Journal of the HETEROPTERA of Turkey

e-ISSN 2687-3249 Volume 1 Number 1-2

November,2019

Powered by peer review management and editorial system Heteropterists.

"*Journal of the Heteroptera of Turkey*" is a international journal, and publish scholarly heteropteran studies.
ISSN: 2687-3249 (only Online edition)

This journal is published semiannually (30 May and 30 November) by Heteropterists of Turkey.

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"Journal of the Heteroptera of Turkey" publishes original research and review articles all key areas in Heteroptera (Insecta) of paleaearctic region. All work needs to have a clear and significant impact on palaearctic Heteroptera taxons.. Review studies considerations are only accepted in combination with new faunistic or taxonomic data in studies area. The journal focuses on research into systematic, taxonomic, ecologic, faunistic etc heteroptera and articles presenting innovative approaches. Prospective review authors should read instruction for authors on the web page (**www.j-ht.org**) before submitting a manuscript.

***Editorial Office*:**
Journal of the Heteroptera of Turkey (*JHT*)
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Phone: (+90) 312 202 11 79 Fax: (+90) 312 212 22 79 E-mail: editor_office@j-ht.org

Powered by peer review management and editorial system Heteropterists.
Publication Frequency: Semiannual [2 issues per year (November and May)]

JHT is indexed/abstracted in: Index Copernicus (ICI), Director of Research Journal Index (DRJI), Google Scholar, Academic Research Index, ResearchGate.

Archived at: Internet Archive-Wayback machine – https://archive.org
Journal web addresse: **www.j-ht.org**

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J.Het.Turk.

"*Journal of the Heteroptera of Turkey*"

ISSN: 2687-3249

***J.Het.Turk.*, Volume 1, Issue 1-2, November 30, 2019**

Table of Contents

Page(s)

Thanks to Reviewers

Editor in Chief of the "*Journal of the Heteroptera of Turkey*" would like to thanks the following scientists/ experts for reviewing the articles to submitted and published in the journal in 2019.

Prof. Dr. Meral Fent (Trakya Univ., Edirne/Turkey), Prof. Dr. Ahmet Dursun (Amasya Univ., Amasya/ Turkey), Prof. Dr. İnanç Özgen (Fırat Univ., Elazığ/Turkey), Prof. Dr. Suat Kıyak (Gazi Univ., Ankara/ Turkey) , Prof. Dr. Demet Çetin (Gazi Univ., Ankara/Turkey), Prof.Dr. Nursel Gül (Ankara Univ., Ankara/ Turkey)

J.Het.Turk.
Journal of the Heteroptera of Turkey
ISSN 2687-3249 (Online edition)
November ,2019
Volume 1, Issue 1-2

Research Article

First record of *Leptopus hispanus* Rambur, 1840 (Hemiptera: Leptopodidae) for Eastern Anatolia (Turkey)

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ABSTRACT: *Leptopus hispanus* Rambur, 1840 is recorded for the first time from Eastern Anatolia (Turkey). This species is widespread from Mediterranean to Central Asia, but in Turkey it was known until now only from the southern of Anatolia. This record is the eastern- and northernmost one for Turkey.

KEYWORDS: *Leptopus hispanus*, Eastern Turkey, first record.

To cite this article: Dioli, P., Özgen, İ., Cianferoni, F., 2019, First record of *Leptopus hispanus* Rambur, 1840 Hemiptera: Leptopodidae) for Eastern Anatolia (Turkey), *J.Het.Turk.*,1(1-2):1-3.

To link to this article: https://www.j-ht.org/wp-content/uploads/2019/11/V11-2-A1.pdf

Received: Sep 13, 2019; **Revised:** Oct 19, 2019; **Accepted:** Oct 20, 2019; **Published online:** Nov 30, 2019

INTRODUCTION

The family of Leptopodidae Brullé, 1836 is very close to that of Saldidae Amyot & Serville, 1843 (Hemiptera: Heteroptera: Leptopodomorpha). Its members live in different habitats: in fact in the face of strictly hydrophilic species, there are others which love warm and dry environments, occasionally wet, including both Saldidae and Leptopodidae.

Fossils of Leptopodomorpha were studied during the last century by Popov (1989). The first Mesozoic Leptopodidae are from Canadian Late Cretaceous amber (McKellar et al. 2014). The extant Leptopodidae comprise 10 genera with 39 species (Schuh et al. 1987, Schuh & Slater 1995, Polhemus & Polhemus 2008), most of them are widespread in the tropics of the Eastern Hemisphere.

In this study, an additional locality record is given for *Leptopus hispanus* Rambur, 1840, for which only few data are known for Turkey.

MATERIAL AND METHODS

Material was collected in 2018 from surveys carried out in streams and creeks in the Munzur valley of Tunceli and its vicinity. The collected specimens have been mounted with usual entomological preparation, dried on label, and preserved in the collection of the Fırat University, Bioengineering Department, Elazığ (Turkey).

The subdivision of Turkey in geographical regions follows the classification original-

ly defined at the First Turkey Geography Congress in 1941 (see Yiğit, 2006).

RESULTS

Leptopus hispanus Rambur, 1840

Material examined:

Turkey, Tunceli, Karşılar village, 39°12'7'' N 39°28'35'' E, at Laç stream edge, 18.5.2018, 2 ♀,1 ♂, Totally: 3 exs. (Fig. 1), leg Özgen.

Distribution in Turkey: İskenderun (Costa, 1874); Gaziantep: Islahiye, Fevzipaşa (Hoberlandt, 1952); Adana, Hatay (Önder et al., 2006): Hatay: Samandağ, Karaçay (Fent et al., 2011).

Distribution in Palaearctic: Centralasiatic-Mediterranean species (Lindskog, 1995).

Europe: France, Greece, Italy, Spain. **North Africa:** Algeria, Canary Islands, Libya, Morocco, Tunisia. **Asia:** Afghanistan, Armenia, Azerbaijan, Cyprus, Iran, Israel, Kirgizia, Syria, Tajikistan, Turkey (Asian part), Turkmenistan, Uzbekistan (Péricart, 1990; Lindskog, 1995; Fent et al. 2011; Ghahari et al., 2013).

DISCUSSION

This record of *Leptopus hispanus* is the first one for the Eastern Anatolia region. Indeed, until now, it was recorded only from the Mediterranean and Southeastern Anatolia regions. The studies about biology and ecology of *L. hispanus* are very scarce. The species overwinters as adult (Baena & Vazquez, 1985). Péricart (1990) writes that this species occupy the same biotopes of *L. marmoratus* (Goeze, 1778): both prey on small arthropods under the stones of dry streams, also completely dry. The habitat of Karşılar is typical for these leptopodids which were found on rocks, often far from the water in a hot and dry climate (xerothermic).

Currently, the number of Enicocephalomorpha, Dipsocoromorpha, Nepomorpha, Gerromorpha, and Leptopodomorpha recorded in Turkey is about of 100 species (Fent et al., 2011).

It is expected that this number will increase, especially in the Eastern and Southeastern Anatolia regions, with further research.

Figure 1. Habitus of *Leptopus hispanus* Rambur, 1840 from Tunceli: Karşılar. Dorsal view (on the left); ventral view (on the right). Photos by İ., Özgen.

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J.Het.Turk.
Journal of the Heteroptera of Turkey
ISSN 2687-3249 (Online edition)
November ,2019
Volume 1, Issue 1-2

Research Article

The Second Record of *Perillus bioculatus* (Fabricius, 1775) (Hemiptera: Heteroptera: Pentatomidae), Invasive Alien Species (IAS) from Anatolia

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ABSTRACT: In this paper new data on invasive alien species (IAS): *Perillus bioculatus* (Fabricius, 1775) as a second record for asian part (Anatolian) of Turkey are presented. Specimen is observed in Ankara, and this is the second record for anatolien part of Turkish (Heteroptera: Pentatomidae) fauna. The results of the study, its is confirmed occurrence in Anatolia.

KEYWORDS: *Perillus bioculatus* (Fb.,1775), Heteroptera, Ankara, second record Anatolia, Turkey

To cite this article: Kıyak, S., Alacapunar, P. & Özdamar, H., 2019, The Second Record of *Perillus bioculatus* (Fabricius, 1775) (Hemiptera: Heteroptera: Pentatomidae), Invasive Alien Species (IAS) from Anatolia, *J.Het.Turk.*,1(1-2):4-6.

To link to this article: https://www.j-ht.org/wp-content/uploads/2019/11/V11-2-A2.pdf

Received: Sep 30, 2019; **Revised:** Oct 18, 2019; **Accepted:** Oct 20, 2019; **Published online**: Nov 30, 2019

Perillus bioculatus (Fabricius,1775) (Hemiptera: Heteroptera: Pentatomidae) was first recorded 2003 in the provinces of Tekirdağ, Edirne and Kırklareli in Thrace part of Turkey in 1992, and 1997 (Kıvan, 2004; Fent & Aktaç, 2007).

In June 2016 in Ankara we found an examplare (adult). This finding has shown that *Perillus bioculatus* second time occurs regularly in the area of Anatolia part of Turkey.

This species firstly record in anatolien part was recorded on 2018 in Amasya province (Dursun & Fent, 2018)

In this study the specimen of *Perillus bioculatus* (Fabricius, 1775) was observed in Ankara province and identificated by first author and photographed by second author (Fig.1). This is the second record in the distribution of *P. bioculatus* (F.) in anatolia.

With new record in Ankara this species is establised penetrated and expanded in the Asian part of Turkey. (Fig.2)

Material Examined:
Turkey, Ankara, Keçiören district, Yakacık, N 39°59'17.644" E 32°52'12.538" 930m, 24.06.2018, 1 male or female ? specimen observed and photographed by second author.

Family: Pentatomidae Leach, 1815

***Perillus bioculatus* (Fabricius, 1775)**

This second record in Anatolia showed that the spread of this invasive alien species is expanding Turkey, it is possible to spread more in Anatolia in the future.

Fig.1. Specimen of *P. bioculatus* (Fb., 1775) from Ankara (Anatolian part of Turkey).

Distribution in Turkey:

Tekirdağ, Edirne and Kırklareli (Euro-pean part of Turkey) (Kıvan, 2004; Fent & Aktaç, 2007). Amasya (Dursun & Fent, 2018), with this study in Ankara.

Distribution in Palaearctic region:

Czechoslovakia, France, Germany, Russia, Yugoslavia (Thomas,1994); North America and European-Turkey (Kıvan, 2004); Balkan Peninsula: Bulgaria, Greece, Serbia, Turkey (Protıć & Žıvıć, 2012; Putchkov, 2013, Simov et al., 2012); North America, Mexico to Canada; Belgium, France, Germany, Italy, Russia, Slovakia, Ukraine, Yugoslavia (Rabitsch, 2008).

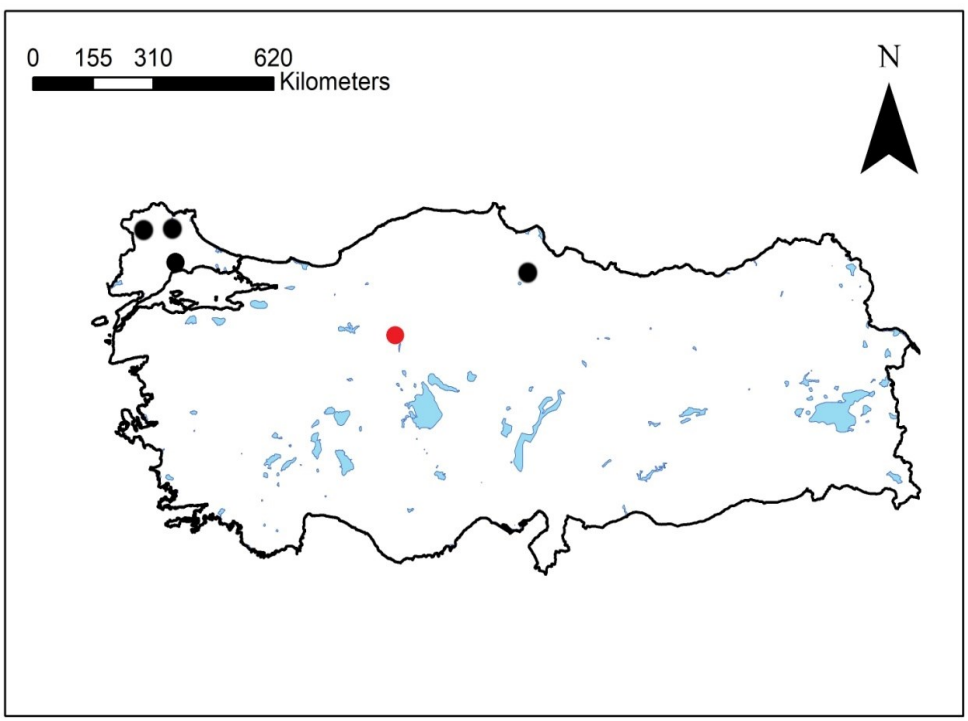

Fig. 2. Distribution of *Perillus bioculatus* (Fabricius, 1775) in Thrace lands provinces and Amasya (●). Second record in Anatolian peninsula (Asia Minor) ● (Asian part of Turkey).

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J.Het.Turk.
Journal of the Heteroptera of Turkey
ISSN 2687-3249 (Online edition)
November ,2019
Volume 1, Issue 1-2

Research Article

The First Assessment of Heteroptera (Hemiptera) Ectoparasite Records on Psittaciformes (Aves) Species

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ABSTRACT: Some insect species of the Heteroptera (Hemiptera) (true bugs) suborder from Arthropoda class, are present as ectoparasites in some reptile, bird and mammal species. These species are fed by blood- sucking and are considered economically harmful. Parrot species belonging to the order Psittaciformes (Aves) show a native distribution in tropical and subtropical regions, but some species have started to be invasive or alien species in other countries except the native range. There is no current list of ectoparasites carried by parrots that are important in the world animal trade. This research was designed on two orders of animals, host and ectoparasites of economic importance. The aim of this study is to present the Heteroptera species that are infected to Psittaciformes species worldwide. Studies on this subject all over the world. Five Psittaciformes species were found to be infected with 11 Heteroptera species. Heteroptera species usually infect insectivorous and predatory birds. Infection of economically important Psittaciformes species by Heteroptera species should be monitored.

KEYWORDS: Insect, True bug, Parrot, Economic importance, infection

To cite this article: Per, E., 2019, The First Assessment of Heteroptera (Hemiptera) Ectoparasite Records on Psittaciformes (Aves) Species, *J.Het.Turk.*,1(1-2):7-15.

To link to this article: https://www.j-ht.org/wp-content/uploads/2019/11/V11-2-A3.pdf

Received: Oct 14, 2019; **Revised:** Nov 8, 2019; **Accepted:** Nov 10, 2019; **Published online:** Nov 30, 2019

INTRODUCTION

The suborder Heteroptera (Hemiptera) (true bugs) are composed of arthropod species that are widely distributed and can live in different habitat types. The species belonging to this suborder have adapted to terrestrial, aquatic and semi-aquatic environments. Terrestrial species generally feed on plants and damage the plant by absorbing the seeds, which are the nutrient reserves of the plants. Some terrestrial heteropters live in soil, caves or ant nests as saprophyte. Some species live as predators of small arthropods. Some species blood-sucking on vertebrates. Cimicidae (true bugs) and Polyctenidae (bat bugs) families of suborder Heteroptera live as ectoparasites on birds and mammals. Bedbugs and *Triatoma* species (kissing bugs) of the Reduviidae family transmit the fatal *Trypanosoma cruzi* disease (Aydın, 2016).

The species belonging to the order Psittaciformes (Aves) are distributed in tropical and subtropical regions. This order consists of three families: Psittacidae (real parrots) (79 genera, 375 species) Cacatuidae (cockatoo) (7 Breed, 21 species) and Strigopidae (New Zealand parrots) (2 genera and 3 species) (Rowley, 2019). 54 of these species were introduced to areas outside their native range and 38 species were established in the non-native range across the World (Avery et al., 2018). Invasions caused by exotic species are accepted as a major threat to global biodi-

versity (Carrete & Tella, 2008). Wildlife trade is an important pathway for the introduction of invasive alien species accross the world. The European Union has banned the importation of wild-caught birds. With this ban there was a strong decline, especially in the western Palearctic region. Although regional bans can reduce the risk of invasion globally, bans must be global to be fully effective and to prevent trade flows from being reoriented (Reino et al., 2017). The global trade in wildlife not only causes outbreaks of human disease but also provides disease transfer mechanisms that threaten the livestock, international trade, rural livelihoods, local wildlife populations and ecosystems. Outbreaks from wildlife trade have caused hundreds of billions of dollars of economic damage worldwide (Karesh et al., 2005).

