldıztugay 1411.
Th.
Cyclamen cilicium Boiss. & Heldr. var. **cilicium**
Kaş Plateau, stony places, 1605 m, 28.10.2008, Yıldıztugay 2092.
Endemic, NT, Medit., Crp.
Anagallis arvensis L. var. **caerulea** (L.) Gouan.
Near Alaköprü, damp places, 550 m, 01.03.2007, Yıldıztugay 1333.
Th.

STYRACACEAE

Styrax officinalis L.
Anamur – Ermenek main road, 21. km, in *Pinus* forest, 580 m, 17.05.2007, Yıldıztugay 1651.
Mcph.

OLEACEAE

Jasminum fruticans L.
Anamur – Ermenek main road, 21. km, open forest, 580 m, 08.04.2007, Yıldıztugay 1521.

Medit., Nph.

APOCYNACEAE

Nerium oleander L.
Near Alaköprü, damp places, 550 m, 18.05.2008, Yıldıztugay 1927.
Medit., Mcph.

GENTIANACEAE

Blackstonia perfoliata (L.) Hudson subsp. **serotina** (W.Koch ex Reichb.) Vollmann
Anamur – Ermenek main road, 21. km, in *Pinus* forest, 580 m, 17.05.2007, Yıldıztugay 1641.
Th.

Centaurium erythraea Rafn subsp. **turcicum** (Velen.) Melderis
Near Alaköprü, in *Pinus* forest, 540 m, 18.08.2008, Yıldıztugay 2075.
Widespread, Th.

C. pulchellum (Swartz) Druce
Anamur – Ermenek main road, 21. km, in *Pinus* forest, 580 m, 17.05.2007, Yıldıztugay 1648.
Widespread, Th.

CONVOLVULACEAE

Convolvulus dorycnium L. subsp. **dorycnium**
Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1936.
Medit., Hcrp.

C. arvensis L.
Near Alaköprü, stony places, 550 m, 18.05.2008, Yıldıztugay 1922.
Hcrp.

C. galaticus Rost. ex Choisy
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1964.
Endemic, LC, Ir.-Tur., Hcrp.

BORAGINACEAE

Heliotropium dolosum De Not.
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1606.
Th.

Rochelia cancellata Boiss. & Bal.
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1961.
Ir.-Tur., Th.

Myosotis incrassata Guss.
Kaş Plateau, near Deliktaş Cave, rocky places, 1500 m, 05.04.2007, Yıldıztugay 1404.
Medit., Th.

M. litoralis Steven ex M.Bieb.
Güney Bahşişler Village, Kesme Hill, stony places, 230 m, 07.04.2007, Yıldıztugay 1499.
Medit., Th.

M. ramosissima Rochel ex Schult. subsp. **uncata** (Boiss. & Bal.) Grav
Anamur – Ermenek main road, 21. km, rocky places, 580 m, 07.04.2008, Yıldıztugay 1805.
Endemic, EN, Medit., Th.

M. refrecta Boiss. subsp. **refrecta**
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1972.
Medit., Th.

M. alpestris F.W.Schmidt. subsp. **alpestris**
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1726.
Widespread, Hcrp.

Lithospermum officinale L.
Güney Bahşişler Village, Kesme Hill, stony places, 230 m, 06.04.2007, Yıldıztugay 1450.
Euro-Sib., Hcrp.

Buglossoides tenuiflora (L.fil.) Johnston
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 740 m, 07.04.2008, Yıldıztugay 1817.
Th.

B. arvensis (L.) Johnst.
Anamur – Ermenek main road, 32. km, rocky places, 1450 m, 05.04.2007, Yıldıztugay 1418.
Widespread, Th.

Echium plantagineum L.
Anamur – Ermenek main road, Sevgi Water Park crossroads, roadsides, 155 m, 06.04.2007, Yıldıztugay 1424a.
Medit., Hcrp.

Onosma frutescens Lam.
Anamur – Ermenek main road, 21. km, in *Pinus* forest, 580 m, 17.05.2007, Yıldıztugay 1634.
Medit., Hcrp.

O. lycaonicum Hub.-Mor.
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1965.
Endemic, NT, Ir.-Tur., Hcrp.

O. bornmuelleri Hausskn.
Güney Bahşişler Village to Sevgi Water Park, in *Pinus* forest, 260 m, 06.04.2007, Yıldıztugay 1461.
Endemic, LC, Ir.-Tur., Hcrp.

Cerinthe minor L. subsp. **auriculata** (Ten.) Domac
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1301.
Hcrp.

Anchusa undulata L. subsp. **hybrida** (Ten.) Cout.
Anamur – Ermenek main road, Ormancık Village around, stony places, 250 m, 01.03.2007, Yıldıztugay 1342.
Medit., Hcrp.

Alkanna punctulata Hub.-Mor.
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1968.
Endemic, VU, Medit., Hcrp.

SOLANACEAE

Solanum nigrum L. subsp. **nigrum**
Anamur – Ermenek main road, Sevgi Water Park crossroads, roadsides, 155 m, 01.03.2007, Yıldıztugay 1372.
Th.

Atropa belladonna L.
Anamur – Ermenek main road, Sevgi Water Park crossroads, roadsides, 155 m, 17.05.2007, Yıldıztugay 1739.
Euro-Sib., Hcrp.

SCROPHULARIACEAE

Verbascum myriocarpum Boiss. & Heldr.
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2029.
Endemic, NT, Medit., Hcrp.

V. splendidum Boiss.
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2063.
Endemic, LC, Medit., Hcrp.

V. glomerulosum Hub.-Mor.
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2064.
Endemic, LC, Medit., Hcrp.

Scrophularia peregrina L.
Near Alaköprü, damp places, 550 m, 01.03.2007, Yıldıztugay 1325.
Medit., Hcrp.

S. xanthoglossa Boiss. var. **decipiens** (Boiss. & Kotschy) Boiss.
Sevgi Water Park around, in *Pinus* forest, 265 m, 06.04.2007, Yıldıztugay 1474.
Ir.-Tur., Hcrp.

Anarrhinum orientale Bentham
Anamur – Ermenek main road, Sevgi Water Park crossroads, stony places, 155 m, 06.04.2007, Yıldıztugay 1425.
Ir.-Tur., Hcrp.

Antirrhinum majus L.
Ovabaşı Village entrance, roadsides, 230 m, 17.05.2008, Yıldıztugay 1899.
Hcrp.

Misopates orontium (L.) Rafin.
Anamur – Ermenek main road, Sevgi Water Park crossroads, stony places, 155 m, 01.03.2007, Yıldıztugay 1370.
Th.

Linaria genistifolia (L.) Mill. subsp. **confertiflora** (Boiss.) P.H.Davis
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1962.
Endemic, LC, Ir.-Tur., Hcrp.

L. chalepensis (L.) Mill. var. **chalepensis**
Anamur – Ermenek main road, Sevgi Water Park crossroads, stony places, 155 m, 06.04.2007, Yıldıztugay 1448.
Medit., Th.

L. simplex (Willd.) DC.
Anamur – Ermenek main road, Sevgi Water Park crossroads, stony places, 160 m, 07.04.2008, Yıldıztugay 1802.
Medit., Th.

L. pelisseriana (L.) Mill.
Anamur – Ermenek main road, Sevgi Water Park crossroads, stony places, 155 m, 06.04.2007, Yıldıztugay 1423.
Medit., Th.

Digitalis davisiana Heywood
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2027.
Endemic, LC, Medit., Hcrp.

Veronica balansae Stroh
Anamur – Ermenek main road, Ormancık Village around, stony places, 250 m, 01.03.2007, Yıldıztugay 1341.

Endemic, LC, Medit., Th.
V. praecox All.
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1973.
Th.
V. cymbalaria Bodard
Near Alaköprü, damp places, 550 m, 01.03.2007, Yıldıztugay 1334.
Medit., Th.
V. anagallis-aquatica L.
Anamur – Ermenek main road, 21. km, roadsides, 580 m, 07.04.2008, Yıldıztugay 1804.
Widespread, Hcrp.
V. macrostachya Vahl. subsp. **macrostachya**
Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1934-1946.
Medit., Hcrp.
V. macrostachya Vahl subsp. **sorgerae** M.A.Fisch.
Kaş Plateau, under *Abies*, 1600 m, 17.05.2007, Yıldıztugay 1675.
Endemic, VU, Medit., Hcrp.
V. elmaliensis M.A.Fisch.
Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1935.
Endemic, LC, Medit., Hcrp.
Parentucellia latifolia (L.) Caruel subsp. **latifolia**
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1970.
Medit., Vp.

OROBANCHACEAE

Orobanche ramosa L.
Güney Bahşişler Village, Kesme Hill, stony places, 230 m, 06.04.2007, Yıldıztugay 1453.
Vp.
O. cernua Loefl.
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1739.
Vp.

ACANTHACEAE

Acanthus hirsutus Boiss.
Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1937.
Endemic, LC, Ir.-Tur., Hcrp.

