



Studies on Scoliidae (Hymenoptera: Vespoidea) of Adana province, Turkey

Ayla TÜZÜN¹, Samet Eray YALNIZ^{*2}

¹ Ankara University, Faculty of Science, Department of Biology, Ankara, Turkey

² Ankara University, Graduate School of Natural and Applied Sciences, Department of Biology, Ankara, Turkey

Abstract

The present study is based on the Scoliidae samples collected from Adana province between June-October 2017. 6 species and 3 subspecies of Scoliinae are recorded from the study area; *Colpa klugii* (Vander Linden, 1827); *Colpa sexmaculata* (Fabricius, 1782); *Megascolia maculata maculata* (Drury, 1773); *Scolia anatolia* Osten, 2004; *Scolia fallax* Eversmann, 1849; *Scolia fuciformis* Scopoli, 1786; *Scolia galbula* (Pallas, 1771); *Scolia hirta hirta* (Schrank, 1781); *Scolia sexmaculata sexmaculata* (Müller, 1766). *Colpa klugii* (Vander Linden, 1827) and *Scolia galbula* (Pallas, 1771) are new records for Scoliidae fauna in Adana province. The systematic, faunistic, ecological, biological and phenological informations of the species were given.

Key words: Scoliidae, systematic, fauna, Adana

----- * -----

Adana ili Scoliidae (Hymenoptera: Vespoidea) türleri

Özet

Bu çalışma 2017 yılı Haziran- Ekim ayları arasında Adana ilinden toplanan Scoliidae örneğine dayanmaktadır. Araştırma bölgesinde; Scoliinae alt familyasına ait 9 tür ve alttür: *Colpa klugii* (Vander Linden, 1827); *Colpa sexmaculata* (Fabricius, 1782); *Megascolia maculata maculata* (Drury, 1773); *Scolia anatolia* Osten, 2004; *Scolia (Scolia) fallax* Eversmann, 1849; *Scolia (Scolia) fuciformis* Scopoli, 1786; *Scolia (Scolia) galbula* (Pallas, 1771); *Scolia (Discolia) hirta hirta* (Schrank, 1781); *Scolia (Scolia) sexmaculata sexmaculata* (Müller, 1766) tespit edilmiştir. *Colpa (Colpa) klugii* (Vander Linden, 1827) ve *Scolia (Scolia) galbula* (Pallas, 1771) Adana ili Scoliidae faunası için yeni kayıttır. Türler hakkında sistematik, faunistik, ekolojik, biyolojik ve fenolojik bilgiler verilmiştir.

Anahtar kelimeler: Scoliidae, sistematik, fauna, Adana

1. Introduction

Hymenoptera species, which are members of the class insecta, are referred to also as membranous-winged animals as a result of having two pairs of wings of membranous nature. The order Hymenoptera is divided into two suborders, namely Symphyta and Apocrita. Apocrita suborder is further divided into two infraorders, namely Tenebrantia (gall wasps, parasitic wasps) and Aculeata (stinging wasps). The group Aculeata comprises three superfamilies, namely Apoidea, Chrysoidea and Vespoidea, and the superfamily Vespoidea comprises 10 families, namely Bradynobaenidae, Formicidae, Mutillidae, Pompilidae, Rhopalosomatidae, Sapygidae, Scoliidae, Sierolomorphidae, Tiphidae and Vespidae (Goulet and Huber, 1993).

The bodies of Scoliidae, known also as spurred bees, have thick hair and yellow, orange and red patterns on a black surface. The wings are black, yellow and brownish color (Goulet and Huber, 1993; Osten, 2000), and these color differences attract the attention of other bees during food intake and mating, and facilitate communication (Osten, 1999a). Unlike wasps, they do not attack human, although females will on rare occasions pierce human skin with the spur-shaped stings on their legs. They can live in different biotopes, from tropical forests to warm savannas, and can reside in same habitats as Scarabeidae, which are their ectoparasites (Osten et al., 2003). Adult Scoliidae, which are solitary, feed on the

* Corresponding author / Haberleşmeden sorumlu yazar: Tel.: +903122126720; Fax.: +903122232395; E-mail: seyalniz@ankara.edu.tr

nectar and pollen of flowers while their larvae feed on other insects (Goulet and Huber, 1993). The female of the species rest after mating and mature their eggs by taking nectar from flowers. Their reproductive capacities are very low. They are bees that can fly fast into the wind, but break flight when they want to feed on flowers. The male s are active at night while the females spend nighttime under the soil. The lifespan of the maleis three to four times shorter than that of the female (Osten, 1999a). Since the body hair is not capable of retaining pollen, their contribution to pollination is limited, although male Scoliidae ensure pollination through their pseudocopulation behavior (Ciotek et al. 2005). They are economically important. The females are ectoparasites of Scarabaeidae and Curculionidae (Coleoptera) larvae, which are pests to agriculture and forestry (Goulet and Huber, 1993). Scoliidae larvae feed on Coleoptera, thus preventing damage to pasture and crops, and serve as biological control agents. A parasitic relationship has also been identified between Scoliidae and some Diptera of the family Conopidae. Sexual dimorphism is apparent in the tribus Campsomerini, while the morphologies of the sexes are homogeneous in other genera (Osten, 1999a, 2000).

