

Important Medicinal-Aromatic Plant Species for Beekeeping in Isparta Region Rangelands

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Abstract: The study was carried out in rangelands of Isparta region in the years 2007-2008, in order to determine the plant species, which forms important source of income for the region and which also have medicinal-aromatic values that is important for beekeeping. As aim of this study, 1st of all the medicinal-aromatic plant species that are found in the rangelands of the region were detected. Totally 181 vascular plant taxa belonging to 25 families that are in condition of pollen and nectar source for bees were detected as a result of observations. The biggest family that is visited by the bees is *Lamiaceae* family with 48 taxa, followed by *Fabaceae* family with 35 taxa and *Asteraceae* family in the 3rd place with 29 taxa. In addition to this, when the flowering periods that is of great importance for beekeeping are taken into regard, April-June were determined to be the richest periods for flowering.

Key words: Beekeeping, medicinal-aromatic plants, flowering period, rangelands, Isparta, Turkey

INTRODUCTION

Beekeeping is an important branch of farming both in developed and in developing countries. By the year 2006, there are approximately 74 millions of bee hives and nearly 1.4 millions of honey is extracted from these hives. China is one of the most hives and produces the most honey with 7.4 million hives. China is followed by Turkey, Argentina, Ukraine and USA in honey production (Gunaydin, 2008).

Turkey has an important potential in means of rich plant existence, suitable ecology and colony existence. However, the sector cannot adequately make use of this natural source richness. However in 2007, Turkey's honey production in total was 74,000 ton, beeswax production was about 3.8 ton. The average honey capacity has 15-18 kg colony⁻¹, which is one 3rd of the value in those developed countries where beekeeping is improved. There have been rise of 20% in honey production in the period of 2000-2007 (Gunaydin, 2008).

Rangelands among natural sources are in the 1st place when their importance in ecological system, their place in animal breeding, their role in erosion prevention, their condition of being biodiversity and gene center are taken into regard. Rangelands have the importance to be the cheapest place that supply roughage, which is needed for animals. In addition to these, rangelands have also many other features, such as; creating biological diversity, being gene source for cultivar, providing habitat for wild animals, protecting the land from erosion functioning as a shield (Acikgoz, 2001).

Table 1: Amount of honey and bee hive production in Isparta province (CED, 2008)

Country	No. bee hive		Honey production (kg)
	Old type	New type	
Merkez	20	4230	42300
Aksu	0	1170	11700
Atabey	0	205	1230
Egirdir	0	3445	28860
Gelendost	20	1650	19800
Gönen	15	830	11570
Keçiborlu	0	1400	28000
Senirkent	0	300	1200
Sütçüler	40	2643	26830
S. Karaagaç	0	4100	65600
Uluborlu	0	480	2800
Yalvaç	10	3150	50400
Y. Bademli	0	500	5000
Total	105	24103	295290

Rangelands forming out of many different plant species are also very important lands for beekeeping sector. Because the plant species found in these areas are in the condition of pollen and nectar source for the bees. Especially The Lakes District where the study has carried out is one of the important areas in country in biological diversity and plant richness. A meadow-rangeland area in total is 82.869 ha in Isparta, which is located in The Lakes District (TKB, 2003). In these areas, especially in rangelands in high points beekeeping together with livestock is an important source of income. As a matter of fact, honey production in 2008 in Isparta and dispersion of old and new hive numbers compare to counties are given in Table 1.

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In this study, detection of plants which are pollen and nectar source that have medicinal and aromatic values and are important for beekeeping is aimed. In this context, plants which have medicinal and aromatic values in the regions were picked, identified and were tried to determine those, which are sources of pollen and nectar for honeybees.

MATERIALS AND METHODS

The study was carried out in the years 2007-2008, in Isparta region rangelands (Davraz Mountain Kulova Plateau (1650 m), Kayi Village Rangeland (1400 m), Sutculer Kizilalan Rangelands (1100-1400 m), Sogut Highland Rangeland (900-1100 m), Candir Rangelands (350 m), Asagigokdere Village Rangelands (250 m) (Fig. 1). The study was carried out in the vegetation periods between March and November every 2 years and flora scanning was done in rangelands that have different topographic structure 2 times a month (biweekly). Observing the flowery plants that have medicinal aromatic features bees were detected whether

they have visited these plants or not. Samples were taken from the plants, which are visited by bees. The collected plant taxa were dried according to herbarium techniques, numbered and recorded to the field notebook. Since, the plants flower in different times, same places were visited at different times and samples were taken from plants that flower at different times. Moreover, digital photos of collected plant taxa were taken.

