



GLOBAL JOURNAL OF ADVANCED RESEARCH
(Scholarly Peer Review Publishing System)

PENTATOMIDAE (HEMIPTERA) SPECIES ON FRUIT TREES IN SARAY DISTRICT OF TEKIRDAG, TURKEY

Özge Sami Orçan

Saray Directorate of District
Food Agriculture and Livestock, Tekirdağ,
Turkey
ozgesami.orcan@tarim.gov.tr

Müjgan Kivan

Department of Plant Protection,
Faculty of Agriculture,
Namik Kemal University, Tekirdağ,
Turkey
mkivan@nku.edu.tr

ABSTRACT

The study was conducted to determine the species of Pentatomidae (Hemiptera) found on fruit trees in the district of Saray in Tekirdağ, Turkey. Specimens were collected from Ayvacik, Büyükyoncali, Küçükyoncali and Sefaalan districts of Saray in between March-November during 2015-2016. As a result of study, 17 species belonging to the family of Pentatomidae was identified. *Rhaphigaster nebulosa* (Poda), *Nezara viridula* (Linnaeus) and *Dolycoris baccarum* (Linnaeus) were found the most abundant phytophagous species in the investigated area. Among the identified species, *Picromerus bidens* (Linnaeus) and *Zicrona caerulea* (Linnaeus) are predator species.

Keywords: Apple, pear, walnut, plum, mulberry, morello, Pentatomidae, Turkey

1. INTRODUCTION

The stink bugs, Pentatomidae is one of the largest family of suborder Heteroptera (Hemiptera) having approximately 906 genera and 4700 species in the world, 219 genera and 841 species in Palearctic Region (Rider 2006) and 54 genera and 162 species in Turkey (Önder et al. 2006). Many detailed studies have been carried out on Pentatomidae in Turkey. At the studies including Aegean and Marmara Region of Turkey, 34 genera and 63 species (Lodos et al. 1978) and of those, 36 species Thrace Region of Marmara have been reported (Fent and Aktaç 1999).

Most species of stink bugs are phytophagous and therefore occur in grassy or herbaceous habitats. They feed by sucking plant juices from immature fruits and seeds with stylate mouthparts and many are recognized as pests of food crops. Some species are predators of insects and others are ectoparasites on chordate (Önder and Lodos 1986).

The stink bugs preferred wild plants to cultivated crops, and that these wild hosts appeared to be necessary for the insect to maintain itself in high numbers. In California, stink bugs detrimental to deciduous fruit trees feed on weed hosts early in the spring and move into orchards when the native plant hosts dry (Panizzi 1997).

Many phytophagous pentatomids are recognized as pests of food crops. *Nezara viridula* (Linnaeus) attacks a wide range of vegetable and field crops including soybean, sunflower, maize, and tomato (Önder and Lodos 1986, Çetin 1999). The stink bugs they invade orchards late in the growing season. *Acrosternum heegeri*, *Apodiphus amygdali* and *Palomena prasina* are recorded attacking and



damage pome and stone fruits (Rings 1957, Lodos 1986, McPherson and McPherson 2000, Mehrnejad 2001, Saruhan and Tuncer 2010).

There are many faunistic records of Pentatomidae in literature. However, no research has been published on stink bugs in orchards, although it was recently increased fruit growing in Tekirdağ of Thrace Region. The study was carried on with the aim of contributing to Pentatomidae species on fruit trees in this small region, pioneering one related to the subject.

2. MATERIAL and METHODS

This study was conducted in the villages of Merkez, Büyükyoncalı, Küçükyoncalı, Ayvacık ve Sefaalan in Saray district of Tekirdağ from end of March to mid of November in 2015 and 2016 at biweekly intervals. The samples were collected from apple, pear, walnut, plum, mulberry and morello trees within the orchards. The orchards generally were consisted of mixed fruit varieties. Material has been collected by beating and visual inspection in randomly chosen trees. All insects caught were transferred into the killing jar to kill by KCN, and the specimen were determined under the stereo binocular microscope. Identification of specimens were made by the second author and M. Fent (Thrace University, Faculty of Science, Biology Department, Edirne, Turkey).

