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TRADITIONAL HONEY PRODUCTION AND BEE FLORA OF ESPIYE, TURKEY

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Keywords: Bee flora; Honeybee; Espiye; Turkey.

Abstract

This paper presents potential honey bee plants in Espiye (Giresun) which can be considered as a guide for beekeepers and researchers. A total of 149 taxa belonging to 125 genara and 48 families were recorded as pollen and nectary sources for honey bee colonies at Espiye (Giresun) region. Among the recorded taxa 58 were Phanerophytes, 57 taxa Hemicryptophytes, 19 taxa Therophytes, 13 taxa Cryptophytes and 2 taxa Chamaephytes. Updated nomenclature along with the families, local names, life form, flowering period and ecological status have been furnished under 94 herbs, 28 shrubs and 27 trees.

Introduction

Turkey is one of the countries where the honey production is at the highest level in the World (Özturk and Erkan, 2010). In the recent past, the forest area in Turkey has increased from 20.2 million/ ha to 22.3 million/ha between 1973 and 2015 (OGM, 2013-2015). Very recently, the Forest General Directorate has started to implementing the honey action plan to promote honey production and contribute to rural development (OGM, 2013-2015). As part of the action plan, up to 356 honey forests have been established and now, Turkey is in the second row in the world's honey production and beekeeping.Turkey produces 92% of the world's pine honey, specifically in its West Mediterranean and South Aegean regions. In Turkey, there are 57,000 registered beekeepers and 6.6 million registered hives as of 2014 (Duyum and Friedman, 2015). Sıralı (2009) reported about 300 species of natural or cultivated nectar plants from Turkey comprising about 75% of the nectar plant species in the world.

The botanic origin of honey is one of the most important parameters of honey quality (Tucak *et al.*, 2000, 2004). The taste, smell and colour of honey are changed according to the nectar of the flowers. In nature, bees visit flowers to produce honey and to take food and they collect pollen, nectar or both from plants during their visit to plants. Nectar is found in the special part of some flowers or in other organs (stem, leaves etc.). Bees visit definite organs of some herbacous and lingeous plants to collect components of honey. Therefore, bee plants can not be determined only by palynologcal studies in honey (Tew, 1998; Tutkun, 2000).

Turkey is the home of three phyto-geographic regions (Euro-Siberian, Mediterranean and Irano-Turanian) in terms of plant geography. Each floristic region has its own plant composition and this affects the variety, quality and authenticity of the produced honey. Furthermore, honey production in Turkey has increased to 114.471 tonnes from 54.655 tonnes in the period from 1991 to 2017 (TUİK, 2018). However, no studies on bee plants have been made in Espiye, Giresun so far. Proper taxonomic identity of bee plants of the country, more particularly in Espiye is lacking.

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Therefore, the present study aimed at producing a bee flora of Espiye, Giresun and preparing a database which will not only contribute to honey producers but also contribute greatly to the determination of honey contents.

Materials and Methods

Espiye (Giresun) is situated in the Eastern Black Sea Region (costal and inner parts), surrounded by the Gorele and Tirebolu in the east, Güce and Alucra in the South, Yağlıdere and Keşap in the west and by Black Sea in the North (Fig. 1). Espiye is located between $140^{0}44'14"$ to $40^{0}58'27"$ N and $38^{0}37'11"$ to $38^{0}48'39"$ E with an area of c. 21,100 ha. The altitude of the study area is 1600 m asl. Approximately 2,500 species have been recorded in the region and this region hosts about 28% of Turkey's flora (Dokap, 2000). Since there is no meteorological station in Espiye, the climatic data of Giresun were taken into consideration. The annual average rainfall of Giresun is 1,288.4 mm and the average temperature is 14.6 °C (Table 1). The climate type of the area is humid based on Thornthwaite climate classification (TSMS, 2017).