There is no current list of ectoparasites carried by parrots, which are important in the world animal trade. This research was designed on two sets of orders host and ectoparasite animals of economic importance. The aim of this study is to present the Heteroptera species that are infected to Psittaciformes species in the world.

MATERIALS AND METHODS

The literature search was made on google scholar, web of science, scopus about parrots and Heteroptera species. Queries on the internet were performed, using the following criteria: “bird”, “Psittaciformes”, “parrot”, “parakeet”, “ecto-parasite”, “Heteroptera”, and “true bug”. The database was established about this subject. Numerical assessments and comparisons have been made about the species in this database.

RESULTS

Five species belonging to the Psittaciformes family were found to be infected with 11 Heteroptera species in four countries in South America; Argentina, Bolivia, Mexico and Papraguay (Table 1). In other parts of the world, no research has been found on bug ectoparasites of parrots (Figure 1).

18 studies and 30 bug records on Heteroptera ectoparasites of parrots in South America continent have been determined (Table 1). Of these records, 62% were found in the monk parakeet (*Myiopsitta monachus*) (MP) nest and stomach content, 21% were found in blue-crowned parrot (*Aratinga acuticaudata*) nests, 7% were found in the thick-billed Parrot (*Rhynchopsitta pachyrhyncha*) nests, 7% were found in the burrowing parrots (*Cyanoliseus patagonus*) nests and 2% were found in the blue-fronted Parrot (*Amazona aestiva*) nests (Figure 2). The highest percentage of true bugs were found in the Monk Parrot nests,

Two species (*Lyctocoris campestris* and *Cardiastethus aequinoctialis*) of the determined Heteroptera species are in family Anthocoridae, three species (*Ornithocoris toledoi, Psitticimex uritui* and *Cyanolicimex patagonicus*) in family Cimicidae, two species (*Chinavia musiva* and *Nezara viridula*) are in family Pentatomidae, four species (*Triatoma delpontei, Triatoma infestans*, *Triatoma platensis* ve *Triatoma sordida*) are in family Reduviidae. Frequency graph shows that *Psitticimex uritui* is the most common species and reported on 38% of records. Following species after that all respectively; *Triatoma infestans* and *Triatoma sordida* (Figure 3). 50% of the records belong to the Cimicidae family (Figure 4).

73% of the research based on parrots infected by bug species has been conducted in Argentina. The other countries respectively; Bolivia (20%), Mexico (4%) and Paraguay (%3) (Figure 5).

CONCLUSION AND DISCUSSION

Parrots spread naturally over five continents in the world (Rowley, 2019). More than 16% of the world's parrot species (Aves: Psittaciformes) currently established at least one breeding population outside their natural distribution areas (Menchetti & Mori, 2014). MP and rose-ringed parakeet (*Psittacula krameri*) (RRP)

J.Het.Turk., 1(1-2), Nov 2019 (eISSN 2687-3249)

are the most successful species that have established breeding populations outside their natural distribution areas across the world (Strubbe & Matthysen, 2007; Conroy & Senar 2009; Gaudioso et al. 2012).

Research has also been carried out on ectoparasites in countries where parrots have spread as invasive - alien species in the Western Palearctic region. In Italy, ectoparasites have been investigated on MP and RRP, but no true bugs have been recorded (Mori et al., 2015). Ectoparasites have been investigated on MP in Barcelona - Spain, but no true bugs have been recorded (Mori et al., 2019). No records of true bug ectoparasites have been identified in the world in IAS status parrots. In ectoparasitic studies conducted in countries where parrots have native distribution, the maximum number of true bugs were found in MP nests.

Among the hemipters known to be harmful due to their bite and blood-sucking functions as well as their damages to agricultural plants, there are many species belonging to the families of Cimicidae, Reduviidae and Anthocoridae (Aydın, 2016). 14 species in Cimicidae family, 11 species in Reduviidae family and two species in Anthocoridae family were evaluated in this research.

Cimicid bugs (Hemiptera, Heteroptera: Cimicidae) are blood-sucking arthropods and found on some birds; parrots, swallows, swifts, sparrow, and domestic fowl (Carpintero & Aramburú 2007). Cimicid species lay eggs in the place where their hosts live. Both adults and nymphal stages suck blood. In particular, a species regularly attacks the raptors. The Mexican chicken bug (*Haemato-siphon inodorus*) has contributed to the death of one or both of the nestling Bald Eagles (*Haliaeetus leucocephalus*) through the depletion of blood and irritation in Arizona (Grubb et al. 1986). Mexican chicken bugs contributed to the deaths of four nestlings from in Prairie Falcon (*Falco mexicams*) nests in southwestern Idaho, US. (Mcfadzen & Marzluff. 1996). Heteroptera species usually infect insectivorous and predatory birds. Infection of economically important Psittaciformes species by Heteroptera species should be monitored.

Cimicid true bug *Psitticimex uritui* (Lent & Abalos, 1946) is one of the most abundant ectoparasites detected in Monk Parakeet nests (Aramburú et al., 2003, Aramburú et al., 2008). The interaction between these two bird populations is related to MP's nest adoption behavior. This may explain the existence of the same true bug species in both nests. The low population of true bugs in the brown cacholote (*Pseudoseisura lophotes*) nests indicates that MP is the main host for *Psitticimex uritui* (Aramburú et al., 2009). The most common species of bugs in parrot nests in South America; *Psitticimex uritui* of the Cimicidae family.

The southern green stink bug (*Nezara viridula*) has a global distribution and is regarded as cosmopolitan. This is a pest (CABI, 2019) and the highly polyphagous species on many crops, able to feed on plants from over 30 families (Todd, 1989). The southern green stink bug is believed to have originated in Ethiopia (Squitier, 2010). It has been recorded in most zoogeographical regions of the world including Africa, Americas, Asia, and Europe (Todd, 1989). Following the spread of agriculture, *N. viridula* spread in many parts of the world, including expansion in the Neotropic and Aphrotropic regions. Nearctic and Palearctic regions are probably affected by global climate change (Panizzi & Lucini, 2016). This species is the phytopage, and it may have been detected in the MP nest due to a temporary visit. In fact, this species is not a direct parrot ectoparasites.

However, since this true bug has a global distribution and extends its range, it can be detected as temporary visitors in the nests of other bird and parrot species in the future. Some species of parrots, such as RRP and MP, whose native distribution areas are tropical and subtropical regions, were introduced to the Nearctic and Palearctic region by parrot trade and established invasive or alien breeding

populations in these regions. Further studies are needed to detect parasite-host interaction of these species. However, two study has been conducted on ectoparasites.

Two parrot species in Turkey; RRP and Alexandrine parakeet (*Psittacula eupatria*) have established populations as alien species (Kirwan et al., 2008). However, no research has been found about Heteroptera ectoparasites of these species. There is no current list of ectoparasites carried by parrots that are important in the world animal trade. This research was designed on two orders of animals, host and ectoparasites of economic importance.

Research on Heteroptera ectoparasites of Psittaciformes species spreading in five continents in the world has been conducted only in South America continent. It is interesting that no research has been conducted in other continents of the world. True bugs may not have been recorded in other studies since they prefer nests instead of birds' feathers as habitats. Five Psittaciformes species were found to be infected with 11 Heteroptera species. This is the preliminary list of bug ectoparasites in parrot nests. In this study, an assessment has been made about ectoparasitic bugs of some parrot species which are spreading all over the world. According to this research; the most dominant parrot species is the MP The most common species of bugs that causes the most infestation is *Psitticimex uritui* from the Cimicidae family. In the coming years, with the studies on different parrot species on different continents, the host and bug diversity will increase.

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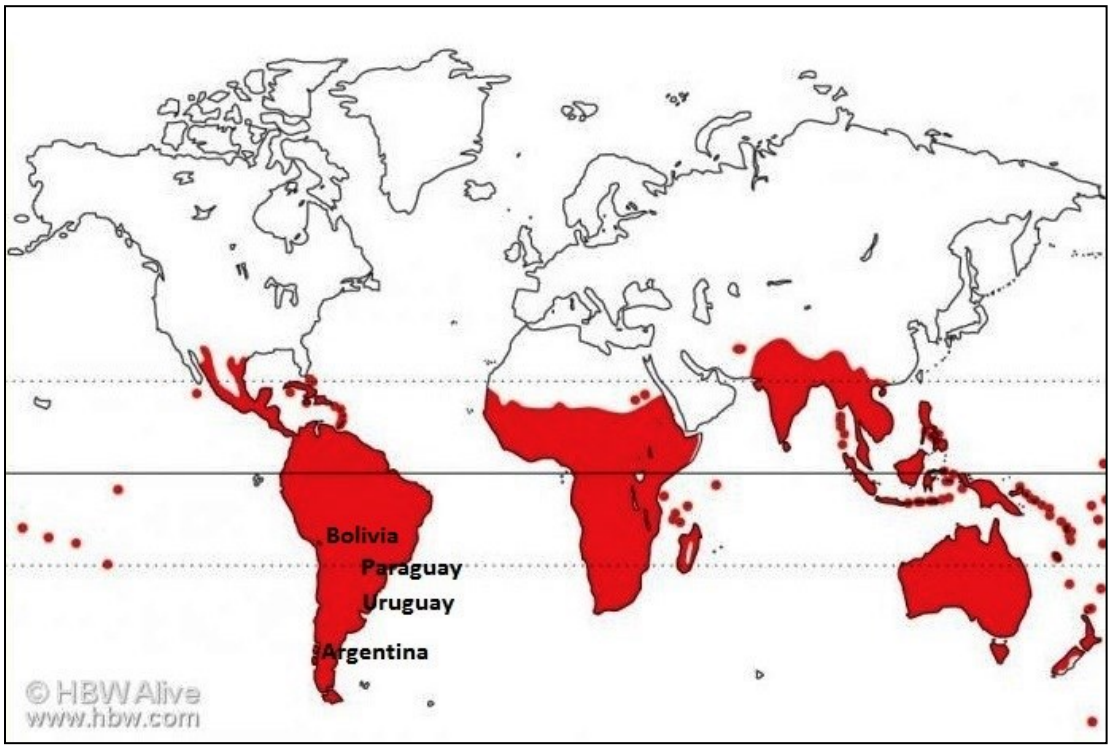

Figure 1.Native distribution range of Psittaciformes species worldwide (Rowley, 2019) and countries where bug & parrot research has been conducted.

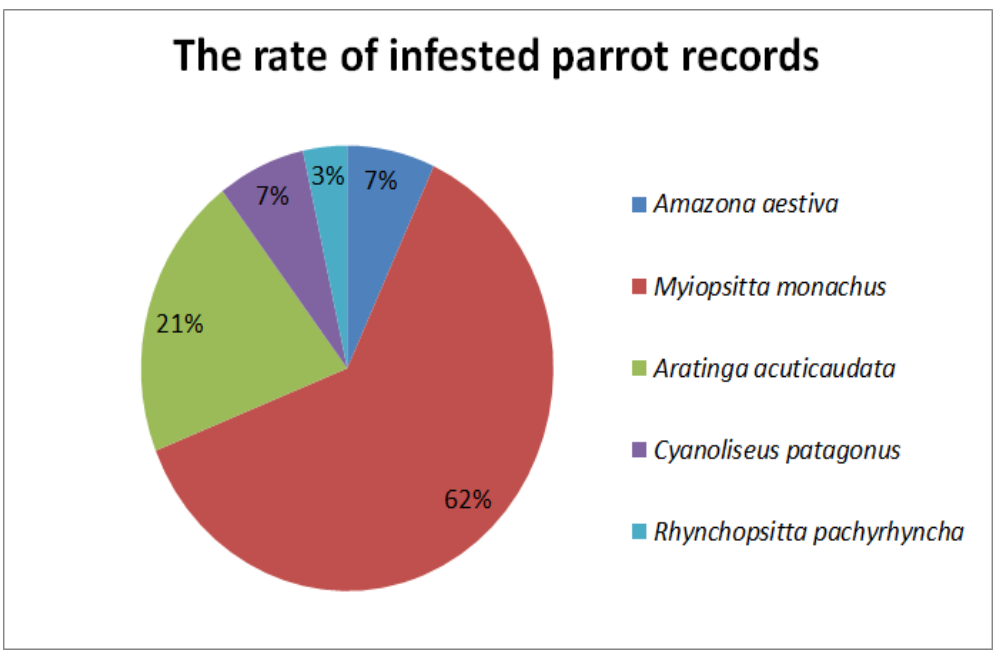

Figure 2. The rate (%) of parrot species infested with bugs

J.Het Turk., 1(1-2), Nov 2019 (eISSN 2687-3249)

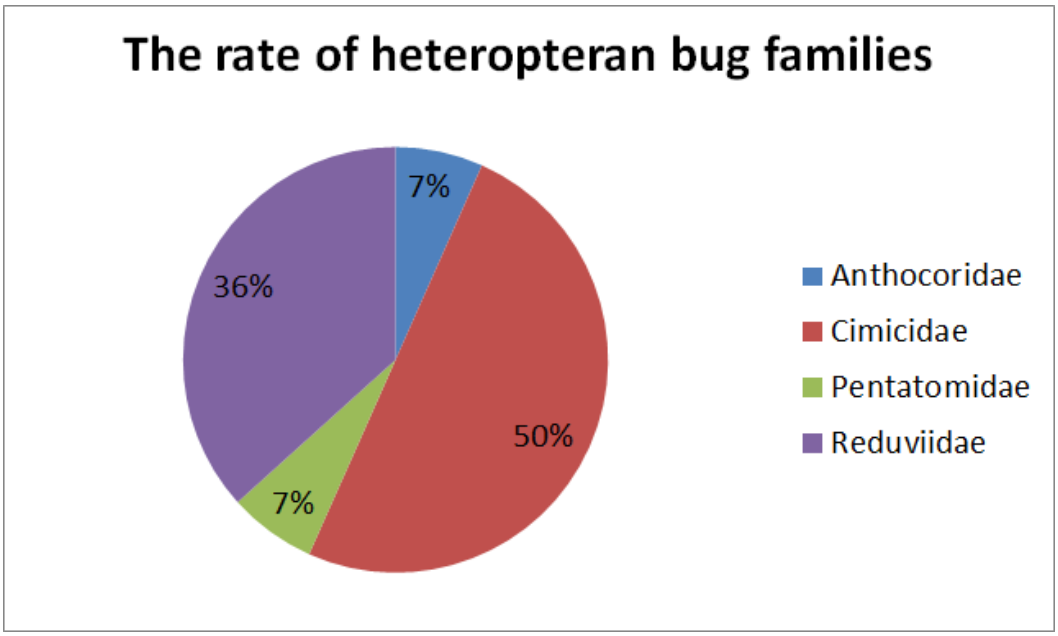

Figure 4. The rate of (%) families Heteroptera detected on parrot species

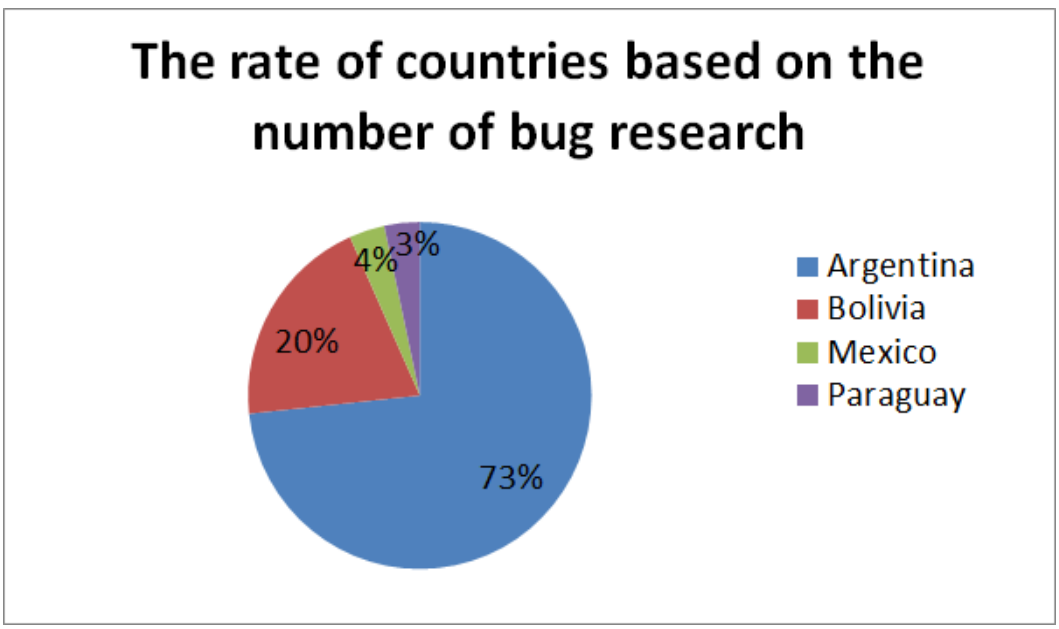

Figure 5. The rate of countries based on the number of Heteroptera ectoparasites and parrot research