3. RESULTS

As a result of this study, 175 samples from 17 species belonging to the family of Pentatomidae was collected (Table 1). The information of the species were given alphabetically as follows.

Table 1. The species of Pentatomidae collected from fruit trees in 2015-2016 years

Species	Fruit varieties	
	2015	2016
<i>Aelia acuminata</i>	Apple, walnut	Apple, walnut
<i>Ancyrosoma leucogrammes</i>	-	Apple
<i>Carpocoris mediterraneus</i>	-	Apple
<i>Carpocoris purpureipennis</i>	-	Apple
<i>Dolycoris baccarum</i>	Apple, walnut, plum	Apple, plum
<i>Eurydema ornate</i>	Apple	Pear
<i>Eurydema ventralis</i>	Morello	-
<i>Eysachoris ventralis</i>	Apple, walnut	-
<i>Graphosoma lineatum</i>	-	Apple, plum
<i>Graphosoma semipunctata</i>	-	Apple
<i>Holcostethus strictus</i>	Plum	Apple, pear
<i>Mustha spinosula</i>	-	Apple
<i>Nezara viridula</i>	Apple, plum, mulberry	Apple, plum, mulberry
<i>Palomena prasina</i>	-	Apple, mulberry
<i>Picromerus bidens</i>	-	Apple
<i>Rhaphigaster nebulosa</i>	Apple, walnut, plum, mulberry	Apple, mulberry
<i>Zicrona caerulea</i>	Apple	-



3.1. *Aelia acuminata* (Linnaeus, 1758)

General distribution: Germany, Albania, Austria, Baltic States, West Russia, Balearic Islands, Bulgaria, Algeria, The Czech Republic, Denmark, Morocco, Finland, France, South Russia, Croatian, Netherland, England, Sweden, Switzerland, Iran, Spain, Italy, Caucasus, Cyprus, Corsica, Hungary, Makedonia, Norway, Poland, Portugal, Romania, Sardinia, Sicily, Slovakia, Syria, Turkestan, Serbia, Siberia, Tunis, Turkey, Greece (Dursun 2004).

Distribution in Turkey: Adana, Afyon, Ankara, Antalya, Artvin, Aydın, Balıkesir, Bartın, Bilecik, Bolu, Bursa, Çanakkale, Çankiri, Denizli, Diyarbakır, Gaziantep, Hatay, İçel, İstanbul, İzmir, Kahramanmaraş, Karabük, Karaman, Kastamonu, Kırklareli, Kırşehir, Kocaeli, Konya, Manisa, Muğla, Nevşehir, Niğde, Osmaniye, Rize, Sakarya, Samsun, Sinop, Tekirdağ, Uşak, Zonguldak (Dursun, 2004).

Material examined: Ayvacık 2016 (2), Büyükyoncalı 2015 (2), Küçükyoncalı 2016 (1), Saray Merkez 2015 (2), Sefaalan 2015 (1). Total 8 specimens.

Note: Collected from apple and walnut.

3.2. *Ancyrosoma leucogrammes* (Gmelin, 1789)

General distribution: The Mediterranean basin, Caucasus, Central Asia, Siberia, Mongolia (Ghahari et al. 2014); Iran, Israel, Cyprus, North Iraq, Egypt, Syria, Tadjikistan (Önder et al. 2006).

Distribution in Turkey: Adana, Ankara, Artvin, Antalya, Aydın, Balıkesir, Batman, Bilecik, Burdur, Bursa, Çanakkale, Çorum, Diyarbakır, Edirne, Erzurum, Gaziantep, Hatay, Isparta, İçel, İstanbul, İzmir, Kahramanmaraş, Kayseri, Kırklareli, Konya, Manisa, Mersin, Muğla, Nevşehir, Sakarya, Tunceli, Tekirdağ (Lodos et al. 1998); Adıyaman, Şanlıurfa (Gözüaçık et al. 2011).

