

Linzer biol. Beitr.	48/1	1753-1771	19.12.2016
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Distribution data of the kleptoparasitic bees in Turkey: Part 2. Genera *Coelioxys* and *Radoszkowskiana* (Hymenoptera: Megachilidae: Megachilinae) with their checklist

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A b s t r a c t : This study updates our present knowledge on occurrence, geographic distribution, hosts and flower visiting of Turkish kleptoparasitic bee genera, *Coelioxys* LATREILLE, 1809 and *Radoszkowskiana* POPOV, 1955 (Hymenoptera: Megachilidae: Megachilinae). Study material comprises of bee samples collected from various parts of Turkey since 1970s. The examination of the material and overview of the published sources allowed to reach the conclusion that *Coelioxys* of Turkey were represented by 24 species and two subspecies in five subgenera, that of *Radoszkowskiana* two species. Among them, some of the *Coelioxys* species were found to be widespread and abundant occurring almost throughout the country, whereas several species were moderately distributed. On the contrary, *C. emarginata* FÖRSTER, *C. erythrura* SPINOLA, *C. alata* FÖRSTER, *C. mandibularis* NYLANDER, *C. polycentris* FÖRSTER, *C. elegantula* ALFKEN and *C. elongatula* ALFKEN were considered to be the rare species, recorded from just one or two localities each. *Radoszkowskiana* is a small genus represented by two species, *R. barrei* (RADOSZKOWSKI) and *R. tkalcui* SCHWARZ, in Turkey. Both of them were found to be rare species, each was recorded in two provinces in the eastern part of the country. Currently, *R. tkalcui* could be treated as endemic to Turkey. New localities for the inspected material were given to make a contribution to the knowledge about the distribution patterns of the species. As kleptoparasitic bees, known host records of the genus *Coelioxys* were also included. Moreover, flower visits were added if available. Finally, for the first time, an updated checklist of the Turkish *Coelioxys* and *Radoszkowskiana* was provided.

K e y w o r d s : *Coelioxys*, *Radoszkowskiana*, kleptoparasitic, Megachilidae, fauna, checklist, Turkey.

Introduction

Bees have been recorded worldwide, in all habitats, wherever flowering plants are present, and have approximately 20.000 described species (MICHEZ et al. 2012, DANFORT et al. 2013, ASCHER & PICKERING 2014). Megachilidae is the second largest bee family, containing more than 4.000 described species worldwide (MICHENER 2007; ASCHER & PICKERING 2014). The non-parasitic females are distinguished from all other bees by the presence of the pollen-collecting scopal hairs under the surface of Metasoma, rather than on the hind legs. In most parts of the world, the Megachilidae are among the more easily recognized families of bees (MITCHEL 1973, MICHENER 2007).

The subfamily Megachilinae have worldwide distribution and can be recognized with two sub-marginal cells of roughly equal length, strong sternal scope and lack of long hairs on the hind legs of females, the reduced and often hairless 7th sternum of the male (MICHENER 2007). Megachilinae comprises of five tribes, Anthidini, Dioxyini, Megachilini, Lithurgini and Osmiini. GONZALEZ et al. (2012) noted that accounting for 2021 species worldwide (ASCHER & PICKERING 2014), the tribe Megachilini is the most common and diverse of all Megachilidae. It is distinguished from other tribes with these characters: background of body is not metallic and no any white, yellow or red maculation, stigma and prestigma long, arolia absent, claws of female simple or with basal tooth, second recurrent vein is basal to second sub-marginal cross vein, vestiture of outer surface of hind tibia with hairs. Megachilini includes three genera, one non parasitic *Megachile* LATREILLE, 1802, which includes most of the species, and two kleptoparasitic genera, *Coelioxys* LATREILLE, 1809 and *Radoszkowskiana* POPOV, 1955 (MICHENER 2007). Females of *Coelioxys* and *Radoszkowskiana* can easily be distinguished from *Megachile* as they lack a ventral scopa (pollen-collecting structure) on the underside of the abdomen, metasoma tapering from near base to narrow, often acutely pointed apex, while in the males it is multispinose (MICHENER 2007, ROWSON & PAVETT 2008). Therefore, they are commonly known as sharp-tailed bees or sharp-abdomen bees. *Coelioxys* is a cosmopolitan genus with six subgenera and approximately 200 described species in the old world (NAGASE 2006, ASCHER & PICKERING 2014), whereas *Radoszkowskiana* is a small genus with four species present in the Asia and Africa continents (SCHWARZ 2001). *Coelioxys* species are generally kleptoparasitic on other megachilid bees, mainly on the genus *Megachile*, while a few species attack species of the genera *Anthophora*, *Centris*, *Euglossa* and *Tetralonia* (MITCHEL 1973, MICHENER 2007). Kleptoparasitism (cleptoparasitism) is defined as an ecological interaction in which the young of one species feeds and develops with the food provided for the young of another species. They do not construct their own nests, they lay their eggs inside nests built by other bee species (hosts) and the larvae feed on pollen provided by the host. They are always associated with solitary bees and it is an obligatory parasitism. The kleptoparasite bees are also known as "cuckoo bees", reminiscent of the behavior of cuckoo birds (ROZEN 2000, ROWSON & PAVETT 2008). As is the case with other kleptoparasitic bees, the female *Coelioxys* seeks out the nest of its host (*Megachile*) and apparently uses its sharp abdomen to pierce the cells. An egg is then laid in the cell. The egg of the *Coelioxys* hatches before that of the host and the newly hatched larva crushes the host's egg with its large jaws. The *Coelioxys* larva can then feed on the contents of the cell. Pupation occurs within a cocoon spun within the host cell where the larva overwinters as a prepupa (ROZEN 2000, MICHENER 2007, ROWSON & PAVETT 2008).

Studies on the genus *Coelioxys* in Turkey is rather limited; *Coelioxys farinosa*, which is currently the synonym of *Coelioxys decipiens* SPINOLA, 1838, was described by SMITH (1804) from Turkey. We suspect this is the first *Coelioxys* species described from Turkey. Later, FRIESE (1895) reported *C. elongata* LEPELETIER, 1841 from Bursa. Afterwards, several Turkish *Coelioxys* species were cited by various authors (FAHRINGER & FRIESE 1921, FAHRINGER 1922, PASTEELS 1968) in Anatolia. As local researcher ÖZBEK (1979) reported the presence of *Coelioxys afra* LEPELETIER, 1841, *C. brevis* EVERSMAHN, 1852, *C. rufescens* LEPELETIER & AUDINET-SERVILLE, 1825, *C. aurolimbata* FÖRSTER, 1853 and *C. quadridentata* (LINNAEUS, 1758) in eastern part of Turkey. WARNCKE (1992) conducted a comprehensive study on *Coelioxys* species of western Palearctic

region and mentioned 34 species including three new species, of which 21 species were reported from Turkey. Moreover, he described *C. rufescens anatolica*, WARNCKE 1992 and *C. aurolimbata orientalis* WARNCKE, 1992 from Hakkari and Konya respectively. ÖZBEK & ZANDEN (1994) noted 19 species, two years later the same researchers listed four more species (ÖZBEK & ZANDEN 1996). Recently, two species, namely *C. artemis* and *C. elsei*, were described by SCHWARZ (2001) from Mersin and Kars provinces respectively. Concerning the genus *Radoszkowskiana*, SCHWARZ (2001) revised this genus and designated *R. barrei* (RADOSZKOWSKI, 1893) as valid species, and noted occurring in Turkey. At the same time, he described *R. tkalcui* SCHWARZ, 2001 from Van.

