Journal of Animal and Veterinary Advances 9 (22): 2788-2796, 2010
ISSN: 1680-5593

Plant Species Diversity in Isparta Region Rangelands

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Abstract: Turkey as a consequence of its exceptionally diverse topographical structure and differing climatic features is one of the world's richest countries of the world as regards to the diversity of the plant species. The Mediterranean region takes the first place in the country, in relation with the number of species grown in a single region. The aim in this study conducted in the rangelands of Isparta which is located in the Mediterranean regio between the years of 2008-2009 is to present the plant species diversity of the local rangelands. In the study area, 302 plant taxa belonging to 43 families and 190 plant genera were identified and 28, 39 and 234 of these belonged to the graminae, legume and other families, respectively. The family that is represented with the most number of taxa with 41 taxa is the Asteraceae family. It is followed by Fabaceae, Lamiaceae and Poaceae families, respectively with 39, 30 and 29 taxa. Among the 302 plant taxa, 84 of the plants are annual; 3 of them are annual and biennial plants; 14 of the plants are biennial and 201 of them are perennial plants. Among the taxa encountered in the study area, 73 of them were recorded as the element of the Mediterranean region; 64 taxa were recorded as the element of Irano-Turanian region; 17 of them were recorded as the element of Euro-Siberian region and 148 taxa were recorded as widepspread or belonging to an unknown region. Moreover, 82 plant taxa were endemic and the endemism ratio was identified as 27.15%.

Key words: Plant species richness, endemic plants, rangelands, isparta, Mediterranean, Turkey

INTRODUCTION

Turkey is one of the richest countries of the word as regards to its flora and vegetation. With approximately 9200 genera and 1200 species and subspecies taxa, the country has one of the richest floras of its climatic zone in the world according to the diversity of the plant species . Moreover, the endemism ratio is approximately 34% with 3925 endemic species (NPNC, 2007). The reason for such richness is that Mediterranean, Irano-turanian and Euro-Siberian floristic regions are located in Anatolia and they even merge in some sections (Davis, 1965-1985). Furthermore, the variety of the topographical, geological and geomorphological structures and climatic differences can be stated as among the reasons for this wide diversity of herbaceous and woody plants (Turkmen, 1987). The Mediterranean region takes the first place with 750 species in relation with the number of species grown in a single region within the country (Ekim *et al*., 2000).

The rangelands, among the natural resources take one of the first places when their significances in the ecological system, places in stockbreeding, roles in preventing the erosion, biological diversities and situations of becoming a gene center are considered (Acikgoz, 2001). In relation with the land use, the richest places are the rangelands with the numerous herbaceous and ligneous plants contained in these lands because the abundance of the number of plant species in the rangeland vegetations is a significant indicator of the biological diversity in the area.

The rangelands of Isparta region as the field of study are located in the intersection zone of Mediterranean and Irano-turanian floristic regions and also have considerably rich structures according to their natural vegetation. In this regard, the aim of this study is to determine the plant species diversity of the rangelands in Isparta region. Moreover, the determination of the endemic and endangered plant species which have the features of a biological heritage for the country is also, aimed with this study.

MATERIALS AND METHODS

The study was conducted, between the years of 2008-2009 in Davraz Mountain, Kulova Plateau Rangeland (1650 m), Darioren Rangeland (1500 m), Kozagaci Plateau Rangeland (1450 m), Kayi village Rangeland (1400 m)

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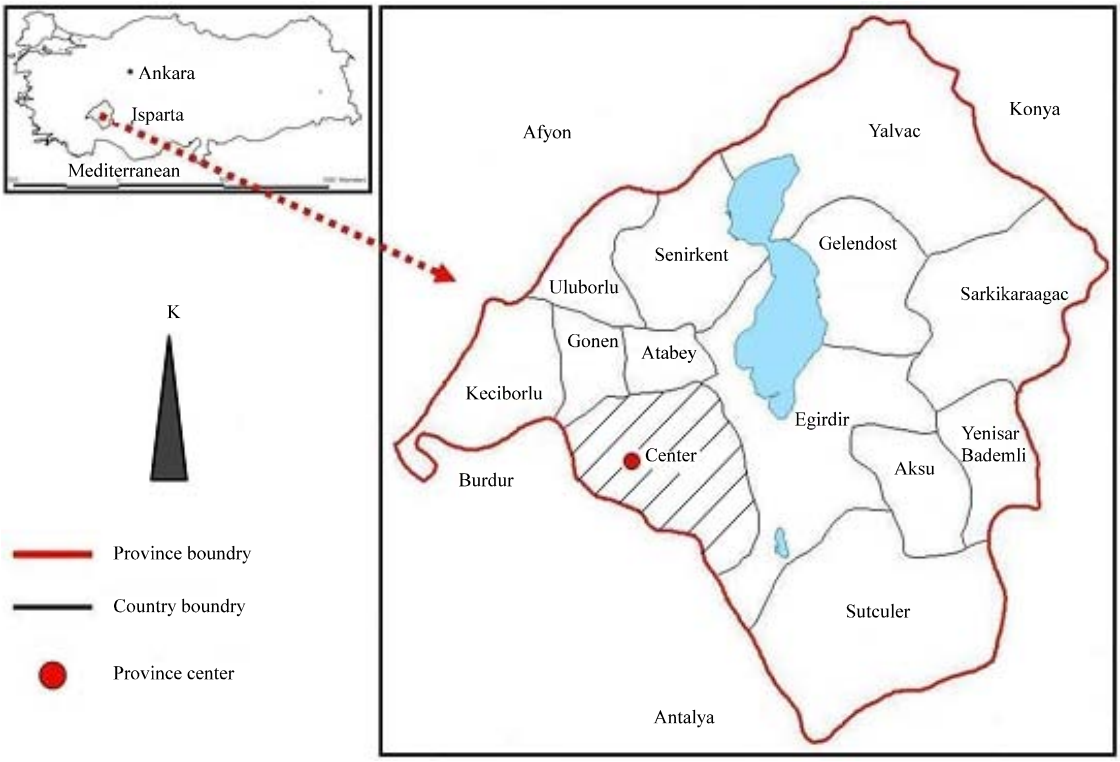

