J. Entomol. Res. Soc., 16(1): 27-35, 2014 *ISSN:1302-0250*

Forficulidae Fauna of Olive Orchards in the Southeastern Anatolia and Eastern Mediterranean Regions of Turkey (Dermaptera)

Gülay KAÇAR[1*] Masaru NISHIKAWA[2]

[1*] Laboratory of Entomology, Biological Control Research Station, Koprukoyu, 01321 Adana, TURKEY, *Corresponding author's e-mail: gulaysahan@yahoo.com
[2] Laboratory of Entomology, Faculty of Agriculture, Ehime University, Matsuyama, 790-8566 JAPAN

ABSTRACT

In this study, we aimed to determine the occurrence of Forficulidae earwigs on olive trees in the eastern Mediterrenean and southeastern Anatolia regions of Turkey. Seasonal changes in occurrence and abundance of earwigs were monitored in olive orchards in (Tarsus) Mersin and Erzin (Hatay) for two successive years. Samples were collected by using aspirator, handing, knocking and with twigs plucked from olive trees and separated in the laboratory. Six species from Forficulidae family in altogether 98 specimens were collected. *Forficula aetolica* Brunner, 1882 (2 specimens), *F. auricularia* Linnaeus, 1758 (13), *F. decipiens* Géné, 1832 (1), *F. lurida* Fischer, 1853 (41), *Guanchia brignolii* (Vigna Taglianti, 1974) (22), *G. hincksi* (Burr, 1947) (1), *Guanchia* sp. (14) and *Forficula* sp. (4) were determined in olive orchards (*Oleae europae* L.) in Adana, Hatay, Kahramanmaraş, Mersin, Osmaniye provinces (eastern Mediterrenean region), Gaziantep and Kilis provinces (southeastern Anatolia region) of Turkey between the years 2008 and 2010. *F. lurida* was detected as the most abundant species. The results of this study also revelead that Forficulidae species were appeared on the trees at the middle of April and after become adults, they migrated to the soil at the end of December.

Key words: Forficulidae, Dermaptera, fauna, olive, Turkey.

INTRODUCTION

The order of Dermaptera includes about 2200 species, which are mainly distributed throughout the warm and wet tropic areas, but few species are found in Nearctic and Palaearctic regions (Popham, 2000; Anlaş and Kočárek, 2012). Earwigs feed on animal, plant of funghi materials (Albouy and Caussanel, 1990; Haas and Henderickx, 2002; Toups *et al*., 2007; Anlaş *et al*., 2010) and even vegetables seedling, annual flowers that they often cause severe damage to mature soft fruit or corn silks (Langston and Powell, 1975; Toups *et al*., 2007; Shetlar and Andon, 2010). Dermaptera have also beneficial role in the fields that they are the important predator of aphids and armoured scale insects (Tabilio *et al*., 1998; Flint, 2002; Canellas *et al*., 2005; Maher and Logan, 2007; Toups *et al*. 2007; Weems and Skelley, 2007; Ayaz *et al*., 2009; Tezcan and Kocarek, 2009).

Altogether, only 19 species of Dermaptera from families Labiduridae, Anisolabididae and Forficulidae have been reported in Turkey (Anlas and Kočárek, 2012). The studies about the distribution of Dermaptera species are very limited in Turkey. Nine species were given based on the material collected between the years of 1970-2010 from different locations of Turkey (Tezcan *et al*., 2011). Tezcan and Kocarek (2009) recorded four species: *Forficula auricularia* Linnaeus, *F. lurida* Fischer, *F. smyrnensis* Serville and *Guanchia hincksi* (Burr) belonging to the Forficulidae in cherry orchards (*Cerasus avium* (L.)), in Manisa and Izmir. *F. auricularia* were determined to be common species in pomegranate orchards of Turkey (Öztürk and Ulusoy, 2009). The damage rate of this species changed from 5% to 14% in apricot orchards in Darende (Malatya), Turkey (Ayaz *et al*., 2009).

Dermaptera fauna of the eastern Mediterrannean and southeastern Anatolia regions of Turkey has been poorly studied. In this study, we aimed to determine the distribution of Turkish Dermaptera fauna in olive orchards and occurrence of Forficulidae species on olive trees.