This is the second series papers of kleptoparasitic bees in Turkey, in the first part; *Sphecodes* LATREILLE (Halictidae) was treated (ÖZBEK et al. 2015). The present paper deals with the genera *Coelioxys* and *Radoszkowskiana* in the tribe Megachilini to provide a country-based distribution data of each species and their hosts and flower visiting if available. Moreover, for the first time, updated checklists were provided for these genera in Turkey. Thus, the present study aims to summarize the current knowledge of the species of these two genera in Turkey as a basis for further investigations of the largely unexplored, yet highly diverse fauna of the country.

Material and Methods

The material was generally collected from various parts of Turkey, but mainly from eastern Anatolia, since the 1970s. All the bee specimens were collected via insect nets, and rarely aspirators and Malaise traps were installed at various habitats during March-October. Additionally, few *Coelioxys* samples, which were previously collected in Turkey by M. SCHWARZ, were included. Meanwhile, the plants visited by bees were also recorded or collected for diagnosis. All captured bee samples and collected plants were properly prepared for collections. Additionally, in the course of the 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.

The species are presented alphabetically according to the subgenera and those that could not be inspected in this work are quoted from published sources. Provinces are presented in alphabetical order and the names of the provinces are given in bold type. Decimal latitude-longitude information is given for certain species if available. The biology section includes information on the habitat, flight season, host species and flower visiting if available. If not mentioned otherwise, all material examined herein is deposited at EMET.

Abbreviations:

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

Results

In the examination of the specimens collected from various parts of the country, 15 species and two subspecies were detected in genus *Coelioxys*. With literature sources, currently the *Coelioxys* is represented by 24 species and two subspecies, whereas *Radoszkowskiana* by two species in Turkey (Table 1).

Genus *Coelioxys* LATREILLE, 1809

Coelioxys (Allocoelioxys) afra LEPELETIER, 1841

Synonyms: *Coelioxys coronate* FÖRSTER, 1853, *C. pusilla* GERSTAECKER, 1857

Material examined: **Antalya:** Arapsuyu, Azmak, 5 m, 30.VI.2002, ♀ (on *Mentha longifolia*), leg. H. Özbek. **Bilecik:** central, 15.VIII.1995, 2 ♀ ♀, leg. E. Yıldırım. **Erzincan:** Horticultural Research Institute, 1300 m, 18.VII.1997, 3 ♀ ♀, ♂, leg. E. Yıldırım; Bahçeli, 09.VIII.1990, 1250 m, ♀, leg. E. Yıldırım; Çatalarmut, 09.VIII.1990, ♀, leg. E. Yıldırım. **Erzurum:** Atatürk University Campus, 15.VI.1986, 2000 m, ♂ (on *Onobrychis viciifolia*), leg. H. Özbek; 31.VIII.1997, ♀, ♂, leg. H. Özbek; 20.IX.1992, 2 ♀ ♀, ♂, leg. H. Özbek; Şenkaya, Turnalı, 08.VIII.1997, 1800 m, ♂, ♀, leg. E. Yıldırım.

Biology: It is rather widespread species, recorded almost all around the country, except the Black Sea Region, samples were found mostly in open areas at altitudes ranging between 5 (Antalya) and 2000 m (Erzurum). Scarcely, samples were collected in orchards. Flight season is from late June to the end of September. *Megachile leachella* CURTIS, 1802, *M. pilidens* ALFKEN, 1924 and *M. apicalis* SPINOLA, 1808 (Megachilidae) were found being the hosts of *C. afra* (PASTEELS 1977, WARNCKE 1992, BANASZAK & ROMASENKO 1998, AMIET et al. 2004, GRACE 2010). It visits *O. viciifolia*, *Onopordum* sp., *Carduus* sp., and *Thymus* sp. (ÖZBEK 1979, ÖZBEK & ZANDEN 1994). Likewise, GRACE (2010) listed the following plant species: *Rubus ulmifolius anatolicus*, *Broteroa corymbosa*, *Teucrium polium micropodioides*, *Teucrium cyprium*, *Linaria elatine*, and *Statice* sp.

Distribution: It has Palearctic distribution (from Western Europe including England through Russia to China and Indonesia and of the whole Africa) (PASTEELS 1977, WARNCKE 1992; BANASZAK & ROMASENKO 1998, AMIET et al. 2004, KHAGHANINIA et al. 2010, ASCHER & PICKERING 2014). In Turkey: Erzincan, Erzurum, İzmir (ÖZBEK 1979, ÖZBEK & ZANDEN 1994); Ankara, Antalya, Bitlis, Bursa, Eskişehir, Hakkâri, Kars, Konya, Kütahya, Nevşehir, Niğde, Van (WARNCKE 1992).

Coelioxys (Allocoelioxys) brevis EVERSMAAN, 1852

Synonyms: *Coelioxys erythropyga* FÖRSTER, 1853, 1894; *C. inflatus* ALFKEN, 1933, *C. brevis armeniaca* HEDICKE, 1938.

Material examined: **Erzincan:** Horticultural Research Institute, 1300 m, 23. VI.1994, ♂, leg. E. Yıldırım; 21.VI.1994, ♂, leg. E. Yıldırım; 30.VII.1991, ♀, leg. E. Yıldırım; Muti köprüsü, 26.IX.1990, ♀, leg. H. Özbek. **Erzurum:** Atatürk University Campus, 03.VI.1996, ♂, leg. H. Özbek (on *Onobrychis viciifolia*); Palandöken, 2200 m, 13.VII.1994, ♀, leg. E. Yıldırım; Dutçu, 2200 m, 11.VIII.1992, ♂, leg. E. Yıldırım; Pasinler, Rabat, 2200 m, 11.VII.1996, 2 ♂ ♂, leg. E. Yıldırım.

Biology: It is basically an open area species, but certain samples were collected in semi open biotopes with shrubs, steppes, and forest margins. It was recorded from all over the country, except Black Sea Region, samples were collected from close areas to

sea level (Adana) up to 2200 m (Erzurum, Erzincan). It is one of the most widespread and abundant *Coelioxys* species present in Turkey. Found on the wing from June to the end of September. Peak flight season is June and July. WARNCKE (1992) listed *Megachile apicalis*, *M. argentata* (FABRICIUS 1793) and *M. pilidens* (FÖRSTER, 1924) as hosts of *C. brevis*. It visits *Carduus* sp., *Eryngium creticum* and *O. viciifolia*.

Distribution: Most of the European countries (Austria, Bohemia, European Russia, France, Greece, Germany, Hungary, Italy, Moravia, Poland, Portugal, Romania, Sardinia, Slovakia, Spain) and many Asian countries (Caucasus, Cyprus, China, Japan, Iran, Israel, Kazakhstan, Palestine, Tajikistan, Turkey, Uzbekistan), also occurs in South Africa (Algeria, Morocco, Tunisia) (WARNCKE 1992, BANASZAK & ROMASENKO 1998; AMIET et al. 2004, GRACE 2010; NADIMI et al., 2013). In Turkey: Erzurum (ÖZBEK 1979); Adana, Ankara, Bayburt, Çankırı, Erzincan, Erzurum, Hakkâri, Kars, Konya, Kütahya, Manisa, Nevşehir, Niğde, Siirt, Sivas, Van (WARNCKE 1992); Erzincan, Erzurum, Şanlıurfa (ÖZBEK & ZANDEN 1994).

***Coelioxys (Allocoelioxys) echinata* FÖRSTER, 1853**

Synonyms: *Coelioxys octodentata* LEPELETIER, 1841; *Coelioxys rufocaudata* SMITH, 1854

Material examined: **Antalya:** Beydağları, Aliminpınarı, 1000 m, 05.VIII.1994, ♀ (on *Mentha longifolia*), leg. H. Özbek. **Aydın:** Çine, 27.VII.1994, 2 ♀ ♀; 03-04.VIII.1994, 4 ♀ ♀, 23-24.VIII.1994, 4 ♀ ♀; 07.IX.1994, 3 ♀ ♀, leg. G. İnce. **Erzurum:** Pazaryolu, 1600 m, 26.VIII.1994, ♀, leg. M. Aksu; Tortum, Kaledibi, 1300 m, 12.VI.1996, ♀, leg. E. Kılıç. **Konya:** Güneysınır, Karagüney, 03.IX.2000, 2 ♀ ♀, leg. M. Kesdek.