Fig. 1: Research area

and Kirtepe Rangeland (1200 m) situated within the province of Isparta (Fig. 1). The study area is located in the transition area of the Mediterranean and continental climatic zones (Babalik and Sonmez, 2010). According to the data of Isparta meteorological station, the annual mean temperature is 12°C while the mean value of annual rainfall is 506 mm (TMS, 2009).

The study was conducted during the vegetation period between May and October in the both years and the assessment of the flora was performed, during these periods by visiting the rangelands which each had different topographical structures bi-weekly.

The samples of the plants identified in these lands were obtained and they were brought to the herbarium by means of placing them in the pressers. Moreover, the digital photographs of the plant species obtained from the areas were taken.

During the obtainment of the samples, it was taken special care that the organs of the plants such as flower, leaf, stem and root which are essential for the identification of the plants were picked as a whole and each sample was numbered.

The lands where the plants were obtained and their picking times were noted. Since, the plants came into blossom at different times, obtaining samples from the plants with different blossom periods were ensured by visiting the same lands at various dates in the vegetation period. After the species identification of the plants brought to the herbarium is performed, their lengths of lives, element regions and conditions of endemism were then determined (Davis, 1965-1985; Davis *et al*., 1988; Guner *et al*., 2000; Tutin *et al*., 1964-1980).

During the identification of the plants, the flora studies conducted in Isparta and its surroundings (Fakir, 2006; Babalik and Fakir, 2009; Fakir *et al*., 2009; Ozcelik and Ozturk, 1999; Ozcelik and Korkmaz, 2002) and the data of the Herbariums belonging to Faculty of Forestry and Faculty of Science and Letters at Süleyman Demirel University were used. Furthermore, the danger categories and endemism conditions of the plants taxa according to the IUCN threatened categories were shown in Table 1 (IUCN, 2001; Ekim *et al*., 2000). The abbreviations used in the floristic list are as follows:

Euro-Sib. : Euro-Siberian Elements
Ir.-Tur. : Irano-Turanian Elements
Medit. : Mediterranean Elements
E. Medit. : East Mediterranean Elements
MR. : Multiregional
UPR. : Unknown Phytogeographical Region

Table 1: Plant taxa encountered in the study area and some of their significant characteristics