Table 1: Worldwide research on Heteroptera ectoparasites and parrot species

Family	Species	Host	Common name of host	Type of ectoparasite	Country	Location	Reference
Anthocoridae	*Lyctocoris campestris* (Fabricius, 1794)	*Myiopsitta monachus*	Monk parakeet	Nest	Argentina	Buenos Aires	Aramburú et al., 2009
Anthocoridae	*Cardiastethus aequinoctialis* Poppius, 1909	*Myiopsitta monachus*	Monk parakeet	Nest	Argentina	Buenos Aires	Aramburú et al., 2009
Cimicidae	*Ornithocoris toledoi* Pinto 1927	*Aratinga a. acuticaudata*	Blue-Crowned Parrot	Nest	Argentina	Chaco	carpintero et al., 2011
Cimicidae	*Psitticimex uritui* (Lent & Abalos, 1946)	*Myiopsitta monachus*	Monk parakeet	Nest	Argentina	Buenos Aires	Aramburú et al., 2003
Cimicidae	*Psitticimex uritui* (Lent & Abalos, 1946)	*Myiopsitta monachus*	Monk parakeet	Food	Argentina	Buenos Aires	Aramburú et al., 2000
Cimicidae	*Psitticimex uritui* (Lent & Abalos, 1946)	*Myiopsitta monachus*	Monk parakeet	Nest	Argentina	Buenos Aires	Aramburú et al., 2009
Cimicidae	*Psitticimex uritui* (Lent & Abalos, 1946)	*Cyanoliseus patagonus*	burrowing parrots	Nest	Argentina	Rio negro	Masello & Quillfeldt, 2004
Cimicidae	*Cyanolicimex patagonicus* Carpintero, Di Iorio, Masello & Turienzo, 2007	*Cyanoliseus patagonus*	The Burrowing Parrot	Nest	Argentina	Rio negro	Di Iorio et al., 2010
Cimicidae	*Ornithocoris* sp	*Rhynchopsitta pachyrhyncha*	Thick-billed Parrot	Nest	Mexico	Chihuahua	Stone et al., 2005
Cimicidae	*Psitticimex uritui* (Lent & Abalos, 1946)	*Myiopsitta monachus*	Monk parakeet	Nest	Argentina	Tucuman	Lent & Abalos, 1946
Cimicidae	*Psitticimex uritui* (Lent & Abalos, 1946)	*Myiopsitta monachus*	Monk parakeet	Nest	Argentina	-	Wygodzinsky, 1951
Cimicidae	*Psitticimex uritui* (Lent & Abalos, 1946)	*Myiopsitta monachus*	Monk parakeet	Nest	Argentina	Tucuman	Usinger, 1966
Cimicidae	*Psitticimex uritui* (Lent & Abalos, 1946)	*Myiopsitta monachus catita*	Monk parakeet	Nest	Argentina	Córdoba	Poggio et al., 2009
Cimicidae	*Psitticimex uritui* (Lent & Abalos, 1946)	*Myiopsitta monachus catita*	Monk parakeet	Nest	Argentina	La pamba	Poggio et al., 2009
Cimicidae	*Psitticimex uritui* (Lent & Abalos, 1946)	*Myiopsitta monachus monachus*	Monk parakeet	Nest	Argentina	Buenos Aires	Poggio et al., 2009
Cimicidae	*Psitticimex uritui* (Lent & Abalos, 1946)	*Myiopsitta monachus*	Monk parakeet	Nest	Argentina	Buenos Aires	Aramburú, 1991
Pentatomidae	*Nezara viridula* (L.)	*Myiopsitta monachus*	Monk parakeet	Nest	Argentina	Buenos Aires	Aramburú et al., 2009
Pentatomidae	*Chinavia musiva* (Berg, 1878)	*Myiopsitta monachus*	Monk parakeet	Nest	Argentina	Buenos Aires	Aramburú et al., 2009
Reduviidae	*Triatoma infestans* (Klug, 1834)	*Amazona aestiva*	Blue-fronted Parrot	Nest	Argentina	Chaco	Berkunsky et al., 2005
Reduviidae	*Triatoma sordida* (Stål, 1859)	*Aratinga a. acuticaudata*	Blue-Crowned Parrot	Nest	Argentina	Chaco	Aramburú et al., 2013
Reduviidae	*Ornithocoris toledoi* Pinto 1927	*Aratinga a. acuticaudata*	Blue-Crowned Parrot	Nest	Argentina	Chaco	Aramburú et al., 2013
Reduviidae	*Triatoma platensis* Neiva, 1913	*Aratinga a. acuticaudata*	Blue-Crowned Parrot	Nest	Bolivia	Chaco	Noireau et al., 1997
Reduviidae	*Triatoma sordida* (Stål, 1859)	*Aratinga a. acuticaudata*	Blue-Crowned Parrot	Nest	Bolivia	Chaco	Noireau et al., 1997
Reduviidae	*Triatoma infestans* (Klug, 1834)	*Myiopsitta monachus*	Monk parakeet	Nest	Bolivia	Chaco	Noireau et al., 2000
Reduviidae	*Triatoma sordida* (Stål, 1859)	*Myiopsitta monachus*	Monk parakeet	Nest	Bolivia	Chaco	Noireau et al., 2000
Reduviidae	*Triatoma infestans* (Klug, 1834)	*Myiopsitta monachus*	Monk parakeet	Nest	Bolivia	Chaco	Noireau et al., 2000
Reduviidae	*Triatoma delpontei* Romaña & Abalos, 1947	*Myiopsitta monachus*	Monk parakeet	Nest	Bolivia	Chaco	Noireau et al., 2000
Reduviidae	*Triatoma infestans* (Klug, 1834)	*Aratinga acuticaudata*	Blue-Crowned Parrot	Nest	Argentina	Chaco	Ceballos et al., 2009
Reduviidae	*Triatoma infestans* (Klug, 1834)	*Amazona aestiva*	Turquoise-fronted Amazon	Nest	Argentina	Chaco	Ceballos et al., 2009
Reduviidae	*Triatoma sordida* (Stål, 1859)	Fallen parrot nest	-	Nest	Paraguay	Chaco	Rolón et al., 2011

J.Het.Turk.
Journal of the Heteroptera of Turkey
ISSN 2687-3249 (Online edition)
November ,2019
Volume 1, Issue 1-2

Research Article

An Overview on the Fauna of Piesmatidae (Heteroptera) of Turkey with a new record for the Turkish Thrace: *Parapiesma quadratum* (Fieber, 1844)

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ABSTRACT: *Parapiesma quadratum* (Fieber, 1844) was identified in Kırklareli province during field studies in the Turkish Thrace in 2016. This is the first record of *P. quadratum* from the Thrace Region and is also the first finding of the Piesmatidae family in this region. In this study, the distribution informations of *P. quadratum* and other species belonging to the family Piesmatidae in Turkey were given and shown on the map.

KEYWORDS: *Parapiesma quadratum*, new record, Piesmatidae, Heteroptera, Turkish Thrace, Turkey

To cite this article: Fent, M., Dursun, A., 2019, An Overview on the Fauna of Piesmatidae (Heteroptera) of Turkey with a new record for the Turkish Thrace: *Parapiesma quadratum* (Fieber, 1844), *J.Het.Turk.*,1(1-2):16-19.
To link to this article: https://www.j-ht.org/wp-content/uploads/2019/11/V11-2-A4.pdf
Received: Oct 28, 2019; **Revised:** Nov 10, 2019; **Accepted:** Nov 11, 2019; **Published online:** Nov 30, 2019

INTRODUCTION

The Piesmatidae family is represented by 19 species belong to two genera (*Parapiesma* Péricart, 1974 and *Piesma* Lepeletier & Serville, 1828).

Genus *Parapiesma* has 16 species and genus *Piesma* has 3 species. Six species of Piesmatidae family are known in Turkey and of them four species belong genus *Parapiesma* and two species to genus *Piesma* (Heiss & Péricart, 2001).

The species of *Parapiesma* genus distributed in Turkey are *Parapiesma atriplicis* (Frey-Gressner, 1963), *P. kolenatii* (Fieber, 1861), *P. quadratum* (Fieber, 1844) and *P. salsolae* (Becker, 1867); and all this species are known only from Anatolia (Heiss & Pericart, 2001).

P. atriplicis was recorded from Aksaray province in Central Anatolia and Erzurum (Narman, Kışlaköy, Oltu, Şenkaya), Kars (Sarıkamış, Karakurt) in Eastern Anatolia.

P. kolenatii and *P. salsolae* have a wider distribution in Anatolia. *P. kolenatii* was reported from Adıyaman (Nemrut Mountain) in Southeast Anatolia, Ağrı (Doğubeyazıt), Kars (Göle, Sarıkamış) and Van province in Eastern Anatolia and Kayseri (Bünyan) and Nevşehir (Cappadocia) in Central Anatolia. *P. salsolae* was recorded from Afyonkarahisar (Köroğlu Passage), Ankara (Hasanoğlan), Çankırı, Eskişehir (Sivrihisar), Kayseri (Pınarbaşı, Yeşilhisar), Kırıkkale (Keskin), Kırşehir (Mucur), Nevşehir (Gülşehir) and Niğde (Çiftehan, Ulukışla) in Central Anatolia, Erzurum (Narman) and Erzincan (Mercan) in Eastern Anatolia, İzmir (Bornova) in Aegean Region and Samsun in the Middle Black Sea Region.

P. quadratum was given so far only from Gökçeada Island located in the Aegean

Sea in Turkey (Awad & Önder, 1997; Heiss & Pericart, 2007; Yıldırım et al., 2013). (Fig. 2a).

Both euromediterrenean species of the genus *Piesma* also are distributed in Anatolia part of Turkey.

Of this species, *Piesma capitatum* was recorded from Afyonkarahisar and Aydın provinces in the Aegean Region of the west Anatolia, Ankara in the Central Anatolia, Kocaeli (Mollafeneri) in Marmara Region and Kars (Centrum, Merdenik) in the Eastern Anatolia.

The other species, *P. maculatum* is known from Bartın, Çankırı, Kastamonu and Samsun provinces in the Western and Central Black Sea Regions and Erzurum (Oltu, Narman, Kışlaköy, Ünlükaya, Şenkaya Turnalı) in the Eastern Anatolia Region (Heiss & Pericart, 2007; Yıldırım et al., 2013). (Fig. 2a).

RESULTS

Family Piesmatidae Amyot & Serville, 1843

Genus *Parapiesma* Péricart, 1974

Parapiesma quadratum (Fieber, 1844)

Material examined: Kırklareli: Lüleburgaz–Dü-ğüncübaşı Village, 270m., 17.07.2016, 1♂ (Fig. 1).

Distribution in Turkey: Çanakkale: Gökçeada (Awad & Önder 1997) (Fig. 2a).

Distribution in Palaearctic: Europa: Austria, Belgium, Bosnia-Herzegovina, Bulgaria, Croatia, Czech Republic, Finland, Germany, Great Britain, Hungary, Ireland, Italy, Macedonia, Polond, Portugal, Romania, Russia (European part), Serbia, Slovakia, Slovenia, Spain, Swedish, Ukraine. **North Africa:** Algeria, Tunusia. **Asia:** Armenia, Azerbaijan, Turkey (Asian part) (Heiss & Pericart, 2001) (Fig. 2b).

Fig. 1. *Parapiesma quadratum* (dorsal view)

DISCUSSION

Parpiesma quadratum was recorded previously in the Gökçeada Island located Çanakkele province of West Turkey. Geologically is Gökçeada actually a part of Anatolia which has been formed with a connection to the mid-Sakarya region (Hacet & Aktaç, 2006).

In this study was recorded this species firstly in the Thrace Region and this finding is second record in Turkey.

Palearctic distribution of *P. quadratum* is very common in Europe. It is distributed in North Africa only in Tunisia and Algeria and in Asia only in Armenia and Azerbaijan (Heiss & Pericart, 2001).

Distributions of other species of Piesmatidae in Turkey are so far only in Anatolia.

They are mostly distributed in Central Anatolia and Eastern Anatolia and partly in Western Anatolia and Black Sea coasts.

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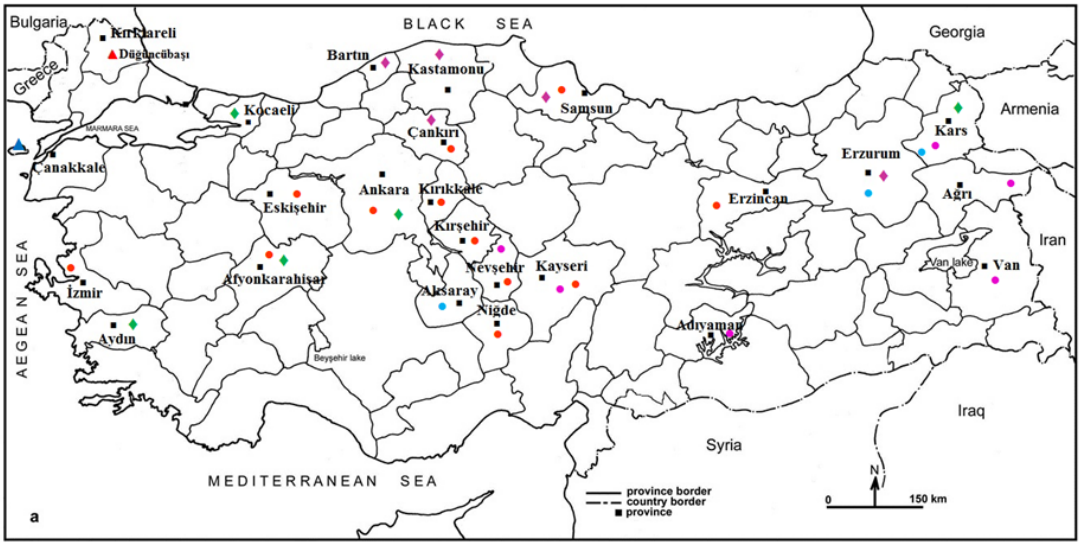

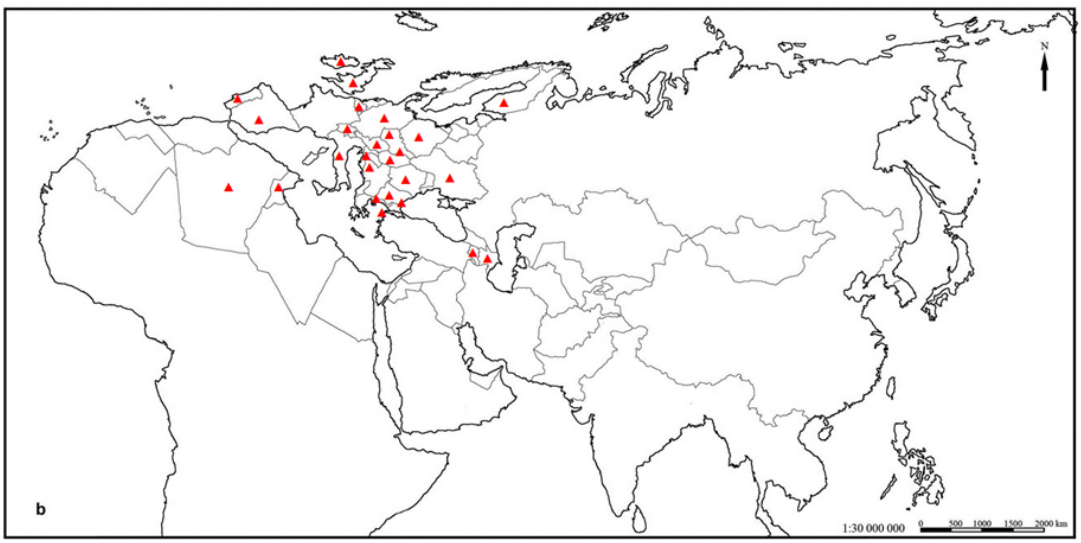

Fig. 2a. Distributions of the species of Piesmatidae in Turkey – *Parapiesma atriplicis* (●), *P. kolenatii* (●), *P. salsolae* (●), *P. quadrata* (▲: new record for the Thrace, ▲: previous record), *Piesma capitatum* (♦). *P. maculatum* (♦)

Fig. 2b. Distribution of Parapiesma quadratum in Palaearctic Region (▲)

J.Het.Turk.
Journal of the Heteroptera of Turkey
ISSN 2687-3249 (Online edition)
November ,2019
Volume 1, Issue 1-2

Research Article

Six new records for the Heteroptera (Hemiptera) fauna of Kosovo

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ABSTRACT: This study was conducted based on 14 specimens belonging to 6 species of 5 genera in 4 families of the suborder Heteroptera (Hemiptera). The specimens were collected during fieldwork in Prizren, Peja, Shtime, Istok, Gjakova and Strpce provinces from Kosovo in 2012. All these six species in this study are new records for the Kosovo. These species; *Brachycoleus decolor* Reuter, 1887 and *Lygus rugulipennis*, (Poppius, 1911) (Miridae); *Nabis limbatus* Dahlbom, 1851 and *Nabis capsiformis* (Germar, 1838) (Nabidae); *Monosteira unicostata* (Mulsant & Rey) (Tingidae); *Gampsocoris culicinus culicinus* Seidenstücker, 1948 (Berytidae).
The distribution of each species are presented in Kosovo and showed map. Infection of economically important Psittaciformes species by Heteroptera species should be monitored.

