

## Re-evaluated conservation status of *Salvia* (sage) in Turkey I: The Mediterranean and the Aegean geographic regions

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**Abstract:** The precise evaluation of the conservation status of endemic and rare species is necessary in order to prevent their extinction. According to our current taxonomic revision of Turkish *Salvia* L., the Mediterranean and Aegean geographic regions of Turkey have 60 taxa, 32 of which are endemic (mainly local endemics), 5 of which are non-endemic rare, and the remaining 23 taxa are widely distributed. The rate of endemism is 53% in the area. The destruction of habitat through human encroachment such as urbanisation, land clearing, overgrazing, pollution, and road and dam constructions is the principal threat in the study area. Based on our field and population observations and the obtained data, we re-evaluated their current conservation status at both regional and (inter)national level using recent IUCN Red List categories. According to the results, threat categories of species at international level are as follows: 1 taxon Data Deficient (DD), 1 taxon Critically Endangered (CR), 8 taxa Endangered (EN), 15 taxa Vulnerable (VU), 7 taxa Near Threatened (NT), and 28 taxa Least Concern (LC). The threatened species are concentrated in 3 regions. The first region covers Antalya, Elmalı, Korkuteli, Denizli, and Burdur. The second region covers Karaman, Mut, Gülnar, and Ermenek. The third region covers Adana, Kahramanmaraş, and Hatay. The areas rich in terms of the endemic species number need to be legally protected with protection of population and vegetation. In addition, the area needs to be urgently modelled and managed by means of the Geographical Information System (GIS). In addition, some other measures need to be considered such as rehabilitation or restoration of damaged habitats and transferring the species to national parks and botanical gardens. Furthermore, public awareness and interest on the conservation of species should be increased.

**Key words:** Aegean, Mediterranean, Red List, *Salvia*, Turkey

### Türkiye’de yayılış gösteren *Salvia* (adaçayı) türlerinin koruma statülerinin yeniden değerlendirilmesi I: Akdeniz ve Ege Bölgesi

**Özet:** Endemik ve nadir türlerin koruma statülerinin kesin olarak belirlenmesi onların soylarının tükenmesinin önlenmesindeki en önemli adımlardan biridir. Türkiye’deki *Salvia* türleri üzerine yaptığımız güncel taksonomik revizyon çalışmasına göre, ülkemizin Akdeniz ve Ege Bölgelerinde 60 takson yetişmektedir. Bu taksonlardan 32 tanesi endemik, 5 tanesi endemik olmayan nadir ve geriye kalan 23 takson ise geniş yayılışlıdır. İnsan faaliyetleri sonucu habitatların yok edilmesi alandaki başlıca tehdittir, örneğin kentleşme, arazi açma, kirlilik, yol ve baraj inşaatları gibi. Çalışma alanındaki türlerin endemik oranı % 53’dir. Arazi çalışmalarımız, popülasyon gözlemlerimiz ve elde edilen veriler dahilinde, en son IUCN Red List kategorilerine göre türlerin hem bölgesel hemde ulusal-uluslararası ölçekte tehlike kategorileri yeniden belirlenmiştir. Bu sonuçlara göre alandaki türlerin tehlike kategorilerine göre dağılımı şöyledir: 1 takson Veri Yetersiz, 1 takson Kritik Derecede Tehlike altında, 8 takson Tehlike’de, 15 takson Hassas, 7 takson Yakında Tehdit altına girebilir ve 28 takson Düşük Seviyede Endişe verici. Endemik ve nadir türler çalışma alanında 3 bölgede yoğunlaşmıştır. 1. Bölge

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Antalya, Elmalı, Korkuteli, Denizli ve Burdur'u içine alan bölge. 2. Bölge Karaman, Mut, Gülnar ve Ermenek'i içine alan bölge. 3. Bölge Adana, Kahramanmaraş ve Hatay'ı içine alan bölgedir. Endemik türler açısından zengin olan alanların yasal kanunlar çerçevesinde hem popülasyon hem de vejetasyon bazında korunmaya ihtiyacı vardır, ayrıca alanın acilen Coğrafik Bilgi Sistemleri (CIS) yardımıyla modellenmesi ve yönetilmesi gerekmektedir. Bunlara ilave olarak, bazı diğer koruma önlemleri de düşünülebilir, örneğin hasar görmüş habitatların yenilenerek eski haline getirilmesi, tehlike altındaki türlerin yakında bulunan milli parklara yada botanik bahçelerine taşınması gibi. Ayrıca türlerin korunması konusunda halkın bilinçlendirilmesi ve ilgisinin artırılması gerekmektedir.

**Anahtar sözcükler:** Ege, Akdeniz, Kırmızı Liste, *Salvia*, Türkiye

## Introduction

Natural ecosystems are degrading and declining rapidly, because of increased human populations. The destruction of habitats through human encroachment seems to be the principal cause of the loss of biodiversity (López-Pujol et al., 2006). Due to the rapid population increase in Turkey within the last few decades, many natural habitats have been fragmented and reduced in size or degraded (Kaya & Raynal, 2001).

Many studies show that narrow endemic species are susceptible to extinction, with one of the most important reasons being the destruction of habitats. Because of that, endemic species are the first to experience the negative effect of habitat destruction or fragmentation. The precise evaluation of the conservation status of a particular species is necessary in order to prevent its extinction (Bernardos et al., 2006).

The genus *Salvia* L. contains nearly 1000 species displaying a remarkable diversity in growth forms, secondary compounds, floral morphology, and pollination biology. *Salvia* is distributed mainly in 3 regions of the world: Central and South America (500 spp.), western Asia (200 spp.), and eastern Asia (100 spp.) (Walker & Sytsma, 2007). It is also the largest genus in the family Lamiaceae both in Turkey and in the rest of the world. Turkey seems to be a major centre for *Salvia* in South-west Asia, with 95 species (Celep et al., 2009a). The distribution in neighbouring countries is as follows: 75 species in the former USSR (Pobedimova, 1954), 70 in *Flora Iranica* (Hedge, 1982a), 36 in Europe (Hedge, 1972), and 21 in *Flora Palaestina* (Zohary, 1966).

*Salvia* species are also used in traditional medicines all around the world, possessing antibacterial, antioxidant, antidiabetic, and antitumor properties (Ulubelen, 2003). In addition, many *Salvia*

species are used as herbal tea and for food flavouring, as well as in cosmetics, perfumery, and the pharmaceutical industry (Demirci et al., 2003). In the area, mostly *S. fruticosa* Miller, *S. pomifera* L., *S. cryptantha* Montbret & Aucher ex Benthams, and *S. aramiensis* Rech.f. are used as herbal tea, and *S. fruticosa* is also exported.

The genus *Salvia* has been subject to a number of studies based on the data mainly morphological (Hedge, 1982a, 1982b), anatomical (Metcalf & Chalk, 1950, 1972; Kahraman et al., 2009a), numerical (Reales et al., 2004), karyological (Nakipoglu, 1993), palynological (Henderson et al., 1968), phylogenetical (Walker et al., 2004), and evolutionary (Claßen-Bockhoff et al., 2004). In addition, the taxonomic significance of the nutlet shape and surface micromorphology of the genus *Salvia* has been studied by Hedge (1970) and Marin et al. (1996).

The first revision of *Salvia* in Turkey was performed by Hedge (1982b), who recognised 86 species, 1 hybrid, and 1 doubtful species. Since then, 6 more new species, 1 new variety, and 3 new records have been described from Turkey (Celep et al., 2009a, 2009b).

Previously, 31 taxa were evaluated under different threat categories in the Turkish Red Data Book (Ekim et al., 2000). However, our studies and field observations show that the previous evaluations of the species were not properly made due to lack of field/herbarium studies and data.

The present study aims to provide a comprehensive assessment of the conservation status of *Salvia* taxa in the Mediterranean and the Aegean regions of Turkey. Moreover, this research is of great importance for a better understanding of human impact on and other threats to the species at both the regional and (inter)national level. In addition, the threats are explained and conservation priorities and

strategies are suggested (Broughton & McAdam, 2002; Celep & Doğan, 2007). This study is the first preliminary step towards the recognition and conservation of the threatened *Salvia* species in Turkey.

### Materials and methods

The research area (Mediterranean and Aegean geographical regions of Turkey) is approximately 194,477 km<sup>2</sup> and lies approximately at 36°16'211"N-26°14'474"E and 37°46'103"N-37°51'359"E. According to Davis' (1965) grid system, the area falls within the B1, B2, B3, B6, C1, C2, C3, C4, C5, and C6 grid squares (Figure 1). The altitude of the study area varies between 0 and 3756 m (Aladağlar-Niğde). The area is located within the Mediterranean and Irano-Turanian phytogeographical regions.

Since 2005, as a part of a taxonomic revision of the genus *Salvia* in the Mediterranean and the Aegean regions of Turkey, the authors have carried out extensive field studies and collected a large number of specimens and have examined many herbarium specimens at ANK, AEF, B, BM, E, G, GAZI, HUB, ISTE, ISTF, K, and KNYA herbaria. In addition, population sizes and phenological and ecological properties were observed in the field. The studies revealed 2 new species (Ilçim et al., 2009; Celep & Doğan, 2010), 1 new variety (Celep et al., 2009b), and 2 new records (Celep et al., 2009a; Kahraman et al., 2009b).

