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Araştırma Makalesi/Research Article

Distribution of the tribe Osmiini bees (Hymenoptera: Megachilidae) of Turkey Part II: the genera *Haetosmia*, *Osmia* and *Protosmia*

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ABSTRACT: In the present study, research materials consisting of approximately 1200 bee samples, which have been collected from almost the entire country since the 1960s, but mainly from the eastern Anatolia region of Turkey, were evaluated, a total of 101 species and subspecies in three genera, *Haetosmia* (1), *Osmia* (87) and *Protosmia* (13) were recognized. Of these, *Osmia (Helicosmia) labialis* Pérez, 1879 is new for Turkey as well Asian Continenet. For the known species new distribution records were provided and the plant species visited were included. Majority of the Turkish species, about 70%, are associated with Europe, mainly Mediterranean basin. Therefore, many species are in Mediterranean and East-Mediterranean chorotypes. Where as about 30% are associated with Asia, most of them are in the Southwest-Asiatic chorotype, 13 species could be accepted as Anatolian endemics. Two taxa, *Osmia (Hoplosmia) bidentata pallens* (Tkalcu, 1979) and *Protosmia (Protosmia) monstrosa* (Pérez, 1895) occur in Asia and North Africa.

Key words: Hymenoptera: Megachilidae, Osmiini, *Haetosmia*, *Osmia*, *Protosmia*, fauna, new record, chorotype, Turkey.

Türkiye'de Osmiini tribüsüne giren arı türleri (Hymenoptera: Megachilidae) Bölüm II: *Haetosmia*, *Osmia* and *Protosmia* cinsleri

Özet: Bu çalışmada; Türkiye'nin hemen her yöresinden, özellikle de Doğu Anadolu Bölgesi'nden 1960'lı yıllardan buyana toplanan 1200 civarındaki arı örneği değerlendirilmiş ve *Haetosmia* (1), *Osmia* (87) ve *Protosmia* (13) cinslerine ait 101 tür ve alttürün bulunduğu belirlenmiştir. Bunlardan *Osmia (Helicosmia) labialis* Pérez, 1879 Türkiye ve Asya faunası için yeni kayıt durumundadır. Bilinen türlerin çoğu için yeni yayılma alanları eklenmiş ve ziyaret ettikleri bitki türleri verilmiştir. Listelenen türlerin yaklaşık %70'i Avrupa'da, özelikle de Akdeniz Havzası'nda bulunan türlerdir. Bu nedenle çok sayıda tür Akdeniz ve Batı-Akdeniz korotiplerine mensuptur. Asya türleri, toplam taxa'nın yaklaşık %30'unu oluşturmakta, bunların da öemli bir kısmı Güneybatı Asya korotipi içerisinde yer alırken 13 taxa Anadolu için endemik durumundadır. Ayrıca iki taxa, *Osmia (Hoplosmia) bidentata pallens* (Tkalcu, 1979) ve *Protosmia (Protosmia) monstrosa* (Pérez, 1895) Asya ve Kuzey Afrika'da bulunmaktadır.

Anahtar sözcükler: Hymenoptera, Megachilidae, Osmiini, *Haetosmia*, *Osmia*, *Protosmia*, fauna, yeni kayıt, korotip, Türkiye.

INTRODUCTION

The osmiine bees constitute a tribe Osmiini (Hymenoptera: Megachilidae) within the family Megachilidae, which is one of the nine currently recognized families of bees (Engel, 2005; Michener, 2007). The tribe Osmiini comprise 15 genera and more than 1600 species worldwide and occur on all continents, with the exception of South America, Australia and Antarctica (Michener, 2007; Praz et al., 2008; Ungricht et al., 2008; Müller, 2014), they are especially diversified in the Mediterranean and desert climates of southern Africa, south-western North America and the Palaearctic (Müller, 2014). The Palaearctic region includes approximately 600 osmiine bee species in 10 genera, including taxa from Cyprus and the Caucasus, approximately 230 species have been recorded so far in Europe (Müller, 2014).

Detail knowledge was given studies on Osmiini bees both in the worl and in Turkey in the "Introduction" section of the first part of Özbek's contribution "Osmiini Bees of Turkey, Part I" (Özbek, 2013). In the stated paper the genera, *Heriades*, *Stenoheriades, Hofferia*, and *Hoplitis* were treated.

The aim of the present paper is to present the distribution, diversity and latest knowledge of Turkish Osmiini bees in the genera *Haetosmia*, *Osmia*, and *Protosmia* and briefly discuss biogeographical affinities as well as possible routes of dispersion and their host plants.

MATERIAL and METHODS

This paper is based on the materials that have been collected from almost all over the country, particularly from eastern Anatolia, since the 1960s by the author and his colleagues in the Plant Protection Department at Atatürk University. All bee specimens were collected via hand nets, raraly aspirators. Meanwhile, the plants that have been visited by bees also recorded or collected for diagnosis. All captured bee samples and collected plants were properly prepared for collections. Additionally, in the course of our joint studies on "Nesting Biology and Immature Stages of Bees" with J. G. Rozen and J. S. Ascher (AMNH, USA), some specimens were collected and included. Identification of the bees was verified by comparison with the preserved specimens, which were determined by the late K

Warncke, B Tkalcu and late G vd Zanden at the Entomology Museum of Erzurum, Turkey (EMET). Certain undetermined specimens were determined and conformed by A. Müller and partly determined by T. Griswold. The catalogue prepared by Müller (2014) serves as a general backbone for this contribution. The taxa were presented alphabetically. The species has not been found any specimen in this work, was quoted from literature. The provinces were presented in alphabetical order and the names of the provinces were given in bold type. Decimal "latidude-longitude" was given for certain species if available.The material was deposited in the EMET, certan specimens were included in the AMNH, and a few specimens were also kept by A. Müller and T. Griswold. The chorotype of the species has been defined according to Vigna Taglianti et al. (1999).

Abbreviations:

AMNH: American Museum of Natural History, New York United States; EMET: Atatürk University, Faculty of Agriculture, Entomology Museum, Erzurum, Turkey

Countries: **Europe**: A: Austria, AL: Albania, ARM: Armenia, AZ: Azerbaijan, BA: Bosnia-Hercegovina, B: Belgium, BG: Bulgaria, BIH: Bosnia and Herzegovina, BY: Belarus, CH: Switzerland, CZ: Czech Republic, D: Germany, DK: Denmark, E: Spain, E(Ba): Balearic Islands, EST: Estonia, F: France, F (Co): Corsica, FL: Finland, GE: Georgia, GB: Great Britain, GR: Greece, GR (Cr): Crete, H: Hungary, HR: Croatia, I: Italy, I(Sa): Sardinia, I(Si): Sicily, IRL: Ireland, L: Luxembourg, LV: Latvia, LT: Lithuania, M: Malta, MC: Monaco, MD: Moldova, ME: Montenegro, MK: Macedonia, MT: Malta, NL: The Netherlands, N: Norway, PL: Poland, P: Portugal, RO: Romania, RUS: Russia, RUS (SR): Southern European Russia**,** RUS (FS): Far Eastern Siberia**,** S: Sweden, SCG: Serbia and Montenegro, SLO: Slovenia, SK: Slovakia, SP: Serbia, UA: Ukraine. A**frica:** AG: Algeria, DZ: Algeria, E (Ca): Canary Iland (Spain), LAR: Libya, MA: Morocco, TN: Tunisia. **North (N.) Asia:** KS: Kazakhstan, KZ: Kyrgyzstan, MGL: Mongolia, RC: China, TJ: Tajikistan, TM: Turkmenistan, UZ: Uzbekistan, CN: China, SG: Singapore. **Southwestern (SW) Asia:** AFG: Afghanistan, CY: Cyprus, JOR: Jordan, IL: Israel, IR: Iran, IQ: Iraq, PAK: Pakistan, SYR: Syria, RL: LB: Lebanon, TR: Turkey. The underlined countries have type localities.

Names of people: AM: Andreas Müller, CG: Coşkun Güçlü, EY: Erol Yıldırım, HB: Hidayet Bostan, HÖ: Hikmet Özbek, GT: Göksel Tozlu, GvdZ: G. van der Zanden, JGR: J. G. Rozen, JSA: J. S. Ascher, İA: İrfan Aslan, LG: Levent Gültekin, RH: Rüstem Hayat, SÇ: Saliha Çoruh, TG: T. Griswold, TK: B.Tkalcu, WR: K. Warncke.

RESULTS

Genus *Haetosmia* Popov, 1952

Haetosmia is a small genus confined to the Palaearctic region. It contains three species, only one occurs in Turkey (Müller, 2014).

1. *Haetosmia vechti* (Peters, 1974)

Distribution: Europe: GR. **SW Asia:** IL, IR, TR. Known from Mersin (Peters, 1974); İzmir, Kayseri (Özbek and Zanden, 1992a) as *Anthcopa (Haetosmia) vechti* (Peters). **Plants associated:** oligolectic on *Heliotropium* (Boraginaceae) (Mavromoustakis 1954). **East Mediterranean chorotype.**

Genus *Osmia* Panzer, 1806

Osmia is the second most diverse osmiine genus in terms of number of species. According to Müller (2014) 336 species have been described so far, 204 of which occur in the Palaearctic.

1. *Osmia (Allosmia) bischoffi* Atanassov, 1938

Distribution: Europe: BG, GR, RO. **SW. Asia:** TR. Known from Bayburt (Özbek and Zanden, 1992). **Europo-Anatolia chorotype.**

Material: **Erzurum**: Ilıca, Ağzıaçık Geçidi, 40.15966-40.99194, 03.VII.2008, 1♀, leg. JGR, HÖ, det. AM (AMNH); Salkımlı, 28.VI.1997, 1♀, leg. HÖ, det. HÖ; İspir, 1200 m, 18.VI.1994, 1♀, leg. HÖ, det. TG; Madenkörübaşı, 1400 m, 18.VI.1994, leg. EY, det. GvdZ; Oltu, Sütkans, 2000 m, 10.VI.1997, 2♀♀, leg. LG, det. AM, HÖ; Zerdenis, 28.V.1997, 1♀, leg. İA, det. AM; İnanmış, 2000 m, 21.VI.1997, 1♀, leg. İA, det. AM; Olur, Süngübayır, 10.VI.1996, 1♀, leg. HÖ, det. HÖ; 30.VI.1991, 1♀, leg. İA, det. TG; 23.VII.1992, 1♀, leg. EY, det. GvdZ; 23.VII.1997, 1♀, leg. EY, det. HÖ; Palandöken, 17.VII.1996, 1♀, leg. İA, det. HÖ; Oltu, 1700 m, 05.VII.1992, 1♀, leg. HÖ, det. GvdZ; Sütkans, 1700 m, 17.VI.1996, 1♀, leg. GT, det. HÖ; Pazaryolu, 1500 m, 18.VI.1994, 1♀, leg. HÖ, det. HÖ; Şenkaya, Turnalı, 1750 m, 25.V.1994, 1♀, leg. EY, det. HÖ (EMET); Tekman, 2 km NW of Geçitköy, 39.74396_41.45340, 05.VII.2007, 1♀, leg. JSA, HÖ, JGR, det. AM (AMNH); Tortum, Aksu Yaylası, 2250 m, 1♀ (*Onobrychis viciifolia*), leg. HÖ, det. GvdZ; Uzundere, Şellale, 1100 m, 09.VI.1996, 1♀, leg. HÖ, det. HÖ (EMET); 5-25 km SSW of Oltu, 40.48666-41.79666, 18.V.2002, 1♀, leg. JGR, HÖ, det. AM (AMNH). **Hatay**: Dörtyol, Belen, 01.V.1996, 1♀, leg. LG, det. HÖ.

Plants associated: *O. viciifolia.* Müller (2014) noted that *O. bischoffi* is polylectic; Fabaceae, Cichorioideae, Convolvulaceae, Brassicaceae, Caryophyllaceae.

2. *Osmia (Allosmia) melanura* Morawitz, 1871

Distribution: Europe: ARM, BG, F, GR, I, I (Si), MK, UA. **SW. Asia:** TR. Recorded from Antalya (Özbek and Zanden, 1992) as *Hoplitis melanura* (Morawitz). **Europo-Anatolia chorotype.**

Material: **Antalya**: 10 km S of Kızılcadağ**,** 26.V.2009, 1♂, leg. JGR, JSA, HÖ, det. AM (AMNH). **Erzurum**: Oltu, 5-25 km SSW of Oltu, 40.48666-41.79666, 18.V.2002, 1♂, leg. JGR, HÖ, det. AM (AMNH); Oltu, Çamlıbel, Karakol, 1900 m, 1♀, leg. ÖÇ, det. AM; Olur, Süngübayır, 23.VII.1992, 1♀, leg. EY, det. GvdZ; Tortum, Kaledibi, 05.VII.1992, 5♀♀, leg. HÖ, det. GvdZ and HÖ. **İzmir**: Menemen, Tarımsal Araştırma Enstitüsü, 02.07.1992, 1♀, leg. HÖ, det. HÖ (on *Medicago sativa*).

Plants associated: *M. sativa*; Polylectic; Fabaceae (e.g. *Lotus creticus, Medicago marina*, Hedysareae), Asteraceae, Boraginaceae (e.g. *Echium*), Caryophyllaceae, Brassicaceae, Cistaceae and Lamiaceae (Müller, 2014).

3. *Osmia (Allosmia) nuda* Friese, 1899

Distribution: Europe: BG. **SW Asia:** TR. Known from Bursa (type locality) as *Hoplitis (Allosmia) nuda* (Friese). **Europo-Anatolia chorotype.**

4. *Osmia (Allosmia) rufohirta* Latreille, 1811

Synonyms: *O. fulvo-hirta* Lepeletier, 1841; *O. spiniventris* Giraud, 1857.

Distribution: almost the whole **Europe**. **N. Africa:** DZ, MA, TN. **N. Asia:** RC; Turkestan. **SW. Asia:** IL, JOR, SYR, TR. Known from Ankara (Alfken, 1935); Kahramanmaraş! Osmaniye! (Friese, 1921); Antalya, Aydın, Denizli, Karaman (Özbek and Zanden, 1992). **Palearctic chorotype.**

Material: **Adana**: Yumurtalık, 22.V.1992, 1♀, leg. HÖ, det. GvdZ. **Diyarbakır**: Silvan, 20.V.1995, 1♂, Leg. EY, det. TG. **Erzincan**: Çağlayan, 1100 m, 06.VII. 2001, 1♀, leg. HÖ, det. HÖ. **Erzurum**: merkez, 05.VII.1992, 1♀, leg. HÖ, det. HÖ (on *O. viciifolia*); Atatürk University Campus, 1800 m, 1♀, leg. HÖ, det. HÖ (on *O. viciifolia*); İspir, 1200 m, 18.VI.1994, 1♀, leg. HÖ, det. HÖ; Madenköprübaşı, 1100 m, 18.VI.1994, 2♀♀, leg. EY, det. HÖ; Olur, 22.VII.1992, 2♀♀, leg. EY, det. HÖ; Süngübayır, 21.V.1994, 1♀, leg. İA, det. T. Griswold (EMET); Süngübayır, 40.84875-42.11520, 25.VI.2001, 1♀, leg. JGR, HÖ, det. AM; Oltu, 5-25 km SSW of Oltu, 40.48666-41.79666, 18.V.2002, 1♀, leg. JGR, HÖ, det. AM (AMNH); Sütkans, 2000 m, 10.VI.1997, 2♀♀, leg. LG, det. AM; Oltu, Başaklı, 40º29'12" N 41º47'48" E, 1850 m, 1♀, leg. HÖ, det. HÖ; Başaklı, 1700 m, 15.VI.1994, 4♀♀, leg. HÖ, det. HÖ; 28.VII.1992, 1♀, leg. HÖ, det. HÖ; İnanmış, 2000 m, 21.VI.1997, 1♀, leg. İA, det. HÖ; Şenkaya, Penek, 19.V.1996, 1♀, leg. GT, det. AM; Tortum, Esendurak, 1400 m, 11.VII.2004, leg. O. Kaya, det. HÖ; Kaledibi, 05.VII.1992, 7♀♀, leg. HÖ, det. GvdZ; Pehlivanlı, 12.VII.1992, 3♀♀, leg. EY, det. GvdZ; Uzundere, Dikyar, 02.VII.1994, 5♀♀, İA, det. HÖ. **Hatay**: Dörtyol, Belen, Atik Yaylası, 01.V.1996, 1♀, leg. LG, det. HÖ. **İzmir**: Bornova, 07.V.1996, 1♀, leg. HÖ, det. AM.; Selçuk, Efes, 05.V.1998, 25♀♀, ♂, leg. GT, det. AM and HÖ.

Plants associated: *Onobrychis viciifolia.* Müller et al. (1997) and Amiet et al. (2004) noted that it is polylectic with a preference for Fabaceae (e.g. *Hippocrepis comosa, L. corniculatus, O. viciifolia*); others Asteraceae, Brassicaceae, Cistaceae Campanulaceae, Boraginaceae, Convolvulaceae and Lamiaceae.

5. *Osmia (Allosmia) sybarita* Smith, 1853

Synonyms: *O. ruficollis* Sichel, 1873; *O. fossoria* Pérez, 1891; *O. (Allosmia) sybarita fossoria* Pérez, 1891

Distribution: **Europe:** AL, GR, GR (Cr). **N. Africa:** DZ, ET, TN. **SW. Asia:** CY, IL, JOR, SYR, TR. Known from Elazığ (Zanden, 1980); Ankara, Antalya, Konya (Özbek and Zanden, 1992) as *Hoplitis (Allosmia) sybarita* (Smith); Mersin (Özbek and Zanden, 1996). **Mediterranean chorotype**

Material: **Elazığ**: Keban, 38º45'41" N 38º46'52" E, 900 m, 16.V.2002, 1♀, leg. HÖ, det. AM (EMET); 3 km SE of Keban, 38.79060-38.77757, 16.V.2002, 1♀, leg. JGR, HÖ, det. AM (AMNH).

Plants associated: polylectic; Fabaceae, Asteraceae, Boraginaceae (e.g. *Echium*), Brassicaceae and Lamiaceae (Müller, 2014).