GLOBULARIACEAE

Globularia trichosantha Fisch. & C.A.Mey.
Kaş Plateau, stony places, 1605 m, 28.10.2008, Yıldıztugay 2088.
Ir.-Tur., Hcrp.

VERBENACEAE

Verbena officinalis L.
Near Alaköprü, in *Pinus* forest, 540 m, 18.08.2008, Yıldıztugay 2072.
Widespread, Hcrp.
Vitex agnus-castus L.
Near Alaköprü, in *Pinus* forest, 540 m, 18.08.2008, Yıldıztugay 2073.
Medit., Mcph.

LAMIACEAE

Ajuga chamaepitys (L.) Schreb. subsp. **cuneatifolia** (Stapf) P.H.Davis
Kaş Plateau, stony places, 1605 m, 07.04.2007, Yıldıztugay 1491.
Ch.
Rosmarinus officinalis L.
Anamur – Ermenek main road, Sevgi Water Park crossroads, roadsides, 150 m, 01.03.2007, Yıldıztugay 1394.
Medit., Ch.
Lavandula stoechas L. subsp. **stoechas**
Ovabaşı Village, roadsides, 230 m, 07.04.2007, Yıldıztugay 1480.
Medit., Ch.
Scutellaria orientalis L. subsp. **alpina** (Boiss.) O.Schwartz var. **alpina**
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1654.
Widespread, Ch.
Phlomis longifolia Boiss. & Bl. var. **bailanica** (Vierh.) Hub.-Mor.
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1653.
Endemic, LC, Medit., Ch.
P. armeniaca Willd.
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2016.
Endemic, LC, Ir.-Tur., Hcrp.
Lamium garganicum L. subsp. **reniforme** (Montbret & Aucher ex Bent.) R.Mill
Kaş Plateau, near Deliktaş Cave, rocky places, 1500 m, 05.04.2007, Yıldıztugay 1408.
Hcrp.
L. amplexicaule L.
Near Alaköprü, stony places, 550 m, 01.03.2007, Yıldıztugay 1311.
Euro-Sib., Th.
Ballota nigra L. subsp. **anatolica** P.H.Davis
Kaş Plateau, stony places, 1605 m, 17.05.2008, Yıldıztugay 1909.
Endemic, LC, Ir.-Tur., Hcrp.
Marrubium bourgaei Boiss. subsp. **bourgaei**
Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1943.
Endemic, LC, Medit., Hcrp.
Sideritis lanata L.
Near Alaköprü, damp places, 550 m, 01.03.2007, Yıldıztugay 1332.
Medit., Th.
S. brevidens P.H.Davis
Near Alaköprü, in *Pinus* forest, 540 m, 10.08.2008, Yıldıztugay 2068.
Endemic, VU, Medit., Hcrp.
S. condensata Boiss. & Heldr.
Near Alaköprü, in *Pinus* forest, 540 m, 10.08.2008, Yıldıztugay 2067.
Endemic, LC, Medit., Hcrp.
S. vuralii H.Duman & Başer
Kaş Plateau, stony places, 1605 m, 18.08.2008, Yıldıztugay 2070.
Endemic, VU, Medit., Ch.
Stachys cretica L. subsp. **anatolica** Rech.fil.
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1662.
Endemic, LC, Ir.-Tur., Hcrp.
S. lavandulifolia Vahl var. **lavandulifolia**
Kaş Plateau, rocky places, 1600 m, 17.05.2007, Yıldıztugay 1682.
Ir.-Tur., Hcrp.
Nepeta nuda L. subsp. **nuda**
Kaş Plateau, rocky places, 1600 m, 17.05.2007, Yıldıztugay 1683.
Hcrp.
N. caesarea Boiss.
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 2005.
Endemic, LC, Medit., Hcrp.
Prunella vulgaris L.
Sevgi Water Park around, in *Pinus* forest, 265 m, 06.04.2007, Yıldıztugay 1477.
Euro-Sib., Hcrp.
Origanum majorana L.
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1604.
Medit., Hcrp.
Calamintha sylvatica Bromf. subsp. **sylvatica**
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1618.
Euro-Sib., Hcrp.
Micromeria myrtifolia Boiss. & Hohen.
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 1982.
Medit., Ch.
Thymus revolutus Celak.
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1738.
Endemic, VU, Medit., Ch.
Mentha spicata L. subsp. **tomentosa** (Briq.) Harley
Near Alaköprü, damp places, 550 m, 18.05.2008, Yıldıztugay 1940.
Hcrp.
Salvia aucheri Bent. var. **aucheri**
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1725.
Endemic, VU, Ch.
S. potentillifolia Boiss. & Heldr. ex Bentham
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1658.
Endemic, LC, Medit., Hcrp.
S. heldreichiana Boiss. ex Benth.
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2015.
Endemic, LC, Medit., Ch.
S. viridis L.
Anamur – Ermenek main road, 21. km, in *Pinus* forest, 580 m, 17.05.2007, Yıldıztugay 1644.
Medit., Th.
S. microstegia Boiss. & Bal.
Kaş Plateau, rocky places, 1600 m, 17.05.2007, Yıldıztugay 1686.
Ir.-Tur., Hcrp.
S. candidissima Vahl subsp. **occidentalis** Hedge
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1660.
Ir.-Tur., Hcrp.
S. virgata Jacq
Anamur – Ermenek main road, Ormancık Village around, stony places, 250 m, 01.03.2007, Yıldıztugay 1338.
Ir.-Tur., Hcrp.

PLUMBAGINACEAE

Plumbago europaea L.

Kaş Plateau, rocky places, 1600 m, 17.05.2007, 28.10.2008, Yıldıztugay 2080.
Euro-Sib., Hcrp.

PLANTAGINACEAE

Plantago coronopus L. subsp. **coronopus**
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1631.
Euro-Sib., Th.
P. cretica L.
Anamur – Ermenek main road, Sevgi Water Park crossroads, stony places, 155 m, 06.04.2007, Yıldıztugay 1445.
Medit., Th.

THYMELAEACEAE

Daphne gnidioides Jaub. & Spach
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1625.
Medit., Ch.

ELAEAGNACEAE

Elaeagnus angustifolia L.
Anamur – Ermenek main road, Ormancık Village around, roadside, 250 m,28.10.2008, Yıldıztugay 2086.
Mcph.

SANTALACEAE

Thesium bergeri Zucc.
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1656.
Medit., Ch.

LORANTHACEAE

Viscum album L. subsp. **album**
Anamur – Ermenek main road, Sevgi Water Park around, on *Pinus*, 210 m, 28.10.2008, Yıldıztugay 2093.
Vp.

RAFFLESIACEAE

Cytinus hypocistis L. subsp. **orientalis** Wettst.
Anamur – Ermenek main road, 28. km, on *Cistus*, 420 m, 07.04.2007, Yıldıztugay 1506.
Medit., Vp.

EUPHORBIACEAE

Euphorbia hierosolymitana Boiss.
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1668.
Medit., Ch.
E. oblongata Griseb.
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1659.
Medit., Hcrp.
E. helioscopia L.
Güney Bahşişler Village, Kesme Hill, stony places, 230 m, 06.04.2007, Yıldıztugay 1449.
Th.
E. peplus L. var. **peplus**
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 740 m, 07.04.2008, Yıldıztugay 1821.
Th.
E. falcata L. subsp. **falcata** var. **falcata**
Anamur – Ermenek main road, Ormancık Village around, stony places, 250 m, 01.03.2007, Yıldıztugay 1345.
Th.
E. virgata Waldst. & Kit.
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 1985.
Hcrp.

URTICACEAE

Parietaria lusitanica L.
Anamur – Ermenek main road, 26. km, rocky places, 420 m, 07.04.2007, Yıldıztugay 1495.
Medit., Ch.

MORACEAE

Morus alba L.
Anamur – Ermenek main road, Ormancık Village around, roadside, 250 m, 18.06.2008, Yıldıztugay 2103.
Mcph.
M. nigra L.
Near Alaköprü, roadside, 550 m, 18.06.2008, Yıldıztugay 2104.
Mcph.

PLATANACEAE

Platanus orientalis L.
Anamur – Ermenek main road, Ormancık Village around, roadsides, 250 m, 18.06.2008, Yıldıztugay 2105.
Msph.

FAGACEAE

Quercus cerris L. var. **cerris**
Anamur – Ermenek main road, Sevgi Water Park around, stony places, 210 m, 28.10.2008, Yıldıztugay 2093.
Msph.
Q. trojana P.B.Webb
Anamur – Ermenek main road, Sevgi Water Park around, stony places, 210 m, 28.10.2008, Yıldıztugay 2094.
Medit., Msph.

SALICACEAE

Salix alba L.
Near Alaköprü, damp places, 550 m, 18.06.2008, Yıldıztugay 2106.
Mcph.
Populus nigra L. subsp. **nigra**
Near Alaköprü, roadside, 550 m, 18.06.2008, Yıldıztugay 2107.
Msph.