Firstly, all published information was reviewed and the herbarium materials were studied. Afterwards, during the period 2005-2009, we visited the type and the other known localities of the species, as well as a number of other sites where they might occur. During the field studies, we aimed to visit as many as different habitats and populations to ensure representative geographical coverage. In the field, the specimens' GPS coordinates, habitat, and relevant field observations were also recorded. During this time, 60 taxa were collected from about 400 different populations in the area. When the species was detected, we observed the following characteristics: the area of occupancy and distribution, populations and their size, and the number of mature individuals. Moreover, current distribution areas of the species and their estimated distributional range were determined using GPS data. Threat categories are proposed for all the taxa according to IUCN Red List Categories Version 3.1 (2001) and the Application of IUCN Red List Criteria at Regional Levels (Gardenfors et al., 2001). Details of the threats are determined for each species and comments are made according to Broughton and McAdam (2002). Studied specimens are given in the Appendix. Our own specimens have been deposited in Middle East Technical University, Department of Biological Sciences. Examined endemic specimens are given in the Appendix.

Based on the results, we revised and assessed their regional, national, and inter(national) red list

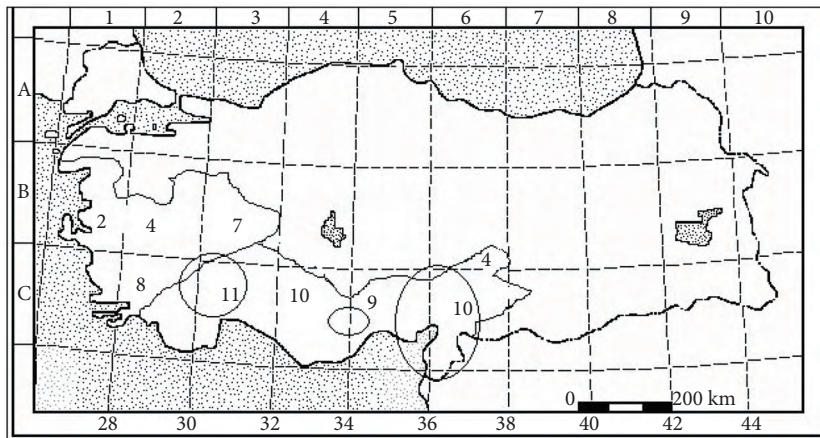


Figure 1. Geographic location and distribution of the endemic species for each grid square.

categories and estimate the proportion (%) of the global population occurring within the area (Table 1). The following categories established and defined by IUCN (2001) were used in this study: Data deficient (DD): inadequate information available to make an direct assessment; Critically endangered (CR): the taxon has an extremely high risk of extinction in the wild; Endangered (EN): the taxon has a very high risk of extinction in the wild; Vulnerable (VU): the taxon has a high risk of extinction in the wild in the medium term future; Near threatened (NT): the taxon is none of the above, but it close to qualifying for or is likely to qualify for a threatened category in the near future; Least concern (LC): the taxon is none of the above. Widespread and abundant taxa are included in this category.

## Results and discussion

According to our recent taxonomic revision of Turkish *Salvia*, the Mediterranean and Aegean geographic regions of Turkey have 60 taxa, 32 of which are endemic (mainly local endemics), 5 of which are non-endemic rare, and the remaining 23 taxa are widely distributed both regionally and globally. The distribution areas of the endemic taxa are given in the Appendix.

According to the geographical distribution of the species, 26 taxa grow in the Aegean geographic region of Turkey, 10 of which are endemic, and 55 taxa grow in the Mediterranean geographic region of Turkey, 28 of which are endemic. Six endemic taxa are also common in both regions. In the Aegean region, endemic and non-endemic rare species are concentrated mostly in İzmir, Uşak, Afyon, and Eskişehir. In the Mediterranean region, endemic and non-endemic rare species are concentrated in 3 regions. The first region covers Antalya, Elmalı, Korkuteli, Denizli, and Burdur in the western Mediterranean region. The second region covers Karaman, Mut, Gülnar, and Ermenek in the central Mediterranean region. The third region covers Adana, Kahramanmaraş, and Hatay in the eastern Mediterranean region. In terms of the number of endemic species, the richest areas are given in Figure 1.

According to IUCN (2001) criteria at national level, *S. haussknechtii* Boiss., known only from type

gathering, is evaluated as Data Deficient (DD). This taxon was not found in a detailed floristic research conducted in the type locality between 1977 and 1981 by Yıldız (2001). Moreover, we could not find any specimens of *S. haussknechtii* in spite of many expeditions to its type location and other potential areas. Therefore, we have not got inadequate information to make a direct or indirect assessment of its vulnerability. This might be due to extinction of the species in the area, or its known type locality being wrong, or the species being distributed somewhere. *S. quezelii* Hedge & Afzal-Rafii is Critically Endangered [CR B1ab(i,ii,iv); C2a(ii): extent of occurrence less than 100 km<sup>2</sup>; area of occupancy less than 10 km<sup>2</sup>; known to exist at only a single location; all mature individuals placed in one population and estimated mature individuals fewer than 100]. *S. tigrina* Hedge & Hub.-Mor., *S. sericeo-tomentosa* Rech.f., *S. smyrnaea* Boiss., *S. marashica* İlçim, F.Celep & Dogan, *S. nydeggeri* Hub.-Mor., *S. albimaculata* Hedge & Hub.-Mor., *S. adenocaulon* P.H.Davis, *S. chrysophylla* Staph, *S. cassia* Samuells. ex Rech.f., *S. pomifera* L., and *S. viscosa* Jacq. are Endangered [EN B2ab(i,ii,iv): area of occupancy less than 500 km<sup>2</sup>, known at no more than 5 locations]. Seventeen taxa are evaluated as Vulnerable [VU B2ab(i,ii,iv): area of occupancy less than 2000 km<sup>2</sup>, known at no more than 10 locations; inferred decline in the area]. Seven taxa are evaluated as Near Threatened (NT) since they are likely to qualify for a threatened category in the near future. The remaining 23 non-endemic taxa are evaluated as Least Concern (LC) since they are widespread or abundant (Table 1, Figure 2).

The distribution of the threatened species according to regional (the Aegean and the Mediterranean geographic regions of Turkey), national, and international level is as follows. At the regional level: 1 taxon DD, 1 taxon CR, 19 taxa EN, 18 taxa VU, and 21 taxa LC. At the national level: 1 taxon DD, 1 taxon CR, 11 taxa EN, 17 taxa VU, 7 taxa NT, and 23 taxa LC. At the international level: 1 taxon DD, 1 taxon CR, 8 taxa EN, 15 taxa VU, 7 taxa NT, and 28 taxa LC (Table 1, Figure 2).

The distribution of the threatened species according to geographic regions is as follows at international level. In the Aegean region: 1 taxon EN, 6 taxa VU, 5 taxa NT, and 14 taxa LC. In the

Table 1. The species of the study area, their IUCN categories and criteria, and an estimated proportion (%) of the global population. (\*) indicates that the species is known only within the region in Turkey, (+) indicates that the species is endemic, (ir-tur.) Irano-Turanian element, (med.) Mediterranean element, (eu.-sib.) Euro-Siberian element, (un. or mu.) Unknown or multiregional.