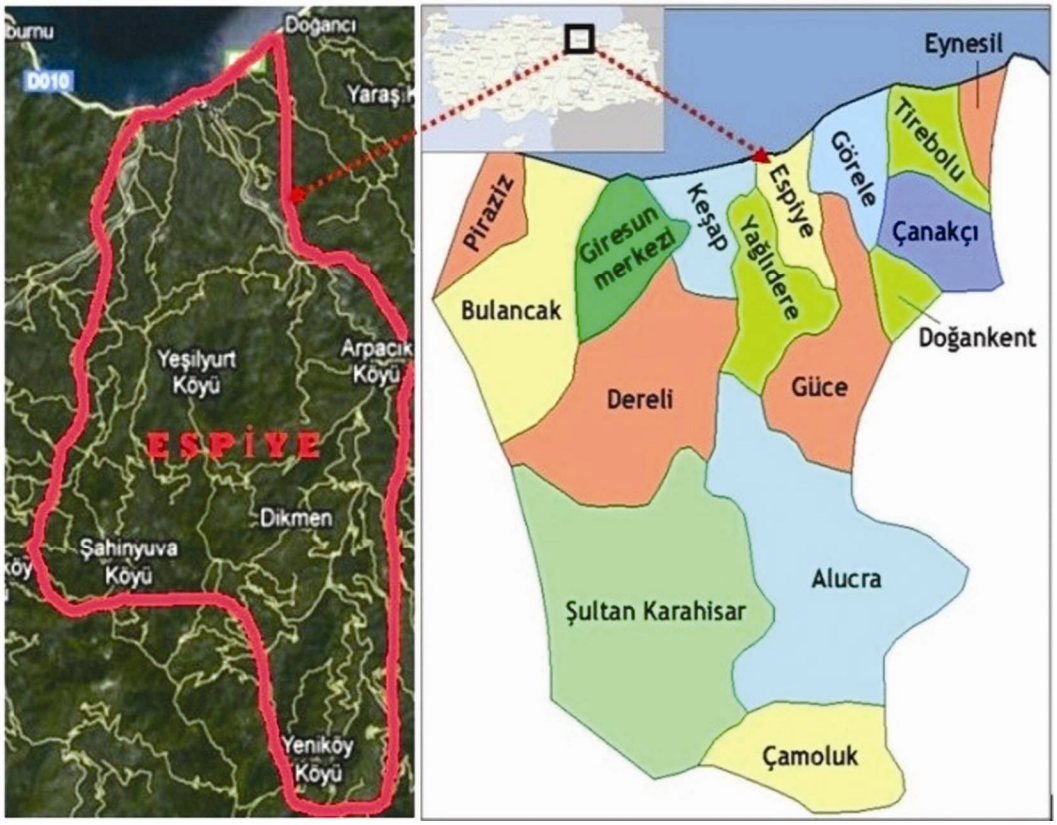

Fig. 1. Map of the study area Espiye, Giresun.

Extensive field surveys were conducted over four years from 2012 to 2016 in the villages and rural areas of Espiye (Giresun) region in different seasons. Field visits were made along with beekeepers and a total of 17 beekeepers over middle age were interviewed to collate information on the bee plants. Abundance and density of the bee and bee plant populations were observed in

the field. Plant samples were collected from the field and the collected specimens were critically studied and identified. Identifications were confirmed using the Flora of Turkey and the East Aegean Islands, and List of Turkish Plants (Davis, 1965-1985; Davis *et al.*, 1988; Güner *et al.*, 2000, 2012). Life forms of these plants were identified according to the Raunkiaer's system (Raunkiaer, 1937). The families are arranged alphabetically and the taxa under each family are placed in an alphabetical order. The voucher specimens have been preserved in Giresun University Herbarium.

Table 1. Average climate values of Giresun Meteorology Station (1929-2016).

Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Temperature (°C)	7.2	7.1	8.0	11.3	15.5	20.1	22.7	23.1	22.0	16.2	12.6	9.4	14.6
Rainfall (mm)	127.5	101.5	97.5	76.1	66.8	77.5	79.4	89.5	129.2	164.7	151.9	126.8	1,288.4

Result and Discussion

A total of 149 plant taxa belonging to 125 genera and 48 families were identified as bee plants (Table 2). Among the identified taxa herbs are represented by 94 taxa, shrubs by 28 and trees by 27 taxa. Asteraceae and Fabaceae are the largest families represented by 17 taxa each, followed by Rosaceae with 15 taxa, Lamiaceae with 12 taxa and Ericaceae with 6 taxa (Fig. 2).

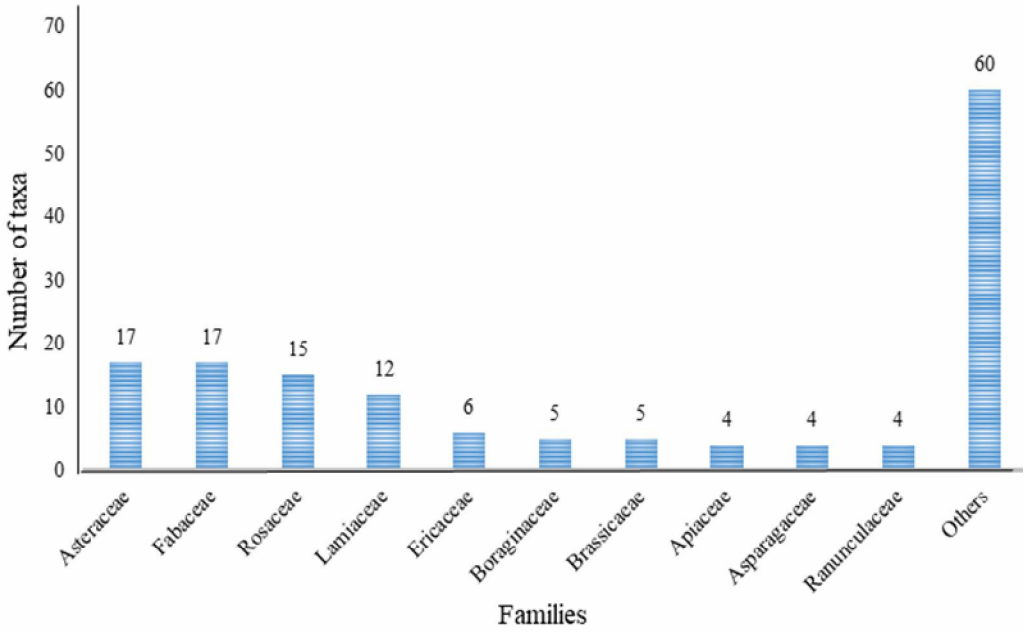

Fig. 2. Distribution of bee plants according to family showing the number of taxa.

The present study revealed that in the study area, 58 taxa are Phanerophytes, 57 taxa Hemicryptophytes, 19 taxa Therophytes, 13 taxa Cryptophytes and 2 taxa are Chamaephytes.

Table 2. Bee plants of Espiye region along with Turkish name, life form, flowering period, status and vouchers.

