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SPATIAL ANALYSES OF *ASTRAGALUS* SPECIES DISTRIBUTION AND RICHNESS IN KAHRAMANMARAŞ (TURKEY) BY GEOGRAPHICAL INFORMATION SYSTEMS (GIS)

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ABSTRACT: The aim of this study is to determine the species richness of the genus *Astragalus* in Kahramanmaraş and to present the updated distribution information with the help of Geographic Information Systems in a conservation point of view. In this study, country flora, recently published articles on the province of Kahramanmaraş, checklists, regional flora studies in the province, section revisions of *Astragalus* and also the plant samples collected from the field surveys in Kahramanmaraş were used. According to the results of the field studies supported by the literature, 95 plant taxa belonging to the genus *Astragalus* are listed together with their valid names and previous synonyms. The number of endemic taxa in Kahramanmaraş is 37 (with the endemism rate 39%). In the plant list, the largest sections of the genus *Astragalus* are *Rhacophorus* with 23 taxa, *Onobrychoidei* with 8 taxa, *Dasyphyllium*, *Malacothrix*, *Myobroma*, *Proselius* and *Pterophorus* with 6 taxa for each. The distribution of the taxa to the phytogeographical regions is as follows; 56 taxa (59%) Irano-Turanian element, 28 taxa (30%) Multi-regional or unknown origin, and the rest; 6 taxa (6%) is an element of the Eastern Mediterranean, 4 taxa (4%) of the Eastern Mediterranean (mountain) element and 1 taxon (1%) of the Euro-Siberian element. IUCN threat categories of endemic taxa were reassessed. As a result, totally 11 taxa are in threatened categories according to IUCN (4 taxa in CR, 2 taxa in EN and 5 taxa in VU categories) and the remaining 26 taxa are in lower threat categories (NT and LR). According to the distributions of species, which produced based on the grid system and the conservation point of view; (J13) in Çağlayancerit, (D4, E4 and G8) in Göksun, (I10) in the place between Ekinözü and central district, and (K10) in the central district of Kahramanmaraş were determined as the richest squares. These areas are very important in terms of conservation

biology as they are the most intense areas of steppic conditions, livestock and grazing pressure.

Keywords: Spatial analyses, Richness, *Astragalus*, Geographical Information System, Kahramanmaraş, Turkey.

COĞRAFİ BİLGİ SİSTEMLERİ (CBS) İLE KAHRAMANMARAŞ'TA (TÜRKİYE) *ASTRAGALUS* TÜR DAĞILIMI VE ZENGİNLİĞİNİN KONUMSAL ANALİZİ

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ÖZET: Bu çalışmanın amacı, Kahramanmaraş'taki *Astragalus* cinsinin bitkisel tür çeşitliliğini tespit etmek ve koruma bakış açısıyla güncellenmiş dağılım bilgilerini Coğrafi Bilgi Sistemleri yardımı ile sunmaktır. Türkiye florası, Kahramanmaraş iline ilişkin yakın zamanda yayınlanan makaleler, kontrol listeleri, il içindeki bölgesel flora çalışmaları, seksiyon revizyonları ve ayrıca *Astragalus* cinsine ilişkin Kahramanmaraş doğasından bizim tarafımızdan toplanan ve herbaryum örneği haline getirilen bitki koleksiyonu kullanılmıştır. Literatür ile de desteklenen saha çalışmalarının sonuçlarına göre, *Astragalus* cinsine ait 95 bitki taksonu geçerli adları ve önceki eş isimleri ile birlikte listelenmiştir. Kahramanmaraş'taki endemik *Astragalus* takson sayısı 37'dir (endemizim oranı %39). Bitki örtüsü içerisinde *Astragalus* cinsine ait en büyük seksiyonlar 23 taksonla *Rhacophorus*, 8 taksonla *Onobrychoidei*, 6'şar taksonla *Dasyphyllium*, *Malacothrix*, *Myobroma*, *Proselius* ve *Pterophorus*'dur. Kahramanmaraş için *Astragalus* cinsine ait taksonların fitocoğrafik bölgelere dağılımı şu şekildedir; 56 takson (%59) İran-Turan elementi, 28 takson (% 30) çok bölgeli veya orijini bilinmeyen ve geri kalanlar ise; 6 takson (%6) Doğu Akdeniz elementi, 4 takson (%4) Doğu Akdeniz (dağ) elementi ve 1 takson (% 1) Avrupa-Sibirya elementidir. Endemik taksonların IUCN tehdit kategorileri belirlenmiştir. Sonuç olarak, IUCN'e göre toplam 11 takson tehdit altında kategorisinde (CR kategorisinde 4 takson, EN kategorisinde 2 takson ve VU kategorisinde 5 takson) yer alırken geriye kalan 26 takson daha düşük tehdit kategorilerindedir (NT ve LR). Karelaj sistemi ile oluşturulan tür dağılımlarına ve koruma bakış açısına göre, Çağlayancerit'te (J13) ve Göksun'da (D4, E4 ve G8) Ekinözü ve merkez ilçe arasında (I10) ve Kahramanmaraş Merkez ilçede (K10) takson sayısı bakımından en zengin kareler olarak belirlenmiştir. Bu alanlar step koşullarının, hayvancılık ve otlatma baskısının en yoğun olduğu bölgeler olması sebebiyle koruma biyolojisi açısından oldukça önemlidir.

Anahtar Kelimeler: Konumsal analiz, Zenginlik, *Astragalus*, Coğrafi Bilgi Sistemleri, Kahramanmaraş, Türkiye

INTRODUCTION

The genus *Astragalus* L. (Leguminosae; Fabaceae) is one of the largest genera of the vascular plants in the world and distributed mainly around semi-arid steppe regions (Chamberlain and Matthews, 1970; Davis et al., 1988; Frodin, 2004). It is represented by approximately over 3000 taxa in the Old and New World. The New World representatives (= species from those of American) of *Astragalus* has almost 550 species, whereas the Old World (= species from those of Asiatic) representatives of the species-rich genus *Astragalus* has almost 2500 species (Podlech & Zarre 2013) (Figure 1).