The Scoliidae family is divided into two subfamilies: Proscoliinae and Scoliinae, and is composed of approximately 560 species, 220 subspecies, 43 genera, 28 subgenera and two subfamilies (Osten, 2005b). The Proscoliinae family, of which there are only two species in the world, is prevalent in the Palearctic region.

There are 24 species and subspecies of the Scoliidae family in Turkey (Tüzün and Bağrıaçık, 2000; Osten and Özbek, 1999; Japoshvili and Karaca, 2010). Özbek and Anlaş (2011) reported 22 Scoliidae species in our country, although only the species *Proscolia spectator* of the Proscoliinae subfamily have been reported in our country. A female sample of the *Proscolia spectator* species was reported in Ankara in 1939. *Proscolia archarica*, as another species of the subfamily, was detected in Aras River, close to the border between Turkey and Iran, according to which the species can be considered to have a wide distribution in our country (Osten and Özbek, 1999).

A literature review uncovered only a few studies related to Scoliidae fauna in Turkey, and there are obvious deficiencies in the determination of the geographical distribution of the species. The present study makes both a systematic and faunistic analysis of the Scoliidae species that inhabit the Adana province. Some ecological, biological and phenological observations of the analyzed species are discussed, and the distribution of the species in Turkey and in the rest of the world is detailed. This study is important in determining the geographical distribution and ecological properties of the Scoliidae family.

2. Materials and methods

Samples were collected between June and October 2017 from the Adana and its adjacent areas, as the selected area of research. Insect nets were used for the collection of samples, which were removed from the nets and placed in killing jars containing KCN. The samples were then removed from the jars using forceps and placed in cardboard boxes with labels detailing the collector, location, date, altitude and coordinates. The plants on which the insects fed and rested were collected and identified, in addition to the samples collected from the field. The studies of Betrem (1935) and Osten (2000) were also taken into account in the detection of samples, and the studies of Osten (2000, 2005a,b) were also taken into account in the scientific nomenclature of the species. A Leica EZ4 stereo microscope was used for the determination of the species.

3. Results

Subfamily Scoliinae Latreille, 1802

Tribus Campsomerini Osten, 2001

Genus *Colpa* Dufour, 1841

Colpa klugii (Vander Linden, 1827)

Material Examined: Adana: Kozan, 342 m, 15.VII.2017, 1 ♂; Ceyhan, 78 m, 2.IX.2017, 1 ♀ (Totally 2 specimens, leg. S. E. Yalnız).

Distribution in Turkey: Amasya, Antalya, Artvin, Balıkesir, Bilecik, Burdur, Çanakkale, Elazığ, Erzurum, Gaziantep, Isparta, İstanbul, İzmir, Malatya, Manisa, Mersin, Muş, Niğde, Osmaniye, Samsun, Tekirdağ (Osten and Özbek, 1999; Anlaş and Çevik, 2004; Özbek and Anlaş, 2011, Elçin and Bağrıaçık, 2015).

World distribution: Portugal, Albania, Balkan peninsula, Ukraine, Iran (Osten, 2000; Özbek and Anlaş, 2007).

Phenology: July-September.

Remarks: This species is new record for Adana province.