After species detection was done on plants, which were taken to herbarium, they were identified according to being whether or not medicinal-aromatic plants (Davis, 1965-1985; Davis *et al.*, 1988; Guner *et al.*, 2000). All of the plant species were kept at the herbarium of Faculty of Forestry, Süleyman Demirel University. The important ones for beekeeping of all these plant taxa were listed alphabetically according to their flowering period and endemic condition. Threatened categories were proposed for endemic and some non endemic taxa according to IUCN risk categories (Table 2) (IUCN, 2001; Ekim *et al.*, 2000).

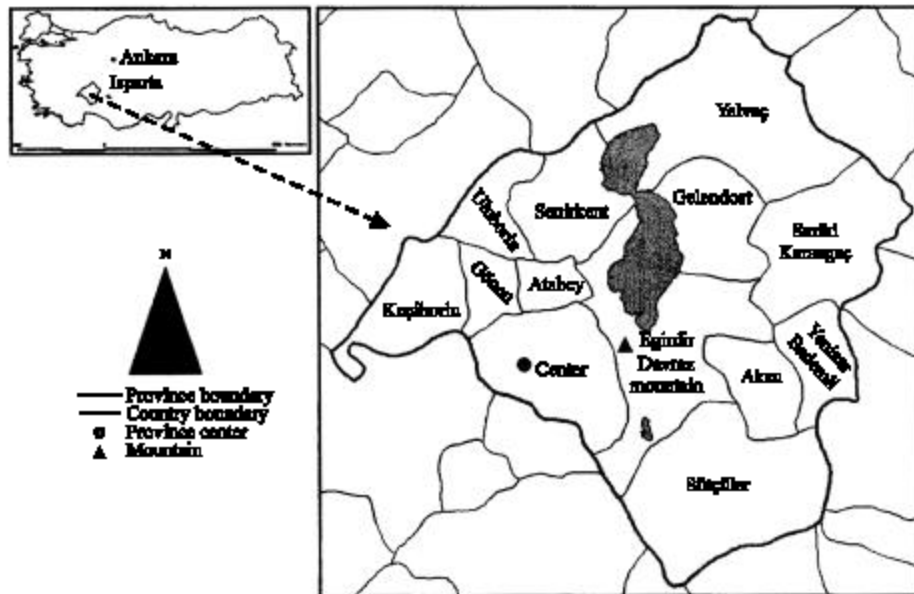


Fig. 1: Research area

Table 2: Important of medicinal aromatic plants for beekeeping and their some of valuable features

Family	Species	Flowering period	Endemic condition
Anacardiaceae	<i>Cotinus coggia</i> Scop.	May-June	-
	<i>Pistacia terebinthus</i> L. subsp. <i>pakistanica</i> (Boiss.) Engler	May-June	-
	<i>Rhus coriaria</i> L.	May-June	-
Apiaceae	<i>Bupleurum rotundifolium</i> L.	June-July	-
	<i>Falcaria vulgaris</i> Bernh.	May-July	-
Asteraceae	<i>Achillea kotschy</i> Boiss. subsp. <i>kotschy</i>	May-July	-
	<i>Artemis cretica</i> L. subsp. <i>casia</i> (Boiss.) Grierson	May-July	-
	<i>A. cretica</i> L. subsp. <i>leucanthemoides</i> (Boiss.) Grierson	May-July	-