6. *Osmia (Erythrosmia) andrenoides* Spinola, 1808

Distribution: almost whole **Europe. N. Africa:** DZ, MA, TN. **SW. Asia:** CY, IL, TR. Known from Osmaniye! (Alfken, 1935); Aydın, Erzurum (Özbek and Zanden, 1992). **West Palearctic chorotype.**

Material: **Antalya**: Arapsuyu, 20 m, 21.V.2000, 2♀♀, leg. HÖ, det. HÖ; 20.VI.2002, 3♂♂, 4♀♀; 30.VI.2002, 2♂♂ (*Trifolium* sp., *Teucrium* sp.); 04.VII.2002, 1♂; 16.VII.2002, 13♀♀, 8♂♂; 24.IX.2004, 1♂, leg. HÖ, det. HÖ. **Artvin**: Yusufeli, 2-8 km SW of Altıparmak, 1300 m, 25-27.VII.2005, 1♂, leg. HÖ, det. AM. **Erzurum**: Oltu, Tutmaç-Başaklı arası, 1700-2000 m, 02.VII.2000, 1♂, leg. HÖ, det. HÖ; Uzundere, Gölbaşı, çamlıyamaç yolu, 1200 m, 2♀♀, 21.V.2002, leg. ÖÇ, det. HÖ.

Plants associated: *Trifolium* sp, *Teucrium* sp. Müller et al. (1997) and Amiet et al. (2004) noted that *O. andrenoides* is polylectic with a preference for Lamiaceae (e.g. *Acinos, Ajuga, Stachys, Teucrium*) and Fabaceae; additionally *Echium* (Boraginaceae), Crassulaceae, Brassicaceae, Cistaceae, Antirrhineae and Campanulaceae.

Remarks: *Osmia andrenoides* was collected in a natural landscape in Antalya (Uncalı), which was extremely stony with some small bushes; the main bee plants were *Ajuga* sp., *Stachys* sp. and *Teucrium*

sp., (Labiatae) and *Trifolium* spp. (Fabaceae). Certain small and medium-sized snail species were very abundant during my collection with an insect net. I had to remove snails from the net every two or three sweeps. I suspect *O. andrenoides* uses the empty shells of one or two species of these snail species. Moreover, the human population of Antalya city has been increasing very rapidly over the last 10 years; currently the habitat in the collection area was completely destroyed and turned into to be a residential area. Additionally, the collection dates of the material collected from Antalya shows that this species is active from May to October in the ecological conditions of Antalya, and probably has more than one generation. Erzurum is the easternmost distribution record of this species.

7. *Osmia (Erythrosmia) erythrogastra* Ferton, 1905

Distribution: **Europe:** BG, F, F(Co), GR, I, I(Sa), SCG. **SW. Asia:** CY, IL, TR. Known from Aydın (Zanden, 1980), Antalya, İzmir (Özbek and Zanden, 1992). **East-Mediterranean chorotype.**

Material: **Antalya**: Arapsuyu, 50 m, 16.VII.2002, 1♀, leg. HÖ, det. HÖ; Belkız, 01.VIII.1994, 1♀, leg. HÖ, det. AM. **Bilecik**: merkez, 600 m, 15.VII.1995, 1♂, leg. EY, det. GvdZ.

8. *Osmia (Helicosmia) aeruginosa* Warncke, 1988

Distribution: **Europe:** BG. GR. **SW. Asia:** IR, TR. Known from Elazığ, Hakkari (type locality), Karaman (Warncke, 1988a). **East-Mediterranean chorotype.**

Material: **Erzurum**: Atatürk University Campus, 04.VI.1997, 1♀ (*O.viciifola*), leg. HÖ, det. AM; Hınıs, 1700 m, 25.VII.1997, 1♀, leg. E. Kılıç, det. HÖ. **Male unknown**.

Plants associated: *O.viciifola*. (Müller (2014) noted that it is Polylectic, pollen sources recorded so far from Fabaceae, Antirrhineae and Boraginaceae.

9. *Osmia (Helicosmia) aquila* Warncke, 1988

Distribution: **SW Asia:** IL, JOR, TR. Known from Hakkari, Mersin, Kars, Konya (type locality) (Warncke, 1988a). **SW Asiatic.**

10. *Osmia (Helicosmia) breviata* Warncke, 1988

Distribution: Europe: GR**. SW**. **Asia**: TR**.** Known from Hakkari, Konya (type locality), Sivas (Warncke, 1988a), Mersin, Kars, Malatya, Sivas (Özbek and Zanden, 1992). **East-Mediterranean (Aegean)**.

Material: **Bayburt**: Demirözü, 20.VIII.1991, 1♀, leg. HB, det. AM; Kopdağı, 2200 m, 09.VIII.1994, 1♀, Leg. EY, det. H Ö. **Erzurum**: Atatürk University Campus, 1850 m, 21.VI.1996, 1♀, leg. HÖ, det. AM. (A. Müller's collection); 15.VIII.1996, 1♀ (on *O. viciifolia*), leg. EY, det. GvdZ; Oltu, İnanmış, 2000 m, 21.VI.1997, 1♀, leg. İA, det. HÖ.

Remark: Kars is the easternmost distribution record of this species.

11. *Osmia (Helicosmia) brevipes* Zanden, 1994

Distribution: SW Asia: TR. Known from Sivas (type locality) (Zanden, 1994). **Anatolian Endemic!**

12. *Osmia (Helicosmia) caerulescens* (L., 1758)

Synonyms: *Apis caerulescens* Linnaeus, 1758; *A. aenea* Linnaeus, 1761; *A. **superbus*** Harris, 1776; *A. muraria* Retzius, 1783 ; *A. cuprea* Geoffroy, 1785; *Andrena cupraria* Walckenaer,1802; *Osmia purpurea* Cresson, 1864; *O. rustica* Cresson, 1864.

Distribution: **Europe:** whole Europe. **N. Africa:** DZ, ET, MA, TN. **N. Asia:** KS, KZ, RC, TJ, TM, UZ. **SW. Asia:** CY, IL, IR, JOR, SYR, TR. **Extralimital:** Nearctic (Canada, USA) [Potentially introduced], Oriental (India). Known from Amasya, İstanbul, Osmaniye (Fahringer, 1922), Kahramanmaraş (Friese, 1921), Erzurum, Kars, Iğdır (Özbek, 1979a), Adana, Ankara, Antalya, Bilecik, Hakkari, Mersin, Karaman, Kars, Konya, Sivas (Warncke, 1988a); Ankara, Aydın, Bursa, Erzincan, Erzurum (on *Prunus* sp. *Malus* sp., *O. viciifoli*a, *Carduus* sp.), Iğdır, Kars, Konya, Sinop (*Onopordum* sp.), (Özbek and Zanden, 1992), Sivas (Güler and Çağatay, 2006), Afyonkarahisar, Güler, 2011). **Holarctic chorotype.**

Material: **Antalya**: Termessos, 09.VII.1991, 4♀♀, leg. HÖ, det. GvdZ. **Artvin**: Ardanuç, Akarsu, 07.VII.1994, 2♀♀, leg. HÖ, det. HÖ; Yusufeli, Altıparmak, 05.VII.1994, 2♀♀, leg. GT, det. GvdZ; Cinnar, 900 m, 15.VII.1992, 1♀, leg. EY, det. HÖ; Sarıgöl, 700 m, 05.VII.1994, 1♀, leg. EY, det. HÖ. Bilecik: 600 m, 15.VII.1995, 1♂, leg. EY, det. GvdZ **Erzincan:** 1250 m, 14.VI.1994, 1♀, leg. EY, det. TG; Üzümlü, 1300 m, 16.VI.1994, 4♀♀, leg. EY, det. HÖ. Erzurum: Atatürk University Campus, 01.VII.1992, 1♀, leg. EY, det. HÖ; 01.IX.1994, 1♀, leg. EY, det. GvdZ; Köşkköyü, 20.VI.1996, leg. İA, det. HÖ; İspir, Maden Köprübaşı, 1100 m, 18.VI.1994, 1♀, leg. İA, det. GvdZ; Narman, Araköy, 12.VII.1996, 1♀, leg. GT, det. HÖ; Olur, 22.VII.1992, 1♀, leg. EY, det. HÖ; Süngübayır, 30.VI.1991, 1♀, leg. İA, det. HÖ; Oltu, 13.V.1991, 1♂, leg. HÖ, det. HÖ; Başaklı, 15.VI.1994, 1♂, leg. HÖ, det. HÖ (EMET); Başaklı, 18 km WSW of Oltu, 40.48722_41.80444, 1♀, leg. JGR, HÖ, det. JSA (AMNH); Tortum, Kaledibi, 05.VII.1992, 1♀, leg. HÖ, det. HÖ; Uzundere, Dikyar, 1♂, leg. İA, det. HÖ; Şenkaya, Turnalı, 12.VI.1992, 1♂, leg. EY, det. GvdZ. Iğdır: Akyumak, 18.VII.1991, 2♀♀, leg. EY, det. GvdZ and HÖ; merkez, 25.VI.1971, 1♀, leg. HÖ, det. HÖ; Aralık, Devlet Üretme Çiftliği, 20.VI.1981, 1♂, leg. H. Özışık, det. GvdZ. **Eskişehir:** Odunpazarı, 02.06.2013, 2♂♂, 2♀♀, (*Prunus* sp.), leg. HÖ, det. HÖ. **Yalova**: Bahçe Kültürleri Araştırma Enstitüsü, 27.IV.2003, 3♂♂, (*Prunus* sp, *Malus* sp.) leg. HÖ, det. AM and HÖ.

Plants associated: *Prunus* sp., *Malus* sp., *Carduus* sp., *Onopordum* sp. Özbek and Zanden (1992) gave *Prunus* sp., *Malus* sp., *Carduus* sp. *O.viciifolia* as pollen hosts of it. Özbek (2008b) mantioned that *O. caerulescens* is one of the important pollinators of fruit trees (*Prunus spp., Malus spp*.) in Turkey. Westrich (1989) and Müller (2014) noted that it is polylectic collects pollen nearly exclusively on Fabaceae (e.g. *Coronilla, Hippocrepis, Lotus, Medicago, Melilotus, Onobrychis, Trifolium, Vicia*), Lamiaceae (e.g. *Ajuga, Clinopodium, Glechoma, Lamium, Prunella, Salvia, Stachys, Teucrium*), Boraginaceae (e.g. *Echium*) and Antirrhineae.

Remarks: *Osmia caerulescens* is the most widespread and abundant species in Turkey as well in the rest of the world. It is active from April to September. Therefore I suspect it has at least two generations per year.

13. *Osmia (Helicosmia) carinoclypearis* Wu, 1985

Synonym: *Osmia (Helicosmia) frunseensis* Warncke, 1992

Distribution: N. Asia: KS, RC(NW), TJ. **SW. Asia:** TR. Previous records have not been ditected. **Turano-Anatolian chorotype.**

Material: Erzurum: Umudum Yaylası, 2800 m, 08.VIII.1991, 1♀, leg. HÖ, det. AM.

Remarks: The above mentioned data reveals that *O. carinoclypearis* is an Asian species; it is not a widespread either in Turkey or in other parts of the world and Turkey (Erzurum) is the westernmost distribution record for this species.

14. *Osmia (Helicosmia) chrysaetos* Warncke, 1988

Distribution: SW Asia: IR, TR. Known from Hakkari (type locality), Mersin, Kars (Warncke, 1988a). **Plants associated**: Fabaceae (Müller, 2014). **SW-Asiatic (Irano-Anatolian)**

15. *Osmia (Helicosmia) cinerea* Warncke, 1988.

Distribution: SW. Asia: TR. Known from Adıyaman, Hakkari (type locality), Nevşehir (Warncke, 1988a).

Plants Associated: Müller (2014) mentioned that possibly oligolectic on Boraginaceae. **Anatolian endemic!**

16. *Osmia (Helicosmia) clypearis acuta* Warncke, 1988

Distribution: SW Asia: IL, JOR, SYR, TR. Known from Hakkari, Kars (type locality), Konya and Sivas (Warncke, 1988a). **SW-Asiatic.**

Material: **Erzurum**: Umudum Yaylası, 2800 m, 08.VIII.1991, 1♀, leg. HÖ, det. GvdZ.

Plants associated: Müller (2014) noted that probably oligolectic on Asteraceae.

Remark: *O. (H.) clypearis* Morawitz, 1871 occurs in BG, E, GR, MK and Caucasus (Müller, 2014).

17. *Osmia (Helicosmia) dimidiata* Morawitz, 1870

Synonyms: *Pseudosmia taurica* Radoszkowski, 1874; *O. taurica* Radoszkowski, 1887; *O. rossica* Friese,

Distribution: Europe: AL, BG, E, F, GR, GR (Cr), I, I (Sa), I (Si), MK, RUS (SR), UA; Caucasus. **N. Africa:** MA. **N. Asia:** KS, TM. **SW. Asia:** CY, IL, IR, RL, TR. Known from Taurus (Tkalcu, 1975); Van (Zanden, 1980), Antalya, Aydın, Karaman, Mersin, Hakkari, Hatay, Kars, Mardin, Şanlıurfa (Warncke, 1988a), Ankara (Güler and Çağatay, 2006), Afyonkarahisar (Güler, 2011). **West-Palearctic.**

Material: Antalya: Termassos, 09.VII.1999, 1♀, leg. HÖ, det. GvdZ; Topçam, 05.VII.1991, 1♀, leg. HÖ, det. AM. **Artvin**: Ardanuç, Akarsu, 07.VII.1994, 1♀, leg. EY, det. HÖ; Yusufeli, Cinnar, 15.VII.1992, 1♀, leg. EY, det. GvdZ. **Bilecik**: merkez, 600 m, 15.VI.1995, 1♀, leg. EY, det. GvdZ. **Erzurum**: İspir, Madenköprübaşı, 17.VII.1992, 1♀, (on *Onopordum* sp.), leg. RH, det. GvdZ. Kars: Digor, Derinöz, 21.VI.1995, 2♀♀, leg. HÖ, det. HÖ.

Plants associated: *Onopordum* sp. Müller (2014) noted that oligolectic on Asteraceae.

18. *Osmia (Helicosmia) diomedia* Warncke, 1988

Distribution: SW Asia: TR. Known from only Hakkari (type locality) (Warncke, 1988a). **Anatolian endemic!**

19. *Osmia (Helicosmia) dlabolae* Tkalcu, 1978

Distribution: **SW. Asia:** TR. Known from Malatya (type locality), Sivas (Zanden, 1989). **Anatolian endemic!**

Material: **Mersin**: Tarsus, Çamlıyayla, 25.V.1992, 1♀, leg. HÖ, det. GvdZ: M**ale unknown**.

20. *Osmia (Helicosmia) gutturalis* Warncke, 1988

Synonym: *Osmia (Chalcosmia) milenae* Tkalcu, 1992 (type locality, Muş).

Distribution: SW. Asia: IL, IR, TR. **SW-Asiatic.** Known from Adıyaman, Hakkari (type locality), Konya, Siirt (Warncke, 1988a); Muş, Erzurum (Tkalcu, 1992) as *O. milenae.*

Material: Erzurum: Atatürk University Camps, 05.VI.1990, 1♀, leg. HÖ, det. TK.

21. *Osmia (Helicosmia) heliaca* Warncke, 1988

Distribution: SW. Asia**:** TR. Known from only Hakkari (type locality) (Warncke, 1988a). **Male unknown**. **Anatolian endemic!**

22. *Osmia (Helicosmia) labialis* Pérez, 1879

Distribution: Europe: A, CH, D, E, F, FL, I, MK, P, SK. **N. Africa:** TN. ***Osmia labialis* is new**

for the Turkish fauna as well as the Asia Continent. **Mediterranean chorotype**

Material: **Erzurum**: Oltu, 2000 m, 21.VI.1997, 1♀, leg. İA, det. AM (in AM's collection); Olur, Süngübayır, 20.VII.1994, 1♀, leg. İA, det. AM.

Plants associated: Oligolectic on Asteraceae (Amiet et al., 2004 and Herrmann, 2010). **Remark**: Erzurum (Turkey) is the easternmost distribution record of *O. labialis*.

23. *Osmia (Helicosmia) leaiana* (Kirby, 1802)

Synonyms: *Apis hirta* Geoffroy, 1785; *Osmia atra* Schenck, 1853; *O. confusa* Morawitz, 1869; *O. solskyi* Morawitz, 1870; *O. truncatula* Thomson, 1872; *O. bidens* Pérez, 1879; *O. forsii* Alfken, 1924, *O. (Helicosmia) ventralis schachti* Warncke, 1988

Distribution: whole **Europe**. **N. Africa:** DZ, MA, TN. **N. Asia:** KZ. **SW. Asia:** IR, TR. Known from Giresun! (Friese, 1921); Erzincan, Erzurum, Hakkari, Kars, Rize (Warncke, 1988a); Ardahan, Erzurum (Özbek 1979a); Ardahan, Erzurum, Tunceli (Özbek and Zanden, 1992). **Palearctic.**

Material: **Erzurum**: Oltu, Uzunoluk, 12.VII.2004, 1♀, leg. JGR, HÖ, det. AM.

Plants associated: *Carduus* sp. *Cirsium* sp. (Özbek and Zanden, 1992). Oligolectic on Asteraceae (Müller, 2014).

24. *Osmia (Helicosmia) livida* Tkalcu, 1978

Distribution: SW Asia: TR. Known from Ağrı, Ankara, Bayburt (type locality), Elazığ, Erzurum, Hakkari, Mersin (Tkalcu, 1978; Warncke, 1988a; Özbek and Zanden, 1992). A**natolian endemic!**

Material: **Erzurum**: Atatürk University Campus, 07.06.2000, 1♀, (on *O. viciifolia*) leg. HÖ, det. HÖ.

Plants associated: *O. viciifolia* (Özbek and Zanden, 1992).

25. *Osmia (Helicosmia) melanogaster* Spinola, 1808

Synonyms: *Osmia aterrima* Morawitz, 1872; *O. carniolica* Morawitz, 1872; *O. incerta* Radoszkowski, 1876.