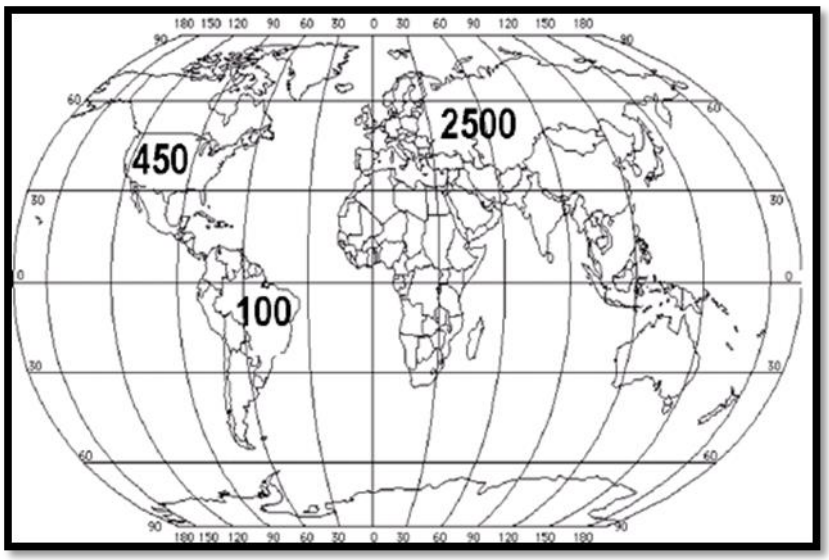

Figure 1. Major centres of distribution of *Astragalus* in the World (Podlech & Zarre 2013)

In addition, the genus is very important in terms of biodiversity. Major areas of species endemism for this genus occur in Turkey, Iran, Kazakhstan, Afghanistan and China (Ghahreman et al. 2002; Podlech 2001; Mahmoodi et al. 2012). In accordance with the diversity centres of the genus *Astragalus*, while Turkey (with ca. 466 taxa including subspecies and varieties and endemism rate of 47% according to Ekici et al. 2015) is found in front of China (with 388 taxa, endemism 54% according to Wei & Ping 2010), it comes immediately after Iran (with 800 taxa, endemism nearly 50% according to Maassoumi 2005).

The genus *Astragalus* is the largest genus in Turkey and classified in 63 sections and the sect. Rhacophorus is the richest one with almost 70 taxa (Aytaç et al. 2012). This is also the most species rich genus in Iran, and sect. *Hymenostegis* (with ca. 44 species) is one of its largest sections in Iran (Podlech et al. 2010). Most species grow in semi-arid and arid areas throughout the world, but a few species prefer humid habitats as stressed by Zarre & Azani (2012). Kahramanmaraş is also on the route of semi-arid steppe region, so it has diverse taxonomical richness of *Astragalus*.

The ecological traits and usages of *Astragalus* are little known in Turkey, although there are many species. The members of the genus prevent erosion with the deep roots and wide branches covering the soil surface. The roots can reach quite deep and serve as a guard against the sliding of soils. They can also live in all kinds of soil and in severe climatic conditions, so they are important for soil conservation (Kadıoğlu et al. 2008). Most species of

the genus have cluster-shaped cushion forms that they are often thorny perennial herbaceous plants as compatible with harsh climates (Aytaç et al. 2012).

This genus is also notable for its "gum". Some pharmacological and physiological actions of *Astragalus* with its dried roots and gum tragacanth as followed: anti-inflammatory, anti-phlegmatic, anti-septic, anti-viral, anti-aging, anti-diabetic, anti-oxidative, anti-tumor, cardio-protection, hepato-protective, neuron-protective, carminative, demulcent, desiccative, fattening, glutinous, laxative, refrigerant, resolvent and styptic (Li et al. 2014; Lysiuk & Darmohray 2016). Flowers of *Astragalus* serve as main source to honey-bees for making honey. Bees make honey from the nectar of flowers. Especially in Şemdinli honey, which is very famous in Turkey. Smell, unique taste and quality are derived from flowers of milkvetch species in the region like Anzer honey from Rize province of Turkey (Karaköse et al. 2018).

Nowadays, because of the rapid increase in technology, using the applications of Geographical Information Systems are increasing steadily. This technology is effective in providing multi-dimensional analysis, time-saving, more accurate results and visual assessment. GIS and its components have become an indispensable tool for spatial inquiry, database creation, managing this database and planning to do things easily. GIS has methods and techniques to determine the spatial data numerically and to work with the data obtained, to save the data in different formats and to perform the subtraction operations on the recorded data, to analyse and model these data and to graph them (Fisher & Nijkamp 1992; Goodchild et al. 1992). Therefore, in this study, it is aimed to transfer the location information of *Astragalus* taxa in Kahramanmaraş province to digital geographic database to create a dataset. Spatial analyses were also performed from the dataset.

MATERIAL AND METHOD

Dataset has been compiled mainly using "Flora of Turkey and the East Aegean Islands" (Davis 1965-85; Davis et al. 1988; Güner et al. 2000) together with the regional floras (Duman & Aytaç 1994; Kara 1995; Karakısa 1997; Varol 1997; Yıldız 2001; Varol & Tatlı 2003; Aytaç & Duman 2005; Başaran 2006; Çenet et al. 2006; Akkaya 2007; İlçim et al. 2008a; Uygun 2014; Kocabaş et al. 2014), vegetation studies (Duman 1985, 1990; Varol & Tatlı 2003; Tel et al. 2018), check lists (Özhatay & Kültür, 2006; Özhatay et al. 2009, 2011, 2013, 2015, 2018), published papers (Duman et al, 1995; Ekici & Aytaç 2001; İlçim et al. 2008b; Podlech & Ekici 2008; Taeb & Uzunhisarcıklı 2012), new records (Duman & Aytaç 1995; Varol et al. 1998), revision works (Aytaç 1997; Ekici & Ekim 2004; Akan & Aytaç 2014; Ekici et al. 2015) and recently collected plants by the authors of this present study pertinent with the flora of Kahramanmaraş. Collected plant samples were deposited at Herbarium of Kahramanmaraş Sütçü İmam University, Faculty of Forestry (KASOF). For reassessing the IUCN threat categories, Red Data Book of Turkish Plants (Ekim et al. 2000; IUCN 2001) and several papers such as Ekici (2010) and Kandemir et al. (2015) were consulted. Updated plant list and photos of some species are presented in the appendix. In order to avoid repetitions, the numbers on the photos are associated with the numbers in the plant list.