MATERIAL AND METHODS

This study was conducted in olive orchars in Adana, Hatay, Kahramanmaraş, Mersin, Osmaniye provinces (eastern Mediterrenean region), Gaziantep and Kilis provinces (southeastern Anatolia region) of Turkey between the years 2008 and 2010. Dermaptera samples were collected by aspirator, knocking to branches (100 trees were beaten with using Steiner funnel in each orchard), handing and pulling of twigs from olive trees. Additionally, occurrence of Forficulidae specimens on the olive trees were determined by knocking (100 trees were beaten with using steiner funnel in each orchard) in the olive orchards of Tarsus (Mersin) (176 m, 37°0'46"N, 36°11'20"E) and Erzin (Hatay) (257 m, 37°0'36"N, 34°46'15"E) once a week from April to November and every fifteen days in other months between 2009 and 2010. Collected adults and nymphs were separated in the laboratory for identification.

Samples were sent to the laboratory of entomology in Ehime University for identification. We used the monographs of Steinmann (1993) and a paper of Kočárek (2007) to identify the specimens. Although other species were identified on species level, *Guanchia* sp. and *Forficula* sp. were identified to genera level. All samples were identified by the second author, and they were deposited in the collection of the Ehime University Museum in Japan.

RESULTS

During this study, six Forficulidae species were determined in the olive orchards in Adana, Gaziantep, Hatay, Kahramanmaraş, Kilis, Mersin and Osmaniye. Totally, 98 specimens of Forficulidae were collected (Table 1). Six species of this family: *Forficula aetolica* Brunner, 1882 (2 specimens), *F. auricularia* Linnaeus, 1758 (13), *F. decipiens* Géné, 1832 (1), *F. lurida* Fischer, 1853 (41), *Guanchia brignolii* (Vigna

Taglianti, 1974) (22), *G. hincksi* (Burr, 1947) (1), *Guanchia* sp. (14) and *Forficula* sp. (4) were identified from studied olive orchards (*Oleae europae* L.). *F. lurida* (41.8%) was determined as the most abundant species in this study (Table 1).

Table 1. Forficulidae species, total numbers and percentages of nymphs, adults in olive orchards of eastern Mediterranean and southeastern Anatolia and Southeastern Turkey.

Species	Nymph	Male	Female	Total	%
Forficula aetolica Brunner, 1882	0	2	0	2	2
Forficula auricularia Linnaeus, 1758	0	7	6	13	13.3
Forficula decipiens Géné, 1832	0	1	0	1	1
Forficula lurida Fischer, 1853	0	18	23	41	41.8
Guanchia brignolii (Vigna Taglianti, 1974)	0	12	10	22	22.4
Guanchia hincksi (Burr, 1947)	0	1	0	1	1
Forficula sp.	4	0	0	4	4.1
Guanchia sp.	0	0	14	14	14.3
Total	4	41	53	98	100
*(%)	4.1	41.8	54.1	100	

* The presences rate of the Forficulidae species on development stages.

Forficulidae

Forficulinae

Forficula aetolica Brunner, 1882

Material examined: Mersin/ Bozyazı-Tekeli, 24 m, 36°8'26"N, 33°8'28"E, 03.11.08, 1♂; Mersin/ Tarsus-Karadiken, 261 m, 37°0'16"N, 34°43'12"E, 05.8.09, 1♂.

Distribution: Turkey: Bursa, Izmir, Manisa East, West, Central South and Southeast Anatolia (Anlaş *et al*., 2010; Anlaş and Kočárek, 2012).

Forficula auricularia Linnaeus, 1758

Material examined: Gaziantep/İslahiye-Kırıkçalı, 510 m, 36°59'9"N, 36°36'58"E, 01.5.08, 1♀; Adana/ Kozan-Oruçlu, 255 m, 37°29'50"N, 35°46'5"E, 15.5.08, 1♂, 2♀♀; Kahramanmaraş/Türkoğlu, 556 m, 37°24'8"N, 36°51'18"E, 12.VI.08, 1♂, 1♀; Osmaniye/Bahçe-Arıklıkaş, 562 m, 37°11'12"N, 36°30'29"E, 13.8.08, 1♂; Kahramanmaraş/Türkoğlu-Beyoğlu, 552 m, 37°17'32"N, 36°46'14"E, 06.11.08, 1♂; Kahramanmaraş/Türkoğlu, 553 m, 37°24'7"N, 36°51'18"E, 06.11.08, 1♂; Kilis/Musabeyli-Dorucak, 593 m, 36°50'57"N, 36°53'8"E, 26.11.08, 1♀; Osmaniye/Kadirli-Topraktepe, 100 m, 37°19'41"N, 36°5'37"E, 26.10.09, 1♂; Hatay/Erzin-Gökdere, 188 m, 36°59'27"N, 36°11'56"E, 03.5.10, 1♂, 1♀.