Distribution: almost whole **Europe**. **N. Africa:** DZ, ET, LAR, MA, TN. **SW. Asia:** CY, IL, IR, JOR, SYR, TR. Known from Ankara, Bursa (Alfken, 1935; Zanden, 1983) as *O. notate aterrima*; Ağrı, Ankara, Denizli, Erzurum, Hakkari, Hatay, Mersin, İstanbul, Kars, Konya, Niğde, Sivas, Şanlıurfa, Rize, Tunceli (Warncke, 1988a) Erzincan (*Arctium lappa*), Erzurum, Eskişehir, Mersin, Konya, Şanlıurfa, Van (Özbek and Zanden, 1992); Mersin, Konya (Özbek and Zanden, 1992) as *O. m. carniolia* Morawitz; Afyonkarahisar (Güler, 2011). **West-Palearctic.**

Material: **Adıyaman**: merkez, Kasımiye Medresesi, 01.VI.2002, 2♀♀, leg. HÖ, det. AM and HÖ. **Antalya**: ca. 6 km E of Saklikent**,** 01.VI.2009, 1♀, leg. JGR, JSA, HÖ, det. AM; 7 km SW of Kargın, 36.37571_30.59704, 24.V.2009, 2♀♀, leg. JSA, HÖ, det. AM. **Artvin**: Şavşat, Karagöl, 08.VII.1998, 1♀, leg. ÖÇ, det. HÖ; Yusufeli, Altıparmak, 05.VII.1994, 1♀, leg. HÖ, det. HÖ. **Denizli**: Pamukkale, 05.V.1994, 2♀♀, leg. RH, det. AM and TG. **Diyarbakır**: Silvan, 12.V.1995, 1♂, leg. EY, det. TG. Eskişehir: Nihalgazi, Alpagut, 27.VI.1992, 1♀, leg. Z. Suna, det. GvdZ. **Erzincan**: merkez, 1250 m, 14.VI.1994, 1♀, 1♂, leg. EY, det. T. Griswold; Bayırbağ, 05.VII.1995, leg. GT, det. GvdZ. **Erzurum**: Atatürk University Campus, 22.VI.1995, 1♀, leg. HÖ, det. HÖ; Hınıs, Hacıömer, 1700 m, 1♀, leg. HÖ, det. HÖ; İspir, 1200 m, 18.VI.1994, 1♀, leg. HÖ, det. HÖ; Olur, Süngübayır, 08.VI.1992, 3♂♂, leg. İA, det. GvdZ; 12.VIII.1991, 1♀, leg. İA, det. GvdZ; Pasinler, Büyükdere, 11.VII.1997, 1♀, leg. EY, det. GvdZ; Şenkaya, 12.VI.1996, 1♀, E. Kılıç, det. HÖ; Turnalı, 25.VI.1991, 1♂, leg. EY, det. T. Griswold; Tortum, Aşağımeydanlar, 21.V.1995, 1♂, leg. İA, det. TG. **Hakkari**: Esendere, 37.71500_44.60000**,** 21.VII.1988, 3♀♀, leg. Schmid-Egger, det. WR (AMNH). **Muş**: merkez, 10.VIII.1996, 2♀♀, leg. B. Başak, det. GvdZ. **Samsun**: Çarşamba, 22.VIII.1991, 1♀, (on *Carduus* sp.), leg. HÖ, det. TG.

Remak: Müller (2014) noted that *O. melanogaster* nests preexisting cavities: empty snail shells (e.g. *Helix, Zonites*) in the herb or in fissures of stone walls with several cells per shell; insect burrows in dead wood; hollow stems. However, 2 samples of *O. melanogaster* were collected from the nest attached on the surface of the ceiling of the entrance hall of Kasımiye Medresesi in Adıyaman. The nest was active, made of mud and comprised 6 cells.

Plants associated: *Carduus* sp.; *Cirsium arvense, Centaurea glastifolia, Arctium lappa* (Özbek and Zanden, 1992). Oligolectic on Carduoideae (Asteraceae) (Müller, 2014).

26. *Osmia (Helicosmia) mirhiji* Mavromoustakis, 1957

Distribution: **Europe:** GR (Lesbos), Portugal. **SW- Asiatic:** IL, RL, SYR, TR. It was recorded from Turkey in 2013 (Müller, 2014) but locality is uncertain. **Asiatic-European chrotype.**

27. *Osmia (Helicosmia) niveata* (Fabricius, 1804)

Synonyms: *Anthophora niveata* Fabricius, 1804; *O. fulvicornis* Latreille, 1809; *O. minuta* Bramson, 1879; *O. sieversi* Morawitz, 1886; *O. carneiventris* Dours, 1887; *O. fulviventris albiscopa* Alfken, 1914

Distribution: **Europe**: whole Europe. **N. Africa:** DZ, E (Ca), ET, LAR, MA, TN Turkestan. **SW. Asia:** CY, IL, IR, JOR, RL, SYR, TR. Known from Samsun, İstanbul, Bursa, Adana, Mardin, Karaman, Niğde, Adapazarı, Bilecik, Zonguldak, Mersin, Kars, Şırnak, Hakkari (Warncke, 1988a), Erzurum (on *Salvia* sp.) (Özbek and Zanden, 1992),

Antalya (Özbek and Zanden, 1996) as *Osmia (Chalcosmia) fulviventris niveata* (Fabricius); Ankara, Çankırı (Güler and Çağatay, 2006), Afyonkarahisar (Güler, 2011) as *O. fulviventris* Panzer; Konya (Özbek and Zanden, 1996); Samsun (Zanden, 1980) last two records as *Osmia sieversi* Morawitz. **West-Palearctic**

Material: **Antalya**: Konyaaltı, 21.V.2009, 5♀♀, leg. JSA, JGR, HÖ, det. AM; 26.V.2009, 2♀♀, leg. JSA, HÖ, det. AM; Saklıkent, 25.V.2009, 1♀, leg. JGR, JSA, HÖ, det. AM. **Erzincan**: Bahçeli, 1350 m, 26.V.2001, 1♀, ÖÇ, det. AM. **Erzurum**: Şenkaya, Turnalı, 1800 m, 21.VI.1997, 2♀♀, leg. EY, det. AM; Turnalı, 1750 m, 25.VII.1996, 1♀, leg. EY, det. HÖ. **Plants associated**: *Salvia* sp. (Özbek and Zanden, 1992). Oligolectic on Asteraceae with a distinct preference for Carduoideae (Müller, 2014).

28. *Osmia (Helicosmia) ocularis* Warncke, 1988

Distribution: SW Asia: TR. Known from Hakkari (type locality) (Warncke, 1988a). **Anatolian endemic!**

29. *Osmia (Helicosmia) onocrotala* Warncke, 1988

Distribution: **Europe:** ARM. **SW Asia:** TR. Known from Hakkari, Hatay, Kars (typ locality) (Warncke, 1988a). **Anatolia-Armenian endemic.**

30. *Osmia (Helicosmia) pennata* Warncke, 1988

Distribution: **SWAsia**: IL, TR. Known from Hakkari, Mersin (type locality) (Warncke, 1988a). **SW-Asiatic chorotype.**

31. *Osmia (Helicosmia) peregrina* Warncke, 1988

Distribution: SW Asia: SYR, TR. Known from Şanlıurfa (type locality) Warncke, 1988a). **SW-Asiatic.**

Material: **Erzurum:** Atatürk University Campus, 27.VI.1972, 1♂ (on *O.viciifolia*), leg. HÖ, det. TG.

Plants associated: *O. viciifolia.*

32. *Osmia (Helicosmia) saxatilis* Warncke, 1988

Distribution: SW Asia: IL, JOR, SYR, TR. Known from Adana, Antalya, Batman, Erzurum, Hakkari, Mersin, Kars (type locality), Muğla, Şanlıurfa (Warncke, 1988a).

Plants associated: Polylectic (Müller, 2014) **SW-Asiatic chorotype.**

33. *Osmia (Helicosmia) subcornuta* Morawitz, 1875

Synonym: *O. rubicola* Friese, 1891.

Distribution: Europe: ARM, GR, GR (Cr), HR, I, MK. **N. Asia:** KS, TJ, UZ. **SW. Asia:** IL, IR, JOR, RL, TR. Known from Adana, Hakkari, Mersin, Karaman, Kars, Konya, Nevşehir, Warncke (1988a); Isparta (Özbek and Zanden, 1992). **Turano-European chorotype.**

Material: **Antalya**: 7 km S of Kargın, 24.V.2009, 1♀; 26.V.2009, 1♂, 1♀; 02.VI.2009, 3♀♀, 1♂, leg. JSA, HÖ, det. AM.; Saklıkent, 25.V.2009, 1♀; ca. 6 km E of Saklikent, 1♀, 31.V.2009; 01.VI.2009, 1♀, 1♂; 4 km E of Saklikent, 30.V.2009, 1♂; Altınyaka, 28.V.2009, 1♀; leg. JGR, JSA, HÖ, det AM (both EMET and ANHM); km, NE Altınyaka, 28.V.2009, 1♂ (*O.viciifola*), leg. HÖ, det. AM.

Plants associated: *O. viciifola*. Müller (2014) mentioned polylectic with a preference for Fabaceae.

34. *Osmia (Helicosmia) torquata* Warncke, 1988

Distribution: SW Asia: TR. Known from type locality, Hakkari (Warncke, 1988a) only. **Plants associated**: *Astragalus* sp. (Warncke, 1988a). **Anatolian endemic!**

35. *Osmia (Helicosmia) aurulenta* (Panzer, 1799)

Synonyms: *Apis haematoda* Panzer, 1801; *Osmia marginella* Lepeletier, 1841

Distribution: almost whole **Europe**. **SW. Asia:** IR, RL, TR. Known from Eskişehir, Hatay (Friese, 1921), Erzurum, Tunceli (Özbek, 1979b), Ağrı, Ankara, Bitlis, Hakkari, Karaman, Konya, Nevşehir, Siirt (1988a), Artvin (on *Sinapis arvensis*), Bitlis, Erzincan, Erzurum, Hatay, Mersin (Özbek and Zanden, 1992), Ankara, Kayseri, Nevşehir (Güler and Çağatay, 2006). **Europeo-East-Mediterranean chorotype.**

Material: **Artvin**: Ardanuç, Akarsu, 900 m, 07.VII.1994, 1♀, leg. HÖ, det. T. Giswold; Ferhatlı, 13.V.2000, 1♀, leg. ÖÇ, det. HÖ. **Bayburt**: Maden, 1600 m, 16.VI.2000, 1♀, leg. ÖÇ, det. HÖ. **Bilecik**: merkez, 600 m, 15.VII.1994, 1♀, leg. EY, det. HÖ. **Burdur**: merkez, 5.VI.1998, 1♂, leg. HÖ, det. AM. **Erzincan**: Ballıköy, 05.VII.1995, 1♀, leg. GT, det. HÖ; Cevizli, 04.VI.1990, 1♀, leg. HÖ, det. AM. **Erzurum**: Palandöken, 2200m, 23.VII.1997, 1♀, leg. EY, det. HÖ; Oltu, Sarısaz, 1300 m, 1♂, leg. LG, det. HÖ; Sütkans, 17.VI.1996, 1♀, leg. GT, det. HÖ; Pasinler, Çalıyazı, 2300 m, 13.VII.1997, 1♂, leg. EY, det. HÖ; Şenkaya, 25.V.1994, 1♂, leg. EY, det. GvdZ; Gaziler, 06.VII.1990, 1♀, leg. R. Kotan, det. TG; Tortum, 1400 m, 21.VI.1997, 1♀, leg. HÖ, det. AM; Kaledibi, 1♀, leg. HÖ, det. GvdZ; Uzundere, Balıklı, 1000 m, 04.V.2002, 1♀, leg. M. Kesdek, det. AM; Dikyar, 30.VI.1996, 1♀, leg. İA, det. HÖ; 02.VII.1994, 1♀, leg. İA, det. TG. Mersin: Çamlıyayla, 25.V.1994, 1♂, leg. EY, det. GvdZ. **Tokat**:15.VII.1994, 1♂, leg. H. Çam, det. GvdZ.

Plants associated: *Sinapis arvensis* (Özbek and Zanden, 1992. Müller (2014) mentioned that it is polylectic with a preference for Fabaceae.

36. *Osmia (Helicosmia) latreillei* (Spinola, 1806)

Synonyms: *Osmia nasidens* Latreille, 1811; *O. quadricornis* Kriechbaumer, 1869

Distribution: **Europe:** CH, E, E(Ba), F, F(Co), GR, GR(Cr), HR, I, I(Sa), I(Si), M, MK, P. **N. Africa:** DZ, E(Ca), ET, LAR, MA, P(Ma), TN. **SW Asia**: CY, IL, JOR, TR. Known from Aydın (Warncke, 1988a). **Weast Palearctic** chorotype

37. *Osmia (Helicosmia) dives* Mocsary, 1877

Synonyms: *Osmia medanae* Magretti, 1890; *O. subintegra* Pérez, 1902; *O. hierosolomita* Benoist, 1934.

Distribution: **Europe:** BG, GR, GR (Cr), H. **N. Asia:** KS, UZ. **SW. Asia:** CY, IL, IR, JOR, SYR, TR. Known from Ankara (Alfken, 1935); Karaman, Sivas (Zanden, 1980) as *O. (Helicosmia) sogdiana* Mocsary; Ankara, Hakkari, Kars (Zanden, 1983) as *Osmia (Chalcosmia) medanae* Magretti; Adıyaman, Ağrı, Ankara, Aydın, Batman, Eskişehir, Hatay, Kars, Kayseri, Kilis, Konya, Mardin, Sivas, Şanlıurfa (Warncke, 1988a) as *O. sogdiana dives* Mocsary; Nevşehir (Özbek and Zanden, 1992) as *O. medanae*; Erzincan (on *Carduus* sp.), Erzurum, Konya (Özbek and Zanden, 1992a). **Turano-European chorotype.**

Material: **Antalya**: Akseki, 03.VIII:1992, 1♀, 1♀, leg. HÖ, det. GvdZ; Beydağları, Yazırgözesi, 1200 m, 10.VII.1991, 1♀, leg. HÖ, det. GvdZ; 7 km S of Kargın, 02.VI.2009, 1♂, leg. JSA and HÖ, det. AM. **Diyarbakır**: Pirinçlik, 700 m, 37º53'2" N 39º58'46" E, 09.V.2002, 1♂, leg. JGR, HÖ, det. AM. **Erzurum**: Pazaryolu, 07.VI.1996, 2♀♀, leg. GT, det. HÖ; Uzundere, Şellale, 09.VI.1996, 1♀, leg. EY, det. HÖ. **Gümüşhane**: Köse, 10.VII.1995, 1♀, leg. İA, det. TG. **Iğdır**: Taşburun, 18.VII.1991, 1♀, leg. HÖ, det. HÖ. Mersin: Silifke, 23.V.1992, 1♀, leg. EY, det. GvdZ. **Osmaniye**: Nurdağı, 26.V.1992, 1♀, leg. HÖ, det. HÖ.

Plants associated: *Carduus* sp. (Özbek and Zanden, 1992). Oligolectic on Carduoideae (Müller, 2014).

Remark: Ascher and Pickering (2012) combined *O. dives* with *O. sogdiana* under the name of *O. sogdiana*.

38. *Osmia (Helicosmia) sogdiana* Morawitz, 1875

Synonym: *O. nassonowi* Pérez, 1902

Distribution: N. Asia: KS, KZ, TJ, TM, UZ. **SW. Asia:** AFG, IL, SYR, TR. Known from Sivas (Zanden, 1980); Erzincan, Gümüşhane, Hakkari (Warncke, 1988a). **Turano-Anatolian chorotype.**

Material: **Ankara**: Beytepe, 20.VII.1994, leg. HÖ, det. GvdZ (on *Onopordum turcicum*). **Antalya**: Saklıkent, 1800 m, 10.VII.1991, leg. HÖ, det. HÖ; 7 km S of Kargın, 24.V.2009, 1♂; 02.VI.2009, 1♂, leg. JSA, HÖ, det. AM. (EMET); 02.VI.2009, 2♀♀, leg. JSA, HÖ, det. AM (AMHN). **Diyarbakır**: Pirinçlik, 700 m, 37.88944_39.97111 09.V.2002, 2♂♂, leg. JGR, HÖ, det. JSA (on *Trifolium* sp.) (as *Osmia sogdiana dives*); Silvan, 12.V.1995, 2♂♂, leg. EY, det. TG and HÖ. **Diyarbakır:** Prinçlik, 37.88944_39.97111**,** 09.V.2002, 2♂♂, leg. JGR, HÖ, det. AM. (EMET and AMHN); Dicle Univiversity Campus, 37.92611_40.28472, 08.V.2002, 1♂, leg. JGR, HÖ, det. AM. **Erzurum**: Atatürk Univiversity Campus, 01.VII.1992, 1♀, leg. EY, det. T. Griswold; 04.VII.1996, 1♀, leg. E. Kılıç, det. GvdZ; 26.VI.1996, 1♀, leg. H.Ö, det. G.v.d. Zanden; 29.VII.1992, 1♀, leg. E Yıldırım, det. A M; İspir, 40º 29.485' N 40º 00.789' E, 28.VI.2006, 1♀, leg. JGR, HÖ, det. JSA (EMET); Çat, 30 km from Çat, Çirişli Geçidi, 2000-2100 m, 12.VI.2001, 2♀♀, leg. HÖ, det. AM (AM's collection); İspir, 40.49666_40.00000, 28VI.2008, 3♀♀, leg. JGR, HÖ, det. JSA (AMNH); Oltu, Başaklı, 1700 m, 07.VII.1994, 1♀, leg. HÖ, det. TG (on *O. turcicum*); Pazaryolu, 40.41761_40.78161, 27.VI.2008, 1♀, leg. JGR, HÖ, det. AM (AMNH); Tortum, 40.29830_41.54830, 27.VI.2001, 1♀, leg. JGR, HÖ, det. JSA (AMNH); 18VII.1974, 1♀, leg. HÖ, det. AM; Uzundere, Çamlıyamaç, 13.VIII.1991, 1♀, leg. HÖ, det. HÖ. **Kars**: Sarıkamış, Akkurt, 1650 m, 1♀, leg. HÖ, det. HÖ. **Konya**: Seydişehir, İnlice, 12.VII.1998, 1♀ (on *O. turcicum*), leg. HÖ, det. AM. **Muş:** Merkez, 10.VI.1996, 1♀, leg. S. Başak, det. GvdZ. **Rize**: Anzer, 28.VI.1996, 1♀, leg. Y. Bacan, det. GvdZ. **Tunceli**: Ovacık, Gözeler, 14.VII.1984, 1♂ (on *Onopordum* sp.), leg. HÖ, det. HÖ. **Van**: 30 km W of Gevaş, 38.38600-42.77500, 1♀, leg. JGR, HÖ, det. AM. Turkey (Antalya) is the westernmost distribution record of it.

Plants associated: *Onopordum* sp., *O. turcicum, Trifolium* sp. Müller (2014) noted probably oligolectic on Asteraceae.