Preparation of the grid system map for the plant species distribution pattern

Since the plant species localities in the references were not specified as coordinates, the locations were processed using the WGS84 coordinate system using the Google Earth

program. These coordinates were then entered into Arc-GIS and created a point layer. In this study, since plant locations were coordinated by using Google Earth program, digitization was done by using the boundaries in Google Earth program for Kahramanmaraş province and the district boundaries. For the spatial analysis of the plants whose coordinates are processed, the grid system was applied within the provincial boundary. Due to its suitability for our study, a 10 km x 10 km grid system has been prepared. This is done by using the Create fishnet feature in the data management tools section of the Arc-Toolbox window using Arc-GIS 10.3 software (ESRI 2011) (Figure 2).

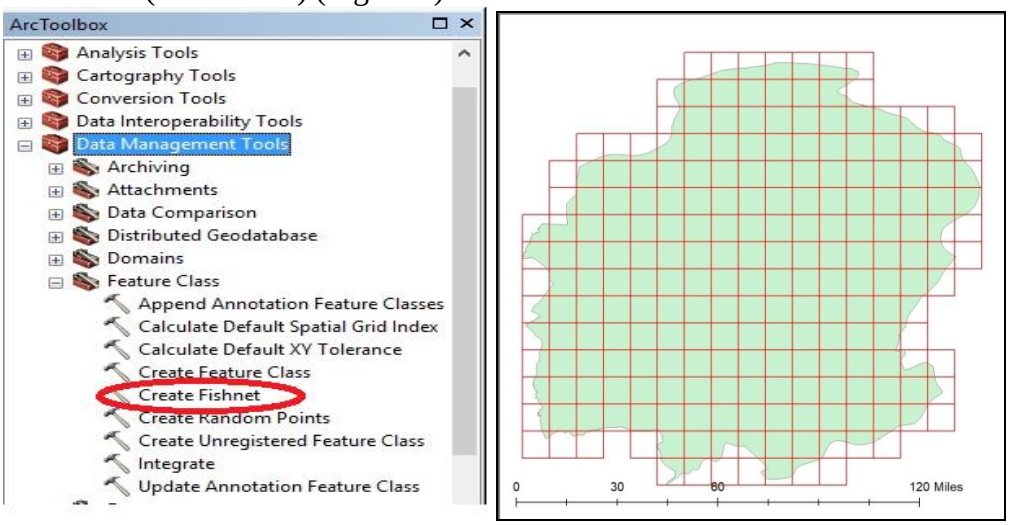

Figure 2. Arc-GIS menu used and 10 km x 10 km grid system

RESULTS AND DISCUSSION

According to the database, 95 *Astragalus* taxa whose valid names are investigated using Güner et al. (2012), are listed for the province of Kahramanmaraş. This number constitutes 20% of the total *Astragalus* taxa (one fifth of the total number) in Turkey. Totally, 37 *Astragalus* taxa (39 %) are endemic for Kahramanmaraş (Figure 3). Nine (9) of them (which indicated with asterisk in the appendix) are unique to this province.

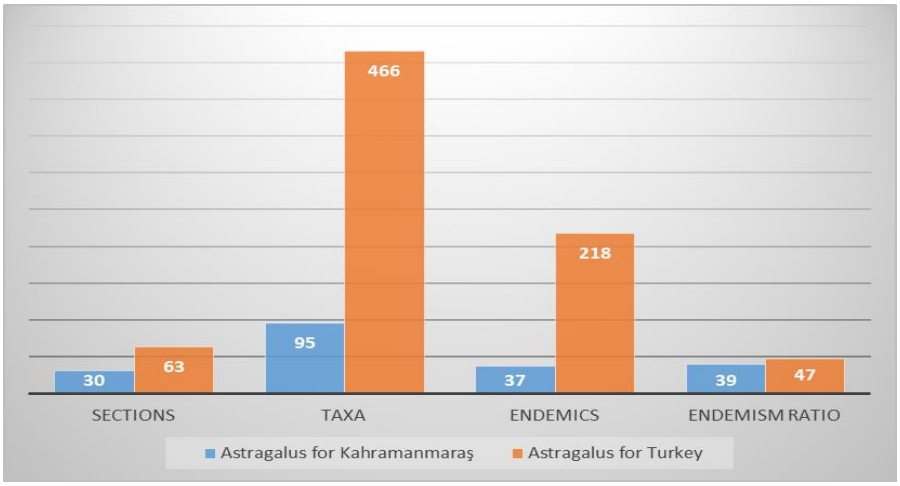

Figure 3. Comparison of Kahramanmaraş with Turkey in terms of the number of taxa.

Astragalus taxa are represented by 30 sections in Kahramanmaraş. This number constitutes almost half (48%) of the total sections in Turkey. Within the plant list, the largest sections are Sect. *Rhacophorus* with 23 taxa (from 49 for Turkey), Sect. *Onobrychoidei* with 8 taxa (from 31), Sect. *Dasyphyllium* with 6 taxa (from 14), *Malacothrix* with 6 taxa (from 10), Sect. *Myobroma* with 6 taxa (from 13), Sect. *Proselius* with 6 taxa (from 22) and Sect. *Pterophorus* with 6 taxa (from 22), and the remaining sections have less than 4 taxa for each (Figure 4).