Distribution: *Forficula auricularia* is one of the most common and widely distributed species in Turkey (Anlas *et al*., 2010). Adıyaman, Afyonkarahisar, Amasya, Ankara, Antalya, Artvin, Bitlis, Bolu, Burdur, Bursa, Çanakkale, Çankırı, Çorum, Diyarbakır, Elazığ, Eskişehir or Izmir (Boz mountain), Giresun, Hakkari, Istanbul, Izmir, Kahramanmaraş (Engizek mountain), Kayseri, Kırşehir, Konya, Malatya, Manisa, Mardin, Muş, Rize, Samsun, Siirt, Tokat, Trabzon, Van, Zonguldak, without provinces: Eastern Anatolia (Karasu and Kandilli) and Toros Dağları of Turkey (Anlaş *et al*., 2010).

Forficula decipiens Géné, 1832

Material examined: Kahramanmaraş/Türkoğlu, 632 m, 37°23'28"N, 36°50'18"E, 12.6.08, 1♂.

Distribution: Turkey: Kahramanmaraş, Adıyaman Istanbul, Izmir, Kastamonu Central Southeast Anatolia (Anlaş and Kočárek, 2012).

Forficula lurida Fischer, 1853

Material examined: Hatay/Dörtyol-Kuzuculu, 83 m, 36°49'31"N, 36°14'10"E, 08.4.08, 1♀; Hatay/Erzin-Yoncadüzü, 188 m, 36°58'21"N, 36°12'16"E, 08.4.08, 1♀; Hatay/İskenderun-Payaş, 25 m, 36°45'25"N, 36°12'33"E, 15.4.08, 1♂; Mersin/Bahçeli, 70 m, 36°54'2"N, 34°43'19"E, 15.4.08, 1♀; Osmaniye/Toprakkale-Kışla Mah., 69 m, 37°3'30"N, 36°9'35"E, 17.4.08, 1♂; Adana/Kozan-Oruçlu, 268 m, 37°29'60"N, 35°46'25"E, 15.5.08, 2♂♂, 1♀; Adana/Sarıçam-Mustafalar, 255 m, 37°6'22"N, 35°30'34"E, 14.7.08, 1♀; Adana/Kozan-Bağlar, 148 m, 37°27'28"N, 35°50'4"E, 14.10.08, 1♂; Osmaniye/Düziçi-Yarbaşı, 515 m, 37°12'20"N, 36°26'25"E, 16.10.08, 2♀♀; Osmaniye/Merkez-Toplukonutlar, 136 m, 37°5'6"N, 36°11'50"E, 16.10.08, 1♂; Osmaniye/Akyar, 139 m, 37°2'45"N, 36°12'5"E, 16.10.08, 1♀; Osmaniye/Çona, 218 m, 37°6'15"N, 36°19'32"E, 16.10.08, 2♂♂; Osmaniye/ Hasanbeyli-Çolaklı, 702 m, 37°9'49"N, 36°32'44"E, 16.10.08, 1♀; Adana/Karaisalı-Bekirli, 243 m, 37°14'47"N, 35°11'55"E, 22.10.08, 1♂; Adana/Karaisalı-Beydemir, 171 m, 37°17'0"N, 35°8'56"E, 27.10.08, 1♀; Adana/Karaisalı-Kırıklı, 101 m, 37°10'34"N, 35°14'33"E, 27.10.08, 1♀; Hatay/Yayladağı, 440 m, 35°54'17"N, 36°4'29"E, 30.10.08, 1♀; Adana/Kozan-Poskabasakal, 374 m, 37°29'33"N, 35°39'46"E, 14.11.08, 1♂; Hatay/Samandağ-Karaçay, 128 m, 36°8'47"N, 36°4'30"E, 25.11.08, 1♀; Mersin/Tarsus, 71 m, 36°56'30"N, 34°51'26"E, 20.4.09, 1♀; Osmaniye/Kadirli-Cığcıt, 92 m, 37°17'25"N, 36°5'45"E, 04.5.09, 1♂; Hatay/Dörtyol-Yeniyurt, 29 m, 36°53'1"N, 36°9'25"E, 11.5.09, 2♂♂, 1♀; Hatay/Dörtyol, 62 m, 36°53'9"N, 36°11'56"E, 11.5.09, 4♀♀; Adana/Ceyhan-Dokuztekne, 173 m, 37°0'5"N, 35°59'8"E, 13.5.09, 1♂; Mersin/Tarsus-Çakırlı, 171 m, 37°1'18"N, 34°44'39"E, 27.5.09, 1♂; Mersin/Tarsus-Ulaş, 267 m, 37°0'31"N, 34°46'8"E, 27.VI.09, 1♀; Adana/Sarıçam-Çiçekli, 151 m, 37°11'1"N, 35°18'58"E, 05.6.09, 1♂; Mersin/Tarsus-İbrişim, 210 m, 36°59'28"N, 34°48'38"E, 11.6.09, 1♀; Mersin/Tarsus-Karadirlik, 187 m, 37°1'9"N, 34°49'35"E, 30.4.09, 1♀; Osmaniye/Topraktepe, 100 m, 37°19'41"N, 36°5'36"E, 13.10.09, 2♂♂, 1♀.