Biology: It is mainly an open area species, but samples were collected in forest margins and shrub lands in Antalya and Aydın. It has been found in all the geographical regions of the country, except the Black Sea Region, at the altitudes between 200 (Aydın)-1650 m (Sivas). WARNCKE (1992) collected samples at the altitude of 2300 m in Bitlis. It has quite a long flight season; June to September, the peak flight is in July. WARNCKE (1992) reported *M. apicalis* and *M. rotundata* as hosts of this species. One individual was collected from *M. longifolia*, which was very abundant flowering plant in the area.

Distribution: It occurs in most of the European countries (Austria, Belgium, Bohemia, France, Germany, Corsica, Greece, Hungary, Italy, Moravia, Poland, Portugal, Romania, Sardinia, Sicily, Slovakia, Slovenia, Spain and Switzerland). In Asian countries, it has been known only in Caucasus, Iran, Iraq and Turkey, in Africa, Algeria, Egypt and Morocco (WARNCKE 1992, ASCHER & PICKERING 2014). In Turkey: Bursa (FRIESE 1895), Ağrı, Ankara, Bitlis, Bursa, Hakkâri, Konya, Kütahya, Van (WARNCKE 1992). ÖZBEK & ZANDEN (1994) recorded in Iğdır and Sivas as *C. rufocaudata* SMITH. Ağrı, Bitlis, Hakkâri, Konya, Kütahya, and Van as *C. ruficauda* LEP. (WARNCKE 1992).

***Coelioxys (Allocoelioxys) emarginata* FÖRSTER, 1853**

Material examined: **Erzurum:** Atatürk University research field, 1900 m, 17.VIII.1995, ♀ leg. H. Özbek.

Biology: Present and previous samples were collected in an open area. *Megachile leucomalla* was reported as the host of *C. emarginata* (STOCKHERT, 1933).

Distribution: As European countries France, Slovakia, Spain and Ukraine, in

Asia China, Kazakhstan, Kyrgyzstan, Russian Far East, Turkey, and Uzbekistan were listed, in Africa known from Morocco only (LECLERCQ 1965, WARNCKE 1992, BANASZAK & ROMASENKO 1998, AMIET et al. 2004). In Turkey: Erzurum (ÖZBEK & ZANDEN 1994).

***Coelioxys (Allocoelioxys) haemorrhoea* FÖRSTER, 1853**

Synonyms: *Coelioxys pulchella* MORAWITZ, 1874, *C. rhodacantha* COCKERELL, 1931.

Material examined: **Bingöl:** Solhan, 2120 m, 25.VI.2000, ♀ (on *Eryngium creticum*), leg. M. Kesdek. **Erzincan:** Bahçe Kùltürleri Arařtırma, Enstitüsü, 1250 m, 11-12.VII.1994, 2♂♂, leg. E. Yıldırım; Üzümlü, Bayırbağ, 1300 m, 10.VII.1992, ♂, leg. R. Hayat; **Erzurum:** Narman, Kireçli Dağı, 2200 m, 02.VII.2000, ♂, leg. C. Güçlü.

Biology: It is a rather widespread *Coelioxys* species that usually occurs in open and semi open biotopes with shrubs, steppes, and margins of wooded areas. It was recorded almost all over the country, except the Black Sea Region. The present study and previous records show that it is active from May to the mid-August and is present from the sea level (Aydın) to 2200 m (Erzurum). *Megachile rotundata* was mentioned as the host of this species (PASTEELS 1977). *Vitex agnus-castus*, *Thymus* sp. (ÖZBEK & ZANDEN 1994), *E. creticum* and *Statice* sp. are visiting plants.

Distribution: Almost all of Europe through Turkey, Iran to China; North Africa (Algeria, Morocco and Tunisia) (ALFKEN 1927, WARNCKE 1992, BANASZAK & ROMASENKO 1998; 2009, GRACE 2010, Nadimi et al., 2013). In Turkey: İzmir (FAHRINGER 1922); Afyonkarahisar, Ankara, Aydın, Çankırı, Eskişehir, Hakkâri, Konya, Mardin, Mersin, Niğde, Siirt, Şanlıurfa (WARNCKE 1992); Aydın, Erzincan, Erzurum, İzmir (ÖZBEK & ZANDEN 1994). Additionally, WARNCKE (1992) recorded this species in Bitlis, Nevşehir and Şanlıurfa as *C. pulchella* MORAWITZ.

***Coelioxys (Allocoelioxys) obtusa* PÉREZ, 1884**

Synonyms: *Coelioxys antennalis* PÉREZ, 1884; *C. laticauda* MORAWITZ, 1894; *C. aegypticola* FRIESE, 1925

Material examined: **Erzincan:** Horticultural Research Institute, 1300 m, 11.VII.1994, ♀, Leg. E. Yıldırım. **Muş:** 39.00000_41.75000, 23.VII.2000, 6♂♂, leg. J. G. Rozen, H. Özbek.

Biology: It is an open area species, has restricted distribution range in Turkey, present knowledge shows that it has been recorded so far above 1000 m in the eastern part of Turkey. GRACE (2010) noted on the wing from June to August when females seek out the nests of their hosts, *Megachile giraudi bicoloriventris* MOCSARY, 1878.

Distribution: In Europe, mainly Mediterranean countries, Croatia, France, Greece, Italy, Poland, Spain; Asia (Caucasus, Iran, Iraq, Turkey, Turkmenistan); Africa (Egypt, Morocco) (ASCHER & PICKERING 2014). In Turkey: Bitlis (ÖZBEK & ZANDEN 1994).

***Coelioxys (Boreocoelioxys) inermis* (KIRBY, 1802)**

Synonyms: *Apis centuncularis acuminata* homonym CHRIST, 1791; *Apis inermis* KIRBY, 1802; *Coelioxys acuminata* homonym NYLANDER, 1852; *C. microdonta* FÖRSTER, 1853, *C. divergens* FÖRSTER, 1853

Material examined: **Erzurum:** Şenkaya, Turnalı, 1750 m, 28.VII.1994, ♂, leg. E. Yıldırım.

B i o l o g y : Although it has large distribution ranges in Palearctic region, so far has been recorded in five provinces in Turkey, which are represented eastern, western and central Anatolia. In general, it is an open area species, present in orchards too. Samples were recorded from the sea level to 1750 m. *Megachile argentata*, *M. bombycina* RADOSZKOWSKI, 1874; *M. centuncularis* (L. 1758); *M. alpicola* ALFKEN 1924, *M. versicolor* SMITH, 1844 and *Hoplitis papaveris* (LATREILLE, 1799) were reported as the host of this species (WARNCKE 1992, BANASZAK & ROMASENKO 1998, AMIET et al. 2004). FAHRINGER (1922) also indicated *Eucera ruficollis* (BRULLÉ 1832) and *Anthophora furcata* (PANZER 1798) as the hosts of *C. inermis*.

D i s t r i b u t i o n : Almost all of European countries, including Ireland and England, many of the Asian countries (China, Hokkaido, Japan, Iran, Kyrgyzstan, northern Asia, Russian Far East, Turkey); Algeria only in Africa (WARNCKE 1992, BANASZAK & ROMASENKO 1998; AMIET et al. 2004; NAGASE 2006). In Turkey: Eskişehir (FAHRINGER 1922); Bursa, Çanakkale, Hakkâri (WARNCKE 1992).