Name of the taxa	Turkish name	Life form	Flowering period	Status	Voucher specimen
Adoxaceae					
Sambucus nigra L.	Ağaç mürver	Ph	4-7	Natural	MK 939
Aizoaceae					
Mesembryanthemum cordifolium L. f.	Buz çiçeği	Ch	5-9	Ornamental	MK 904
Apiaceae					
Daucus carota L.	Yabani havuç	H	4-8	Natural	MK 857
Foeniculum vulgare Mill.	Rezene	H	5-9	Natural	MK 870
Pimpinella anisum L.	Anason	Th	6-8	Cultivation	MK 913
Smyrnium olusatrum L.	Deli kereviz	H	3-5	Natural	MK 943
Araliaceae					
Hedera helix L.	Duvar sarmaşığı	Ch	8-9	Natural	MK 875
Asparagaceae					
Hyacinthus orientalis L. subsp. *orientalis*	Sümbül	Cr	3-5	Ornamental	MK 878
Muscari armeniacum Leich. *ex* Baker	Gavurbaşı	Cr	3-5	Natural	MK 905
Ornithogalum oligophyllum E.D. Clarke	Kurt soğanı	Cr	4-7	Natural	MK 908
Scilla bifolia L.	Orman sümbülü	Cr	3-6	Natural	MK 940
Asteraceae					
Artemisia vulgaris L.	Kaba yavşan	H	6-9	Natural	MK 828
Bellis perennis L.	Koyungözü	H	3-8	Natural	MK 825
Bidens tripartita L.	Üç suketeni	Th	7-9	Naturalized	MK 830
Calendula officinalis L.	Aynısafa	Th	1-6	Ornamental	MK 832
Cichorium inthybus L.	Hindiba	H	4-9	Natural	MK 842
Cirsium arvense (L.) Scop.	Köygöçüren	H	5-10	Natural	MK 843
Cosmos bipinnatus Cav.	Meksika Yıldızı	Th	6-10	Ornamental	MK 851
Cota tinctoria (L.) J. Gay	Boyacı papatyası	H	6-7	Natural	MK 852
Dimorphotheca ecklonis DC.	Bodrum papatyası	H	4-6	Ornamental	MK 859
Erigeron annuus (L.) Pers.	Hemşin şifaotu	Th	6-9	Naturalized	MK 866
Eupatorium cannabinum L.	Koyuntırpağı	H	7-10	Natural	MK 869
Helichrysum plicatum DC. subsp. *plicatum*	Mantuvar	H	6-8	Natural	MK 876
Lapsana communis L. subsp. *intermedia* (M. Bieb.) Hayek	Şebrek	H	5-10	Natural	MK 888
Solidago virgaurea L. subsp. *virgaurea*	Altınbaşak çiçeği	H	7-9	Natural	MK 944
Sonchus asper (L.) Hill subsp. *glaucescens* (Jord.) Ball.	Gevirtlek	H	3-8	Natural	MK 945
Taraxacum laxum Hagl.	Gevşek çıtlık	H	4-8	Natural	MK 949
Tussilago farfara L.	Öksürükotu	Cr	3-4	Natural	MK 956
Begoniaceae					
Begonia cucullata Willd.	Bahçe begonyası	H	7-1	Ornamental	MK 827
Berberidaceae					
Berberis vulgaris L.	Kızılkaramuk	Ph	5-6	Natural	MK 829
Betulaceae					
Alnus glutinosa (L.) Gaertn. subsp. *barbata* (C.A. Mey.) Yalt.	Kızılağaç	Ph	2-4	Natural	MK 823

Table 2 (Contd.)

Name of the taxa	Turkish name	Life form	Flowering period	Status	Voucher specimen
Corylus avellana L. var. *avellana*	Fındık	Ph	2-3	Natural	MK 850
C. maxima Mill.	Tombul fındık	Ph	3	Cultivation	MK 849
Bignoniaceae					
Campsis radicans (L.) Seem.	Acem borusu	Ph	4-7	Ornamental	MK 836
Boraginaceae					
Cynoglossum creticum Mill.	Pisiktetiği	H	3-7	Natural	MK 856
Echium angustifolium Mill.	Agres	H	3-8	Natural	MK 863
E. vulgare L. subsp. *vulgare*	Engerek otu	H	5-9	Natural	MK 862
Myosotis laxa Lehm. subsp. *caespitosa* (Schultz) Hyl. *ex* Nordh.	Hüthütgözü	H	5-8	Natural	MK 906
Trachystemon orientalis (L.) G. Don	Kaldirik	Cr	3-5	Natural	MK 951
Brassicaceae					
Barbarea vulgaris R. Br. subsp. *vulgaris*	Nicarotu	H	4-5	Natural	MK 826
Brassica oleracea L.	Lahana	H	5-6	Cultivation	MK 831
Cardamine impatiens L. subsp. *impatiens*	Sultan kodimotu	Th	6-8	Natural	MK 837
C. quinquefolia (M. Bieb.) Schmalh.	Hanımgömleği	H	3-5	Natural	MK 838
Eruca vesicaria (L.) Cav.	Roka	Th	3-5	Cultivation	MK 868
Caprifoliaceae					
Lonicera japonica Thunb.	Japon hanımeli	Ph	4-7	Naturalized	MK 894
L.orientalis Lam.	Has çakkana	Ph	5-7	Natural	MK 895
Weigela floribunda C.A. Mey.	Gelin tacı	Ph	5-6	Ornamental	MK 963
Cistaceae					
Cistus creticus L.	Laden	Ph	3-6	Natural	MK 844
C. salviifolius L.	Kartli	Ph	3-5	Natural	MK 845
Commelinaceae					
Tradescantia fluminensis Vell.	Ak telgrafçiçeği	Cr	5-9	Naturalized	MK 952
Convolvulaceae					
Calystegia sylvatica (Kit.) Griseb.	Bürük	H	4-8	Natural	MK 835
Convolvulus arvensis L.	Tarla sarmaşığı	H	4-9	Natural	MK 847
Cornaceae					
Cornus mas L.	Kızılcık	Ph	4-5	Natural	MK 848
Cucurbitaceae					
Cucumis sativus L.	Hıyar	Th	7-9	Cultivation	MK 854
Cucurbita pepo L.	Sakız kabağı	Th	7-8	Cultivation	MK 853
Sicyos angulatus L.	İtdolanbacı	Th	7-10	Naturalized	MK 942
Ebenaceae					
Diospyros lotus L.	Hırnık	Ph	5-6	Natural	MK 860
Ericaceae					
Arbutus andrachne L.	Sandal ağacı	Ph	3-5	Natural	MK 824
Calluna vulgaris (L.) Hull	Süpürge çalısı	Ph	8-10	Natural	MK 834
Erica arborea L.	Funda	Ph	3-7	Natural	MK 865
Rhododendron luteum Sweet	Zifin	Ph	4-9	Natural	MK 927
R. ponticum L.	Kumar	Ph	3-8	Natural	MK 928
Vaccinium arctostaphylos L.	Likarpa	Ph	5-7	Natural	MK 957