***Colpa sexmaculata* (Fabricius, 1782)**

Material Examined: Adana: Ceyhan, 32 m, 12.VI.2017, 1 ♀, 1 ♂; Yumurtalık, 24 m, 13.VI.2017, 2 ♀♀, 2 ♂♂; Karataş, 13 m, 14.VI.2017, 1 ♂; Karaisalı, 317 m, 15.VI.2017, 2 ♀♀, 1 ♂; Seyhan, 312 m, 18.VI.2017, 1 ♂; Çukurova, 27 m, 19.VI.2017, 3 ♀♀, 2 ♂♂; Kozan, 284 m, 20.VI.2017, 2 ♂♂; İmamoğlu, 85 m, 21.VI.2017, 2 ♀♀, 1 ♂; Ceyhan, 33 m, 22.VI.2017, 3 ♂♂; Kozan, 316 m, 10.VII.2017, 3 ♂♂; Feke, 364 m, 11.VII.2017, 2 ♀♀, 3 ♂♂; Saimbeyli, 950 m, 12.VII.2017, 1 ♂; Kozan, 304 m, 13.VII.2017, 3 ♀♀, 2 ♂♂; Feke, 557 m, 14.VII.2017, 2 ♂♂; Feke, 603 m, 15.VII.2017, 2 ♀♀, 1 ♂; Kozan, 356 m, 16.VII.2017, 2 ♂♂; Tufanbeyli, 1470m, 17.VII.2017, 1 ♂; İmamoğlu, 86 m, 18.VII.2017, 2 ♂♂; Sarıçam, 312 m, 19.VII.2017, 3 ♀♀, 1 ♂; Seyhan, 33 m, 20.VII.2017, 2 ♀♀, 1 ♂; Çukurova, 30 m, 21.VII.2017, 2 ♂♂; Ceyhan, 156 m, 22.VII.2017, 4 ♀♀, 2 ♂♂; Ceyhan, 212 m, 23.VII.2017, 1 ♂; Yüreğir, 42 m, 24.VII.2017, 2 ♀♀, 1 ♂; Yumurtalık, 17 m, 25.VII.2017, 1 ♂; Yumurtalık, 20 m, 26.VII.2017, 3 ♀♀, 1 ♂; Karataş, 8 m, 27.VII.2017, 3 ♂♂; Ceyhan, 43 m, 28.VII.2017, 1 ♂; Feke, 580 m, 14.VIII.2017, 2 ♀♀, 1 ♂; Kozan, 342 m, 15.VIII.2017, 2 ♂♂; Kozan, 371 m, 16.VIII.2017, 3 ♀♀, 1 ♂; İmamoğlu, 94 m, 17.VIII.2017, 1 ♀, 1 ♂; Feke, 364 m, 18.VIII.2017, 1 ♂; Saimbeyli, 884 m, 19.VIII.2017, 1 ♂; Sarıçam, 337 m, 24.VIII.2017, 2 ♂♂; Yumurtalık, 14 m, 25.VIII.2017, 2 ♂♂; Ceyhan, 72 m, 26.VIII.2017, 3 ♂♂; Yumurtalık, 20 m, 27.VIII.2017, 1 ♀, 4 ♂♂; Karataş, 42 m, 28.VIII.2017, 1 ♂; Ceyhan, 38 m, 29.VIII.2017, 1 ♂; Çukurova, 48 m, 30.VIII.2017, 1 ♂; Seyhan, 58 m, 31.VIII.2017, 1 ♂; Ceyhan, 37 m, 3.IX.2017, 1 ♀, 1 ♂; Kozan, 371m, 18.IX.2017, 2 ♂♂; Feke, 364 m, 19.IX.2017, 1 ♂; Saimbeyli, 570 m, 20.IX.2017, 1 ♂; Seyhan, 326 m, 21.IX.2017, 1 ♂; Karataş, 24 m, 22.IX.2017, 2 ♂♂; Aladağ, 225 m, 23.IX.2017, 1 ♂; İmamoğlu, 278 m, 23.IX.2017, 3 ♂♂; Pozantı, 1036 m, 24.IX.2017, 1 ♂; Karaisalı, 306 m, 24.IX.2017, 2 ♂♂ (Totally 121 specimens, leg. S. E. Yalnız).

Distribution in Turkey: Adana, Ankara, Antalya, Artvin, Aydın, Balıkesir, Çanakkale, Diyarbakır, Edirne, Elazığ, Erzincan, Erzurum, Iğdır, İzmir, Kars, Kırıkkale, Konya, Malatya, Manisa, Mersin, Muğla, Muş, Nevşehir, Tokat, Tunceli, Uşak (Madl, 1997; Osten and Özbek, 1999; Tüzün and Bağrıaçık, 2000; Tüzün, 2004; Anlaş and Çevik, 2004; Tezcan et al., 2004; Özbek and Anlaş, 2007; Özbek and Anlaş, 2011; Bağrıaçık, 2016).

Distribution in the world: Crete, Rhodes, from Turkey through Uzbekistan (Osten, 2000).

Phenology: June-September.

Tribus Scoliini Osten, 2001

Genus *Megascolia* Betrem, 1928

***Megascolia maculata maculata* (Drury, 1773)**

Material Examined: Adana: Kozan, 284 m, 20.VI.2017, 1 ♀; Feke, 364 m, 11.VII.2017, 1 ♀, 1 ♂; İmamoğlu, 86 m, 18.VII.2017, 1 ♀; Seyhan, 33 m, 20.VII.2017, 1 ♀; Yüreğir, Camuzcu, 42 m, 24.VII.2017, 1 ♀; Ceyhan, 154 m, 1.IX.2017, 1 ♀; Ceyhan, 37 m, 3.IX.2017, 2 ♀♀; İmamoğlu, 278 m, 23.IX.2017, 1 ♀, 1 ♂ (Totally 12 specimens, leg. S. E. Yalnız).