***Coelioxys (Boreocoelioxys) mandibularis* NYLANDER, 1848**

M a t e r i a l e x a m i n e d : **Erzurum:** Karagöbek, 2300 m, 20.VII.1995, ♂, (on *Eryngium creticum*) leg. H. Özbek.

B i o l o g y : Present data show that it could be accepted as a mountainous species living in cooler regions, recorded at 2300-2400 m in Erzurum and Kayseri. Similarly, GRACE (2010) noted it to be present in the Greek mountains at 2000-2200 m. It is on the wing in July and August. *Osmia villosa*, *Hoplitis papaveris*, *Megachile leachella*, *M. argentata*, *M. centuncularis*, *M. circumcincta*, *M. versicolor* were listed as the hosts of *C. mandibularis* (WARNCKE 1992). Above mentioned sample was collected from *E. creticum*.

D i s t r i b u t i o n : It is a Continental Euro-Asian bee, almost all of Europe including England; in various Asian countries (Turkey, China, northern Asia, and Russian Far East) (ACHER & PICKERING, 2014). In Turkey: Kayseri (2400 m) (WARNCKE 1992); Erzurum (ÖZBEK & ZANDEN 1994).

***Coelioxys (Boreocoelioxys) rufescens* LEPELETIER & AUDINET-SERVILLE, 1825**

S y n o n y m s : *Coelioxys umbrina* SMITH, 1843; *C. hebesceus* NYLANDER, 1848, *C. apiculata* NYLANDER, 1848, *C. trinacria* FÖRSTER, 1853, *C. diglypha* FÖRSTER, 1853, *C. longiuscula* SCHENCK, 1855, *C. parvula* SCHENCK, 1855; *C. fallax* MOCSARY, 1881, *C. rufescens var agona* ALFKEN, 1912; *Coelioxys rufescens nigrescens* COCKERELL, 1924, *C. (Boreocoelioxys) rufescens anatolica* WARNCKE, 1992.

D i s t r i b u t i o n : It has a wide distribution range (whole Europe and Asia including Russian Far East, Japan and North Africa) (WARNCKE 1992, ACHER & PICKERING 2014).

WARNCKE (1992) described *C. rufescens anatolica* in Hakkâri (Turkey).

***Coelioxys (Boreocoelioxys) rufescens anatolica* WARNCKE, 1992**

Material examined: **Erzurum:** Atatürk University Campus, 2000 m, 03.VII.1977, ♀, leg. H. Özbek (on *O. viciifolia* SCOP.); Yeşildere, 14.VIII.1977, ♀, leg. H. Özbek (on *Onopordum* sp., *Carduus* sp.); Oltu, Başaklı, 25.VI.1971, ♀, leg. H. Özbek; Çamlıbel, 22 km WSW of Oltu, 40.47166 41.77777, 1700 m, 23-25.VI.2001, 5 ♀♀, 4 ♂♂, leg. J.G. Rozen and H. Özbek; 29-30.VII.2003, 4 ♀♀, 2 ♂♂, leg. J. G. Rozen and H. Özbek; 02.VII.2001, 11 ♀♀, 2 ♂♂, leg. J.G. Rozen and H. Özbek; 07.VII.2007, 3 ♀♀, leg. J. S. Ascher, H. Özbek, J. G. Rozen (in AMNH); 23.VI.2001, 6 ♀♀, 2 ♂♂, leg. H. Özbek; 15.VII.2001, 3 ♀♀, leg. H. Özbek; 22.VII.2001, 5 ♀♀, leg. H. Özbek; 28.VII.2003, ♀, leg. H. Özbek.

Biology: It lives in a wide variety of habitats; samples were collected at altitudes ranging from the sea level (Aydın) to 2000 m (Ardahan, Erzurum). Flight season is from June to the end of August, peak flight occurs in July. *Anthophora bimaculata* (PANZER, 1798); *A. borealis*, MORAWITZ, 1865; *A. fulvitaris* BRULLÉ, 1832, *A. furcata* (PANZER, 1798), and *A. quadrimaculata* (PANZER, 1798) in the tribe Anthophorini were reported as the hosts of *C. rufescens* (WARNCKE 1992). He listed certain species in the family Megachilidae as unlikely hosts, *Megachile circumcincta*, *M. willugbiella*, *Osmia adunca* (PANZER, 1798) and *O. xanthomelana* (KIRBY, 1802). Visiting plants: *Centaurea solstitialis*, *O. viciifolia*, *Onopordon* sp., *Carduus* sp. and *V. agnus-castus*.

Distribution: Armenia, Azerbaijan, Turkey (WARNCKE 1992) in Turkey: Ankara, Erzurum, Hakkâri (type locality), Konya, Kars, Niğde (WARNCKE 1992); Aydın, Ardahan, Erzurum, Iğdır, Tokat (ÖZBEK & ZANDEN 1994). ÖZBEK (1979) reported in Erzurum and Kars as *C. rufescens*.

***Coelioxys (Coelioxys) aurolimbata* FÖRSTER, 1853**

Synonyms: *Coelioxys apiculata* homonym FÖRSTER, 1853; *C. recurva* SCHENCK, 1853, *C. reflexa* SCHENCK, 1853, *C. ogivalis* PEREZ, 1895, *C. aurolimbata algeriensis* FRIESE 1895, *C. aurolimbata orientalis* WARNCKE, 1992, (valid subspecies); *C. mongolica* FRIESE, 1925; *C. aurolimbata mongolica* FRIESE, 1925.

Distribution: Western Europe; Asian (China, Iran, Kazakhstan, Lebanon, Tajikistan and Turkey); Africa, Morocco only. In Turkey: Bursa, Edirne (WARNCKE 1992).

***Coelioxys aurolimbata orientalis* WARNCKE, 1992**

Material examined: **Erzincan:** Horticultural Research Institute, 1300 m, 13.VI.1994 ♂, leg. E. Yıldırım. **Erzurum:** 22 km WSW of Oltu, Çamlıbel, 40.47166 41.77777, 1700 m; 02.VII.2001, ♀, leg. J. G. Rozen and Özbek; 30.VII.2003, 2 ♀♀, leg. J. G. Rozen and Özbek (in AMNH); 23.VI.2001, 2 ♀♀, leg. H. Özbek; 15.VII.2001, 10 ♀♀, leg. H. Özbek; 22.VII.2001, 5 ♀♀, leg. H. Özbek; Başaklı, 1800 m, 13.VI.1992, ♂, leg. Özbek (on *O. viciifolia*); Atatürk University Campus, 1900 m, 01.VII.1992, ♂, leg. E. Yıldırım.

Biology: Samples were collected mostly in open areas; on the wing from the end of May to August at the altitudes of 650-1900 m; floral visits were recorded to *O. viciifolia*, *Vicia* sp. and *Cirsium* sp. WARNCKE (1992) reported *Megachile ericetorum* LEPELETIER, 1841 and *Anthophora parietina* FABRICIUS 1793 as the hosts of *C. aurolimbata*.

Distribution: Armenia, Iran, Lebanon, Turkey (WARNCKE 1992). In Turkey: Konya (type locality), Ankara, Erzurum, Hakkâri, Iğdır, Nevşehir, Samsun, Siirt, Van (WARNCKE 1992; Erzurum (ÖZBEK 1979, ÖZBEK & ZANDEN 1994).

Remark : Present data reveal that *C. aurolimbata orientalis* is present mainly in the Anatolian part of Turkey and extends to east Armenia and Iran, south to Lebanon, whereas *C. aurolimbata* was recorded in the western part of Turkey (Bursa and Edirne).