Table 2 (Contd.)

Name of the taxa	Turkish name	Life form	Flowering period	Status	Voucher specimen
Fagaceae					
Castanea sativa Mill.	Kestane	Ph	6-7	Natural	MK 839
Geraniaceae					
Geranium asphodeloides Burm. f. subsp. *asphodeloides*	Yaramerhemi	H	4-6	Natural	MK 872
G. pusillum Burm. f.	İncegelinçarşafı	Th	5-6	Natural	MK 873
G. robertianum L.	Dağ ıtırı	Th	4-6	Natural	MK 874
Hydrangeaceae					
Deutzia gracilis Siebold & Zucc.	Havlu püskülü	Ph	4-6	Ornamental	MK 858
Hydrangea macrophylla (Thunb.) Ser.	Ortanca	Ph	5-6	Ornamental	MK 879
Philadelphus coronarius L.	Filbahri	Ph	5-6	Ornamental	MK 911
Hypericaceae					
Hypericum androsaemum L.	Kamaniça	Cr	6-7	Natural	MK 880
Iridaceae					
Iris lazica Albov	Laz süseni	Cr	2-4	Natural	MK 882
I. pseudacorus L.	Bataklı süseni	Cr	4-5	Natural	MK 883
Iris × *germanica* L.	Göksüsen	Cr	4-5	Ornamental	MK 881
Juglandaceae					
Juglans regia L.	Ceviz	Ph	5	Cultivation	MK 884
Lamiaceae					
Ajuga orientalis L.	Dağmayasılı	H	4-7	Natural	MK 821
Lamium album L. subsp. *album*	Balıcak	H	5-8	Natural	MK 885
L. galeobdolon (L.) L. subsp. *galeobdolon*	Sarı balıcak	H	4-6	Natural	MK 886
L. purpureum L. subsp. *purpureum*	Ballıbaba	Th	3-5	Natural	MK 887
Prunella vulgaris L.	Gelinciklemeotu	H	5-9	Natural	MK 920
Melissa officinalis L. subsp. *officinalis*	Oğulotu	H	6-7	Natural	MK 901
Mentha longifolia (L.) L. subsp. *longifolia*	Pünk	H	6-8	Natural	MK 902
M. pulegium L.	Yarpuz	H	6-9	Natural	MK 903
Origanum vulgare L. subsp. *viridulum* (Martrin-Donos) Nyman	Karakınık	H	5-10	Natural	MK 907
Rosmarinus officinalis L.	Biberiye	Ph	2-5	Natural	MK 932
Salvia verticillata L. subsp. *verticillata*	Dadırak	H	6-8	Natural	MK 938
Stachys sylvatica L.	Hamısırgan	H	6-9	Natural	MK 947
Lauraceae					
Laurus nobilis L.	Defne	Ph	3-5	Natural	MK 891
Leguminosae					
Acacia dealbata Link.	Gümüşi akasya	Ph	2-4	Ornamental	MK 817
Albizia julibrissin Durazz.	Gülibrişim	Ph	7-8	Ornamental	MK 822
Cercis siliquastrum L. subsp. *siliquastrum*	Erguvan	Ph	4-5	Natural	MK 841
Lathyrus laxiflorus (Desf.) O. Kuntze subsp. *laxiflorus*	Deli burçak	H	5-8	Natural	MK 889
Lotus corniculatus L. var. *tenuifolius* L.	Gazalboynuzu	H	4-9	Natural	MK 896

Table 2. (Contd.)