Material examined: Küçükyoncalı 2016 (1), Saray Merkez 2016 (3). Total 4 specimens.

Note: Collected from apple.

3.3. *Carpocoris mediterraneus* (Tamanini, 1958)

General distribution: The Mediterranean surroundings, Iran, Iraq, Turkmenistan, Ethiopia, (Önder et al. 2006); Italy, Balkans, Egypt (Lupoli et al. 2013).

Distribution in Turkey: Adana, Ankara, Antalya, Aydın, Balıkesir, Bilecik, Bursa, Çanakkale, Edirne, Gaziantep, Hatay, Isparta, İçel, İstanbul, İzmir, Kahramanmaraş, Kırklareli, Konya, Manisa, Muğla, Sakarya, Tekirdağ (Fent and Aktaş 1999); Diyarbakır, Çankırı, Çorum, Kastamonu, Kayseri, Zonguldak (Lodos et al. 1978); Diyarbakır, Mardin, Şanlıurfa (Özgen et al. 2005); Bartın, Bolu, Karabük, Karaman, Osmaniye (Lodos et al. 1998).

Material examined: Büyükyoncalı 2016 (1), Saray Merkez 2016 (3). Total 4 specimens.

Note: Collected from apple.

3.4. *Carpocoris purpureipennis* (De Geer, 1773)

General distribution: Afghanistan, Germany, Albania, Austria, West Russia, Baltic Region, Belgium, Bulgaria, The Czech Republic, Denmark, Finland, France, South Russia, Netherland, Spain, England, Sweden, Switzerland, Italy, North Africa, Corsica, Hungary, Manchuria, Mongolia, Poland, Romania, Siberia, Serbia, Slovakia (Dursun 2004); Pakistan (Ghahari et al. 2014).

Distribution in Turkey: Adana, Ankara, Antalya, Aydın, Balıkesir, Bilecik, Bursa, Çanakkale, Diyarbakır, Gaziantep, Hatay, Isparta, İçel, İzmir, Kahramanmaraş, Kastamonu, Kayseri, Kırklareli, Kütahya, Manisa, Muğla, Tekirdağ, Zonguldak (Fent and Aktaş 1999); Osmaniye (Lodos et al. 1998).

Material examined: Küçükyoncalı 2016 (2), Saray Merkez 2016 (1). Total 3 specimens.



Note:Collected from apple.

3.5. *Dolycoris baccarum* (Linnaeus, 1758)

General distribution: Germany, Albania, Austria, The Balearic Islands, Belgium, Bulgaria, Czechoslovakia, China, Denmark, Finland, France, Crete, Gronland, South England, India, Netherland, Iran, Ireland, Spain, Sweden, Switzerland, Italy, Japan, Canary Islands, Cyprus, Corsica, Hungary, Norway, Portugal, Romania, Russia, Sardinia, Siberia, Sicily, Syria, Serbia (Awad 2000), Iraq, Israel, Caucasus, Syria, Romania (Morariu and Moglan 2014).

Distribution in Turkey: Adana, Afyon, Ağrı, Ankara, Antalya, Artvin, Aydın, Balıkesir, Bilecik, Burdur, Bursa, Bolu, Çanakkale, Çorum, Denizli, Diyarbakır, Edirne, Erzincan, Erzurum, Eskişehir, Gaziantep, Kahramanmaraş, Kars, Kastamonu, Kayseri, Kocaeli, Konya, Kırklareli, Isparta, İzmir, Manisa, Mardin, Muğla, Muş, Nevşehir, Niğde, Sakarya, Tekirdağ, Uşak, Zonguldak (Fent and Aktaş 1999), Adıyaman, Diyarbakır, Mardin, Şanlıurfa, Şırnak (Özgen et al. 2005).

