MELLIFERA RESEARCH ARTICLE

Contributions to *Bombus* Latreille (Hymenoptera: Apidae) Fauna of Eskişehir Province of Turkey

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A B S T R A C T

In this study, *Bombus* species, which are distributed in Eskişehir province, were considered. The study was conducted in 2020. A total 72 specimens were examined, 11 species were recorded and *B. barbutellus*, *B. rupestris*, *B. laesus* and *B. ruderarius* were reported for the first time from Eskişehir. Besides, the data about their distribution among Turkey are given in addition to the data about the plant taxa on which the specimens were caught. As a consequence, the decreased population trends of some bumblebees of Turkey were discussed.

Keywords: *Bombus*, Bees, Apoidea, Fauna, IUCN, Foraging Plants, Turkey, Distribution

Introduction

Bumblebees (*Bombus* Latreille) contain species that attract everyone's attention because of their large and colorful bodies [1]. They are distributed especially in alpine, subalpine and arctic belts of Palaearctic, Nearctic, Oriental and Neotropic regions [2, 3]. Bumblebees are considered highly efficient pollinators because they show activity even at extreme temperatures due to their thermoregulatory mechanisms [4, 5, 6].

Bombus contains more than 250 species in the world [7]. Turkey is one of the highest species richness in the West-Paleartic region with 48 species [8, 9]. While there is a web-based atlas of bumblebees, faunistic studies especially northwest of Turkey are needed.

Eskişehir is a province in the northwestern Turkey (39°06'N and 40°09'N; 29°58'E and 32°04'E). It locates at the intersection of 3 different phytogeographical regions (Irano-Turanian, Euro-Siberian and Mediterranean), which cause the formation of many different habitat types and an increase in plant diversity. There are about 1400 plant taxa belonging to 96 families in this region. Besides there are 225 endemic

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plant taxa and 34 of them are local endemic. Asteraceae (188 taxa), Fabaceae (145 taxa), Brassicaceae (106 taxa), Caryophyllaceae (86 taxa) and Lamiaceae (84 taxa) families are reported as the most common families for Eskişehir province [10, 11, 12]. Among these, Fabaceae, Asteraceae and Lamiaceae members are known as the most preferred plants by bees. However neither specific plant preferences of *Bombus* species of Eskişehir nor *Bombus* fauna of this province studied before. Because of this fact, in this study we aim to expose *Bombus* spp. fauna of Eskişehir.

Materials and Methods

Field studies were performed in Eskişehir province in 2020. All specimens were captured on plants by sweep net, prepared for collection and deposited in the Apoidea collection of Morphometry Laboratory of Hacettepe University's Department of Biology. The specimens were examined with stereoscopic binocular microscope and were identified according to Aytekin [13, 14], Özbek [15] and Williams et al [7]. Also plants were collected, properly dried and pressed for diagnosis. Plants were identified according to the Flora of Turkey [16, 17].

The species are listed below in alphabetical order within subgenera.

Abbreviations: ♀ : Queen, ☿: Worker, ♂ :Male

Results

In total 72 collected specimens were identified as 11 species from Eskişehir province.

***Bombus* (*Bombus*) *terrestris* (L., 1758)**

Material examined: 11-VIII-2020 Kayakent, Günyüzü (39°18'2.72"N 31°44'50.61"E) 1780 m., 1☿, 1♂; 11-VIII-2020 Büyükdere, Seyitgazi (39°34'50.97"N 30°45'13.74"E) 935 m. 2☿☿.

Plants recorded: *Consolida regalis* S.F.Gray subsp. *paniculata* var. *paniculata* (Host) Soo (Ranunculaceae), *Sideritis galatica* Bornm. (Lamiaceae).