Distribution: The most common and widely distributed species in Turkey (Anlaş and Kočárek, 2012).

Forficula sp.

Material examined: Mersin/Tarsus-Nacarlı, 45 m, 36°52'40"N, 34°41'40"E, 15.4.08, 1 N; Hatay/Altınözü-Babatorun, 514 m, 36°4'19"N, 36°18'25"E ,17.4.08, 1 N; Adana/Kozan-Bağlar, 148 m, 37°27'28"N, 35°50'4"E, 17.4.08, 1 N; Hatay/Altınözü-Keskincik, 431 m, 36°5'57"N, 36°19'59"E, 29.4.08, 1 N.

Notes: These specimens seem to be nymph of *F. lurida*, but in the absence of adult it is not possible to determine these nymphs up to species level.

Guanchia brignolii (Vigna Taglianti, 1974)

Material examined: Hatay/Samandağ-Karaçay, 99 m, 36°8'33"N, 36°4'36"E, 05.4.08, 1♂, 1♀; Hatay/Samandağ-Yeşilköy, 85 m, 36°7'3"N, 36°0'55"E, 05.6.08, 1♂, 1♀; Hatay/Altınözü, 276 m, 36°7'16"N, 36°16'0"E, 16.7.08, 1♂, 1♀; Hatay/Samandağ-Karaçay, 118 m, 36°8'38"N, 36°5'3"E, 18.8.08, 1♂; Adana/Yüreğir-Yeniyayla, 242 m, 37°6'45"N, 35°33'25"E, 30.10.08, 2♂♂, 4♀♀; Hatay/Yayladağı, 594 m, 35°57'29"N, 36°4'8"E, 30.X.08, 1♂; Hatay/Altınözü-Altınkaya, 375 m, 36°9'3"N, 36°14'51"E, 11.XI.08, 1♂; Hatay/Altınözü-Altınkaya, 242 m, 36°9'58"N, 36°16'2"E, 11.11.08, 1♂; Kilis/Merkez, 643 m, 36°44'8"N, 37°5'4"E, 26.11.08, 1♂, 3♀♀; Hatay/Samandağ-Karaçay-Özbek mevki, 102 m, 36°7'52"N, 36°3'55"E, 27.9.10, 1♂; Hatay/Erzin-Haydarlı, 89 m, 36°56'30"N, 36°8'43"E, 19.7.10, 1♂.

Notes: Female specimens were captured together with the male. The shape of each female pronotum is well in agreement with that of male and the figure shown by Kocarek (2007).

Distribution: Turkey: Hatay, Gaziantep-Osmaniye (Kočárek, 2007).

Guanchia hincksi (Burr, 1947)

Material examined: Mersin Çeşmeli, 34 m, 36°41'27"N, 34°25'14"E, 18.11.08, 1♂.

Distribution: Turkey: Adana, Ankara, Denizli, Eskişehir or Izmir (Boz mountain), Izmir (Oren), Manisa, Mersin, South and Northwest Anatolia (Anlaş and Kočárek, 2012).

Guanchia sp.