Distribution in Turkey: Adana, Adıyaman, Ankara, Antalya, Aydın, Balıkesir, Bilecik, Bingöl, Bitlis, Çanakkale, Denizli, Edirne, Elazığ, Erzincan, Erzurum, Gaziantep, Gümüşhane, Hatay, Iğdır, Isparta, İstanbul, İzmir, Kahramanmaraş, Konya, Kütahya, Malatya, Manisa, Mardin, Mersin, Muğla, Niğde, Şırnak, Tokat, Tunceli, Uşak, Van, Yalova (Tkalcu, 1987; Madl, 1997; Osten and Özbek, 1999; Anlaş and Çevik, 2004; Tezcan et al., 2004; Özbek and Anlaş, 2007; Elçin and Bağrıaçık, 2015; Bağrıaçık, 2016).

World distribution: Mediterranean, France, Greece, Caucasus, Albania, Austria, Bosnia and Herzegovina, Bulgaria, Crete, Croatia, Cyclades Islands, Dodecanese Islands, Iraq, Hungary, Macedonia, North Africa, Romania, southern Russia, Turkmenistan, Slovenia (Osten, 2000; Fallahzadeh and Saghaei, 2010).

Phenology: June-September.

Genus *Scolia* Fabricius, 1775

***Scolia anatolia* Osten, 2004**

Material Examined: Adana: Ceyhan, 32 m, 12.VI.2017, 4 ♂♂; Kozan, 284 m, 20.VI.2017, 2 ♀♀, 1 ♂; İmamoğlu, 85 m, 21.VI.2017, 3 ♂♂; Ceyhan, 33 m, 22.VI.2017, 4 ♀♀, 3 ♂♂; Kozan, 316 m, 10.VII.2017, 5 ♂♂; İmamoğlu, 86 m, 18.VII.2017, 3 ♂♂; Sarıçam, 312 m, 19.VII.2017, 3 ♂♂; Seyhan, 33 m, 20.VII.2017, 4 ♀♀, 1 ♂; Çukurova, 30 m,

21.VII.2017, 1 ♂; Seyhan, 58 m, 31.VII.2017, 2 ♂♂; Feke, 364 m, 18.VIII.2017, 2 ♂♂; Yumurtalık, 14 m, 25.VIII.2017, 4 ♀♀, 1 ♂; Ceyhan, 72 m, 26.VII.2017, 6 ♂♂; Karataş, 42 m, 28.VII.2017, 3 ♂♂; Ceyhan, 38 m, 29.VIII.2017, 5 ♂♂; Çukurova, 48 m, 30.VIII.2017, 5 ♂♂; Ceyhan, 37 m, 3.IX.2017, 2 ♀♀, 4 ♂♂; Kozan, 371 m, 18.IX.2017, 2 ♂♂; Feke, 364 m, 19.IX.2017, 3 ♂♂; Karataş, 24 m, 22.IX.2017, 2 ♀♀, 1 ♂; İmamoğlu, 278 m, 23.IX.2017, 2 ♂♂ (Totally 78 specimens, leg. S. E. Yalnız).

Distribution in Turkey: Adana, Antalya, Artvin, Aydın, Erzurum, Iğdır, Kars, Kilis, Konya, Mersin, Muğla, Niğde, Osmaniye, Rize (Osten and Özbek, 1999; Osten, 2004; Özbek and Anlaş, 2007, Özbek and Anlaş, 2011; Elçin and Bağrıaçık, 2015; Bağrıaçık, 2016).

Distribution in the world: Crete, Dodecanese Islands, Iran, Turkey, Turkmenistan, Uzbekistan, Syria (Fallahzadeh and Saghaei, 2010).

Phenology: June-September.

Scolia fallax Eversmann, 1849

Material Examined: Adana: Kozan, 371 m, 16.VIII.2017, 1 ♀ (Totally 1 specimen, leg. S. E. Yalnız).

Distribution in Turkey: Adana, Ankara, Artvin, Elazığ, Erzurum, Gaziantep, Hatay, İstanbul, İzmir, Kars, Kütahya, Manisa, Muğla, Niğde, Tokat (Madl, 1997; Osten and Özbek, 1999; Tüzün, 2004; Anlaş and Çevik, 2004; Tezcan et al., 2004; Özbek and Anlaş, 2004; Özbek and Anlaş, 2011; Elçin and Bağrıaçık, 2015; Bağrıaçık, 2016).

World distribution: Spain, Italy, France, Greece, Caucasus, Armenia, Azerbaijan, Dodecanese Islands, Iran, Turkmenistan, Turkey, Ukraine (Osten, 2000; Fallahzadeh and Saghaei, 2010).

Phenology: August.