Species	According to Turkish Red Data Book	Recommended Threat Categories for Regional Level	Recommended Threat Categories for National Level	Recommended Threat Categories for International Level	An estimate of the proportion (%) of the global population occurring within the region	IUCN Red List Criteria (2001)
1	*, med. <i>Salvia haussknechtii</i>	DD	DD	DD	100, ?	?
2	*, med. <i>S. quezelii</i>	EN	CR	CR	100	B1ab(i,ii,iv); C2a(ii)
3	*, med. <i>S. tigrina</i>	EN	EN	EN	80-100	B2ab(i,ii,iv)
4	*, med. <i>S. sericeo-tomentosa</i>	EN	EN	EN	80-100	B2ab(i,ii,iv)
5	*, med. <i>S. smyrnaea</i>	EN	EN	EN	100	B2ab(i,ii,iv)
6	*, med. <i>S. marashica</i>	-	EN	EN	100	B2ab(i,ii,iv)
7	*, med. <i>S. nydeggeri</i>	EN	EN	EN	100	B2ab(i,ii,iv)
8	*, med. <i>S. albimaculata</i>	VU	EN	EN	100	B2ab(i,ii,iv)
9	*, med. <i>S. adenocaulon</i>	EN	EN	EN	80-90	B2ab(i,ii,iv)
10	*, med. <i>S. chrysophylla</i>	NT	EN	EN	100	B2ab(i,ii,iv)
11	*, med. <i>S. adenophylla</i>	VU	VU	VU	100	B2ab(i,ii,iv)
12	*, med. <i>S. cedronella</i>	VU	VU	VU	100	B2ab(i,ii,iv)
13	*, med. <i>S. aucheri</i> var. <i>aucheri</i>	VU	VU	VU	100	B2ab(i,ii,iv)
	*, med. <i>S. aucheri</i> var. <i>canescens</i>	VU	VU	VU	100	B2ab(i,ii,iv)
14	*, med. <i>S. cilicica</i>	VU	VU	VU	90	B2ab(i,ii,iv)
15	*, ir-tur. <i>S. modesta</i>	VU	EN	VU	30-40	B2ab(i,ii,iv)
16	*, med. <i>S. chionantha</i>	NT	VU	VU	100	B2ab(i,ii,iv)
17	*, ir-tur. <i>S. blepharochlaena</i>	NT	EN	VU	10-20	B2ab(i,ii,iv)
18	*, med. <i>S. potentillifolia</i>	NT	VU	VU	100	B2ab(i,ii,iv)
19	*, ir-tur. <i>S. tchihatcheffii</i>	NT	EN	VU	10-20	B2ab(i,ii,iv)
20	*, ir-tur. <i>S. pilifera</i>	LC	EN	VU	20-30	B2ab(i,ii,iv)
21	*, med. <i>S. pisidica</i>	LC	VU	VU	90-100	B2ab(i,ii,iv)
22	*, ir-tur. <i>S. recognita</i>	LC	EN	VU	10-20	B2ab(i,ii,iv)
23	*, ir-tur. <i>S. wiedemannii</i>	LC	EN	VU	10-15	B2ab(i,ii,iv)
24	*, ir-tur. <i>S. yosgadensis</i>	LC	EN	VU	10-15	B2ab(i,ii,iv)
25	*, un. or mu. <i>S. cadmica</i>	LC	VU	NT	40-50	-
26	*, ir-tur. <i>S. caespitosa</i>	LC	VU	NT	10-20	-
27	*, ir-tur. <i>S. cryptantha</i>	LC	VU	NT	10-15	-
28	*, ir-tur. <i>S. cyanescens</i>	LC	VU	NT	10-15	-
29	*, ir-tur. <i>S. dichroantha</i>	LC	VU	NT	10-20	-
30	*, med. <i>S. heldreichiana</i>	LC	VU	NT	60-70	-
31	*, ir-tur. <i>S. hypargeia</i>	LC	VU	NT	10-20	-
32	*, med. <i>S. aramiensis</i>	-	VU	VU	20-30	B2ab(i,ii,iv)
33	*, med. <i>S. cassia</i>	-	EN	EN	20-30	B2ab(i,ii,iv)
34	*, ir-tur. <i>S. indica</i>	-	EN	VU	?	B2ab(i,ii,iv)
35	*, med. <i>S. pomifera</i>	-	EN	EN	10-20	B2ab(i,ii,iv)
36	*, med. <i>S. viscosa</i>	-	EN	EN	10-20	B2ab(i,ii,iv)
37	*, med. <i>S. tomentosa</i>	-	LC	LC	?	Widely distributed
38	*, med. <i>S. pinnata</i>	-	LC	LC	?	Widely distributed
39	*, ir-tur. <i>S. bracteata</i>	-	LC	LC	?	Widely distributed
40	*, ir-tur. <i>S. suffruticosa</i>	-	LC	LC	?	Widely distributed
41	*, ir-tur. <i>S. multicaulis</i>	-	LC	LC	?	Widely distributed
42	*, med. <i>S. viridis</i>	-	LC	LC	?	Widely distributed
43	*, ir-tur. <i>S. syriaca</i>	-	LC	LC	?	Widely distributed
44	*, ir-tur. <i>S. palaestina</i>	-	LC	LC	?	Widely distributed
45	*, un. or mu. <i>S. sclarea</i>	-	LC	LC	?	Widely distributed
46	*, un. or mu. <i>S. aethiopsis</i>	-	LC	LC	?	Widely distributed
47	*, ir-tur. <i>S. ceratophylla</i>	-	LC	LC	?	Widely distributed
48	*, med. <i>S. argentea</i>	-	LC	LC	?	Widely distributed
49	*, ir-tur. <i>S. microstegia</i>	-	LC	LC	?	Widely distributed
50	*, ir-tur. <i>S. frigida</i>	-	LC	LC	?	Widely distributed
51	*, ir-tur. <i>S. candidissima</i> subsp. <i>candidissima</i>	-	LC	LC	?	Widely distributed
	*, ir-tur. <i>S. candidissima</i> subsp. <i>occidentalis</i>	-	LC	LC	?	Widely distributed
52	*, eu.-sib. <i>S. glutinosa</i>	-	VU	LC	?	Widely distributed
53	*, ir-tur. <i>S. virgata</i>	-	LC	LC	?	Widely distributed
54	*, med. <i>S. fruticosa</i>	-	LC	LC	5-10	Widely distributed
55	*, med. <i>S. verbenaca</i>	-	LC	LC	?	Widely distributed
56	*, ir-tur. <i>S. verticillata</i> subsp. <i>amasiaca</i>	-	LC	LC	?	Widely distributed
57	*, ir-tur. <i>S. russellii</i>	-	VU	LC	?	Widely distributed
58	*, med. <i>S. napifolia</i>	-	LC	LC	?	Widely distributed

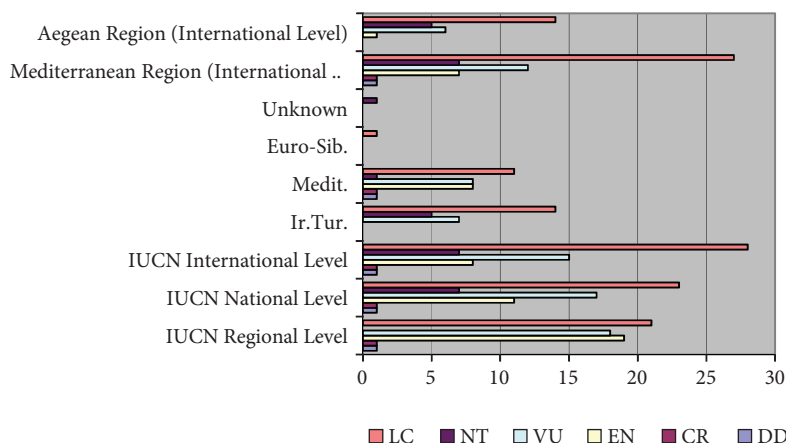


Figure 2. Distribution of the species according to IUCN Red List categories (regional, national and international level), phytogeographic elements, and geographic distribution.

Mediterranean region: 1 taxon DD, 1 taxon CR, 7 taxa EN, 12 taxa VU, 7 taxa NT, and 27 taxa LC (Figure 2).

The distribution of species according to phytogeographical regions is as follows: 30 taxa (50%) Mediterranean elements (1 taxon DD, 1 taxon CR, 8 taxa EN, 8 taxa VU, 1 taxon NT, and 11 taxa LC), 26 taxa (43%) Irano-Turanian elements (7 taxa VU, 5 taxa NT, and 14 taxa LC), 1 taxon (2%) Euro-Siberian element (LC), and 3 taxa (5%) unknown or multiregional elements (1 taxon NT and 2 taxa LC) (Figure 2). Mediterranean elements are distributed mainly at lower altitudes than Irano-Turanian elements and they usually prefer south facing slopes of the Taurus Mountains. Irano-Turanian elements are mostly distributed in the inner parts of the regions. In the area, there is only one species, *S. glutinosa* L., that

is a Euro-Siberian element. It was found in humid shadowy areas under *Fagus orientalis* Lipsky forest in the Amanos Mountains.

Twenty-two taxa (18 endemics and 4 non-endemics) grow only in the study area (Table 2). In this study, their distribution maps and exact localities based on GPS coordinates are given in Figures 3-7. Between 2005 and 2009, the authors visited the type localities of these 18 endemic taxa. In spite of many expeditions, *S. potentillifolia* Boiss., *S. nydeggeri*, *S. adenocaulon*, *S. sericeo-tomentosa*, and *S. quezelii* were not found in their type localities, but they were found at other locations. In Table 2, details of threats, endemism, and important comments are given for all examined taxa.

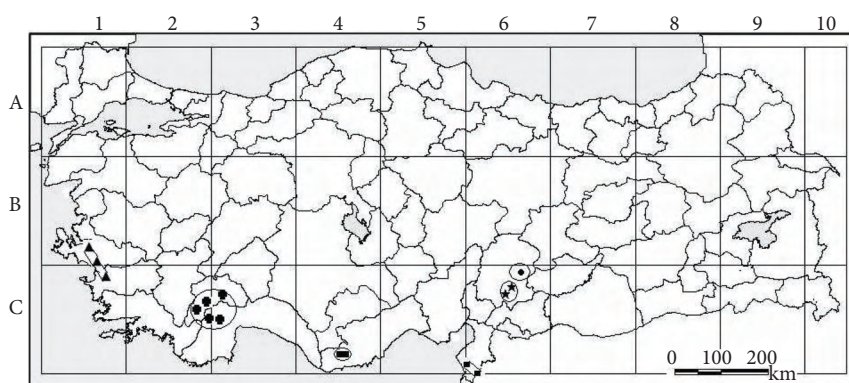


Figure 3. Distribution map (●) *S. haussknechtii*, (■) *S. tigrina*, (▣) *S. quezelii*, (▲) *S. smyrnaea*, (★) *S. marashica*, (✦) *S. chionantha*.

Table 2. The principle threats and comments on the taxa. (\*) indicates that the species is known only within the region in Turkey, (†) indicates that the species is endemic.