Table 2: Continue

Family	Species	Flowering period	Endemic condition
	<i>A. tinctoria</i> L. var. <i>tinctoria</i>	May-July	-
	<i>Artemisia campestris</i> L.	June-July	-
	<i>Bellis perennis</i> L.	June-July	-
	<i>Calendula arvensis</i> L.	April-May	-
	<i>Cardus nutans</i> L.	May-June	-
	<i>Centaurea pulchella</i> Ledeb.	July-August	-
	<i>C. solstitialis</i> L. subsp. <i>solstitialis</i>	July-August	-
	<i>C. urvillei</i> DC. subsp. <i>urvillei</i>	July-August	-
	<i>Chondrilla juncea</i> L. var. <i>juncea</i>	July-August	-
	<i>Cichorium intybus</i> L.	June-July	-
	<i>Conyza canadensis</i> (L.) Cronquist.	June-July	-
	<i>Crepis alpina</i> L.	May-June	-
	<i>Echinops viscosus</i> DC. var. <i>bithynicus</i> (Boiss.) Rech.	July-August	-
	<i>Helichrysum plicatum</i> DC. subsp. <i>plicatum</i>	June-July	-
	<i>Inula anatolica</i> Boiss.	June-July	E, LR (Ic)
	<i>Lactuca serriola</i> L.	July-August	-
	<i>Matricaria chamomilla</i> L.	May-June	-
	<i>Onopordum carduchorum</i> Bomm. and Beauverd.	July-August	-
	<i>Picnomon acarna</i> (L.) Cass.	May-June	-
	<i>Ptilostemon chamaepeuce</i> (L.) Less.	May-June	-
	<i>Senecio vulgaris</i> L.	April-May	-
	<i>Silybum marianum</i> (L.) Gaertn	May-June	-
	<i>Sonchus asper</i> (L.) Hill.	April-May	-
	<i>Taraxacum syriacum</i> Boiss.	March-April	-
	<i>Tussilago farfara</i> L.	March-April	-
	<i>Xanthium spinosum</i> L.	June-July	-
Berberidaceae	<i>Berberis crataegina</i> DC.	May-June	-
Boraginaceae	<i>Anchusa azurea</i> Miller	May-June	-
	<i>Echium vulgare</i> L.	June-July	-
	<i>Moltkia aurea</i> Boiss.	April-May	E, LR (Ic)
	<i>Myosotis arvensis</i> (L.) Hill.	April-May	-
	<i>M. refracta</i> Boiss. subsp. <i>refracta</i>	April-May	-
	<i>Onosma aucheranum</i> DC.	April-June	-
Brassicaceae	<i>Arabis ionocalyx</i> Boiss.	April-May	-
	<i>Capsella bursa-pastoris</i> (L.) Medik.	April-June	-
	<i>Cardaria draba</i> (L.) Desv. subsp. <i>draba</i>	May-July	-
	<i>Diplotaxis tenuifolia</i> (L.) DC.	June-Sept.	-
	<i>Erophila verna</i> (L.) Chevall. subsp. <i>verna</i>	March-April	-
	<i>Erysimum kotschyianum</i> Gay	May-June	E, LR (Ic)
	<i>Iberis attica</i> Jord.	March-April	-
	<i>Sinapis arvensis</i> L.	April-June	-
	<i>Sisymbrium altissimum</i> L.	March-May	-
	<i>Thlaspi perfoliatum</i> L.	May-June	-
Cistaceae	<i>Cistus creticus</i> L.	March-June	-
	<i>C. salvifolius</i> L.	March-June	-
Campanulaceae	<i>Asyneuma rigidum</i> (Willd.) Grossh. subsp. <i>sibthorpiatum</i>	June-July	E, LR (Ic)
	<i>Campanula lyrata</i> Lam. subsp. <i>lyrata</i>	May-June	E, LR (Ic)
Caryophyllaceae	<i>Arenaria deflexa</i> Dec. subsp. <i>microsepala</i> McNeill	May-June	-
	<i>Bolanthus minuartioides</i> (Jaub. and Spach) Hub. -Mor.	May-June	E, LR (Ic)
	<i>Holosteum umbellatum</i> L. var. <i>umbellatum</i>	March-April	-
	<i>Minuartia hybrida</i> (Vill.) Schischk. subsp. <i>hybrida</i>	April-June	-
	<i>Petrohragia hispidula</i> (Boiss. and Heldr.) Ball and Heywood	June-July	E, VU
	<i>Saponaria pumilio</i> Boiss.	April-June	-
	<i>Silene armena</i> Boiss. var. <i>armena</i>	May-June	E, LR (Ic)
	<i>S. leptoclada</i> Boiss.	May-June	E, LR (nt)
	<i>S. tunicoides</i> Boiss.	May-June	E, LR (nt)
	<i>S. vulgaris</i> (Moench) Garcke var. <i>vulgaris</i>	April-May	-
Convolvulaceae	<i>Convolvulus arvensis</i> L.	May-June	-
	<i>C. lineatus</i> L.	May-June	-
Ericaceae	<i>Arbutus andrachne</i> L.	April-May	-
	<i>Erica manipuliiflora</i> Salisb.	Sept. -Nov.	-
Fabaceae	<i>Astragalus gymnolobus</i> Fisher	May-June	E, LR (Ic)
	<i>A. oxytropifolius</i> Boiss.	May-July	-
	<i>A. vulnerariae</i> DC.	June-July	E, LR (Ic)
	<i>Coronilla emerus</i> L. subsp. <i>emeroides</i> (Boiss. and Sprun.) Uhrova	May-June	-
	<i>C. varia</i> L. subsp. <i>varia</i>	May-June	-
	<i>Ceratonia siliqua</i> L.	May-June	-
	<i>Cercis siliquastrum</i> L.	April-June	-
	<i>Cohutea melanocalyx</i> Boiss. and Heldr. subsp. <i>davisiana</i> (Brawicz) Chamb.	May-July	E, LR (Ic)