Name of the taxa	Turkish name	Life form	Flowering period	Status	Voucher specimen
Medicago sativa L. subsp. *sativa*	Karayonca	H	4-9	Natural	MK 899
Melilotus officinalis (L.) Desr.	Kokulu yonca	Th	5-9	Natural	MK 900
Phaseolus vulgaris L.	Fasulye	Th	4-5	Cultivation	MK 910
Pisum sativum L.	Bezelye	Th	4-5	Cultivation	MK 914
Robinia hispida L.	Kıllı akasya	Ph	4-7	Ornamental	MK 930
R. pseudoacacia L.	Yalancı akasya	Ph	4-6	Naturalized	MK 929
Trifolium campestre Schreb.	Üçgül	Th	2-4	Natural	MK 953
T. pratense L. var. *pratense*	Çayır üçgülü	H	5-9	Natural	MK 955
T. repens L. var. *repens*	Ak üçgül	H	3-9	Natural	MK 954
Securigera varia (L.) Lassen	Körigen	H	5-8	Natural	MK 941
Vicia cracca L. subsp. *stenophylla* Vel.	Meşe fiği	H	5-7	Natural	MK 961
Wisteria sinensis (Sims) Sweet	Çin mor salkımı	Ph	4-7	Ornamental	MK 964
Lythraceae					
Lythrum salicaria L.	Hevhulma	H	6-8	Natural	MK 897
Malvaceae					
Malva sylvestris L.	Ebegümeci	H	5-10	Natural	MK 898
Tilia rubra DC. subsp. *caucasica* (Rupr.) V. Engl.	Kafkas ıhlamuru	Ph	6-7	Natural	MK 950
Myrtaceae					
Callistemon viminalis (Sol. *ex* Gaertn.) G. Don *ex* Loudon	Fırça çalısı	Ph	4-6	Ornamental	MK 833
Leptospermum scoparium J.R. Forst. & G. Forst.	Okyanus mersini	Ph	5-9	Ornamental	MK 892
Oleaceae					
Ligustrum japonicum Thunb.	Lügüstrüm	Ph	5-6	Ornamental	MK 893
Syringa vulgaris L.	Leylak	Ph	5-6	Ornamental	MK 948
Onagraceae					
Epilobium angustifolium L.	Yakıotu	H	6-8	Natural	MK 864
Oxalidaceae					
Oxalis articulata Savigny	Pembe ekşiyonca	H	6-9	Ornamental	MK 909
Pinaceae					
Picea orientalis (L.) Peterm.	Doğu ladini	Ph	4-5	Natural	MK 912
Pittosporaceae					
Pittosporum tobira (Thunb.) W.T. Aiton	Yıldız çalısı	Ph	4-6	Ornamental	MK 915
Plantaginaceae					
Plantago lanceolata L.	Damarlıca	H	4-10	Natural	MK 916
Veronica beccabunga L. subsp. *beccabunga*	At teresi	Cr	5-10	Natural	MK 959
V. persica Poir.	Cırcamuk	Th	1-12	Natural	MK 960

Table 2 (Contd.)

Name of the taxa	Turkish name	Life form	Flowering period	Status	Voucher specimen
Poaceae					
Zea mays L. subsp. *mays*	Mısır	Th	6-10	Cultivation	MK 965
Primulaceae					
Primula acaulis (L.) L. subsp. *acaulis*	Çuhaçiçeği	H	3-6	Natural	MK 918
P. acaulis (L.) L. subsp. *rubra* (Sm.) Greuter & Burdet	Evvelbahar çiçeği	H	3-5	Natural	MK 919
Ranunculaceae					
Helleborus orientalis Lam.	Çöpleme	H	3-5	Natural	MK 877
Ranunculus constantinopolitanus (DC.) d'Urv	Kâğıthane çiçeği	H	5-6	Natural	MK 924
R. ficaria L. subsp. *bulbifera* Lawalrée	Buğdaycık	Cr	3-4	Natural	MK 925
R. repens L.	Tiktakdana	H	5-7	Natural	MK 926
Rosaceae					
Cerasus avium (L.) Moench	Kiraz	Ph	3-5	Cultivation	MK 840
Cydonia oblonga Mill.	Ayva	Ph	5-6	Cultivation	MK 855
Duchesnea indica (Andrews) Focke	Sabun çileği	H	5-9	Naturalized	MK 861
Eriobotrya japonica (Thunb.) Lindl.	Yenidünya	Ph	10-1	Cultivation	MK 867
Fragaria vesca L.	Dağ çileği	H	4-6	Natural	MK 871
Laurocerasus officinalis M. Roem.	Karayemiş	Ph	4-6	Natural	MK 890
Potentilla reptans L.	Reşatınotu	H	5-8	Natural	MK 917
Prunus divaricata Ledeb. var. *divaricata*	Yunus eriği	Ph	4-5	Natural	MK 921
Pyracantha coccinea M. Roem.	Ateşdikeni	Ph	4-6	Natural	MK 922
Pyrus communis L. subsp. *communis*	Armut	Ph	4-5	Cultivation	MK 923
Rosa canina L.	Kuşburnu	Ph	5-7	Natural	MK 931
Rubus canescens DC. var. *glabratus* (Godr.) Davis & Meikle	Çobanköşteği	Ph	5-8	Natural	MK 933
R. idaeus L. subsp. *idaeus*	Ahududu	Ph	6-7	Natural	MK 934
R. sanctus Schreb.	Böğürtlen	Ph	6-8	Natural	MK 935
Spiraea vanhouttei (Briot) Carrière	İspirya	Ph	4-5	Ornamental	MK 946
Rutaceae					
Citrus sinensis (L.) Osbeck	Portakal	Ph	4-6	Cultivation	MK 846
Salicaceae					
Salix alba L. subsp. *alba*	Ak söğüt	Ph	4-5	Natural	MK 936
S. caprea L.	Sorgun	Ph	4-5	Natural	MK 937
Sapindaceae					
Acer cappadocicum Gled. subsp. *cappadocicum*	Beşparmak ağacı	Ph	3-5	Natural	MK 819
A. heldreichii Orph. *ex* Boiss. subsp. *trautvetteri* (Medw.) A.E. Murray	Kafkas akçaağacı	Ph	3-5	Natural	MK 818
Scrophulariaceae					
Verbascum gnaphalodes M. Bieb.	Uslu sığırkuyruğu	H	5-9	Natural	MK 958

Table 2 (Contd.)

Name of the taxa	Turkish name	Life form	Flowering period	Status	Voucher specimen
Simaroubaceae					
Ailanthus altissima (Mill.) Swingle	Kokarağaç	Ph	5-6	Naturalized	MK 820
Violaceae					
Viola odorata L.	Kokulu menekşe	H	4-5	Natural	MK 962

Ph = Phanerophytes, Ch = Chamaephytes, H = Hemicryptophytes, Th = Therophytes, Cr = Cryptophytes.