RUBIACEAE

Crucianella macrostachya Boiss.
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 2003.
Medit., Th.
C. latifolia L.
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1610.
Medit., Th.
Galium verum L. subsp. **glabrescens** Ehrend.
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2010.
Ir.-Tur., Ch.
G. canum Req. ex DC. subsp. **canum**
Near Alaköprü, in *Pinus* forest, 500 m, 07.04.2007, Yıldıztugay 1510-1515.
Medit., Hcrp.
G. spurium L. subsp. **spurium**
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1956.
Euro-Sib., Th.
G. setaceum Lam.
Kaş Plateau, stony places, 1550 m, 5-50 m, 17.05.2008, Yıldıztugay 1904.
Th.
G. bracteatum Boiss.
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1727.
Ir.-Tur., Th.
G. stepparum Ehrend. & Schönb. – Tem.
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 2004.
Endemic, LC, Ir.-Tur., Th.
Cruciata taurica (Pall. ex Willd.) Ehrend.
Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1938.
Ir.-Tur., Hcrp.
Valantia hispida L.
Güney Bahşişler Village, Kesme Hill, stony places, 230 m, 06.04.2007, Yıldıztugay 1451.
Medit., Th.

MONOCOTYLEDONEAE

ARACEAE

Arum elongatum Steven subsp. **detruncatum** (C.A.Mey. ex Schott) H.Riedl
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1701.
Ir.-Tur., Crp.
Biarum bovei Blume
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1603.
Ir.-Tur., Crp.

LILIACEAE

Asphodelus aestivus Brot.
Anamur – Ermenek main road, Ormancık Village around, stony places, 250 m, 01.03.2007, Yıldıztugay 1346.
Medit., Crp.
Asphodeline rigidifolia (Boiss.) Baker

Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1730.
Endemic, LC, Ir.-Tur., Crp.
Allium pallens L. subsp. **pallens**
Anamur – Ermenek main road, Sevgi Water Park around, stony places, 210 m, 28.10.2008, Yıldıztugay 2095.
Medit., Crp.
A. bassitense Thieb.
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1665.
Medit., Crp.
A. sipyleum Boiss.
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1600.
Medit., Crp.
A. staticiforme Sm.
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1612.
Medit., Crp.
A. scorodoprasum L. subsp. **rotundum** (L.) Stearn
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2021.
Crp.
Urginea maritima (L.) Baker
Near Alaköprü, in *Pinus* forest, 540 m, 18.08.2008, Yıldıztugay 2078.
Medit., Crp.
Scilla bifolia L.
Kaş Plateau, rocky places, 1670 m, 07.04.2008, Yıldıztugay 1829.
Medit., Crp.
Ornithogalum pyrenaicum L.
Anamur – Ermenek main road, 21. km, in *Pinus* forest, 580 m, 17.05.2007, Yıldıztugay 1636.
Crp.
O. narbonense L.
Near Alaköprü, stony places, 550 m, 18.05.2008, Yıldıztugay 1925.
Medit., Crp.
O. oligophyllum E.D.Clarke
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1975.
Crp.
O. lanceolatum Labill.
Kaş Plateau, near Deliktaş Cave, rocky places, 1500 m, 05.04.2007, Yıldıztugay 1412.
Medit., Crp.
O. ulophyllum Hand.-Mazz.
Kaş Plateau, rocky places, 1600 m, 17.05.2007, Yıldıztugay 1684.
Crp.
O. umbellatum Ten.
Near Alaköprü, stony places, 550 m, 01.03.2007, Yıldıztugay 1320.
Widespread, Crp.
O. orthophyllum Ten.
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 740 m, 07.04.2008, Yıldıztugay 1814.
Widespread, Crp.
Muscari comosum (L.) Mill.
Güney Bahşişler Village, Kesme Hill, stony places, 230 m, 06.04.2007, Yıldıztugay 1458.
Medit., Crp.
Bellevalia dubia (Guss.) Roem. & Schult.
Kaş Plateau, rocky places, 1670 m, 07.04.2008, Yıldıztugay 1831.
Medit., Crp.
Tulipa humilis Herb.
Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1955.
Crp.
Gagea fibrosa (Desf.) Schult. & Schult.fil.
Kaş Plateau, rocky places, 1670 m, 07.04.2008, Yıldıztugay 1828.
Crp.
G. foliosa (J. & C.Presl) Schult. & Schult.fil.
Kaş Plateau, near Deliktaş Cave, rocky places, 1500 m, 05.04.2007, Yıldıztugay 1401.
Crp.
G. villosa (M.Bieb.) Duby var. **villosa** Pers.
Near Alaköprü, stony places, 550 m, 01.03.2007, Yıldıztugay 1306.
Medit., Crp.

AMARYLLIDACEAE

Galanthus elwesii Hook.fil.
Kaş Plateau, near Deliktaş Cave, rocky places, 1500 m, 01.03.2007, Yıldıztugay 1350.
Medit., Crp.

IRIDACEAE

Crocus biflorus Mill. subsp. **isauricus** (Siehe ex Bowles) Mathew
Kaş Plateau, near Deliktaş Cave, rocky places, 1500 m, 01.03.2007, Yıldıztugay 1347.
Endemic, LC, Medit., Crp.
C. cancellatus Herbert subsp. **pamphylicus** Mathew
Kaş Plateau, stony places, 1605 m, 28.10.2008, Yıldıztugay 2091.
Endemic, VU, Medit., Crp.
Romulea ramiflora Ten. subsp. **ramiflora**
Anamur – Ermenek main road, Karabahşişler Village entrance, roadsides, 150 m, 01.03.2007, Yıldıztugay 1352.
Medit., Crp.
R. columnae Seb. & Mauri subsp. **columnae**
Anamur – Ermenek main road, Sevgi Water Park crossroads, stony places, 155 m, 01.03.2007, Yıldıztugay 1361.
Medit., Crp.
Gladiolus illyricus W.Koch.
Güney Bahşişler Village, Kesme Hill, stony places, 230 m, 06.04.2007, Yıldıztugay 1459.
Medit., Crp.

ORCHIDACEAE

Limodorum abortivum (L.) Swartz
Near Alaköprü, in *Pinus* forest, 550 m, 07.04.2007, Yıldıztugay 1487.
Widespread, Crp.
Spiranthes spiralis (L.) Chevall.
Anamur – Ermenek main road, Sevgi Water Park around, in *Pinus* forest, 210 m, 28.10.2008, Yıldıztugay 2096.
Medit., Crp.
Orchis sancta L.
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1601.
Medit., Crp.
O. anatolica Boiss.
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 740 m, 07.04.2008, Yıldıztugay 1810.
Medit., Crp.

CYPERACEAE

Carex divisa Hudson
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1974.
Widespread, Crp.

POACEAE

Brachypodium pinnatum (L.) P.Beauv.
Anamur – Ermenek main road, 26. km, roadsides, 740 m, 07.04.2007, Yıldıztugay 1501.
Euro-Sib., Hcrp.
Trachynia distachya (L.) Link
Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1952.
Th.
Elymus tauri (Boiss. & Bal.) Melderis
Near Alaköprü, stony places, 550 m, 09.04.2007, Yıldıztugay 1585.
Ir.-Tur., Hcrp.
Aegilops peregrina (Hackel) Maire & Weiller
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1627.
Th.
Hordeum murinum L. subsp. **glaucum** (Steud.) Tzvelev
Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1931.
Th.
H. bulbosum L.
Kaş Plateau, rocky places, 1575 m, 18.05.2008, Yıldıztugay 1948.
Widespread, Crp.
Taeniatherum caput-medusae (L.) Nevski subsp. **crinitum** (Schreb.) Melderis
Anamur – Ermenek main road, 21. km, in *Pinus* forest, 580 m, 17.05.2007, Yıldıztugay 1635.
Ir.-Tur., Th.
Bromus japonicus Thunb. subsp. **anatolicus** (Boiss. & Heldr.) Penzes
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1616.
Th.
B. tectorum L.
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1615.
Widespread, Th.
Avena barbata Pott ex Link subsp. **barbata**
Anamur – Ermenek main road, Sevgi Water Park crossroads, stony places, 155 m, 06.04.2007, Yıldıztugay 1437.
Medit., Th.
Phragmites australis (Cav.) Trin ex Steud.
Near Alaköprü, stream edge, 550 m, 09.04.2007, Yıldıztugay 1580.
Euro-Sib., Crp.
Rostraria cristata (L.) Tzvelev var. **cristata**
Anamur – Ermenek main road, 26. km, roadside, 600 m, 08.04.2007, Yıldıztugay 1552.
Widespread, Th.