39. *Osmia (Helicosmia) signata* Erichson, 1835

Synonyms: *O. melanippa* Spinola, 1808; *O. jucunda* Smith, 1853; *O. vidua* Gerstaecker, 1869; *O. cincta* Dours, 1873 ; *Pseudosmia taurica* Radoszkowski, 1874 ; *O. laticincta* Pérez, 1879; *O. atriventris* Costa, 1883; *O. costaniana* Dalla Torre &Friese, 1895

Distribution: **Europe:** AL, E, E (Ba), F, F (Co), GR, GR (Cr), I, I (Sa), I (Si), P, UA. **N. Africa:** DZ, ET, MA. **N. Asia:** RC, TM. **SW. Asia:** CY, IL, IR, JOR, SYR, TR. Known from Afyonkarahisar, Ankara, Bursa, Kahramanmaraş, Karaman, Yalova, (Alfken, 1935; Friese, 1921) as *O. vidua* Gestaecker; Bursa, Karaman (Zanden, 1980), Adana, Ankara, Antalya, Aydın, Birecik, Eskişehir, Çanakkale, Hakkari, Hatay, Mersin, İstanbul, Kayseri, Kilis, Konya, Mardin, Nevşehir, Şırnak, Uşak, Van (Warncke,1988a); Ankara, Eskişehir (*Salvia* sp.), Erzurum, Muş, Yalova (Özbek and Zanden 1992). **West-Palearctic chorotype.**

Material: **Aksaray**: 01.VI.1945, 2♀♀, leg. HÖ, det. TG and AM. Ankara: Beytepe, 20.VII.1994,

10♀♀ (on *O. turcicum*), leg. HÖ, det. HÖ. **Antalya**: Konyaaltı, 21.V.2009, 2♀, 1♀, leg. JGR, JSA, HÖ, det. AM; 7 km S of Kargın**,** 02.VI.2009, 1♀**,** leg. JSA, HÖ, det AM (ANHM). **Bayburt**: Yaylapınar, 26.VII.1992, 1♂, leg. HB, det. GvdZ. **Bilecik**: merkez, 600 m, 15.VII.1995, 1♂, leg. EY, det. GvdZ. **Bingöl**: Ilıcalar, 1250m, 07.V.2002, 1♂, leg. HÖ, det. AM. **Bitlis**: Adilcevaz, 07.VI.1970, leg. ♂, HÖ, det. Tk. **Diyarbakır**: Dicle University Campus, 700 m, 08.V.2002, 1♂, leg. HÖ, det. AM; 09.V.2002, 1♂, leg. JGR, HÖ, det. AM; Pirinçlik, 700 m, 37º53'22" N 39º 56' 16" E, 09.V.2002, 3♂♂ (on *Trifolium* sp.), leg. JGR, HÖ, det. AM (2 samples in AMNHM). **Erzincan**: merkez, 1250 m, 14.VI.1994, 1♀, 1♂, leg. EY, det. TG; Üzümlü, Bayırbağ, 10.VIII.1992, 1♂, leg. RH, det. GvdZ; 12 km NNE of Arapgir, 16.V.2002, 1♂, leg. JGR, HÖ, det AM (ANHM). **Erzurum**: Atatürk Atatürk University Campus, 30.VI.1992, 1♂, leg. EY, det. GvdZ; 01.VII.1992, 1♂, leg. EY, det. GvdZ; Pasinler, 08.VIII.1995, 2♂♂, leg. İA, det. GvdZ. **Hakkari**: Süvari-Halil Pass, 2200-2400 m, 22.VII.1986, 1♂, leg. A. W. Ebmer, det. GvdZ. **Iğdır**: Merkez, 17.VIII.1997, 1♀, leg. D. Bacara, det. AM; Çalpala, 950 m, 1♀, leg. CG, det. HÖ. Mersin: Erdemli, 23.V.1992, 6♀♀ (*O. turcicum*), leg. HÖ, det. GvdZ and HÖ; Silifke, 7♀♀, leg. HÖ, det. GvdZ and HÖ. **Kars**: Sarıkamış, Kalebaşı, 1♀, 25.VIII.1997, leg. EY, det. HÖ. **Muş**: 07.VI.1970, 1♀, 1♂, leg. M. Doğanlar, det. TK; 01.VI.1972, 1♂, leg. M. Doğanlar, det. Tk. **Şanlıurfa**: Siverek, Karabahçe, 09.V.2002, 1♂, leg. JGR, HÖ, det AM. (ANHM).

Plants associated: *Onopotdum turcicum, Trifolium* sp. Müller (2014**)** noted that it is oligolectic on Asteraceae.

40. ***Osmia (Hemiosmia) difficilis*** Morawitz, 1875

Synonyms: *Osmia falcata* Morawitz, 1875; *O. alborufa* Alfken, 1935

Distribution: N. Asia: KS, KZ, RUS, TJ, UZ. **SW. Asia:** IL, IR, TR. Known from Ankara (Alfken, 1935) as *O. alborufa* Alfken, Erzurum (Tkalcu, 1979), Ankara, Balıkesir, Mersin, Sivas (Zanden, 1987); Ankara, Elazığ, Hakkari, Mersin, Kars, Konya, Sivas, Tunceli, Van (Warncke, 1988b); Erzurum (on *Cirsium* sp., *O. viciifolia*, *Medicago sativa*) (Özbek and Zanden, 1992). **Turano-Anatolian chorotype.**

Material: **Antalya**: 4 km E of Saklıkent, 36º 52 51 N 30º 30 954 E, 1♂, leg. JSA, JGR, HÖ, det. AM; 6 km E of Saklıkent, 01.VI.2009, 1♀, leg. JSA, JGR, HÖ, det. AM. **Erzurum**: Atatürk University Campus, 1850 m, 01.VI.1992, 6♀♀ (on *O. viciifolia*), leg. EY, det. HÖ; 25.VII.1994, 1♀, leg. EY, det. HÖ; Narman, 1500 m, 27.VI.1997, 1♀, leg. E. Kılıç, det. HÖ; Oltu, Başaklı, 1700 m, 18.VII.1992, 5♀♀, leg. HÖ, det. HÖ; Palandöken, 01.VII.1996, 1♂, leg. EY, det. AM.

Plants associated: *O. viciifolia*, *M. sativa, Cirsium* sp. (Özbek and Zanden, 1992): Özbek, 2008a) and present study. Probably oligolectic on Fabaceae (Müller, 2014).

41. ***Osmia (Hoplosmia) croatica*** Friese, 1893

Distribution: Europe: BG, GR, HR, I, SCG, SLO. **SW. Asia:** TR. Known from Erzurum, İstanbul (Özbek and Zanden, 1996). **Europo-Anatolica chorotype.**

Material: **Bilecik**: 600 m, 15.VII.1995, 1♂, leg. EY, det. GvdZ. **Erzurum**: Pazaryolu, 07.VII.1996, 2♀♀, leg. EY, det. HÖ. Erzurum is the easternmost distribution record of this species.

Plants associated: Oligolectic on Asteraceae (Müller, 2014).

42. ***Osmia (Hoplosmia) elegans*** Tkalcu, 1992

Distribution: **Europe**: GR(Lesbos). **SW. Asia**: JOR, TR. Known from Antalya (type locality), Muğla **(**Tkalcu, 1992). **East-Mediterranean chorotype.**

43. ***Osmia (Hoplosmia) spinigera*** Latreille, 1811

Synonym: *O. clavicula* Gerstaecker, 1869

Distribution: **Europe:** BG, GR, MK. **N. Africa:** ET. **SW. Asia:** IL, JOR, RL, SYR, TR. Known from Erzincan (Özbek and Zanden, 1992) as *Anthocopa (Hoplosmia) spinigera* (Latreille. 1811). **Mediterranean chorotype.**

Material: **Erzurum**: İspir, 40.49666-40.00000, 28.VI.2008, 1♂, leg. JGR, HÖ, det AM (AMNH); Madenköprübaşı, 1100 m, 18.VI.1994, 1♂ (on *Onopordum* sp.), leg. İA, det. TG; Şenkaya, Penek, 09.VII.1992, 1♂, leg. EY, det. GvdZ. Erzurum is the easternmost distribution record of this species.

Plants associated: *Onopordum* sp. Müller (2014) indicated that it is oligolectic on Asteraceae

44. ***Osmia (Hoplosmia) spinulosa*** (Kirby, 1802)

Synonyms: *Apis spinulosa* Kirby, 1802; *Osmia euchreiformis* Radoszkowski, 1882; *Hoplosmia (Hoplosmia) spinulosa* (Kirby, 1802)

Distribution: almost whole **Europe**. **N. Asia:** KS, KZ. **SW. Asia:** TR. Known from Ankara (Alfken, 1935); Osmaniye! (Friese, 1921); Erzurum (Özbek, 1979b); Ağrı, Aydın (Özbek and Zanden, 1992). **Turano-European chorotype.**

Material: **Antalya**: Termesos, 09.VII.1992, 1♀, leg. HÖ, det. GvdZ. **Ardahan**: Posof, Yurtbekler, 27.VII.1991, 1♀ (*Carduus* sp.), leg. HÖ, det. HÖ; Sarıdarı, 20.VIII.1991, 1♀, leg. HÖ, det. HÖ. **Bilecik**: 600 m, 15.VII.1995, 2♀♀, leg. EY, det. GvdZ and HÖ. **Erzurum**: Atatürk University Campus, 21.VIII.1996, 1♀, EY, det. HÖ; Güzelova, 12.VIII.1992, 2♀♀, 1♂, leg. HÖ and EY, det. HÖ and GvdZ; Ilıca, Ağzıaçık, 20.VII.2003, 1♀, leg. JGR, HÖ, det AM (ANHM); Oltu, Başaklı,

17.VIII.1992, 2♀♀, 1♂ (*Cirsium* sp.), leg. HÖ, det. HÖ and GvdZ; Olur, Süngübayır, 23.VII.1992, 4♀♀, 1♂, leg. EY, det. GvdZ; 20.VII.1994, 1♀, leg. İA, det. HÖ; 20.VIII.1992, 1♀, leg. İA, det. GvdZ; Güngöründü, 21.VIII.1992, 1♀, leg. HÖ, det. T. Grisworld. **Konya**: Güneysınır, Gürağaç, 28.VII.2000, 1♀, leg. M. Kesdek, det. AM.**Tokat**: merkez, 19.VIII.1992, 2♀♀, leg. EY, det. GvdZ.

Plants associated: *Carduus* sp.. *Cirsium* sp. Amiet et al. (2004) mentioned that *O. spinulosa* was oligolectic on Asteraceae.

45. *Osmia (Hoplosmia) bidentata pallens* (Tkalcu, 1979)

Distribution: N. Africa: ET. **SW Asia:** IL, IR, JOR, SYR, TR. Known from Kayseri (Kohl, 1905), İstanbul, Zonguldak (Fahringer, 1922) as *Anthocopa bidentata* Morawitz, 1876; Antalya, Aydın, Balıkesir, İstanbul, İzmir, Nevşehir, Sivas (Özbek and Zanden, 1992); Erzurum (type locality), Ardahan, Bayburt (Tkalcu, 1979); Ağrı, Ardahan, Bitlis, Erzurum, Kars, Van (Özbek and Zanden, 1996). **Mediterranean chorotype.**

Material: **Ankara**: Beytepe, 20.VII.1994, 2♀♀ (on *O. turcicum*), leg. HÖ, det. HÖ; Şereflikoçhisar, 08.VII.1998, 1♀, leg. CG, det. AM. **Antalya**: Akseki, 03.V.1992, 2♀♀, leg. HÖ, det. GvdZ and HÖ; Saklıkent, 10.VII.1991, 1♀, leg. HÖ, det. HÖ; Karain Mağarası, 250 m, 21.V.2009, 1♀, leg. HÖ, det. HÖ; Termessos, 09.VII.1991, 1♀, leg. HÖ det. HÖ; **Bayburt**: Demirözü, 12.VII.1992, 2♀♀, leg. HÖ det. HÖ; 14.VII.1992, 3♀♀, leg. HB, det. HÖ. **Bilecik**: merkez, 600 m, 15.VII.1995, 5♂♂, 13♀♀, leg. EY, det. GvdZ and HÖ. **Bingöl**: Solhan, Bağlan, 2122 m, 24.VI.2000, 1♂, leg. M. Kestek, det. AM. **Bitlis**: Tatvan, 30.VII.1978, 5♀♀, leg. HÖ, det. GvdZ and HÖ (on *Carduus* sp.). **Erzincan**: merkez, 1250 m, 18.VII.1997, 1♂, 11.VII.1994, 1♀, 1♂, leg. EY, det. HÖ and AM; Bahçe Kültürleri Araştırma Merkezi, 05.VII.1995, 1♂, leg. GT, det. GvdZ. **Erzurum**: Hınıs, Akören, 39.49336_41.70222, 19.VII.2003, 1♂, leg. JGR, HÖ, det AM (AMNH); Atatürk University Campus, 20.VI.1994, 1♂, leg. HÖ, det. TG; 23.VII.1994, 1♀, leg. EY, det. HÖ; Köprüköy, Söylemez, 1850, 19.VII.2001, leg. EY, det. HÖ; Ilıca, 21.VI.1997, 4♀♀, leg. M. Gürbüz, det. AM, HÖ; İspir, Demirbilek, 28.VII.1992, 2♀♀, leg. HÖ, det. HÖ; Olur, Süngübayır, 12.VII.1991, 2♀♀, 1850 m, 24.VII.1996, 1♂, leg. İA, det. GvdZ; Süngübayır, 1850 m, 26.VII.1995, 1♀, 1♂, leg. İA, det. GvdZ and HÖ; Oltu, 22 km WSW of Oltu, 40.47166_41.77777, 08.VII.2007, 2♀♀, leg. JSA, HÖ, JGR, det AM (AMNH); Oltu, 12.VII.1979, 3♂♂, leg. HÖ, det. Tk, and Wr; Başaklı, 1700 m, 08.VII.1992, leg. HÖ, det. HÖ; 30.VII.1992, 1♀, leg. HÖ, det. HÖ; Çamlıbel, 1750 m, 04.VII.2004, 2♀♀, leg. HÖ, det. AM; Çamlıbel, 1750, 40º28'22" N 41º46'35" E, 1.VII.2004, leg. HÖ, det. HÖ; 08.VII.2007, 1♀, leg. HÖ, det. HÖ; Karakol, 1900m, 01.VII.2000, 1♂, leg. ÖÇ, det. HÖ; Başaklı, 1850m, 04.VII.2004, 1♂, leg. HÖ, det. AM; Palandöken, 2200 m, 23.VII.1997, leg. EY, det. AM; Palandöken, 2300 m, 17.VII.1996, 1♀, leg. İA, det. HÖ; Pazaryolu, 07.VII.1996, 1♀, leg. EY, det. HÖ; 07.VII.1996, 1♀, leg. GT, det. HÖ; 14 km ENE of Pasinler, 40.03030_41.83500, 04.VII.2007, 1♂, leg. JSA, HÖ, JGR, det. AM; Pasinler, 01.VII.1983, 2♂♂, leg. H. Özışık, det. GvdZ; Şenkaya, 16.VII.1993, 1♀, leg. EY, det. HÖ; 24.VII.1993, 2♀♀, leg. EY, det. HÖ; 01.VIII.1993, 1♀, leg. EY, det. GvdZ; Akşar, 1300 m, 26.VII.1994, 7♀♀, leg. EY, det. HÖ. **Kars**: Sarıkamış, Karakurt, TCKÇ, 40º07 870' N 42º31 855' E, 1500 m, 16.VII.2005, 2♀♀, leg. SÇ, det. HÖ, 8-23.VI.2005, 1♀, leg. HÖ, det. AM. **Konya**: Çumra, 1617m, 12.VIII.2000m, 2♀♀, leg. M. Kestek, det. HÖ. **Muş**: merkez, 10.VIII.1996, 1♀, leg. S. Başak, det. HÖ. **Tokat**: merkez, 900 m, 19.VIII.1992, 2♀♀, leg. EY, det. GvdZ. **Tunceli**: Gözeler, 14.VII.1994, 1♀ (*Onopordum* sp.), leg. HÖ, det. AM. **Yozgat**: Ankara-Yozgat yolu, 22.VII.1991, 2♀♀ (*Onopordum* sp), leg. HÖ, det. HÖ. **Plants associated**: *Carduus* sp., *Centaurea glastifolia*, *C. solstitialis*, *Cirsium* sp., *Onopordum* sp., *O. turcicum*, *Arctium lappa* (Özbek and Zanden, 1992) and present study. Oligolectic on Asteraceae (Müller, 2014). However, Güler and Sorkun (2007) mentioned that *O. bidentata* to be polylectic, harvesting pollen from eleven plant families in Turkey.

46. *Osmia (Hoplosmia) distinguenda* (Tkalcu, 1974)

Distribution: Europe: ARM, GR. **SW. Asia:** IL, JOR, SYR, TR. Known from Erzurum (Tkalcu, 1979); Erzurum, Hakkari, Mersin, Kayseri, Konya, Malatya, Mardin, Muş, Sivas (Özbek and Zanden, 1992). **East-Meditrranean chorotype.**

Material: **Bitlis**: Kokarsu, 27.VII.1978, 1♀, leg. HÖ, det. AM; Varto, 30.VII.1978, 1♂, leg. HÖ, det.Tk. **Erzurum**: Atatürk University Campus, 17.VIII.1992, 1♀, leg. İA, det. GvdZ; Umudum Yaylası, 2800 m, 08.VIII.1991, 2♀♀, leg. İA, det. GvdZ and AM (*Onopordum* sp.); Narman, Kireçli Dağı, 02.VII.2000, 2♀♀, leg. CG, det. AM, HÖ; Olur, Süngübayır, 2300 m, 26.VII.1995, 4♂♂, leg. İA, det. GvdZ and HÖ; 20.VII.1994, 4♀♀, leg. İA, det. HÖ; 23.VII.1992, 1♀, leg. İA, det. GvdZ; 01.VIII.1996, 1♀, leg. HÖ, det. AM; 12.VIII.1991, leg. İA, det. HÖ; Palandöken, 2300 m, 17.VII.1996, 2♀♀, 2♂♂, leg. İA, det. AM, HÖ. **Kars**: Sarıkamış, Akkurt, 1028 m, 40º07' 872 N 42º31' 887 E, 17.VII.2005, 1♀, leg. CG, det. AM; Karakurt, 1500 m, 40º07'543" N 42º20'941" E, 05VIII.2002, 1♂, leg. HÖ, det. AM. **Van**: Erciş, Çakırbey, 29.VII.1978, 1♀ (*Centaurea glastifolia* L), det. HÖ, det. HÖ.

Plants associated: *Onopordum* sp., *C. glastifolia* L. Oligolectic on Asteraceae (Müller, 2014).