Scolia fuciformis Scopoli, 1786

Material Examined: Adana: Ceyhan, 32 m, 12.VI.2017, 1 ♂; Yumurtalık, 24 m, 13.VI.2017, 1 ♂; Feke, 364 m, 11.VII.2017, 1 ♀, 1 ♂; Saimbeyli, 950 m, 12.VII.2017, 1 ♂; İmamoğlu, 86 m, 18.07.2017, 1 ♂; Sarıçam, 312 m, 19.VII.2017, 1 ♂; Ceyhan, 156 m, 22.VII.2017, 1 ♂; Yumurtalık, 20 m, 26.VII.2017, 1 ♂; Karataş, 8 m, 27.VII.2017, 1 ♂; Ceyhan, 38 m, 29.VII.2017, 1 ♂; İmamoğlu, 94 m, 17.VIII.2017, 1 ♂; Saimbeyli, 903 m, 22.VIII.2017, 1 ♂; Karataş, 42 m, 28.VIII.2017, 1 ♂; Ceyhan, 37 m, 3.IX.2017, 1 ♀, 2 ♂♂ (Totally 17 specimens, leg. S. E. Yalnız).

Distribution in Turkey: Adana, Ankara, Antalya, Artvin, Aydın, Balıkesir, Bitlis, Diyarbakır, Erzincan, Erzurum, Hatay, İzmir, Kars, Konya, Manisa, Muş, Niğde, Osmaniye, Tunceli, Yozgat (Osten and Özbek, 1999; Tüzün, 2004; Tezcan et al., 2004; Özbek and Anlaş, 2007; Özbek and Anlaş, 2011; Elçin and Bağrıaçık, 2015; Bağrıaçık, 2016).

Distribution in the world: Balkan peninsula, Egypt, Italy, Iran (Osten, 2003).

Phenology: June-September.

Scolia galbula (Pallas, 1771)

Material Examined: Adana: Karataş, 13 m, 14.VI.2017, 1 ♀, 1 ♂; Kozan, 284 m, 20.VI.2017, 2 ♀, 1 ♂; Feke, 364 m, 11.VII.2017, 1 ♂; Kozan, 304 m, 13.VII.2017, 1 ♀; İmamoğlu, 86 m, 18.VII.2017, 2 ♂♂; Ceyhan, 156 m, 22.VII.2017, 1 ♂; Yüreğir, 42 m, 24.VII.2017, 1 ♂; Yumurtalık, 20 m, 26.VII.2017, 1 ♀; Feke, 364 m, 18.VIII.2017, 1 ♂; Yumurtalık, 20 m, 27.VIII.2017, 1 ♀; Kozan, 371 m, 18.IX.2017, 1 ♂; İmamoğlu, 278 m, 23.IX.2017, 1 ♀ (Totally 16 specimens, leg. S. E. Yalnız).

Distribution in Turkey: Afyonkarahisar, Ankara, Antalya, Artvin, Aydın, Denizli, Erzincan, Erzurum, Hakkari, Hatay, İzmir, Kars, Konya, Manisa, Mersin, Muğla, Trabzon (Osten and Özbek, 1999; Tüzün, 2004; Anlaş and Çevik, 2004; Tezcan et al., 2004; Özbek and Anlaş, 2007; Özbek and Anlaş, 2011).

Distribution in the world: Azerbaijan, Georgia, Transcaucasia, France, Italy, Balkan peninsula, Hungary, Ukraine, Bulgaria, Cyprus, Caucasus, Egypt, Greece, Israel (Osten, 1999a, 2002, 2005a; Tüzün, 2004).

Phenology: June-September.

Remarks: This species is new record for Adana province.

Scolia hirta hirta (Schrank, 1781)

Material Examined: Adana: Yumurtalık, 24 m, 13.VI.2017, 1 ♂; Karataş, 13 m, 14.VI.2017, 1 ♂; Karaisalı, 317 m, 15.VI.2017, 1 ♂; Kozan, 284 m, 20.VI.2017, 1 ♂; Ceyhan, 33 m, 22.VI.2017, 1 ♂; Kozan, 316 m, 10.VII.2017, 1 ♀, 1 ♂; Feke, 364 m, 11.VII.2017, 2 ♀♀, 1 ♂; Feke, 603 m, 15.VII.2017, 2 ♂♂; Kozan, 356 m, 16.VII.2017, 1 ♂; İmamoğlu, 86 m, 18.VII.2017, 1 ♂; Sarıçam, 312 m, 19.VII.2017, 1 ♂; Ceyhan, 212 m, 23.VII.2017, 2 ♂♂; Yüreğir, 42 m, 24.VII.2017, 2 ♀♀, 2 ♂♂; Yumurtalık, 20 m, 26.VII.2017, 1 ♂; Karataş, 8 m, 27.VII.2017, 1 ♂; Kozan, 371 m, 16.VIII.2017, 1 ♂; Saimbeyli, 884 m, 19.VIII.2017, 1 ♀, 1 ♂; Yumurtalık, 14 m, 25.VIII.2017, 1 ♂; Seyhan, 58 m, 31.VIII.2017, 1 ♂; Ceyhan, 78 m, 2.IX.2017, 2 ♀♀, 1 ♂; Feke, 364 m, 19.IX.2017, 1 ♂; Seyhan, 326 m, 21.IX.2017, 1 ♀; Aladağ, 225 m, 23.IX.2017 1 ♀, 1 ♂, Karaisalı, 306 m, 24.IX.2017, 1 ♂ (Totally 36 specimens, leg. S. E. Yalnız).