Material examined: Ayvacık 2016 (1), Büyükyoncalı 2015 (3), Büyükyoncalı 2016 (3), Saray Merkez 2015 (4), Saray Merkez 2016 (3). Total 14 specimens.

Note: Collected from apple, plum and walnut.

3.6. *Eurydema ornata* (Linnaeus, 1758)

General distribution: Iran, Israel, Caucasus, Cyprus, Egypt, Syria, Turkestan, Ethiopia, India, Pakistan (Önder et al. 2006).

Distribution in Turkey: Adana, Afyon, Ankara, Antalya, Aydın, Balıkesir, Bolu, Burdur, Bursa, Bilecik, Çanakkale, Çorum, Diyarbakır, Edirne, Eskişehir, Gaziantep, Kahramanmaraş, Kastamonu, Kayseri, Kırklareli, Kocaeli, Konya, Isparta, Hatay, İçel, İstanbul, İzmir, Manisa, Mersin, Muğla, Nevşehir, Niğde, Sakarya, Uşak, Tekirdağ, Yozgat, Zonguldak (Fent and Aktaş 1999); Adıyaman, Artvin, Amasya, Batman, Bitlis, Çankırı, Elazığ, Erzincan, Hakkari, Iğdır, Kırıkkale, Konya, Malatya, Mardin, Ordu, Samsun, Sinop, Şanlıurfa, Tokat, Trabzon (Gözüaçık et al. 2011); Aksaray, Karaman (Lodos et al. 1998).

Material examined: Küçükyoncalı 2015 (1), Saray Merkez 2015 (1), Saray Merkez 2016 (1). Total 3 specimens.

Note: Collected from apple and pear.

3.7. *Eurydema ventrale* (Kolenati, 1846)

General distribution: Albania, Austria, Balkans, Bulgaria, Algeria, The Czech Republic, Morocco, France, Güney Russia, India, Spain, Switzerland, Israel, Italy, Sicily, Sardinia, Cyprus, Corsica, Malta, Hungary, Egypt, Poland, Portugal Romania, Slovakia, Syria, Greece, Tunis, Turkey, Turkestan (Dursun 2004).

Distribution in Turkey: Afyon, Ağrı, Artvin, Ankara, Balıkesir, Bilecik, Burdur, Bursa, Bolu, Çorum, Edirne, Erzurum, Kırklareli, Kütahya, İstanbul, İzmir, Kastamonu, Kırşehir, Konya, Muğla, Niğde, Tekirdağ, Uşak (Fent and Aktaş 1999), Karaman, Kırıkkale, Kırşehir (Lodos et al. 1998), Adana, Antalya, Bayburt, Erzincan, Iğdır, Manisa, Tunceli (Yazıcı et al. 2014).

Material examined: Saray Merkez 2015 (1). Total 1 specimen.

Note: Collected from Morello.

3.8. *Eysarcoris ventralis* (Westwood, 1837)

General Distribution: Palearctic Region (Önder et al. 2006).

Distribution in Turkey: Antalya, Artvin, Erzincan, Erzurum, İstanbul, İzmir, Osmaniye (Yazıcı et al. 2014), Adıyaman, Diyarbakır, Şanlıurfa (Gözüaçık et al. 2011).



Material examined: Ayvacık 2015 (2), Saray Merkez 2015 (1). Total 3 specimens.

Note: Collected from apple and walnut.

3.9. *Graphosoma lineatum* (Linnaeus, 1758)

General distribution: Palearctic Region (Önder et al. 2006), The Czech Republic (Tietz and Zrzavy 1996), Romania (Morariu and Moglan 2014).

Distribution in Turkey: Adana, Ağrı, Ankara, Artvin, Antalya, Aydın, Balıkesir, Bilecik, Bursa, Çanakkale, Denizli, Edirne, Eskişehir, Gaziantep, Hatay, Isparta, İstanbul, İzmir, Kahramanmaraş, Kars, Kastamonu, Kırklareli, Kocaeli, Kütahya, Manisa, Muğla, Sakarya, Zonguldak (Fent and Aktaş 1999), Erzincan, Erzurum, Kayseri, Konya, Mersin, Sivas, Yozgat (Yazıcı et al. 2014).