***Bombus* (*Megabombus*) *argillaceus* (Scopoli, 1805)**

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Material examined: 10-VIII-2020 Günyüzü 1♀; 11-VIII-2020 Kayakent, Günyüzü (39°18'2.72"N 31°44'50.61"E) 1780 m., 2♀♀, 1♂; 11-VIII-2020 Büyükdere, Seyitgazi (39°34'50.97"N 30°45'13.74"E) 935 m., 3♀♀, 2♂♂; 22-VIII-2020, Balık Damı, Sivrihisar (39°12'16.20"N 31°39'34.67"E) 799 m. 1♀.

Plants recorded: *Consolida regalis* S.F.Gray subsp. *paniculata* var. *paniculata* (Host) Soo (Ranunculaceae), *Sideritis galatica* Bornm. (Lamiaceae), *Cephalaria transsylvanica* (L.) Schrader (Dipsacaceae).

***Bombus* (*Melanobombus*) *lapidarius* (L., 1758)**

ssp. *lapidarius*

Material examined: 11-VIII-2020 İdrisyayla, Seyitgazi (39°23'56.48"N 30°24'42.72"E) 1388 m. 7♀♀, 2♂♂; 20-VIII-2020 Büyükyayla, Seyitgazi (39°10'53.49"N 30°33'20.64"E) 1138 m. 2♀♀.

Plants recorded: *Carduus nutans* L. (Asteraceae), *Dipsacus laciniatus* L. (Dipsacaceae).

***Bombus* (*Psithyrus*) *barbutellus* (Kirby, 1802)**

Material examined: 19-VIII-2020 Hekimdağ (39°54'9.30"N 30°35'48.42"E) 1272 m. 1♀.

Plants recorded: *Marrubium parviflorum* Fisch. & Mey. subsp. *oligodon* (Boiss.) Seybold (Lamiaceae).

***Bombus* (*Psithyrus*) *rupestris* (Fabricius, 1793)**

Material examined: 11-VIII-2020 İdrisyayla, Seyitgazi (39°23'56.48"N 30°24'42.72"E) 1388 m. 4♀♀.

Plants recorded: *Echium italicum* L. (Boraginaceae).

***Bombus* (*Sibiricobombus*) *niveatus* Kriechbaumer, 1870**

ssp. *niveatus*

Material examined: 11-VIII-2020 Kayakent, Günyüzü (39°18'2.72"N 31°44'50.61"E) 1780 m. 2♂♂.

Plants recorded: *Sideritis galatica* Bornm. (Lamiaceae).

ssp. *vorticosus* Gerstaecker, 1872

Material examined: 11-VIII-2020 Kayakent, Günyüzü (39°18'2.72"N 31°44'50.61"E) 1780 m. 2♀♀; Odunpazarı (39°45'19.62"N 30°29'50.67"E) 809 m. 2♀♀, 1♂.

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Plants recorded: *Sideritis galatica* Bornm. (Lamiaceae), *Carduus nutans* L. (Asteraceae), *Syringa vulgaris* L. (Oleaceae).

***Bombus* (*Subterraneobombus*) *fragrans* (Pallas, 1771)**

Material examined: 22/23-VIII-2020 Balık Damı, Sivrihisar (39°12'16.20"N 31°39'34.67"E) 799 m., 2 ♀♀, 3 ♂♂.

Plants recorded: *Cirsium arvense* (L.) Scop. subsp. *vestitum* (Wimmer & Grab.) Petrak (Asteraceae).

***Bombus* (*Thoracobombus*) *laesus* Morawitz, 1875**

Material examined: 11-VIII-2020 Büyükdere, Seyitgazi (39°34'50.97"N 30°45'13.74"E) 935 m. 1 ♀; 23-VIII-2020 Balık Damı, Sivrihisar (39°12'16.20"N 31°39'34.67"E) 799 m., 3 ♀♀.

Plants recorded: *Cirsium arvense* (L.) Scop. subsp. *vestitum* (Wimmer & Grab.) Petrak (Asteraceae), *Stachys byzantina* C. Koch (Lamiaceae).