Deschampsia caespitosa (L.) P.Beauv.
in *Pinus* forest, 550 m, 07.04.2007, Yıldıztugay 1503.
Widespread, Th.
Aira elegantissima Schur subsp. **elegantissima**
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 1989.
Medit., Th.
Phleum pratense L.
Near Alaköprü, roadside, 550 m, 17.05.2007, Yıldıztugay 1736.
Euro-Sib., Th.
P. subulatum (Savi) Aschers. & Graebn. subsp. **subulatum**
Anamur – Ermenek main road, 26. km, in *Pinus* forest, 600 m, 17.06.2008, Yıldıztugay 2001.
Medit., Th.
Lolium perenne L.
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1963.
Euro-Sib., Hcrp.
Catapodium rigidum (L.) C.E.Hubbard ex Dony subsp. **rigidum** var. **rigidum**
Anamur – Ermenek main road, 26. km, stony places, 600 m, 09.04.2008, Yıldıztugay 1859.
Widespread, Th.
Poa annua L.
Kaş Plateau, rocky places, 1675 m, 18.05.2008, Yıldıztugay 1960.
Th.
P. bulbosa L.
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1705.
Crp.
Dactylis glomerata L. subsp. **glomerata**
Near Alaköprü, stony places, 550 m, 18.05.2008, Yıldıztugay 1923.
Crp.
Cynosurus echinatus L.
Anamur – Ermenek main road, 28. km, in *Pinus* forest, 750 m, 17.05.2007, Yıldıztugay 1670.
Medit., Th.
Briza maxima L.
Near Alaköprü, stony places, 550 m, 17.05.2007, Yıldıztugay 1611.
Th.
Melica ciliata L. subsp. **ciliata**
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2023.
Widespread, Hcrp.
Stipa holosericea Trin.
Kaş Plateau, stony places, 1605 m, 17.06.2008, Yıldıztugay 2022.
Ir.-Tur., Hcrp.
Piptatherum coerulescens (Desf.) P.Beauv.
Kaş Plateau, rocky places, 1675 m, 17.05.2007, Yıldıztugay 1734.
Hcrp.
Aeluropus littoralis (Gouan) Parl.
Sevgi Water Park around, in *Pinus* forest, 265 m, 06.04.2007, Yıldıztugay 1469.
Hcrp.
Cynodon dactylon (L.) Pers. var. **dactylon**
Anamur – Ermenek main road, 26. km, stony places, 600 m, 09.04.2007, Yıldıztugay 1576.
Crp.

4. Conclusions and discussion

As a result of the examination of 840 plants specimens which were collected from the research area between 2006-2008, 470 taxa that belong to 73 families and 279 genera have been determined. Three of them belong to Pteridophyta and 467 belong to Spermatophyta divisions. The subdivision Gymnospermae has 7 taxa and Angiospermae has 460. Of these, 397 taxa belong to the Dicotyledones while the other 63 belong to the Monocotyledones (Table 2).

Table 2. The dispersion of taxa into large taxonomical groups.

	Families	Genera	Species	Subsp.	Var.	Taxa	Endemics
Pteridophyta	3	3	3	-	-	3	-
Spermatophyta	70	276	311	109	47	467	62
Gymnospermae	3	5	4	3	-	7	1
Angiospermae	67	271	307	106	47	460	61
Dicotyledones	60	227	263	91	44	397	58
Monocotyledones	7	44	44	15	4	63	3
Total	73	279	314	109	47	470	62

According to the number of species the largest families are presented in Table 3. The largest family is Fabaceae including with 59 taxa in the study area. The family Asteraceae is the second largest group, with 58 taxa. The family Caryophyllaceae ranks third, with 35 taxa. When researches performed near the region were compared with regard to the largest two families, flora of Mount Musa (Düzenli and Çakan, 2001) is the closest study to our research (Table 4). The family Lamiaceae ranks first in Kozlar Highplateau (Everest and Rauss, 2004). In other studies Asteraceae ranks first as the family with the highest number of taxa (Sümbül and Erik, 1988a-1988b-1990a-1990b; Ertuğrul et al., 2002). In most floristic studies, Asteraceae and Fabaceae are usually the richest families. This can be explained by the diversity of vegetation types, soil construction, climatic conditions and topography (Balos and Akan, 2008). Because of these reasons taxa belonging to these families were dominant in the research area.

Table 3. The families containing the highest number of taxa.

Families	Number of taxa	Rate (%)
Fabaceae	59	12.6
Asteraceae	58	12.3
Caryophyllaceae	35	7.4
Lamiaceae	31	6.6
Brassicaceae	31	6.6
Poaceae	28	6.0
Apiaceae	23	4.9
Liliaceae	22	4.7
Scrophulariaceae	21	4.5
Boraginaceae	17	3.6
Total	325	69.2

Table 4. Comparison of large families in the Kaş Plateau and neighbouring areas.

Families (%)	Kaş	Taşeli	Çekiç	Kozlar	Musa
Fabaceae	12.6	9.9	7.9	8.8	12.8
Asteraceae	12.3	11.4	13.8	11.0	10.5
Caryophyllaceae	7.4	5.4	6.7	3.3	3.2
Lamiaceae	6.6	7.2	8.7	12.5	8.6
Brassicaceae	6.6	7.1	9.0	5.5	3.0
Poaceae	6.0	3.4	6.2	6.3	8.0
Apiaceae	4.9	4.6	4.8	2.9	2.6
Liliaceae	4.7	4.7	4.9	2.9	3.0
Scrophulariaceae	4.5	3.7	4.1	3.7	4.0
Boraginaceae	3.6	3.5	2.8	6.6	2.5

Kaş: The Flora of Kaş Plateau and Its Surroundings (Anamur - Mersin).
Taşeli: The Flora of Taşeli Plateau (İçel-Konya-Antalya).
Çekiç: The Flora of Çekiç Mountain and Gevne Valley (Hadim-Konya).
Kozlar: Investigations Flora in Mersin: Kozlar Highplateau of South Turkey.
Musa: Flora of Mount Musa (Hatay-Turkey).

In point of number of genera Asteraceae (33), Poaceae (24), Fabaceae (23), Brassicaceae (20), Lamiaceae (18), Caryophyllaceae (12), Apiaceae (12), Boraginaceae (10) and Liliaceae (10) were the largest families. The genera containing the highest number of species in this study are listed in Table 5. The genus *Silene* L. ranks first, with 11 taxa (2.34%). *Vicia* L. ranks second, with 8 taxa (1.70%) and *Astragalus* L. ranks third, with 7 taxa (1.49%).

Table 5. The genera containing the highest number of taxa.

Genera	Number of taxa	Rate (%)
Silene	11	2.34
Vicia	8	1.70
Astragalus	7	1.49
Salvia	7	1.49
Ornithogalum	7	1.49
Veronica	7	1.49
Arabis	7	1.49
Trifolium	6	1.28
Ranunculus	6	1.28
Galium	6	1.28
Total	72	15.33

The species of the study area, categorised according to phytogeographical regions, can be listed as follows: Mediterranean elements 158 (33.6%), Irano-Turanian elements 48 (10.2%), Euro-Siberian elements 20 (4.3%) and the remaining 244 (51.9%) taxa are Multiregional or unknown. The results of the studies conducted in close and similar areas, along with phytogeographical distribution, are presented in Table 6. Except from the flora of Çekiç Mountain (Ertuğrul et al., 2002) The Mediterranean elements seem to be dominant in all areas studied and the Irano-Turanian elements come second.

Table 6. A comparison of the phytogeographical elements and endemism.

Research area (%)	Kaş	Taşeli	Çekiç	Kozlar	Musa
Mediterranean	33.6	29.0	18.0	18.7	40.8
Irano-Turanian	10.2	16.9	22.0	16.9	3.6
Euro-Siberian	4.3	5.8	5.4	4.4	8.2
Multiregional or unknown	51.9	48.3	54.6	60.0	47.4
Endemism	13.2	20.2	21.9	12.0	9.3

The total number of endemic taxa is 62 (13.2%). The proportion of endemism in the area is low (13.2%), below the average of Turkey (34%) (Ekim, 2005; Behçet et al., 2009). The endemism rate is 20.2% for Taşeli (Sümbül and Erik, 1988a-1988b-1990a-1990b), 21.9% for Çekiç (Ertuğrul et al., 2002), 12.0% for Kozlar (Everest and Rauss, 2004) and 9.3% for Musa (Düzenli and Çakan, 2001) (Table 6). According to the IUCN red data book categories (Ekim et al., 2000; IUCN, 2001), *Clypeola ciliata* Boiss., *Silene balansae* Boiss., *Centaurea cheirolepidoides* Wagenitz and *Myosotis ramosissima* Rochel ex Schult. subsp. *uncata* (Boiss. & Bal.) Grav are EN; *Arenaria pamphylica* Boiss. & Heldr. subsp. *pamphylica* var. *turcica* McNeill, *Velezia pseudorigida* Hub.-Mor., *Silene pompeiopolitana* Gay ex Boiss., *Alkanna punctulata* Hub.-Mor., *Veronica macrostachya* Vahl subsp. *sorgerae* M.A.Fisch., *Sideritis brevidens* P.H.Davis, *Sideritis vuralii* H.Duman & Başer, *Thymus revolutus* Celak., *Salvia aucheri* Bent. var. *aucheri* and *Crocus cancellatus* Herbert subsp. *pamphylicus* Mathew are VU; *Cyclamen cilicium* Boiss. & Heldr. var. *cilicium*, *Onosma lycaonicum* Hub.-Mor. and *Verbascum myriocarpum* Boiss. & Heldr are NT and 42 endemic taxa are LC (IUCN, 2001).