Material examined: Mersin/Taşucu, 6 m, 36°19'19"N, 33°53'14"E, 22.V.08, 1♀; Osmaniye/Düziçi-Atalan, 339 m, 37°15'16"N, 36°20'9"E, 19.6.08, 1♀; Hatay/Erzin, 119 m, 36°57'2"N, 36°10'32"E, 03.7.08, 1♀; Hatay/Altınözü, 276 m, 36°7'16"N, 36°16'0"E, 16.7.08, 2♀♀; Adana/Karaisalı-Salbaş-Pirili, 178 m, 37°7'15"N, 35°8'7"E, 27.10.08, 1♀; Hatay/Altınözü-Altınkaya, 375 m, 36°9'3"N, 36°14'51"E, 11.11.08, 2♀♀; Hatay/Altınözü, 246 m, 36°6'41"N, 36°14'43"E, 11.11.08, 1♀; Hatay/İskenderun-Arpaderesi, 148 m, 36°31'11"N, 36°4'44"E, 16.12.08, 1♀; Adana/Karaisalı-Salbaş, 102 m, 37°6'35"N, 35°5'13"E, 05.6.09, 1♀; Hatay/Dörtyol-Yeşiltepe, 36 m, 36°55'9"N, 36°8'0"E, 22.6.09, 1♀; Adana/Seyhan-Karahan, 75 m, 37°3'1"N, 35°10'2"E, 08.7.09, 1♀; Osmaniye/Kadirli-Topraktepe, 100 m, 37°19'41"N, 36°5'36"E, 13.11.09, 1♀.

Seasonal changes and occurrence of Forficulidae on the olive trees

In the total, 109 individuals of Forficulidae were collected and monitored in two orchards. In the first orchard (Erzin), totally 24 individuals were collected: *F. aetolica* (1 specimen)*, F. lurida* (11)*, G. brignolii* (10) and *Guanchia* sp. (2) (Fig. 1)*.* Most of specimens were collected between 12 May (3 individuals) and 9 October (5 individuals) in 2010 (Table 2, Fig. 1.).

In second orchard (Tarsus), 85 individuals were collected: *F. aetolica* (42 specimens), *F.lurida* (36), *Guanchia* sp. (4) and Forficuladae sp. gen 1, 2, 3 (3) (Fig. 2). The species of Forficulidae occurred between 06 June (2 individuals) and 12 November (3 individuals) in 2009. Most samples were collected between 28 May and 12 November in 2010 (Table 3).

Forficulidae nymphs started to appear on the trees in the middle of April and, after becoming adults, they migrate to the soil at the end of December.

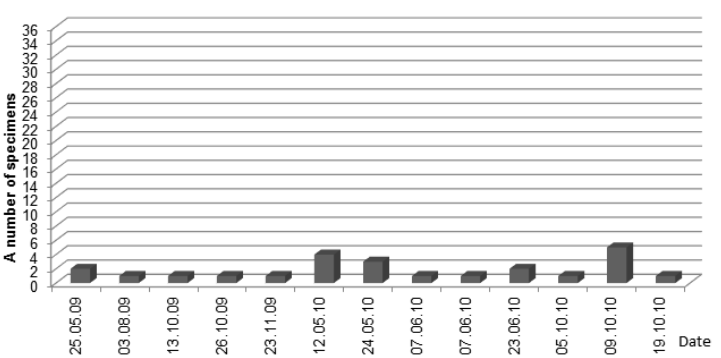

Fig. 1. Seasonal changes and occcurence of Forficulidae specimens in Erzin (Hatay) in 2009-2010.

Table 2. List of Forficulidae specimens in Erzin (Hatay) in 2009-2010.

Date	Number of individuals	Species
25.05.09	2♀♀	*Forficula lurida*
03.08.09	1♀	*Guanchia* spp.
13.10.09	1♂	*Guanchia brignolii*
26.10.09	1♀	*Forficula lurida*
23.11.09	1♂	*Forficula lurida*
12.05.10	1♂, 2♀♀	*Forficula lurida*
12.05.10	1♀	*Guanchia brignolii*
24.05.10	1♀	*Guanchia brignolii*
24.05.10	1♀	*Forficula aetolica*

Date	Number of individuals	Species
24.05.10	1♂	*Forficula lurida*
07.06.10	1♀	*Forficula lurida*
07.06.10	1♀	*Guanchia brignolii*
23.06.10	1♀	*Forficula lurida*
23.06.10	1♀	*Guanchia* sp.
05.10.10	1♀	*Guanchia brignolii*
09.10.10	2♂♂	*Guanchia brignolii*
09.10.10	1♂, 2♀♀	*Guanchia brignolii*
19.10.10	1♂	*Forficula lurida*
Total	24 individuals	

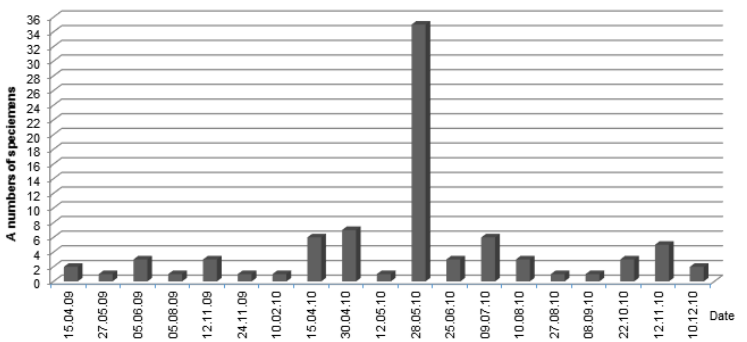

Fig. 2. Seasonal changes and occcurence of Forficulidae specimens in Tarsus (Mersin) in 2009-2010.