Table 2: Continue

Family	Species	Flowering period	Endemic condition
	<i>Genista acanthoclada</i> DC.	May-July	-
	<i>Glycyrrhiza asymmetrica</i> Hub.-Mor.	June-July	E, VU
	<i>G. glabra</i> L. var. <i>glandulifera</i> (Waldst. and Kit.) Boiss.	June-July	-
	<i>Hedysarum varium</i> Willd.	June-July	-
	<i>Lathyrus hirsutus</i> L.	April-May	-
	<i>Lotononis genistoides</i> (Fenzl.) Benth.	May-June	-
	<i>Lotus corniculatus</i> L. var. <i>temuifolius</i> L.	June-July	-
	<i>Melilotus officinalis</i> L.	June-Sept.	-
	<i>M. sativa</i> L. subsp. <i>sativa</i>	May-Sept.	-
	<i>Medicago orbicularis</i> (L.) Bart	May-Sept.	-
	<i>M. minima</i> (L.) Bart. var. <i>minima</i>	May-Sept.	-
	<i>M. polymorpha</i> L. var. <i>polymorpha</i>	May-Sept.	-
	<i>Onobrychis caput-galli</i> (L.) Lam.	May-August	-
	<i>Ononis spinosa</i> L. subsp. <i>leiosperma</i> (Boiss.) Sirj.	May-June	-
	<i>Robinia pseudo-acacia</i> L.	April-June	-
	<i>Spartium junceum</i> L.	April-June	-
	<i>Trifolium campestre</i> Schreb.	May-July	-
	<i>T. echinatum</i> Bieb.	May-July	-
	<i>T. globosum</i> L.	May-July	-
	<i>T. hirtum</i> All.	May-July	-
	<i>T. pratense</i> L. var. <i>pratense</i>	May-July	-
	<i>T. repens</i> L. var. <i>repens</i>	May-July	-
	<i>T. scabrum</i> L.	May-July	-
	<i>Vicia cracca</i> L. subsp. <i>stenophylla</i> Vel.	May-August	-
	<i>V. peregrina</i> L.	May-August	-
	<i>V. sativa</i> L. subsp. <i>nigra</i> (L.) Ehrh. var. <i>nigra</i>	May-August	-
	<i>V. sativa</i> L. subsp. <i>sativa</i>	May-August	-
Hyperaceae	<i>Hypericum perforatum</i> L.	May-July	-
	<i>H. scabrum</i> L.	May-July	-
Lamiaceae	<i>Ajuga chamaepitys</i> (L.) Schreber subsp. <i>chia</i> (Schreber) Arcangeli var. <i>chia</i>	April-May	-
	<i>Ballota nigra</i> L. subsp. <i>anatolica</i> Davis (1965-1985)	May-June	E, LR (lc)
	<i>Calamintha nepeta</i> (L.) Savi. subsp. <i>nepeta</i>	Sept.-Nov.	-
	<i>Clinopodium vulgare</i> L. subsp. <i>arundanum</i> (Boiss.) Nyman	July-August	-
	<i>Lamium album</i> L.	April-June	-
	<i>L. amplexicaule</i> L.	April-June	-
	<i>L. maculatum</i> L. var. <i>maculatum</i>	April-May	E
	<i>L. purpureum</i> L.	April-June	-
	<i>Lavandula stoechas</i> L. var. <i>stoechas</i>	May-July	-
	<i>Marrubium globosum</i> Montbret and Aucher ex Bentham subsp. <i>globosum</i>	July-August	E, LR (lc)
	<i>M. vulgare</i> L.	July-August	-
	<i>Melissa officinalis</i> L. subsp. <i>altissima</i> (Sm.) Arcangeli	May-June	-
	<i>Mentha longifolia</i> (L.) Hudson subsp. <i>typhoides</i> Brig.	May-July	-
	<i>M. pulegium</i> L.	July-August	-
	<i>Micromeria myrtifolia</i> Boiss. and Hohen.	May-June	-
	<i>Nepeta cadmea</i> Boiss.	April-May	E, LR (lc)
	<i>Origanum majorana</i> L.	May-June	-
	<i>O. minutiflorum</i> O. Schwarz and P.H. Davis	July-August	E, LR (nt)
	<i>O. onites</i> L.	May-June	-
	<i>O. vulgare</i> L. subsp. <i>hirtum</i>	July-August	-
	<i>Phlomis armeniaca</i> Willd.	June-July	E, LR (lc)
	<i>P. grandiflora</i> H.S. Thompson var. <i>grandiflora</i>	April-June	-
	<i>P. lunariifolia</i> Sm.,	April-May	-
	<i>P. pungens</i> Willd. var. <i>pungens</i>	May-June	-
	<i>Prunella orientalis</i> Borrm.	June-July	-
	<i>P. vulgaris</i> L.	June-July	-
	<i>Rosmarinus officinalis</i> L.	June-Sept.	-
	<i>Salvia frigida</i> Boiss.	May-June	-
	<i>S. sclarea</i> L.	May-June	-
	<i>S. tomentosa</i> Miller	May-June	-
	<i>S. verticillata</i> L. subsp. <i>amasiaca</i> (Freyn and Borrm.) Borrm	May-June	-
	<i>S. viridis</i> L.	April-May	-
	<i>Satureja thymbra</i> L.	May-July	-
	<i>Sideritis condensata</i> Boiss. and Heldr. apud Bentham	June-July	E, LR (cd)
	<i>S. curvicens</i> Stapf	June-July	-
	<i>S. lanata</i> L.	June-July	-
	<i>S. libanotica</i> Labill. subsp. <i>linearis</i> (Bentham) Borrm	June-July	E, LR (lc)
	<i>S. pisidica</i> Boiss. and Heldr.	June-July	E, LR (nt)
	<i>Stachys cretica</i> L. subsp. <i>vacillans</i> Rech	April-May	-
	<i>S. lavandulifolia</i> Vahl var. <i>lavandulifolia</i>	April-May	-