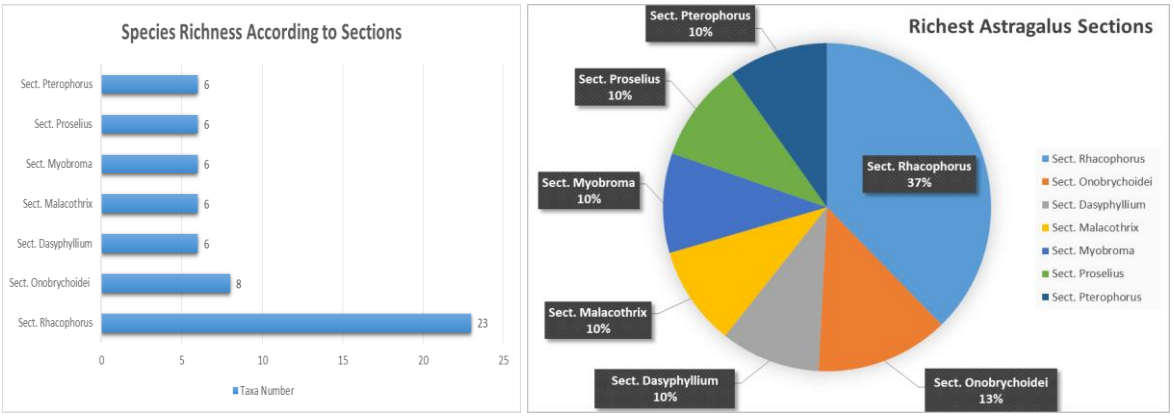

Figure 4. Richest *Astragalus* sections in Kahramanmaraş

The distribution of phytogeographical elements of the *Astragalus* taxa in the plant list; 59 % (56 taxa) for Irano-Turanian elements, 30 % (28 taxa) for Multi-regional or unknown and the remaining; 6 % (6 taxa) for East Medit. element, 4 % (4 taxa) East Medit. (mt.) element and 1 % (1 taxon) Euro-Siberian element (Table 1, Figure 5).

Table 1. The distribution of phytogeographical elements of the *Astragalus* taxa

	Kahramanmaraş		**Turkey**	
	Taxa Number	Ratio (%)	Taxa Number	Ratio (%)
Irano-Turanian element	**56**	58.9	**236**	50.6
Multi regional or unknown	**28**	29.5	**172**	36.9
East Medit. element	**6**	6.3	**27**	5.8
East Medit. (mt.) element	**4**	4.2	**7**	1.5
Euro-Siberian element	**1**	1.1	**4**	0.9
Mediterranean element	0	0.0	**7**	1.5
Euxine element	0	0.0	**7**	1.5
Euxine (mt.) element	0	0.0	**6**	1.3
Total	**95**	**100.0**	**466**	**100.0**

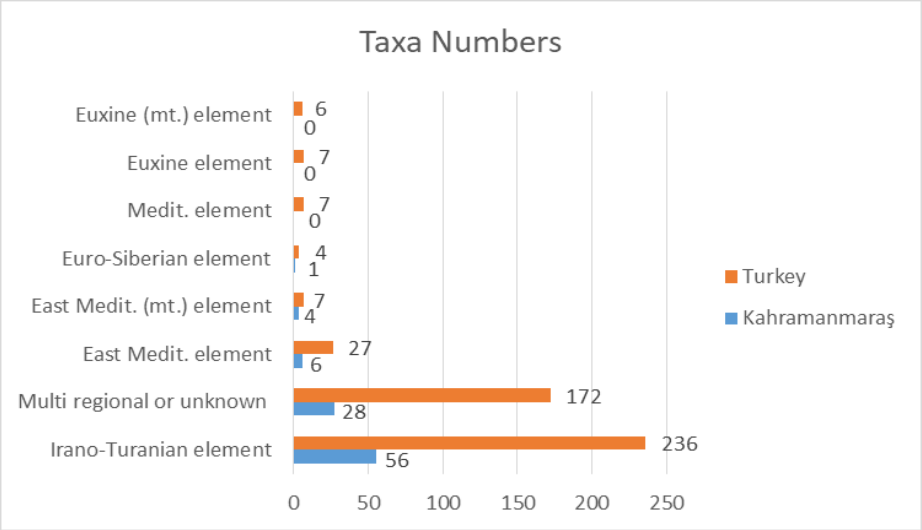

Figure 5. Phytogeographical elements

According to distributions, squares (J13) in Çağlayancerit, (D4, E4 and G8) in Göksun, (I10) between Ekinözü and central district, and (K10) in the central district of Kahramanmaraş are the richest squares in accordance with the taxa numbers (Figure 6). These areas are important in terms of conservation biology as they are the most intense areas of steppic conditions, livestock and grazing pressure. In addition, these areas are the highest mountain series (Binboğa, Berit, Koç, Ahir and Engizek Mountains) forming the roof of the province.