The life forms of the taxa according to Raunkiaer (1934) are given in Table 7; 186 (39.6%) of the taxa are therophytes, 165 (35.1%) of the taxa are hemicryptophytes, 54 (11.5%) of the taxa are cryptophytes, 25 (5.3%) of the taxa are chamaephytes, 20 (4.3%) of the taxa are microphanerophytes, 8 (1.7%) of the taxa are mesophanerophytes, 7 (1.5%) of the taxa are nanophanerophytes and 5 (1.1%) of the taxa are vascular parasites. Because of the weather is dry from the beginning of may until the end of september, therophytes are dominant in the area.

Table 7. Life forms in the research area.

Life form	Number of taxa	Rate (%)
Therophyte	186	39.6
Hemicryptophyte	165	35.1
Cryptophyte	54	11.5
Chamaephyte	25	5.3
Microphanerophyte	20	4.3
Mesophanerophyte	8	1.7
Nanophanerophyte	7	1.5

Vascular parasite	5	1.1
Total	470	100

The specimens of *Bituminaria* Heist. ex Fabr. were collected during the floristic study from Kaş Plateau (Mersin–Anamur). At first, we were not able to identify these specimens by using the Flora of Turkey (Davis, 1965-1985; Davis et al., 1988; Güner et al., 2000). After that plant specimens were identified as *Bituminaria bituminosa* (L.) C.H.Stirt. according to the Flora Iberica (Talavera, 1999). After thorough examinations of all the specimens and the relevant literature, it was decided that this species is a new record for C4 square according to the grid system.

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Presence of *Centaurea regia* Boiss. subsp. *regia* (Subgen. *Cynaroides* (Boiss. ex Walp.) Dostál, Compositae) in Turkey

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Abstract

Centaurea regia subsp. *regia* (Subgen. *Cynaroides* (Heywood, 1975)) was noted but not collected by *Handel-Mazetti* near Diyarbakır and Cizre. Therefore, Wagenitz indicated the taxon under the headline "*Species doubfully recorded*" in Flora of Turkey. In this paper, presence of *Centaurea regia* in Turkey was shown. Description of the taxon was given together with its habitat, ecology and conservation status. Additionally, it was illustrated, and a distribution map was presented.

Key words: *Cynaroides, Centaurea regia, Turkey*

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Centaurea regia Boiss. subsp. *regia* (Subgen. *Cynaroides* (Boiss. ex Walp.) Dostál, Compositae)' nın Türkiye' deki varlığı

Özet

Centaurea regia subsp. *regia* (Subgen. *Cynaroides*) taksonu Handel-Mazetti tarafından, Diyarbakır - Cizre arasından not edilmiş, fakat toplanmamıştır. Bu nedenle Wagenitz, bu taksonu Türkiye florasında şüpheli kayıt başlığı altında belirtmiştir. Bu çalışmada, bu taksonun ülkemizdeki varlığı kanıtlanmıştır. Taksonun tanıtıcı özellikleri, yetişme ortamı ve koruma durumu belirtilmiştir. Ayrıca bu makalede taksonun, fotoğrafları ve yayılış haritası da verilmiştir.

Anahtar kelimeler: *Cynaroides, Centaurea regia, Türkiye*

1. Introduction

1. Introduction

Centaurea L. is largest genus of Compositae family in Turkey. This genus are represented with 151 species, 6 imperfectly and 6 doubtfully known species in the Flora of Turkey with supplement I and II (excluding Sections *Aetheopappus, Amblyopogon, Centaurea, Hyalinella, Odontolophoideae, Psephelloideae, Psephellus, Sosnovskya* and *Xanthopsis*) (Wagenitz, 1975**;** Davis et al., 1988**;** Güner et al., 2000**;** Wagenitz & Hellwig, 2000**;** Greuter, 2003). Since then 16 new species and 2 new records were discovered from Turkey (Özhatay and Kültür, 2006**;** Aksoy et al., 2008**;** Uysal, 2008**;** Uysal et al., 2008**;** Armağan and Ünal, 2009**;** Daşkın and Yılmaz, 2009**;** Doğan and Duran, 2009**;** Hamzaoğlu and Budak, 2009**;** Kaya, 2009**;** Özhatay et al., 2009**;** Uysal and Köse, 2009). *C. amplifolia* Boiss. & Heldr. (Sect. *Centaurea*) in Flora of Turkey (supplement 1) was described a new species as *C. wagenitziana* Bancheva & Kit Tan (Sect. *Centaurea*) by Tan et al. (2009). Finally, the total number of *Centaurea* was increased to 169 species and

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199 taxa (excluding above mentioned sections). Finally, endemic taxa were increased to 129, and rate of endemism are 65%.

In addition, chemical analysis of this taxon have been studied by Ulubelen et al. (Ulubelen et al., 1988).

2. Material and Methods

During floristic investigations, the authors collected some *Centaurea* L. specimens between Midyat and Dargeçit (Mardin) in 2009. At the beginning, collected specimens were thought as *Centaurea cynarocephala* Wagenitz (Wagenitz, 1975). But after, it has been understood that these specimens have some different characters from *C. cynarocephala*. They were checked from Flora of Turkey together with Supplements and Check-list III and IV of Additional Taxa to the Supplements Flora of Turkey (Davis et al., 1988**;** Güner et al., 2000**;** Özhatay and Kültür, 2006**;** Özhatay et al., 2009).

These specimens were determined as *Centaurea regia* subsp. *regia*. It was related to *C. cynarocephala*, but it has straw-coloured appendages with more vigorous terminal spine (8-14 mm). Collected specimens were compared with the type specimens of *C. cynarocephala* and *C. regia* of herbarium G and also other specimens in herbaria B and ISTE. For acronyms of herbaria see (Holmgren et al., 1990).

The description of the species given below was based on collected specimens and other references (Boissier, 1875, Wagenitz, 1980).

3. Results

3.1. Description of species

Centaurea regia Boiss. Diagn. Pl. Orient. ser. 1, 6: 135. 1846. (Figure 1)
Syn.: *Cynaroides regia* (Boiss.) Dostál, Acta Bot. Acad. Sci. Hung. 19: 77 (1973).

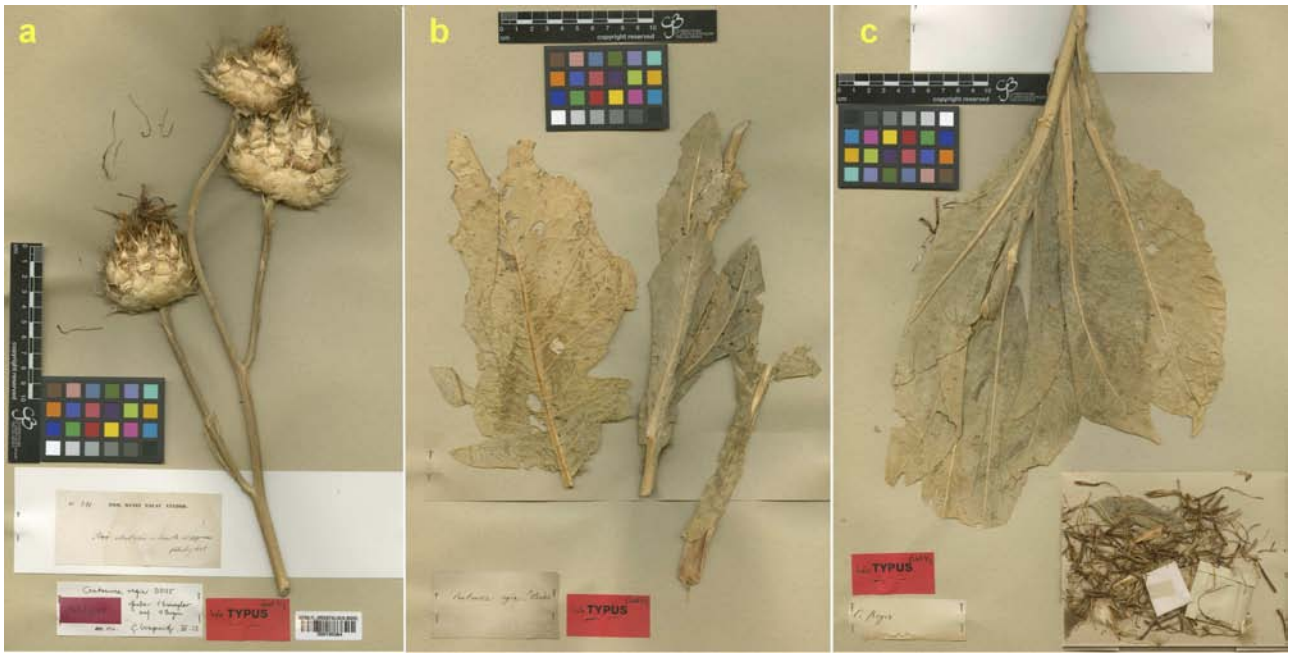

Figure 1. Type specimen of *Centaurea regia* subsp. *regia* (Barcode No: G00150364)