Material examined: Küçükyoncalı 2016 (2). Total 2 specimens.

Note: Collected from apple and plum.

3.10. *Graphosoma semipunctatum* (Fabricius, 1775)

General distribution: Afghanistan, Iran, Israel, Caucasus, Cyprus, Turkestan, Turkey, Turkmenistan (Önder et al. 2006).

Distribution in Turkey: Adana, Ankara, Artvin, Aydın, Çanakkale, Çorum, Diyarbakır, Elazığ, Gaziantep, Hatay, İstanbul, İzmir, Kahramanmaraş, Kars, Kayseri, Mardin, Osmaniye, Sakarya (Önder et al. 2006).

Material examined: Saray Merkez 2016 (1). Total 1 specimen.

Note: Collected from apple.

3.11. *Mustha spinosula* (Lefebvre, 1831)

General distribution: Afghanistan, Iran, Israel, Caucasus, Cyprus, Turkestan, Turkey, Turkmenistan (Önder et al. 2006).

Distribution in Turkey: Adana, Ankara, Antalya, Aydın, Bursa, Çanakkale, Diyarbakır, Edirne, Gaziantep, Isparta, İzmir, Konya, Manisa, Mardin, Muğla, Uşak (Önder et al. 2006).

Material examined: Saray Merkez 2016 (1). Total 1 specimen.

Note: Collected from apple.

3.12. *Nezara viridula* (Linnaeus, 1758)

General distribution: Germany, Albania, Austria, Azor Islands, Balearic Islands, Bulgaria, Algeria, China, Ethiopic and Nearctic Region; Morocco, France, Croatia, Iraq, England, Iran, Switzerland, Spain, India-Australia, Italy, Sicily, Sardinia, Japan, Canary Islands, Cyprus, Libya, Hungary, Madeira Island, Egypt, Portugal, Russia, Syria, Tunis, Corsica, Turkey, Cape Verde Islands, Greece, New Zealand (Dursun 2004).

Distribution in Turkey: All regions of Turkey (Önder et al. 2006).

Material examined: Büyükyoncalı 2015 (1), Büyükyoncalı 2016 (8), Küçükyoncalı 2015 (6), Küçükyoncalı 2016 (13), Saray Merkez 2015 (1), Saray Merkez 2016 (8), Sefaalan 2015 (2), Sefaalan 2016 (2). Total 41 specimens.

Note: Collected from apple, plum and mulberry.



3.13. *Palomena prasina* (Linnaeus, 1761)

General distribution: Germany, Austria, Balkans, Belgium, Bulgaria, The Baltic, West and South Russia, The Czech Republic, China, Denmark, France, India, Netherland, Spain, Sweden, Italy, Kore, Hungary, Poland, Romania, Slovakia, Turkey (Dursun 2004).

Distribution in Turkey: Adana, Ankara, Antalya, Artvin, Aydın, Balıkesir, Bartın, Bilecik, Bolu, Burdur, Bursa, Denizli, Erzincan, Eskişehir, Gümüşhane, Çanakkale, Gaziantep, Hakkâri, Hatay, İçel, İzmir, Karabük, Karaman, Kahramanmaraş, Kırıkkale, Kocaeli, Kütahya, Manisa, Ordu, Osmaniye, Sakarya, Samsun, Sinop, Tokat, Trabzon, Zonguldak illerinde yayılış göstermektedir (Lodos et al. 1978; 1989; 1998; Lodos and Önder 1983; Fent and Aktaş, 1999; Awad 2000; Tuncer and Saruhan 2001; Dursun, 2004).

Material examined: Küçükyoncalı 2016 (2). Total 2specimens.

Note:Collected from apple and mulberry.

