

Original article (Orijinal araştırma)

Tachinid (Diptera: Tachinidae) parasitoids reared from some hemipterous hosts from Türkiye

Türkiye'deki bazı hemipter konukçulardan elde edilen tachinid (Diptera: Tachinidae) parazitoitler

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Abstract

This study was carried out to determine tachinid (Diptera: Tachinidae) parasitoids obtained from some hemipterous hosts in Adana, Ankara, Hatay, Konya and Uşak provinces of Türkiye between 2001 and 2020. For this purpose, adult hemipters were collected from perennial arboreal and annual herbaceous plants. The samples were brought to the laboratory and cultured on the relevant host plant material. As a result of the study, 11 tachinid species were determined from 10 different hemipterous hosts. Of these, four parasitoid-host couples are new records. These were *Aelia rostrata* Boheman, 1852 (Hemiptera: Pentatomidae) and *Scantius aegyptius* (L., 1758) (Hemiptera: Pyrrhocoridae) for *Gymnosoma clavata* (Rohdendorf, 1947) (Diptera: Tachinidae), *Dolycoris baccarum* (L., 1758) (Hemiptera: Pentatomidae) for *Eulabidogaster setifacies* (Rondani, 1861) (Diptera: Tachinidae) and *Piezodorus lituratus* (Fabricius, 1794) (Hemiptera: Pentatomidae) for *Cylindromyia rubida* (Loew, 1854) (Diptera: Tachinidae). Also, eight new hosts were reported for the first time in Türkiye. In addition, host information and distributions of each parasitoid are presented in the study.

Keywords: Host records, new record, parasitoid, Tachinidae, Türkiye

Öz

Bu çalışma, 2001 ve 2020 yılları arasında Türkiye'nin Adana, Ankara, Hatay, Konya ve Uşak illerinde bazı hemipter konukçulardan elde edilen tachinid (Diptera: Tachinidae) parazitoitleri belirlemek amacıyla yürütülmüştür. Bu amaçla ergin hemipterler konukçu bitkileri olan çok yıllık ağaçsı ve tek yıllık otsu bitkiler üzerinden toplanmıştır. Örnekler laboratuvara getirilip ilgili konukçu bitki materyali üzerinde kültüre alınmıştır. Çalışma sonucunda, 10 farklı hemipter konukçudan 11 tachinid türü tespit edilmiştir. Yürütülmüş olan çalışmalar ile 10 adet farklı hemipter olan konukçudan 11 adet farklı tachinid türü belirlenmiştir. Bunlardan dört parazitoit-konukçu çifti yeni kayıt niteliğindedir. Bunlar; *Gymnosoma clavata* (Rohdendorf, 1947) (Diptera: Tachinidae) için *Aelia rostrata* Boheman, 1852 (Hemiptera: Pentatomidae) ve *Scantius aegyptius* (L., 1758) (Hemiptera: Pyrrhocoridae), *Eulabidogaster setifacies* (Rondani, 1861) (Diptera: Tachinidae) için *Dolycoris baccarum* (L., 1758) (Hemiptera: Pentatomidae) ve *Cylindromyia rubida* (Loew, 1854) (Diptera: Tachinidae) için *Piezodorus lituratus* (Fabricius, 1794) (Hemiptera: Pentatomidae)'dur. Ayrıca Türkiye'de sekiz yeni konukçu ilk kez kayıt edilmiştir. Buna ek olarak, bu çalışmada her bir parazitoitin konukçu bilgileri ve dağılımları sunulmuştur.

Anahtar sözcükler: Konukçu kayıtları, yeni kayıt, parazitoit, Tachinidae, Türkiye