	Species	Urbanisation & Tourism	Constructions (Road, Dam and others.)	Overgrazing	Land Clearing & Fire	Comments
1	* <sup>+</sup> <i>Salvia haussknechtii</i>			+		The species is only known from type gathering. Despite many expeditions, the species was not found. Overgrazing likely to be a major factor limiting distribution. More information is required before reaching any conclusion.
2	* <sup>+</sup> <i>S. quezelii</i>		+		+	The species was not found in its known localities. Recently, we found it from another location as a small population.
3	* <sup>+</sup> <i>S. tigrina</i>			+	+	Only known from type gathering. Despite many expeditions, the species was not found in its type location; however, another herbarium specimen of the species has been seen in BM from Syria borealis.
4	* <sup>+</sup> <i>S. sericeo-tomentosa</i>	+	+			The species was not found in its type location, but another population was found in Samandağ-Hatay.
5	* <sup>+</sup> <i>S. smyrnaea</i>		+	+		Restricted to western Anatolia and only 3 populations are currently known.
6	* <sup>+</sup> <i>S. marashica</i>	+	+			The species has been recently described from Kahramanmaraş. Urbanisation, and road and dam constructions are the major threats to the species.
7	* <sup>+</sup> <i>S. nydeggeri</i>		+		+	Restricted to the western Mediterranean region of Turkey.
8	* <sup>+</sup> <i>S. albimaculata</i>		+		+	Restricted to around Ermenek-Karaman. Road/dam constructions and land clearing are the major threats.
9	* <sup>+</sup> <i>S. adenocaulon</i>			+		Restricted to the central Mediterranean region of Turkey. Likely to be threatened as a result of overgrazing.
10	* <sup>+</sup> <i>S. chrysophylla</i>		+	+	+	Recorded only 5 times. Road construction, overgrazing, and land clearing are the major threats.
11	* <sup>+</sup> <i>S. adenophylla</i>		+		+	Restricted to the western Mediterranean region and southern Aegean region of Turkey.
12	* <sup>+</sup> <i>S. cedronella</i>		+		+	Restricted to the western Mediterranean region and southern Aegean region of Turkey.
13	* <sup>+</sup> <i>S. aucheri</i> var. <i>aucheri</i>		+		+	Restricted to the eastern Mediterranean region of Turkey. Its leaves are used as herbal tea.
	* <sup>+</sup> <i>S. aucheri</i> var. <i>canescens</i>		+		+	Restricted to around Ermenek, Mut, Gülnar, and Karaman. Road/dam constructions and land clearing are the major threats.
14	* <sup>+</sup> <i>S. cilicica</i>		+	+	+	Restricted to the eastern Mediterranean region of Turkey.
15	* <sup>+</sup> <i>S. modesta</i>		+	+		In the area, the species is very rare. Only known from 2 small isolated populations at high altitude.
16	* <sup>+</sup> <i>S. chionantha</i>		+		+	Restricted to the western Mediterranean region of Turkey. Only known from small isolated populations.
17	* <sup>+</sup> <i>S. blepharochlaena</i>		+	+		In the area, only known from a few small isolated populations.
18	* <sup>+</sup> <i>S. potentillifolia</i>		+		+	Restricted to the western Mediterranean region of Turkey. A major population occurs in Cedar Research Forest (Elmalı- Antalya).
19	* <sup>+</sup> <i>S. tchihatcheffii</i>		+	+		In the study area, the species is known from the eastern Aegean region as small populations.
20	* <sup>+</sup> <i>S. pilifera</i>		+			In the study area, restricted to the eastern Mediterranean region of Turkey.
21	* <sup>+</sup> <i>S. pisidica</i>	+	+			Restricted to the western Mediterranean region of Turkey.
22	* <sup>+</sup> <i>S. recognita</i>		+	+		In the area, only known from a few small isolated populations.
23	* <sup>+</sup> <i>S. wiedemannii</i>		+			In the area, the species is known from the eastern Aegean region of Turkey in small populations.
24	* <sup>+</sup> <i>S. yosgadensis</i>		+	+		In the area, only known from one population. However, it is distributed mainly in central Anatolia.
25	* <sup>+</sup> <i>S. cadmica</i>			+		Frequently in rocky places in the central Anatolia and the western part of the study area.

Table 2. Continued.

	Species	Urbanisation & Tourism	Constructions (Road, Dam and others.)	Overgrazing	Land Clearing & Fire	Comments
26	* <i>S. caespitosa</i>		+	+		In the study area, frequent in rocky places in eastern Mediterranean region. However, one extant population occurs in Antalya.
27	* <i>S. cryptantha</i>		+			The endemic species is mainly distributed in the central Anatolia and the northern Mediterranean region of Turkey. Its leaves are used as herbal tea.
28	* <i>S. cyanescens</i>		+	+		The endemic species is mainly distributed in the central Anatolia and the northern Mediterranean region of Turkey.
29	* <i>S. dichroantha</i>		+			The endemic species is mainly distributed in the central Anatolia and the northern Mediterranean region of Turkey.
30	* <i>S. heldreichiana</i>		+			The species is mainly distributed in the Mediterranean region of Turkey and it can be seen in the central Anatolia.
31	* <i>S. hypargeia</i>					This endemic species is mainly distributed in central Anatolia and the northern Mediterranean region of Turkey.
32	* <i>S. aramiensis</i>		+		+	Only known from Amanos Mountains. Its leaves are used as herbal tea in Hatay.
33	* <i>S. cassia</i>		+		+	Restricted to Amanos Mountains and the eastern Mediterranean region of Turkey.
34	<i>S. indica</i>		+	+		Restricted to the eastern Mediterranean region of Turkey in the study area.
35	* <i>S. pomifera</i>		+			Restricted to the western Mediterranean region of Turkey. Only known from small isolated populations around Aydin. Its leaves are used as herbal tea.
36	* <i>S. viscosa</i>		+			Restricted to Hatay-Yayladağ. Only 2 populations are known.
37	<i>S. tomentosa</i>		+	+		Widespread and common wherever suitable habitat exists.
38	<i>S. pinnata</i>		+			Widespread and common, although populations occur at a lower density.
39	<i>S. bracteata</i>		+			Widespread and common wherever suitable habitat exists.
40	<i>S. suffruticosa</i>		+			Although relatively widespread, it is known from only 2 records in the area.
41	<i>S. multicaulis</i>		+			Widespread and common in the eastern Mediterranean region of Turkey.
42	<i>S. viridis</i>		+			Widespread and common wherever suitable habitat exists.
43	<i>S. syriaca</i>		+		+	Widespread and common wherever suitable habitat exists.
44	<i>S. palaestina</i>		+			In the area, restricted to the eastern Mediterranean region of Turkey.
45	<i>S. sclarea</i>					Widespread and common wherever suitable habitat exists.
46	<i>S. aethiopsis</i>					Widespread and common wherever suitable habitat exists.
47	<i>S. ceratophylla</i>					Widespread and common wherever suitable habitat exists.
48	<i>S. argentea</i>		+	+		In the area, the species is known from the western Mediterranean region of Turkey.
49	<i>S. microstegia</i>		+	+		In the area, the species is known from the eastern Mediterranean region of Turkey in the uplands.
50	<i>S. frigida</i>		+	+		Widespread and common wherever suitable habitat exists.
51	<i>S. candidissima</i> subsp. <i>candidissima</i>					Widespread and common wherever suitable habitat exists.
	<i>S. candidissima</i> subsp. <i>occidentalis</i>					Widespread and common wherever suitable habitat exists.
52	<i>S. glutinosa</i>		+		+	In the study area, the species is known only from Amanos Mountain.
53	<i>S. virgata</i>					Widespread and common wherever suitable habitat exists.
54	<i>S. fruticosa</i>		+		+	Restricted to the western Anatolia. Its leaves are used as herbal tea.
55	<i>S. verbenaca</i>					Widespread and common wherever suitable habitat exists.
56	<i>S. verticillata</i> subsp. <i>amasiaca</i>					Widespread and common wherever suitable habitat exists.
57	<i>S. russellii</i>					Although widespread and common in central Anatolia, rarely recorded in the study area.
58	<i>S. napifolia</i>					Widespread and common wherever suitable habitat exists.



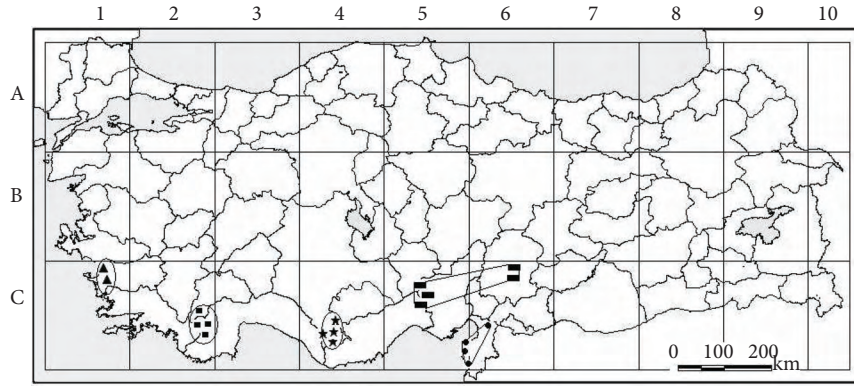


Figure 4. Distribution map (●) *S. sericeo-tomentosa*, (■) *S. nydeggeri*, (▣) *S. cilicica*, (▲) *S. pomifera*, (★) *S. albimaculata*.

