

*Orijinal araştırma (Original article)*

**New records of Chamaemyiidae and Cryptochaetidae (Diptera) on Scale Insects (Hemiptera: Coccoomorpha) in Turkey<sup>1</sup>**

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**Türkiye’de Coccoomorpha (Hemiptera) üzerindeki Chamaemyiidae ve Cryptochaetidae türlerine ait yeni kayıtlar**

**Özet:** Türkiye’de bazı Chamaemyiidae ve Cryptochaetidae türlerinin kabuklubit ve koşnillerin (Hemiptera: Coccoomorpha) doğal düşmanları olduğu bilinmektedir. Bu çalışma Antalya, İzmir ve Muğla illerinde farklı zamanlarda yapılan iki araştırmada (2009-2011, 2016-2018) yılları arasında yürütülmüştür. Bahar ve yaz ayları boyunca iki haftalık aralıklarla örnek toplanmıştır. *Leucopomyia palliditarsis* (Rondani) (Diptera: Chamaemyiidae)’nın *Lichtensia viburni* Signoret (Hemiptera: Coccidae) ve *Pseudococcus comstocki* (Kuwana) (Hemiptera: Pseudococcidae) türleri ile beslendiği Türkiye’de ilk kez tespit edilmiştir. Ayrıca endoparazitoit olan *Cryptochaetum buccatum* Hendel (Cryptochaetidae), *Palaeococcus fuscipennis* (Burmeister) (Monophlebidae) üzerinde Türkiye’de ilk defa saptanmıştır. *C. grandicorne* Rondani ise *Gueriniella serratulae* Fabricius (Monophlebidae) üzerinde Ankara’da tespit edilmiştir. Bu türlerin konukçuları ve yayılışları hakkında bilgi verilmiştir.

**Anahtar sözcükler:** Coccoomorpha, Pseudococcidae, Monophlebidae endoparazitoit, avcı

**Abstract:** Some species of Chamaemyiidae and Cryptochaetidae are natural enemies of scale insects (Hemiptera: Coccoomorpha) in Turkey. To further that knowledge, this study involved field sampling in two weeks period in Antalya, İzmir and Muğla Provinces during two different projects that covered the springs and summers between 2009 and 2011, and then between 2016 and 2018. From that sampling, *Lichtensia viburni* Signoret (Hemiptera: Coccidae) and *Pseudococcus comstocki* (Kuwana) (Pseudococcidae) are reported as new host records for *Leucopomyia palliditarsis* (Rondani) (Diptera: Chamaemyiidae) in Turkey. In addition, the endoparasitoid *Cryptochaetum buccatum* Hendel (Cryptochaetidae) was recorded for the first time on *Palaeococcus fuscipennis* (Burmeister) (Monophlebidae) in Turkey. Also, *Cryptochaetum grandicorne* Rondani is reported from *Gueriniella serratulae* Fabricius (Monophlebidae) in Ankara. In addition, their hosts and distribution in Turkey are provided.

**Key words:** Coccoomorpha, Pseudococcidae, Monophlebidae, endoparasitoid, predator

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## Introduction

Scale insects (Hemiptera: Coccoomorpha), which are cryptic and mostly sedentary, are protected by a waxy and powdery covering. Some species are very important pests in agriculture, including horticulture, and on forest plants (Kosztarab & Kozar, 1988). They suck plant sap and can transmit plant diseases (Williams, 2004). Scale insects have a very rich array of natural enemies (Kosztarab & Kozar, 1988; Ülgentürk et al, 2013). For example, a total of 45 natural enemies (23 predators and 22 parasitoids) of 22 mealybug species (Hemiptera: Pseudococcidae) were reported for Ankara, Turkey (Kaydan et al, 2006). The natural enemy complex of scale insects is generally effective in the control of scale insect populations. Chamaemyiidae and Cryptochaetidae (Diptera) species are predatory and parasitoid flies, respectively, of scale insects. Chamaemyiidae (silver flies) species are potential biological control agents of pest species of Aphidoidea and Coccoidea (Clausen, 1940; Raspi & Benelli, 2016). The larvae of silver flies feed on aphids and scale insects and their eggs. The first record from Turkey of a species of Chamaemyiidae on scale insects was made by Süreyya & Hovasse (1931). They reported that the larvae of *Leucopis* sp. (Diptera: Chamaemyiidae) was successfully feeding on *Marchalina hellenica* Gennadius (Hemiptera: Marchalinidae), which was damaging pine trees on Princes Island in the Marmara Sea of Turkey. After that, Bodenheimer (1953) reported that the predator *Leucopis* sp. had 2-3 generations on *M. hellenica* in a year. Ülgentürk (1999) noted that *Leucopomyia silesiaca* (Egger) (as *Leucopis silesiaca*) was feeding on eggs in ovisac of *Filippia follicularis* Targioni-Tozzetti (Coccoomorpha) on *Fraxinus* sp. (Oleaceae) in Ankara, Turkey. Kaydan et al (2006) reported *L. silesiaca*, *L. alticeps* and *Parochthiphila (Euestelia) decipia* Tanajsijtshuk (Diptera: Chamaemyiidae) as mealybugs predators in Ankara. Ülgentürk et al (2013) reported 13 predators, including *Neoleucopis kartliana* Tanasijtshuk, feeding on nymphs and adult females of *M. hellenica*. More recently, Ebejer & Bartak (2019) reported a total of 40 species in five genera of Chamaemyiidae from Turkey, with updated nomenclature.