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Introduction

Tachinids (Diptera: Tachinidae) are one of the largest groups of the order Diptera with 8.592 species (O'Hara et al., 2021). This family includes 341 species in Türkiye (Kara et al., 2020). Three more species have been added to this in a study recently published by Soykan & Atay (2022). All tachinids live as endoparasites in various insects. These parasitoid insects were used by inoculative, augmentative or inundative releases and sometimes great successes were obtained (Grenier, 1988). It is known that tachinids play an important role in suppressing the populations of important pests found in both agricultural and forest areas under natural conditions. Their hosts are larvae, nymphs and adults of important pest species, especially those belonging to the orders Lepidoptera, Heteroptera and Coleoptera. In addition, they have a broad oviposition strategy that allows them to parasitize hosts in a variety of habitats (Cerretti & Tschorsnig, 2010; Dindo & Grenier, 2014). For this reason, they have attracted attention in biological control studies and, more than 100 tachinids species have been employed in biological control programs against different insect pests. Some of these programs have been partially or completely successful. For example, since the early 1900s, *Exorista larvarum* (L., 1758) and *Exorista japonica* (Townsend, 1909) (Diptera: Tachinidae) have been introduced several times against *Lymantria dispar* (L., 1758) (Lepidoptera: Lymantridae) into the Northern United States and only *E. larvarum* has established (Sabrosky & Reardon, 1976). Both in our country and many other countries, it has been determined that there is a high parasitization of Sunn pests, *Eurygaster* spp. (Hemiptera: Scutelleridae). For example, in a study conducted in İslahiye district of Gaziantep province in our country, it was reported that overwintered adults collected in wheat fields during the nymphal survey period parasitized at a rate of 40.7% (Tarla, 2002). Similarly, a study carried out in Iran by Amir-Maafi (1991), it was reported that up to 66.9% of Sunn pests were parasitized by adult parasitoids. In this context, studies on host identification and parasitization strategies of tachinid flies may provide useful information for their use as a biocontrol agent today and in the future.

Numerous studies have been conducted on tachinids and their hosts in the Palearctic region, including Türkiye. The most comprehensive catalog of Palearctic region has been recently produced by Tschorsnig (2017). It consists of 827 tachinid species reared from 2672 arthropod hosts belonging to eleven insect orders and one chilopod order. The host-parasitoid pairs of Turkish tachinids are unfortunately not well known. Kara & Alaoğlu (2001), Atay & Kara (2014), Atay et al. (2018) and Aytar et al. (2021) conducted detailed studies to determine the hosts of tachinids in Türkiye. In addition, two detailed catalogs of tachinid-host couples were prepared by Kara & Tschorsnig (2003) and Kara et al. (2014) in Türkiye.

This paper focused on the tachinid parasitoids of some species belonging to the order Hemiptera in different provinces of Türkiye.

Materials and Methods

The study was conducted in Adana, Ankara, Hatay, Konya and Uşak provinces of Türkiye between 2001 and 2020. Hosts were collected from agricultural and forest areas. The collected insects were brought to the laboratory for rearing with the plants they fed on and transferred to distinct rearing boxes and kept at 25±2°C and 60-70% relative humidity. A periodic check of boxes was carried out and the food was replaced when required.

After the adult parasitoids hatched, tachinids were prepared for identification and described according to Herting (1983), Tschorsnig & Herting (1994), Tschorsnig & Richter (1998), Zimin (1966), Gilasian et al. (2013) and Sahebari et al. (2016). The tachinids presented in the study were identified by the second and third authors. Herting & Dely-Draskovits (1993) followed for Tachinidae species nomenclature. New tachinid/ host-couple records were confirmed by Dr. H.-P. Tschorsnig (Staatliches Museum für Naturkunde, Stuttgart, Germany). Pentatomidae and Scutelleridae species were identified by the first author

and Pyrrhocoridae species was identified by Dr. Gülten Yazıcı (Directorate of Plant Protection Central Research Institute, Ankara-Türkiye).

The date of emergence, the number of males and females, hosts, host locations and the plants were presented separately. In addition, the distribution and hosts (in Türkiye) of reared parasitoids were described.

Results and Discussion

As a result of the examination of the samples, 11 different Tachinidae species were reared as parasitoids of 10 hemipteran hosts.

Subfamily: Phasiinae

Tribe: Phasiini

Clytiomya continua (Panzer, 1798)

Reared specimen. 27.V.2020, ♂, reared from *Eurydema ornata* (L., 1758) (Hemiptera: Pentatomidae), collected in Uşak: Sivaslı, 38°29'24"N, 29°41'57"E, 999 m.

Distribution in Türkiye. Tokat (Kara, 1998; Atay, 2011; Atay & Kara, 2014; Lekin, 2014; Lekin et al., 2016), Eskişehir (Aksu, 2005), Sakarya (Balkan, 2014; Balkan et al., 2015), Karabük (Atay, 2017).