Table 3. List of Forficulidae specimens in Tarsus (Mersin) in 2009-2010.

Date	Number of individuals	Species
15.04.09	1♀	*Forficula lurida*
15.04.09	1N	Forficulidae sp. gen 1
27.05.09	1♂	*Forficula lurida*
05.06.09	1♀	*Forficula lurida*
05.06.09	2♀♀	*Guanchia* spp.
05.08.09	1♀	*Guanchia* spp.
12.11.09	2♂♂, 1♀	*Forficula lurida*
24.11.09	1♀	*Guanchia* sp.
10.02.10	1♂	*Forficula lurida*
15.04.10	1♂, 4♀♀	*Forficula lurida*
15.04.10	1 N	Forficulidae gen. sp. 2
30.04.10	4♂♂, 2♀♀	*Forficula lurida*
30.04.10	1 N	Forficulidae gen. sp. 3

Date	Number of individuals	Species
12.05.10	1♂	*Forficula lurida*
28.05.10	11♂♂, 6♀♀	*Forficula aetolica*
28.05.10	3♂♂, 6♀♀	*Forficula lurida*
28.05.10	4♂♂, 5♀♀	*Forficula aetolica*
25.06.10	2♂♂, 1♀	*Forficula aetolica*
09.07.10	5♂♂, 1♀	*Forficula aetolica*
10.08.10	2♂♂,1♀	*Forficula aetolica*
27.08.10	1♂	*Forficula aetolica*
08.09.10	1♂	*Forficula aetolica*
22.10.10	2♂♂, 1♀	*Forficula lurida*
12.11.10	5♀♀	*Forficula lurida*
10.12.10	1♂, 1♀	*Forficula aetolica*
Total	85 individuals	

DISCUSSION

In this first part of study, 98 Forficulidae specimens consisted of 4 nymphs (4.1%), 41 males (41.8%) and 53 females (54.1%) were collected. The majority of specimens belonged to *Forficula lurida* with 41 specimens (41.8%), *Guanchia brignoli* with 22 specimens (22.4 %), *Guanchia* sp. with 14 specimens (14.3%) and *F. auricularia* with 13 specimens (13.3%). Most of the female and male samples were found belonging to *F. lurida* (23 females and 18 males) and *G. brignoli* (10 females and 12 males).

Similar to our study, Anlaş and Kočárek (2012) reported that *F. auricularia, F. lurida* and *Labidura riparia* (Pallas, 1773) are the most common and widely distributed species in Turkey. *F. lurida* was observed as a pest in many cultured plants (Moderraes Awal, 1997), but this finding contrasts with the results of Haas and Henderickx (2002) who suggested the carnivorous feeding habit based on cuticle fragments of arthropods found in the gut contents (Anlaş and Kočárek, 2012). *F. auricularia, F. lurida* and *Guanchia* sp. have been reported from olive orchards in recent years in eastern Mediterranean region (Tüfekli, 2010; Kaçar and Ulusoy, 2011a).

Four species: *F. auricularia*, *F. lurida*, *F. smyrnensis* and *G. hincksi* were recorded in cherry orchards of Manisa and Izmir, Turkey. *F. smyrnensis* was the most abundant species (Tezcan and Kocarek, 2009). Ayaz *et al*. (2009) reported that *F. auricularia* damage rate was found between 5% and 14% in Malatya apricort orchards. *F. auricularia* is one of the common and widely distributed species in Turkey. In other study, *F. smyrnensisn* was the dominant species followed by *F. lurida* and *F. auricularia* with percent dominance values of 64.59; 18.18 and 16.27%, respectively in cherry orchards (Tezcan and Kocarek, 2009). But, *F. lurida* was found the most common species by followed *G. brignolii, Guanchia* sp. and *F. auricularia* in olive orchars in our study.