Table 2: Continue

Family	Species	Flowering period	Endemic condition
	<i>S. tmolea</i> Boiss.	May-June	E, LR (Ic)
	<i>Teucrium chamaedrys</i> L. subsp. <i>chamaedrys</i>	April-July	-
	<i>T. polium</i> L.	May-July	-
	<i>Thymbra spicata</i> L. var. <i>spicata</i>	June-Sept.	-
	<i>Thymus longicaulis</i> C. Presl subsp. <i>chaubardii</i> var. <i>antalyanus</i> (Klokov) Jalas	June-Sept.	E, LR (nt)
	<i>T. revolutus</i> Celak	June-Sept.	E, VU
	<i>Wiedemannia orientalis</i> Fisch. and Mey.	June-July	E, LR (Ic)
	<i>Ziziphora capitata</i> L.	June-August	-
Malvaceae	<i>Alcea calvertii</i> (Boiss.) Boiss.	May-June	E, LR (Ic)
	<i>Aithaea cannabina</i> L.	April-May	-
	<i>Malva sylvestris</i> L.	April-June	-
Papaveraceae	<i>Papaver rhoeas</i> L.	April-May	-
	<i>Glaucium flavum</i> Crantz.	May-June	-
	<i>G. leiocarpum</i> Boiss.	March-May	-
	<i>Hypecoum procumbens</i> L.	April-May	-
Plumbaginaceae	<i>Acantholimon acaesum</i> (Willd.) Boiss. var. <i>brachystachyum</i> Boiss.	June-July	E, LR (Ic)
Polygonaceae	<i>Atraphaxis billardieri</i> Jaub. and Spach. var. <i>billardieri</i>	May-June	-
Ranunculaceae	<i>Anemone coronaria</i> L.	April-May	-
	<i>Consolida orientalis</i> (Gay) Schröd.	May-June	-
	<i>Delphinium peregrinum</i> L.	June-July	-
Rosaceae	<i>Amygdalus communis</i> L.	March-April	-
	<i>Crataegus monogyna</i> subsp. <i>azarella</i> (Gris.) Franco.	May-June	-
	<i>C. orientalis</i> Palas ex Bieb.	May-June	-
	<i>Malus sylvestris</i> Mill. subsp. <i>orientalis</i> (A.Uglit) Brow.	May-June	-
	<i>Prunus spinosa</i> L.	April-May	-
	<i>Pyrus elaeagnifolia</i> Pallas	May-June	-
	<i>Rosa canina</i> L.	May-June	-
	<i>Rubus sanctus</i> Schreber	May-July	-
Rubiaceae	<i>Galium verum</i> L. subsp. <i>verum</i>	May-June	-
Thymelaeaceae	<i>Daphne sericea</i> Vahl.	March-May	-
Scrophulariaceae	<i>Verbascum pestalozzae</i> Boiss.	July-Sept.	E, EN
	<i>Veronica caespitosa</i> Boiss. var. <i>caespitosa</i>	April-May	E, LR (Ic)
Verbenaceae	<i>Vitex agnus-cactus</i> L.	June-Sept.	-
Zygophyllaceae	<i>Tribulus terrestris</i> L.	June-Sept.	-