Distribution in Turkey: Adana, Ankara, Antalya, Artvin, Aydın, Burdur, Denizli, Elazığ, Erzincan, Erzurum, Hakkari, Hatay, Isparta, İçel, İzmir, Karabük, Kars, Kayseri, Konya, Muğla, Niğde, Osmaniye, Tokat, Rize (Osten and Özbek, 1999; Tüzün and Bağrıaçık, 2000; Tüzün, 2004; Anlaş and Çevik, 2004; Tezcan et al., 2004; Özbek and Anlaş, 2007; Japoshvili and Karaca, 2010; Özbek and Anlaş, 2011; Elçin and Bağrıaçık, 2015; Bağrıaçık, 2016).

Distribution in the world: Southern and eastern Europe, central Europe, north Africa, Israel, Lebanon, Iran, southern Russia (Osten, 2000).

Phenology: June-September.

Scolia sexmaculata sexmaculata (Müller, 1766)

Material Examined: Adana: Ceyhan, 32 m, 12.VI.2017, 1 ♂; Yumurtalık, 24 m, 13.VI.2017, 1 ♀, 1 ♂; Karataş, 13 m, 14.VI.2017, 2 ♀♀, 1 ♂; Karaisalı, 317 m, 15.VI.2017, 1 ♂; Seyhan, 312 m, 18.VI.2017, 1 ♂; Çukurova, 27 m, 19.VI.2017, 1 ♂; Kozan, 284 m, 20.VI.2017, 2 ♂♂; İmamoğlu, 85 m, 21.VI.2017, 1 ♂; Ceyhan, 33 m, 22.VI.2017, 3 ♂♂; Kozan, 316 m, 10.VII.2017, 2 ♀♀, 1 ♂; Feke, 364 m, 11.VII.2017, 3 ♂♂; Saimbeyli, 950 m, 12.VII.2017, 1 ♂; Kozan, 304 m, 13.VII.2017, 1 ♀, 2 ♂♂; Feke, 557 m, 14.VII.2017, 1 ♂; Feke, 603 m, 15.VII.2017, 1 ♂; Kozan, 356 m, 16.VII.2017, 1 ♂; Tufanbeyli, 1470m, 17.VII.2017, 1 ♂; İmamoğlu, 86 m, 18.VII.2017, 1 ♂; Sarıçam, 312 m, 19.VII.2017, 1 ♂; Seyhan, 33 m, 20.VII.2017, 1 ♂; Çukurova, 30 m, 21.VII.2017, 2 ♂♂; Ceyhan, 156 m, 22.VII.2017, 1 ♀, 2 ♂♂; Ceyhan, 212 m, 23.VII.2017, 1 ♂; Yüreğir, 42 m, 24.VII.2017, 1 ♂; Yumurtalık, 17 m, 25.VII.2017, 1 ♂; Yumurtalık, 20 m, 26.VII.2017, 2 ♀♀, 1 ♂; Karataş, 8 m, 27.VII.2017, 1 ♂; Ceyhan, 43 m, 28.VII.2017, 1 ♂; Feke, 580 m, 14.VIII.2017, 1 ♂; Kozan, 342 m, 15.VIII.2017, 2 ♂♂; Kozan, 371 m, 16.VIII.2017, 1 ♂; İmamoğlu, 94 m, 17.VIII.2017, 1 ♂; Feke, 364 m, 18.VIII.2017, 1 ♂; Saimbeyli, 884 m, 19.VIII.2017, 1 ♂; Sarıçam, 337 m, 24.VIII.2017, 1 ♂; Yumurtalık, 14 m, 25.VIII.2017, 1 ♀, 2 ♂♂; Ceyhan, 72 m, 26.VIII.2017, 2 ♀♀, 3 ♂♂; Yumurtalık, 20 m, 27.VIII.2017, 1 ♂; Karataş, 42 m, 28.VIII.2017, 1 ♂; Ceyhan, 38 m, 29.VIII.2017, 1 ♂; Çukurova, 48 m, 30.VIII.2017, 1 ♂; Seyhan, 58 m, 31.VIII.2017, 1 ♂; Ceyhan, 37 m, 3.IX.2017, 1 ♂; Kozan, 371m, 18.IX.2017, 1 ♀, 1 ♂; Feke, 364 m, 19.IX.2017, 2 ♀♀, 1 ♂; Saimbeyli, 570 m, 20.IX.2017, 1 ♂; Seyhan, 326 m, 21.IX.2017, 1 ♂; Karataş, 24 m, 22.IX.2017, 2 ♂♂; Aladağ, 225 m, 23.IX.2017, 1 ♂; İmamoğlu, 278 m, 23.IX.2017, 1 ♂; Pozanti, 1036 m, 24.IX.2017, 1 ♂; Karaisalı, 306 m, 24.IX.2017, 1 ♂ (Totally 80 specimens, leg. S. E. Yalnız).