***Coelioxys (Coelioxys) conoidea* (ILLIGER, 1806)**

Synonyms : *Anthophora conoidea* ILLIGER, 1806; *Coelioxys vectis* CURTIS, 1831; *C. conica* SPINOLA, 1839; *C. punctata* LEPELETIER, 1841, *C. temporalis* NYLANDER, 1848, *C. ambigua* SCHENCK, 1855, *C. spissicauda* PASTEELS, 1968.

Material examined : **Artvin:** Yusufeli, Altuparmak, 1700 m, 05.VII.1994, 2♂♂, leg. E. Yıldırım. **Erzincan:** Horticultural Research Institute, 1300 m, 13.VI.1994, ♂, leg. E. Yıldırım. **Kars:** Sankamış, Karakurt, 1500 m, 40,07543°N, 42,20941°E, 19.VII.2007, 2♂♂, leg. H. Özbek.

Biology : Unlike most of the other *Coelioxys* species, some samples were collected in forest margins and heath locations. It occurs at altitudes ranging from 200 (Sinop) to 2300 m (Bitlis). Previous and present data show that on the wing from June to September. *Megachile maritima* (KIRBY, 1802), *M. lagopoda* (LINNAEUS, 1761) and *M. ericetorum* were listed as the hosts of *C. conoidea* (WARNCKE 1992; BANASZAK & ROMASENKO 1998; AMIET et al. 2004). *Rubus ulmifolius anatolicus*, *Statice* and *Vicia cracca elegans* were noted as visiting plant species (GRACE 2010).

Distribution : Whole Europe including European Russia through Turkey and Iran to Far East; Algeria only in Africa (ALFKEN 1935, WARNCKE 1992, BANASZAK & ROMASENKO 1998; AMIET et al. 2004; NADIMI et al., 20013). In Turkey: Artvin, Bitlis, Bursa, Hakkâri, İstanbul, Konya (WARNCKE 1992); Erzurum, Kars, Sinop (ÖZBEK & ZANDEN 1994).

***Coelioxys (Coelioxys) elongata* LEPELETIER, 1841**

Synonyms : *Coelioxys simplex* homonym NYLANDER, 1852; *C. tricuspidata* FÖRSTER, 1853, *C. denticulata* SCHENCK, 1855, *C. stigmatica* SCHENCK, 1855, *C. distincta* SCHENCK, 1855, *C. sponsa* SMITH, 1855, *C. tridenticulata* SCHENCK, 1861, *Coelioxys gracilis* SCHENCK, 1861, *C. obscura* SCHENCK, 1861, *C. claripennis* SCHENCK, 1870; *C. kudiana* COCKERELL, 1924, *C. popovici* FRIESE, 1925.

Material examined : **Erzurum:** Atatürk University Campus, 1900 m, 27.VI.2003, ♂, leg. H. Özbek.

Biology : *C. elongata* was first recorded from Bursa by FRIESE (1895). Remarkably, WARNCKE (1992) did not encounter this species. ÖZBEK & ZANDEN (1994) collected one sample from each province, Erzurum and Tunceli at the altitudes of 1400 and 1800 m, respectively in bushed land. On the contrary, in the present study, one sample was collected in an open area. *Megachile leachella*, *M. bombycina* RADOSZKOWSKI, 1874, *M. centuncularis*, *M. circumcincta*, and *M. ligniseca* (KIRBY, 1802), *M. willughbiella* (KIRBY, 1802) were listed as the hosts of *C. elongata* (WARNCKE, 1992; AMIET et al., 2004). *Cirsium* sp. was noted as visiting plant (ÖZBEK & ZANDEN 1994).

Distribution : Almost all European countries including European Russia; in Asian countries, Caucasus, Turkey, Iran, far east Russia; in Africa, Morocco and Tunisia (WARNCKE 1992; AMIET et al. 2004; NADIMI et al., 2013). In Turkey: Bursa (FRIESE 1895); Erzurum, Tunceli (ÖZBEK & ZANDEN 1994).

***Coelioxys (Coelioxys) quadridentata* (LINNAEUS, 1758)**

Synonyms: *Apis quadridentata* LINNAEUS, 1758; *A. conica* LINNAEUS, 1758; *A. acuminata* GMELIN, 1790, *A. bidentata* PANZER, 1798, *C. acuta* NYLANDER, 1848, *C. fissidens* FÖRSTER, 1853, *C. fraterna* FÖRSTER, 1853, *C. convergens* SCHENCK, 1855, *C. truncata* HÖPPNER, 1901.

Material examined: **Erzurum:** Atatürk University research field, 1900 m, 21.VI.1977, ♂ (on *O. viciifolia*), leg. H. Özbek.

Biology: ROWSON & PAVETT (2008) noted that this species was listed as rare (category 3) in the Red Data Book for British invertebrates. Its hosts nest in a variety of habitats so *C. quadridentata* is not known to show a clear habitat preference. We suspect this is valid for Turkey, too. It is not an abundant species and the samples were collected in various habitats such as open, wooded, and even residential area. *Megachile leachella*, *M. centuncularis*, *M. circumcincta*, *M. willughbiella*, *Trachusa byssina*, *Anthophora bimaculata*, *A. furcata*, *A. plagiata* and *A. parietina* were listed as the hosts of this species (WARNCKE 1992; BANASZAK & ROMASENKO 1998; GRACE 2010). One sample was collected from *O. Viciifolia*.

Distribution: Almost whole Europe; as Asian countries China, Iran, Siberia, Turkey (WARNCKE 1992, BANASZAK & ROMASENKO 1998, AMIET et al., 2004; Wu, 2006; GRACE 2010). In Turkey: Istanbul (FAHRINGER 1922); Erzurum (ÖZBEK 1979, ÖZBEK & ZANDEN 1994); Bolu, Erzurum, Konya (WARNCKE 1992).

***Coelioxys (Liothyrapis) decipiens* SPINOLA, 1838**

Synonyms: *Coelioxys Cretensis* FÖRSTER, 1853, *C. farinosa* SMITH, 1854; *Dioxys albofasciata* RADOSZKOWSKI, 1888, *Coelioxys seraxensis* RADOSZKOWSKI, 1893, *C. decedentata* PEREZ, 1902, *C. proximata* POPOV, 1946.

Material examined: **Antalya:** Serik, 10.VI.1993, 2♀, leg. A. Lökçü. **Mersin:** Silifke, Göksu deltasi, Dalyan, 26.VII.1992, ♂, leg.?

Biology: In the previous studies (ÖZBEK & ZANDEN 1994, 1996) and the present study, several samples were collected in forest margins and shrub lands in Antalya and Aydın. Moreover, one sample was found on costal sand dune in Mersin. Other samples were collected in different habitats, such as grassland, arable land and open areas with sparse trees and bushes. Therefore, *C. decipiens* lives in a wide variety of habitats. Flight season is June and July. WARNCKE (1992) mentioned *Megachile nigripes* SPINOLA, 1838 as the host of this species. GRACE (2010) noted *M. flavipes* MAVROMOISTAKIS as a likely host. *V. agnus-castus* was recorded as visiting plant (ÖZBEK & ZANDEN 1994. Likewise, GRACE (2010) reported the following plant species in Cyprus: *Alhagi maurorum*, *Trifolium* sp., *Medicago* sp. and *Linaria elatine*.

Distribution: In Europe known from Crete, Germany and Greece; widespread in Asia: Burma, China, Cyprus, India, Iraq, Iran, Kazakhstan, Kyrgyzstan, Oman, Thailand, Turkey, Turkmenistan, Uzbekistan, Yemen; present in Africa (Morocco, Sudan, Tunisia) (WARNCKE 1992, GUPTA 1993, NADIMI et al. 2013). In Turkey: Niğde, Osmaniye (FAHRINGER 1922), Denizli, Hatay, Kars, Konya, Osmaniye (WARNCKE 1992); Antalya, Aydın (ÖZBEK & ZANDEN 1994).