***Bombus* (*Thoracobombus*) *ruderarius* (Müller, 1776)**

ssp. *ruderarius*

Material examined: 11-VIII-2020 İdrisyayla, Seyitgazi (39°23'56.48"N 30°24'42.72"E) 1388 m. 6 ♀♀.

Plants recorded: *Echium italicum* L. (Boraginaceae).

***Bombus* (*Thoracobombus*) *sylvarum* (L., 1761)**

ssp. *citrinofasciatus* Vogt, 1909

Material examined: 11-VIII-2020 Büyükdere, Seyitgazi (39°34'50.97"N 30°45'13.74"E) 935 m. 1 ♀; 19-VIII-2020 Hekimdağ (39°54'9.30"N 30°35'48.42"E) 1272 m., 4 ♀♀; 19-VIII-2020 Yukarısöğüt, Seyitgazi (39°27'6.26"N 30°34'48.99"E) 1089 m., 2 ♀♀.

Plants recorded: *Carduus nutans* L. (Asteraceae), *Marrubium parviflorum* Fisch. & Mey. subsp. *oligodon* (Boiss.) Seybold (Lamiaceae), *Echium italicum* L. (Boraginaceae).

***Bombus* (*Thoracobombus*) *zonatus* Smith, 1854**

Material examined: 09-VIII-2020 Paşakadın, Sivrihisar (39°29'20.34"N 31°19'25.21"E) 1045 m. 1 ♂; 09-VIII-2020 Kaymazyayla, Mahmudiye (39°29'6.89"N 31°6'42.89"E) 868 m., 1 ♀; 11-VIII-2020 Büyükdere, Seyitgazi (39°34'50.97"N 30°45'13.74"E) 935 m., 5 ♀♀; 11-VIII-2020 Akın, Seyitgazi (39°19'54.86"N 30°31'4.02"E) 1028 m., 1 ♀; 19-VIII-2020 Hekimdağ (39°54'9.30"N

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30°35'48.42"E) 1272 m., 1♀; 19-VIII-2020 Yukarısöğüt, Seyitgazi (39°27'6.26"N 30°34'48.99"E) 1089 m., 1 ♀; 23-VIII-2020 Balık Damı, Sivrihisar (39°12'16.20"N 31°39'34.67"E) 799 m., 2 ♀♀, 1 ♂.

Plants recorded: *Consolida regalis* S.F.Gray subsp. *paniculata* var. *paniculata* (Host) Soo (Ranunculaceae), *Centaurea solstitialis* subsp. *solstitialis* L. (Asteraceae), *Cephalaria transsylvanica* (L.) Schrader (Dipsacaceae), *Vicia cracca* L. subsp. *cracca* L. (Fabaceae), *Echium italicum* L. (Boraginaceae), *Teucrium orientale* L. var. *orientale* (Lamiaceae), *Marrubium parviflorum* Fisch. & Mey. subsp. *oligodon* (Boiss.) Seybold (Lamiaceae).

Discussion

Faunistic studies [9, 14, 20, 24, 28 – 30, 36] revealed that bumblebees are represented by 13 different species in Eskişehir (Table 1). But some of these records are suspicious because of the discrepancies between faunistic studies. For example, Özsaltık [24] recorded *B. alagesianus* from Eskişehir but subsequent studies [9, 37] showed that this species distribute in North-east of Turkey (Transcaucasia, Caucasus and North Iran). The discrepancy between these studies can be the result of misevaluation of the specimens that were collected by Özsaltık [24] but we can not be sure without re-examining of the specimens.

Although these previous studies showed that *B. lucorum*, *B. incertus*, *B. armeniacus*, *B. pascuorum*, and *B. pomorum* distribute in Eskişehir, we did not encounter in the related field and other areas. Decreasing in population size can be one of the reasons that we could not observe these species. *B. pomorum* is considered in vulnerable (VU) category whereas *B. armeniacus* in endangered (EN) category in IUCN Red List and their population trend are decreasing [38]. Only one worker *B. pascuorum* was recorded by Özsaltık [24] in Bozdağ, but we did not observe this species in this area. *B. pascuorum* is considered in least concern (LC) category in IUCN but its population trend is also decreasing [38].