The current status of honeybee plants in Espiye revealed that the identified 149 taxa were clustered into four different ecological groups comprising 69% natural, 16% ornamental, 10% cultivation and 5% naturalized. The majority of species are natural (103 taxa) followed by the ornamental (23 taxa), cultivation (15 taxa) and naturalized (8 taxa). In addition, flowering period of the identified taxa has been determined. As seen in Figure 3, the flowering period for plants in the study area is mostly between April and August. In May, many plants can be seen in flowering state in the study area. Some important natural, ornamental and naturalized bee plant species of Espiye region are shown in Figures 4 and 5.

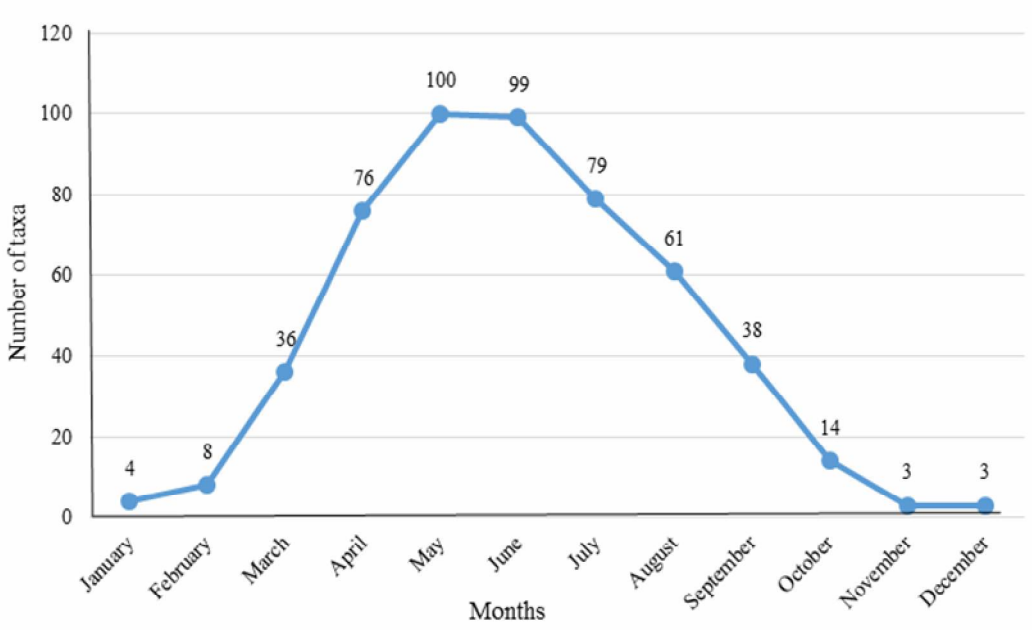

Fig. 3. Flowering period of the honeybee plants of Espiye, Giresun.

Honeybees cannot operate below 12-13°C (Korkmaz, 2015). Honeybees start to collect nectar and pollen in the month of May. Flowering in plants reach top level in Espiye in May and there is direct correlation between temperature, precipitation and flowering plants. Honeybee activity remains during May to October (Fig. 6). As seen in Figure 6, when flowering in plants accounts reach at the top level temperature is appropriate, and precipitation is at the least level.