Host in Türkiye. *Eurydema ornata* (Atay & Kara, 2014).

Remarks. Pentatomidae (Hemiptera) (especially *Eurydema* spp.) is the usual host family for this parasitoid. In addition, the host range includes several species of Scutelleridae, Coreidae, and Ciydniidae (Hemiptera) (Tschorsnig, 2017).

Clytiomya sola (Rondani, 1861)

Reared specimens. 31.V.2010, ♀, reared from *Ventocoris fischeri* (Herrich-Schaeffer, 1851) (Hemiptera: Pentatomidae), collected in Uşak: Sivaslı, 38°33'00"N, 29°37'03"E, 786 m; 16.III.2011, ♂, reared from *Dolycoris baccarum* (L., 1758) (Hemiptera: Pentatomidae), collected in Uşak: Sivaslı, 38°32'27"N, 29°38'32"E, 830 m.

Distribution in Türkiye. Konya (Tuatay et al., 1972), Manisa, İzmir (Karsavuran & Kara, 2003), Çorum (Uysal, 2018; Uysal & Atay, 2021), Muğla (Lutovinovas et al., 2018).

Host in Türkiye. *Ancyrosoma leucogrammes* (Gmelin, 1790) (Hemiptera: Pentatomidae) (Karsavuran & Kara, 2003), *Carpocoris* sp. (Hemiptera: Pentatomidae) (Tuatay et al., 1972), *Graphosoma lineatum* (L., 1758) (Hemiptera: Pentatomidae) (Kara & Tschorsnig, 2003).

Remarks. *Ventocoris fischeri* and *D. baccarum* are new hosts for *C. sola* in Türkiye. Pentatomidae (Hemiptera) is the usual host family for this parasitoid and commonly was reared host of this family. In addition, the host range includes several species of Reduviidae and Scutelleridae (Hemiptera) (Tschorsnig, 2017).

Ectophasia oblonga (Robineau-Desvoidy, 1830)

Reared specimens. 20.IV.2007, ♀, reared from *Eurygaster integriceps* Puton, 1881 (Hemiptera: Scutelleridae), collected in Hatay: Reyhanlı, 36°15'37"N, 36°30'05"E, 94 m; 27.V.2020, ♂, 02.VI.2020, ♂, reared from *E. ornata*, collected in Uşak: Sivaslı, 38°29'24"N, 29°41'57"E, 999 m and 38°31'58"N, 29°39'55"E, 913 m.

Distribution in Türkiye. Diyarbakır (Dupuis, 1963), Adana (Herting & Tschorsnig, 1993), Ankara (Memişoğlu & Özer, 1994), Tekirdağ (Öncüer & Kıvan, 1995; Kıvan, 1996), Tokat (Kara, 1998; Atay, 2011; Atay & Kara, 2014; Lekin, 2014; Lekin et al., 2016), Gaziantep, Kahramanmaraş, Kilis (İslamoğlu & Kornoşor, 2003, 2007), Eskişehir (Aksu, 2005), Bartın, Karabük, Kastamonu, Zonguldak (Korkmaz, 2007), Adıyaman, Batman, Diyarbakır, Mardin, Siirt, Şanlıurfa (Gözüaçık et al., 2010), Kastamonu (Atay, 2017), Çorum (Uysal, 2018; Uysal & Atay, 2021), Burdur, Muğla (Lutovinovas et al., 2018).

Host in Türkiye. *Eurygaster integriceps* (Dupuis, 1963; Yüksel, 1968; Herting & Tschorsnig, 1993; Öncüer & Kivan, 1995; Kivan, 1996; İslamoğlu & Kornoşor, 2003, 2007; Gözüaçık et al., 2010), *Eurygaster maura* (L., 1758) (Memişoğlu & Özer, 1994), *Lygaeus equestris* (L., 1758) (Hemiptera: Lygaeidae) (Kara & Alaoğlu, 1999), *Aelia* sp., *D. baccarum* (Kara & Tschorsnig, 2003); *E. ornata* (Kara & Tschorsnig, 2003; Atay & Kara, 2014).