KEYWORDS: Heteroptera, new records, fauna, Kosovo

To cite this article: Baymak, D., Kıyak,S., 2019, Six new records for the Heteroptera (Hemiptera) fauna of Kosovo, *J.Het.Turk.*,1(1-2):20-24.
To link to this article: https://www.j-ht.org/wp-content/uploads/2019/11/V11-2-A5.pdf
Received: Oct 15, 2019; **Revised:** Nov 10, 2019; **Accepted:** Nov 12, 2019; **Published online:** Nov 30, 2019

INTRODUCTION

Suborder Heteroptera are represented by 9365 species and 246 subspecies belong to 1632 genera in the Palearctic region (Aukema et al., 2013).

The state of knowledge of the suborder Heteroptera in Kosovo is, at present, still in its initial stage, and still relying heavily on the 20th century works by Protic (1990 -2012) and supplemented by the catalog published by Aukema and Rieger (1996, 1999, 2001).

No studies have been conducted on the species of Heteroptera in Kosovo, except for what Protic has reported, and have been established. Chronologically detailed information about the studies on heteroptera in the geography of the former Yugoslavia are given by (Protic, 2000), and she stated that the first record *Apodiphus amygdali* (Germar, 1817) was given from Croatia.

Protic (2000) summarized the studies of Heteroptera fauna in old Serbia in five periods. During these five periods, she discussed the studies and investigations carried out in Serbia and Montenegro in the former Yugoslayva; Fieber (1861), Horvath (1903), Kormilev (1927-1945) today's Macedonia -Skopje and Tetovo, Gradojevic (1963), Jankovic (1963, 1964, 1966, 1972) of Yugoslavia, Serbia and Macedonia are mentioned in the records of researchers.

According to the studies conducted to date, 222 species belonging to 29 families are known from Heteroptera in Kosovo (Protic, 1988, 1990, 2008, 2009, 2001, 2012). As a result of the search of all the literature related to the region, no previous records of the species recorded in Kosovo in this study were found (Fieber, 1861; Horváth, 1903, 1916; Wagner, 1970/71, 1975; Stichel 1957-1962, 1956 -1958, 1958-1960; Protic, 1990, 1998, 2000, 2001, 2002, 2004, 2005, 2006, 2007a,b, 2008, 2009, 2010, 2011a,b,c; Protic, Zivic, 2012; Josifov, 1986; Josifov,Simov, 2006; Schumacher, 1918; Csiki, 1940).

MATERIALS AND METHODS

A total of 14 adult specimens of six species were collected from 8 locations in Kosovo from June to September in . (Figure 1 and Table 1).

Samples were collected by insect trap and killed in 70% alcohol jars., the samples were prepared and. Entomogical materials were prepared based on technical and standards of data collection of the zoology museum.

The samples were determined using identification keys by Stichel (1955-1962), Wagner (1970/71) and Bei-Bienko (1964).

In Table 2 was given the provinces of Kosovo where new faunistic records of six species belonging to four families of the suborder Heteroptera collected and recorded. (Table 2).

The distribution of the species is marked on the map (Figure 1).

All samples are deposited in the collection of the Zoological Museum of Gazi University (ZMGU), Ankara, Turkey.

RESULTS

New recorded data on Heteroptera fauna of Kosovo are as follows:

Family: Miridae Hahn 1831,

***Brachycoleus* Fieber, 1858**

***Brachycoleus decolor* Reuter, 1887**

Material examined:

Loc. D6, Prizren 42°12'22.N 20°45'21.E 400-500 m 25.07.2012, 1♀, 1♂,

***Lygus* Hahn, 1833**

***Lygus rugulipennis* (Poppius, 1911)**

Material examined:

Loc. D7, Gjakova (Dujak) 42°27'37.N 20° 22'34.E, 420-480 m, 23.07.2012, 1♀; Loc. D8, Strpce (Brezovica) 42°11'59.N 20° 59'5.E, 900-1250 m, 28.07.2012, 1♀, 1♂.

Family: Nabidae A. Costa, 1853

***Nabis* Latreille 1802**

***Nabis limbatus* Dahlbom, 1851**

Material examined:

Loc. D4, Shtime,(Belaj) 42°26'14.N, 21° 1'23.E, 600-650 m, 25.07.2012, 1♂.

***Nabis capsiformis* Germar,1838**

Material examined:

Loc. D5, Istok, 42°46'48.N 20°28'50.E, 450-650 m, 28.06.2012, 1♀.

Family: Tingidae Laporte, 1832

***Monosteira* Costa, 1862**

***Monosteira unicostata* (Mulsant & Rey, 1852)**

Material examined:

Loc.D1, Prizren 42°12'36. N, 20°44'7.E, 400-420 m, 15.08.2012, 1♀,; Loc.D2, Prizren 42°12'28. N, 20°43'34.E, 380-420 m, 18.09.2012, 1♀, 1♂; Lok: D3, Peja 42° 39'12.N, 20°17'26.E, 500-550 m, 22.07.2012, 1♀, 2♂♂.

Family: Berytidae Fieber, 1851

***Gampsocoris* Fuss, 1852**

***Gampsocoris culicinus* Seidenstücker, 1948**

Material examined:

Loc. D6, Prizren Kara Potok, 42° 12'22.22"N 20°45'21.14"E, 400-500m, 25.07.2012, 1♂.

DISCUSSION

In this study, 14 specimes were collected belonging to four families of Heteroptera.

These are identified as six species and new records for Kosovo. And these six species were recorded from follows Kosovo provinces: Prizren, Peja, Shtime, Istok, Gjakova, Strpce for the first time (Table.2) The number of species by families is as follows:

Miridae 2, Nabidae 2, Tingidae 1, and Berytidae 1.

The newly recorded six species from Kosovo are *Monosteira unicostata* (Mulsant & Rey) (Tingidae); *Nabis limbatus* Dahlbom, 1851 and *Nabis capsiformis* (Germar, 1838) (Nabidae); *Brachycoleus decolor* Reuter, 1887 and *Lygus rugulipennis*, (Poppius, 1911) (Miridae); *Gampsocoris culicinus* (Seidenstücker 1948) (Berytidae).

Fig. 1. Study area and localities(D1-D8) at the Republic of Kosovo

J.Het.Turk., 1(1-2), Nov 2019 (eISSN 2687-3249)

Table 1. Sampling localities of Heteroptera specimens from Kosovo. Geographical coordinates, sampling date, number of examples (n).

Locality no	Province	Coordinates	Altitude (m)	Sampling Date	n
D1	Prizren	42°12'36. N, 20°44'7. E	400-420	15.08.2012	1
D2	Prizren	42°12'28. N, 20°43'34. E	380-420	18.09.2012	2
D3	Peja	42°39'12. N, 20°17'26. E	500-550	22.07.2012	3
D4	Shtime(Belaj)	42°26'14. N, 21°1'23. E	600-650	25.07.2012	1
D5	Istok	42°46'48. N, 20°28'50. E	450-650	28.06.2012	1
D6	Prizren	42°12'22. N, 20°45'21. E	400-500	25.07.2012	3
D7	Gjakova (Dujak)	42°27'37. N, 20°22'34. E	420-480	23.07.2012	1
D8	Strpce (Brezovica)	42°11'59. N, 20°59'5. E	900-1250	28.07.2012	2

Table 2. Heteropteran species recorded from Kosovo provinces.

Province	The name of Species
Prizren	*Monosteira unicostata* (Mulsant & Rey, 1852), *Brachycoleus decolor* Reuter, 1887; *Gampsocoris culicinus* (Seidenstucker 1948)
Peja	*Monosteira unicostata* (Mulsant & Rey, 1852)
Shtime(Belaj)	*Nabis limbatus* Dahlbom, 1851
Istok	*Nabis capsiformis* Germar 1838
Gjakova (Dujak)	*Lygus rugulipennis* (Poppius 1911)
Strpce (Brezovica) (Brezovica)	*Lygus rugulipennis* (Poppius 1911)

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J.Het.Turk., 1(1-2), Nov 2019 (eISSN 2687-3249)

J.Het.Turk.
Journal of the Heteroptera of Turkey
ISSN 2687-3249 (Online edition)
November ,2019
Volume 1, Issue 1-2

Research Article

Contribution to the knowledge of Lygaeidae and Miridae (Hemiptera: Heteroptera) in East Anatolia

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ABSTRACT: In this paper, 11 species of the family Lygaeidae and Miridae belonging to the subordo Heteroptera (Hemiptera) recorded from Elazığ, Tunceli and Malatya provinces of Eastern Anatolia, Turkey, are discussed. Among them, belonging to Lygaeidae family *Peritrechus meridionalis* Puton, 1877, *Pezocoris apicimacula* (A. Costa, 1853), *Tropistethus fasciatus* Ferrari, 1874, *Horvathiolus superbus* (Pollich, 1781) and belonging to Miridae family *Globiceps (Globiceps) sphaegiformis* (Rossi, 1790), *Psallus quercus* (Kirschbaum, 1856), *Grypocoris melanopygus* Horváth, 1906, *Acetropis carinata* (Herrich-Schäffer, 1842) are reported for the first time from Eastern Anatolia of Turkey. In addition, many species are newly reported to studied provinces.

KEYWORDS: Contribution, Fauna, East Anatolia, Lygaeidae, Miridae, Heteroptera.

To cite this article: Özgen, İ., Dioli, P,, 2019, Contribution to the knowledge of Lygaeidae and Miridae (Hemiptera: Heteroptera) in East Anatolia, *J.Het.Turk.*,1(1-2):25-32.
To link to this article: https://www.j-ht.org/wp-content/uploads/2019/11/V11-2-A6.pdf
Received: Oct 25, 2019; **Revised:** Nov 11, 2019; **Accepted:** Nov 13, 2019; **Published online:** Nov 30, 2019

INTRODUCTION

The Lygaeidae and Miridae family species of the Eastern Turkey are still little known. The Heteroptera (Hemiptera) fauna of Eastern part of Turkey is still little known compared to the one of the other parts of Anatolia. Önder et al. (2006) listed a total of 1526 heteropteran species/ subspecies for the whole Turkey, in which they included eastern species Last papers (Matocq et al., 2014; Çerçi et al.,2018, Dioli and Özgen, 2018, Özgen and Dioli, 2018 a, b. gave good review of the studies realized in this area. The bugs specimens were collected in the area near Elazığ, and Tunceli country (Eastern Turkey), in different localities.

MATERIAL AND METHODS

Specimens were caught by sweep-netting the herbaceous vegetation by the first author. They were identified by the second author. All the material is preserved in the Collections of Fırat University, Engineering Faculty, Bioengineering Department, Elazığ, Turkey.

RESULTS AND DISCUSSION

Taxonomic status of the family of Lygaeidae follows Aukema & Rieger (2001). Ge-

neral distribution, when not otherwise specified, is referred to the Catalogue of Palaearctic Region (Aukema & Rieger 1999 and 2001; Aukema et al., 2013).

Lygaeidae Schilling, 1829

***Lygaeus simulans* Deckert, 1985**

Material examined: Elazığ, Baskil, 26.06.2018, 3 ♂, leg. Ozgen (Figure 1.).

Distribution in the World: Europe: Albania (van der Heiden & Dioli, 2019), Austria, Bulgaria, Czech Republic, Kazakhstan, France, Great Britain (vagrant), Germany, Hungary, Italy, Macedonia, Moldavia, Poland, Romania, Western Russia, Slovakia, Spain, Switzerland, Ukraine, Yugoslavia. Asia: Azerbaijan, Afghanistan, Kazakhstan, Armenia, Turkey, China (NO NW WP), Cyprus, Georgia, Iran, Kirgizia, Mongolia, Eastern Russia, (WS) Taiwan, Tadzhikistan, Turkmenistan, Uzbekistan.

Distribution in Turkey: Ankara, Elazığ, İzmir, Kahramanmaraş, Kayseri, Malatya, Nevşehir, Niğde (Péricart, 1998a)

Remarks: reports in Turkey, prior to 1985, are dubious and must be controlled. Infact the species, in the past, was confused with the congeneric *Lygaeus equestris* (Linnaus, 1758) with whom it often coexists, generally in mountain areas, above 700-800 meters of altitude. (Dioli et al., 1994)

***Peritrechus meridionalis* Puton, 1877**

Material examined: Malatya, Arguvan, Omikan, 27.10.2018, 1 ♂, leg. Özgen.

Distributıon in the World: Europe: Albania, Austria, Bosnia Hercegovina, Bulgaria, Croatia, France, Greece, Hungary, Italy, Malta, Montenegro, Romania, Russia (CT ST), Serbia, Spain, Ukraine. North Africa: Algeria, Egypt, Libya, Morocco, Tunisia. Asia: Azerbaijan, Afghanistan, Kazakhstan, Armenia, Turkey, Georgia, Iran, Mongolia, Syria, Tadzhikistan, Turkmenistan, Uzbekistan.

Distribution in Turkey: Ağrı, Ankara, Balıkesir, Çankırı, Kayseri, Kırşehir, Konya, Nevşehir, Sakarya, İzmir (Önder et. al., 2006, Abacıgil et.al., 2010, Anonymous, 2018, Çerçi, 2019).

Note: First record in East Anatolia.

***Pezocoris apicimacula* A. Costa, 1853**

Material examined: Elazığ, Maden, Kavak village, 07.04.2018, 2 ♂ , leg. Özgen.

Dıstrıbutıon in the World: Europe: Albania, Bosnia Hercegovina, Bulgaria, Greece, Italy, Macedonia, Romania, Russia (ST), Spain, Ukraine. North Africa: Algeria, Morocco. Asia: Azerbaijan, Kazakhstan, Armenia, Turkey, Georgia, Iran, Israel, Kirgizia, Syria, Tadzhikistan, Uzbekistan.

Distribution in Turkey: Ankara, Balıkesir, Burdur, Bursa, Kayseri, Sivas, Tatvan (Pericart, 1998, Dursun, 2016).

Remarks: Rare species in the considered area, in dried soil often with stones (Pericart, 1998).

Note: First record in Elazığ province.

***Tropistethus fasciatus* Ferrari, 1874**

Material examined: Elazığ, Baskil, Kayabeyli village, 30.03.2018, 3 ♂ leg. Özgen.

Distribution in the World: Europe: Albania, Bosnia Hercegovina, Bulgaria, Greece, Italy, Macedonia, Romania, Russia (ST), Spain, Ukraine. North Africa: Algeria, Morocco. Asia: Azerbaijan, Kazakhstan, Armenia, Turkey, Georgia, Iran, Israel, Kirgizia, Syria, Tadzhikistan, Uzbekistan.

Distribution in Turkey: Ankara, Bolu, Çankırı, Zonguldak (Önder et al., 2006).

Remarks: Rare species in the considered area.

Note: First record in East Anatolia

***Lasiocoris anomalus* Kolenati, 1845**

Material examined: Malatya, Kale, 18.03.2018, 3 ♂, leg. Özgen.

Distribution in the World: Europe: Andorra, Bosnia Hercegovina, Bulgaria,

J.Het.Turk., 1(1-2), Nov 2019 (eISSN 2687-3249)

Croatia, France, Greece, Italy, Macedonia, Portugal, Russia (ST), Slovenia, Spain, Ukraine. North Africa: Algeria, Morocco. Asia: Azerbaijan, Armenia, Turkey, Cyprus, Georgia, Iran, Israel, Jordan, Turkmenistan.