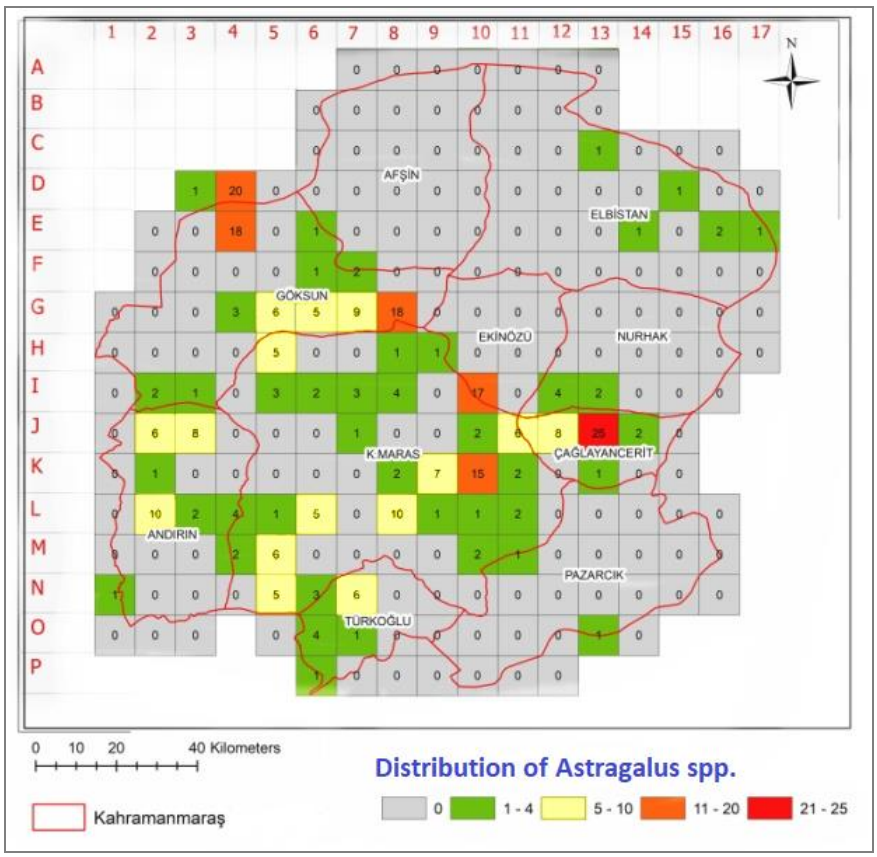

Figure 6. Distribution of *Astragalus* species in Kahramanmaraş

Endemism and Red List Assessment

Totally 37 *Astragalus* taxa (39 %) are endemic to Kahramanmaraş province (Ekim et al. 2000; IUCN 2001). Eleven (11) of the total number of taxa are in threatened categories (CR, EN, VU). As a result, 4 endemic *Astragalus* taxa (*A. akmanii* Aytaç & H. Duman, *A. argentophyllus* Taeb & Uzunh., *A. dumanii* M. Ekici & Aytaç and *A. ekimii* Zarre & H. Duman) are in Critically Endangered (CR) category, 2 endemic taxa (*A. distinctissimus* Rech.f. & Edelb. and *A. lineatus* Lam. var. *bibracteolatus* H. Duman & Vural) are in Endangered (EN) category, 5 endemic taxa (*A. aintabicus* Boiss., *A. macrouroides* Hub.-Mor., *A. melitenensis* Boiss., *A. talasseus* Boiss. & Balansa, *A. zahlbruckneri* Hand.-Mazz.) are in Vulnerable (VU) category, while 11 endemic taxa in Near Threatened (NT) and 15 endemic taxa are in Least Concern (LC) threat category (Table 2, Figure 7).

Table 2. Comparison of IUCN threat categories of *Astragalus* spp.

	Kahramanmaraş		**Turkey**	
	Taxa Number	Ratio (%)	Taxa Number	Ratio (%)
EX	0	0.0	1	0.5
CR	4	10.8	33	15.1
EN	2	5.4	35	16.1
VU	5	13.5	49	22.5
NT	11	29.7	37	17.0
LC	15	40.5	44	20.2
DD	0	0.0	19	8.7
Total	37	100.0	218	100.0

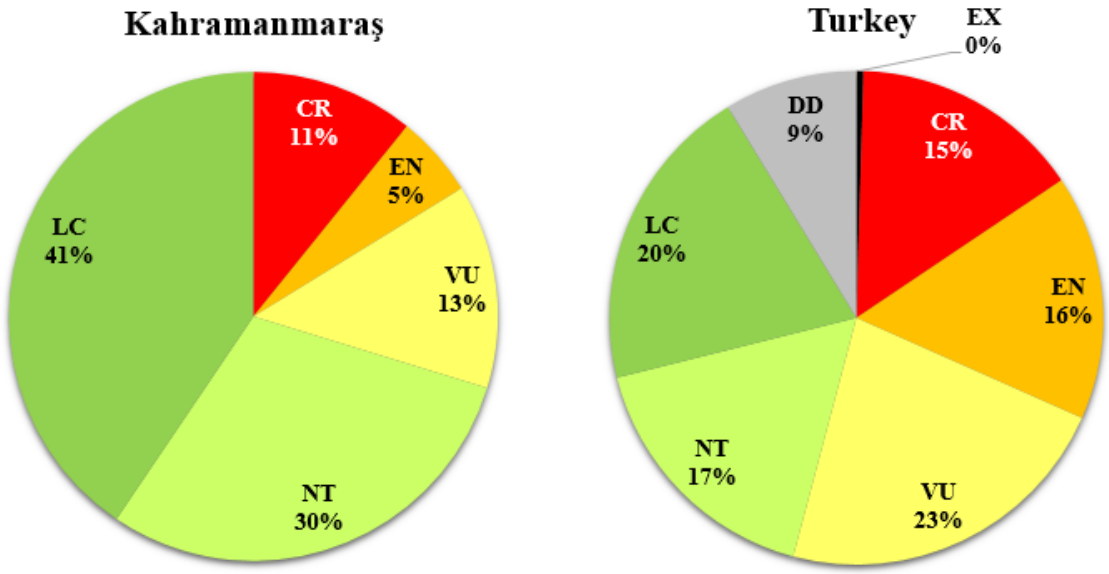

Figure 7. Comparison of IUCN threat categories of studied *Astragalus* spp.

Previous taxonomic studies related to flora of Kahramanmaraş have resulted with the discoveries of some new *Astragalus* species (such as *A. dumanii* M. Ekici & Aytaç, *A. akmanii* Aytaç & H. Duman, *A. ekimii* Zarre & H.Duman and *Astragalus lineatus* var.

bibracteolatus H. Duman & Vural) and new some distributions (Duman et al. 1995; Zarre & Duman 1998; Ekici & Aytaç 2001). With this present study, we also confirmed that *Astragalus chamaphaca* Freyn and *Astragalus podperae* Širj. have local distribution in Kahramanmaraş (Göksun).

Previous taxa names which are considered as synonyms were given as follows; *Astragalus psilacmos* Bunge, *Astragalus andrachnifolius* var. *grandiflorus* Eig, *Astragalus tuna-ekimii* N. Adıgüzel, *Astragalus sericans* Freyn & Sint., *Astragalus macroscepus* Boiss., *Astragalus eriophyllus* Boiss., *Astragalus berytius* Bunge, *Astragalus glycyphyllos* L. subsp. *glycyphylloides* (DC.) Matthews, *Astragalus elbistanicus* Hub.- Mor. & D.F.Chamb., *Astragalus kurdicus* var. *muschianus* (Kotschy & Boiss.) D.F.Chamb., *Astragalus campylosema* subsp. *campylosema* Boiss., *Astragalus fodinarum* Boiss. & Noë ex Bunge, *Astragalus ramicaudex* D.F.Chamb., *Astragalus plumosus* var. *akardaghicus* (Eig) D.F.Chamb. & V.A.Matthews, *Astragalus plumosus* var. *krugianus* (Freyn & Bornm.) Chamb. & Matthews, *Astragalus pycnocephalus* var. *seytunensis* (Bunde) Chamb., *Astragalus suberosus* subsp. *ancyleus* (Boiss.) V.A.Matthews, *Astragalus xylobasis* var. *angustus* (Freyn & Sint.) Freyn & Bornm. The valid names of these old names are listed in the appendix.