RESULTS AND DISCUSSION

In the study area, 181 plant taxa belonging to 25 families that have medicinal and aromatic features were determined (Table 2).

The biggest family that is visited by the bees is *Lamiaceae* family with 48 taxa, followed by *Fabaceae* family with 35 taxa and *Asteraceae* family in the 3rd place with 29 taxa (Table 3). In addition to this, April-June were determined to be the richest periods for flowering.

It was seen that Isparta region rangelands has a rich flora and medicinal-aromatic plants have important place in this flora. *Lamiaceae* family, rich in terms of medicinal and aromatic plants was also pointed out to be important for beekeeping. In addition to this, *Fabaceae* and *Asteraceae* families were known to be important for beekeeping too. It would be advantageous to move the bee hives to the places where these plants are abundant where migratory beekeeping is spread.

As for time, the bee hives are most suitable to be placed on low altitude regions when flowering just begins at the end of March and beginning of April and to places where flowering begins late in mountainous regions with high altitude in months May and June.

Table 3: Separation families of important medicinal aromatic plants for beekeeping

Family	Plant taxa
<i>Lamiaceae</i>	48
<i>Fabaceae</i>	35
<i>Asteraceae</i>	29
<i>Caryophyllaceae</i>	10
<i>Rosaceae</i>	8
Other families	51

As a result of the studies, *Erica manipuliflora*, which spread over a lowland in the region was known to be the most visited plant by bees. In addition to this, *Arbutus andrachne*, *Daphne sericea* and *Corronilla varia* were the other species that were mostly visited by bees. In the high elevations; *Astragalus* sp., *Phlomis armeniaca* and *Trifolium* sp. were the most visited plants by bees.

Rangelands in Isparta region are known to be provided over 2-2.5 more than its grazing capacity (Babalik, 2007). Placing the animals more than, it can handle in rangelands, these animals eating grass with its roots, grazing in months when there are fresh grass and when grazing just begins causes the flora to disappear and rangeland quality to deteriorate (Balabanli *et al.*, 2005). According to the study of Babalik and Fakir (2007),

it was pointed out that in rangelands where over-grazing was carried out in Isparta region, stooling capacity of bush species blinds and leaf length, width and petiole length and lob depth values have reduced relative to non-grazed areas, moreover, these species did not flower and therefore, did not fertilize and there are dryings in bush species. Moreover, in the areas where grazing was intensive there were apertures in patches and erosion force was observed as rising.

As a result of this early grazing and over grazing and erosion following these, biodiversity is getting low and low in Isparta region and medicinal and aromatic plants are effected from this situation. It can be clearly realized that rangelands which are highly sensitive ecosystems in this situation are ruined ecologically. The foremost sectors, which are harmed from this are beekeeping and livestock.

Especially in the places, where the goat population is dense and there is natural deterioration in ecosystems, animal owners should be given alternative sources of income (Kucukaydin, 2005), the compulsion of getting income only from ovine breeding should be abolished and beekeeping facilities should be supported. Moreover locals should be educated and informed about grazing and beekeeping. In addition to this, while grazing planning, grazing capacities of rangelands should be detected and flowering periods of medicinal and aromatic rangelands plants, which are important for beekeeping should be taken into regard. On condition of these plans taken to regulation, this will provide big supports to beekeeping in this region.

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