Distribution in Turkey: Adana, Ağrı, Ankara, Bursa, Diyarbakır, Elazığ, Gaziantep, Hakkari, Iğdır, Karaman, Konya, Malatya, Nigde (Önder et al., 2006; Dursun and Fent., 2017).

***Horvathiolus superbus* Pollich, 1781**

Material examined: Elazığ, Güney çevre village, 30.03.2018, 5 ♂, 2 ♀ specimens, leg. Özgen.

Distribution in the World: Europe: Albania, Andorra, Austria, Belgium, Bosnia Hercegovina, Bulgaria, Croatia, Czech Republic, France, Great Britain (Jersey), Germany, Greece, Hungary, Italy, Luxembourg, Malta, Macedonia, The Netherlands, Poland (doubtful), Portugal, Romania, Russia (ST), Serbia, Slovakia, Spain, Switzerland, Ukraine. North Africa: Canary Islands, Madeira. Asia: Azerbaijan, Afghanistan, Kazakhstan, Armenia, Turkey, China (NW), Cyprus, Georgia, Iran, Iraq, Israel, Kirgizia, Mongolia, Tadzhikistan, Turkmenistan, Uzbekistan.

Distribution in Turkey: Balıkesir, Edirne, Isparta (Fent and Aktaç, 2008, Abacıgil et al., 2010; Fent and Japoshvili, 2012).

Note: First record in East Anatolia

Miridae Hahn, 1833

***Globiceps sphaegiformis* Rossi, 1790**

Material examined: Elazığ, Sütlüce, 15.05.2018, 2 ♂ , leg. Özgen.

Distribution in the World: Central and South Europe, extending to Turkey and Caucasus, Iran (Linnavuori, 2007). Europe: Albania, Andorra, Austria, Belgium, Bosnia Hercegovina, Bulgaria, Byelorussia, Croatia, Czech Republic, Estonia, Turkey, France, Germany, Greece, Hungary, Italy, Macedonia, Moldavia, Montenegro, Netherlands, Poland, Portugal, Romania, Russia (CT ST), Serbia, Slovakia, Slovenia, Spain, Switzerland, Ukraine, Yugoslavia. Asia: Azerbaijan, Turkey, Cyprus, Georgia, Iran.

Distribution in Turkey: Afyonkarahisar, Ankara, Antalya, Artvin, Bartın, Bilecik, Bolu, Bursa, Çanakkale, Çankırı, Denizli, Diyarbakır, Karaman, Kastamonu, Kayseri, Konya, Kütahya, Mersin, Muğla, Tekirdağ, Uşak. (Önder e et al., 2006; Matocq et al., 2014; Anonymous, 2019).

Remarks: Rare species in the considered area.

Note: First faunistic report in East Anatolia. It lives on *Fagus* sp. and *Quercus* sp. (Linnavuori, 2007).

***Brachycoleus steini* Reuter, 1877**

Material examined: Elazığ, Günbağı, 21.06.2018, 7 ♂, leg. Özgen.

Distribution in the World: Europe: Bulgaria, Turkey, Greece, Italy, Macedonia, Romania. Asia: Azerbaijan, Armenia, Turkey, Georgia, Iran.

Distribution in Turkey: Antalya, Kahramanmaraş, Kayseri, Kırşehir, Konya, Niğde, Afyon, Aydın, Balıkesir, Burdur, Bursa, Çanakkale, Denizli, Edirne, Gaziantep, Isparta, İstanbul, İzmir, Kahramanmaraş, Kayseri, Kırklareli, Kırşehir, Konya, Kütahya, Manisa, Muğla, Muş, Niğde, Tekirdağ, Uşak (Lodos et al., 2003; Önder et al., 2006).

***Rhabdomiris striatellus wagneri* Kerzhner & Schuh 1998**

Material examined: Elazığ, Günbağı, 11.06.2018, 8 ♂, 2 ♀, leg. Özgen.

Distribution in the World: Asia: Turkey (endemic).

Distribution in Turkey: Ankara, Elazığ (Keban) (Matocq et al., 2014).

Remarks: a new name for *Rhabdomiris striatellus fasciatus* Wagner, 1960, homonym with *Calocoris fasciatus* Jakovlev, 1875.

Note: It was found on *Quercus* also in the area of findings.

***Psallus (Phylidea) quercus* Kirschbaum, 1856**

Material examined: Elazığ, Baskil, Sultanuşağı, 30.0.2018, 2 ♂, 1 ♀ , leg. Özgen; Tunceli, Pertek, 21.05.2018, 3 ♂ specimen, leg. Özgen.

Distribution in the World: Europe: Austria, Belgium, Bosnia Hercegovina, Bulgaria, Croatia, Czech Republic, Denmark, Finland, France, Great Britain, Germany, Hungary, Ireland, Italy, Liechtenstein, Luxembourg, Macedonia, Moldavia, Netherlands, Norway, Poland, Portugal, Romania, Russia (ST), Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine, Yugoslavia. Asia: Asian Turkey, Azerbaijan, Georgia.

Distribution in Turkey: Artvin, Bartın, Diyarbakır, Kahramanmaraş, Kastamonu, Kayseri (Önder et al., 2006; Matocq et al., 2014).

Note: First record in East Anatolia.

***Grypocoris melanopygus* Horv., 1906**

Material examined: Tunceli, Pertek, Akdemir, 21.05.2018, 2 ♂, leg. Özgen.

Distribution in the World: Asian Turkey (endemic) (Rosenzweig, 1997).

Distribution in Turkey: Ankara, Kahramanmaraş, Kastamonu, Kayseri, Konya, Nevşehir, Osmaniye (Önder et al., 2006), Beynam (Hoberlandt, 1955; Kıyak & Akar, 2010).

Remarks: "occurring on undergrowth below *Pinus nigra* of wooded hil formation" (Hoberlandt, 1955).

Note: First record in East Anatolia.

***Acetropis carinata* H.-Sch., 1842**

Material examined: Elazığ, Kayabeyli village, 13.09.2018, 1 ♂, leg. Özgen.

Distribution in the World: Europe: Austria, Belgium, Bosnia Hercegovina, Bulgaria, Byelorussia, Croatia, Czech Republic, Denmark, Kazakhstan, France, Germany, Greece, Hungary, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Moldavia, Netherlands, Poland, Romania, Russia (CT ST), Serbia, Slovakia, Spain, Switzerland, Ukraine. North Africa: Algeria, Tunisia (dubtful). Asia: Azerbaijan, Kazakhstan, Armenia. Turkey.

Distribution in Turkey: Ankara, Bayburt, Bursa, Erzurum, Kayseri, Kütahya, Mersin (Önder et al., 2006; Yazıcı and Yıldırım, 2017).

It was given to habitus for some species (Figure 2a and 2b).

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Figure 1. The habitus of *Lygaeus simulans* Deckert, 1985.

J.Het.Turk., 1(1-2), Nov 2019 (eISSN 2687-3249)

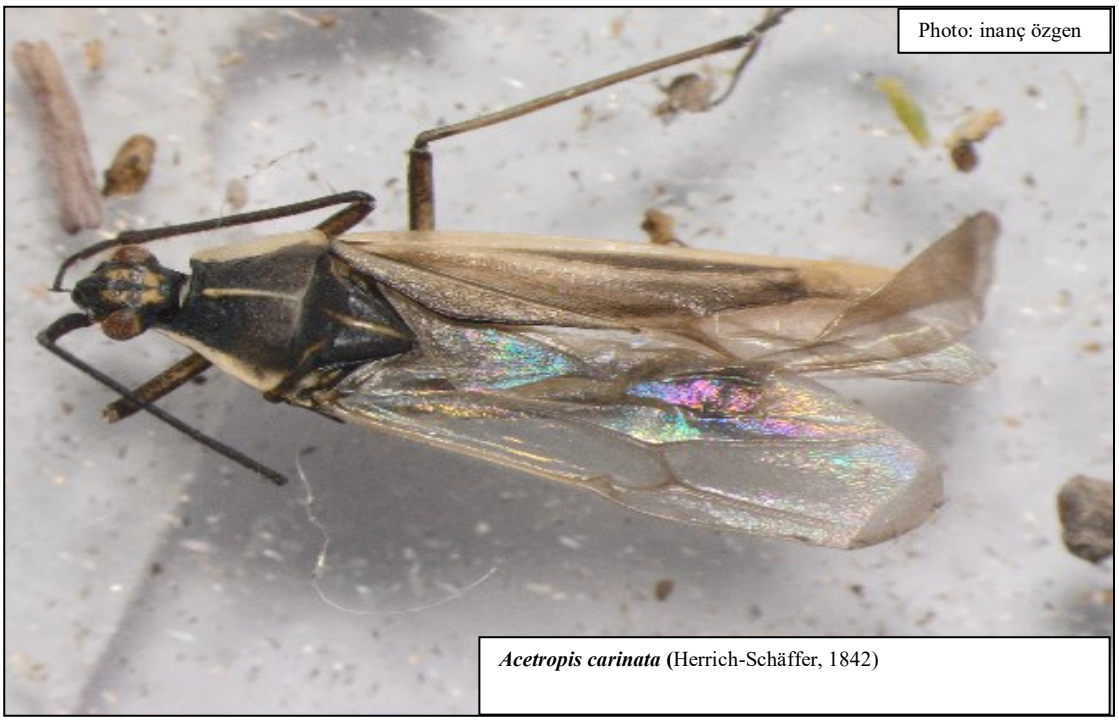

Figure 2a. Habitus of some species.

J.Het Turk., 1(1-2), Nov 2019 (eISSN 2687-3249)

Globiceps sphaegiformis (Rossi, 1790)

Rhabdomiris striatellus wagneri Kerzhner & Schuh 1998

Figure 2b. Habitus of some species.

J.Het.Turk.
Journal of the Heteroptera of Turkey
ISSN 2687-3249 (Online edition)
November ,2019
Volume 1, Issue 1-2

Research Article

Contribution to Pentatomoidea (Heteroptera) Fauna of Iğdır and Istanbul with Three New Records for Turkish Fauna

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ABSTRACT: In this study, 34 species of Pentatomidae and 3 species of Scutelleridae are recorded from Iğdır and 1 species of Scutelleridae is recorded from Istanbul. Among these species, *Tarisa elevata* Reuter, 1901, *Brachynema signatum* Jakovlev, 1879 and *Phimodera amblygonia* Fieber, 1863 are recorded from Turkey for the first time.

KEYWORDS: Pentatomidae, Scutelleridae, Iğdır, Istanbul, new records, Turkey.

To cite this article: Çerçi, B., Gözüaçık, G., 2019, Contribution to Pentatomoidea (Heteroptera) Fauna of Iğdır and Istanbul with Three New Records for Turkish Fauna, *J.Het.Turk.*,1(1-2):33-40.
To link to this article: https://www.j-ht.org/wp-content/uploads/2019/11/V11-2-A7.pdf
Received: Nov 8, 2019; **Revised:** Nov, 19, 2019; **Accepted:** Nov 20, 2019; **Published online:** Nov 30, 2019

INTRODUCTION

The superfamily Pentatomoidea (Heteroptera) consists of 16 families worldwide (Henry, 2017), of which only Acanthosomatidae, Cydnidae, Dinidoridae, Pentatomidae, Plataspidae, Scutelleridae and Thyreocoridae are present in Turkey (Önder et al., 2006).

Pentatomidae Leach, 1815 is a diverse family with over 4700 species known worldwide and 953 of which are present in Palaearctic region (Rider, 2006; Aukema et al., 2013). Most species of Pentatomidae are phyto-phagous and several are considered serious economic pest (e.g. *Nezara viridula*, *Aelia* spp., *Halyomorpha halys*) (Rider, 2006).

Up to now, 166 species of Pentatomidae are recorded from Turkey (Belousova, 1999; Önder et al., 2006; Rider, 2006; Fent & Aktaç, 2007; Memon & Ahmad, 2008; Fent et al., 2010a; 2010b; Fent et al., 2013; Dursun & Fent, 2013; Yazıcı et al., 2014; Çerçi & Koçak, 2017).

Scutelleridae Leach, 1815 is a less diverse family with about 450 species known worldwide and 180 species in Palaearctic region. They are strictly plant-feeding and some of them are economically important pests, especially some species of *Eurygaster* (Göllner-Scheiding, 2006). This family is represented by 40 species in Turkish fauna (Lodos, 1963; Önder et al., 2006; Göllner-Scheiding, 2006; Carapezza, 2009; Yıldırım et al., 2014).

The Pentatomoidea fauna of Iğdır is poorly investigated. The first investigations

were done by Horváth (1894) and Kiritshenko (1918) who had recorded only 6 species from this province. Later, Lodos & Önder (1978) described a new *Tarisa* species, *T. ıgdırensis,* and recorded another species, *Tarisa subspinosa subspinosa* (Germar, 1839) from Iğdır.

Most recently, several authors have put some attention to the Pentatomoidea fauna of Iğdır and recorded additional 30 species (Önder et al., 2006; Külekçi et al., 2009; Yazıcı et al., 2014; Yıldırım et al., 2014; Yazıcı et al., 2015; Dursun & Fent, 2015).

As a result, a total of 32 Pentatomidae, 4 Scutelleridae and 2 Cynidae species are known from Iğdır. Pentatomoidea fauna of Istanbul is also very poorly studied with 38 Pentatomidae, 8 Scutelleridae, 8 Cydnidae, 3 Acanthosomatidae, 1 Plataspidae and 1 Thyreocoridae species recorded up to now (Horváth, 1917; 1918; Fahringer, 1922; Linnavuori, 1965; Lodos & Önder, 1979; Önder et al., 1981; Lodos & Önder, 1982; Önder et al., 2006; Fent & Aktaç, 2007; 2009; Yazıcı et al., 2014).

MATERIAL AND METHODS

The study was conducted in 29 different locations in Center, Aralık, Karakoyunlu and Tuzluca counties of Iğdır province between 2014 and 2019 and a single species was collected in 2016 from Esenyurt, Istanbul.

The specimens were collected with hand, sweeping net and light traps between April and November, killed with ethylacetate and etiquette informations were added. Later on, specimens were pinned with insect pins and deposited for identification. Photographs were taken by Nikon D 3300 DSLR Camera combined with Tokina 100mm F2.8 AT-X PRO Macro Lens and 68mm extension tubes. Stacking of images was done by Combine ZM stacking program. Genital examination was done under Celestron Micro 360 Dual Purpose Microscope. The specimens are preserved in the private collection of the first author.

RESULTS

Among the 38 species of Pentatomoidea recorded from Iğdır and İstanbul in this study, 20 species are new for the fauna of Iğdır and 1 is new for the fauna of Istanbul.

Consequently, total number of Pentatomoidea species recorded from Iğdır and İstanbul rises to 58 and 60, respectively.

Among them, three species are new for the fauna of Turkey, therefore total number of Pentatomoidea species recorded from Turkey rises to 269.

Species marked with single asterisk (*) are new records for the province they have been collected from, those marked with double asterisks (**) are new records for the fauna of Turkey.

PENTATOMIDAE Leach, 1815

ASOPINAE Amyot & Serville, 1843

***Zicrona caerulea* (Linnaeus, 1758)**
Material examined: Iğdır: 3 males 5 females, 01.05.2019 (Aralık), C. Gözüaçık leg., B. Çerçi det.

PODOPINAE Amyot & Serville, 1843

****Derula flavoguttata* Mulsant & Rey, 1856**
Material examined: Iğdır: 1 female, 21.06.2014 (Tuzluca). C. Gözüaçık leg., B. Çerçi det.

***Graphosoma (Graphosoma) italicum italicum* (O.F. Müller, 1876)**

Material examined: Iğdır: 5 males 7 females, 05.10.2018 (Melekli). C. Gözüaçık leg., B. Çerçi det.

****Graphosoma (Graphosoma) semipunctatum* (Fabricius, 1775)**
Material examined: Iğdır: 5 males 3 females, 08.06.2015 (Tuzluca). C. Gözüaçık leg., B. Çerçi det.

J.Het.Turk., 1(1-2), Nov 2019 (eISSN 2687-3249)

****Tarisa elevata Reuter, 1901 (Fig. 1)**

Material examined: Iğdır: 1 male 1 female, 02.07.2014 (Kent Ormanı). C. Gözüaçık leg., B. Çerçi det.