Remarks. Scutelleridae and Pentatomidae (Hemiptera) are the usual host families for this parasitoid. In addition, the host range includes several species of Lygaeidae, Coreidae, Alydidae, Acanthosomatidae, Reduviidae, Rhopalidae and Stenocephalidae (Hemiptera) (Tschorsnig, 2017).

Gymnosoma clavata (Rohdendorf, 1947)

Reared specimens. 15.IV.2011, ♂, reared from *Aelia rostrata* Boheman, 1852 (Hemiptera: Pentatomidae), collected in Uşak: Sivaslı, 38°29'20"N, 29°41'40"E, 976 m; 19.V.2011, ♀, 23.VI.2016, ♂, 14.III.2019, ♀, reared from *D. baccarum*, collected in Uşak: Central District, 38°41'58"N, 29°20'17"E, 949 m, 38°40'27"N, 29°20'09"E, 896 m and 38°40'19"N, 29°19'17"E, 870 m; 24.V.2011, ♂, 12.VI.2016, ♀, reared from *D. baccarum*, collected in Uşak: Sivaslı, 38°29'51"N, 29°41'33"E, 973 m and 38°30'53"N, 29°41'26"E, 956 m; 25.IV.2017, ♀, reared from *Carpocoris* sp. (Hemiptera: Pentatomidae), collected in Uşak: Sivaslı, 38°29'26"N, 29°42'08"E, 1.012 m; 07.VII.2018, ♂, reared from *Scantius aegyptius* (L., 1758) (Hemiptera: Pyrrhocoridae) collected in Uşak: Sivaslı, 38°31'38"N, 29°39'59"E, 928 m.

Distribution in Türkiye. Erzurum (Doğanlar, 1982), İzmir (Karsavuran, 1986; Herting & Tschorsnig, 1993; Karsavuran & Kara, 2003), Tokat (Kara, 1998; Atay, 2011; Atay & Kara, 2014; Lekin, 2014; Lekin et al., 2016), Eskişehir (Aksu, 2005), Antalya, Burdur (Keçeci et al., 2007), Karabük (Korkmaz, 2007; Atay, 2017), Kastamonu (Atay, 2017), Sakarya (Balkan, 2014; Balkan et al., 2015), Muğla (Lutovinovas et al., 2018), Çorum (Uysal, 2018; Uysal & Atay, 2021).

Host in Türkiye. *Dolycoris baccarum* (Karsavuran, 1986; Herting & Tschorsnig, 1993; Kara & Tschorsnig, 2003; Keçeci et al., 2007), *Carpocoris* sp. (Herting & Tschorsnig, 1993), *A. leucogrammes* (Karsavuran & Kara, 2003), *Carpocoris fuscispinus* (Boheman, 1850) (Hemiptera: Pentatomidae) (Atay, 2011; Atay & Kara, 2014).

Remarks. Pentatomidae (Hemiptera) is the usual host family for *G. clavata* and it is commonly reared from *D. baccarum*. *A. rostrata* and *S. aegyptius* are new hosts for this tachinid. In addition, this is the first record of a tachinid being reared from a host belonging to the family Pyrrhocoridae (Tschorsnig, 2017).

Cistogaster globosa (Fabricius, 1775)

Reared specimen. 26.V.2004, ♀, reared from *A. rostrata*, collected in Konya: Sarayönü, 38°17'23"N, 32°29'55"E, 1.063 m.

Distribution in Türkiye. Manisa (Soykan, 2021; Soykan & Atay, 2022).

Hosts in Türkiye. Unknown.

Remarks. *A. rostrata* is new host for *C. globosa* in Türkiye. This tachinid commonly parasitizes *Aelia* spp. (Pentatomidae). In addition, the host range includes only one species of Scutelleridae (Tschorsnig, 2017).

Elomya lateralis (Meigen, 1824)

Reared specimen. 05.IV.2015, ♂, reared from *E. maura*, collected in Ankara, 39°50'06"N, 32°53'26"E, 1.164 m.