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Table 1. *Bombus* spp. recorded in Eskişehir and their IUCN Red List Categories (LC: least concern; NT; near threatened; VU: vulnerable; EN: endangered) [9, 14, 20, 24, 28 – 30, 36, 38].

Species	Previous Studies	This Study	IUCN Red List Category - Population Trend
Bombus (Bombus) lucorum	+	-	LC - Stable
Bombus (Bombus) terrestris	+	+	LC - Increasing
Bombus (Melanobombus) alagesianus	+	-	-
Bombus (Megabombus) argillaceus	+	+	LC - Stable
Bombus (Melanobombus) incertus	+	-	-
Bombus (Melanobombus) lapidarius	+	+	LC - Increasing
Bombus (Psithyrus) barbutellus	-	+	LC - Decreasing
Bombus (Psithyrus) rupestris	-	+	LC - Unknown
Bombus (Sibiricobombus) niveatus	+	+	LC - Stable
Bombus (Subterraneobombus) fragrans	+	+	EN - Decreasing
Bombus (Thoracobombus) armeniacus	+	-	EN - Decreasing
Bombus (Thoracobombus) laesus	-	+	NT - Decreasing
Bombus (Thoracobombus) pascuorum	+	-	LC - Increasing
Bombus (Thoracobombus) pomorum	+	-	VU - Decreasing
Bombus (Thoracobombus) ruderarius	-	+	LC - Decreasing
Bombus (Thoracobombus) sylvarum	+	+	LC - Decreasing
Bombus (Thoracobombus) zonatus	+	+	EN - Decreasing

Distribution map of species, which were recorded in this study, in Turkey were given in Figure 1 [9, 13 - 15, 18 - 36]. The most widespread and abundant species across Turkey is *B. argillaceus. B. terrestris, B. niveatus, B. zonatus* and *B. sylvarum* are also distributed in a wide range of the country. On the other hand *B. fragrans* is one of the rarest and least abundant species. Although Reinig [20], Özsaltık [24] and Özbek [28] recorded *B. fragrans* from different localities in Eskişehir, we only observed this species in one locality – Balık Damı that is one of the protected areas. To encounter with this species is hard since it is considered EN species according to IUCN Red List [38]. On the other hand, although *B. zonatus* is also evaluated under EN category [38], members of this species are more common than *B. fragrans* and observed especially on the edges of agricultural lands. Also *B. zonatus* are quite abundant species all over the country.