Families and plant taxa	Length of life	Element region	Endemic condition	Threat categories
Acanthaceae				
Acanthus hirsutus Boiss.	Per.	Medit.	End.	LR(lc)
Anacardiaceae				
Pistacia terebinthus L. subsp. *palaestina* (Boiss.) Engler	Per.	E.Medit.	-	-
Rhus coriaria L.	Per.	MR.	-	-
Apiaceae				
Bupleurum falcatum L. subsp. *polyphyllum* (Ledeb.) Wolff.	Per.	Euro-Sib.	-	-
Bupleurum rotundifolium L.	Ann.	MR.	-	-
Eryngium campestre L. var. *virens*	Per.	MR.	-	-
Falcaria vulgaris Bernh.	Per.	MR.	-	-
Torilis japonica (Houtt.) DC.	Ann.	MR.	-	-
Torilis ucranica Sprengel	Ann.	MR.	-	-
Araceae				
Arum elongatum Steven	Per.	Ir.-Tur.	-	-
Asteraceae				
Achillea biebersteinii Afan.	Per.	Ir.-Tur.	-	-
Achillea kotschyi Boiss. subsp. *kotschyi*	Per.	E.Medit.	End.	LR (lc)
Achillea lycaonica Boiss. and Heldr.	Per.	Ir.-Tur.	End.	LR (lc)
Anthemis cretica L. subsp. *cassia* (Boiss.) Grierson	Per.	UPR.	-	-
Anthemis tinctoria L. var. *tinctoria*	Per.	Mr.	-	-
Anthemis wiedemanniana Fisch. and Mey.	Ann.	UPR.	End.	LR (lc)
Artemisia campestris L.	Per.	MR.	-	-
Bellis perennis L.	Per.	Euro-Sib.	-	-
Carduus olympicus Boiss. subsp. *hypoleucus* (Bornm.) Davis	Per.	UPR.	End.	LR (lc)
Centaurea mathiolifolia Boiss.	Per.	Ir.-Tur.	End.	VU
Centaurea pulchella Ledep.	Ann.	Ir.-Tur.	-	-
Centaurea reuterana Boiss. var. *phrygia* Bornm.	Per.	E.Medit.	End.	LR (lc)
Centaurea solstitialis L subsp. *Solstitialis*	Ann.	MR.	-	-
Centaurea virgata Lam.	Per.	Ir.-Tur.	-	-
Chondrilla juncea L. var. *juncea*	Per.	MR.	-	-
Cichorium intybus L.	Per.	MR.	-	-
Cirsium vulgare (Savi) Ten.	Bia.	MR.	-	-
Conyza canadensis (L.) Cronquist	Ann.	MR.	-	-
Crepis alpina L.	Ann.	MR.	-	-
Crupina crupinastrum (Moris) Vis.	Ann.	Medit	-	-
Echinops viscosus DC. var. *bithynicus* (Boiss.) Rech.	Per.	Ir.-Tur.	-	-
Helichrysum compactum Boiss.	Per.	E.Medit	End.	EN.
Hieracium pannosum Boiss.	Per.	E.Medit	-	-
Hieracium phrygiense Sell and West	Per.	E.Medit	End.	LR (lc)
Ýnula anatolica Boiss.	Per.	Medit	End.	LR (lc)
Lactuca intricata Boiss.	Per.	E.Medit.	-	-
Lactuca scarioloides Boiss.	Bia.	Ir.-Tur.	-	-
Onopordum anatolicum (Boiss.) Eig.	Bia.	Ir.-Tur.	End.	LR (lc)
Picnomon acarna (L.) Cass.	Ann.	Medit.	-	-
Pilosella hoppeana (Schultes) C.H. and F.W. Schultz subsp. *cilicica* (NP.) Sell and West	Per.	MR.	-	-
Scorzonera cana (C. A. Meyer) Hoffm. var. *alpina* (Boiss.) Chamberlain	Per.	UPR.	-	-
Scorzonera mollis Bieb. subsp. *szowitzii* (DC.) Chamberlain	Per.	Ir.-Tur.	-	-
Senecio vulgaris L.	Ann.	MR.	-	-
Taraxacum turcicum Van Soest	Per.	UPR.	-	LR (lc)
Tragopogon dubius Scop.	Bia.	MR.	-	-
Tragopogon latifolius Boiss. var. *angustifolius* Boiss.	Per.	Ir.-Tur.	-	-
Tragopogon olympicus Boiss.	Per.	E.Medit.	End.	LR (lc)
Tussilago farfara L.	Per.	Euro-Sib.	-	-
Xanthium spinosum L.	Ann.	MR.	-	-
Xanthium strumarium L.	Ann.	Medit.	-	-
Xeranthemum annuum L.	Ann.	Ir.-Tur.	-	-
Berberidaceae				
Berberis crataegina DC.	Per.	Ir.Tur.	-	-
Boraginaceae				
Alkanna incana Boiss.	Per.	E.medit.	End.	LR (cd)
Anchusa azurea Miller var. *azurea*	Per.	Mr.	-	-
Anchusa stylosa Bieb.	Ann.	Mr.	-	-
Buglossoides arvensis (L.) Johnston	Ann.	Mr.	-	-
Echium italicum L.	Bia.	Medit.	-	-
Moltkia aurea Boiss.	Per.	Ir-Tur	-	-
Myosotis refrecta Boiss. subsp. *refrecta*	Ann.	E.medit.	-	-
Onosma aucheranum DC.	Per.	E.medit.	-	-
Onosma mite Boiss. and Heldr.	Per.	E.medit.	-	-