Biennial with thick fleshy taproot and erect stem, 40 – 110 cm, arachnoid-tomentose, at last glabrescent. Leaves rigid papyraceus (on drying), hirsute with articulate hairs, densely on veins. Basal leaves long petiolate, ovate-subcordate or rarely lyrate, up to 40 × 20 cm (included petiole). Lower cauline leaves broadly lanceolate, entire or lower part pinnatilobate; median leaves broadly lanceolate or oblong, sessile and decurrent, 20 x 10 cm; upper leaves lanceolate, narrowly decurrent; Inflorescence raceme; capitula with involucres, 40 – 55 × 40 – 60 mm diam., subglobose; phyllaries multiseriate, coriaceus-scarious, median phyllaries ca. 20 - 25 × 20 - 25 mm (included cilia and spine); appendages large, ovate or broadly triangular, concealing basal part of phyllaries, white or straw-coloured to brownish purple with 10 – 17 cilia; cilia (3-) 4 – 7 mm long, ending in a (3-) 4 - 14 mm spine. Flowers purple, ca. 45 mm. Achenes 6 – 9 × 3 – 4 mm, shiny. Pappus double (inner row shorter), barbellate, straw-coloured to brownish, 10 – 13 (-15) mm, inner 2 – 5 mm (Figure 2).

Distribution of species: SE Anatolia, Syria, Iran, Iraq.

3.2. Identification key of subspecies of C. regia:

1- Terminal spine of median phyllaries 8 – 14 mm long; appendages white or straw-coloured, rarely brownish……..…….subsp. *regia*
1- Terminal spine of median phyllaries (3-) 4 - 8 mm long; appendages brownish or brownish-purple……..……subsp. *cynarocephala*

3.3. Examined specimens

Centaurea regia* Boiss. subsp. *regia
Type: Assyria, in deserto ad Tigridem (Kotschy 371), (holo. G-image!; iso. BM, K, W)

Turkey. SE Anatolia. C8 Mardin: between Midyat and Dargeçit, around İzbırak village, roadsides and vineyard clearings, 950 m, 37° 30’ 34” N, 41° 32’ 53” E, 10.06.2009, *S. Aslan* 3869 & *B. Şahin*; ibid., 37° 30’ 29” N, 41° 32’ 45” E, 20.07.2009, *S. Aslan* 3969*;* between Midyat and Dargeçit, roadside, 37° 28’ 23” N, 41° 27’ 09” E, 20.07.2009, *S. Aslan* 3968 (GAZI!); Şırnak: Eruh – Şırnak yolu, 15. km, roadside, 18.06.2008, 1175 m, degraded *Quercus* woodland, *F.A.Karavelioğulları* 3657 & *S. Çelik*!; Siirt: Uludere – Şırnak, 15. km, on calcareous rocky places, 18.06.2008, 1163 m, *F.A.Karavelioğulları* 3658 & *S. Çelik*!*;* Midyat - Cizre arası, Midyat’tan 55 km, 05.07.1980, *T. Baytop* (ISTE 45500 - image!)

Ir.-Tur. element. Syria, Iraq and Persia occidentalis (Wagenitz, 1980)

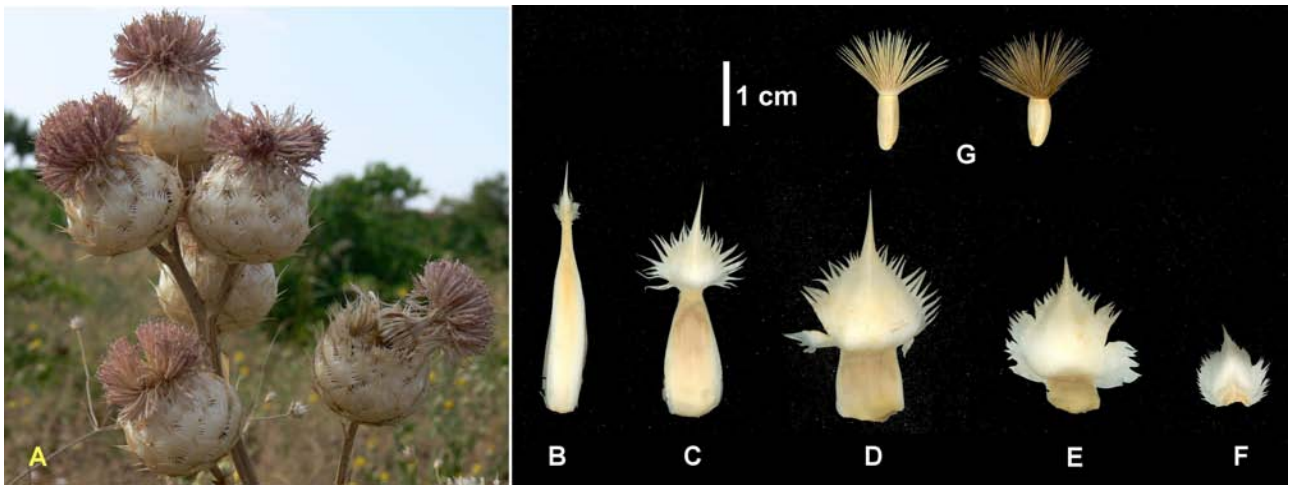

Figure 2. *Centaurea regia* subsp. *regia*. (A) capitulum, (B) inner phyllary, (C-D) median phyllaries, (E-F) outer phyllaries, (G) achenes with pappus

subsp. *cynarocephala* (Wagenitz) Wagenitz in Fl. Iranica, 139b: 365. 1980 (Wagenitz, 1980).
Syn.: *C. cardunculus* Boiss., Diagn. Pl. Or. Nov. Ser. 1, 6: 135 (1845) *non* Pallas (1771); *C. cynarocephala* Wagenitz in Willdenowia 2: 477 (1960).

Lectotype: Turkey C8: in Assyria inter Merdin (Mardin) et Assuaner, 12 vi 1841, *Kotschy* 349 (G-image!, iso. K, W).

SE Anatolia C8 Mardin: Mardin, *Sint.* 1888: 941; 5 km E. of Mardin, *D.* 28430.

Ir.-Tur. element. SE Anatolia, N Iraq.

4. Conclusions and Discussion

At first, *Centaurea cardunculus* was published in 1771 by Pallas. Later, Boissier published a species under the same name in 1845, too (Boissier, 1875, Wagenitz, 1975). According to the Code (Principle III, Art. 6) (McNeill et al., 2006), Pallas’s name has been accepted as valid. *C. cardunculus* named by Boiss. was published as an invalid name and renamed as *C. cynarocephala* by Wagenitz in 1960 (Wagenitz, 1975). Then, Wagenitz published *C. regia* subsp. *cynarocephala* comb. et stat. nova in Flora Iranica (Wagenitz, 1980, Greuter and Raab-Straube, 2008).

As stated by Wagenitz (1975), this species was noted but not collected by Handel-Mazetti near Diyarbakir and Cizre. We collected subsp. *regia* from the same area where was noted by Handel-Mazetti.

In addition, this species was collected between Mardin and Midyat in 1980 by Turhan Baytop, and kept in the herbarium ISTE with correct determination. But it has not been published as a new record, yet. Some other species within Subgen. Cynaroides (e.i. *C. sclerolepis* Boiss., *C. kurdica* Reichardt, *C. gigantea* Schultz Bip. ex Boiss., *C. haradjianii* Wagenitz, *C. haussknechtii* Boiss.) localized in SE Anatolia, too (Özuslu and Tel, 2008). They spread on similar habitats which usually are calcareous grassland and vineyards. They are superficially similar to each other. Their populations are usually weak and fragmented. Their habitats must stricly be protected from intensive agricultural activities and housing developments. People should be responsive to keep alive the rare plants like these.

4.1. Habitat and Ecology

It grows in roadsides, vineyards and fallow fields, disturbed field on calcareous stony areas (Figure 3). Some species present in the area along with *C. regia* subsp. *regia* are as follows: *Allium myrianthum* Boiss., *Avena barbata* Pott ex Link. subsp. *barbata, Centaurea balsamita* Lam., *Imperata cylindrica* (L.) Raeuschel, *Scabiosa rotata* Bieb., *Zoegea leptaurea* L.