The genus *Cryptochaetum* Rondani is in the family Cryptochaetidae, which includes 41 known species worldwide. Only eight species have been recorded from the Palearctic region (Yang & Yang, 2001). The larvae of *Cryptochaetum* are endoparasitoids of Monophlebidae (Thorpe, 1934; Cadahi, 1984; Mendel et al, 1998). In the 1880's, *Cryptochaetum iceryae* (Williston) was introduced into California from Australia as a biocontrol agent of *Icerya purchasi* Maskell (Hemiptera: Monophlebidae) and it provided complete control (Thorpe, 1931). In addition, *Cryptochaetum jorgepastori* Cadahia was introduced from Spain to Israel for the control of *Palaeococcus fuscipennis* (Burmeister) (Hemiptera: Monophlebidae), a pest of pine forests there (Mendel et al, 1998). The first record of *Cryptochaetum* in Turkey, on *Gueriniella serrutulae* Fabricius (Hemiptera: Monophlebidae), was published by Bodenheimer (1953).

The aim of this study was to further investigate the feeding of species of Chamaemyiidae and Cryptochaetidae on scale insects in the field in Turkey, and to review briefly the literature on the Turkish species of these two families.

## Materials and Methods

Surveys were carried out in Antalya, İzmir and Muğla in the Aegean Region of Turkey between the years 2009 and 2011, and between 2016 and 2018. Sampling was done twice a week in spring and summer in İzmir and Muğla and on an irregular basis in Ankara in central Anatolia. Plant parts infested with scale insects were brought to the laboratory and examined under a stereo-microscope. If there were fly larvae in the ovisacs of the scale insects, the samples were placed in a labelled plastic jar with the host, and the emergence of adults was monitored. The adult flies were placed in labelled vials for later identification. The scale insects were prepared according to the procedures of Kosztarab & Kozár (1988), and the identifications were also done by the authors of the present study by using the keys and plates of Kosztarab & Kozár (1988) and Williams (2004). The Cryptochetidae and Chamaemyiidae species were identified by Dr. Rüstem Hayat (Turkey) and Dr. Martin Ebejer (England), respectively.

## Results and Discussion

In this study, 1 predatory fly (Chamaemyiidae) and 2 endoparasitoid flies (Cryptochaetidae) of scale insects in Turkey are presented. Their distributions, hosts and biologies are provided, with additional literature.

### *Leucopomyia palliditarsis* (Rondani, 1875) (Chamaemyiidae)

Examined material: 4♂♂, 2♀♀, İzmir (38°22'00.5"N 26°50'11.1"E), ex *Lichtensia viburni* (Signoret) on *Olea europaea* (Oleaceae) (coll. Ş. Balcı), 16.vi.2018; 4♂♂, 4♀♀, Ankara, Kızılcahamam (40°28'15.96"N, 32°41'42.64"E), ex *Pseudococcus comstocki* (Kuwana) on *Morus alba* L. (Moraceae), 19.ix.2015 (Coll. S. Ülgentürk).