CONCLUSIONS

Kahramanmaraş (in Turkey) has a very rich plant biodiversity because of its different climatic zones over the rough and mountainous terrains. Existing biodiversity needs to be protected. In order to protect the plant species resources, planning and management are necessary. Considering the benefits and facilities of the GIS mentioned above, it is appropriate to use it in planning methods to protect biodiversity. It is possible to perform an in-depth analysis by combining several data layers with GIS. For example, when planning a conservation plan for an endangered plant, it is not enough to know the botanical characteristics of a current plant species. Therefore, a more accurate result will be obtained if a conservation plan is made by adding such ecological characteristics (temperature, precipitation and soil), spatial information and threats to the endangered plants. As a result, using GIS, a multidimensional analysis can be performed by adding more data layers in a targeted study. Furthermore, it is recommended that local establishments take care of areas with endemic plant density especially in their planning.

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Appendix. (Plant list of *Astragalus* spp.)

No	Sections	Scientific name	Endemism	IUCN	Floristic region	Determined via
01	Onobrychium	*Astragalus aduncus* Willd.	-	-	Irano-Turanian	literature / field work
02	Rhacophorus	***Astragalus aintabicus*** Boiss**.**	end.	**VU**	Multi regional or unknown	literature
03	Hypoglottidei	***Astragalus akmanii*** Aytaç & H. Duman	*end.	**CR**	Multi regional or unknown	literature
04	Rhacophorus	*Astragalus amblolepis* (Fisch.) Podlech (**syn**: *Astragalus psilacmos* Bunge)	-	-	Irano-Turanian	literature / field work
05	Myobroma	***Astragalus angustiflorus*** subsp. ***amanus*** (Boiss.) D.F.Chamb.	end.	**NT**	East Medit.	literature / field work
06	Melanocercis	*Astragalus angustifolius* subsp. *angustifolius* Lam.	-	-	Multi regional or unknown	literature / field work
07	Melanocercis	*Astragalus angustifolius* subsp. *pungens* (Willd.) Hayek	-	-	Multi regional or unknown	literature
08	Malacothrix	***Astragalus argentophyllus*** Taeb & Uzunh**.**	*end.	**CR**	Irano-Turanian	literature
09	Onobrychium	*Astragalus asciocalyx* Bunge	-	-	Irano-Turanian	literature
10	Rhacophorus	*Astragalus barbeyanus* Post	-	-	East Medit. (mt)	literature
11	Brachycalyx	*Astragalus brachycalyx* Fisch. ex Boiss.	-	-	Irano-Turanian	literature
12	Pterophorus	*Astragalus brachypterus* Fisch.	-	-	Irano-Turanian	literature / field work
13	Myobroma	*Astragalus brachystachys* DC.	-	-	Irano-Turanian	literature
14	Onobrychium	***Astragalus cadmicus*** Boiss.	end.	**LC**	Multi regional or unknown	literature
15	Christiana	*Astragalus caraganae* Fisch. & C.A.Mey.	-	-	Irano-Turanian	literature
16	Rhacophorus	*Astragalus cephalotes* var. *brevicalyx* Eig (**syn**: *Astragalus andrachnifolius* var. *grandiflorus* Eig)	-	-	Multi regional or unknown	literature
17	Rhacophorus	*Astragalus cephalotes* var. *cephalotes* Banks & Sol.	-	-	Multi regional or unknown	literature

18	Macrosemium	*Astragalus chamaephaca* Freyn (**syn:** *Astragalus tuna-ekimii* N. Adıgüzel)	-	-	Irano-Turanian	literature / field work
19	Christiana	*Astragalus christianus* subsp. *christianus* L. (**syn:** *Astragalus sericans* Freyn & Sint.)	-	-	Multi regional or unknown	literature / field work
20	Rhacophorus	***Astragalus commagenicus*** (Hand.-Mazz.) Širj.	end.	**LC**	East Medit. (mt)	literature
21	Pterophorus	***Astragalus condensatus*** Ledeb.	end.	**LC**	Irano-Turanian	literature / field work
22	Stereothrix	***Astragalus coodei*** D.F.Chamb. & V.A.Matthews	end.	**LC**	Irano-Turanian	literature
23	Dasyphyllium	*Astragalus cretaceus* Boiss.	-	-	Irano-Turanian	literature
24	Rhacophorus	*Astragalus cuspistipulatus* Eig	-	-	East Medit.	literature
25	Pterophorus	***Astragalus cymbibracteatus*** Hub.-Mor. & D.F.Chamb.	end.	**NT**	Irano-Turanian	literature
26	Rhacophorus	***Astragalus cymbostegius*** Bunge	*end.	**NT**	East Medit. (mt)	literature
27	Dasyphyllium	*Astragalus densifolius* subsp. *densifolius* Lam. (**syn**: *Astragalus macroscepus* Boiss., *Astragalus eriophyllus* Boiss.)	-	-	Irano-Turanian	literature / field work
28	Tapinodes	*Astragalus depressus* var. *depressus* L.	-	-	Multi regional or unknown	literature
29	Rhacophorus	*Astragalus diphtherites* var. *diphtherites* Fenzl	-	-	Irano-Turanian	literature
30	Macrophyllium	*Astragalus dipodurus* Bunge	-	-	Irano-Turanian	literature / field work
31	Dasyphyllium	***Astragalus distinctissimus*** Rech.f. & Edelb.	end.	**EN**	East Medit.	literature
32	Pterophorus	*Astragalus drusorum* Boiss.	-	-	Multi regional or unknown	literature
33	Hololeuce	***Astragalus dumanii*** M. Ekici & Aytaç	*end.	**CR**	Irano-Turanian	literature
34	Rhacophorus	***Astragalus ekimii*** Zarre & H.Duman	*end.	**CR**	East Medit. (mt)	literature
35	Proselius	*Astragalus elongatus* subsp. *elongatus* Willd.	-	-	Irano-Turanian	literature
36	Proselius	*Astragalus elongatus* subsp. *nucleiferus* (Boiss.) D.F.Chamb.	-	-	Multi regional or unknown	literature / field work
37	Dasyphyllium	*Astragalus emarginatus* Labill. (**syn**: *Astragalus berytius* Bunge)	-	-	Irano-Turanian	literature