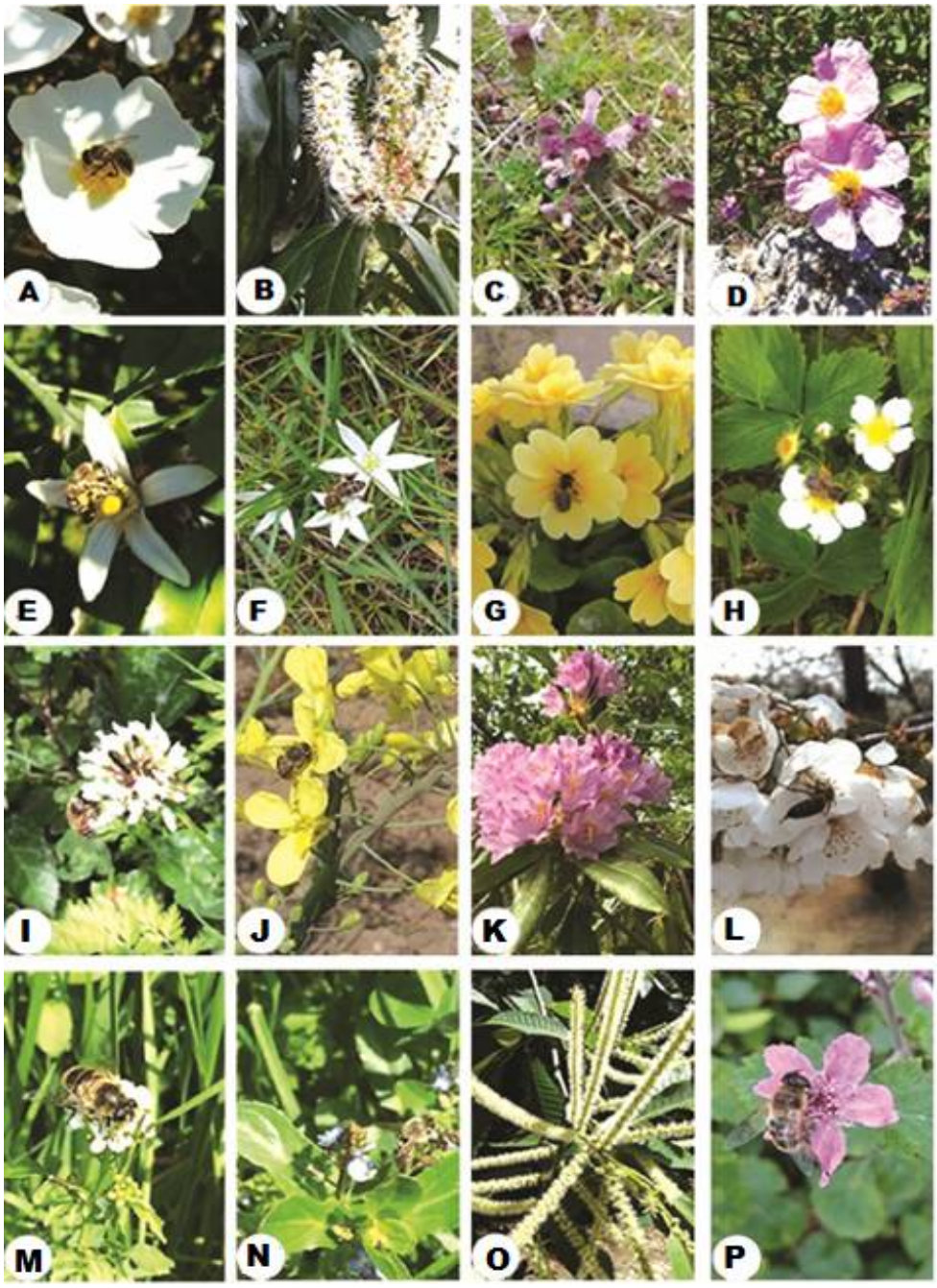

Fig. 4. Some important natural bee plants of Espiye region: A. *Cistus salviifolius*; B. *Laurocerasus officinalis*; C. *Lamium purpureum*; D. *Cistus creticus*; E. *Citrus sinensis*; F. *Ornithogalum oligophyllum*; G. *Primula acaulis*; H. *Fragaria vesca*; I. *Trifolium repens*; J. *Brassica oleracea*; K. *Rhododendron ponticum*; L. *Cerasus avium*; M. *Cardamine impatiens*; N. *Veronica beccabunga*; O. *Castanea sativa*; P. *Rubus sanctus*.

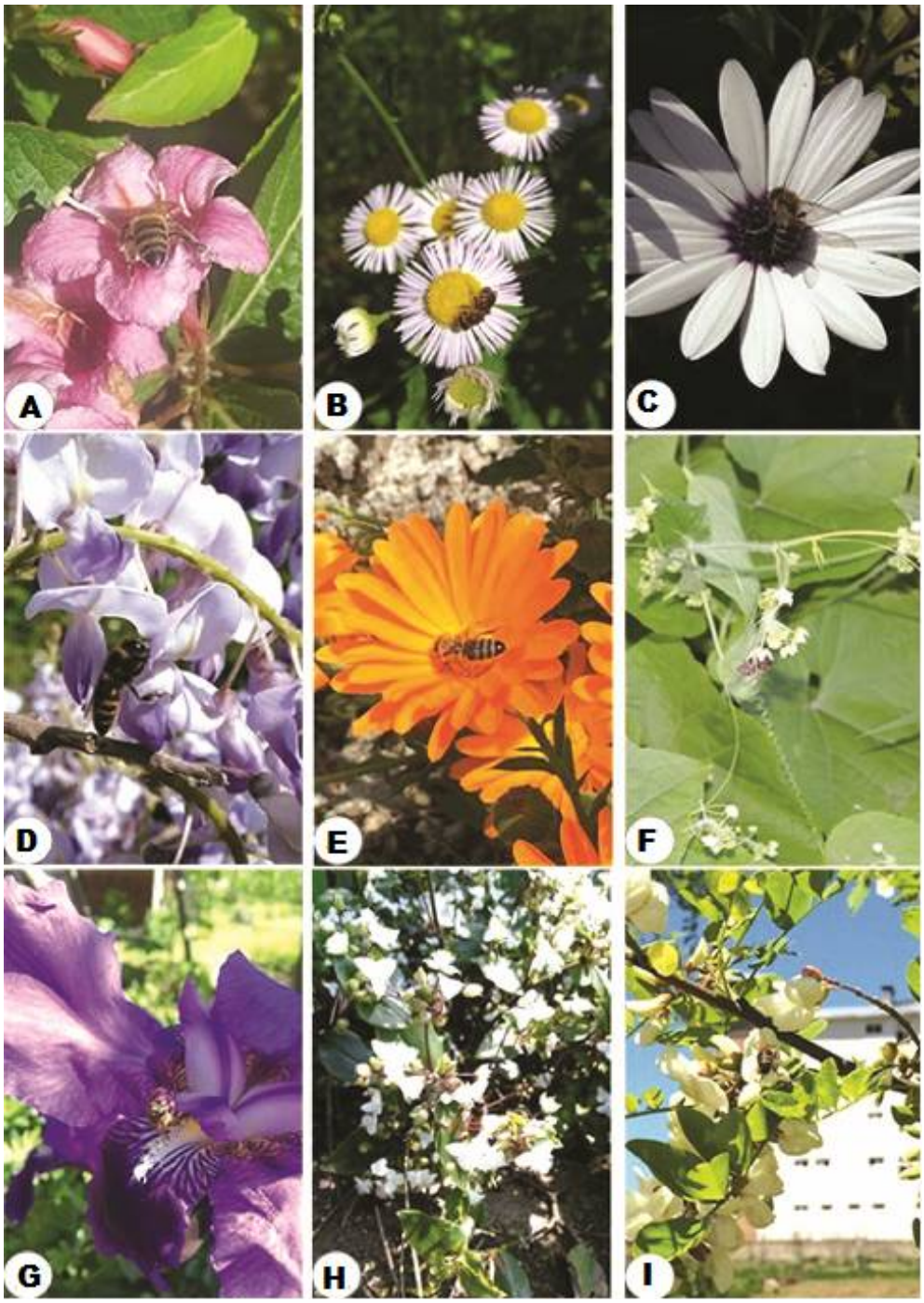

Fig. 5. Some important ornamental and naturalized bee plants of Espiye region: A. *Weigela floribunda*; B. *Erigeron annuus*; C. *Dimorphotheca ecklonis*; D. *Wisteria sinensis*; E. *Calendula officinalis*; F. *Sicyos angulatus*; G. *Iris* × *germanica*; H. *Tradescantia fluminensis*; I. *Robinia pseudoacacia*.