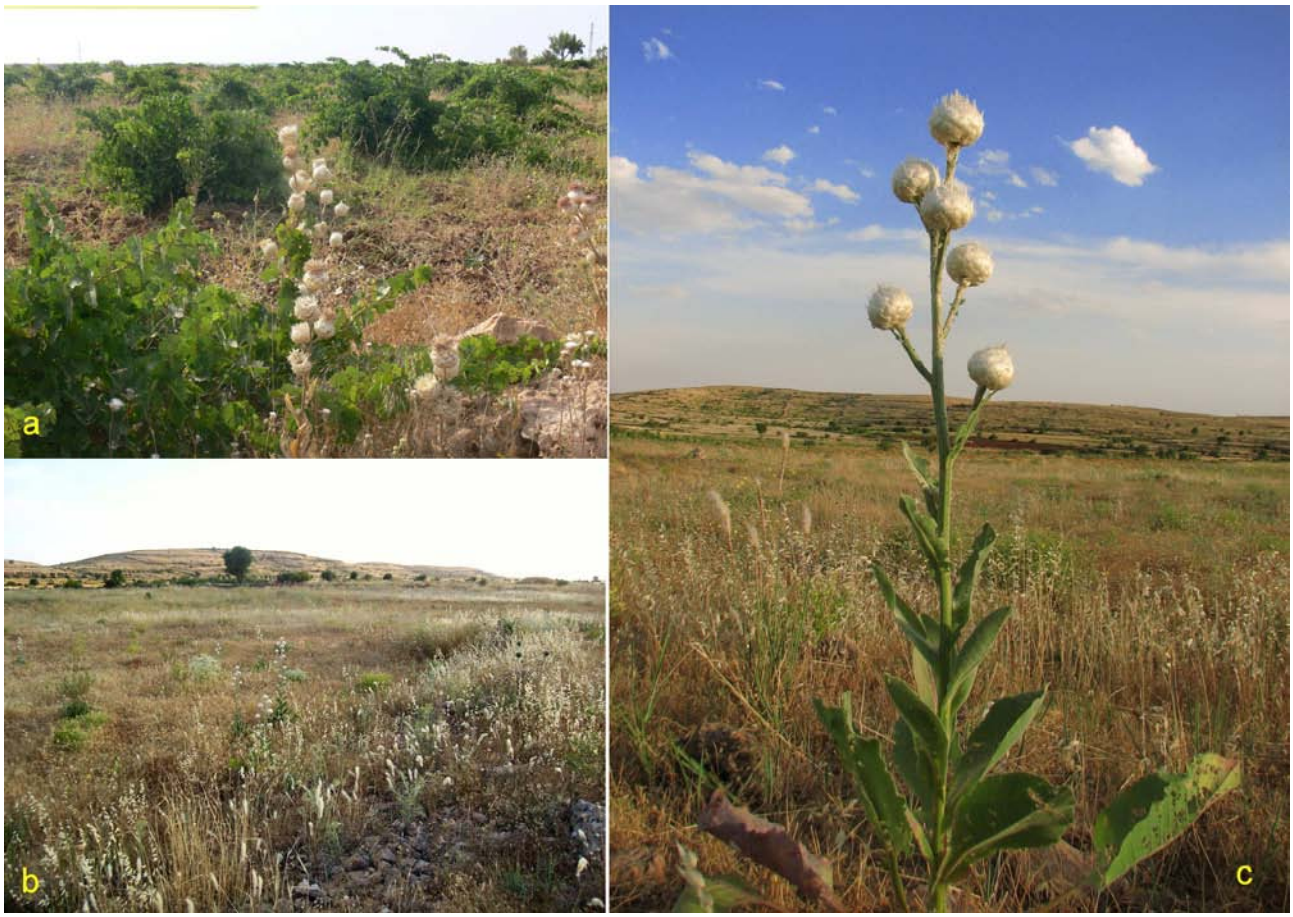

Figure 3. Habitat of *Centaurea regia* subsp. *regia*. (a) in vineyards (b, c) in fallow fields

4.2. Other localities in Flora Iranica

Iraq: Arbil.: in montibus inter Harir et Rawandiz, Bornm. 1488 (B-image!), Mosul: 86 km N Mosul versus Zakho, Rech. 10632 (B-image!), 5 km S Zakho, 700 m, Rawi & Rech. 16690; Olaka, 700 m, Rawi 8769; Kirkuk: Prope Kirkuk, Haines s.n.; Hausskn. 582;, Persia: W. Kermanshah: M. Shahu, Str. (Figure 4).

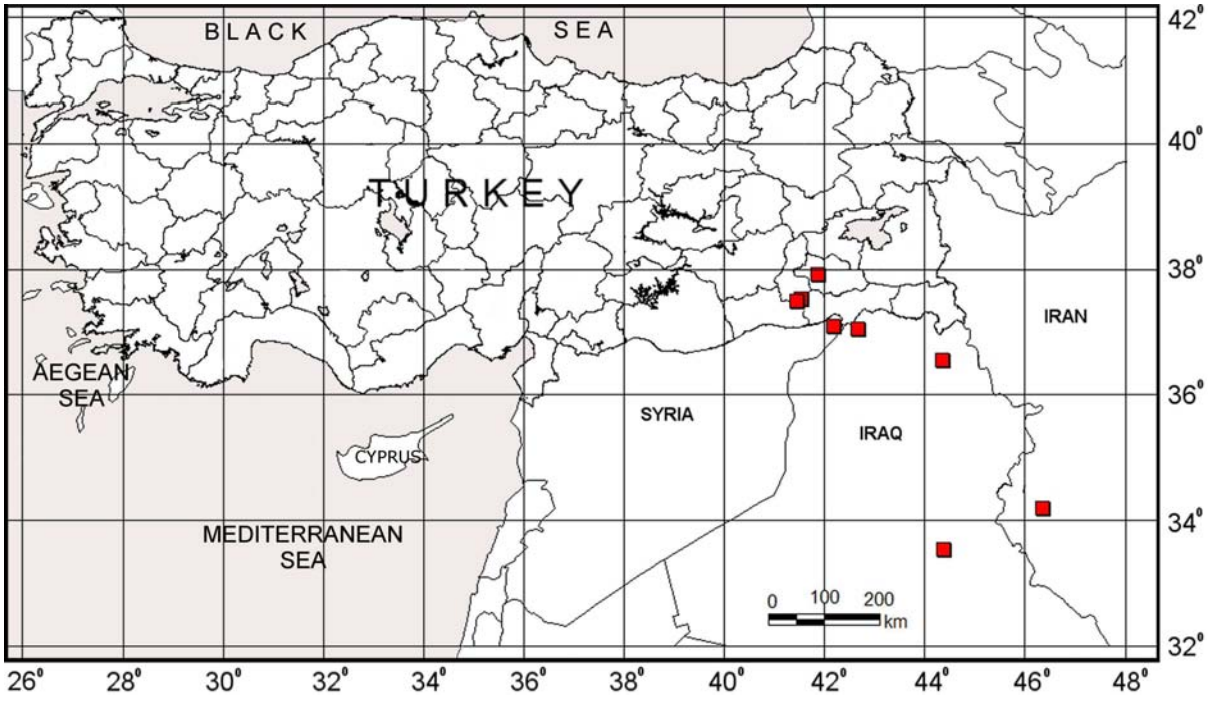

Figure 4. Distribution map of *Centaurea regia* Boiss. subsp. *regia*

4.3. Threats and conservation status

The species is under the threat due to cultivated activities on vineyards by local people. Also, we observed an insect (*Larinus latus* Herbst, 1784 – capitulum weevil) feeding with achenes on the capitula (Figure 5). It was possible be under severely threat in Iraq and Iran. We suppose that it should be recommended as globally Vulnerable (VU). According to our observations, it was regionally assessed as Critically Endangered (CR; B1a) in Turkey (IUCN, 2001).