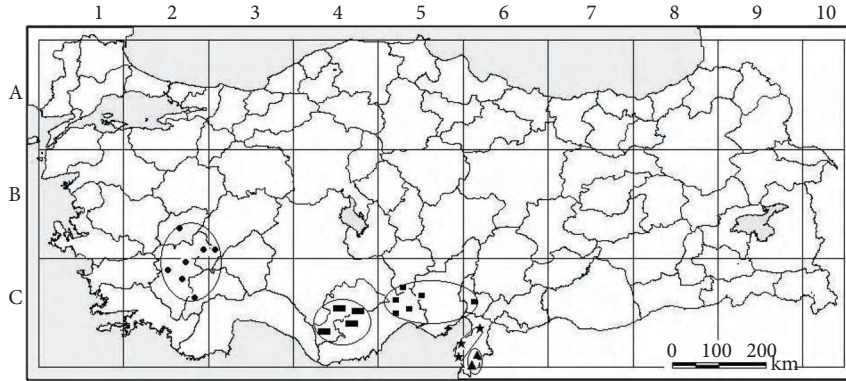


Figure 5. Distribution map (●) *S. cedronella*, (■) *S. aucheri* var. *aucheri*, (▣) *S. aucheri* var. *canescens*, (▲) *S. viscosa*, (★) *S. aramiensis*.

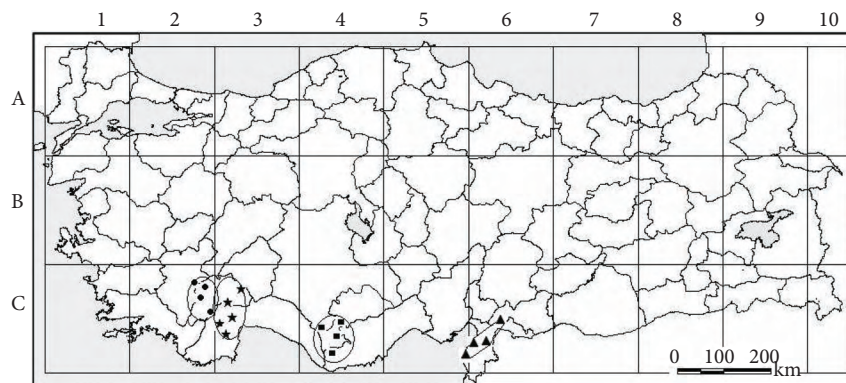


Figure 6. Distribution map (●) *S. adenophylla*, (■) *S. adenocaulon*, (▲) *S. cassia*, (★) *S. potentillifolia*.

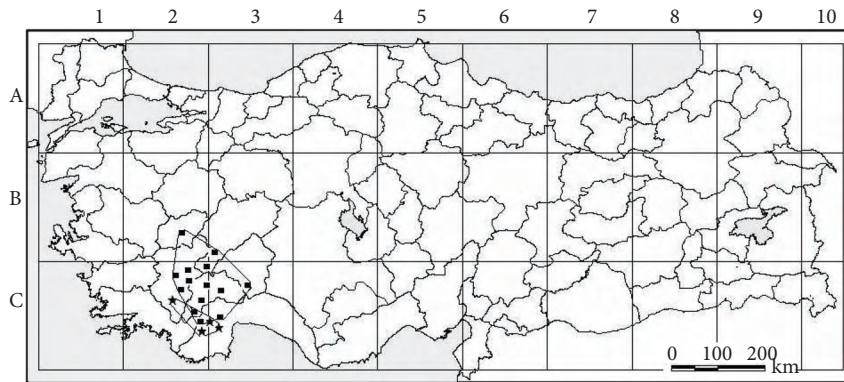


Figure 7. Distribution map (■) *S. pisidica*, (★) *S. chrysophylla*.

The principle threats in the study area are urbanisation, cultivation, tourism, fire, overgrazing, pollution, and road and dam constructions. In the near future, plant diversity may decline and threatened species may disappear in the area if necessary conservation measures are not taken. The richest regions in terms of the endemic species number need to be legally protected with protection of the small population and vegetation (in-situ conservation); moreover, the areas must be urgently modelled and managed by means of Geographical Information System (GIS) images. In addition, several other measures need to be considered such as rehabilitation or restoration of damaged habitats, and transferring the species to surrounding protected areas such as national parks and botanical gardens (ex-situ conservation) (Akhani & Ghorbani, 2003).

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Furthermore, public awareness and interest on the conservation of species should be increased.

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## Appendix

### *S. aucheri* Benth. var. *aucheri*

**Type:** Described from Cilicia

S. Anatolia. C5 Adana: Pozantı, around Gülek Boğazi, open shrubs and calcareous rocks, 1130-1140 m, 24.vii.2005, 37°17'25"N, 34°47'07"E, G.Akaydm & F.Celep 980; Adana: Pozantı to Akçatekir, about 100-200 m, roadsides, 18.vii.2008, 778 m, 37°24'949"N, 34°52'594"E, F.Celep 1574; ibid., 26.vii.2006, F.Celep 1198; Mersin: Çamlıyayla (Namrun), Pozantı to Çamlıyayla, Kadıncık Vadisi, around

Kaburgediği village, slopes, 17.vii.2008, 580 m, 37°09'450"N, 34°48'650"E, F.Celep 1570; ibid., 24.vii.2005, G.Akaydm & F.Celep 983; Niğde-Adana: Çiftelhan, Bolkar Mountain, Çiftelhan to Alihoca village about 1-2 km from main road, 30.vii.2008, 1020-1200 m, 37°30'665"N, 34°44'304"E, G.Akgül & F.Celep 1359; C6 Adana: Osmaniye, 550 m, Akman 3029 (E!). Hatay: 10 km W of Hassan Beyli, M. & D.Zohary 3434 (E!).

var. *canescens* Boiss. & Heldr.

**Type:** Syntypes: [Turkey C4 Konya] ad Bounarbachı (Pınarbası), 25.vi.1845, Heldreich

951 (G!); et in valle Djoksu (Göksu) inter Karaman et Ermenek Isauriae, Heldreich (G!).

C4 Karaman: Mut to Ermenek, 25 km before Ermenek, Çamlıca village to Damlaçal, roadsides, 1200 m, 25.vii.2008, 36°37'846"N, 33°01'761"E, G.Akaydm & F.Celep 994; Karaman: Ermenek, Mut to Ermenek, 1.5-2 km before Ermenek, 1300-1400, 26.vii.2005, 36°37'715"N, 32°54'609"E, G.Akaydm & F.Celep 999; ibid., 15.vi.2006, F.Celep 1126; Karaman: Mut to Ermenek, 39 km before Ermenek, slopes, 872 m, 21.vi.2007, 36°34'171"N, 33°10'196"E, F.Celep 1245;

Konya: Karaman to Mut, 1350 m, *Hub.-Mor.* 17191 (Hub.-Mor.); İçel: 1 km NE of Gülnar, 950 m, *Hub.-Mor.* 9587 (G!).

*S. tigrina* Hedge & *Hub.-Mor.*

**Type:** Turkey. C6 Hatay: Musa Dag west-lich ob Batiayas (Teknepinar), Hecke, 800 m, 22.vi.1953, *A. Huber-Morath* 11871 (holo. Hb. Hub.-Mor!).

Plantae montium Syriae Borealis, Nord's Jurn Kalah, 10.vi.1884, *Post* 278 (BM!).

*S. recognita* Fisch. & C.A.Mey.

**Type:** Turkey. B5 Kayseri: Ali-Dağı, prope Kaiseriam (Kayseri), 1849, *Tchihatcheff*.

Central Anatolia, rarely South and East Anatolia.

**C4** İçel: 33 km E of Mut, 1260 m, *Hub.-Mor.* 9602 (Hub.-Mor.); **C5** Niğde: Ala Dağlar, Demirkazık village, Cımbar Valley, 24.vii.2005, 1500-1600 m, *G.Akaydin* & *F.Celep* 997; *ibid.*, 14.vi.2006, *F.Celep* 1102

*S. pilifera* Montbret & Aucher ex Benth.

**Syntypes:** Turkey. C6 Adiyaman: ad Akdağ in Tauro orientali, Besni, 1834, *Aucher* 1927, 1952 (G!).

Eastern Mediterranean region of Turkey. **B6** Kahramanmaraş: Göksun, Berit Da., 1000-1200 m, 1865, *Hauskn.* (type of *S. cataonica!*) (G!); Kahramanmaraş: Ahır Dağı, Merkez to Sarıçukur village about 2 km, 764 m, 27.iv.2006, 37°37'207"N, 36°49'920"E, *F.Celep* 1017; Kahramanmaraş: Çağlayançerit, above Erince village, 1281 m, 3.v.2008, 37°44'279"N, 37°24'221"E, *G.Akaydin* & *F.Celep* 1417; **C6** Kahramanmaraş: Göksun to Kahramanmaraş, Püren tüneli, above Kurucuova village, Güney-oluk, 1783 m, 12.vii.2008, 37°58'386"N, 36°33'677"E, *F.Celep* 1547 (fruit); Adiyaman: Gölbaşı, NE of Harmanlı, 946 m, 3.v.2008, 37°51'328"N, 37°45'478"E, *G.Akaydin* & *F.Celep* 1420; Gaziantep: Gaziantep-Fevzipaşa arası, Fevzipaşa'ya 30 km kala, 800 m, 18.v.1956, *H.Birand* (ANK!); Gaziantep: Sof Dağı, TV kulesi civarı, 1450-1500 m, 24.vi.1978, *T.Ekim* 3729 (ANK!); Adana-Hatay: Haruniye to İskenderun, c. 300 m, *Meincke* 275 (type of *S. amana* Bornm!) (G!).