Comments: The genus *Tarisa* Amyot & Serville, 1843 consists of 17 species and 1 subspecies distributing in Africa, south of Europe, Anatolia, Middle East and Middle Asia (Rider, 2006). It is represented by following 3 species in Turkey: *T. subspinosa subspinosa* (Germar, 1839), *T. virescens* Herrich-Schaeffer, 1851 and *T. ıgdırensis* Lodos & Önder, 1978, while the latter is endemic to Turkey (Önder et al., 2006). Şerban (2010) recorded *Tarisa flavescens* Amyot & Serville, 1843 from Turkey. But it should be noted that the specimen, illustrated in the black and white photograph given by Şerban (2010), lacks the characteristic tubercules of *T. flavescens* on the pronotum and scutellum and that specimen infact very probably refers to *T. virescens* which is common in Anatolia. All of these species are known from Iğdır (Lodos & Önder, 1978; Yazıcı et al., 2014).

Tarisa elevata Reuter, 1901 is known from most Middle Asian countries, south of Russia and Iran (Rider, 2006). *T. elevata* (Fig. 1A) differs from *T. virescens* by the very small and almost indistinct callous elevations of the basal angles of the scutellum. It also differs from *T. ıgdırensis* (Fig. 1B) and *T. subspinosa subspinosa*, which also lack such callous elevations, by the middle tubercule of the scutellum exceeding the level of pronotum in height (Fig. 1C). *T. elevata* can also be distinguished from *T. virescens* by the hooks of the aedeagus being short and broad (Fig. 1E) which are long and thin in the latter (Fig. 1F) (Kerzhner, 1964).

***Tholagmus flavolineatus (Fabricius, 1798)**

Material examined: Iğdır: 1 female, 08.06.2015 (Tuzluca). C. Gözüaçık leg., B. Çerçi det.

***Ventocoris (Astirocoris) oblongus (Horváth, 1889)**

Material examined: Iğdır: 1 male 4 females, 25.05–02.07.2014 (Aralık). C. Gözüaçık leg., B. Çerçi det.

***Ventocoris (Astirocoris) bulbifer Seidenstücker, 1964**

Material examined: Iğdır: 1 male, 23.05.2015 (Tuzluca). C. Gözüaçık leg., B. Çerçi det.

PENTATOMINAE Leach, 1815

***Acrosternum heegeri Fieber, 1861**

Material examined: Iğdır: 1 female, 22.06.2018 (Aralık), 1 male, 31.05.2014 (Melekli). C. Gözüaçık leg., B. Çerçi det.

Aelia acuminata Linnaeus, 1758

Material examined: Iğdır: 1 male, 24.05.2014 (Kılıçlar), 1 male, 25.05.2014 (Aralık), 1 female, 22.06.2019 (Aralık), 1 female, 08.05. 2014 (Center), 1 male 1 female, 11.07.2014 (Karakoyunlu), 1 female, 29.06.2015 (Hakmehmet), 1 female, 23.05.2015 (Üçkaya). C. Gözüaçık leg., B. Çerçi det.

***Aelia melanota Fieber, 1868**

Material examined: Iğdır: 1 male 1 female, 18.05.2015 (Aralık), 1 male, 22.05.2015 (Kasımcan), 1 female, 23.05.2015 (Üçkaya), 1 female, 12.06.2015 (Kağızman), 1 female, 23.07.2018 (Suveren), 1 female, 15.07.2018 (Suveren), 3 females, 03.10.2018 (Suveren). C. Gözüaçık leg., B. Çerçi det.

Aelia rostrata Boheman, 1852

Material examined: Iğdır: 1 male, 25.05.2015 (Hakmehmet), 1 male 1 female, 05.06.2016 (Üçkaya). C. Gözüaçık leg., B. Çerçi det.

Aelia virgata (Herrich-Schaeffer, 1841)

Material examined: Iğdır: 1 male, 23.05.2015 (Karabulak), 1 male, 03.10.2018 (Suveren), 3 males 1 female, 09.07.2019 (Donaltı). C. Gözüaçık leg., B. Çerçi det.

J.Het Turk., 1(1-2), Nov 2019 (eISSN 2687-3249)

***Apodiphus amygdali* (Germar, 1817)**
Material examined: Iğdır: 2 females, 15.09.2018 (Karaağaç). C. Gözüaçık leg., B. Çerçi det.

***Antheminia pusio* (Kolenati, 1846)**
Material examined: Iğdır: 2 males, 1 female, 22.06.2019 (Aralık), 2 males, 1 female, 19.06.2019 (Gödekli). C. Gözüaçık leg., B. Çerçi det.

***Bagrada (Nitilia) abeillei* Puton, 1881**
Material examined: Iğdır: 1 female, 16.05.2014 (Ü. Çiftliği), 1 female, 25.05.2014 (Emince). C. Gözüaçık leg., B. Çerçi det.

****Brachynema germarii* (Kolenati, 1846)**
Material examined: Iğdır: 1 male, 28.05.2019 (Aralık); 1 female, 09.07.2019 (Donaltı). C. Gözüaçık leg., B. Çerçi det.

*****Brachynema signatum* Jakovlev, 1879 (Fig. 2A)**
Material examined: Iğdır: 2 males, 3 females, 22.06.2019 (Aralık). C. Gözüaçık leg., B. Çerçi det.
Comments: The genus *Brachynema* Mulsant & Rey, 1852 has of 4 species and 3 subspecies in the Palearctic region (Rider, 2006; Ribes & Pagola-Carte, 2007). In Turkey, only *B. germarii* (Kolenati, 1846) and *B. cinctum* (Fabricius, 1775) are known (Önder et al., 2006). While the first one is widely distributed in Anatolia, latter is only known from Amasya and Erzurum (Önder et al., 2006; Dursun & Kartal, 2008; Yazıcı et al., 2014). *Brachynema signatum* Jakovlev, 1879 is a unique species among its congenres with the presence of a whitish-yellow spot at the middle of anterior margin of the pronotum and very large spots at the base of the scutellum (Fig.2A) (Ribes & Schmitz, 1992). It is known from Armenia, Azerbaijan, Georgia and Iran which are all close neigbours of Iğdır province.

***Carpocoris (Carpocoris) coreanus* Distant, 1899**
Material examined: Iğdır: 1 female, 23.05.2015 (Pirli), 1 male, 08.05.2015 (Çamurlu), 2 males, 25.05.2015 (Melekli). C. Gözüaçık leg., B. Çerçi det.

***Carpocoris (Carpocoris) pudicus* (Poda, 1761)**
Material examined: Iğdır: 1 female, 23.05.2015 (Pirli), 1 female, 23.05.2015 (Aliköse); 1 male, 05.06.2016 (Küçükova), 1 male, 15.07.2018 (Suveren). C. Gözüaçık leg., B. Çerçi det.

****Chroantha ornatula* (Herrich-Schaeffer, 1842)**
Material examined: Iğdır: 1 female, 08.09.2018 (Suveren). C. Gözüaçık leg., B. Çerçi det.

****Codophila varia* (Fabricius, 1787)**
Material examined: Iğdır: 4 males, 10 females, 03.10.2018 (Suveren). C. Gözüaçık leg., B. Çerçi det.

***Dolycoris baccarum* (Linnaeus, 1758)**
Material examined: Iğdır: 1 male, 16.05.2014 (Center). C. Gözüaçık leg. & det.

****Eurydema (Rubrodorsalium) blanda* Horváth, 1903**
Material examined: Iğdır: 1 male, 09.06.2016 (Üçkaya). C. Gözüaçık leg., B. Çerçi det.

***Eurydema (Eurydema) oleracea* (Linnaeus, 1758)**
Material examined: Iğdır: 1 male, 17.06.2014 (Hamurkesen). C. Gözüaçık leg., B. Çerçi det.

***Eurydema (Eurydema) ornata* (Linnaeus, 1758)**
Material examined: Iğdır: 2 males, 2 females, 01.07.2014 (Tuzluca), 3 males, 4 females, 30.06.2014 (Bayraktutan). C. Gözüaçık leg., B. Çerçi det.

****Eysarcoris ventralis* (Westwood, 1837)**
Material examined: Iğdır: 1 male 2 females, 22.06.2019 (Aralık). C. Gözüaçık leg., B. Çerçi det.

****Mustha spinosula* (Lefebvre, 1831)**
Material examined: Iğdır: 1 female, 19.09.2018 (Aralık). C. Gözüaçık leg., B. Çerçi det.

****Palomena prasina* (Linnaeus, 1761)**
Material examined: Iğdır: 1 female,

J.Het.Turk., 1(1-2), Nov 2019 (eISSN 2687-3249)

05.06.2016 (Üçkuyu). C. Gözüaçık leg., B. Çerçi det.

***Pausias (Pausias) martini* (Puton, 1890)**
Material examined: Iğdır: 4 males, 8 females, 11.10.2018 (Melekli). C. Gözüaçık leg., B. Çerçi det.

***Peribalus (Peribalus) strictus strictus* (Fabricius, 1803)**
Material examined: Iğdır: 1 female, 23.05.2015 (Yaycı), 1 female, 01.05.2019 (Center), C. Gözüaçık leg., B. Çerçi det.

***Piezodorus lituratus* (Fabricius, 1794)**
Material examined: Iğdır: 1 female, 08.05.2015 (Aralık). C. Gözüaçık leg., B. Çerçi det.

***Rhaphigaster nebulosa* (Poda, 1761)**
Material examined: Iğdır: 1 male, 23.10.2014 (Suveren). C. Göcüaçık leg. & det.

***Sciocoris (Sciocoris) sulcatus* Fieber, 1851**
Material examined: Iğdır: 2 males, 12 females, 17.05.2015 (A. Çiftlik) (on *Medicago* sp.). C. Gözüaçık leg., B. Çerçi det.

SCUTELLERIDAE Leach, 1815
EURYGASTERINAE Amyot & Serville, 1843

***Eurygaster integriceps* Puton, 1881**
Material examined: Iğdır: 1 female, 22.05.2015 (Karakoyunlu). C. Gözüaçık leg., B. Çerçi det.

ODONTOTARSINAE Mulsant & Rey, 1865

***Odontotarsus purpureolineatus* (Rossi, 1790)**
Material examined: Iğdır: 1 female, 15.07.2018 (Suveren), 1 female, 12.09.2018 (Suveren); 1 female, 27.05.2015 (Karakoyunlu); 1 female, 08.06.2015 (Pirli). C. Gözüaçık leg., B. Çerçi det.

****Phimodera amblygonia* Fieber, 1863 (Fig. 2B)**
Material examined: İstanbul: 1 female, 01.10.2016 (Esenyurt). B. Çerçi leg. & det.
Comments: The genus *Phimodera* Germar, 1839 consists of 24 species in Palaearctic region, most of which distribute in Middle Asia and a few in Europe and Turkey (Göllner-Scheiding, 2006). The species of this genus prefer steppic habitats (Davidová-Vilímová & Král, 2003). There are 3 species of *Phimodera* recorded from Turkey up to now: *Phimodera fumosa* Fieber, 1863, *Phimodera tuberculata* Jakovlev, 1874 and *Phimodera flori* Fieber, 1863 (Önder et al., 2006; Dursun & Fent, 2010; Yıldırım et al., 2014). Among these 3 species, *P. tuberculata* is very distinctive with very prominent and strong tubercules on each connexival segment (Reuter, 1906). *P. amblygonia* is characterized by the presence of numerous large rounded pale coloured tubercules on the scutellum and pronotum, obliquely truncated apical margins of juga and strongly elevated carina of clypeus which lies along all the length of the clypeus (Reuter, 1906). It can be easily distinguished from *P. fumosa* by the lateral margins of the pronotum being almost straight. It can also be easily distinguished from *P. flori* by the presence of numerous large rounded pale coloured tubercules on the scutellum and pronotum and strongly elevated carina of clypeus which lies along all the length of the clypeus (Reuter, 1906). It distributes in Middle Asia, western part of Russia and Ukraine (Göllner-Scheiding, 2006). This record from İstanbul expands the known distribution of this species about 500 km to the south.

***Phimodera fumosa* Fieber, 1863**
Material examined: Iğdır: 1 female, 29.05.2015 (Hakmehmet). C. Gözüaçık leg., B. Çerçi det.

DISCUSSION

In this study, 37 species of Pentatomidae and Scutelleridae and 1 species of Scutelleridae are recorded from Iğdır and İstanbul, respectively. Among these species, 20 species were recorded from Iğdır province for the first time. The total number of Pentatomoidea species recorded from Iğdır was increased to 58 but this number possibly does not reflect the whole Pentatomoidea fauna of Iğdır and further

researches from this poorly studied area may even reveal new species for science. Following three species are recorded from Turkey for the first time: *Tarisa elevata* Reuter, 1901, *Brachynema signatum* Jakovlev, 1879 and *Phimodera amblygonia* Fieber, 1863. While the first two species were found in Iğdır and were known from neighbouring countries, the latter was found from İstanbul and its finding in İstanbul expands the known distribution of this species about 500 km south. Overall, these records contribute to a better knowledge of Pentatomoidea fauna of Turkey. But further researches are needed to understand the true diversity of Pentatomoidea fauna of Turkey.

ACKNOWLEDGEMENTS

We would like to thank to Boris Loboda (Kharkiv, Ukraine) for sharing some of the literatures used in the identification of some species in this paper.

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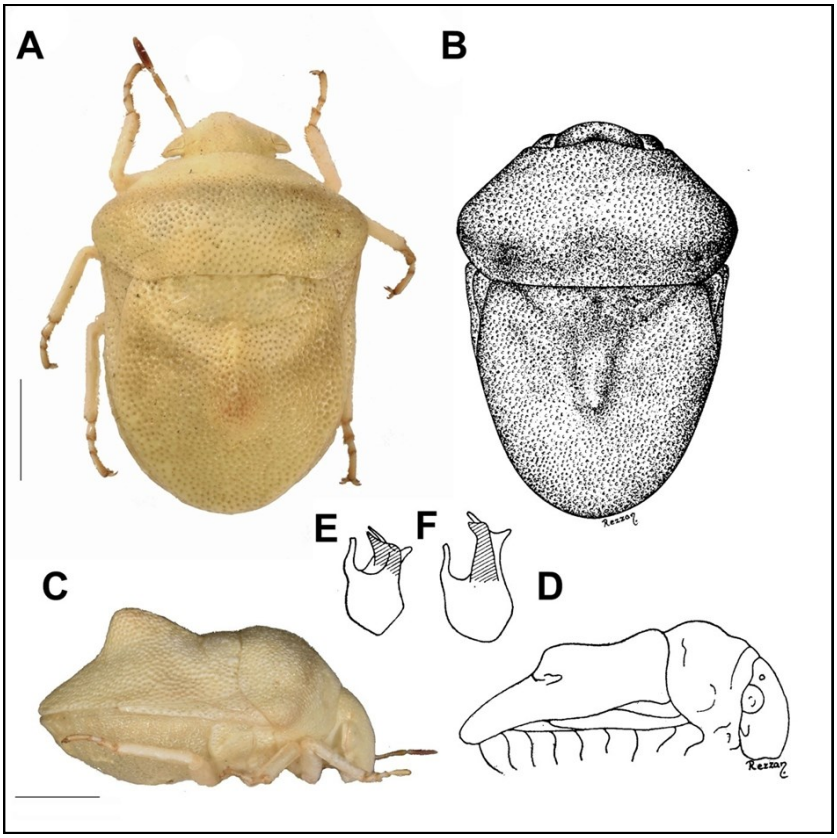

Fig. 1A–F. A – *Tarisa elevata* Reuter, 1901, female, dorsal view (Scale = 1 mm). **B** – *Tarisa ıgdırensis* Lodos & Önder, 1978, dorsal view. **C –** *Tarisa elevata* Reuter, 1901, female, lateral view (Scale = 1 mm). **D** – *Tarisa ıgdırensis* Lodos & Önder, 1978, lateral view. **E** – *Tarisa elevata* Reuter, 1901, aedeagus. **F** – *Tarisa virescens* Herrich-Schaeffer, 1851, aedeagus. [**B** and **D** originated from Lodos & Önder (1978), **E** and **F** originated from Kerzhner (1964)]

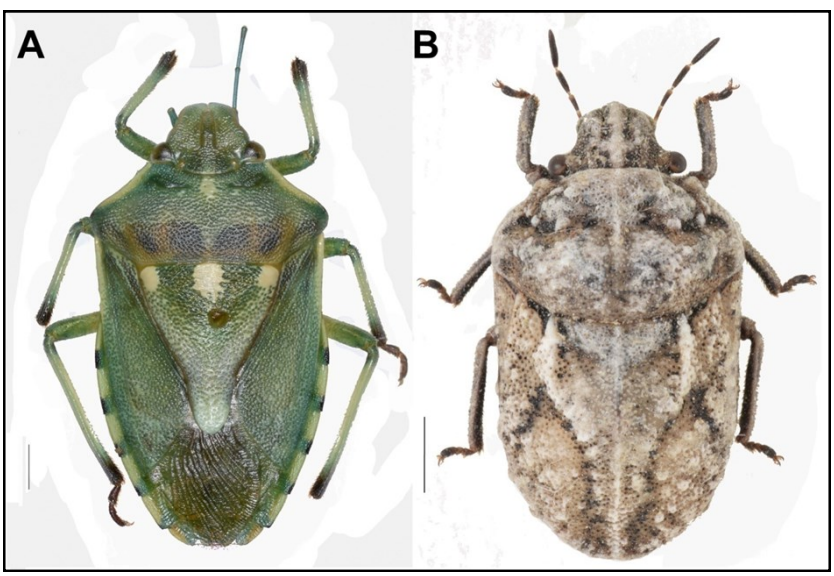

Fig. 2A–B. A – *Brachynema signatum* Jakovlev, 1879, female, dorsal view (Scale = 1 mm) **B –** *Phimodera amblygonia* Fieber, 1863, female, dorsal view (Scale = 1 mm).