Distribution in Turkey: Adana, Adıyaman, Ankara, Antalya, Aydın, Bitlis, Burdur, Bursa, Diyarbakır, Erzincan, Erzurum, Gaziantep, Isparta, İçel, İstanbul, İzmir, Kars, Kayseri, Konya, Manisa, Muğla, Muş, Nevşehir, Niğde, Osmaniye, Van (Madl, 1997; Osten and Özbek, 1999; Tüzün and Bağrıaçık, 2000; Tüzün, 2004; Anlaş and Çevik, 2004; Tezcan et al. 2004; Japoshvili and Karaca, 2010; Özbek and Anlaş, 2011; Elçin and Bağrıaçık, 2015; Bağrıaçık, 2016).

Distribution in the world: North Africa, England, Germany, southern and eastern Europe, Balkan peninsula, Israel, Iran (Osten, 2000).

Phenology: June-September.

4. Conclusions and discussion

This is the first comprehensive study of its kind to be carried out in the Adana province, involving 363 Scoliidae samples. As a result of the study, nine Scoliidae species of three genera were determined, and were evaluated systematically, faunistically and ecologically. *Colpa klugii* (Vander Linden, 1827); *Colpa sexmaculata* (Fabricius, 1782); *Megascolia maculata maculata* (Drury, 1773); *Scolia anatolia* Osten, 2004; *Scolia fallax* Eversmann, 1849; *Scolia fuciformis* Scopoli, 1786; *Scolia galbula* (Pallas, 1771); *Scolia hirta hirta* (Schrank, 1781); *Scolia sexmaculata sexmaculata* (Müller, 1766) were collected from study areas, and among these, *Colpa klugii* (Vander Linden, 1827 and

Scolia galbula (Pallas, 1771) were firstly recorded from Adana with this study. The population density was the highest in the *Colpa sexmaculata* (33%) and *Scolia sexmaculata sexmaculata* (22%) species, and lowest in the *Colpa klugii* and *Scolia fallax* (1%) species. Scoliidae species were found at altitudes of between 8 and 1740 meters, but mostly at altitudes between 212 and 980 meters. The *Colpa sexmaculata* species was found to have a wide tolerance of altitudes, being found at altitudes of between 960 meters and 1470 meters in Tufanbeyli. Phenologically, *Scolia fallax* species was found only in August. Other species were abundant between June and September, with the highest species diversity and population density observed in July and August. The flight activities of the male samples were higher than the females, as female Scoliidae were generally observed to hide beneath the soil. Turkey is very rich as regards to ophiolitic rock and endemism.

Except for the eastern and south eastern part of the country the ultramaphic rocks are present all over Turkey. They are frequently observed in Kütahya, Balıkesir, Antalya, Muğla, Hatay and Adana regions in Amanos Mountains, in Eastern Taurus, north and northeast of Mersin and between Niğde and Adana, in Aladağ massive and thousands of kilometer square land from Adana to Erzincan. Also they are locally present between Ankara and Çanakkale regions (Kurt et al., 2013). Scoliidae were generally reported to feed on red, purple and blue flowers, such as *Alhagi*, *Carthamus* and *Mentha*, and during the field studies, the Scoliidae species were mostly seen to feed together on the same plants. *Colpa klugii* and *Megascolia maculata maculata* species were most often collected from *Echinops* plants, while the *Scolia hirta hirta* was collected from *Origanum* plants.

This study has identified nine taxa of the Scoliidae family in the Adana province, while *Colpa klugii* (Vander Linden, 1827) and *Scolia galbula* (Pallas, 1771) from the Hymenoptera fauna were reported for the new records in the Adana province. The present study has detailed the distribution of the Scoliidae species in the Adana province, and has identified their contribution to Turkey's biological diversity.