In this second part of study, Forficulidae species were found to occur on the olive trees between May and December in Erzin and Tarsus. Most of the olive pests and natural enemies feed on trees during this period. Most of olive pests: *Palpita unionalis* Hübn. (Crambidae), *Zelleria oleastralla* (Milliere) (Yponomeutidae), *Cacoecimorpha pronubana* (Hübner) (Tortricidae) of Lepidoptera, *Euphyllura* spp. (Hemiptera: Psyllidae) were found on olive trees from April to December (Tüfekli, 2010; Kaçar and Ulusoy, 2011a,b; Kaçar and Ulusoy, 2012a,b). *F. auricularia, F. lurida* and *Guanchia* sp. were reported that they are natural enemies of *C. pronubana, P.unionalis* and *Euphyllura straminea* Loginova in olive orchards (Tüfekli, 2010; Kaçar and Ulusoy, 2011a; 2012b). Furthermore, most of earwigs feed on soft-bodied insects such as aphids, insect eggs, and they can exert significant biological control under some circumstances (Flint, 1998). *F. auricularia* feeds on eggs of some insect: *Cydia pomonella* (Linnaeus) (Tortricidae) and *Chilo suppressalis* Walker (Crambidae) of Leridoptera, *Eriosoma lanigerum* (Hausmann) (Aphididae) or scale insects (Diaspididae) of Hemiptera (Glen, 1975; Moderraes Awal, 1997; Helsen *et al*. 1998, Maher and Logan, 2007).

CONCLUSION

Forficulidae fauna of olive orchards in Turkey was studied for the first time. Totally, 98 specimens of six species were collected: *Forficula aetolica*, *F. auricularia*,

F. decipiens, *F. lurida*, *Forficula* sp., *Guanchia brignolii, G. hincksi* and *Guanchia* sp.. *F. lurida* was the dominant species in this study. Some species of Forficulidae are known to cause damage of some cultural plants, but they might be potentially predators of some insect pest. The ecological function of earwigs in olive orchards is still unknown. According to current knowledge, we can not determine the rate of their significance as predators of pests. It is necessary to perform further studies to find out their importance in agriculture. Additionally, the result of this study also revelead that Forficulidae species were appeared on the trees at the middle of April and after become adults, they migrated to the soil at the end of December.

The specific movement of an insect in time is related to several factors such as quantity and quality of food (host plants and prey), plant phenology, temperature and humidity. Therefore, further studies are required to reveal the factors of occurance.

REFERENCES

Albouy, V., Caussanel, C., 1990, *Dermaptères ou Perce-oreilles*. *Faune de France* 75. Fédération Française des Societés de Sciences Naturelles, Paris, 245 p.

Anlaş, S., Haas, F., Tezcan, S., 2010, Dermaptera (Insecta) fauna of Bozdaglar mountain, western Turkey. *Linzer Biologische Beiträge*, 42(1): 389-399.

Anlaş, S., Kočárek, P., 2012, Current status of Dermaptera (Insecta) fauna of Turkey and Cyprus. *Turkish Journal of Entomology*, 36(1): 43-58.

Ayaz, T., Özgen, İ., Kaplan, M., 2009, Prevalence, Population Changing and Damage Ratio of *Forficula auricularia* (Linnaeus, 1758) (Dermaptera: Forficulidae)'in Apricot Orchards of Malatya Türkiye III. Plant Protection Congress, Van 30, 2009.

Cañellas, N., Pinol, J., Espadaler, X., 2005, Earwigs (Dermaptera, Forficulidae) and Aphid control in citrics. *Boletín de Sanidad Vegetal Plagas*, 31: 161-169.

Flint, M. L., 1998, *Pests of the Garden and Small Farm: A Grower's Guide to Using Less Pesticide.* 2nd ed. Oakland: 11. *University of California Agriculture and Natural Research Publition*, 3332, 276

Flint, M. L., 2002, Pests in Gardens and Landscapes Earwigs. UC IPM Education and Publications, University of California Statewide IPM Program, 7 Publ.4102 Published 9/02.

Glen, D. M., 1975, The effect of predators on the eggs of Codling moth *Cydia pomonella*, in a cider-apple orchard in south-west England. *Annals of Applied Biology,* 80: 115-135.

Helsen, H., Fredy, V., Blommers, L., 1998, Phenology of the common Earwig *Forficula auricularia* L. (Dermaptera: Forficulidae) in an apple orchard. *International Journal of Pest Management*, 44: 75-79.

Haas, F., Henderickx, H., 2002, Dermaptera from Cyprus and Turkey. *Beiträge zur Entomologie,* 52: 235-239.