*S. cedronella* Boiss.

**Type:** Type. C2 Denizli: in collibus argillo-sis elatis ad orientem urbis Denisleh (Denizli) sitis, ad radices cacuminem orientalium Cadmi (Honaz Da.), vi 1842, *Boissier* (holo. G!, iso. W!).

Southwest Anatolia. **B2** Uşak: S.E. of Uşak, Bal. 1857:1185! (G!); **B3** Afyon: Dinar to Dazkırı, about 8 km, open *Pinus* forest, 978 m, 22.vi.2007, 38°02'383"N, 30°04'609"E, *F.Celep* 1290; **C2** Denizli-Burdur: Acıpayam to Gölhisar, ca. 2 km before from Çamköy, close to stream and main road, 970 m, 8.vi.2008, 37°16'297"N, 29°32'855"E, *F.Celep* 1470; Denizli: Denizli to Burdur from Yeşilova road, junction of Pınarbaşı village, around stream slopes, 937-950 m, 9.vi.2008, 37°30'463"N, 29°27'727"E, *F.Celep* 1499.

*S. adenophylla* Hedge & *Hub.-Mor.*

**Type:** Turkey. C2 Denizli: Kizilhisar - Yesilova, *Quercus coccifera* Macchie 72 südöstlich Denizli 2 km vor Sirçalik, 1030 m, 16.vi.1954, *A.Huber-Morath* 12722 (holo. El, iso. Hb. Hub.-Mor!).

S.W. Anatolia. **C2** Denizli: Denizli to Burdur from Yeşilova road, junction of Pınarbaşı village, around stream slopes, 937-950 m, 9.vi.2008, 37°30'463"N, 29°27'727"E, *F.Celep* 1500; Denizli/Burdur: Acıpayam to Gölhisar, ca. 2 km before from Çamköy, close to stream and main road, 970 m, 8.vi.2008, 37°16'297"N, 29°32'855"E, *F.Celep* 1467.

*S. potentillifolia* Boiss. & Heldr. ex Benth.

**Type:** Turkey. C4 Konya: in Tauro Isaurico supra Ermenek, *Heldreich* (G!).

S.W. Anatolia **C2** Afyon: 10 km from Dinar, Denizli to Çardak, 1100 m, *Dudley* (D. 35645) (E!); Antalya: Kuhu Da., S. of Elmalı, Çıglikara, *Fitz* & *Spitz*. 934 (E!); **C3** Antalya: Elmalı, Elmalı to Finike ca 10 km, entrance of Cedar Research Forest, 1094 m, 3.vii.2006, 36°35'987"N, 29°57'659"E, *F.Celep* 1159; *ibid.*, 22.vi.2007, *F.Celep* 1262; *ibid.*, 1396-1450 m, 9.vi.2008, *F.Celep* 1480; Antalya: Elmalı, around Avlan Lake (Kofu Da.) to Çıglikara forest, 1080 m, 9.vi.2008, *F.Celep* 1488; Antalya: Elmalı to Fethiye, after Pirhasan village ca. 500 m, 1070 m, 9.vi.2008, *F.Celep* 1490.

*S. nydeggeri* *Hub.-Mor.*

**Type:** Type: [Turkey C2] Muğla: Föhrenwald 51 km südlich von Dirmil (Altinyayla) gegen Fethiye, 1000 m, 20.vi.1981, *M.Nydegger* 16328 (Holo.Hb. Nydegger, Basel, iso.G!)

S.W. Anatolia. **C2** Antalya: Elmalı to Fethiye, after Eskihisar village, slopes, 1163-1263 m, 22.vi.2007, 36°48'474"N, 29°47'586"E, *F.Celep* 1264; Antalya/Muğla: Elmalı to Fethiye, before Seki, around Zorlar village, 1465 m,

22.vi.2007, 36°48'661"N, 29°41'439"E, *F.Celep* 1272; Muğla: Seki, Eren Da., 1300-1450 m, 7.vii.2008, *F.Celep* 1329.

*S. wiedemannii* Boiss.

**Type:** Turkey. **A3** Ankara: prope Kadikioi, *Wiedemann* 340 (holo. G!).

Central Anatolia **B3** Eskişehir: Sivrihisar to Emirdağ, around Camili village (main road), 885 m, 26.iv.2008, 39°11'387"N, 31°18'137"E, *F.Celep* 1361.

*S. marashica* İlçim, *F.Celep* & *Dogan*

**Type:** Turkey. C6 Kahramanmaraş: Yukarı Ceyhan vadisi (upper Ceyhan valley), Ahır Dağı, (Ahır Mt.), around Maksutlu village, 1450-1600 m, rocky places, 17.iv.2001 *A.İlçim* 995 (holotype KSUH; isotypes El, Kl, ANK, GAZI, VANF).

**C6:** Kahramanmaraş: Ahır Da. Sarıçukur to Maksutlu village, 871 m, 27.iv.2006, 37°39'140"N, 36°50'538"E, *F.Celep* 1020.

*S. pisidica* Boiss. & Heldr. ex Benth.

**Type:** Turkey. C3 Burdur: in collibus tophaceis prope Burdur, v.1845, *Heldreich* (holo. G!, iso. El, W!).

S.W. Anatolia. **B2** Uşak: Yaparlar Kieni, SE of Uşak, *Bal.* 1857:1191 (G!); **B3** Afyon: Dazkırı to Dinar, before about 8-10 km from Dinar, 1026 m, 5.vii.2006, 38°02'240"N, 30°03'320"E, *F.Celep* 1170; **C2** Burdur: Dirmil (Altinyayla) to Tefenni, *Hub.-Mor.* 5202 (G!); **C3** Burdur: 6 km after Burdur towards Antalya, *A.Baytop* (ISTE 9506!); Burdur: Burdur to Yeşilova, after Burdur ca. 20 km, 940 m, 8.vi.2008, 37°36'559"N, 30°08'494"E, *F.Celep* 1460; Burdur: Burdur to Çavdır, above Hacılar village, 950 m, 8.vi.2008, 37°33'470"N, 30°04'483"E, *F.Celep* 1461; Burdur: Tefenni to Çavdır, before Çavdır ca. 13 km, 1236-1250 m, 37°14'398"N, 29°44'914"E, *F.Celep* 1465; Burdur: Çavdır to Korkuteli, above Kızılcaadağ, Koru Da, Çıglik Yaylası, 1600-1900 m, 8.vi.2008, 37°03'259"N, 29°59'301"E, *F.Celep* 1473; Antalya: Korkuteli to Antalya about 7-8 km, slopes, 1140 m, 3.v.2006, 36°59'230"N, 30°09'120"E, *F.Celep* 1041; *ibid.*, about 9-12 km from Korkuteli, 1256 m, 2.vii.2006, *F.Celep* 1156; Antalya: Elmalı, Yeşiloba to Söğüt, 1410 m, 3.v.2006, 37°02'550"N, 29°51'560"E, *F.Celep* 1042; Antalya: Elmalı, Finike to Elmalı, before Elmalı about 1-2 km, rocky slopes, 1027 m, 28.iv.2008, 36°42'674"N, 29°55'035"E, *F.Celep* 1381; Isparta: Isparta to Dinar, 20 km before Dinar, 1170 m, 7.vi.2008, 37°55'168"N, 30°16'187"E,

*F.Celep* 1454; **C4** Antalya: Anamur to Gazipaşa, *Akman* 6113 (G!).

**S. albimaculata** Hedge & Hub.-Mor.

**Type:** Turkey: [Turkey C4] Konya: d. Ermenek, Kalkmangel, 2 km ob Ermenek am Weg nach Karaman, 1360 m, 9 vi 1948, *H.Reese, J.Renz, Huber-Morath* 8382 (holo. Hb. Hub.-Mor!).

**C4** Karaman: Ermenek to Mut, about 300-500 m, 1273 m, 1.v.2006, 36°37'149"N, 32°55'327"E, *F.Celep* 1032; Karaman: above Ermenek, Ermenek to Karaman, 1477 m, 2.vii.2006, 36°37'941"N, 32°55'336"E, *F.Celep* 1142; Karaman: Ermenek, Ermenek to Karaman, around Tekeçatı, 1650 m (obs.); Karaman, Güneyyurt to Ermenek, about 3-4 km, 1235 m, 31.v.2009, 36°39'397"N, 32°49'956"E, *F.Celep* 1610.

**S. tchihatcheffii** (Fisch. & C.A.Mey.) Boiss.

**Type:** Turkey. B4 Ankara: in vallibus herbosis sylvaticis montis, Kure-dagh (Galatia), 950 m, *Tchihatcheff* (E!, G!).

Central (west) Anatolia. **B2** Kütahya: Kütahya-Bozüyük arası, İnönü'nün 22 km güneyi, 950 m, *Hub.-Mor.* 12720 (E!); **B3** Kütahya: Kütahya'dan Eskişehir'e 40 km, 930 m, *A.Baytop* (ISTE 25368!).

**S. quezelii** Hedge & Afzal-Rafii

**C4** Mersin: Anamur to Ermenek, about 37-39 km, 1023 m, 31.v.2009, 36°13'060"N, 32°53'970"E, *A.Kahraman & F.Celep* 1626.