*Leucopomyia palliditarsis* was recorded as a predator of *Phenacoccus aceris* (Signoret), *Planococcus ficus* (Signoret) and *P. vovae* (Nasonov) in Ankara (Kaydan et al, 2006). It was also reported as a predator of *L. viburni* in Italy (Raspi and Bertolini, 1993). *Eriopeltis lichtensteini* Signoret and *Parthenolecanium persicae* (Fabricius) (Hemiptera: Coccidae) were determined to be hosts of *L. palliditarsis* (as *Leucopis alticeps*) in Central Europe by Kosztarab & Kozár (1988). The present study reports *L. viburni* and *P. comstocki* as new hosts for *L. palliditarsis* in Turkey. The larvae of *Leucopomyia* species prey on the eggs in the egg sacs of Coccidae, Pseudococcidae and Eriococcidae (Hemiptera: Cocomorpha) (Raspi & Bertolini, 1993). A live larva of *L. palliditarsis* was found in each ovisac of *L. viburni* in İzmir. Females of *P. comstocki* often congregate on pruning scars and the nodes of branches, in crevices and under bark where they produce a white, waxy egg-sac. In Kızılcahamam, Ankara, a large number of *L. alticeps* larvae were found in the egg

masses of mealybugs during hibernation and the adults were on colonies of *P. comstocki*. Based on this observation, *L. palliditarsis* probably overwinters as the last larval instar with the host mealybug in Ankara.

### ***Cryptochaetum buccatum* Hendel (Diptera: Cryptochaetidae)**

Examined material: 1♂, 4♀♀, Muğla/ Fethiye (36°35'40.96"N, 29°09'03.93"E), ex *P. fuscipennis*, *Pinus brutia* Ten. (Pinaceae), 23.iv.2009, 1♂, 2♀♀, İzmir/Aliağa (38°49'37.13"N, 26°59'03.86"E), *P. fuscipennis*, *Pinus halepensis* Miller (Pinaceae), 17.vii.2010 (Coll. S. Ülgentürk).

*Cryptochaetum buccatum* is recorded for the first time in Turkey; there were five exit holes of *C. buccatum* on a female *P. fuscipennis*. Cadahi (1984) stated that *Cryptochaetum jorgepastori* is an endoparasite of *P. fuscipennis*, as well as *C. buccatum*, at Huleva in Spain. Both *Cryptochaetum* species are found together in the coastal pine forests of Huelva.

### ***Cryptochaetum grandicorne* Rondani (Diptera: Cryptochaetidae)**

Examined material: 2♂♂, 2♀♀, Ankara/Kızılcahamam (Kurtboğazi) (40°16'25.08"N, 32°41'42.64"E) ex *Gueriniella serratulae* Fabricius (Hemiptera: Coccoidea; Monophlebidae) *Vicia* sp., 2♀♀, *Pyrus* sp., 19.v.2009 (Coll. S. Ülgentürk).

The larvae and pupae of *C. grandicorne* were observed in prepared slides of *G. serratulae* and there were exit holes in the parasitoid mummies. Thorpe (1934) reported that *C. grandicorne* is an endoparasitoid of *G. serratulae* and had one generation per year in southern Italy. According to Bodenheimer (1953), *G. serratulae* was heavily parasitized by *C. grandicorne* on *Amygdalus armeniaca* (L.) Dum. (Rosaceae) at Malatya in Turkey. Papp et al (2018) erroneously mentioned it as a new record for *C. grandicorne* in Turkey. In this study, Ankara is a new locality record for *C. grandicorne*.

The Comstock mealybug (CMB), *Pseudococcus comstocki* (Kuwana) (Hemiptera: Pseudococcidae), is a highly polyphagous species that is native to eastern Asia and widely distributed in that region (Pellizzari et al, 2012). Recently, *P. comstocki* has become an important pest of mulberry production in Turkey (Ülgentürk & Mohammed, 2017) and *P. fuscipennis* is a common pine forest pest in Turkey (Ülgentürk et al, 2013). On the other hand, *G. serrulatae* is known from non-agricultural areas. Anatolian Turkey has considerable floristic and faunistic richness due to its geographical position and heterogeneous topography. Ebejer & Barták (2019) reported 40 species of Chamaemyiidae in Turkey. Papp et al (2018) reported *Cryptochaetum jorgepastori* for the first time in Turkey. Based on the results of the current study, the number of Cryptochaetidae species known in Turkey has increased to three.

For the environmentally friendly control of plant pests in agriculture and forests, the use of indigenous natural enemies is of particular importance. Therefore, the

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findings of the current study provide the opportunity to use the three newly reported species as biological control agents.

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