38	Acmothrix	*Astragalus fragrans* Willd.	-	-	Multi regional or unknown	literature
39	Glycyphyllos	*Astragalus fraxinifolius* DC.	-	-	Irano-Turanian	literature
40	Hololeuce	***Astragalus globosus*** Vahl	end.	**LC**	Irano-Turanian	literature
41	Glycyphyllos	*Astragalus glycyphylloides* DC. (**syn**: *Astragalus glycyphyllos* L. subsp. *glycyphylloides* (DC.) Matthews)	-	-	Euro-Siberian	literature / field work
42	Platonychium	*Astragalus gummifer* Labill.	-	-	Irano-Turanian	literature
43	Buceras	*Astragalus hamosus* L.	-	-	Multi regional or unknown	literature
44	Dasyphyllium	***Astragalus haussknechtii*** Bunge	*end.	**NT**	Irano-Turanian	literature
45	Rhacophorus	*Astragalus hilaris* Bunge	* -	-	Multi regional or unknown	literature / field work
46	Hololeuce	***Astragalus hirsutus*** Vahl	end.	**LC**	Multi regional or unknown	literature
47	Onobrychium	***Astragalus karamasicus*** Boiss. & Balansa	end.	**LC**	Irano-Turanian	literature
48	Rhacophorus	*Astragalus kurdicus* Boiss.	-	-	Multi regional or unknown	literature
49	Rhacophorus	***Astragalus lamarckii*** Boiss**.**	end.	**LC**	Irano-Turanian	literature
50	Dasyphyllium	*Astragalus lanatus* Lab.	-	-	Irano-Turanian	literature
51	Myobroma	***Astragalus leporinus*** var**.** ***hirsutus*** (Post) D.F.Chamb.	*end.	**LC**	Irano-Turanian	literature / field work
52	Myobroma	***Astragalus leporinus*** var**.** ***leporinus*** Boiss**.**	end.	**LC**	Irano-Turanian	literature
53	Rhacophorus	***Astragalus leucomallophorus*** Bornm. & Širj. **(syn:** *Astragalus elbistanicus* Hub.- Mor. & D.F.Chamb.**)**	end.	**NT**	Irano-Turanian	literature
54	Grammocalyx	***Astragalus lineatus*** var. ***bibracteolatus*** H. Duman et Vural	*end.	**EN**	Irano-Turanian	literature
55	Grammocalyx	*Astragalus lineatus* var. *lineatus* Lam.	-	-	Multi regional or unknown	literature

56	Grammocalyx	*Astragalus lineatus* var. *longidens* (Freyn) Matthews	-	-	Irano-Turanian	literature / field work
57	Onobrychium	***Astragalus lycius*** Boiss.	end.	**NT**	Multi regional or unknown	literature / field work
58	Alopecias	*Astragalus macrocephalus* subsp. *finitimus* (Bunge) D.F.Chamb.	-	-	Irano-Turanian	literature / field work
59	Alopecias	*Astragalus macrocephalus* subsp. *macrocephalus* Willd.	-	-	Irano-Turanian	literature
60	Malacothrix	*Astragalus macrostachys* DC.	-	-	Irano-Turanian	literature
61	Malacothrix	***Astragalus macrouroides*** Hub.-Mor.	end.	**VU**	Irano-Turanian	literature
62	Malacothrix	*Astragalus macrourus* Fisch. & C.A.Mey.	-	-	Multi regional or unknown	literature
63	Hypoglottidei	***Astragalus melanocarpus*** Bunge	end.	**NT**	Irano-Turanian	literature
64	Cystodes	*Astragalus melanocephalus* Boiss	-	-	Multi regional or unknown	literature
65	Onobrychium	***Astragalus melitenensis*** Boiss.	end.	**VU**	Irano-Turanian	literature
66	Rhacophorus	*Astragalus microcephalus* Willd.	-	-	Irano-Turanian	literature
67	Rhacophorus	***Astragalus micropterus*** Fisch.	end.	**LC**	Irano-Turanian	literature
68	Malacothrix	*Astragalus mollis* M.Bieb.	-	-	Irano-Turanian	literature
69	Rhacophorus	*Astragalus muschianus* Kotschy & Boiss. ex Boiss. (**syn:** *Astragalus kurdicus* var. *muschianus* (Kotschy & Boiss.) D.F.Chamb.)	-	-	Irano-Turanian	literature
70	Stereothrix	*Astragalus nanus* DC.	-	-	Multi regional or unknown	literature
71	Xiphidium	*Astragalus nitens* Boiss. & Heldr.	-	-	Irano-Turanian	literature
72	Euodmus	*Astragalus odoratus* Lam.	-	-	Multi regional or unknown	literature
73	Onobrychium	*Astragalus onobrychis* L.	-	-	Multi regional or unknown	literature