Distribution in Türkiye. Tokat (Kara & Alaoğlu, 1999; Atay & Kara, 2014), Ankara (Brown, 1962; Memişoğlu & Özer, 1994), Central Anatolia (Dikyar, 1981), Konya (Memişoğlu et al., 1994; Tschorsnig, 2017), Adana (Tschorsnig, 2017), Tekirdağ (Kivan, 1996; Tschorsnig, 2017), Diyarbakır (Lodos, 1961; Dupuis, 1963; Gözüaçık et al., 2010; Duman & Sertkaya, 2015), Gaziantep, Kilis (İslamoğlu & Kornoşor, 2003), Kahramanmaraş (İslamoğlu & Kornoşor, 2007), Mardin, Siirt, Şanlıurfa (Gözüaçık et al., 2010).

Hosts in Türkiye. *Ceraleptus gracilicornis* (Herrich-Schäffer, 1835). (Hemiptera: Coreidae) (Kara & Alaoğlu, 1999), *A. rostrata* (Brown, 1962; Dikyar, 1981; Memişoğlu et al., 1994), *D. baccarum* (Kara & Tschorsnig, 2003), *E. ornata* (Tschorsnig, 2017), *Corizus hyoscyami* (L., 1758) (Hemiptera: Rhopalidae) (Atay & Kara, 2014), *E. integriceps* (Lodos, 1961; Dupuis, 1963; Lodos, 1986; Tschorsnig, 2017; Öncüer & Kivan, 1995; Kivan, 1996; İslamoğlu & Kornoşor, 2003, 2007; Gözüaçık et al., 2010; Duman & Sertkaya, 2015), *E. maura* (Memişoğlu & Özer, 1994; Tschorsnig, 2017).

Remarks. *E. lateralis* commonly parasites *Eurygaster* spp. Pentatomidae and Scutelleridae are the usual host families for this parasitoid. In addition, the host range includes several species of Lygaeidae, Coreidae, Acanthosomatidae, Alydidae, and Rhopalidae (Hemiptera) (Tschorsnig, 2017).

***Phasia subcoleoprata* (L., 1767)**

Reared specimens. 28.IV.2007, ♂, reared from *E. integriceps*, collected in Hatay: Reyhanlı, 36°15'45"N, 36°29'36"E, 96 m.

Distribution in Türkiye. Diyarbakır (Lodos, 1952, 1961; Brown, 1962; Dupuis, 1963; Sun & Marshall, 2003; Duman & Sertkaya, 2015), Konya (Tuatay et al., 1972), Ankara (Memişoğlu & Özer, 1994), Adana, Antalya, Gaziantep, Hatay, Kahramanmaraş, Mersin (Şimşek et al., 1994), Tekirdağ (Öncüer & Kivan 1995; Kivan, 1996), Gaziantep, Kilis (İslamoğlu & Kornoşor, 2003), Kahramanmaraş (İslamoğlu & Kornoşor, 2007), Antalya, Burdur (Keçeci et al., 2007), Adıyaman, Batman, Diyarbakır, Mardin, Siirt, Şanlıurfa, Şırnak (Gözüaçık et al., 2010), Adıyaman, Gaziantep, Hatay (Gün, 2010), Sivas (Atay, 2011; Atay & Kara, 2014), Şanlıurfa (Duman et al., 2015).

Hosts in Türkiye. *E. integriceps* (Lodos, 1952, 1986; Brown, 1962; Dupuis, 1963; Şimşek et al., 1994; Öncüer & Kivan, 1995; İslamoğlu & Kornoşor, 2003; Sun & Marshall, 2003; İslamoğlu & Kornoşor, 2007; Keçeci et al., 2007; Gözüaçık et al., 2010; Gün, 2010; Duman & Sertkaya, 2015; Duman et al., 2015; Tschorsnig, 2017), *E. maura* (Lodos, 1961; Tuatay et al., 1972; Memişoğlu & Özer, 1994; Atay, 2011; Atay & Kara, 2014).

Remarks. This tachinid commonly was reared from *Eurygaster* spp. (Tschorsnig, 2017).

Tribe: Leucostomatini

***Eulabidogaster setifacies* (Rondani, 1861)**

Reared specimens. 08.VIII.2010, ♂, reared from *D. baccarum*, collected in Uşak: Sivaslı, 38°27'25"N, 29°41'44"E, 985 m.

Distribution in Türkiye. Tokat (Kara, 1998; Kara & Alaoğlu, 1999; Atay, 2011; Atay & Kara, 2014); Zonguldak (Korkmaz, 2007), Kastamonu (Atay, 2017), Muğla (Lutovinovas et al, 2018).