Table 1: Continue

Families and plant taxa	Length of life	Element region	Endemic condition	Threat categories
Brassicaceae				
Alyssum alyssoides (L.) L.	Ann.	MR.	-	-
Alyssum murale Waldst. and Kit. var. *murale*	Per.	MR.	-	-
Arabis aubrietioides Boiss.	Per.	MR.	End.	LR (Ic)
Arabis ionocalyx Boiss.	Per.	E.Medit.	-	-
Aubrieta pinardii Boiss.	Per.	Ir.Tur.	End.	LR (Ic)
Barbarea verna (Mill.) Aschers.	Bia.	MR.	-	-
Capsella bursa-pastoris (L.) Medik.	Bia.	MR.	-	-
Cardamine hirsuta L.	Ann.	MR.	-	-
Cardaria draba (L.) Desv. subsp. *draba*	Per.	MR.	-	-
Descurainia sophia (L.) Webb ex Prantl	Bia.	MR.	-	-
Diplotaxis tenuifolia (L.) DC.	Per.	MR.	-	-
Erophila verna (L.) Chevall. subsp. *verna*	Ann.	MR.	-	-
Eruca sativa Miller	Ann.	MR.	-	-
Erysimum crassipes Fisch. and Mey.	Per.	MR.	-	-
Erysimum leptocarpum Gay.	Per.	UPR.	End.	End.
Isatis glauca Aucher ex Boiss. subsp. *glauca*	Per.	Ir.Tur.	-	-
Lepidium latifolium L.	Per.	MR.	-	-
Lepidium perfoliatum L.	Bia	MR.	-	-
Malcolmia africana (L.) R. Br.	Ann.	MR.	-	-
Rapistrum rugosum (L.) All.	Ann.	MR.	-	-
Sinapis arvensis L.	Ann.	MR.	-	-
Sisymbrium altissimum L.	Bia	MR.	-	-
Sisymbrium orientale L.	Ann.	MR.	-	-
Thlaspi perfoliatum L.	Ann.	MR.	-	-
Campanulaceae				
Asyneuma compactum (Boiss. and Heldr.) Damboldt	Per.	E.Medit.	End.	LR (nt)
Asyneuma isauricum Contandr.	Per.	E.Medit.	End.	LR (cd)
Asyneuma rigidum (Willd.) Grossh. subsp. *sibthorpianum*	Per.	E.Medit.	End.	LR (Ic)
(Roemer and Schultes) Damboldt	Per.	E.Medit.	End.	LR (cd)
Campanula balansae Boiss. and Hausskn.	Per.	E.Medit.	End.	LR (nt)
Campanula fruticulosa (Schwarz and Davis.) Damboldt.	Per.	E.Medit.	End.	EN
Campanula peregrina L.	Bia.	Medit.	-	-
Legousia speculum-veneris (L.) Chaix	Ann.	Medit.	-	-
Caryophyllaceae				
Arenaria deflexa Dec. subsp. *microsepala* McNeill	Per.	E.Medit.	End.	LR (nt)
Bolanthus minuartioides (Jaub. and Spach) Hub.-Mor.	Per.	UPR.	End.	LR (Ic)
Cerastium banaticum (Roch.) Heuffel	Per.	MR.	-	-
Cerastium chlorifolium Fisch. and Mey.	Ann.	MR.	-	-
Dianthus brevicaulis Fenzl. subsp. *setaceus* Reeve	Per.	UPR.	End.	VU
Dianthus micranthus Boiss. and Heldr.	Per.	UPR.	-	-
Dianthus orientalis Adams	Per.	MR.	-	-
Dianthus zonatus Fenzl. var. *zonatus*	Per.	UPR.	-	-
Gypsophila elegans Bieb.	Ann.	Ir.-Tur.	-	-
Gypsophila pilosa Hudson	Ann.	Ir.-Tur.	-	-
Holosteum umbellatum L. var. *umbellatum*	Ann.	MR.	-	-
Minuartia gracilis Mc Neill	Per.	UPR.	End.	VU
Minuartia hybrida (Vill.) Schischk. subsp. *hybrida*	Per.	MR.	-	-
Minuartia umbellulifera (Boiss.)	Per.	UPR.	End.	LR (Ic)
McNeill subsp. *umbellulifera* var. *umbellulifera*				
Petrorhagia hispidula (Boiss. and Heldr.) Ball and Heywood	Ann.	UPR.	End.	VU
Sagina apetala Ard.	Ann.	MR.	-	-
Saponaria dalmasii Boissieu	Ann.	UPR.	End.	DD
Saponaria pamphylica Boiss. and Heldr.	Per.	UPR.	End.	LR (Ic)
Saponaria pinetorum Hedge	Per.	E.Medit.	End.	LR (cd)
Saponaria pumilio Boiss.	Per.	MR.	-	-
Silene armena Boiss. var. *armena*	Per.	UPR.	End.	LR (Ic)
Silene leptoclada Boiss.	Per.	E.Medit.	End.	LR (nt)
Silene lycaonica Chowdh.	Per.	Ir.Tur.	End.	EN
Chenopodiaceae				
Atriplex rosea L.	Ann.	MR.	-	-
Chenopodium botrys L.	Ann.	MR.	-	-
Chenopodium foliosum (Moench) Aschers.	Per.	MR.	-	-
Salsola kali L.	Ann.	MR.	-	-
Convolvulaceae				
Convolvulus arvensis L.	Per.	MR.	-	-
Cucurbitaceae				
Ecballium elaterium (L.) A. Rich.	Per.	Medit.	-	-