***Coelioxys (Mesocoelioxys) argentea* LEPELETIER, 1841**

Synonyms: *Coelioxys constricta* FÖRSTER, 1853, *C. diplotaenia* FÖRSTER, 1853; *C. transcaspica* RADOSZKOWSKI, 1886

Material examined: **Antalya:** Beydağları, Aliminpinarı, 1000 m, 05.VIII.1994, ♂, (on *M. longifolia*) leg. H. Özbek. **Erzincan:** 12 km W of Erzincan, 07.VII.2001, ♂, leg. J. G. Rozen and H. Özbek (in AMNH).

Biology: Samples collected in both wooded and pasture areas on *M. longifolia* and *V. agnus-castus*. Found on the wing in July and August. *Megachile sericans* (BISCHOFF 1927) was reported as the host of *C. argentea* (WARNCKE 1992).

Distribution: In Europe mainly in Mediterranean countries, Coroticus, France, Greece, Germany, Italy, Portugal, Spain; as Asian countries, Caucasus, China, Cyprus, Kazakhstan, Iran, Israel, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan and North Africa (Algeria, Morocco, Tunisia) (WARNCKE 1992; ASCHER & PICKERING 2014). In Turkey: Çankırı, Hakkâri, Osmaniye (WARNCKE 1992); Afyonkarahisar, Aydın (ÖZBEK & ZANDEN 1994).

Genus *Radoszkowskiana* POPOV, 1955

SCHWARZ (2001) recognized four species ranging from Algeria to the Trans-Caspian region; of which two species are present in Turkey:

***Radoszkowskiana barrei* (RADOSZKOWSKI, 1893)**

Distribution: India, Iran, Kazakhstan, Tajikistan, Turkey, Turkmenistan, Uzbekistan (SCHWARZ 2001). In Turkey: Erzincan, Iğdır (SCHWARZ, 2001). So far, 5 samples have been collected in June and July (SCHWARZ 2001).

***Radoszkowskiana tkalcui* SCHWARZ, 2001**

Distribution: Turkey: Bitlis, Van (type locality), endemic to Turkey. So far, 13 samples have been collected in July (SCHWARZ 2001).

Discussion

In the present study, the occurrence of the genera, *Coelioxys* and *Radoszkowskiana* of Turkey were studied and 15 species and two subspecies of *Coelioxys* in five subgenera were recorded from various localities. Together with the published records, 24 species in *Coelioxys* and two species in *Radoszkowskiana* were recognized as present in Turkey. Currently, the genus *Coelioxys* has 474 described species worldwide and with about 200 species in old world, it is a relatively diverse taxon (WARNCKE 1992, NAGASE 2006, MICHENER 2007, ASCHER & PICKERING 2014). More than 10% of the old world *Coelioxys* species is present in Turkey. It is surely beyond doubt that the occurrence of bees in nature depends mainly on various abiotic and biotic factors, but for parasitic bees, such as genera *Coelioxys* and *Radoszkowskiana* host availability is an important factor. The genus *Megachile* bees, which comprise 66 species in Turkey (ÖZBEK & ZANDEN 1994, ASCHER & PICKERING 2014), are the main hosts of *Coelioxys* species, although a few

species attack certain species of the bee genera *Anthophora*, *Centris*, *Euglossa* and *Tetralonia* (MICHENER 2007). Moreover, Turkey, and particularly Anatolia, is a biologically diverse region mainly due to the variable topography and climate, which provide many macro- and micro-habitats. Turkey also forms a natural bridge between two continents, Asia and Europe, and in the south it is also linked to the Ethiopian region via the Arabian peninsula, thus providing a natural pathway for the spread of species both north-south and east-west (TCHERNOV 1992).

From a biogeography viewpoint, distributional ranges of Turkish *Coelioxys* species are variable; many of them have Palearctic distribution: *C. acanthura*, *C. afra*, *C. brevis*, *C. caudata*, *C. echinata*, *C. emarginata*, *C. haemorrhoea*, *C. inermis*, *C. conoidea*, *C. decipiens* and *C. argentea*. Of which, *C. afra*, *C. brevis*, *C. caudata*, *C. echinata*, *C. haemorrhoea*, *C. inermis*, *C. conoidea*, *C. decipiens* and *C. argentea* are widespread and abundant throughout the country. Those of *C. obtusa* and *C. elongata* are moderately distributed, whereas *C. acanthura*, *C. emarginata* are rare species. (*Coelioxys acanthura* was newly recorded by WARNCKE (1992) in Çankırı and Şanlıurfa only one sample each. That of *C. emarginata* has been recorded from Erzurum only and represented by two samples. Although *C. erythrura* occurs in three of the continents, it has a narrow distribution range, among European countries, it is present in Italy only. In Turkey, WARNCKE (1992) collected five samples in Mersin as new record. We suspect no material has been collected related to *C. acanthura* and *C. erythrura*, since WARNCKE'S records. Then both of them could be treated as rare species in Turkey. On the other hand, following species present in two continents, Europe and Asia: *C. artemis*, *C. elegantula*, *C. elongatula*, *C. elsei*, *C. alata*, *C. quadridentata*, *C. mandibularis* and *C. polycentris*. Among them, *C. alata*, *C. mandibularis* and *C. polycentris* are widely distributed outside of Turkey but they have narrow distribution ranges in Turkey. WARNCKE (1992) did not encounter *C. alata* but ÖZBEK & ZANDEN (1996) found it in Rize, one sample only. *Coelioxys mandibularis* was recorded from Erzurum and Kayseri (WARNCKE 1992, ÖZBEK & ZANDEN 1994), that of *C. polycentris* from Eskişehir and Osmaniye (FAHRINGER 1922). We suspect, since then, no material has been collected in Turkey related to *C. polycentris*. *Coelioxys quadridentata* is widely distributed both in Turkey and abroad. On the contrary, *C. artemis* and *C. elsei* have narrow distribution ranges abroad, the first one is known in Greece apart from Turkey, that of the second one from Greece and Bulgaria among European countries and they could be accepted as moderately distributed species. Concerning the species, *C. elegantula* and *C. elongatula*, both have similar distribution ranges, they are East-Mediterranean species. *Coelioxys elegantula*, known in Greece, Crete, Cyprus, Israel, Egypt and Turkey, was recorded in Çankırı and Antalya (PASTEELS 1982). *Coelioxys elongatula* is known in Greece, Crete, Cyprus, Israel, and Turkey. FRIESE (1895) recorded it in Bursa, since then no sample has been found. Accordingly, NIETO et al. (2014) included *C. elongatula* in the "European Red List of Bees" considering the threatened category as vulnerable (VU) species, whereas *C. elegantula* was placed in the category of Least Concern (LC) species. Concerning the two species, *C. rufescens* and *C. aurolimbata* are widespread in Palearctic region. The subspecies, *C. rufescens anatolica* and *C. aurolimbata orientalis* were described by WARNCKE (1992) new to science in Turkey. Present knowledge reveals that *C. rufescens* is represented in Turkey by the subspecies, *C. rufescens anatolica*. Whereas *C. aurolimbata* is present in Thrace and Marmara Region, WARNCKE (1992) recorded in Edirne and Bursa, the remaining part of Turkey is represented by the

subspecies *C. aurolimbata orientalis*. Both of these subspecies are widely distributed in the country, in addition, the distribution area of *C. rufescens anatolica* extends to Armenia and Azerbaijan, whereas *C. aurolimbata orientalis* to Armenia, Iran and Lebanon.