47. *Osmia (Hoplosmia) ligurica* Morawitz, 1868

Synonyms: *O. ligurica* Morawitz, 1868; *O. detrita* Pérez, 1879

Distribution: almost whole **Europe. N. Africa:** MA. **SW. Asia:** CY, IL, IR, JOR, SYR, TR. Known from Osmaniye (Friese, 1921); Mersin (Zanden, 1980), Erzincan, Konya (Özbek and Zanden, 1992). **West-Palearctic.**

Material: **Adana**: Yumurtalık, 22.V.1992, 2♀♀, 1♂, leg. EY, det. GvdZ and HÖ; 22.V.1992, 1♀, leg. HÖ, det. AM. **Adıyaman**: Fidanlık, 800 m, 11.V.2002, 1♂, leg. HÖ, det. AM. **Aksaray**: merkez, 27.VII.1996, 1♀, leg. A. Tarım, det. HÖ. **Antalya**: Arapsuyu, Azmak, 26.V.2004, 1♀, leg. HÖ, det. AM; Konyaaltı, 24.V.2009, 1♀, leg. JSA, det. AM; Karacaören Barajı, 23.V.2009, 1♂, leg. JGR, HÖ, det. AM. **Artvin**: Ardanuç, Akarsu, 900 m, 01.VII.1994, 1♀, leg. HÖ, det. T. Grisworld (on *Onopordum* sp.); Yusufeli, Altıparmak, 05.VII.1994, 2♀♀, leg. GT and EY, det. HÖ; Sarıgöl, 1♀, leg. EY, det. TG. Erzincan: merkez, 1250 m, 04.VII.1994, 1♀, leg. EY, det. TG. **Bayburt**: Kopdağı, 2200 m, 09.VIII.2010, 1♀, leg. ÖÇ, det. HÖ. **Erzurum**: Atatürk University Campus, 15.VII.1996, 1♀, Leg. EY, det. HÖ; Olur, Süngübayır, 23.VII.1992, 1♂, leg. EY, det. GvdZ; Oltu, Başaklı, 1850 m, 04.VII.2004, 1♀, leg. HÖ, det. AM; Tortum, Aşağı Meydanlar, 21.V.1991, 1♀, leg. İA, det. AM; Uzundere, Şellale, 1100 m, 09.VI.1996, 1♀, leg. EY, det. HÖ. Mersin: Tarsus, Çamlıyayla, 25.V.1992, 6♂♂, leg. EY and HÖ, det. HÖ, GvdZ, AM.

Plants associated: *Onopordum* sp. Amiet et al. (2004) and Müller (2014) mentioned that it is oligolectic on Asteraceae with a preference for Asteroideae.

48. *Osmia (Hoplosmia) olgae* (Tkalcu, 1978)

Distribution: Europe: BG. **SW. Asia:** SYR, TR. Known from Nevşehir (Özbek and Zanden, 1992). **East-Mediterranean chorotype.**

49. *Osmia (Hoplosmia) padri* (Tkalcu, 1974)

Distribution: Europe: BG, GR, HR, MK, SCG. **SW. Asia:** SYR, TR. Known from Turkey (Müller, 2014), but locality is uncertain. **East-Mediterranean chorotype..**

Material: **Erzincan**: Avcılar, 1250 m, 04.VIII.2003, 1♀, leg. SÇ, det. AM. **Yozgat**: Ankara-Yozgat yolu, 22.VII.1991, 1♀, (*Onopordum* sp.), leg. HÖ, det. GvdZ.

Plants associated: *Onoprdum* sp. Müller (2014) mentioned that probably oligolectic on Asteraceae.

50. *Osmia (Hoplosmia) scutellaris* Morawitz, 1868

Distribution: Europe: AL, BG, CH, E, F, GR, GR (Cr), H, HR, I, I (Si), MK, P, RO, RUS, SK, SLO, UA; Caucasus. **N. Africa:** DZ, MA, TN. **SW. Asia:** CY, IL, JOR, SYR, TR. Known from Ankara (Alfken, 1935), Mersin (Özbek and Zanden, 1992) as *Anthocopa (Odontanthocopa) scutellaris* (Morawitz). **West-Palearctic chorotype**

Material: **Adana**: Balcalı, 25.V.1992, 1♀, leg. EY, det. GvdZ. **Antalya**: Konyaaltı, 21.V.2009, 1♂, leg. JSA, JGR, HÖ, det. AM; 24.V.2009, 1♀, leg. JSA, HÖ, det. AM. **Artvin**: Yusufeli, Darıca, 895 m, 15.VI.2006, 1♀ (*Carduus* sp.), leg. HÖ, det. HÖ; Darıca, 600m, 15.VI.2009, 1♀, leg. HÖ, det. AM; Demirkent, 450m, 06.VIII.1994, 2♀♀, leg. İA, det. GvdZ; Sarıgöl, 05.VII.1994, 1♀, leg. HÖ, det. HÖ; Altıparmak, 1100 m, 21.VIII.1992, 1♀, leg. EY, det. HÖ. **Diyarbakır**: Silvan, 17.IV.1995, 2♂♂, leg. EY, det. GvdZ. **Erzurum**: Oltu, Çamlıbel, 1700 m, 14.VII.1996, 1♀, leg. EY, det. GvdZ; Sütkans, 25.VI.1996, leg. EY, det. HÖ; Tortum, Aksu Yayla, 2250 m, 14.VII.1996, 1♀ (*Onopordum* sp.), leg. HÖ, det. GvdZ; Uzundere, Dikyar, 02.VII.1994, 1♀, leg. İA, det. HÖ; 30.VII.1996, 1♂, leg. İA, det. GvdZ; Şellale, 09.VI.1996, 2♀♀, 1♂, leg. EY, det. HÖ; Palandöken, 2300 m, 17.VII.1996, 3♂♂, 1♂, leg. İA, det. AM and HÖ. **Isparta**: Deremahallesi, 1150 m, 24.V.2004, leg. HÖ, det. AM. **Plants associated**: *Carduus* sp., *Onopordum* sp. Müller (2014) mentioned oligolectic on Asteraceae with a preference for Cichorioideae.

51. *Osmia (Melanosmia) thoracica* Radoszkowski, 1874

Synonym: *O. pentheri* Kohl, 1905

Distribution: **Europe:** ARM. **SW. Asia:** TR. Known from Kayseri (type locality) (Kohl, 1905) as *O. pentheri*; Bursa, Erzurum, Van (Zanden, 1983; Özbek and Zanden, 1992).

Plants associated: *Astragalus* sp., *Taraxacum* sp. (Özbek and Zanden, 1992). **Anadolo-Armanian.**

52. *Osmia (Melanosmia) parietina* Curtis, 1828

Synonyms: *Anthophora angustula* Zetterstedt, 1838; ***O.*** *vankovitzii* Radoszkowski, 1887

Distribution**:** whole Europe. N. Asia: **RUS.** SW. Asia**: TR.** Known from Erzurum (Özbek and Zanden, 1996).

Plants associated: *O. viciifolia*. (Özbek and Zanden, 1996). Polylectic with a preference for Fabaceae (Amiet et al., 2004). **Asiatic-European chorotype.**

53. ***Osmia (Melanosmia) nigriventris*** (Zetterstedt, 1838)

Distribution: **Europe:** A, CH, CZ, D, F, FIN, I, LT, LV, N, PL, RUS, S, SK. **N. Asia:** MGL, RC, RUS(ES), RUS(FS). **Extralimital:** Nearctic (Canada, USA). Known from Afyonkarahisar (Güler, 2011). However, Müller (2014) has not listed in the catalogue.

Plants associated: polylectic with a preference for *Vaccinium* (Ericaceae) (Amiet et al., 2004). **Holarctic.**

54. *Osmia (Metallinella) brevicornis leucogastra* Morawitz, 1875

Synonyms: *Eucera brevicornis* Fabricius, 1798; *Osmia atrocaerulea* Schilling, 1849; *O. panzeri* Morawitz, 1869; *O. leucogastra* Morawitz, 1875; *O. atrocaerulea cyanella homonym* Alfken, 1931; *O. atrocaerulea subcyanea* Alfken, 1935; *O. (Metallinella) brevicornis leucogastra* Morawitz, 1875; *O. (Metallinella) brevicornis subcyanea* Alfken, 1935

Distribution: **Europe.** ARM, BG, GR, MK; Caucasus. **Northern Asia:** KS, KZ, TJ, TM, UZ; Central Asian Ranges. **SW Asia:** AFG, CY, IR, TR. Known from Amasya, Ankara, Osmaniye (Alfken, 1935; Fahringer, 1922) Adapazarı, Bursa, İstanbul, Konya, Sivas, Nevşehir, Kayseri, Kastamonu, Burdur, Mersin, Diyarbakır, Kars, Hakkari (Warncke, 1991); Artvin (on *Sinapis arvensis*), Erzincan, Erzurum, Kayseri, Konya (Özbek and Zanden, 1992) as *M. brevicornis leucogastra* (Morawitz). **Asiatic-European chorotype.**

Material: **Antalya**: 7 km SW of Kargın, 36.37571_30.59704, 24.V.2009, 1♂, leg. JSA, HÖ, det. AM; 26.V.2009, 1♀, leg. JSA, HÖ, JGR, det. AM; ca. 6 km E of Saklikent, 31.V.2009, 1♂, leg. JGR, JSA, HÖ, det. AM; Şeklik Mevkii, 03.VI.2009, 1♀, leg. JSA, HÖ, JGR, det. AM (AMNH). **Artvin**: Kafkasör, 1300, 41º09'54" N 41º47'40" E, 1♂, leg. ÖÇ, det. AM. Erzincan: merkez, 1250 m, 14.VI.1994, 1♀, leg. EY, det. HÖ. **Erzurum**: Atatürk University Campus, 39.90250_41.23500, 07.VI.2007, 1♀, leg. JSA, HÖ, JGR, det. AM (AMNH); 1850 m, 26.V.1994, 1♂, leg. EY, det. HÖ; 10.VI.2000, leg. M. Kesdek, det. AM; İspir, 1200 m, 18.VI.1994, 1♀, leg. HÖ, det. HÖ; Oltu, 1275 m, 03IV.1994, 1♂, leg. HÖ, det. HÖ. **Diyarbakır**: Silvan, 12.V.1995, 1♀, leg. EY, det. HÖ**.** Mersin: Tarsus, Çamlıyayla, 25.V.1992, 1♀, leg. HÖ, det. GvdZ. **Tokat**: 900 m, 20.VIII.1992, 1♀, leg. H. Çam, det. GvdZ.

Plants associated: *Sinapis arvensis* (Özbek and Zanden, 1992). Amiet et al. (2004) noted that *O. brevicornis* is oligolectic on Brassicaceae.

55. *Osmia (Osmia) apicata* Smith, 1853

Synonym: *Osmia macroglossa* Gerstaecker, 1869

Distribution: Europe: AL, ARM, BG, I, GE, GR, HR, MK, RUS, SCG, SLO. **SW. Asia:** IL, IR, JOR, SYR, TR. Known from Osmaniye! (Friese, 1921), Mersin (Özbek, 1979a), Aydın, Erzincan, Erzurum, Konya (Özbek and Zanden, 1992). **Europo- East Mediterranean chorotype.**

Material: **Antalya**: 4 km E of Saklikent, 36.86944_30.51666**,** 30.V.2009, 5♀♀**,** 3♂♂**;** ca. 6 km E of Saklikent, 01.VI.2009, 1♀, Şeklik Mevkii, 03.VI.2009, 1♀, Altınyaka, 36.55598_30.35005, 28.V.2009, 2♀♀, leg. JGR, JSA, HÖ, det. AM (AMNH). **Artvin**: Altıparmak, 05.VII.1994, 1♀, leg. GT, det. TG. **Diyarbakır**: Silvan, 12.V.1995, 1♂, leg. EY, det. TG.

Erzurum: Hınıs, 40 km SE of Hınıs, 14.VI.2002, 1♂, leg. ÖÇ, det. HÖ; Ilıca, Atlıkonak, 2000 m. 11.VI.2000, 1♂, leg. ÖÇ, det. AM; Ilıca, Şöğütlü, 1900 m, 15.VI.2002, 1♂, leg. ÖÇ, det. AM; Oltu, Çamlıbel, 1750 m, 04.VII.2004, 1♀, leg. HÖ, det. AM; 22 km WSW of Oltu, 40.47166_41.76666, 23.VI.2001, 1♀, leg. JGR, HÖ, det. AM (AMNH); Şenkaya, Turnalı, 1800 m, 21.VI.1997, 1♂, leg. EY, det. AM. **Muş**: Devlet Üretme Çiftliği, 01.VI.1972, 1♀, leg. M. Doğanlar, det. TK.

Plants associated: Oligolectic on *Onosma* (Müller, 2014).

56. *Osmia (Osmia) maxschwarzi* Müller, 2012

Distribution: **SW. Asia:** IR, TR. Known from Antalya, Hakkâri, Mersin (Müller, 2012b). **Plants associated:** Possibly oligolectic on Fabaceae with long flower corollas, e.g. *Astragalus* (Müller, 2014). **SW-Asiatic (Irano-Anatolian) chorotype.**

57. ***Osmia (Osmia) scheherazade*** **Peters, 1978**

Synonyms: *O. (Orientosmia) maxillaris scheherazade* Peters, 1978 (type locality Sivas); *O. (O.) maxillaris dinazade* Peters, 1978

Distribution: **SW Asia:** IR, TR. Known from Sivas, as *O. (Orientosmia) maxillaris scheherazade* (Peters, 1978); Erzurum (*Medicago sativa*), Mersin (Özbek, 1979a; Özbek and Zanden, 1992) as *O. (Orientosmia) maxillaris scheherazade*. **SW-Asiatic (Irano-Anatolian)**

Material: **Antalya**: 6 km E of Saklıkent, 31.V.2009, 1♂, leg. JSA, JGR, HÖ, det. AM (EMET); 4 km E of Saklikent, 36.86944_30.51666, 30.V.2009, 1♂, leg JSA, JGR, HÖ, det. AM; 6 km E of Saklıkent, 31.V.2009, 2♂♂, leg. JSA, JGR, HÖ, det. AM; ca. 6kms E of Saklikent, 01.VI.2009, 2♀♀, 6♂♂, leg. JSA, JGR, HÖ, det. AM; Şeklik Mevkii, 03.VI.2009, 1♂, leg. JSA, JGR, HÖ, det. AM (AMNH). **Erzurum**: Sütkans, 1700 m, 17.VI.1996 (*Astragalus*), 1♂, leg. GT, det. HÖ.

Plants associated: *M. sativa* (Özbek, 1979a; 2008a; Özbek and Zanden, 1992), *Astragalus* sp. Possibly oligolectic on Fabaceae with long flower corollas, e.g. *Astragalus* (Müller, 2014).

Remarks: *Osmia (Orientosmia) maxillaris scheherazade* was described by Peters (1978) as subspecies of *O. maxillaris* Morawitz, 1875 from Gürün (Sivas). More recently, Müller (2012b) earned a species rank. After type locality Özbek (1979a) first collected some samples from a small alfalfa (*M. sativa*) field at the bottom of the Oltu Castel (Erzurum). In 1970s it was very ubundant in this alfalfa field, this could be related to the suitable nesting sides surrounding with rocky landscape scattered with small bushes. Unfortunately, currently,

this habitat was complately destroyed, since than no material has been collected from Oltu.

58. *Osmia (Osmia) mutensis* Peters, 1978

Distribution: SW Asia: TR**.** Mersin (type locality) (male unknown) (Peters, 1978). **Anatolian endemic!**

59. *Osmia (Osmia) bicornis* (Linnaeus, 1758)

Synonyms: *Apis rufa* L., 1758; *Osmia (Osmia) rufa* (L., 1758)

Distribution: almost whole Europe. **N. Africa:** DZ, MA, TN. **N. Asia:** KS, KZ, RUS (FS), TM; ~~J.~~ **SW. Asia:** CY, IL, IR, SYR, TR. Known from Balıkesir, Bursa, Kastamonu (Peters, 1978); Erzurum (Özbek, 1979a); Antalya, Erzurum (on *Prunus* sp.), Osmaniye (Özbek and Zanden, 1992) as *Osmia (Osmia) rufa cornigera* (Rossi, 1790). **Palearctic chorotype.**

Material: **Aydın**: Kuşadası, Davutlar Milli Park, 30.VI.1992, 1♂, leg. HÖ, det. GvdZ. **Erzurum**: Şenkaya, Ormanlı, 1800 m, 20.V.1994, 23♀♀ (*Prunus* sp., *Malus communis*), leg. EY, det. HÖ and TG. **Eskişehir**: Büyükdere, Odunpazarı, 18.III.2014, 20♀♀, 12♂♂, leg. HÖ, det. HÖ [(*Prunus armeniaca* (L.) and *Prunus* sp.]. **Trabzon**: Gölcük, Arsin, 23.IV.1997, 1♀, leg. LG, det. AM.

Plants associated: *Prunus* sp, *Malus communis* (Özbek and Zanden, 1992; Özbek, 2008b). Polylectic (Amiet et al., 2004; Westrich, 1989).

Note: the subspecies *Osmia (Osmia) bicornis globosa* (Scopoli, 1763) occurs in Turkey. This subspecies is synonymy with *Apis cornigera* Rossi, 1790 and *A. fronticornis* Panzer, 1799.

60. *Osmia (Osmia) cerinthidis* Morawitz, 1876

Distribution: Europe: A, ARM, BG, CZ, D, F, GE, GR, I, I (Si), MK, PL, RO, RUS, SK, SLO, UA. **SW. Asia:** IR, TR. Known from Ankara, Artvin, Amasya, Bursa, Eskişehir, Konya, Sivas (Peters, 1978); Erzurum (Özbek, 1979a); Erzincan, Erzurum, Kars, Konya (Özbek and Zanden, 1992) (on *Sinapis arvensis*, *Prunus* spp., *Malus communis*, *Salix* spp.); Afyonkarahisar (Güler, 2011). **Europo-East Mediterranean chorotype.**

Material: **Ağrı**: Eleşkirt, 2000 m, 1♂, HÖ, det. HÖ. **Antalya**: 1 km NE Altunyaka, 3622 366 E, 3636 071 N, 28.V.2009, 1♂, leg. HÖ, det. HÖ. **Erzincan**: Gülkaynak, 1200 m, 25.V.2001, 3♀♀, leg. RH, det. JSA and HÖ; 25.V.2001, 2♀♀, leg. CG, det. HÖ. **Erzurum**: Atatürk University Campus, 17.V.1995, 2♂♂, leg. HÖ, det. GvdZ; 05.VI.1996, 1♂, leg. E. Kılıç, det. GvdZ; 06.VI.1992, 1♀, leg. EY, det. GvdZ; 4 nolu kuyu, 1850 m, 10.VI.2000, 1♂, leg. M. Kesdek, det. AM; 16.VI.2007, 1♂, leg. HÖ, det. HÖ; 30.VI.1992, 1♂, leg. EY, det. GvdZ; 01.VII.1992, 1♂, leg. EY, det. GvdZ; 12.VII.1996, 1♂, leg. S. Fırat, det. HÖ; 17.VII.1995, 1♀, leg. HÖ, det. HÖ; Köşk Köyü, 1900 m, 20.VI.1996, 1♀, 2♂♂, leg. İA, det. GvdZ; Ilıca, Atlıkonak, 12.VI.1994, 1♂, leg. ÖÇ, det. HÖ; Söğütlü, 1900 m, 15.VI.2002, 1♀, leg. HÖ, det. HÖ; Tüysüz, 20.VI.1996, 1♀, leg. S. Pekel, det. HÖ; Umudum Yaylası, 1♀, leg. HÖ, det. GvdZ; İspir, Madenköprübaşı, 1♀, leg. EY, det. GvdZ; Ilıca, Ağzıaçık Bakımevi, 2300 m, 16.VI.2002, 1♂, leg. HÖ, det. AM; Söğütlü, 1900 m, 16.VI.2002, 1♂, leg. HÖ, det. AM; Olur, Süngübayır, 10.IV.1991, 1♂, leg. İ. Aslan, det. G. v.d. Zanden; 21.V.1994, 21♂♂, leg. İA, det. TG and HÖ; 07.VI.1991, 1♀, leg. İA, det. HÖ; 08.VI.1992, 2♀♀, 28♂♂, leg. İAslan, det. GvdZ and HÖ; 30.VI.1991, 2♀♀, leg. İA, det. TG and HÖ; 07.VII.1991, 3♀♀, leg. İA, det. HÖ; Oltu, Başaklı, 29.V.1995, 4♀♀, 36♂♂ (on *Malus communis*), leg. HÖ, det. HÖ and TG; 15.VI.1994, 12♀♀, 1♂, leg. HÖ, det. HÖ; Sütkans, 1700 m, 1♂, leg. GT, det. GvdZ; 22 km WSW of Oltu, 40.47166_41.77777, 25.VI.2001, 6♀♀, leg. JGR, HÖ, det. TG (2♀♀ EMET), (4♀♀ AMNH); 23.VI.2001, 1♀; det. JSA, HÖ; 03.VII.2007, 1♀; 08.VII.2007, 2♀♀, leg. JSA, HÖ, JGR, det. JSA (AMNH); Pasinler, Çalıyazı, 13.VII.1997, 1♂, leg. EY, det. AM; Şenkaya, Akşar, 1♂, leg. EY, det. TG; Ormanlı, 20.V.1994, 1800 m, 5♂♂, leg. EY, det. HÖ; Turnalı, 25.V.1994, 7♂♂, leg. EY, det. TG and HÖ; 25.VI.1991, 2♀♀, leg. EY, det. GvdZ and HÖ. **Isparta**: Dere Mahallesi, 1150 m, 24.V.2004, 1♂, leg. HÖ, det. AM. **İzmir**: Bornova, 07.VI.1994, 1♀, leg. HÖ, det. HÖ. **Trabzon**: merkez, 03.VIII.1996, 1♀, leg. H. Emir, det. HÖ.