Kaçar, G., Ulusoy, M. R., 2011a, Doğu Akdeniz Bölgesi zeytin bahçelerinde Zeytin fidantırtılı [Palpita unionalis (Hübn.) (Lepidoptera: Pyralidae)] parazitoit ve predatörlerinin belirlenmesi. *Türkiye Biyolojik Mücadele Dergisi*, 2(1): 39-47.

Kaçar, G., Ulusoy, M. R., 2011b, *Zelleria oleastrella* (Milliere) (Lepidoptera: Yponomeutidae), a new record for the Fauna of Turkey. *Turkish Journal of Zoology,* 35(6): 891-892.

Kaçar, G., Ulusoy, M. R., 2012a, Doğu Akdeniz bölgesi zeytin bahçelerinde Zeytin fidantırtılı, *Palpita unionalis* (Hübn.) (Lepidoptera, Pyralidae)'in yayılış alanı, bulaşıklık oranı ve zararı. *Bitki Koruma Bülteni*, 52(2): 175-188.

Kaçar, G., Ulusoy, M. R., 2012b, Karanfil yaprakbükeni, *Cacoecimorpha pronubana* (Hübner) (Lepidoptera: Tortricidae)'nın zeytin bahçelerindeki parazitoit ve predatörleri. Türkiye *Biyolojik Mücadele Dergisi*, 3(3): 13-20.

Kočárek, P., 2007, *Guanchia brignolii* Vigna Taglianti, 1974 in Turkey (Dermaptera: Forficulidae). *Acta Entomologica Slovenica*, 15(1): 91-94.

Langston, R. L., Powell, J. A., 1975. The Earwigs of California (Order Dermaptera). *Bulletin of the California Insect Survey,* 20: 1-25

Maher, B. J., Logan, D. P., 2007, European Earwigs, *Forficula auricularia*, and predation of scale insects in organic and conventionally managed kiwifruit. *New Zealand Plant Protection*, 60: 249-253.

Moderraes Awal, M., 1997, *List of agricultural pests and their natural enemies in Iran*. Ferdowsi University Press, Mashhad, 429 p.

Özturk, N., Ulusoy, M. R., 2009, Pests and natural enemies determined in pomegranate orchards in Turkey. I. International Symposium on Pomegranate and Minor Mediterranean Fruits, 16-19 October 2006, Adana- Turkey. *Acta Horticulturae*, 818: 277-284.

Popham, E. J., 2000, The gegraphical distribution of the Dermaptera (Insecta) with reference to continental drift. *Journal of Natural History*, 35: 2007-2027.

Shetlar, D. J., Andon, J. E., 2010, *Earwigs.* The Ohio State University, Entomology, Fact Sheet, Agriculture and Natural Resources, HYG-2068-10, 1-3

Tabilio, M. R., Ronco, M., Vita, G., 1998, The biological control of peach Aphids obtained using Forficula decipiens. A three years trial Latium - Prunus persica Stokes. *Informatore Fitopatologico*, 48(5): 69-70.

Tezcan, S., Kocarek, P., 2009. Dermaptera fauna of the ecologically managed cherry orchards in western Turkey. *Munis Entomology and Zoology*, 4(2): 572-576

Tezcan, S., Karsavuran, Y., Pehlivan, E., Anlaş, S., 2011, Contributions to the Dermaptera fauna of Turkey. *Munis Entomology and Zoology*, 6(2): 929-931.

Toups, I., Zimmer, J., Trautmann, M., Fieger-Metag, N., Buchleithe, S., Bathon, H., 2007, Control of the Woolly apple aphid (*Erisoma lanigerum* Hausm.) by releasing earwigs (*Forficula auricularia L.*) and support oil applications-an interim report of first year results. Archived at http://orgprints.org/13677. 203-207. (05.07.2012)

Tüfekli, M., 2010, Determination of the olive Psyllid [E*uphyllura* spp. (Hemiptera: Psyllidae)] species, population development with parasitoids and predators in olive orchards in Adana and Mersin provinces. MSc Thesis, Adana, Turkey: University of Çukurova, 65 p.

Weems, Jr. H. V., Skelley, P. E., 2007, European Earwig. *Forficula auricularia* Linnaeus (Insecta: Dermaptera: Forficulidae). *Institute of Food and Agricultural Sciences*, University of Florid,a EENY-032 (IN159) http://edis.ifas.ufl.edu.DPI Entomology Circular: 318. http://entnemdept.ufl.edu/creatures/veg/european_earwig.htm, (05.07.2012).

Received: August 17, 2012 *Accepted: January 29, 2014*