Table 1: Continue

Families and plant taxa	Length of life	Element region	Endemic condition	Threat categories
Cuscutaceae				
Cuscuta planiflora Ten.	Per.	MR.	-	-
Cyperaceae				
Blysmus compressus (L.) Panzer ex Link.	Per.	MR.	-	-
Carex distans L.	Per.	Euro-Sib.	-	-
Carex hirta L.	Per.	Euro-Sib.	-	-
Dipsacaceae				
Cephalaria salicifolia Post.	Per.	UPR.	End.	DD
Pterocephalus plumosus (L.) Coulter	Ann.	MR.	-	-
Scabiosa argentea L.	Per.	MR.	-	-
Scabiosa hololeuca Bornm.	Per.	Ir.-Tur.	End.	EN
Ephedraceae				
Ephedra major Host.	Per.	Medit.	-	-
Euphorbiaceae				
Andrachne aspera Sprengel	Per.	MR.	-	-
Euphorbia erythrodon Boiss. and Heldr.	Per.	Ir.-Tur.	End.	LR (Ic)
Euphorbia kotschyana Fenzl	Per.	E.Medit.	-	-
Euphorbia seguieriana Necker subsp. *seguieriana*	Per.	Euro-Sib.	-	-
Fabaceae				
Astragalus albifolius Freyn and Sint.	Per.	Ir.-tur.	End.	LR (cd)
Astragalus campylosema Boiss. subsp. *atropurpureus* (Boiss.) Chamberlain	Per.	UPR.	End.	LR (Ic)
Astragalus gymnolobus Fisher	Per.	Ir.-Tur.	End.	LR (Ic)
Astragalus heldreichii Boiss.	Per.	UPR.	End.	LR (nt)
Astragalus macrocephalus Willd. subsp. *finitimus* (Bunge) Chamberlain	Per.	Ir.-Tur.	-	-
Astragalus microcephalus Willd.	Per.	Ir.-Tur.	-	-
Astragalus nanus DC.	Per.	Ir.-Tur.	-	-
Astragalus oxytropifolius Boiss.	Per.	Ir.-Tur.	End.	DD
Astragalus paecilanthus Boiss.andHeldr.	Per.	UPR.	End.	DD
Astragalus pinetorum Boiss.	Per.	Ir.-Tur.	End.	LR (Ic)
Astragalus ponticus Pall.	Per.	MR.	-	-
Astragalus prusianus Boiss.	Per.	E.Medit.	End.	DD
Astragalus vulnerariae DC.	Per.	UPR.	End.	LR (Ic)
Astragalus zederbaueri Stadlman	Per.	Ir.-Tur.	End.	LR (Ic)
Coronilla varia L. subsp. *varia*	Per.	MR.	-	-
Genista tinctoria L.	Per.	Euro-Sib.	-	-
Hedysarum varium Willd.	Per.	Ir.-Tur.	-	-
Lathyrus digitatus (Bieb.) Fiori	Per.	E.Medit.	-	-
Lathyrus hirsutus L.	Ann.Bia.	MR.	-	-
Lotus corniculatus L. var. *tenuifolius* L.	Per.	MR.	-	-
Medicago minima (L.) Bart. var. *minima*	Ann.	MR.	-	-
Medicago sativa L. subsp. *sativa*	Per.	MR.	-	-
Melilotus alba Desr.	Ann.	MR.	-	-
Melilotus officinalis (L.) Desr.	Ann.	MR.	-	-
Onobrychis hypargyrea Boiss.	Per.	MR.	-	-
Onobrychis pisidica Boiss.	Per.	Ir.-Tur.	End.	LR (nt)
Ononis spinosa L. subsp. *antiquorum* (L.) Briq.	Per.	Medit.	-	-
Spartium junceum L.	Per.	Medit.	-	-
Trifolium affine C. Presl	Ann.	MR.	-	-
Trifolium barbulatum (Freyn and Sint.) Zoh.	Ann.	UPR.	End.	LR (Ic)
Trifolium campestre Schreb.	Ann.	MR.	-	-
Trifolium pratense L. var. *pratense* Boiss. and Bal.	Per.	MR.	-	-
Trigonella lunata Boiss.	Ann.	Ir.-Tur.	-	-
Vicia caesarea Boiss. and Bal.	Ann.	Ir.-Tur.	End.	LR (Ic)
Vicia cracca L. subsp. *atroviolacea* (Bornm.) Davis	Per.	MR.	-	-
Vicia grandiflora Scop. var. *grandiflora*	Ann.	MR.	-	-
Vicia peregrina L.	Ann.	MR.	-	-
Vicia sativa L. subsp. *nigra* (L.) Ehrh. var. *nigra*	Ann.	MR.	-	-
Vicia villosa Roth. subsp. *dasycarpa* (Ten.) Cav.	Bia.	MR.	-	-
Fagaceae				
Quercus coccifera L.	Per.	Medit.	-	-
Geraniaceae				
Erodium absinthoides Willd. subsp. *absinthoides*	Per.	Ir.-Tur.	End.	LR (Ic)
Erodium moschatum (L.) L'Herit.	Ann.	Medit.	-	-
Geranium cinereum Cav. subsp. *subcaulescens* var. *subcaulescens*	Per.	MR.	-	-
Globulariaceae				
Globularia orientalis L.	Per.	Ir.-Tur.	-	-