Plants associated: *Sinapis arvensis*, *Prunus* spp., *M. communis*, *Salix* spp. (Özbek and Zanden, 1992) and present study). Özbek (2008b) indicated that O. *cerinthidis* is an important pollinator of fruit trees whereas Amiet et al. (2004) noted that oligolectic on *Cerinthe* (Boraginaceae)

61. *Osmia (Osmia) cornuta* (Latreille, 1805)

Distribution: Europe: whole Europe. **N. Africa:** ET, DZ, TN. **N. Asia:** TM; Turkestan. **SW. Asia:** CY, IR, TR. Known from Ankara, Bursa, Eskişehir, İzmir, Konya, Nevşehir, Tekirdağ (Peters, 1978), Ankara, Erzurum (on *Prunus* sp.), Eskişehir, Konya, Şanlıurfa, Tokat (Özbek and Zanden, 1992). **Palearctic.**

Material: **Ankara**: The garden of Agricultural Faculty, 17.IV.1995, 2♀♀, (*Malus* sp.), leg. HÖ, det. HÖ. Eskişehir: Odunpazarı, 08 IV.1992, 1♀, leg. Z. Suna, det. GvdZ; Büyükdere, 16♀♀, 8♂♂, 21.III.2014, leg. HÖ, det. HÖ [(*Prunus armeniaca* (L.) and *Prunus* sp.]. **Erzurum**: merkez, 13.VII.1966, 1♀, leg. HÖ, det. TG. **Kars**: Kağızman, 20.IV.1977, 18♀♀ (*Prunus* sp.), leg. HÖ, det.TG. **Iğdır**: merkez, 21.IV.1977, 21♀♀ (*Prunus* sp., *M. communis*), leg. HÖ, det.T. Griswold and AM.

Plants associated: *Prunus* sp., *M. communis*). Özbek (2008b) noted that *O. cornuta* is one of the important pollinators of fruit trees in Turkey. Polylectic; pollen sources include plants belonging to

13 different families (Amiet et al., 2004; Westrich, 1989). The subspecies *Osmia cornuta quasirufa* Peters, 1978 occurs in Turkey (Müller, 2014).

62. *Osmia (Osmia) mustelina* Gerstaecker, 1869

Synonym: *Osmia emarginata* Lepeletier 1835

Distribution: Europe: A, ARM, CH, CZ, D, FL, GE, GR, H, HR, I, I(Si), L, MK, PL, RO, RUS, SK, SLO, UA. **SW. Asia:** IL, IR, RL, TR. Known from Aladağ? (Friese, 1921) as *O. emerginata* Lepeletier; Ankara (Alfken, 1935) as *O. emarginata*; Bolu, Bursa, Konya, Mersin (Peters, 1978), Mersin, Kars (Özbek, 1979a); Mersin, Van (Zanden, 1989); Aksaray, Eskişehir, Gümüşhane (Özbek and Zanden, 1992). **Europo-East Mediterranean chorotype.**

Material: **Antalya**: Saklıkent, 3650 399 N 3019 934 E, 26.V.2009, 2♂♂, leg. JSA, JGR, HÖ, det. AM. (EMET); Şeklik Mevkii, 03.VI.2009, 1♀, leg. JSA, JGR, HÖ, det. AM; 7 km SW of Kargın, 36.37571_30.59704, 26.V.2009, 2♀♀, leg. JSA, HÖ, JGR (AMNH). **Bayburt**: Yaylapınar, 26.VII.1992, 1♀, leg. HB, det. AM. **Erzurum**: Köşkköyü, 14.VII.1992, 1♀, leg. HÖ, det. GvdZ; İspir, Maden Köprübaşı, 17.VII.1992, 1♂, leg. RH, det. GvdZ; Olur, Süngübayır, 23.VII.1992, 1♀, leg. EY, det. HÖ; Oltu, Sütkans, 17.VI.1996, 1♀, leg. ÖÇ, det. HÖ; Şenkaya, Ormanlı, 1800 m, 20.V.1994, 1♀, leg. EY, det. HÖ.

Plants associated: polylectic; Fabaceae, Boraginaceae, Cistaceae, *Scabiosa* (Dipsacaceae) and *Ajuga* (Lamiaceae) (Amiet et al., 2004).

63. *Osmia (Osmia) nigrohirta* Friese, 1899

Distribution: **Europe:** AL, GR, MK; Caucasus. **SW. Asia:** IR, RL, TR. Known from Osmaniye! (Friese, 1921), Ankara (Alfken, 1935); Erzurum (on *O. viciifolia*) (Özbek, 1979a), Afyonkarahisar, Ankara, Mersin, Karaman, Konya (Peters, 1978), Denizli, Kayseri, Kars (on *Centaurea* sp.), Konya, Sivas (Özbek and Zanden, 1992). *Centaurea* sp. **East- Mediterranean chorotype.**

Material: **Antalya**: ca 6 km E of Saklıkent, 01.VI.2009, 1♂, leg. JSA, JGR, HÖ, det. AM (EMET); 4 km NNE of Altınyaka, 28.V.2009, 1♀, leg. JSA, HÖ, JGR, det. AM M; ca 6 km E of Saklıkent, 01.VI.2009, 1♂, leg. JSA, JGR, HÖ, det. AM (AMNH). **Erzurum**: Oltu, İnanmış, 2000 m, 21.VI.1997, 1♀, leg. İA, det. HÖ.

Plants associated: *O. viciifolia*, *Centaurea* sp. (Özbek, 1979a; Özbek and Zanden, 1992a). Polylectic; Fabaceae (e.g. *Onobrychis*), Boraginaceae (e.g. *Echium*), Cistaceae, Brassicaceae and Carduoideae (Asteraceae) (Müller, 2014).

64. *Osmia* (*Osmia*) *avosetta* Warncke, 1988

Distribution: SW. Asia: IR, JOR, SYR, TR. Known from Ağrı, Antalya, Erzurum, Hakkari, Malatya, Van (type locality) (Warncke, 1988b); Antalya, Erzurum (*O.viciifolia*) (Özbek and Zanden, 1992). **SW-Asiatic**

Material: **Antalya**: Saklıkent yolu, Şeklik Mevkii, 03.VI.2009, 1♀, 3♂♂, leg. JSA, JGR, HÖ, det. JSA. Erzurum: Atatürk University Campus, 21.VI.1996, leg. HÖ, det. HÖ (*O.viciifolia*); 09.VII.1997, 2♀♀, leg. E. Kılıç, det. HÖ; Pasinler, Rabat, 2200 m, 01.VII.1996, 1♀, 1♂, leg. HÖ, det. HÖ. Antalya is the westernmost distributio record of *O. avosetta.*

Plants associated: *O. viciifolia* (Özbek and Zanden, 1992) and present study. *O. viciifolia* (Özbek and Zanden, 1992) and present study.

65. *Osmia (Pyrosmia) amathusica* Mavromoustakis, 1937

Distribution: Europe: GR, GR (Cr), I(Si). **SW. Asia:** CY, IL, JOR, SYR, TR. Known from Erzurum (Özbek, 1979a); Hatay, Konya, Nevşehir, Şanlıurfa (Zanden, 1991); Hakkari, Hatay, Şanlıurfa (Warncke, 1992); Antalya, Konya (Özbek and Zanden, 1992) as *Osmia (Caerulosmia) amathusica* Mavromoustakis. **East-Mediterranean chorotype.**

Material: Erzurum: Atatürk University Campus, 2000 m, 24.04.1970, 1♂ (on *O. viciifolia*), leg. HÖ, det. HÖ; 01.VI.1996, 1♀, leg. E. Kılıç, det. HÖ.

Plants associated: *O. viciifolia.*

66. *Osmia (Pyrosmia) cyanoxantha* Pérez, 1879

Synonym: *O. (Pyrosmia) elbalba* Warncke, 1992

Distribution: Europe: ARM, E, F, F (Co), GR, HR, I, I (Si), MK, P, SLO. **N. Africa:** DZ, MA, TN. **SW. Asia:** CY, IL, IR, JOR, SYR, TR. Known from Elazığ, Mersin, Sivas (Zanden, 1991); Ankara, Antalya, Aydın, Balıkesir, Batman, Erzurum, Hakkari, Kars, Kırşehir, Konya, Mardin, Sivas, Van (Warncke, 1992); Elazığ, Erzurum (*O. viciifolia*), (Özbek and Zanden, 1992). **West Palearctic chorotype.**

Material: **Antalya**: 7 km S of Kargın, 02.VI.2009, 1♀, leg. JSA, JGR, HÖ, det. AM. (EMET); 4 km E of Saklikent, 36.86944_30.51666, 25.V.2009, 1♀, 1♂; 7 km S of Kargin, 02.VI.2009, 2♀♀; Saklıkent yolu, Seklik Mevkii, 03.VI.2009, 1♀, leg. JSA, JGR, HÖ, det. AM; **Bayburt**: Demirözü, 14.08.1992, 1♀, leg. HB, det. GvdZ. **Elazığ**: Keban, 900 m, 16.V.2002, 1♀, leg. HÖ, det. AM. **Erzurum**: 40.00000_41.50000, 10.VII.2004, 1♀, leg. JGR, HÖ, det. AM (AMNH); Atatürk University Campus, 07.VI.1996, 1♀ (*O. viciifolia*), leg. EY, det. HÖ; 10.VI.1994, 2♂♂, leg. EY, det. T. Glisword; 13.VI.1994, 1♀, leg. EY, det. T. Gliswold; 21.VI.1995, 3♀, 1♂, leg. HÖ, det. HÖ; 03.VII.1996, 3♀♀, leg. EY, det. HÖ; 23.VII.1992, leg. EY, det. HÖ; Palandöken, 2200 m, 02.VI.1992, 2♀♀, leg. EY, det. HÖ; İspir, Maden Köprübaşı, 1100 m, 18.VI.1994, 1♀, leg. İA, det. TG; Narman, Araköy, 12.VII.1996, 1♀, leg. GT, det. AM; Olur, 22.VII.1992, 1♂, leg. EY, det. HÖ; Pasinler, 13.VI.1996, leg. SÇ, det. HÖ; Şenkaya, Turnalı,

12.VI.1992, 1♂, leg. EY, det. HÖ. **Konya**: Güneysınır, Gürağaç, 02.VI.2002, 1020 m, 1♀, leg. M. Kestek, det. AM.

Plants associated: *O. viciifolia* (Özbek and Zanden, 1992) and present study. Polylectic; Fabaceae, *Echium* (Boraginaceae) and Lamiaceae (Müller, 2014).

67. *Osmia (Pyrosmia) dilaticornis* Morawitz, 1875

Distribution: **Europe**: GR**. N. Asia**: TJ, UZ**. SW. Asia**: IL, IR, JOR, SYR, TR. Known from Ankara, Hakkari, Konya, Sivas, Van (Warnke, 1992).

Plants associated: Possibly oligolectic on Fabaceae (Müller, 2014). **Turano-European chorotype.**

68. *Osmia (Pyrosmia) forticornis* Zanden, 1989

Distribution: **Europe:** ARM, GR. **SW. Asia:** TR. Known from Eskişehir, Mersin, Nevşehir, Sivas (Zanden, 1989); Adıyaman, Mersin, Karaman, Kars, Kayseri, Mardin, Sivas, (Warncke, 1992); Konya (Özbek and Zanden, 1992). **East Mediterranean chorotype.**

Material: **Erzurum**: Atatürk University Campus, 17.VIII.1992, 1♀, (*O. viciifolia*), leg. İA, det. GvdZ; Aşkale, Pırnakapan, 1750 m, 28.V.2001, 1♂, leg. CG, det. AM.

Plants associated: *O. viciifolia*. Müller (2014) noted that it is polylectic; Fabaceae and Lamiaceae.

69. *Osmia (Pyrosmia) hermona* Warncke, 1992

Distribution: **N. Asia:** TJ. **SW. Asia:** IL, SYR, TR. Known from Hakkâri (Warncke, 1992a). **Turano-Anatolian chorotype.**

70. *Osmia (Pyrosmia) laticauda* Stanek, 1969

Distribution: **Europe:** GR, MK. **SW. Asia:** IR, TR. Known from Mersin (type locality), Burdur, Hakkari (as *Osmia tichodroma* Warncke, 1992) (Stanek, 1969; Zanden, 1989; Warncke, 1992).

Plants associated: polylectic; Fabaceae and Lamiaceae (Müller, 2014). **East Mediterranean chorotype.**

71. *Osmia (Pyrosmia) moreensis* Zanden, 1984

Distribution: **Europe:** GR, GR (Cr). **SW. Asia:** IL, SYR, TR. Known from Antaya, Aydın, Hakkari, Mersin, İstanbul, Konya, Nevşehir, Osmaniye, Sivas (Warncke, 1992). **East-Mediterranean chorotype.**

Material: **Elazığ**: Keban, 38º45'40'' N 38º46'52'' E, 16.V.2002, 900 m, 4 ♀♀, leg. HÖ, det. AM. **Mersin**: Çamlıyayla, 25.V.1992, 1♀, 1♀, leg. HÖ, det. GvdZ.

72. *Osmia (Pyrosmia) oramara* Warncke, 1992

Distribution: **SW.** IR, TR. Known from Hakkari (type locality), Elazığ. **Plants associated**: possibly oligolectic on Fabaceae (Müller, 2014)**. SW-Asiatic (Irano-Anatolia) chorotype.**

73. *Osmia (Pyrosmia) saxicola* Ducke, 1899

Synonyms: *Osmia caelestina* Benoist, 1934; *O. (Chalcosmia) cypricola* Mavromoustakis, 1937, *O. (Chalcosmia) posti* Mavromoustakis, 1956.

Distribution: **Europe:** E, F, GR, GR (Cr), HR, I, SCG. **N. Asia:** TJ. **SW. Asia:** CY, IL, IR, JOR, RL, SYR, TR. Known from Erzurum (Özbek, 1979a); Antalya, Konya, Sivas (Zanden, 1980); Adıyaman, Hakkari, Hatay, Mersin, Elazığ, Erzurum, Kars, Kayseri, Konya, Muğla, Nevşehir, Sivas, Şanlıurfa, Siirt, Van (Warncke, 1992); Erzurum (on *Carduus* sp. and *O. viciifolia*), Nevşehir, Tunceli (on *Salix* sp.) (Özbek and Zanden, 1992) as *O. cypricola*; Kayseri as *O. (Caerulosmia) caelestina* Benoist (Özbek and Zanden, 1992). **Asiatic-European chorotype.**

Material: **Antalya:** 4 km E of Saklikent, 24.V.2009, 1♂; 31.V.2009, 1♂; leg. JSA, JGR, HÖ, det. AM (in ANHM). **Erzurum**: Atatürk University Campus, 24.VI.1997, 1♀, leg ÖÇ, det. AM.

Plants associated: *Carduus* sp., *O. viciifolia* and *Salix* sp. (Özbek and Zanden, 1992). Polylectic with a probable preference for Fabaceae (Müller, 2014).

74. *Osmia (Pyrosmia) submicans* Morawitz, 1870

Synonyms: *Osmia (Chalcosmia) giraudi* Schmiedeknecht, 1886; *O. aurantiaca* Stanek, 1969.

Distribution: almost whole **Europe. Asia:** Japan, Kazakhstan. **N. Africa:** DZ, E (Ca), ET, LAR, MA, TN. **SW. Asia:** CY, IL, JOR, RL, SYR, TR. Known from Adana, Antalya, Mersin, İstanbul, İzmir (Warncke, 1992); Antalya (Özbek and Zanden, 1992). **Palearctic chorotype.**

Material: **Antalya**: Saklıkent, 8 km W of Doyran, 36.89997_30.45991, 30.V.2009, 1♀ (*O. viciifolia*), leg. JSA, HÖ, det. AM (AMNH); Side, 02.V.1994, 1♀, leg. GT, det. TG.

Plants associated: polylectic with a strong preference for Fabaceae (Amiet et al., 2004).