Figure 5. *Larinus latus* on the capitulum

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DOĞAL YAYILIŞI VE
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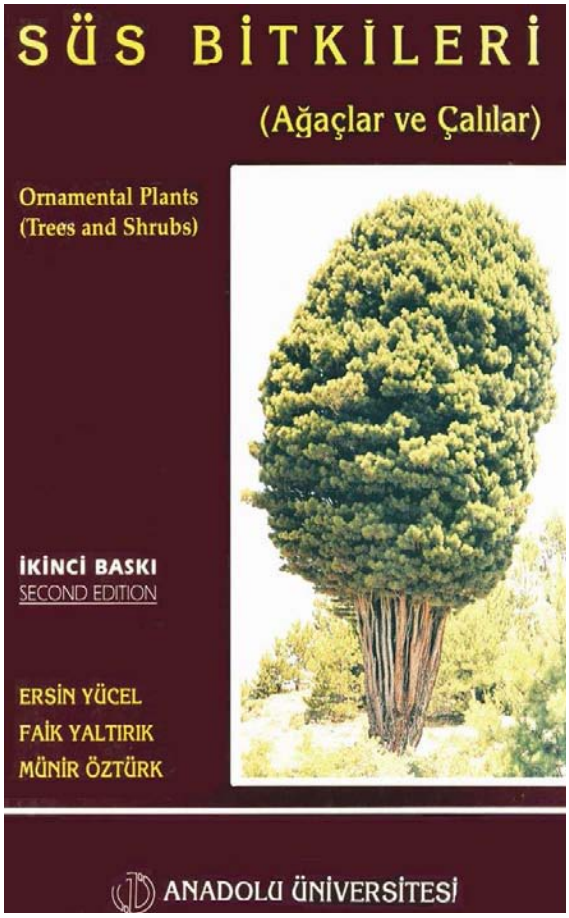
ERSİN YÜCEL
ANADOLU ÜNİVERSİTESİ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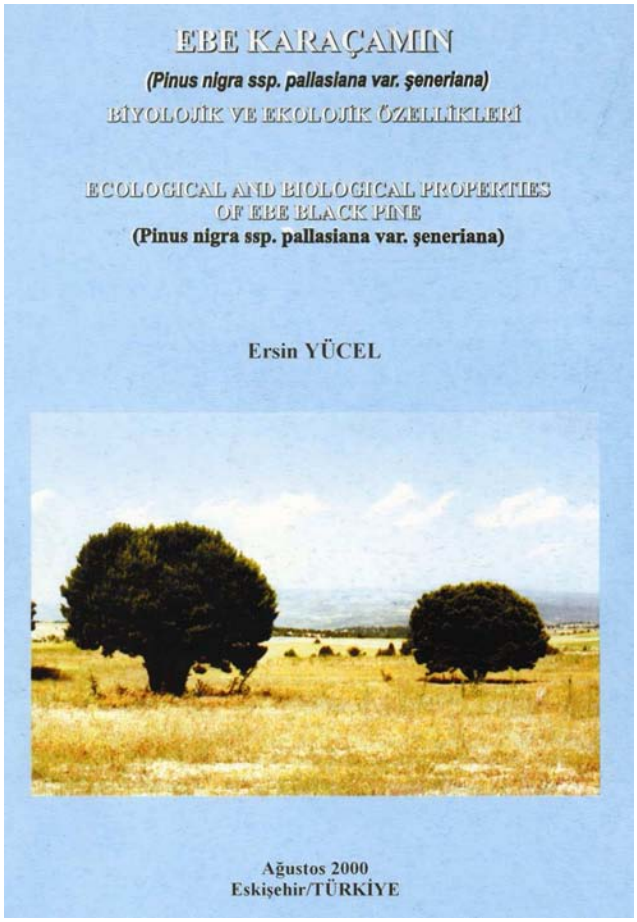
(Ağaçlar ve Çalılar)
Ornamental Plants
(Trees and Shrubs)
İKİNCİ BASKI
SECOND EDITION
ERSİN YÜCEL
FAİK YALTIRIK
MÜNİR ÖZTÜRK
ANADOLU ÜNİVERSİTESİ


EBE KARAÇAMIN
(Pinus nigra ssp. pallasiana var. şeneriana)
BİYOLOJİK VE EKOLOJİK ÖZELLİKLERİ
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OF EBE BLACK PINE
(Pinus nigra ssp. pallasiana var. şeneriana)
Ersin YÜCEL
Ağustos 2000
Eskişehir/TÜRKİYE


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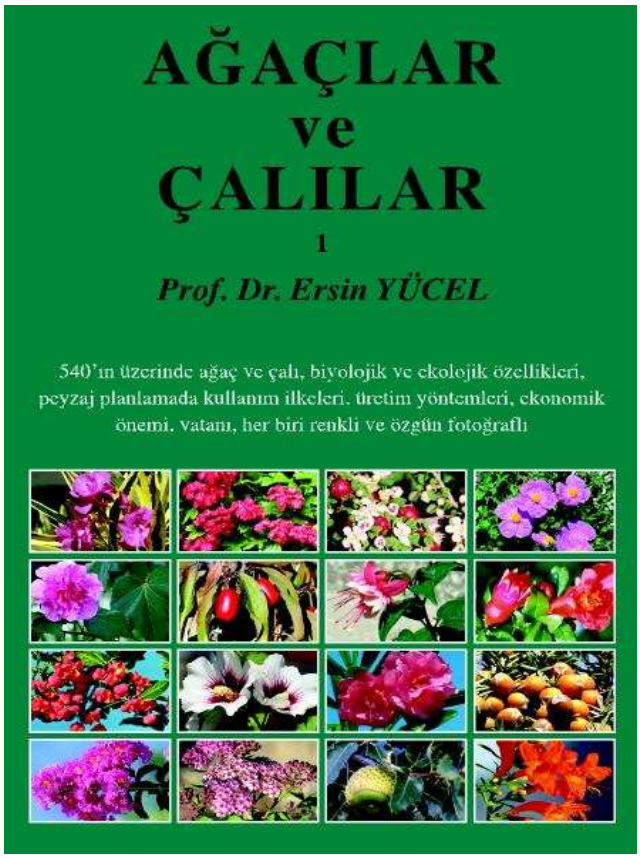
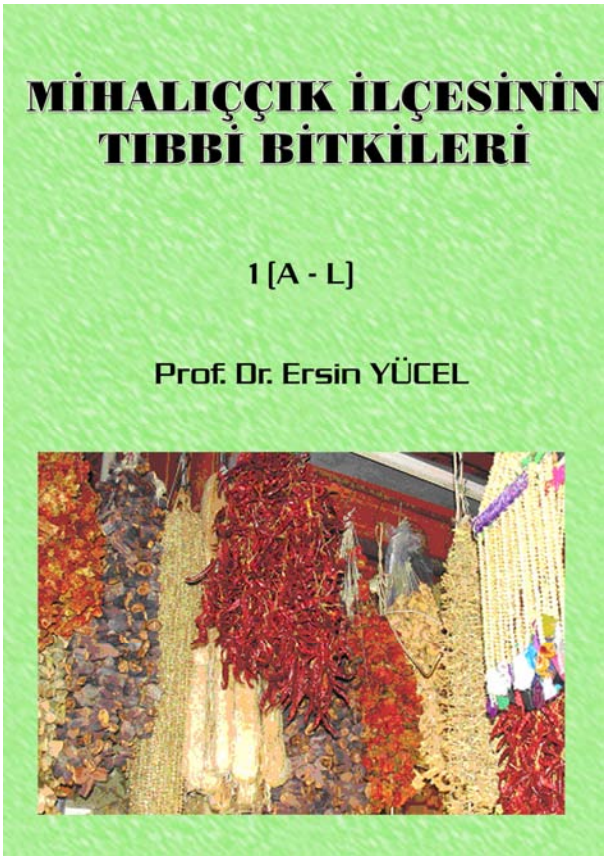
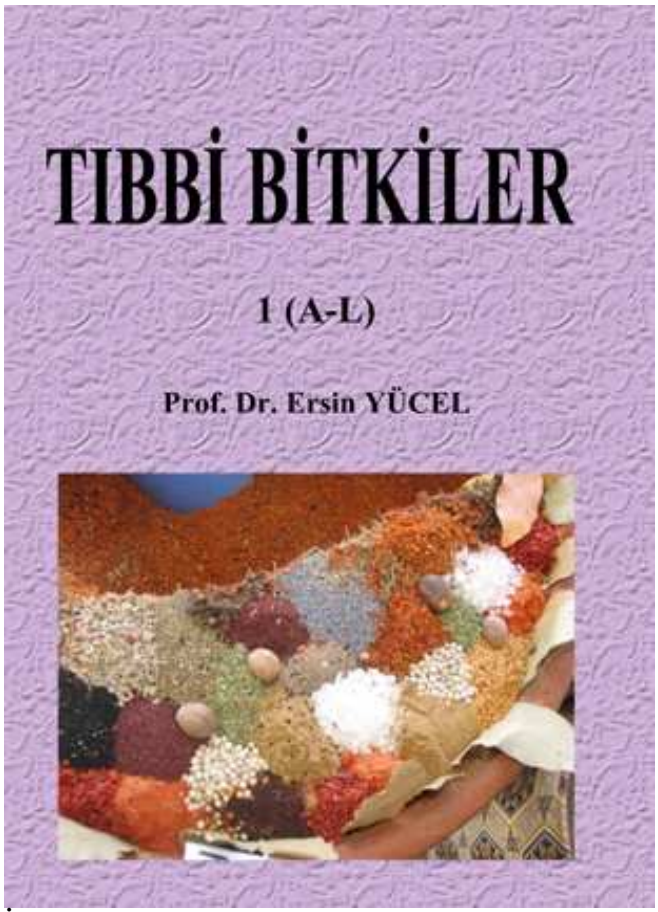
YERÖRTÜCÜLER
Prof.Dr. ERSİN YÜCEL







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