Radoszkowskiana is a small genus, currently comprises of four described species present in Asia and Africa continents (SCHWARZ 2001). *Radoszkowskiana* is represented by two species, *R. barrei* and *R. tkalcui* in Turkey. The first one was recorded in Erzincan and Iğdır provinces, although it has large distribution range abroad. With present knowledge, Erzincan is found to be the western most distribution record of *R. barrei*. *Radoszkowskiana tkalcui* was described in Van by SCHWARZ (2001) and is currently known from Bitlis and Van only and it is endemic to Turkey. Concerning the remaining two species, *R. gusevi* SCHWARZ 2001 is present in Syria, whereas *R. rufiventris* (SPINOLA 1838) in Egypt and Algeria. Notably, since *R. gusevi* is present in neighboring country, Syria, occurrence of this species in Turkey seems likely or at least possible. We think that this species theoretically could occur in Turkey, although intensive collections must be conducted in various places, in particular southern part of the country, at the appropriate time of the year.

In conclusion, with 24 species and two subspecies, the *Coelioxys* fauna of Turkey is very rich compared to other certain Mediterranean countries, such as Greece (21), France (20), Italy (18), and Iran (14) (ASCHER & PICKERING 2014). Likewise, with two species, Turkey comprises 50% of the total species of *Radoszkowskiana*. With the variable topography, climate, and other features of Anatolia support a great richness of flower species and plant communities, which undoubtedly promote the rich diversity of bee species found in the country. Therefore, it could be expected that there should be some species remaining to be discovered. Moreover, in spite of above mentioned data, it should be pointed out that faunal studies on these two genera are in a poor state in Turkey. The bee survey over the country is inadequate; certain species are represented by one sample and some species were recorded in one province only. Thus, with further researches in various parts of the country, the recorded *Coelioxys* and *Radoszkowskiana* species will be considerably increased.

Acknowledgements

We are grateful to the individuals listed below for helping in the collection of the bee samples in the course of the study: Rüstem Hayat, Erol Yıldırım, Coşkun Güçlü, Memiş Kesdek, and A. Lökçü in the Plant Protection Department, Atatürk University, Erzurum.

Zusammenfassung

Diese Studie ergänzt die bisher in der Literatur vorhandenen Kenntnisse über das Auftreten, die geografische Ausbreitung, sowie die Wirts- und Blütenwahl des türkischen kleptoparasitischen Bienen-Genus *Coelioxys* LATREILLE, 1809 und *Radoszkowskiana* POPOV, 1955 (Hymenoptera: Megachilinae: Megachilinae). Das Material wurde seit 1970 in unterschiedlichen Gebieten der Türkei gesammelt. Die Untersuchung des Materials und die eingehenden Literaturstudie haben gezeigt, dass *Coelioxys* mit 24 Arten und zwei Unterarten in fünf Subgenus und *Radoszkowskiana* mit zwei Arten in der Türkei vertreten sind. Einige *Coelioxys*-Arten sind häufig und weit verbreitet,

während andere Arten sehr selten vorkommen. *C. emarginata* FÖRSTER, *C. erythrura* SPINOLA, *C. alata* FÖRSTER, *C. mandibularis* NYLANDER, *C. polycentris* FÖRSTER, *C. elegantula* ALFKEN und *C. elongatula* ALFKEN wurden als selten vorkommende Arten ermittelt, die nur in einem oder zwei Orten registriert wurden. Das artenarme Genus *Radoszkowskiana* tritt nur mit zwei Arten *R. barrei* (RADOSZKOWSKI) und *R. tkalcui* SCHWARZ auf, die sehr selten und nur in zwei Städten im Osten der Türkei gefunden wurden. *Radoszkowskiana tkalcui* SCHWARZ tritt in der Türkei endemisch auf. In der Studie wurden gleichzeitig die neuen Fundorten des gesammelten Materials für die Ergänzung der Kenntnisse über Ausbreitung wiedergegeben. Die bekannten Wirte sowie mögliches Blütenbesuchverhaltens dieses kleptoparasitischen Bienen-Genus *Coelioxys* sind ebenso in der Studie berücksichtigt worden. Abschließend wurde auch zum ersten Mal eine aktualisierte Liste von türkischen *Coelioxys* und *Radoszkowskiana* zusammengestellt. Siehe Appendix.

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Appendix

Checklist of *Coelioxys* LATREILLE and *Radoszkowskiana* POPOV of Turkey

Taxa	Distribution in Turkey	Host and Flower visiting	References
<i>Coelioxys</i> LATREILLE, 1809			
<i>C. (Allocoelioxys) acanthura</i> (ILLIGER, 1806)	Çankırı, Şanlıurfa	<i>Megachile</i> sp. <i>Broteroa corymbosa</i> , <i>Centaurea cilicica</i> , <i>C. hyalolepis</i> , <i>Statice virgata</i>	WARNCKE 1992, GRACE 2010
<i>C. (A.) afra</i> LEPELETIER, 1841	Ankara, Antalya, Bitlis, Bursa, Eskişehir, Erzincan, Erzurum, Hakkâri, İzmir, Kars, Konya, Kütahya, Nevşehir, Niğde, Van	<i>Megachile leachella</i> , <i>M. pilidens</i> , <i>M. apicalis</i> ; <i>Onobrychis viciifolia</i> , <i>Mentha longifolia</i> , <i>Rubus ulmifolius anatolicus</i> , <i>Broteroa corymbosa</i> , <i>Teucrium polium micropodioides</i> , <i>T. cyprium</i> , <i>Linaria elatine</i> , <i>Statice</i> sp.	Present study, ÖZBEK 1979, ÖZBEK & ZANDEN 1994, WARNCKE 1992, GRACE 2010
<i>C. (A.) artemis</i> SCHWARZ, 2001	Bitlis, Denizli, Elazığ, Gaziantep, Konya, Mardin, Mersin (type locality), Nevşehir, Şanlıurfa, Van	Unknown	SCHWARZ 2001
<i>C. (A.) brevis</i> EVERSMAHNN, 1852	Adana, Ankara, Bayburt, Çankırı, Erzincan, Erzurum, Hakkâri, Kars, Konya, Kütahya, Manisa, Nevşehir, Niğde, Siirt, Sivas, Van Erzurum, Şanlıurfa	<i>Megachile apicalis</i> , <i>M. argentata</i> , <i>M. pilidens</i> ; <i>Carduus</i> sp., <i>Eryngium creticum</i> , <i>Onobrychis</i>	Present study, WARNCKE 1992, ÖZBEK & ZANDEN 1994
<i>C. (A.) caudata</i> SPINOLA, 1838	Ağrı, Ankara, Bitlis, Çankırı, Hakkâri, Isparta, Kars, Konya, Niğde, Sivas	Unknown	WARNCKE, 1992
<i>C. (A.) echinata</i> FÖRSTER, 1853	Ağrı, Ankara, Antalya, Aydın, Bitlis, Bursa, Hakkâri, Erzurum, Iğdır, Konya, Kütahya, Sivas, Van	<i>Megachile apicalis</i> , <i>M. rotundata</i> ; <i>Mentha longifolia</i>	Present study; FRIESE, 1895; WARNCKE 1992 ÖZBEK & ZANDEN 1994
<i>C. (A.) elegantula</i> ALFKEN, 1934	Çankırı, Antalya, Muğla	<i>Statice</i> , <i>Broteroa corymbosa</i> , <i>Teucrium polium micropodioides</i>	PASTEELS 1982, GRACE 2010
<i>C. (A.) elongatula</i> ALFKEN, 1938	Bursa	Unknown	FRIESE 1895
<i>C. (A.) elsei</i> SCHWARZ, 2001	Kars (type locality), Konya, Mersin, Nevşehir	Unknown	SCHWARZ 2001