**S. heldreichiana** Boiss. ex Benth

**Syntypes:** Turkey. C5 İçel: in monte Tauro prope Gülek Boghas, *Kotschy* 437 (G!); [Turkey B4 Konya] in collibus aridis Lycaoniae ad Karaman, *Heldreich* (G!).

Mediterranean region of Turkey & rarely Central Anatolia. **B3** Isparta: Sarkikaraağaç, Kale Da., 1250 m, *Simon* 75-079 (E!). **C3** Konya: 19 km from Sarkikaraağaç to Beyşehir, 1100 m, *Hub.-Mor.* 8380 (Hub.-Mor.); Isparta-Konya: Beyşehir to Şarkıkırkağaç, 18 km before Şarkıkırkağaç, above Kiyakdede village, limestone, 1300 m, 6.vi.2008, 37°57'637"N, 31°28'515"E, *F.Celep* 1427; **C4** İçel: 33 km W. from Silifke to Gülnar, c. 900 m, *Hub.-Mor.* 9590 (Hub.-Mor.); Karaman: Ermenek, Ermenek to Karaman, around Bayır village, 1160 m, 26.vii.2005, *G.Akaydm & F.Celep* 1004; Karaman: Ermenek, above Çamlıca village, Damlaçal, 1755 m, 25.vii.2005, 36°39'846"N, 33°01'053"E, *G.Akaydm & F.Celep* 995; Kara-

man: Ermenek, above Başayla town, 1526-1794 m, 2.vii.2006, 36°45'865"N, 32°40'525"E, *F.Celep* 1144; Karaman: above Kazımkarabekir, Hacibaba Tepesi, 1318 m, 1.vii.2006, 37°09'882"N, 32°57'969"E, *F.Celep* 1130; ibid., 1519 m, *F.Celep* 1132; **C5** Adana: Pozantı, Gülek, Kandilsırtı pass, 1370 m, 14.vi.2006, 37°17'176"N, 34°44'231"E, *F.Celep* 1108; Mersin: Çamlıyayla (Namrun), 1.5-2 km from Sebil village to Cehennem valley, 1207 m, 25.vii.2005, *G.Akaydm & F.Celep* 988.

**S. caespitosa** Montbret & Aucher ex Benth

**Type:** B6 Sivas: in Monte Saru-tchitchek (Sarıççek) in Cappadocia Orientali, *Montbret* 2015, (iso. E!, W!).

Mainly C. & S. Anatolia. **B5** Kayseri: Bakır Da. at Akoluk Y. above Kisge, 2000 m, *Davis* 19455 (E!) **B6** Kayseri: Sarız, Yeşilkent (Yalak), Binboğa Da., above Dayuluk village, Afan Yaylası, 2172 m, 10.vi.2006, 38°21'082"N, 36°30'905"E, *F.Celep* 1070; Kayseri: Pınarbaşı to Sarız, after 2 km from Aşağı Beyçayır village, 1634-1690 m, 19.vi.2007, 38°39'070"N, 36°26'801"E, *F.Celep* 1218; Kahramanmaraş: Göksun, Ericcek, Berit Da, above Kınıkız village, 2496 m, 24.vii.2006, 38°00'793"N, 36°49'966"E, *F.Celep* 1195; Adana: d. Saimbeyli, Bozoğlan Da. above Obruk Y., 2000 m, *Davis* 19712 (E!); Adana, Tufanbeyli, above Tozlu village, limestone slopes, ca. 2300-2600 m, obs. *F.Celep*; **C3** Antalya: Tahtali Da., Kemer, 2200 m, *Davis* 14173 (E!); Antalya: Kemer, top of Tahtali Mountain, 2200-2300 m, 9.vi.2008, 36°32'338"N, 30°26'347"E, *F.Celep* 1520; Antalya: Merkez, above Feslikan Yaylası, Karçukuru mevkii, 1929-1950 m, 3.vii.2006, 36°48'693"N, 30°23'098"E, *F.Celep* 1154; **C5** Niğde: Ala Da., Arpalık cave, 2190 m, 26.6.1963 (E!).

**S. haussknechtii** Boiss.

**Type:** Turkey. B6 Maraş; in saxosis mentis Berytdagh (Berit Da.) Cataoniae, 2135-2440 m, 10.viii.1865, *Haussknecht* (holo. G!, iso. JE!).

**S. cadmica** Boiss

**Lectotype:** Turkey. C2 Denizli: in Cadmo orientalis, Honaz Da., vi.1842, *Boissier* (holo G!, iso W!).

**B2** Kütahya: Gediz to Kütahya, 18 km S of Kütahya, 1000 m, limestone gorge, 7.vii.1962, *Davis* 36917 (E!). **C2** Denizli: Acıpayam, Bozdağ, Geyran Yaylası, 1450 m, open forest, 4.vii.1997, *Aytaç* 7643 (GAZI); **C3** Burdur: 16 km from Burdur to Antalya, 1300 m, 11.vi.1962 (E!); **C4** Konya: Bozkır, Bozkır to Akseki,

around Dere village, 37°10'034"N, 32°09'489"E, 1150 m, on limestone rocks, 11.v.2007, *F.Celep* 1208; Şarkıkaraağaç to Aksehir, Sultan mountain, above Bağkonak village, 38°13'197"N, 31°17'375"E, 1250 m, on limestone rocks, *F.Celep* 1210; Aksehir, Sultan Da., 1100 m, 14.iv.1899, *Bornmüller* 5427 (E!, Type of *S. cadmica* var. *bracycalycina*).

**S. smyrnaea** Boiss.

**Type:** Turkey. Bl İzmir; in cacumine montis Tartali (Tahtali Da.) ad orientem Smyrneam (İzmir), v.1842, *Boissier* (holo. G!, iso. W!).

West Anatolia. **B1** İzmir: Kemalpaşa, Nif Dağı, around summit, 1450-1510 m, 4.v.2006, 38°23'225"N, 27°21'350"E, *A.Kahraman & F.Celep* 1053; ibid., 1057 m, 9.vii.2007, 38°23'021"N, 27°22'292"E, *F.Celep* 1354! (in fruit); **C1** Aydın: Söke, Gümüşdağ, 920 m, *Uslu* 4127.

**S. blepharochlaena** Hedge & Hub.-Mor.

**Type:** Turkey. B6 Sivas: d. Kangal, Tecer-Gürün, Gipsschutt, 37 km nordlich Tecer, 1570 m, 27.vi.1955, *A.Huber-Morath* 13048 (holo. G!).

Central and NE Mediterranean region of Turkey. **B6** Kayseri: Pınarbaşı to Sarız, after 2 km from A. Beyçayır, 38°39'070"N, 36°26'801"E, 1634 m, *F.Celep* 1217; Sarız, Binboğa Dağı, Kırkısrak-Bakır köyleri arası, 38°27'587"N, 36°38'601"E, 1677 m, 23.vii.2008, *A.Kahraman* 1583B; **C4** Karaman, Karaman to Mut, c. 1.2 km, 1112, 1.vii.2006, 37°08'205"N, 33°13'618"E, *F.Celep* 1134.

**S. serico-tomentosa** Rech.f.

**Type:** Turkey. C6 Hatay: Amanus, ascent to Achagi Zarkoun (Aşağı Zerkum) from the Karakisieh side (Jabal al Ahmar), 800-1000 m, *Pinus* sp., 30.vi.1932, *Eig & M.Zohary*.

Mediterranean. Amanos Mountain. Hatay: Samandag to Arsuz, among *Quercus coccifera* shrubs, 36°15'684"N, 35°48'706"E, 20-50 m, 19.vi.2007, *F.Celep* 1232.

**S. cryptantha** Montbret & Aucher ex Benth

**Type:** Turkey. B5-6: in Cappadocia orientali, *Montbret* 2282.

Central Anatolia **B2** Kütahya: Gediz to Kütahya, c. 10 km before Kütahya, 961 m, 11.vi.2008, 39°22'098"N, 30°04'022"E, *F.Celep* 1516; **B3** Afyon: c. 9.5 km SW of İşçehisar towards Afyon, 1070 m, *Buttler* 13196 (E!); **C3** Konya: Şarkıkırkağaç to Beyşehir, c. 10 km before Beyşehir, 1139 m, 4.v.2008, 37°45'887"N,

31°40'401"E, *F.Cecep* 1429; **C4** Karaman, Karaman to Mut, c. 1.2 km, 1112 m, 1.vii.2006, 37°08'205"N, 33°13'618"E, *F.Cecep* 1135; Konya: Konya to Akören, 35-40 km before Akören, 3-5 km before Sarıkız village, 1302 m, 11.v.2007, 34°40'216"N, 32°23'975"E, *F.Cecep* 1204; **C5** Niğde: Pozanti to Niğde, 1300 m, *Coode & Jones* 1239 (E!).