75. *Osmia (Pyrosmia) versicolor viricephalica* Warncke (1992)

Distribution: **SW. Asia:** IL, JOR, RL, SYR, TR. Known from İstanbul (Friese, 1922); Aydın, Sivas (Zanden, 1984); Ankara, Antalya, Aydın (type locality), Balıkesir, Batman, Çanakkale, Erzurum, Hakkari, Hatay, Mersin, İstanbul, İzmir, Karaman, Kayseri, Konya, Mardin, Muğla, Nevşehir, Niğde, Siirt, Sivas (Warncke, 1992); Eskişehir, Isparta, Mersin, Tokat (Özbek and Zanden, 1992). **SW-Asiatic chorotype.**

Material: **Antalya**: 25.V.2009, 2♂♂, leg. JGR**,** HÖ, det. AM; 7 km SW Kargın, 24.V.2009, 1♀, leg. JSA, H Ö, det AM; 36.37571_30.59704, 26.V.2009, 1♀, 1♂, leg. JSA, HÖ, JGR, det. AM; 02.VI.2009, 1♀, leg. JSA, HÖ, det AM; Saklıkent, 36.84444_30.31666, 25.V.2009; ♂, leg. JGR, JSA, HÖ, det. AM (AMNH). **Bayburt**: Demirözü, 30.VII.1997, 1♀, leg. HB, det. GvdZ. **Erzurum**:

İspir, Maden Köprübaşı, 1100 m, 18.VI.1994, 1♀ (*Astrgalus* sp,), leg. İA, det. T. Griswold; Oltu, 25 km SSW of Oltu, 18.V.2002, 40.48666_41.79666, 2♂♂, leg. JGR, HÖ, det. AM (EMET); 5-25 km SSW of Oltu, 18.V.2002, 1♂, leg. JGR, HÖ, det. AM (AMNH); Narman, Araköy, 12.VII.1996, 1♀, leg. GT, det. AM; Tortum, Aksuyaylası, 2250 m, 14.VII.1996, 1♀ (*Astrgalus* sp,), leg. HÖ, det. HÖ; Pehlivanlı, 12.VII.1992, 2♀♀, leg. EY, det GvdZ; Uzundere, 01.VII.1996, 1♀, leg. HÖ, det. HÖ. Mersin: Tarsus, Çamlıyayla, 25.V.1992, 1♀, leg. HÖ, det. GvdZ. **Kars**: 14 km W of Kağızman, 18.V.2002, 3♂♂, leg. JGR, HÖ, det. AM (AMNH).

Plants associated: *Astrgalus* sp.; polylectic with a strong preference for Fabaceae (Amiet et al., 2004; Westrich, 1989; Müller, 2014).

76. *Osmia (Pyrosmia) viridana* Morawitz, 1874

Osmia angulata Pérez, 1896; *O. rufispina* Morawitz, 1875

Distribution: almost whole **Europe**. **N. Africa:** DZ, TN. **N. Asia:** KS, KZ, TJ, TM, UZ. **SW. Asia:** CY, IL, IR, JOR, SYR, TR. Known from Aydın, Nevşehir (Zanden, 1984) as *O. v. mulleolus* Zanden, 1984; Adana, Ankara, Antalya, Aydın, Erzurum, Hakkari, Mersin, Mardin, Muğla, Nevşehir, Siirt, Şanlıurfa (Warncke, 1992); Erzurum (on *O. viciifolia*), Nevşehir, Kahramanmaraş (Özbek and Zanden, 1992) as *O. v. mulleolus* Zanden. **Palearctic**

Material: **Adıyaman**: Gölbaşı, 20 km E of Gölbaşı, 600 m, 37º40'25" N 37º 55' 26" E, 09.V.2002, 1♂, leg. HÖ, det. AM. **Diyarbakır**: Silvan, 17.IV.1995, 1♀, leg. EY, det. GvdZ. **Erzurum**: İspir, 40.49666_40.00000, 28.VI.2008, 1♀, leg. JGR, HÖ, det. AM; 5-25 km SSW of Oltu, 40.48666-41.79666, 18.V.2002, 1♀, leg. JGR, HÖ, det. AM (AMNH); Palandöken, 12.VII.1995, 1♀ (*Astragalus* sp), leg. E. Kılıç, det. HÖ; 28.VII.1992, 1♀, leg. EY, det. GvdZ: Olur, Süngübayır, 23.VII.1997, 1♀, leg. İA, det. GvdZ; Oltu, 08.VII.1978, 1♀, leg. HÖ, det. GvdZ; Çamlıbel, 1600 m, 26.VII.2000, 1♀, leg. HÖ, det. AM; Pasinler, Rabat, 2400 m, 1♀ (*Astrgalus* sp), leg. EY, det. HÖ; Uzundere, Dikyar, 1500 m, 20.V.1992, 1♀, leg. İA, det. GvdZ. Mersin: Tarsusu, Çamlıyayla, 25.V.1992, 1♀, leg. HÖ, det. GvdZ.

Plants associated: polylectic with a strong preference for Fabaceae (Amiet et al., 2004).

77. *Osmia (Pyrosmia) cephalotes* Morawitz, 1870

Synonyms: *Osmia longiceps* Morawitz, 1876; *O. bacillus* Pérez, 1879; *O. pulsata* Buysson, 1899

Distribution: **Europe:** ARM, AZ, BG, E, F, GE, GR, H, HR, I, I (Si), P, RO, RUS, SLO. **N. Africa:** DZ, LAR, MA, TN. **N. Asia:** TM. **SW. Asia:** CY, IL, IR, JOR, SYR, TR. Known from Mersin (Zanden, 1991); Adana, Antalya, Hakkari, Hatay, Mersin, İzmir, Kayseri, Mardin, Muğla, Nevşehir, Siirt, Şanlıurfa, Van (Warncke, 1992); Diyarbakır, Isparta (Özbek and Zanden, 1992). **West-Palearctic**

Material: **Antalya**: 5 km W of Doyran, 31.V.2009, 2♀♀, leg. JGR, JSA, HÖ, det. AM; Saklıkent, 25.V.2009, 2♂♂; 4 km E of Saklıkent, 36.86944_30.51666, 1608 m, 30.V.2009, 1♀, 2♂♂, leg. JGR, JSA, HÖ, det. AM; 7 km S of Kargın, 02VI.2009, 3♀♀, leg. JSA, HÖ (AMNH)**. Artvin**: merkez, 15.IX.1997, 1♀, leg. Ş. Aydemir, det. AM. Diyarbakır: Silvan, 12.V.1995, 1♀, leg. EY, det. TG. **Bingöl**: Ilicalar, 17 km E of Bingol**,** 38.99750_40.68750, 09.V.2002, 1♂, leg. JGR, HÖ, det. AM. **Erzurum**: İspir, Madenköprübaşı, 1100 m, 18.VI.1994, 1♀, leg. İA, det. TG; 18.VI.1994, 1♀, leg. EY, det. TG.

Plants associated: **p**olylectic with a preference for Fabaceae (Müller, 2014).

78. *Osmia (Pyrosmia) gallarum* Spinola, 1808

Synonym: *Osmia ruborum* Dufour and Perris, 1840; *O. lapidistructor* Ferton, 1921.

Distribution: **Europe:** A, AL, BG, CH, CZ, D, E, F, GR, H, HR, I, L, MK, P, PL, RO, RUS, SK, SLO. **N. Africa:** DZ, MA, TN. **SW. Asia:** TR. Known from Muş (Özbek, 1979a); Ankara, Antalya, Aydın, Eskişehir, Gümüşhane, Hakkari, Kars, İstanbul, Mersin, İzmir, Konya, Muğla, Nevşehir, Niğde, Siirt, Şanlıurfa, (Warncke, 1992). **West Palearctic chorotype.**

Material: **Artvin**: merkez, 300 m, 16.V.2005, 1♀, leg. CG, det. AM.; Ardanuç, Ferhatlı, 13.V.2000, 1♀ leg. ÖÇ, det. AM. **Bilecik**: merkez, 600 m, 15.VI.1995, 1♀, leg. EY, det. TG. **Erzincan**: merkez, 1250 m, 14.VI.1994, 1♀, leg. EY, det. TG. **Erzurum**: Oltu, İnanmış, 2000 m, 12.VI.1997, 3♀♀, leg. İA, det. AM. **Isparta**: Deremahallesi, 1150 m, 25.IV.2004, 1♀, leg. HÖ, det. AM.; Eğirdir, Yukarı Gökdere, 1000 m, 25.V.2004, leg. HÖ, det. HÖ.

Remark: Erzurum (Turkey) is the easternmost distribution record of this species.

Plants associated: Oligolectic on Fabaceae (Amiet et al., 2004; Müller, 2014).

79. *Osmia (Pyrosmia) hellados* Zanden, 1984

Distribution: **Europe:** AZ, BG, GE, GR, GR(Cr), I(Si); former Yugoslavia**. SW. Asia**: CY, IL, JOR, TR. Known from Aydın, Burdur, Hatay, Konya, Sivas (Zanden, 1984; Özbek and Zanden, 1992). **East-Mediterranean chorotype.**

80. *Osmia (Pyrosmia) nana* Morawitz, 1874

Synonym: *Osmia tetrodonta* Benoist, 1934

Distribution: **Europe:** BG, GR, GR (Cr), HR, I, I (Si), RUS (SR); Caucasus. **N. Asia:** Turkestan. **SW. Asia:** CY, IL, JOR, RL, SYR, TR. Known from Erzincan, Sivas (Zanden, 1991); Adana, Antalya, Aydın, Burdur, Erzincan, Hakkari, Hatay, Mersin, İzmir, Konya, Muğla, Nevşehir, Osmaniye, Siirt,

Sivas, Şanlıurfa, Tekirdağ (Özbek and Zanden, 1992). **Asiatic-European**

Material: **Antalya**: W of Doyran, 25.V.2009, 1♀, leg. JGR, JSA, HÖ, det. AM; Altınyaka, 36.55598-30.35005, 28.V.2009, 3♀♀, leg. JSA, JGR, HÖ, det. AM; E of Saklikent, 25.V.2009, 1♀, leg. JSA, HÖ, JGR, det. AM; 7 km SW of Kargin, 26.V.2009, 1♀ (*O. viciifolia*), leg. JSA, HÖ, JGR, det. AM (AMNH); Side, 02.V.1994, 1♀, leg. GT, det. HÖ. **Mersin**: Tarsus, Çamlıyayla, 25.V.1992, 1♀, leg. HÖ, det. GvdZ. **Osmaniye**: 6 km W of Hassa, 36.81166_36.47555, 850 m, 13.V.2002, 1♂, leg. JGR, HÖ, det AM (AMNH); Nurdağı, 24.V.1992, 1♀, leg. HÖ, det. TG.

Plants associated: *O. viciifolia*; Müller (2014) noted it is polylectic with a strong preference for Fabaceae.

81. ***Osmia (Pyrosmia) nigricollis*** Warncke, 1992

Distribution: **SW. Asia:** TR. Known from only Hakkari (type locality) (Warncke, 1992). **Anatolian endemic!**

82. ***Osmia (Pyrosmia) tawildara*** Warncke, 1992

Distribution: **N. Asia:** TJ. **SW. Asia:**TR. Known from Hakkari (type locality) (mail unknown) (Warncke, 1992). **Turano-Anatolian.**

83. ***Osmia (Pyrosmia) teunisseni*** Zanden, 1981

Distribution : Europe: GR, HR, I. **SW. Asia:** CY, IL, JOR, SYR, TR. Known from Antalya, Hatay (Zanden, 1981); Adana, Antalya, Aydın, Mersin (Warncke, 1992). **East-Mediterranean**

Material: **Antalya**: Side, 02.V.1994, 1♀, 1♂, leg. GT, det. TG and HÖ.

Plants associated: polylectic; Fabaceae, Lamiaceae and Crassulaceae (Müller, 2014).

84. ***Osmia (Tergosmia) glareola*** Warncke, 1988

Distribution: **SW. Asia:** JOR, SYR, TR. Known from Kırşehir, Şanlıurfa, Van (type locality), Yozgat (Warncke, 1988b).

Plants associated: Possibly oligolectic on Fabaceae (Müller, 2014). **SW-Asiatic chorotype.**

85. ***Osmia* (*Tergosmia*) *pratincola*** Warncke, 1988

Distribution: **SW. Asia:** TR Known from Ağrı (type locality), Ankara, Elazığ, Sivas (Warncke, 1988b). **Anatlian endemic!**

86. ***Osmia (Tergosmia) rhodoensis*** (Zanden, 1983)

Distribution: **Europe:** ARM, GR. **SW. Asia:** IL, JOR, TR. Known from Antalya, Denizli, Mersin, Konya (Warncke, 1988b); Artvin, Batman, Bolu, İstanbul, Kars, Mardin, Rize (Type locality), Şanlıurfa (Warncke, 1988b) as *O. rhodoensis arquata* Warncke, 1988. However, validity of this subspecies doubted by Özbek and Zanden (1992); Mersin (Zanden, 1989), Erzurum, Gaziantep, Kars, Tunceli (Özbek and Zanden, 1992). **East-Mediterranean**

Material: **Antaly**a: 7 km SW of Kargın, 36.37571-30.59704, 24.V.2009, 26.V.2009, 2♀♀, 2♂♂, leg. JSA, HÖ, det AM; Saklikent, 36.84444-30.31666, 25.V.2009, 1♀, leg. JGR, JSA, HÖ, det. AM (AMNH). Denizli: Pamukkale, 05.V.1994, 1♀, leg. GT, det. T. Grisworld. **Erzurum**: Atatürk University Campus, 39.90250-41.23500, 03.VII.2007, 1♀, leg. JGR, JSA, HÖ, det. AM; 18 km SW of Söylemez, 05.VI.2007, 1♀, leg. JSA, HÖ, JGR, det. AM (AMNH); Palandöken, 01.VII.1996, 1♂ (*O. viciifolia*), leg. EY, det. HÖ; Oltu, Uzunoluk, 02.VII.1996, 1♀, leg. HÖ, det. HÖ; Olur, Süngübayır, 21.V.1994, 2♂♂, leg. İA, det. TG; Şenkaya, Turnalı, 06.VIII.1990, 1♂, leg. EY, det. GvdZ. Mersin: Uzuncaburç, 37.70620_34.91410, 20.V.1990, 1♂, 1♀, leg. Schmid-Egger, det. WR (AMNH); Tarsus, Çamlıyayla, 25.V.1992, 1♀, leg. HÖ, det. HÖ.

Plants associated: *O. viciifolia.* Polylectic preference for Fabaceae (e.g. *Onobrychis*); additionally, Campanulaceae, Brassicaceae, Asteraceae, Lamiaceae (Rozen et al. 2010; Müller, 2014)

87. ***Osmia (Tergosmia) tergestensis*** Ducke, 1897

Synonym: *Osmia wolhynica* Noskiewicz, 1922

Distribution: Europe: A, BG, CH, CZ, E, F, GR, H, HR, I, P, PL, SK, SLO, UA. **N. Africa:** ET, MA. **N. Asia:** KZ. **SW. Asia:** TR. Known from Ankara, Konya (Warncke, 1988b), Erzurum (on *O. viciifolia*, *Astragalus* sp, *C. solstitialis*), Hakkari (Özbek and Zanden, 1992). **Turano-Europeo-Mediterranean**

Material: **Erzurum**: Atatürk University Campus, 24.VI.1996, 1♀ (*O.viciifolia*), leg. HÖ, det. AM (AM's col.); 28.VI.2001, 1♀, leg. JGR, HÖ, det. AM, (ANHM); 03.VII.1992, 1♀, leg. EY, det. GvdZ; 03.VII.1996, 1♂, leg. HÖ, det. HÖ; 06.VII.1992, 2♀♀, leg. EY, det. GvdZ; 20.IX.1992, 1♀, leg. EY, det. GvdZ; Merkez, 01VIII.1997, 1♂, leg. HÖ, det. AM; Palandöken, 02.VII.1995, 1♀, leg. E. Kılıç, det. HÖ; 15.VIII.1991, 2♀♀, leg. EY, det. GvdZ; 28.VII.1992, leg. EY, det. TG. Mersin: Tarsus, Çamlıyayla, 25.V.1992, 1♂, leg. EY, det. GvdZ.

Remarks: Warncke (1988b) synonymised the subspecies, *O. tergestensis ononidis* Ferton, 1897 to *Anthocopa tergestensis remota* Tkalcu, 1979 (type locality Erzurum, Turkey) and cited Ankara, Erzurum, and Konya as distribution areas of this subspecies. *Osmia rondoui* Pérez, 1902 and *O, atlantica* Benoist, 1934 are other synonyms of *O. tergestensis ononidis* (Warncke, 1988b).

Plants associated: *O. viciifolia*, *Astragalus* sp, *C. solstitialis* (Özbek and Zanden, 1992). Oligolectic

on Fabaceae (e.g. *Hippocrepis, Lotus, Onobrychis*) Amiet et al., 2004; Rozen et al. 2010);

Genus *Protosmia* Ducke, 1900

The genus *Protosmia* Ducke is mainly distributed in the Palaearctic region with one species each occurring in the Nearctic and in the Oriental region (Michener, 2007; Ungricht et al., 2008). Currently, there are 24 described *Protosmia* species, 22 of which occur in the Palaearctic (Müller, 2014). According to Griswold and Michener (1997) *Protosmia* is a Northern Hemisphere genus of Osmiini that includes four subgenera of which three occure in Turkey.

1. *Protosmia (Chelostomopsis) longiceps* (Friese, 1899)

Synonym: *Heriades depauperata* Benoist, 1928

Distribution: **Europe:** GR, GR(Cr)**. SW. Asia:** IL, JOR, RL, SYR, TR. Known from Antalya, Isparta (Özbek and Zanden, 1992). **East-Mediterranean chorotype.**

Material: **Antalya:** Altınyaka, decimal latitude_longitude 36.55598_30.35005, 28.V.2009, 1010m, 14♀♀, 1♂, leg. JSA, HÖ, JGR, det. AM; ca. 6 km E of Saklikent, 01.VI.2009, 1♀, 2♂♂, leg. JGR, JSA, HÖ, det. AM; E of Saklıkent, 25.V.2009, 1♂; W of Doyran, 28.V.2009, 1♀, leg. JGR, JSA, HÖ, det. AM (in AMNH).

Plants associated: Polylectic; Fabaceae, Lamiaceae, Asteraceae, Cistaceae, Boraginaceae, Crassulaceae, Caryophyllaceae and monocots (Müller, 2014).

2. *Protosmia (Nanosmia) limbata* (Benoist, 1935)

Distribution: **SW. Asia:** RL, SYR, TR. Known from Hakkari (type locality) (female unknown) (Zanden, 1989). **SW-Asiatic chorotype.**

3. *Protosmia (Nanosmia) montana* Müller, 2012

Distribution: **Europe:** GR, **SW Asia:** TJ, TR.