J.Het.Turk., 1(1-2), Nov 2019 (eISSN 2687-3249)

J.Het.Turk.
Journal of the Heteroptera of Turkey
ISSN 2687-3249 (Online edition)
November ,2019
Volume 1, Issue 1-2

Ventocoris fischeri (Herrich-Schaeffer, 1851) (Heteroptera-Pentatomidae)'nin Tükürük Bezlerinin Morfolojisi ve Histolojisi

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ÖZET: Bu çalışmada, bir Hemiptera türü olan *Ventocoris fischeri* (Herrich-Schaeffer, 1851)'in tükürük bezinin morfoloji ve histolojisi stereomikroskop, ışık mikroskobu ve taramalı elektron mikroskobu (SEM) kullanılarak detaylı bir şekilde araştırılmıştır. *V. fischeri*'nin sindirim kanalının ön bağırsağına paralel uzanan bir çift tükürük bezi bulunmaktadır. Her tükürük bezi, esas tükürük bezi ve yardımcı tükürük bezi olmak üzere iki parçadan oluşmaktadır. Esas tükürük bezi ise anterior lob ve posterior lob olarak adlandırılan iki farklı kısma ayrılmaktadır. Esas tükürük bezinin her iki lobunun kesitleri incelendiğinde bezin lümenini tek tabaklı epitel dokunun çevrelediği görülmektedir. Yardımcı tükürük bezlerinde de tek katlı epitel bulunmaktadır. Ancak bu tabakaya ek olarak hücrelerin apikal tarafında lümeni kitin tabakası çevrelemektedir. Yapılan bu çalışma ile *V. fischeri*'nin tükürük bezi yapısı araştırılmış, daha önce yapılan diğer çalışmaların bulguları ile benzerlik ve farklılıkları ortaya konmuştur.

ANAHTAR KELİMELER: Böcek, tükürük bezi, Heteroptera, ışık mikroskobu, taramalı elektron mikroskobu, *Ventocoris fisheri* (H.-S.,1851)

Morphology and Histology of Salivary Glands of *Ventocoris fischeri* (Herrich-Schaeffer, 1851) (Heteroptera: Pentatomidae)

ABSTRACT: In this study, the morphology and histology of the salivary gland of *Ventocoris fischeri* (Herrich-Schaeffer, 1851), a Hemiptera species, were investigated in detail using stereomicroscope, light microscope and scanning electron microscope (SEM). *V. fischeri* has a pair of salivary glands extending parallel to the foregut of the digestive tract. Each salivary gland is composed of two parts, main salivary gland and accessory salivary gland. The main salivary gland is divided into two different parts called anterior lobe and posterior lobe. When the sections of both lobes of the main salivary gland are examined, it is seen that the lumen of the gland is surrounded by monolayer epithelial tissue. There is also a single-layer epithelium in the accessory salivary glands. However, in addition to this layer, chitin layer surrounds the lumen on the apical side of the cells. With this study, the structure of *V. fischeri*'s salivary gland was investigated and similarities and differences with the

KEYWORDS:Insect, salivary gland, Heteroptera, light microscope, scanning electron microscope, *Ventocoris fisheri* (H.-S.,1851)

To cite this article: Amutkan Mutlu, D., Polat, I., Gözüpek, H., Suludere, Z., 2019, *Ventocoris fischeri* (Herrich-Schaeffer, 1851) (Heteroptera:Pentatomidae)'nin Tükürük Bezlerinin Morfolojisi ve Histolojisi, *J.Het.Turk.*,1(1-2):41-51.
To link to this article: https://www.j-ht.org/wp-content/uploads/2019/11/V11-2-A8.pdf

GİRİŞ

Böcek tükürük bezleri, böcek ağız boşluğu ile ilişkili olan ve yutma sırasında gıda ile karıştırılan salgı (tipik olarak tükürük üreten bir çeşit ekzokrin bezdir.
Hipofarinks bezleri, maksiller bezler, mandibular bezler, labiyal bezler olmak üzere temel olarak dört çeşit bez vardır ve bu bezlerin hepsi böceklerde genel olarak tükürük bezleri olarak adlandırılabilir. Ancak 4 tip bezin hepsi aynı anda, aynı böcekte bulunmayabilir (Walker, 2009; Chapman, 2013).

Tükürük bezleri, enzimlerin üretiminde ve salgılanmasında önemli rol oynamaktadır (Chapman, 2013). Tükürük sadece hidrolitik enzimler içermez, aynı zamanda ağız parçalarını nemlendirir ve temizlemeye yardımcı olur (Wheeler, 2001). Bu görevlerle birlikte, tükürük bezlerinin ana ürünü olan tükürüğün farklı işlevleri de vardır. Bu görevler farklı türlerde ve hatta aynı türün farklı yaşam evrelerinde değişiklik gösterebilir. Örneğin kanla beslenen böceklerde, üretilen tükürüğün kritik fonksiyonlarından biri kanın pıhtılaşmasını önlemektir. Hymenoptera takımındaki türlerde tükürük bezinin işlevi alarm feromonu gibi feromonlar üretmektir. Tükürük bezlerinin diğer bir özel rolü larval Lepidoptera, Trichoptera ve Psocoptera'da olduğu gibi ipek salgısı üretmektir. Ayrıca tükürük bezleri böceklerde yuva yapımı ve avlara karşı böceğin savunmasında da önemli görevlere sahiptir (Baptist, 1941; Suiçmez, 1993; Andersen ve diğerleri, 2005; Walker, 2009; Polat, 2016).

Tükürük bezlerinin yapı ve fonksiyonu farklılıklar gösterse de böcek türlerinin çoğunda ortak özelliklere sahiptir (Baptist, 1941). Bezler çiftler halinde bulunur ve her bir bezden gelen kanallar genellikle tek bir ortak kanalda birleşerek ağız boşluğuna açılır. Hemosolde serbest olarak bulunan tükürük bezleri genellikle salgı bölgesi ve geri emilim bölgesi olmak üzere en az iki bölgeye sahiptir (Haridass & Ananthakrishnan, 1981; Swart & Felgenhauer, 2003; Serrão ve diğerleri, 2008; Walker, 2009). Salgı bölgesi, ana bileşeni su olan birincil tükürüğü üretir. Bezin salgı bölgesi ayrıca tükürük enzimleri ve tükürüğün diğer organik bileşenleri gibi proteinleri sentezler. Tükürük bezlerinin geri emilim bölgesi ise tükürükten potasyum veya sodyum iyonlarını emer ve hemolenf içine taşır (Walker, 2009).

Hemiptera takımına ait türlerin tükürük bezleri, yapı olarak çok çeşitlilik göstermektedir (Baptist, 1941). Bu konuyla ilgili elde edilen bulgular daha çok sindirim sisteminin yapısının aydınlatılmasıyla ilgili çalışmalarda ortaya çıkmıştır (Cecil, 1930; Hamner, 1936; Barber ve diğerleri, 1980; Amutkan ve diğerleri, 2015).

Ventocoris fischeri (Herrich-Schaeffer, 1851) Hemiptera takımına ait, dağlardan tarım alanlarına göç edebilen, buğday ve diğer tahılların yerine büyük oranda otlarla beslenen bir türdür. Göç etmelerinin, rüzgâr koşullarından ve güneşin yönünden kaynaklandığı belirtilmiştir (Schuh & Slater, 1995). Daha önce çalışılmamış bir tür olan *Ventocoris fischeri* (Herrich-Schaeffer, 1851)'nin tükürük bezlerinin morfolojisi ve histolojisinin araştırıldığı bu çalışmada, elde edilen veriler farklı takımlardaki türlerin ve Hemiptera takımında bulunan diğer türlerin tükürük bezlerinin yapısıyla karşılaştırılarak benzerlik ve farklılıkların ortaya konması amaçlanmıştır.

MATERYAL VE METOT

Işık mikroskobu için örneklerin hazırlanması

V. fischeri'nin ergin bireyleri Temmuz 2018 tarihinde Ankara'nın Çağa Köyü ve Sinanlı beldesinden hasat edilen ekinlerin içinden toplandı. Laboratuvar ortamına getirilen bireyler, etil asetat buharı ile anestezi edildi ve %70 etil alkol içerisinde türün iç organları

J.Het.Turk., 1(1-2), Nov 2019 (eISSN 2687-3249)

disekte edildi. Sindirim sistemi ile birlikte çıkartılan tükürük bezleri % 10 Formaldehit içerisinde tespit edildi. Örnekler yükselen etil alkol serilerinden (%70, %80, %90, %96 ve % 100) geçirildikten sonra parafin bloklar içine gömüldü.
Parafin bloklardan alınan yaklaşık 6-7 mikron kalınlığındaki kesitler ışık mikroskobu incelemeleri için Hematoksilen-Eosin ve Mallory'nin 3'lü boyası ile boyandı. Kesitler Olympus BX51 mikroskobu kullanılarak incelendi ve fotoğraflandı.

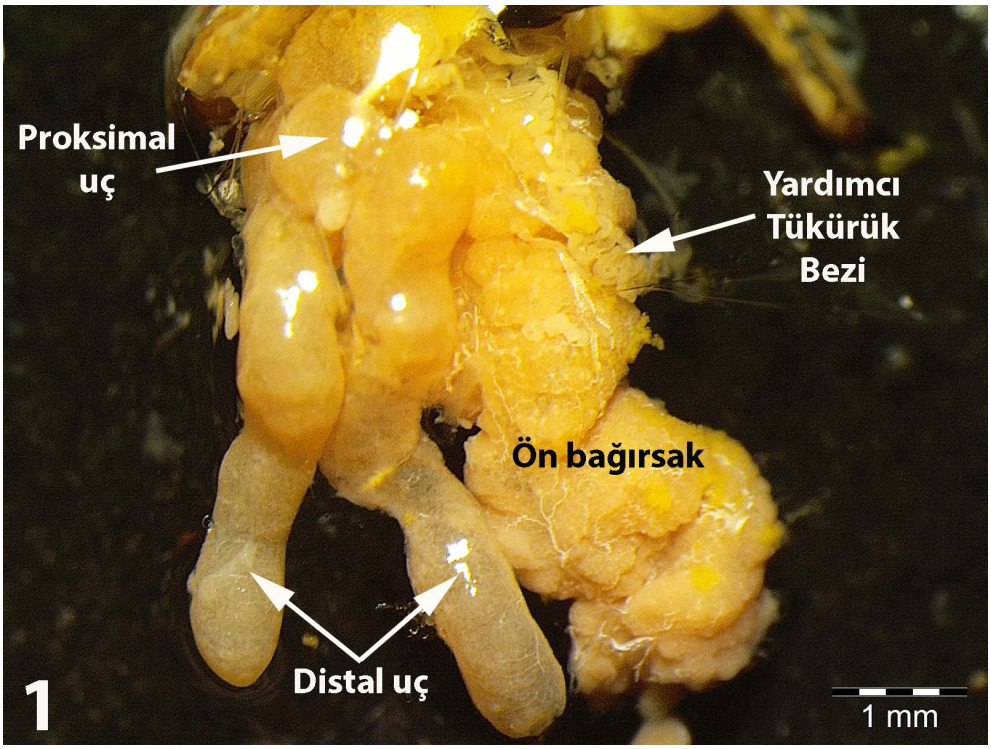
Taramalı elektron mikroskobu için örneklerin hazırlanması (SEM)

Taramalı elektron mikroskobu (SEM) için, disekte edilen örnekler % 2,5 gluteraldehit içerisinde en az 24 saat tespit edildikten sonra fosfat tamponuyla yıkanmış ve ardından yükselen alkol serilerinden geçirilmiştir.
İki kez amil asetat içerisinde bekletilen örnekler kritik noktada kurutma cihazı kullanılarak (Polaron, CPD 7501) kurutulmuştur. Kurutulan örnekler çift taraflı bantlarla SEM stablarının üzerine yapıştırılmış ve Polaron SC 502 kaplama cihazı ile altınla kaplanmıştır.
Daha sonra 5-10 kV voltajda JEOL JSM 6060 LV SEM (Gazi Üniversitesi, Fen Fakültesi, Elektron Mikroskop Laboratuvarı, Türkiye) cihazı kullanılarak incelenmiş ve fotoğraflanmıştır.

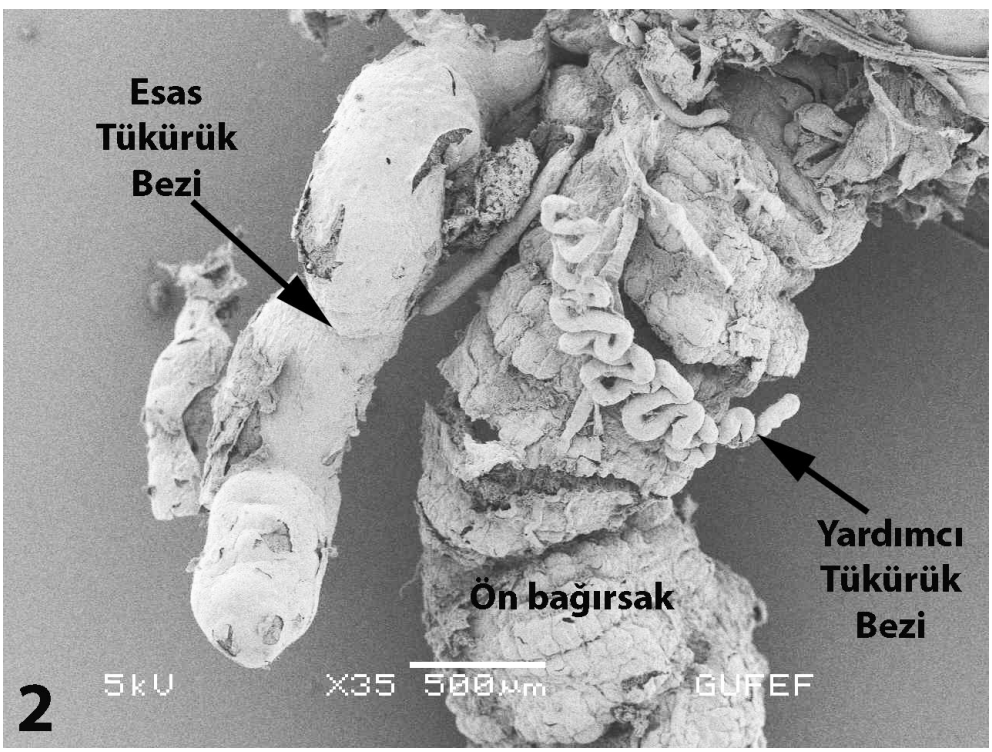
SONUÇLAR

V. fischeri'nin tükürük bezleri, bir çift esas tükürük bezi ve bir çift yardımcı tükürük bezi olmak üzere böceğin toraksında, sindirim kanalının iki tarafında, abdomenin büyük bir kısmını kapsayacak şekilde konumlanmıştır.
Bezin proksimal ucu sindirim kanalına bağlı, distal ucu ise hemolenf içerisinde serbest olarak bulunmaktadır (Şekil 1).