Hosts in Türkiye. *Corizus hyoscyami* (Hemiptera: Rhopalidae) (Atay, 2011; Atay & Kara, 2014).

Remarks. *D. baccarum* is a new host for this tachinid. The host range of this species is rather narrow. It was reared only from *C. hyoscyami* (Tschorsnig, 2017).

Tribe: Cylindromyiini

***Cylindromyia rubida* (Loew, 1854)**

Reared specimens. 04.X.2001, ♀, reared from *Piezodorus lituratus* (Fabricius, 1794) (Hemiptera: Pentatomidae), collected in Adana. Balcalı, 37°03'028"N, 35°21'31"E, 136 m, on *Firaxinus* sp. (Oleaceae).

Distribution in Türkiye. İzmir (Çerçi, 2017).

Hosts in Türkiye. Unknown.

Remarks. *P. lituratus* is a new host for this tachinid. It is also the first record of *C. rubida* reared from a host.

***Cylindromyia brassicaria* (Fabricius, 1775)**

Reared specimens. 19.III.2002, ♀, reared from *D. baccarum*, collected in Adana: Balcalı, 37°03'07"N, 35°21'46"E, 116 m; 27.V.2017, ♂, 16.IV.2019, ♂, reared from *D. baccarum*, collected in Uşak: Central District. 38°41'59"N, 29°20'18"E, 944 m and 38°38'56"N, 29°19'21"E, 815 m.

Distribution in Türkiye. Erzurum (Doğanlar, 1982), İzmir (Karsavuran, 1986), Tokat (Kara, 1998; Kara & Alaoğlu, 1999; Atay, 2011; Atay & Kara, 2014; Lekin, 2014; Lekin et al., 2016), Eskişehir (Aksu, 2005), Antalya, Burdur (Keçeci et al., 2007; Kastamonu (Atay, 2017); Çorum (Uysal, 2018; Uysal & Atay, 2021); Aydın, Muğla (Lutovinovas et al., 2018).

Hosts in Türkiye. *Dolycoris baccarum* (Karsavuran, 1986; Kara & Tschorsnig, 2003; Keçeci et al., 2007; Atay, 2011; Atay & Kara, 2014), *Holcostethus vernalis* (Wolff, 1804) (Hemiptera: Pentatomidae) (Kara & Alaoğlu, 1999).

Remarks. Pentatomidae (Hemiptera) is the usual host family for *C. brassicaria*. It is commonly reared from *D. baccarum*. In addition, it has a few hosts from Scutelleridae (Hemiptera) (Tschorsnig, 2017).

***Cylindromyia pilipes* (Loew, 1844)**

Reared specimens. 17.IX.2002, ♂, reared from *H. vernalis*, collected in Adana: Balcalı, 37°03'07"N, 35°21'34"E, 113 m.

Distribution in Türkiye. Bursa, İstanbul (Herting, 1984; Herting & Dely-Draskovits, 1993), Bartın, Kastamonu (Atay, 2017), Burdur (Lutovinovas et al., 2018), Çorum (Uysal, 2018; Uysal & Atay, 2021).

Hosts in Türkiye. Unknown.

Remarks. *H. vernalis* is new host for *C. pilipes* in Türkiye. *C. pilipes* has a narrow host range and Pentatomidae (Hemiptera) is the only host family for this parasitoid. Tschorsnig (2017) mentioned *D. baccarum*, *P. lituratus* and *Peribalus strictus* (Fabricius, 1803) (syn: *H. vernalis*) (Hemiptera: Pentatomidae) as hosts of this parasitoid.

In this study, tachinid parasitoids of some hemipteran species were determined in Adana, Ankara, Hatay, Konya and Uşak provinces of Türkiye. 11 tachinid species were reared from 10 different hosts. Four parasitoid-host couples were recorded for the first time. These were *A. rostrata* and *S. aegyptius* for *G. clavata*, *D. baccarum* for *E. setifacies*, *P. lituratus* for *C. rubida*. In addition, eight new host records for Türkiye were recorded. More comprehensive studies are required to determine the host-parasitoid couples in various regions and ecosystems in Türkiye.

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