Table 1: Continue

Families and plant taxa	Length of life	Element region	Endemic condition	Threat categories
Hyperiaceae				
Hypericum perforatum L.	Ann.	MR.	-	-
Iridaceae				
Crocus biflorus Miller subsp. *punctatus* Mathew	Per.	E.Medit.	End.	LR (nt)
Crocus fleischeri Gay	Per.	E.Medit.	End.	LR (Ic)
Juncaceae				
Juncus gerardi Loisel subsp. *libanoticus* (Thieb.) Snog.	Per.	Ir.-Tur.	-	-
Lamiaceae				
Ajuga chamaepitys (L.) Schreber var. *mesogitana* (Boiss.) Bornm.	Per.	E.Medit.	-	-
Ballota nigra L. subsp. *foetida* Hayek	Per.	E.Medit.	-	-
Clinopodium vulgare L. subsp. *vulgare*	Per.	Euro-Sib.	-	-
Lamium amplexicaule L.	Ann.	Euro-Sib.	-	-
Lamium pisidicum R. Mill.	Per.	UPR.	End.	LR (cd)
Marrubium globosum Montbret and Aucher ex Bentham subsp. *globosum*	Per.	Ir.-Tur.	End.	LR (Ic)
Marrubium parviflorum Fisch. and Mey. subsp. *parviflorum*	Per.	Ir.-Tur.	-	-
Marrubium vulgare L.	Per.	MR.	-	-
Melissa officinalis L. subsp. *altissima* (Sm.) Arcangeli	Per.	E.Medit.	-	-
Nepeta caesarea Boiss.	Per.	E.Medit.	End.	LR (nt)
Origanum sipyleum L.	Per.	E.Medit.	End.	LR (Ic)
Phlomis armeniaca Willd.	Per.	Ir.-Tur.	End.	LR (Ic)
Phlomis pungens Willd. var. *pungens*	Per.	UPR.	-	-
Salvia candidissima Vahl. subsp. *occidentalis* Hedge	Per.	Ir.-Tur.	-	-
Salvia ceratophylla L.	Bia.	Ir.-Tur.	-	-
Salvia frigida Boiss.	Per.	Ir.-Tur.	-	-
Salvia tomentosa Miller	Per.	Medit.	-	-
Scutellaria orientalis L. subsp. *pinnatifida* Edmondson	Per.	MR.	-	-
Sideritis leptoclada Schwarz and Davis.	Per.	E.Medit.	End.	LR (cd)
Sideritis perfoliata L.	Per.	E.Medit.	-	-
Sideritis pisidica Boiss. and Heldr.	Per.	E.Medit.	End.	LR (nt)
Stachys buttleri R. Mill.	Per.	E.Medit.	End.	EN
Stachys germanica L. subsp. *bithynica* (Boiss.) Bhattacharjee	Per.	Euro-Sib.	-	-
Stachys tmolea Boiss.	Per.	E.Medit.	-	-
Teucrium polium L.	Per.	Euro-Sib.	End.	LR (Ic)
Teucrium pruinosum Boiss.	Per.	Ir.-Tur.	-	-
Thymus longicaulis C. Presl. subsp. *chaubardii* Jalas var. *chaubardii*	Per.	UPR.	-	-
Thymus zygioides Griseb. var. *lycaonicus* (Celak) Ronniger	Per.	E.Medit.	End.	LR (Ic)
Wiedemannia orientalis Fisch. and Mey.	Ann.	Ir.-Tur.	End.	LR (Ic)
Ziziphora clinopodioides Lam.	Per.	Ir.-Tur.	-	-
Liliaceae				
Allium orientale Boiss.	Per.	E.Medit.	-	-
Bellevalia tauri Feinbrun	Per.	E.Medit.	End.	LR (Ic)
Gagea granatellii (Parl.)	Per.	Medit.	-	-
Gagea pedunculoris (J. and C. Presl.) Pascher	Per.	Medit.	-	-
Muscari discolor Boiss. and Hausskn.	Per.	Ir.-Tur	End.	LR (cd)
Muscari neglectum Guss.	Per.	MR.	-	-
Ornithogalum nivale Boiss.	Per.	E.Medit.	End.	LR (Ic)
Ornithogalum pyrenaicum L.	Per.	MR.	-	-
Linaceae				
Linum tenuifolium L.	Per.	MR.	-	-
Malvaceae				
Alcea apterocarpa (Fenzl.) Boiss.	Per.	Ir.-Tur.	End.	LR (Ic)
Alcea pallida Waldst. and Kit.	Per.	MR.	-	-
Malva neglecta Wallr.	Per.	MR.	-	-
Malva sylvestris L.	Per.	MR.	-	-
Morinaceae				
Morina persica L.	Per.	Ir.-Tur.	-	-
Orchidaceae				
Dactylorhiza romana (Seb.) Soo. subsp. *romana*	Per.	Medit.	-	-
Orchis spitzelii Sauter ex W. Koch	Per.	Medit.	-	-
Papaveraceae				
Fumaria cilicica Hausskn.	Ann.	Ir.-Tur.	-	-
Glaucium flavum Crantz	Per.	MR.	-	-
Glaucium leiocarpum Boiss.	Per.	MR.	-	-
Hypecoum pendulum L.	Ann.	MR.	-	-
Hypecoum procumbens L.	Ann.	Medit.	-	-
Papaver spicatum Boiss. and Bal. var. *spicatum*	Per.	UPR.	End.	LR (Ic)
Papaver virchowi Aschers. and Sint. ex Boiss.	Ann.	UPR.	End.	LR (cd)