Remark: recently, *P. montana* was desribed from Greece by Müller (2012a). More recently, Griswold (2013) identified several specimens, which had been collected previously by different persons from Adıyaman, Ankara, Antalya, Bitlis, Hakkari, Kahramanmaraş, Konya and Sivas provinces in various years (one sample (♀) from Ankara, Kavaklıdere in August 1960). **Turano-European chorotype**

4. *Protosmia (Nanosmia) trifida* Griswold, 2013

Distribution: Hakkari (type locality) (Griswold, 2013)**. Anatolian endemic!**

5. *Protosmia (Protosmia) glutinosa* (Giraud, 1871)

Distribution: **Europe:** BG, E, F, GR, HR, I, RO, SLO; Caucasus. **N. Africa:** DZ, MA. **SW. Asia:** CY, IR, JOR. SYR, TR. Known from Kayseri (Kohl, 1905); Erzurum (Özbek and Zanden, 1992); Artvin, Erzurum (Özbek and Zanden, 1996). **Mediterranean chorotype**

Material: **Erzurum**: 22 km WSW of Oltu, 40.47166_41.77777, 1700 m, 23.VI.2001, 1♀, leg. JGR, HÖ, det. TG; 02.VII.2001, 1♀, leg. JGR, HÖ, det. TG (AMNH); Çamlıbel, 40,47166_41,77777, 11.VII.2004, 1♀, leg. HÖ, det. AM; Çamlıbel, 1750 m, 04.VII.2004, 2♀♀, leg. HÖ, det. AM; Çamlıbel, 1700 m, 14.VII.1995, 1♀, leg. EY, det. AM.

Plants associated: polylectic; Fabaceae, Lamiaceae, Boraginaceae (e.g. *Echium*), Alliaceae (e.g. *Allium*) and Campanulaceae (Müller, 2014).

6. *Protosmia (Protosmia) humeralis* (Pérez, 1895)

Distribution: **Europe:** E. **N. Africa:** DZ. **SW. Asia:** IL, JOR, SYR, TR. Known from **Şanlıurfa** (Özbek and Zanden, 1992). **Plants associated**: polylectic; Fabaceae, Asteraceae, Lamiaceae, Boraginaceae. Alliaceae, Campanulaceae (Müler, 2014). **Mediterranean chorotype.**

7. *Protosmia (Protosmia) magnicapitis* (Stanek, 1969)

Distribution: **SW. Asia:** TR. Known from Şanlıurfa (type locality) (mail unknown) (Stanek, 1969). **Anatolian endemic!**

8. *Protosmia (Protosmia) monstrosa* (Pérez, 1895)

Distribution: **N. Africa:** DZ. **SW. Asia:** CY, IL, JOR, RL, SYR, TR. Known from Aydın, Isparta (Özbek and Zanden, 1992).

Plants associated: polylectic; Fabaceae, Asteraceae, Crassulaceae, Brassicaceae, Boraginaceae, Lamiaceae, Campanulaceae (Müller, 2014). **Mediterranean chorotype.**

9. *Protosmia (Protosmia) paradoxa* (Friese, 1899)

Distribution: **Europe:** GR. **SW. Asia:** CY, IL, JOR, RL, SYR, TR. Known from Mersin (Zanden, 1980). **Plants associated**: Polylectic; Fabaceae, Brassicaceae, Zygophyllaceae, Asteraceae, Boraginaceae Cistaceae (Müller, 2014). **East-Mediterranean** chorotype.

10. *Protosmia (Protosmia) sideritis* Tkalcu, 1978

Distribution: Europe: BG, GR, MK. **SW Asia:** TR. Known from Sivas (Zanden, 1989). **Plants associated**: Polylectic; Lamiaceae, Fabaceae, Boraginaceae (e.g. *Echium*) Brassicaceae (Müller, 2014). **East-Mediterranean (Aegien) chorotype.**

11. *Protosmia (Protosmia) stigmatica* (Pérez, 1895)

Distribution: Europe: E, F, GR. **N. Africa:** MA, DZ. **SW Asia:** TR. Known from Turkey, but locality is uncertain. **Mediterranean chorotype.**

12. ***Protosmia (Protosmia) tauricola*** Popov, 1961

Distribution: Europe: BG, RUS, UA. **SW. Asia:** TR. Known from Hakkâri (Özbek and Zanden, 1992). **East-Mediterranean**

13. ***Protosmia (Protosmia) tiflensis*** (Morawitz, 1876)

Synonym: *Osmia (Acanthosmia) gräffei* Schmiedeknecht, 1890r

Distribution: Europe: BG, GE, GR, HR, I, MK, RUS, SLO, UA. **SW. Asia:** IL, JOR, TR. Known from Antalya, Kahramanmaraş, Sivas (Özbek and Zanden, 1992). **Europo-East-Mediterranean**

Material: **Antalya**: Altınyaka, 28.V.2009, 1♀, 1♂, leg. JSA, HÖ, JGR, det. AM; Saklıkent, 30.V.2009, 2♂♂, leg. JGR, JSA, HÖ; 4 km E of Saklikent**,** 30.V.2009, 1♀**,** leg. JGR, JSA, HÖ**,** det. AM. **Osmaniye**: 6 km W of Hassa, 13.V.2002, 1♂, leg. JGR, HÖ, det. AM. (AMNH). **Plants associated**: polylectic; Lamiaceae, Fabaceae and Boraginaceae (e.g. *Echium*) (Müller, 2014).

Discussion

In the present study the genera *Haetosmia*, *Osmia* and *Protosmia* were treated in the tribe Osmiini and totally 101 species and subspecies (*Haetosmia* 1, *Osmia* 87, and *Protosmia* 13) were recognized.

Turkey forms a natural bridge between Asia, Europe and Africa. Thirthy-two species occur in three continenets. However, *O. caerulescens* and *O. nigriventris* were introduced to North America and the first species occurred in four of the continents; Europe, Africa, Asia, and North America, the second species occurred in Europe, Asia, and North America, not present in Africa. From a zoo-geographical stand point, these two species could be included in the **Holacrtic** chorotype. Although *O. caerulescens* is the most widespread and abundant species in Turkey, that of *O. nigriventris* is extremely rare and has been recorded recently from Afyonkarahisar only (Güler, 2011).

Palearctic chorotype is represented with five species, *Osmia rufohirta, O. leaiana, O. cornuta, O. submicans* and *O. viridana*. Among them *O. leaiana* occurs in the eastern part of Turkey only, the rest are widespread species in the country. Almost all of the species in **Palearctic** chorotype, particularly *O. rufohirta* and *O. submicans,* concentrated in the Mediterranean basin. There are 11 species in the **West-Palearctic** chorotype: *Osmia andrenoides, O. melanogaster, O. dimidiata, O. niveata, O. latreillei, O. scutellaris*, *O. signata, O. ligurica, O. cyanoxantha, O. cephalotes* and *O. gallarum.* All species have a wide distribution ranges in Turkey. *Osmia gallarum* is known from Turkey only among the Asian countries and Erzurum is the easternmost distribution record of this species.

Of the 101 taxa 33 species occur only in Asia Continent. **Southwest-Asiatic (SW-Asiatic)** chorotype includes majority of these species. This pattern includes the areas from eastern Mediterranean coastal regions east to the Sind, through the Arabian Peninsula, Mesopotamia and Iran north of Caucasus and SW Turkmenistan (both included). In this main chorotype 27 species were listed. Of which, *O. brevipes, O. cinerea, O. diomedia, O. dlabolae, O. heliaca, O. livida, O. ocularis, O. torquata, O. mutensis, O. nigricollis, O. pratincola, Protosmia trifida,* and *P. magnicapitis* (13 species) have been known only from Anatolia. Of course, it is difficult at present to correctly evaluate the distribution of the species to date considered as endemic without a better knowledge of the fauna of adjacent areas, as such the Caucasus and the Middle East. However, with the present data, these species could be accepted being **Anatolian endemics**. Certain endemic species are very rare and are known from type localities only: Hakkari is the type locality of five species, *O. heliaca, O. diomedia, O. nigricollis* and *O. torquata* and *Protosmia trifida.* Similarly, Sivas, Mersin and Şanlıurfa are type localities of *O. brevipes, O. mutensis* and *P. magnicapitis,* respectively. Additionaly, the males of *O. heliaca, O. mutensis* and *P. magnicapitis* are unknown. Six species, *O. chrysaetos, O. warnckei,* O. *scheherazade, O. maxschwarzi, O. oramara,* and *O. avosetta* occur only in Turkey and Iran. These species could be included in the **Irano-Anatolian** subchorotype**,** that of *O. peregrina* in Turkey and Syria, as **Syro-Anatolian** subchorotype. Similarly, *O. carinoclypearis, O. sogdiana, O. difficilis, O. hermona* and *O. tawildara* are in the **Turano-Anatolian** subchorotyp. Among them *O. hermona* and *O. tawildara* are known from Hakkari (type locality) onlyin Turkey and male of the second species is unknown. The remaining species are quite common species in the country. Among the **SW-Asiatic** species *P. limbata* occurs in RL, SYR, TR but female is unknown and in Turkey recorded from Hakkari only.

Majority of the Turkish species, approximately 70 taxa, are associated with Europe.These species could be included in various chorotypes: **Asiatic-European** chorotype species are widespread through the Eurasian, south to the Himalayan chain. *Osmia mirhiji***,** *O. parietina, O. brevicornis leucogastra, O. saxicola,* and *O. nana* could be included in this chorotype. The first two species are rare in Turkey, remain species are moderately common. **Turano-European** chorotype includes species widespread in Europe, mainly in southern and western countries, Middle East, Anatolia, Caucasus, Iran, and W.

Turkestan. *Osmia subcornuta, O. dives, O spinulosa, O. dilaticornis* and *Protosmia montana* could be placed in this chrotype. The last species was recently described by Müller (2012a) from Greece. Morower, more recently, Griswold (2013) identified previously collected samples from various provinces of Turkey as *P. montana*. All species are modarately distributed in the country. Two species, *O. onocrotala* and *O. thoracica* occur in Armenia and Turkey; they could be treated as **Anatolo-Armanian endemics.**

When we take a look at the main chorological patterns represented in the Osmiini fauna of Turkey, most of the species occurring in Turkey are associated with the Mediterranean basin including the Middle East. **Mediterranean chorotype** includs those species are widespread in Mediterranean countries including N. Africa. *Osmia sybarita, O. labialis, O. spinigera,* ***O.*** *bidentata pallens, Protosmia glutinosa, P. humeralis, P. monstrosa* and *O. stigmatica* could be included in this chorotype. Among these species; although *O. sybarita, O. spinigera,* and *O. latreillei* have large distributin ranges in outside of Turkey they are rare in the country and first one known from Elazığ only and this province is the easternmost distribution record of *O. sybarita*. *Osmia spinigera* has been recorded only in Erzincan and Erzurum and Erzurum is the easternmost distribution record of it. Although *O. latreillei* has large distribution in the out side of Turkey so far it has been recorded from Aydın only. *Protosmia humeralis* and *P. monstrosa* are not widespread species either in Turkey or abroad, the first one has been recorded from Şanlıurfa that of *P. monstrosa* from Aydın and Isparta. *Osmia labialis* is new for the Turkish fauna as well as the Asia Continent. Erzurum (Turkey) is the easternmost distribution record for *O. labialis.* The **East-Maditerranean** chorotype is one of the most important chorotypes, includes species occurring in the eastern countries of the Mediterranean basin, east of the Italian Peninsula and the Gulf of Sirte, east to the Black Sea. Some extensions occur east of Iran and the Middle East, south-west of the Sahara. There are approximately 24 species in this chorotype; most species have wide distribution ranges, although certain species are very rare known from one or two localities only: *Protosmia paradoxa* from Mersin, *Osmia elegans* from Antalya and Muğla, *O. olgae* from Nevşehir, and *P. sideritis* from Sivas. Erzurum is the easternmost distribution record for the newly recorded *O. labialis*, which is moderately distributed in Mediterranean countries. Additionally, *O. breviata* is known from Greece and Turkey only and it could be included in the **Aegean,** which is one of the detail distribution patterns of the main chorotype of **E-Mediterranean**. Seven species, *O. bischoffi, O. melanura, O. nuda, O. croatica, O. forticornis, Protosmia sideritis* and *P. tauricola* occur in Europe and in Turkey only among the Asian countries. Basically, these taxa could be included in **East Mediterranean** chorotype, but because of this stuation I prefer to place them in a **Europo-Anatolian chorotype**. Erzurum is the easternmost distribution records for *O. bischoffi, O. lanura, O. croatica* and *O. forticornis* for that of *O. amathusica* Hakkari. Among the E-Mediterranean species *O. aeruginosa* was described by Warncke (1988a) from Hakkari on female, it has been recorded various provinces in Turkey, also from Iran. Unfortunately, male has not been encountered so far. Elazığ is the easternmost distribution record for *O. moreensis.* **Europo-East-Mediterranean** chorotype comprises species widespread in Europe and East Mediterranean countries. *Osmia aurulenta, O. apicata, O. cerinthidis, O. mustelina* and *Protosmia tiflensis* are included in this chorotype. All are widespread species in Turkey.

It is remarkable to note that among the listed species only two taxa, *O. bidentata pallen* and *P. monstrosa* occur both in Asia (including Turkey) and North Africa.

As a conclusion, in the present study the genera, *Haetosmia* (1 species), *Osmia* (87 species), and *Protosmia* (13 species) were treated and 101 species and subspecies were listed. Previously, Özbek (2011) mentioned presence of 25 *Chelostoma* species occurring in Turkey. Recently, Müller (2012a) described five new *Chelostoma* species from different countries and four of them, namely *C.* (*Chelostoma*) *comosum* Müller 2012, *C.* (*Foveosmia*) *longifacies* Müller 2012 (Antalya), *C.* (*Foveosmia*) *incognitum* Müller 2012, *C.* (*Gyrodromella*) *aegaeicum* Müller 2012 occur in Turkey. So the number of Turkish *Chelostoma* species rose to 29. More recently, Özbek (2013) noted six species in the genus *Heriades*, two species in the genus *Stenoheriades,* one species in the genus *Hofferia* and 93 species and subspecies in the genus *Hoplitis*. These data allow us to reach the conclusions that currently, the tribe Osmiini comprises approxymatelly 232 species and subspecies with 8 genera in Turkey. The Osmiini includes approximately 1160 species in 15 genera worldwide, in the Palaearctic region these numbers about 600 and 10 respectively, including taxa from Cyprus and the Caucasus. Approximately 230 species have been recorded so far in Europe (Michener, 2007; Praz et al., 2008; Ungricht et al., 2008; Michez et al*.,* 2009; 2012; Müller, 2014). Under these circumstences, with 232 species and subspecies Turkey accounts for about 40% of the Palaearctic and almost equal number of European osmiine bees.

Osmiini bees as pollinators of cultivated and wild plants

Agricultural production forms one of the most important economic sectors. More than 75% of the 115 leading crop species worldwide are dependent on or at least benefit from animal pollination, whereas wind and self-pollinaton are sufficient for only 28 crop species (Klein et al., 2007). Wild bees are of enormous ecological and economical importance as pollinators of many cultivated and wild plants, and are thought to account for 75% of crop pollination requirements (Nabhan and Buchmann, 1997). Hence they are often termed a keystone species (O'Toole, 1993). Cross-pollination among the compatible varieties of various species of plants leads to high fruit-set (Free, 1993; Delaplane, 2000; Bosch and Kemp, 2002). It has often been observed that wild bee species are either somewhat greatly more efficient than the most widely-used managed pollinator, *Apis mellifera* L. in a variety of crops (e.g. alfalfa, blueberry, cranberry, sunflower, watermelon, tomayto and many others) (Parker et al., 1987; Kevan et al., 1990; Özbek, 2008a). On the other hand, in practice, although the honey bee is the main and more economic pollinator compared to the commercially- managed other bees used in different fruit orchards, because it is cheaper for farmers to provide honey bee colonies and they have much more workers in the colony comparing to the other pollinator bees (Delaplane, 2000). However, for early blooming plants, rainy weather conditions and lower temperatures limit the pollination activity of honey bee (Huang, 2003). Various wild bee species may display better activity under the same conditions. For instance, *Osmia cornuta* can maintain its activity during the temperatures below 10 - 12°C, light rain and 200 W/m2 wind power (Vicens and Bosch, 2000). Woodcock (2012) indicated that even plants that are considered self-fertile can often realize a benefit in the quantity or quality of production from cross-pollination, or even from the activity of insects moving pollen around on the flower that results in more grains being delivered.

Present data reveal that Osmiini bees show a large variation in the host- plant choices. They visit different plant species in the families Alliaceae, Antirrhineae, Apiaceae, Asteraceae, Brassicaceae, Boraginaceae, Campanulaceae, Caryophyllaceae, Cichorioideae, Cistaceae, Convolvulaceae, Crassulaceae, Dipsacaceae, Euphorbiaceae, Fabaceae, Lamiaceae, Rosaceae, Scrophulariaceae and Zygophyllaceae. Among them Fabaceae includes some important fodder crops, such as alfalfa (*M. sativa*), sainfoin (*O. viciifolia*), red clover (*T. pratense*), and white clover (*T. repens*), which are the major species growing in Turkey. *Osmia bischoffi, O. melanura, O. rufohirta, O. aeruginosa, O. breviata, O. peregrine, O. subcornuta, O. difficilis, O. parietina, O. scheherazade, O. nigrohista, O. avosetta, O. cyanoxantha, O. forticornis, O. saxicola, O. viridana, O. nana, O. tergestensis* and *O. rhodoensis* visit these plants and help in the pollination of them. Of course, the preferences of each species any of the above mention crops are changeable. Whereas, certain *Osmia* species, namely, *O. caerulescens, O. bicornis, O. cerinthdis*, and *O. cornuta* show preferences to the family Rosaceae. They are mportant pollinators of temperate climate fruit species, such as almonds, apricots, plums, cherries, peaches, nectarines, pears, and apples. Thus, currently three *Osmia* species, *O. cornifrons* (Radoszkowski), *O. lignaria* Say and *O. cornuta* (Latreille) are commercially used to pollinate the flowers of fruit in Japan, the USA and Europe, respectively (Maeta, 1978; Bosch and Kemp, 2001).

Osmia caerulescens, O. bicornis, O. cerinthdis, and *O. cornuta* are early flying wild bees. Therefore they are important on the pollination of early flowering fruit trees, namely almond, apricot and plum trees. I observed the activities of *O. bicornis* and *O. cornuta* on the flowers of apricot and plum trees in Eskişehir; they appeared on the middle of March in 2014, they were quite abundant, their populations were very close to that of honey bee. Conserning to these species Güler (2012) studied the nesting behaviour of *O. bicornis* and *O. caerulescens* in sweet charry orchards in Afyonkarahisar.

It is evident from this study and the literature data that, in addition to cultivated plants, osmiini bees visit many wild plant species in the above mentioned plant families and pollinate them. In order to conserve and maintain biodiversity and to keep ecology in good conditions, in addition to cultivated plants, wild plant species also have to be pollinated at the optimum level. Furthermore, pollinator bees are indirectly responsible for the persistence of other guilds that depend upon floral resources, such as herbivores and seed-eaters.

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