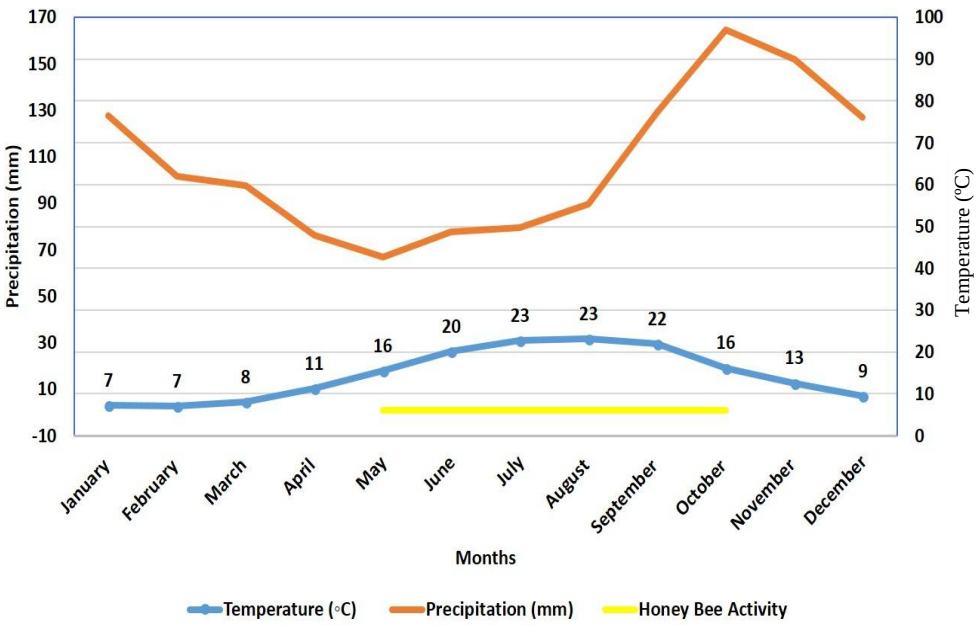

Fig. 6. Correlation between honeybee activity, temperature and precipitation.

In the present study 23 ornamental and eight naturalized plant species were identified as visited by the honeybees. The presence of these plants in ecosystems causes changes in the pollen and nectar resources of the honeybees. These changes have caused both the deterioration of the functions provided by the ecosystems and the decrease of the agricultural gains. In addition, this differentiation will also cause a change in the quality of the local honeys. Therefore, on the use of mostly local indigenous species there will be a significant share in the conservation of ecosystem balance.

References

Davis, P.H. (Ed.). 1965-1985. Flora of Turkey and the East Aegean Islands, Vols. **1**–**9**. Edinburgh University Press, UK.

Davis, P.H, Mill, R.R. and Tan, K. 1988. Flora of Turkey and the East Aegean Islands. Vol. **10**. Edinburgh University Press, UK.

Dokap, 2000. Dokap (Doğu Karadeniz Bölgesi Gelişme Planı), pp.1–9.

Duyum, S. and Friedman, S. 2015. The Turkish beekeeping and honey sector, Ankara, Report No. TR5021.

Güner, A., Özhatay, N. and Başer, K.H.C. 2000. Flora of Turkey and the East Aegean Islands, Vol. **11**, Supplement-II. Edinburgh University Press, UK.

Güner, A., Aslan, S., Ekim, T., Vural, M. and Babaç, M.T. 2012. Türkiye bitkileri listesi (Damarlı bitkiler). Nezahat Gökyiğit Botanik Bahçesi ve Flora Araştırmaları Derneği Yayını, İstanbul.

Korkmaz, A. 2015. Bal Arısı Polinasyonu, Samsun Gıda Tarım ve Hayvancılık İl Müdürlüğü Yayını, Samsun, p. 72.

OGM (Orman Genel Müdürlüğü). 2013-2015. Türkiye orman varlığı kitabı. Orman İdaresi ve Planlama Dairesi Başkanlığı, No. 115.

Özturk, F. and Erkan, C. 2010. Bee plants of Van Lake basin (Turkey). Int. J. Bot. **6**: 101–106.

Raunkiaer, C. 1937. The Life Forms of Plants and Statistical Plant Geography. Clarendon Press, Oxford.

Sıralı, R. 2009. Important honey production regions of Turkey. J. Beekeeping Res. **1**: 16–20.

Tew, J.E. 1998. Some Ohio Nectar and Pollen Production Plants. Ohio State University, Columbus.

TSMS. 2017. Turkish State Meteorological Service Bulletin.

Tucak, Z., Tucak, A., Puskadija, Z. and Tucak, M. 2000. Nutritious healing composition of some kinds of honey in Eastern Croatia. Agriculture **6**: 129–132.

Tucak, Z., Perispic, M., Beslo, D. and Tucak, I. 2004. Influence of the beehive type on the quality of honey. Coll Antropol. **28**: 463–467.

TUİK. 2018. Turkish Statistical Institute. [Accessed on 07.02.2018]

Tutkun, E. 2000. Technical Beekeping Handbook. Development Foundation of Turkey, Ankara.

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