**S. hypargeia** Fisch. & C.A.Mey.

**Type:** Turkey. B4 Kırşehir: inter Karadjeli (İsahocalı) et Gaman (Kaman), 900 m, 1849, *Tchihatcheff* (holo. P).

Central, South and East Anatolia. **B5** Kayseri, Bakır Dağı to Gezbeli pass, 1400-1500 m, obs. *F.Cecep*; Kayseri: Pınarbaşı-Sarız arası, Sarız'a 3-4 km kala, 38°30'010"N, 36°26'530"E, 1692 m, 8.vi.2006, *A.Kahraman* 1234; **C4** Karaman: Ermenek-Balkusan deresi yolu, 1611 m, *F.Cecep* 1704; Karaman: Değirmenbaşı köyü çevresi, 1500 m, *Pinus nigra* ormanı açıklıkları, 22.vi.1979, *M.Vural* 1578 et al. (GAZI!); Karaman: Ermenek-Karaman yolu 22. km, Aktepe alanı, 1600 m, *Pinus nigra* açıklıkları, 28.vi.1980, *E.Tuzlacı* (ISTE 45168!); **C5** Konya: d. Ereğli, Aydos Da., 1400 m, *S.Erik* 2948 (HUB!); Konya: Ereğli, Bolkar Da. Berendi village to Meydan Yaylası, 19.vi.2008, 37°17'110"N, 34°03'882"E, 1992 m, *F.Cecep* 1579; Mersin: Tarsus, Namrun yolu, Sarıkavak köyü çevresi, 900 m, 6.vi.1981, *M.Koyuncu* 4398 & *S.Erik* (AEF!); **C5** Niğde: Çamardı, Aladağlar, above Çukurbağ village, 1613 m, 14.vi.2006, 37°47'601"N, 35°03'792"E, *F.Cecep* 1097.

**S. chrysophylla** Stapf

**Type:** Turkey. C2 Antalya: Lyciaad Guruva (Göyre), 14.vii.1882, *Luschan* (holo. WU).

S.W. Anatolia. **C2** Denizli: Boz Da. nr Geyran Y., 1370 m, *Davis* 13341 (E!); Denizli: Acıpayam, Boz Dağ, around Geyran Yaylası, (obs.) *F.Cecep*; Muğla: Girdev (Eren) Da., 70 km E of Fethiye, 2250 m, *Lambert & Thorp* 618 (E!); Antalya: Elmalı, Elmalı to Kaş, Göyre town, Akdağlar, above Uçansu, 2119-2300 m, 7.vii.2007, 36°34'432"N, 29°36'432"E, *F.Cecep* 1327!; Muğla: Elmalı to Fethiye, Seki, Eren Da., 7.vii.2007, 1800-1850 m, 36°44'890"N, 29°36'477"E, *F.Cecep* 1330; Antalya: Kuhu Da. S. of Elmalı, *Fitz & Spitz*. 206 (E!) **C3** Antalya: Antalya to Elmalı, 1920 m, *Çetlik* 2070 (E!).

**S. chionantha** Boiss.

**Type:** Turkey. C2 Denizli: inter segetes

planitiei interioris elatae Cariensis ad meridiem Cadmi, vi.1842, *Boissier* (holo. G!).

Southwest Anatolia. **C2** Antalya: 6 km from Akçay to Elmali, 1000 m, *Hub.-Mor.* 16624 (*Hub.-Mor.*!); Antalya: Elmalı, Yeşiloba to Söğüt (Korkuteli to Altınyayla), 1410 m, 3.v.2006, only basal leaves, 37°02'550"N, 29°51'560"E, *F.Cecep* 1043; Muğla: Elmalı to Fethiye, Seki, Zorlar village, 1448 m, 3.vii.2006, 36°48'777"N, 29°41'426"E, *F.Cecep* 1165; Muğla: Fethiye, Fethiye to Altınyayla, 1270 m, 22.vi.2007, 36°53'835"N, 29°40'040"E, *F.Cecep* 1273; Burdur: Tefenni to Çavdır, about 4-6 km, fields, 1166 m, 8.vi.2007, 37°15'406"N, 29°45'288"E, *F.Cecep* 1464; **C3** Antalya: Elmalı, around Avlan Lake, road of Çıgıkkara forest (Kofu Da.), 1055 m, 9.vi.2008, 36°34'737"N, 29°55'211"E, *F.Cecep* 1485; Antalya: Elmalı to Korkuteli, about 17-20 km, 1289 m, 3.vii.2006, 38°55'734"N, 30°04'924"E, *F.Cecep* 1158; ibid., about 25 km, 1285 m, 21.vi.2007, 36°55'975"N, 30°05'492"E, *F.Cecep* 1258.

**S. silicica** Boiss. & Kotschy

**Type:** Turkey. C5 Niğde: in schistosis vine-torium pagi Anadscha Tauri Cilicici, in calcareis ad fluvium Bosantetchai (Pozanti Cay) in via inter Tar-sous et Caesaream (Kayseri), 1220 m, viii.1855, *Balansa* 546 (holo. G!).

East Mediterranean region of Turkey. **B6** Maraş: Berit Da., 2100 m, *Hauskn.* 1256 (G!); Kahramanmaraş: Göksun, Berit Da., Yeşilköy to Kınık köy village, 1411-1514 m, 10.vi.2006, 38°00'693"N, 36°43'968"E, *F.Cecep* 1077; **C5** Niğde: Çiftelhan, Çiftelhan to Ulukışla, Alihoca-Madenköy road, ca. 1-2 km from main road, 1020-1200 m, 30.vii.2007, 37°30'665"N, 34°44'304"E, *F.Cecep* 1358; Adana: Pozanti, Pozanti to Akçatekir, about 3-4 km, 858-945 m, 24.vii.2005, 37°23'287"N, 34°51'027"E, *G.Akaydın & F.Cecep* 979.

**S. yosgadensis** Freyn & Bornm.

**Type:** Turkey. B5 Kayseri/Yozgat: inter Caesaream (Kayseri) et Yosgad (Yozgat), 1400 m, 23.vi.1890, *Bornmueller* 2175 (holo. B).

Central Anatolia and Eastern part of Aegean Region. **B3** Kütahya: Kütahya to Eskişehir c. 40 km, 950-1100 m, 11.vi.2008, 39°42'311"N, 30°09'480"E, *F.Cecep* 1518; Konya: above Akşehir, 1900 m, 3.vi.1974, *A.Baytop* (ISTE 29338, E!); **C5** Konya: Ereğli to Ulukışla, 1200 m, *Leyd.* 1959:1018.

**S. modesta** Boiss.

**Type:** Turkey. B5 Kayseri: in Cappadociae

regione subalpina montis Argaei (Erciyas Da.) in valle Kamechly Tchay (Çomaklı çay), 1700 m, 16.vi.1856, *Balansa* 242 (holo. G!).

Central Anatolia and Anti-Taurus. **B5** Kayseri: Bakırdağ to Saimbeyli, 2000 m, *Hub.-Mor.* 10763 (Hub.-Mor!); Kayseri/Adana: Bakırdağ to Saimbeyli, Gezbeli pass, 1970 m, 9.vi.2006, 38°12'225"N, 35°59'650"E, *F.Cecep* 1065; Kayseri, Sarız, Yeşilkent (Yalak), Binboğa Da., above Dayoluk village, Afan Yaylası, 2172 m, 10.vi.2006, 38°21'065"N, 36°30'649"E, *F.Cecep* 1072.

**S. adenocaulon** P.H.Davis

**Type:** Turkey. [Turkey C4] Konya: distr. Ermenek, between Hamitseydi Bogaz and Beşkuyu (between Ermenek and Anamur), 1500-1700 m, 16.vii.1949, *Davis* 16224 (holo. K! iso. BM! E!, G!).

**C4** Karaman: Karaman to Ermenek, around Karaman Bey Pass, 1920 m, 26.vii.2005, 36°49'713"N, 32°56'630"E, *F.Cecep* 1002; ibid., 1.7.2006, *F.Cecep* 1141; Karaman: Ermenek, Başyayla to Taşkent, around Feslikan pass, 1735 m, 2.vii.2006, 36°51'448"N, 32°31'902"E, *F.Cecep* 1147; Ermenek: Sarıveliler, above Civandere village, 1694 m, 21.vi.2007, 36°41'918"N, 32°31'046"E, *F.Cecep* 1251.

**S. dichroantha** Stapf

**Type:** Turkey. C2 Muğla: inter Baschibunar (Başpınar) et Gurdef (Girdev), 19.vii.1882, *Luschan*, (holo. WU, photo E!).

**B2** Kütahya: Domaniç, 900 m, *Davis* 36429 (E!); **B4** Konya: Beyşehir to Ilgın yolu before Aşağıçığil, 38°01'021"N, 31°53'868"E, 1386 m, *S.Bagherpour* 214; **B5** Kayseri: Bakırdağ to Saimbeyli, before Gezbeli pass, ca. 1500-1600 m, obs. *F.Cecep*; **C2**: Muğla: Elmalı to Fethiye, Seki Kasabası, Eren Dağı Kayak merkezi, 7.vii.2007, 36°44'890"N, 29°36'477"E, 1800-1850 m, *F.Cecep* 1340; Antalya: Elmalı to Finike, Avlan Beli üzeri, Ördibek yaylası, 7.vii.2007, 36°29'501"N, 29°55'831"E, 1573 m, *F.Cecep* 1214; Antalya: Feslikan Yaylası, 3.vii.2006, 36°51'402"N, 30°24'495"E, 1579 m, *F.Cecep* 1153; **C3** Isparta: d. Egridir, Yukarı Gökdere, 1700 m, *Pesmen & Güner* 1817 (E!); Antalya: Çalbalı Da., 1700 m, *Davis* 15247 (E!); **C4** Konya: 12 km W of Konya, *Davis* 16128 (E!).