3.14. *Peribalus strictus* (Fabricius, 1803)

General distribution: The Mediterranean surroundings, Near East, Central Asia, European Siberia, Pakistan, Iran (Ghahari 2014), Romanya (Morariu and Moglan 2014), Israel, Cyprus, Syria (Önder et al. 2006).

Distribution in Turkey: Adana, Antalya, Çorum, Gaziantep, Edirne, Hatay, Mardin, Zonguldak (Önder et al. 2006).

Material examined: Büyükyoncalı 2016 (2), Küçükyoncalı 2015 (3), Küçükyoncalı 2016 (3), Saray Merkez 2016 (2). Total 10specimens.

Note:Collected from apple, pear and plum.

3.15. *Picromerus bidens* (Linnaeus, 1758)

General distribution: Albania, Balkans, Bulgaria, Romania, Russia, Turkestan, Turkey, Greece, Serbia (Önder et al. 2006).

Distribution in Turkey: Artvin, Çanakkale, Çorum, Giresun, Kırklareli, Nevşehir, Ordu, Tekirdağ (Önder et al. 2006).

Material examined: Saray Merkez 2016 (2). Total 2specimens.

Note:Collected from apple.

3.16. *Rhaphigaster nebulosa* (Poda, 1761)

General distribution: The Mediterranean surroundings, China, North Iraq, Iran, Caucasus, Turkestan (Önder et al. 2006).

Distribution in Turkey: Ege, Marmara, İç Anadolu Bölgeleri, Ankara, Ağrı, Bursa, Edirne, İstanbul, İzmir, Manisa (Önder et al. 2006).

Material examined: Büyükyoncalı 2015 (4), Büyükyoncalı 2016 (6), Küçükyoncalı 2015 (10), Küçükyoncalı 2016 (14), Saray Merkez 2015 (11), Saray Merkez 2016 (26), Sefaalan 2015 (2), Sefaalan 2016 (3). Total 76specimens.

Note:Collected from apple, walnut, plum and mulberry.

3.17. *Zicrona coerulea* (Linnaeus, 1758)

General distribution: Germany, USA, Albania, Austria, Bulgaria, Balearic Islands, The Baltic, Belgium, Borneo, Burma, Algeria, The Czech Republic, Denmark, China, Morocco, Finland, France, Netherland, India, England, Iraq, Iran, Scotland, Spain, Italy, Sweden, Japan, Java, Canada, Cyprus, Kore, Hungary, Malaysia, Mongolia, Norway, Poland, Romania, Russia, Sardinia, Serbia, Slovakia, Sumatra, Turkestan, Taiwan, Tunis, Greece (Dursun 2004).



Distribution in Turkey: Adana, Adıyaman, Ağrı, Artvin, Balıkesir, Bartın, Çankırı, Diyarbakır, Edirne, Gaziantep, Hatay, İzmir, Kırklareli, Kilis, Konya, Mersin, Samsun, Siirt, Tokat, Zonguldak (Önder et al. 2006).

Material examined: Saray Merkez 2015 (1). Total 1 specimen.

Note: Collected from apple.

4. CONCLUSIONS

As a result of this study, 17 species belonging to Pentatomidae were determined. Among those, 15 species are phytophagous and only two species, *Picromerus bidens* and *Zicrona caerulea* are predators. Probably some of them were collected accidentally on those trees: While *Ancyrosoma leucogrammes*, *Graphosoma lineatum*, *Graphosoma semipunctata* feed the species of Umbelliferae; *Eurydema ornatum*, *Eurydema ventrale* and *Carpocoris mediterraneus*, *Carpocoris purpureipennis* feed the species of Cruciferae and Compositae respectively, and also host plants of *Aelia acuminata* are Graminae species and Leguminosae species for *Eysarcoris ventralis* and *Peribalus strictus* (Lodos, 1982, Fent and Aktaş, 1999).