References

- Anlaş, S., Çevik, E. İ. (2004). Manisa ilindeki Scoliidae (Hymenoptera) familyası türleri üzerinde faunistik araştırmalar. Turkish Journal of Entomology, 28, 221-228.
- Bağrıaçık, N. (2016). The Situation of the Scoliidae (Hymenoptera: Vespoidea) in the Çukurova Region. Hacettepe Journal of Biology and Chemistry, 44(2), 149-153.
- Betrem, J.G. (1935). Beitrag zur Kenntnis der palaarktischen Arten des Genus *Scolia*. Tijdschrift Voor Entomologie, 78, 1-78.
- Ciotek, L., Giorgis, P., Benitez-Vieyra, S., Cocucci, A.A. (2005). First confirmed case of pseudocopulation in terrestrial orchids of South America: Pollination of *Geoblasta pennicillata* (Orchidaceae) by *Campsomeris bistrimaculata* (Hymenoptera, Scoliidae). Flora, 201, 365-369.
- Elçin, G.B., Bağrıaçık, N. (2015). A study on Turkish Scoliidae (Hymenoptera). Entomofauna, 36(3), 49-52.
- Fallahzadeh, M., Saghayeh, N.A. (2010). A Brief Study on The Scoliidae in Iran (Insecta: Hymenoptera). Munis Entomology and Zoology, 5, 792-795.
- Japoshvili, G., Karaca, İ. (2010). List of Vespidae, Scoliidae and Tiphiidae (Hymenoptera) of Gölcük Natural Park in Isparta Province, Turkey. Süleyman Demirel University Journal of Science, 5, 194-199.
- Goulet, H., Huber, J.T. (1993). Hymenoptera of the world: An identification guide to families. Research Branch Agriculture Canada Press, Canada, 668p.
- Kurt, L., Özbey, B.G., Kurt, F., Özdeniz, E., Bölükbaşı, A. (2013). Serpentine Flora of Turkey. Biological Diversity and Conservation, 6(1), 134-152.
- Madl, M. (1997). Über Vespiden, Pompiliden, Scoliiden und Tiphiiden der Türkei (Hymenoptera). Linzer biologischen Beiträge, 29, 823-827.
- Osten, T. (1999a). Beobachtungen an Scoliiden (Hymenoptera) in der Türkei. Linzer biologischen Beiträge, 31, 449-457.
- Osten, T., Özbek, H. (1999). Beitrag zur Kenntnis der Scoliiden-Fauna der Türkei (ohne Zypren) mit Anmerkungen zur Systematik und Taxonomie (Hymenoptera, Scoliidae). Entomofauna, 31, 429-444.
- Osten, T. (2000). Die Scoliiden des Mittelmeer-Gebietes und angrenzender Regionen (Hymenoptera) Ein Bestimmungsschlüssel. Linzer biologischen Beiträge, 32, 557-593.
- Osten, T. (2002). Beitrag zur Kenntnis der Scoliidenfauna von Israel (Hymenoptera, Scoliidae). Zeitschrift für entomologie, 28, 337-352.
- Osten, T., Ebrahimi, E., Chahartaghi, A.M. (2003). Die Scoliiden des Iran und angrenzender Regionen mit Anmerkungen zu ihrer Lebensweise (Hymenoptera, Scoliidae). Entomofauna, 26, 353-380.
- Osten, T. (2004). Beitrag zur Kenntnis der Scoliiden-Fauna Griechenlands (ohne Zypren) (Hymenoptera, Scoliidae). Zeitschrift für entomologie, 20, 305-320.
- Osten, T. (2005a). Die Scoliiden-Fauna Mittelasiens (Hymenoptera, Scoliidae) (Kazakhstan, Turkmenistan, Uzbekistan, Tadschikistan, Kirgistan) Ein Bestimmungsschlüssel. Linzer biologischen Beiträge, 37, 1451-1479.
- Osten, T. (2005b). Checkliste der Dolchwespen der Welt (Insecta: Hymenoptera: Scoliidae). Bericht der Naturforschenden Gesellschaft Augsburg, 1-62.
- Özbek, H., Anlaş, S. (2007). New records for some Turkish Scoliidae (Hymenoptera). Zoology in the Middle East, 41, 112-114.

- Özbek, H., Anlaş, S. (2011). Distribution of Scoliidae (Hymenoptera: Aculeata) of Turkey with their zoogeographic characterization. *Turkish Journal of Entomology*, 35, 627-639.
- Tezcan, S., Karsavuran, Y., Pehlivan, E., Anlaş, S. (2004). Contribution to the knowledge of Scoliidae (Hymenoptera) fauna of Turkey. *Turkish Journal of Entomology*, 28, 247-252.
- Tkalcu, B. (1987). Ergebnisse der Tschechoslowakisch-Iranischen Entomologischen Expedition nach dem Iran 1970, 1973 und 1977 (Mit Angaben über einige Sammelresultate in Anatolien) Hymenoptera: Scoloidea, Scoliidae. *Acta Entomology Museum Natural Prague*, 42, 287-291.
- Tüzün, A., Bağrıaçık, N. (2000). Some Faunistic Records on The Scoliidae (Insecta: Hymenoptera) Species in Balıkesir, İzmir, Manisa and Muğla Provinces. *Selçuk Üniversitesi Fen-Edebiyat Fakültesi Fen Dergisi*, 17, 1-13.
- Tüzün, A. (2004). Studies on Scoliidae (Insecta: Hymenoptera) Fauna of Ankara Province. *Fırat Üniversitesi Fen ve Mühendislik Bilimleri Dergisi*, 16, 25-29.

(Received for publication 4 October 2018; The date of publication 15 December 2018)