74	Omithopodium	*Astragalus ornithopodioides* Lam.	-	-	Irano-Turanian	literature
75	Myobroma	*Astragalus ovinus* Boiss.	-	-	Multi regional or unknown	literature
76	Sisyrophorus	***Astragalus pelliger*** Fenzl	end.	**LC**	East Medit.	literature
77	Proselius	*Astragalus pendulus* DC. **(syn**: *Astragalus campylosema* subsp. *campylosema* Boiss., *Astragalus fodinarum* Boiss. & Noë ex Bunge)	-	-	Irano-Turanian	literature / field work
78	Rhacophorus	***Astragalus pennatulus*** Huber-Mor. & Chamberlain	end.	**NT**	Irano-Turanian	literature
79	Rhacophorus	***Astragalus pennatus*** subsp. ***pennatus*** Boiss.	*end.	**NT**	Multi regional or unknown	literature
80	Myobroma	*Astragalus pinetorum* subsp. *pinetorum* Boiss. (**syn**: *Astragalus ramicaudex* D.F.Chamb.)	-	-	Irano-Turanian	literature
81	Rhacophorus	*Astragalus plumosus* Willd. (**syn**: *Astragalus plumosus* var. *akardaghicus* (Eig) D.F.Chamb. & V.A.Matthews, *Astragalus plumosus* var. *krugianus* (Freyn & Bornm.) Chamb. & Matthews)	-	-	Irano-Turanian	literature
82	Pterophorus	*Astragalus podperae* Širj.	-	-	Irano-Turanian	field work
83	Rhacophorus	*Astragalus pycnocephalus* Fischer (**syn**: *Astragalus pycnocephalus* var. *seytunensis* (Bunde) Chamb.)	-	-	Irano-Turanian	literature
84	Proselius	*Astragalus schizopterus* Boiss.	-	-	East Medit.	literature / field work
85	Rhacophorus	***Astragalus schottianus*** Boiss.	end.	**NT**	Irano-Turanian	literature
86	Proselius	***Astragalus sigmoideus*** Bunge	end.	**LC**	Multi regional or unknown	literature
87	Theiochrus	*Astragalus siliquosus* Boiss.	-	-	Irano-Turanian	literature
88	Stereothrix	***Astragalus sparsipilis*** Hub.-Mor. & D.F.Chamb.	end.	**NT**	Irano-Turanian	literature / field work
89	Proselius	*Astragalus spruneri* Boiss.	-	-	East Medit.	literature / field work
90	Platyglottis	*Astragalus suberosus* Banks & Sol. (**syn**: *Astragalus suberosus* subsp. *ancyleus* (Boiss.) V.A.Matthews)	-	-	Multi regional or unknown	literature

91	Pterophorus	***Astragalus talasseus*** Boiss. & Balansa	end.	**VU**	Irano-Turanian	literature
92	Malacothrix	***Astragalus tauricolus*** Boiss.	end.	**LC**	Irano-Turanian	literature / field work
93	Hymenocoleus	***Astragalus vaginans*** DC.	end.	**LC**	Multi regional or unknown	literature
94	Onobrychium	*Astragalus xylobasis* Freyn & Bornm. (**syn**: *Astragalus xylobasis* var. *angustus* (Freyn & Sint.) Freyn & Bornm.)	-	-	Irano-Turanian	literature
95	Rhacophorus	***Astragalus zahlbruckneri*** Hand.-Mazz.	end.	**VU**	Irano-Turanian	literature

* Holo-types are based on the collections in Kahramanmaraş


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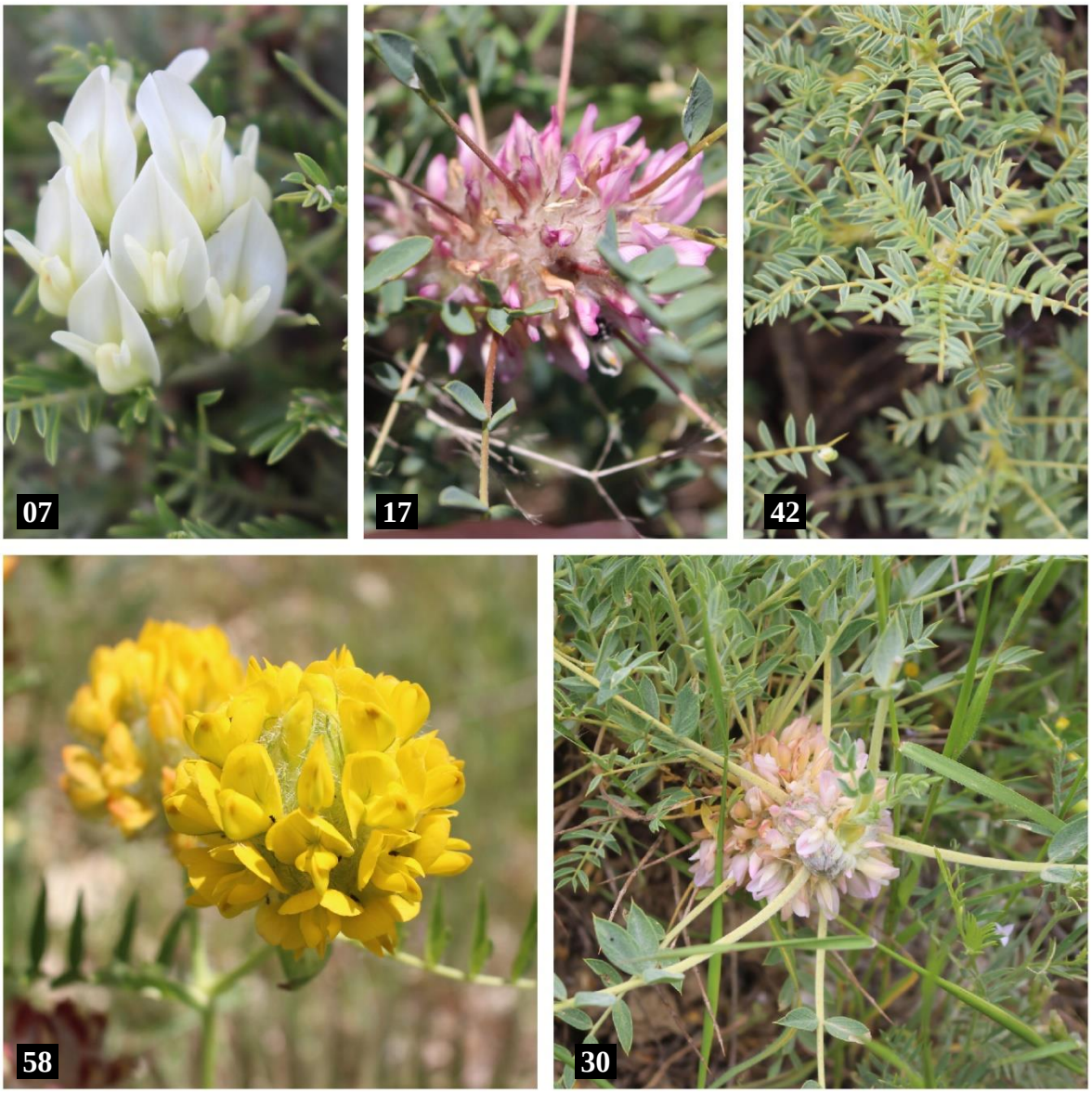
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