From the identified phytophagous species, *Dolycoris baccarum*, *Mustha spinosula*, *Nezara viridula*, *Palomena prasina* and *Rhaphigaster nebulosa* are known really feeding on perennial plants and various fruit trees, such as olive, mulberry, pistachio, hazelnut (Lodos 1986; Bolu, 2002; Kaplan et al., 2003; Özgen et al., 2005). Among those *R. nebulosa*, *N. viridula* and *D. baccarum* were found the most abundant species in the investigated area. These species can be considered as important pests of fruit trees, especially apple, in future.

REFERENCES

- [1] Awad, T. I. 2000. Systematic and faunistic study of the species of the tribe Carpacoroni (Heteroptera: Pentatomidae: Pentatominae) (PhD Thesis). University, Institute of Natural and Applied Sciences, Bornova-Izmir.
- [2] Bolu, H. 2002. Investigations on the fauna of insects and mites in pistachio areas in South Eastern Anatolia Region of Turkey. Turkish Journal of Entomology, 26 (3): 197-208.
- [3] Çetin, M. 2000. Feeding behaviour of laboratory reared *Nezara viridula* (L.) (Heteroptera: Pentatomidae) on different hosts. Turkish Journal of Entomology, 24(1): 41-54.
- [4] Dursun, A. 2004. A faunistic and taxonomic study on the Pentatomidae (Heteroptera) species of the Middle Black Sea region of Turkey (PhD thesis). On dokuz Mayıs University, Institute of Natural and Applied Sciences, Samsun.
- [5] Fent, M. and Aktaş, N. 1999. Taxonomic and Faunistic Studies of The Fauna of Pentatomidae (Heteroptera) in The Region of Edirne. Turkish Journal of Zoology 23(2): 377-395.
- [6] Ghahari, H., Moulet, P. and Rider, D. A. 2014. An Annotated Catalog of The Iranian Pentatomoidea (Hemiptera: Heteroptera: Pentatomomorpha). Zootaxa 3837 (1): 001-095.
- [7] Gözüaçık, C., Fent, M. and İnanç, Ö. 2011. Contribution to the knowledge of Pentatomidae (Hemiptera: Heteroptera) Fauna of Southeastern Anatolia Region of Turkey. Turkish Bulletin of Entomology, 1 (4): 235-252.
- [8] Kaplan, C., Eren, S. and Ayaz, T. 2003. GAP Bölgesinde zeytin alanlarındaki entomolojik sorunlar ve çözüm önerileri. GAP III. Tarım Kongresi, 387- 390. Şanlıurfa.
- [9] Lodos, N., Önder, F., Pehlivan, E. and Atalay, R. 1978. Ege ve Marmara Bölgesinin zararlı bölgeler faunasının tespiti üzerine çalışmalar [Curculionidae, Scarabaeidae (Coleoptera); Pentatomidae, Lygaeidae, Miridae (Heteroptera)]. T.C. Gıda-Tarım ve Hayvancılık Bakanlığı Zirai Mücadele ve Zirai Karantina Genel Müdürlüğü, 301p., Ankara.
- [10] Lodos, N. 1986. Türkiye Entomolojisi (Genel, Uygulamalı ve Faunistik) Cilt II. Ege Üniversitesi Ziraat Fakültesi Yayınları No. 429, 580 p. Bornova- İzmir.
- [11] Lodos N, Önder F, Pehlivan E, Atalay, R, Erkin E, Karsavuran Y, Tezcan S, 1989. Akdeniz Bölgesi'nin ziraatta zararlı ve faydalı böcek faunasının tespiti üzerinde araştırmalar [Curculionidae, Scarabaeidae (Coleoptera), Plataspidae, Cydnidae, Acanthosomatidae, Scutelleridae, Pentatomidae, Lygaeidae, Miridae (Heteroptera)]. Doğa Türk Tarım ve Ormancılık Dergisi, 13 (1): 81-88.