Taxa	Distribution in Turkey	Host and Flower visiting	References
<i>C. (A.) emarginata</i> FÖRSTER, 1853	Erzurum	<i>Megachile leucomalla</i>	Present study; STÖCKHERT, 1933; ÖZBEK & ZANDEN 1994
<i>C. (A.) erythrura</i> SPINOLA, 1838	Mersin	Unknown	WARNCKE, 1992
<i>C. (A.) haemorrhoea</i> FÖRSTER, 1853	Afyonkarahisar, Ankara, Aydın, Bingöl, Bitlis, Çankırı, Eskişehir, Hakkâri, İzmir, Kars, Konya, Mardin, Mersin, Niğde, Siirt, Şanlıurfa, Erzincan, Erzurum	<i>M. rotundata</i> ;	Present study, FAHRINGER 1922, WARNCKE 1992, ÖZBEK & ZANDEN 1994
		<i>Eryngium creticum</i> , <i>Statice</i> sp., <i>Thymus</i> sp., <i>Vitex agnus—castus</i>	
<i>C. (A.) obtusa</i> PÉREZ, 1884	Bitlis, Erzincan, Muş	<i>Megachile giraudi bicoloriventris</i>	Present study, ÖZBEK & ZANDEN 1994, GRACE 2010
<i>C. (A.) polycentris</i> FÖRSTER, 1853	Eskişehir, Osmaniye	<i>Megachile deceptoris</i> , <i>Tetralonia nana</i>	FAHRINGER 1922, JOZAN 1971, WARNCKE 1992
<i>C. (Boreocoelioxys) alata</i> FÖRSTER, 1853	Rize	<i>Megachile ligniseca</i> , <i>Anthophora furcata</i>	FRIESE 1926, SCHMIEDEKNECHT 1930, ÖZBEK & ZANDEN 1996
<i>C. (B.) inermis</i> (KIRBY, 1802)	Erzurum, Eskişehir, Bursa, Çanakkale, Hakkâri	<i>Megachile argentata</i> , <i>M. bombycina</i> , <i>M. alpicola</i> , <i>M. centuncularis</i> , <i>M. versicolor</i> , <i>Hoplitis papaveris</i> , <i>Anthophora furcata</i> , <i>Eucera ruficollis</i> ,	Present study, FAHRINGER 1922; WARNCKE 1992; BANASZAK & ROMASENKO 1998, AMIET et al. 2004; NAGASE 2006, STOCKHERT 1938
<i>C. (B.) mandibularis</i> NYLANDER, 1848	Erzurum, Kayseri	<i>Megachile leachella</i> , <i>M. argentata</i> , <i>M. centuncularis</i> , <i>M. circumcincta</i> , <i>M. versicolor</i> , <i>Osmia villosa</i> , <i>Hoplitis papaveris</i> ;	Present study, WARNCKE 1992, ÖZBEK & ZANDEN 1994
		<i>Eryngium creticum</i>	
<i>C. (B.) rufescens anatolica</i> WARNCKE, 1992	Ankara, Ardahan, Erzurum, Hakkâri (type locality), Konya, Kars, Niğde, Afyon, Erzurum, Iğdır, Tokat	<i>Anthophora bimaculata</i> , <i>A. borealis</i> , <i>A. fulvitaris</i> , <i>A. furcata</i> , <i>A. quadrimaculata</i> ; <i>Megachile circumcincta</i> , <i>M. willugbiella</i> , <i>Osmia</i> , <i>xanthomelana</i> , <i>O. adunca</i> ;	Present study, WARNCKE 1992, ÖZBEK & ZANDEN 1994
		<i>Centaurea solstitialis</i> ; <i>Onobrychis viciifolia</i> , <i>Onopordon</i> sp., <i>Carduus</i> sp., <i>Vitex agnus-castus</i>	
<i>C. (Coelioxys) aurolimbata</i> FÖRSTER, 1853	Bursa, Edirne	<i>Megachile ericetorum</i> , <i>Anthophora parietina</i>	WARNCKE 1992

Taxa	Distribution in Turkey	Host and Flower visiting	References
<i>C. (Coelioxys) aurolimbata orientalis</i> WARNCKE, 1992	Ankara, Erzincan, Erzurum, Hakkâri, Iğdır, Konya (type locality), Nevşehir, Samsun, Siirt, Van	<i>Megachile ericetorum?</i> <i>Anthophora parietina?</i> <i>O. viciifolia</i> , <i>Vicia</i> sp. <i>Cirsium</i> sp	Present study, WARNCKE 1992, ÖZBEK & ZANDEN 1994
<i>C. (C.) conoidea</i> (ILLIGER, 1806)	Artvin, Bitlis, Bursa, Erzincan, Erzurum, Hakkâri, İstanbul, Kars, Konya, Sinop	<i>Megachile maritime</i> , <i>M. lagopoda</i> , <i>M. ericetorum</i> <i>Rubus ulmifolius anatolicus</i> , <i>Statice</i> , <i>Vicia cracca elegans</i>	Present study, WARNCKE 1992, ÖZBEK & ZANDEN 1994, GRACE 2010
<i>C. (C.) elongata</i> LEPELETIER, 1841	Bursa, Erzurum, Tunceli	<i>Megachile leachella</i> , <i>M. bombycina</i> , <i>M. centuncularis</i> , <i>M. circumcincta</i> , <i>M. ligniseca</i> , <i>M. willughbiella</i> ; <i>Cirsium</i> sp.	Present study, FRIESE 1895, ÖZBEK & ZANDEN 1994
<i>C. (C.) quadridentata</i> (LINNAEUS, 1758)	Bolu, Erzurum, İstanbul, Konya	<i>Megachile leachella</i> , <i>M. centuncularis</i> , <i>M. circumcincta</i> , <i>M. willughbiella</i> , <i>Trachusa byssina</i> , <i>Anthophora bimaculata</i> , <i>A. furcata</i> , <i>A. plagiata</i> , <i>A. parietina</i> ; <i>Onobrychis viciifolia</i> , <i>Vicia</i> sp.	Present study, WARNCKE 1992, ÖZBEK 1979, ÖZBEK & ZANDEN 1994, BANASZAK & ROMASENKO 1998
<i>C. (Liothyrapis) decipiens</i> SPINOLA, 1838	Antalya, Osmaniye, Denizli, Hatay, Kars, Konya, Mersin	<i>Megachile nigripes</i> <i>M. flavipes</i> ; <i>Vitex agnus-castus</i> , <i>Alhagi maurorum</i> , <i>Trifolium</i> sp., <i>Medicago sativa</i> , <i>Linaria elatine</i>	Present study, FAHRINGER 1922, WARNCKE 1992, ÖZBEK & ZANDEN 1994, GRACE 2010
<i>C. (Mesocoelioxys) argentea</i> LEPELETIER, 1841	Afyonkarahisar, Ankara, Çankırı, Erzincan, Hakkâri, İzmir, Osmaniye	<i>Megachile sericans</i> ; <i>Mentha longifolia</i> ; <i>V. agnus-castus</i> .	Present study, WARNCKE 1992, ÖZBEK & ZANDEN 1994
Genus <i>Radoszkowskiana</i> POPOV, 1955			
<i>R. barrei</i> (RADOSZKOWSKI, 1893)	Erzincan, Iğdır	Unknown	SCHWARZ 2001
<i>R. tkalcui</i> SCHWARZ, 2001	Bitlis, Van (type locality)	Unknown	SCHWARZ 2001

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Zeitschrift/Journal: [Linzer biologische Beiträge](#)

Jahr/Year: 2016

Band/Volume: [0048_2](#)

Autor(en)/Author(s): Özbek Hikmet, Schwarz Maximilian

Artikel/Article: [Distribution data of the kleptoparasitic bees in Turkey: Part 2. Genera Coelioxys and Radoszkowskiana \(Hymenoptera: Megachilidae: Megachilinae\) with their checklist 1753-1771](#)