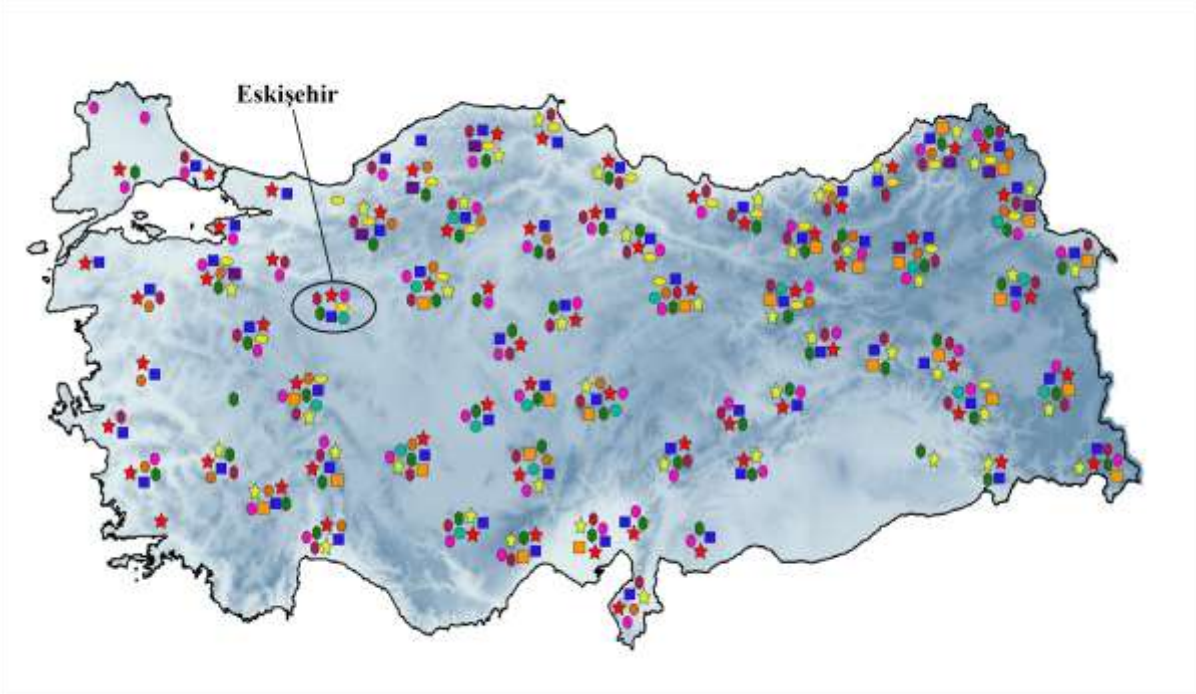

Figure 1. Distributions of *Bombus terrestris* (★), *B. argillaceus* (■), *B. lapidarius* (■), *B. barbutellus* (■), *B. rupestris* (■), *B. niveatus* (■), *B. fragrans* (■), *B. laesus* (■), *B. ruderarius* (★), *B. sylvarum* (■), and *B. zonatus* (■) in Turkey.

B. barbutellus, *B. rupestris*, *B. laesus* and *B. ruderarius* were reported for the first time from this province in this study. Among these *Bombus* species *B. barbutellus* and *B. rupestris* are classified under *Psithyrus* subgenus whose members are parasitic [7].

Main host of *B. barbutellus* in Europe is *B. hortorum*, *B. ruderatus* and *B. argillaceus* but main host of this species in Turkey is not known [9, 37]. On the other hand, *B. rupestris* was recorded in the locality where its potential host *B. lapidarius* was also recorded [9].

Another new record for Eskişehir, *B. laesus* is a near threatened (NT) species according to IUCN risk category [38]. *B. laesus* was recorded various localities in Turkey with few specimens [28]. Our field observations are in agreement with these findings, only four specimens were found from two different locations, in Eskişehir. Although the *B. ruderarius* is evaluated in the LC category, the population trend of this species is also decreasing [38]. Our field studies support the propositions of IUCN Red List [38] since only four specimens from one locality were found.

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As a conclusion, according to previous studies and our current study, *Bombus* spp. is represented by 17 species, four of them are new records, in Eskişehir province. Their most preferred plants are recorded as Lamiaceae and Asteraceae. The population trends in bumblebees give us an emergency signal about the wild bee populations in Europe and Turkey. Such local studies that monitor the bee population trends should be increased in order to minimize the risk of extinctions.

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Eskişehir *Bombus* Latreille (Hymenoptera: Apoidea: Apidae) Faunasına Katkılar

Bu çalışmada Eskişehir ilinde yayılışı olan Bombus türleri ele alınmıştır. Çalışma 2020 yılında gerçekleştirildi. Toplam 72 örnek incelenmiş, 11 tür tespit edilmiş ve *B. barbutellus*, *B. rupestris*, *B. laesus* ve *B. ruderarius* Eskişehir'de ilk kez kaydedilmiştir. Ayrıca, türlerin Türkiye dağılımı ve üzerinden yakalandığı bitki taksonları da verilmiştir. Sonuç olarak, Türkiye'deki bazı bombus arılarının azalan popülasyon trendleri tartışılmıştır.

Anahtar kelimeler: *Bombus*, Arılar, Apoidea, Fauna, IUCN, Bitki tercihi, Türkiye, Dağılış

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