- [12] Lodos, N. and Önder, F. 1983. Contribution to the study on the distribution of sunn pest, *Eurygaster integriceps* Put.in Turkey. Plant Protection Bulletin, 23 (2): 53-60.
- [13] Lodos, N., Önder, F., Pehlivan, E., Atalay, R., Erkin, E., Karsavuran, Y., Tezcan, S. and Aksoy, S. 1998. Faunistik studies on Pentatomoidea (Plataspidae, Acanthosomatidae, Cydnidae, Scutelleridae, Pentatomidae) of Western Black Sea, Central Anatolia and Mediterranean Regions of Turkey. Bornova-İzmir.
- [14] Lupoli, R., Dusoulier, F., Cruaud, A., Arteil, S. C. and Streito, J. C. 2013. Morphological, Biogeographical and Molecular Evidence of *Carpocoris mediterraneus* as A Valid Species (Hemiptera: Pentatomidae). Zootaxa 3609 (4): 392–410.
- [15] McPherson, J. E. and McPherson, R. M. 2000. Stink bugs of Economic Importance in America North of Mexico. 253 p, FL,USA.
- [16] Mehrnejad, M. R. 2001. The current status of pistachio pests in Iran. — Cahiers Options Méditerranéennes, 56: 315-322.
- [17] Morariu, E. and Moglan, I. 2014. Contributions to The Study of Pentatomidae (Hemiptera: Heteroptera) Fauna From Nature Reserves of Iași County, Romania. North-Western Journal of Zoology 10 (Supplement 1): 38-43.
- [18] Önder, F. and Lodos, N. 1986. Heteroptera. Türkiye ve Palearktik Bölge Familyaları Hakkında Genel Bilgi. II. Baskı. Ege Üniversitesi Ziraat Fakültesi Yayın No: 359, 111 p.
- [19] Önder, F., Karsavuran, Y., Tezcan, S. and Fent, M. 2006. Heteroptera (Insecta) Catalogue of Turkey. Meta Basım, 164 s, İzmir.
- [20] Özgen, İ., Gözüaçık, C., Karsavuran, Y. and Fent, M. 2005. Investigations on the Pentatomidae (Heteroptera) Fauna in Apricot, Cherry, Olive and Pistachio Plantations in East and Southeastern Anatolia Region (Turkey). The Journal of Ege University Faculty of Agriculture, 42 (2): 35-43.
- [21] Panizzi, A. R. 1997. Wild hosts of pentatomids: Ecological significance and role in their pest status on crops. *Annu. Rev. Entomol.* 42:99-122.
- [22] Rider, D. 2006. Family Pentatomidae Leach, 1815. In: Catalogue of the Heteroptera of the Palearctic Region Pentatomomorpha II (Eds: B. Aukema and Ch. Rieger), The Netherlands Entomological Society, Vol. 5, Amsterdam, 550p.
- [23] Rings, R. W. 1957. Types and seasonal incidence of stink bug injury to peaches. *Journal of Economic Entomology* 50: 599–604.
- [24] Saruhan, İ. and Tuncer, C. 2010. Research on damage rate and type of green shieldbug (*Palomena prasina* L. Heteroptera: Pentatomidae) on hazelnut. *Anadolu J. Agric. Sci.*, 25(2): 75-83.
- [25] Tietz, D. and Zrzavy, J. 1996. Dorsoventral Pattern Formation: Morphogenesis of Longitudinal Coloration in *Graphosoma lineatum* (Heteroptera: Pentatomidae). *Eur. J. Entomol.*, 93: 15-22.
- [26] Tuncer, C. and Saruhan, İ. 2001. Bazı önemli fındık zararlılarının Samsun ilindeki popülasyon değişimi ve yoğunluğu üzerine araştırmalar. *The Journal of Agricultural Faculty of Ondokuz Mayıs University*, 16(1):56-63.
- [27] Yazıcı, G., Yıldırım, E. and Moulet, P. 2014. Contribution to The Knowledge of The Pentatomidae and Plataspidae (Hemiptera, Heteroptera, Pentatomomorpha) Fauna of Turkey. *Linzer Biol. Beitr.* 46/2, 1819-1842.