Table 1: Continue

Families and plant taxa	Length of life	Element region	Endemic condition	Threat categories
Plumbaginaceae				
Acantholimon acerosum (Willd.) Boiss. var. *brachystachyum* Boiss.	Per.	Ir.-Tur	End.	LR (Ic)
Poaceae				
Aegilops neglecta Req. ex Bertol.	Ann.	Medit.	-	-
Agrostis stolonifera L.	Per.	Euro-Sib.	-	-
Alopecurus myosuroides Hudson var. *myosuroides*	Ann.	Euro-Sib.	-	-
Arrhenatherum palaestinum Boiss.	Per.	E.Medit.	-	-
Avena sterilis L. subsp. *sterilis*	Ann.	MR.	-	-
Briza media L.	Per.	MR.	-	-
Bromus sterilis L.	Ann.	MR.	-	-
Bromus tectorum L.	Ann.	MR.	-	-
Bromus tomentellus Boiss.	Per.	Ir.-Tur.	-	-
Cynodon dactylon (L.) Pers. var. *dactylon*	Per.	MR.	-	-
Dactylis glomerata L. subsp. *hispanica* (Roth) Nyman	Ann.	E.Medit.	-	-
Eremopoa capillaris R. Mill.	Ann.	E.Medit.	-	-
Festuca ovina L.	Per.	Medit.	-	-
Hordeum murinum L. subsp. *glaucum* (Steudel) Tzvelev	Ann.	MR.	-	-
Hordeum murinum L. subsp. *murinum*	Ann.	MR.	-	-
Koeleria cristata (L.) Pers.	Per.	MR.	-	-
Lolium rigidum Gaudin var. *rigidum*	Ann.	MR.	-	-
Melica ciliata L. subsp. *ciliata*	Per.	MR.	-	-
Phalaris arundinacea L.	Per.	MR.	-	-
Phleum montanum C. Koch subsp. *serrulatum* (Boiss.) M. Doðan	Per.	E.Medit.	-	-
Poa pratensis L.	Per.	MR.	-	-
Poa psychrophila Boiss. and Heldr.	Per.	MR.	-	-
Poa speluncarum Edmondson	Ann.	E.Medit.	-	-
Rostraria cristata (L.) Tzvelev var. *cristata*	Ann.	MR.	-	-
Secale cereale L. var. *cereale*	Bia.	MR.	-	-
Stipa ehrenbergiana Trin. and Rupr.	Per.	Ir.-Tur.	-	-
Stipa pulcherrima C. Koch.	Per.	Ir.-Tur.	-	-
Taeniatherum caput-medusae (L.) Nevski subsp. *crinitum* (Schreber) Melderis	Per.	Ir.-Tur.	-	-
Zingeria pisidica (Boiss.) Tutin	Ann.	Ir.-Tur.	-	-
Polygonaceae				
Atraphaxis billardieri Jaub. and Spach. var. *billardieri*	Per.	Ir.-Tur.	-	-
Polygonum pulchellum Lois.	Ann.	UPR.	-	-
Rumex conglomeratus Murray	Per.	MR.	-	-
Ranunculaceae				
Adonis aestivalis L. subsp. *aestivalis*	Ann.	MR.	-	-
Adonis flammea Jacq.	Ann.	MR.	-	-
Adonis microcarpa DC.	Ann.	Medit.	-	-
Ceratocephalus falcatus (L.) Pers.	Ann.	MR.	-	-
Consolida glandulosa (Boiss. and Huet.) Bornm.	Ann.	Ir.-Tur	End.	LR (Ic)
Consolida orientalis (Gay) Schröd.	Ann.	Ir.-Tur	-	-
Consolida stenocarpa (Davis and Hossain) Davis	Ann.	Ir.-Tur	End.	LR (Ic)
Delphinium peregrinum L.	Ann.	E.Medit.	-	-
Delphinium venolosum Boiss.	Ann.	Ir.-Tur.	End.	LR (Ic)
Ranunculus argyreus Boiss.	Per.	MR.	-	-
Ranunculus brevifolius Ten.	Per.	MR.	-	-
Ranunculus cadmicus Boiss.	Per.	UPR.	-	-
Ranunculus cuneatus Boiss.	Per.	UPR.	-	-
Resedaceae				
Reseda lutea L. var. *lutea*	Per.	MR.	-	-
Rosaceae				
Cotoneaster nummularia Fisch. and Mey.	Per.	MR.	-	-
Crataegus monogyna Jacq. subsp. *monogyna*				
Crataegus orientalis Pallas ex Bieb. var. *orientalis*	Per.	MR.	-	-
Rosa canina L.	Per.	MR.	-	-
Rubus sanctus Schreber	Per.	MR.	-	-
Sorbus umbellata L. var. *umbellata* (Desf.) Fritsch	Per.	MR.	-	-
Rubiaceae				
Galium verum L. subsp. *verum*	Per.	Euro-Sib.	-	-
Scrophulariaceae				
Digitalis cariensis Boiss. ex Jaub. and Spach	Per.	E.Medit.	End.	LR (Ic)
Digitalis ferruginea L.	Per.	Euro-Sib.	-	-
Linaria corifolia Desf.	Per.	Ir.-Tur.	End.	LR (Ic)
Scrophularia canina L. subsp. *bicolor* (Sm.) Greuter	Per.	E.Medit.	-	-

Table 1: Continue

Families and plant taxa	Length of life	Element region	Endemic condition	Threat categories
Verbascum mucronatum Lam.	Bia.	E.Medit.	-	-
Verbascum natolicum (Fisch. and Mey.) Hub. and Mor.	Bia.	Ir.-Tur.	End.	LR (nt)
Verbascum pestalozzae Boiss.	Per.	E.Medit.	End.	EN
Verbascum salviifolium Boiss.	Per.	Ir.-Tur.	End.	LR (cd)
Veronica caespitosa Boiss. var. *caespitosa*	Per.	E.Medit.	End.	LR (lc)
Veronica campylopoda Boiss.	Ann.	Ir.-Tur.	-	-
Thymelaeaceae				
Daphne sericea Vahl	Per.	E.Medit.	-	-
Urticaceae				
Urtica dioica L.	Per.	Euro-Sib.	-	-
Zygophyllaceae				
Tribulus terrestris L.	Ann.	MR.	-	-

End. : Endemic
EN : Endangered
VU : Vulnerable
LR : Lower Risk
(cd) : Conservation dependent
(nt) : Near threatened
(lc) : Least concern
DD : Data Deficient
Ann. : Annual
Bia. : Biannual
Per. : Perennial

RESULTS AND DISCUSSION

In the study areas, total of 302 plant taxa, belonging to 43 families and 190 genera were encountered. Some characteristics of the taxa identified in the rangelands such as their plant families, lengths of lives, element regions, endemism conditions and IUCN risk categories are shown in Table 1. Among the 302 plant taxa identified in the study areas, 28, 39 and 234 of them belonged to the graminae, legume and other families, respectively. About 84 among these plants are annual; 3 of them are annual and biennial plants; 14 of the plants are biennial and 201 of them are perennial plants.

About 73 of the plant taxa were recorded as the element of the Mediterranean region; 64 taxa were recorded as the element of Irano-Turanian region; 17 of them were recorded as the element of Europe-Siberia region and 148 taxa were recorded as widespread or belonging to an unknown region (Table 2). Moreover, 82 plant taxa were endemic and the endemism ratio was calculated as 27.15%.

When these endemic species are evaluated according to IUCN (2001) risk categories, it can be observed that 8 of them falls into the category of Endangered (EN) while 4 of them is categorized as Vulnerable (VU) and 65 of the endemic species falls into the category of Least risk (LC) whereas 5 of them is classified in the Data Deficient (DD) category (Table 1) (IUCN, 2001; Ekim *et al*., 2000). The family that is represented with the most number of taxa

Table 2: Phytogeographic distribution of the plant taxa located in the study area

Phytogeographical region	No. of taxa	Rates (%)
Mediterranean	73	24.17
Irano-Turanian	64	21.19
Euro-Siberian	17	5.63
Multiregional or unknown phytogeographical region	148	49.01
Total	302	100.00

Table 3: The families with the most number of taxa at the species and subspecies level

Family	No. of taxa	Rates (%)
Asteraceae	41	13.58
Fabaceae	39	12.91
Lamiaceae	30	9.93
Poaceae	29	9.60
Brassicaceae	24	7.95
Other families	139	46.03
Total	302	100.00

with 41 taxa is the Asteraceae family. It is followed by Fabaceae, Lamiaceae and Poaceae families, respectively with 39, 30 and 29 taxa (Table 3).

The families that contain the most of number of genera, on the other hand can be listed, respectively as Asteraceae (27 genera), Poaceae (23 genera) and Brassicaceae (19 genera) families.

CONCLUSION

As a result of the study, the region of Isparta was observed to have a considerably rich flora with a total of 302 plants from 43 families and 190 genera. The fact that the rangelands in the field of study were located in the intersection zone of Mediterranean region and Irano-Turanian floristic regions and accordingly contained various topographical structures and climatic features had a significant effect on this diversity of plants in the region. Nonetheless, 77 taxa among the 82 endemic plant taxa identified in the rangelands within the field of study are threatened according to the IUCN (2001). The most significant factor causing this threat in the rangelands is encountered as early grazing and overgrazing. It was ascertained that the rangelands in Isparta region were

benefited 2-2.5 times exceeding its grazing capacity (Babalik, 2007). Thrusting animals, more in number than it can feed into the rangelands; these animals eating the grass together with their roots and practice of grazing during the period when these grass are newly growing and thus not fully developed, cause the extinction of vegetation that covers the surface of the soil and the decrease in the quality of rangelands (Balabanli *et al*., 2005). The endangered species, especially are eaten by the animals before they reach their seeding periods under the pressure of early and excessive grazing thus, their number decreases day by day and their generations are imperiled. For the protection of endemic and endangered plant species which are considered as natural heritages, there is a need for preventing the excessive and disorganized benefitting from the rangelands and in these regions:

- Grazing with the number of animals compatible with the grazing capacity of the rangeland
- Practice of grazing during the grazing season and duration
- Enabling the uniform distribution of animals in the rangeland
- Grazing with the animal species compatible with the rangeland are highly significant

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