Esas tükürük bezi birbirine eşit olmayan, biri büyük diğeri küçük iki lobdan meydana gelmektedir. Küçük lob kısmen küreseldir. Diğer lob ise daha büyük ve daha uzun bir yapıdadır (Şekil 1, 2). Yardımcı tükürük bezi dar, tüm uzunluğu boyunca aynı kalınlıkta ve dalgalı bir yapıya sahiptir (Şekil 2).
Taramalı elektron mikroskobu görüntülerinden elde edilen veriler, esas tükürük bezlerinin iki lobunun da dış yüzeyinin oldukça düz olduğunu göstermektedir (Şekil 2, 3). Esas tükürük bezi dışta bağ dokusu, içte ise tek tabakalı kübik epitel dokuyla astarlanmıştır (Şekil 4, 5, 6) Epitel hücre çekirdekleri oval-yuvarlak şekildedir ve heterokromatin bölgeleri belirgindir (Şekil 5).
Bu hücrelerin sitoplazmasında çok sayıda salgı vezikülü bulunur (Şekil 6). Bezin lümeninde de salgı hücrelerinden salgılanan salgı granülleri gözlenir (Şekil 4, 5).
V. fischeri'nin yardımcı tükürük bezlerinin çapı, esas tükürük bezlerine oranla daha küçüktür ve S şeklinde çok sayıda kıvrımlıdır (Şekil 2, 7, 8). Yardımcı tükürük bezlerinin dış yüzeyi oldukça düzdür (Şekil 7,8).
Bezin dış yüzünde trake ağı ve bağ dokusu kılıfı içinde trakeoller taramalı elektron mikroskobu görüntülerinde seçilmektedir (Şekil 7, 9). Yardımcı tükürük bezi tek tabakalı epitelden oluşur (Şekil 9, 10). Bezin lümeni oldukça dardır ve epitelin yüzeyini çevreleyen halka şeklinde bir kitin tabakası ile astarlıdır (Şekil 9, 10). Epitel hücrelerinde salgı granülleri ve yüzeyinden kitin tabakasına doğru uzananan mikrovillüsler, hücre uzantıları belirgindir (Şekil 9, 10).

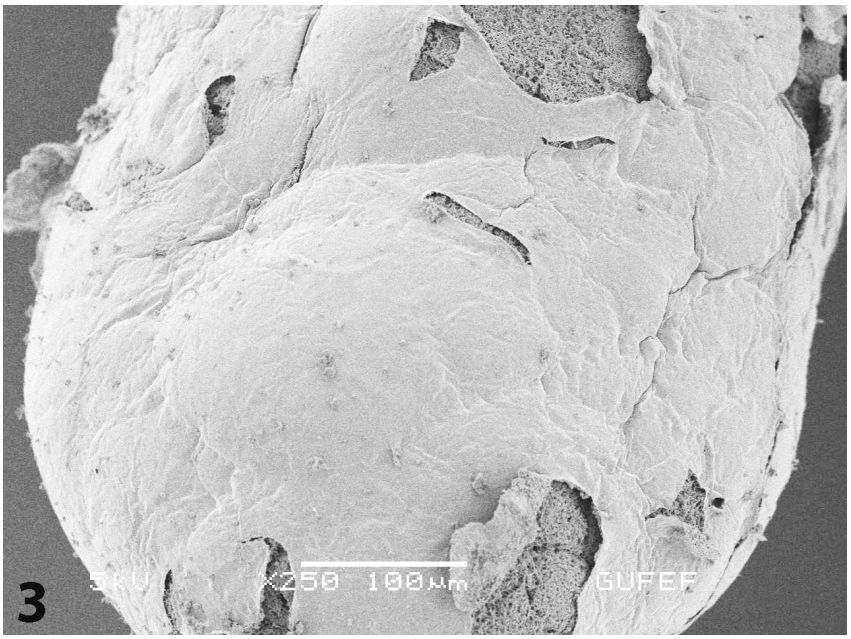


Şekil 1. Esas ve yardımcı tükürük bezlerinin stereo mikroskopta genel görünüşü.

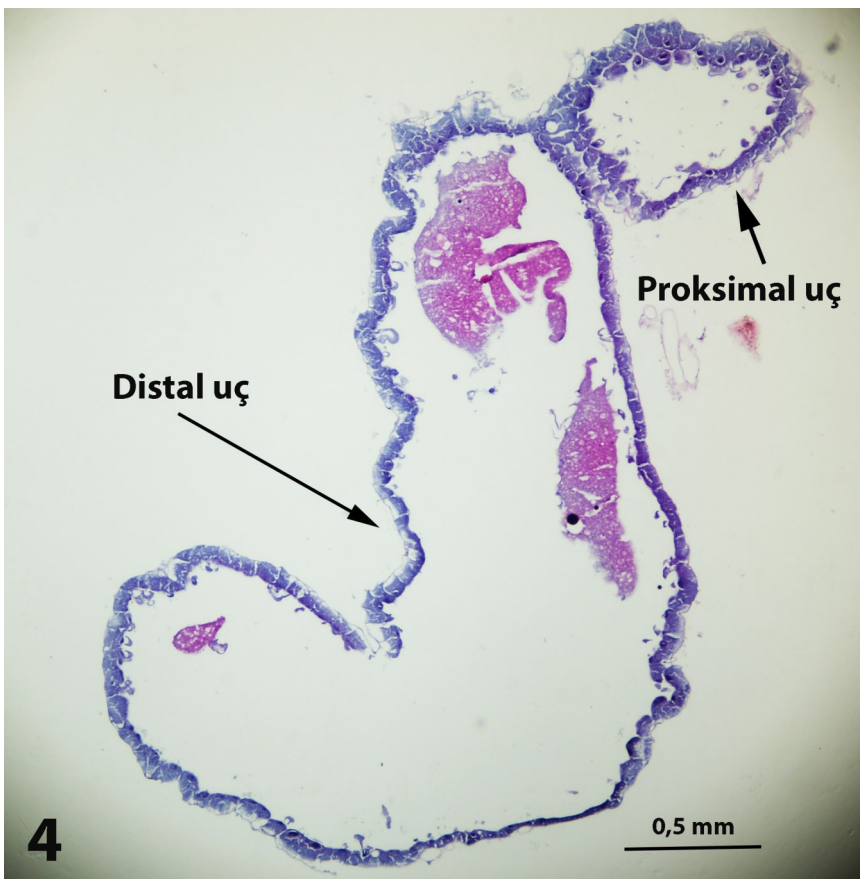


Şekil 2. Esas ve yardımcı tükürük bezlerinin taramalı elektron mikroskobundaki (SEM) genel görünüşü.

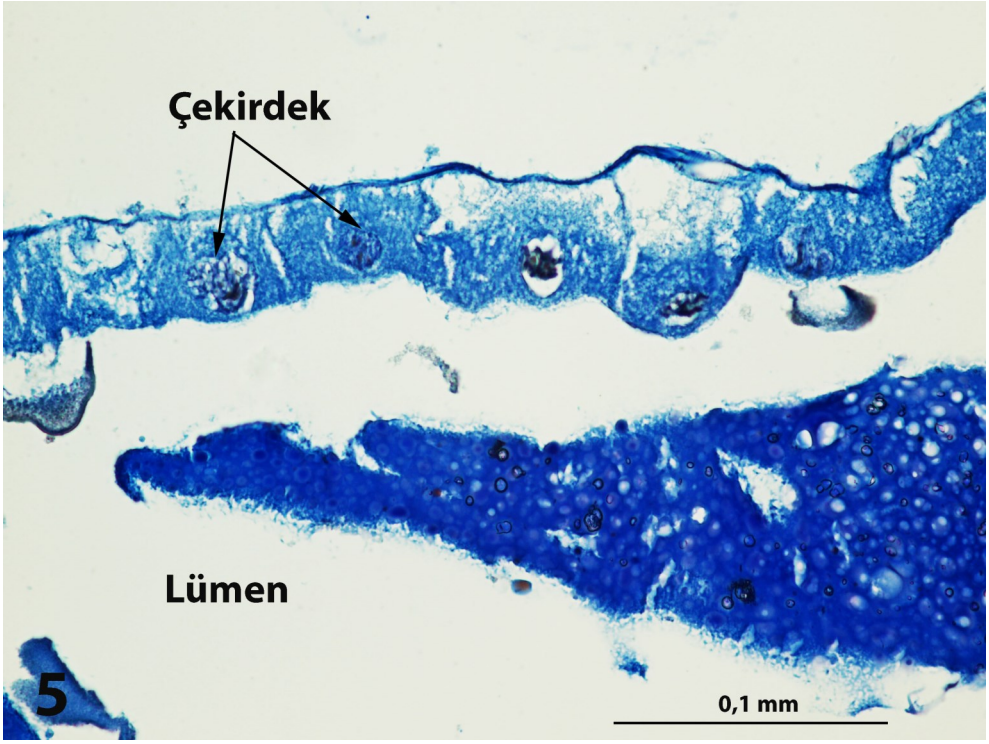
J.Het.Turk., 1(1-2), Nov 2019 (eISSN 2687-3249)



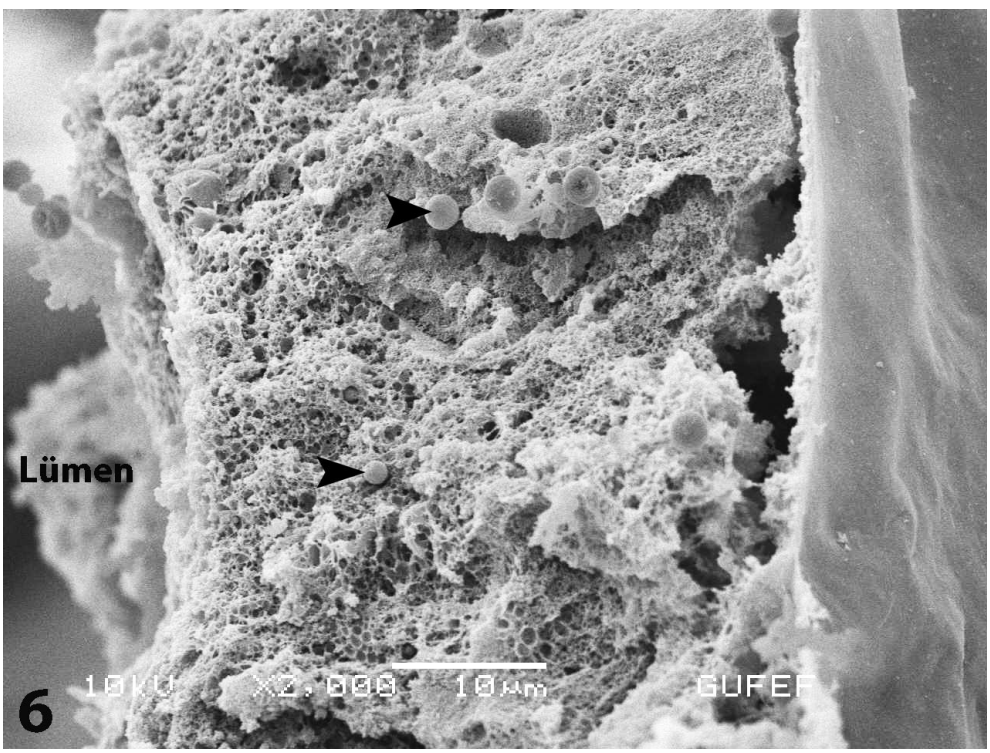
Şekil 3. Esas tükürük bezinin taramalı elektron mikroskobundaki (SEM) dış yüzeyinin görünüşü.



Şekil 4. Esas tükürük bezinin ışık mikroskobundaki boyuna kesitinin görüntüsü (Hematoksilen-Eosin boyaması, X4 büyütme).



Şekil 5. Esas tükürük bezinin ışık mikroskobundaki boyuna kesitinin görüntüsü (Mallory 3'lü boyaması, X40 büyütme).



Şekil 6. Esas tükütük bezinin taramalı elektron mikroskobundaki (SEM) kesit görüntüsü. Sal gı granülleri (►).

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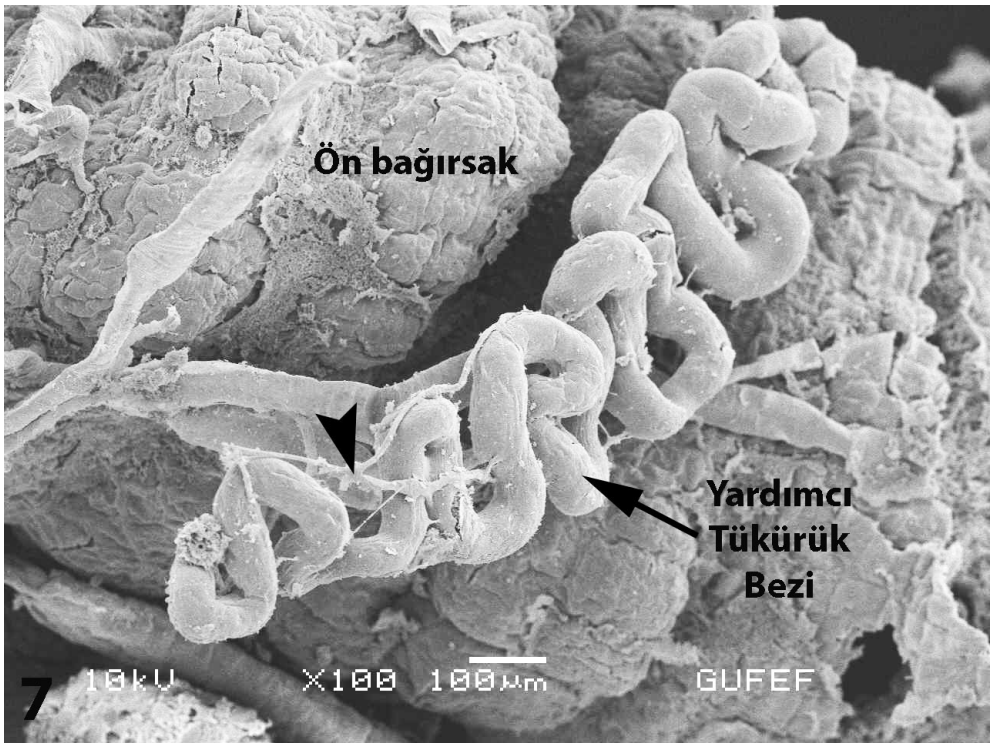
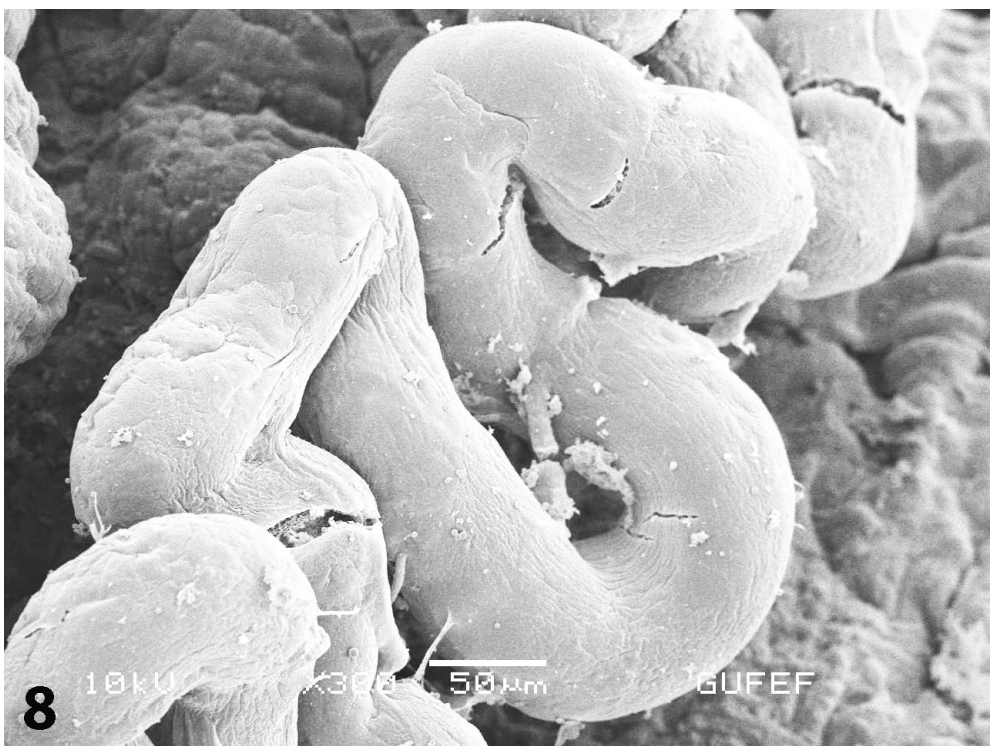
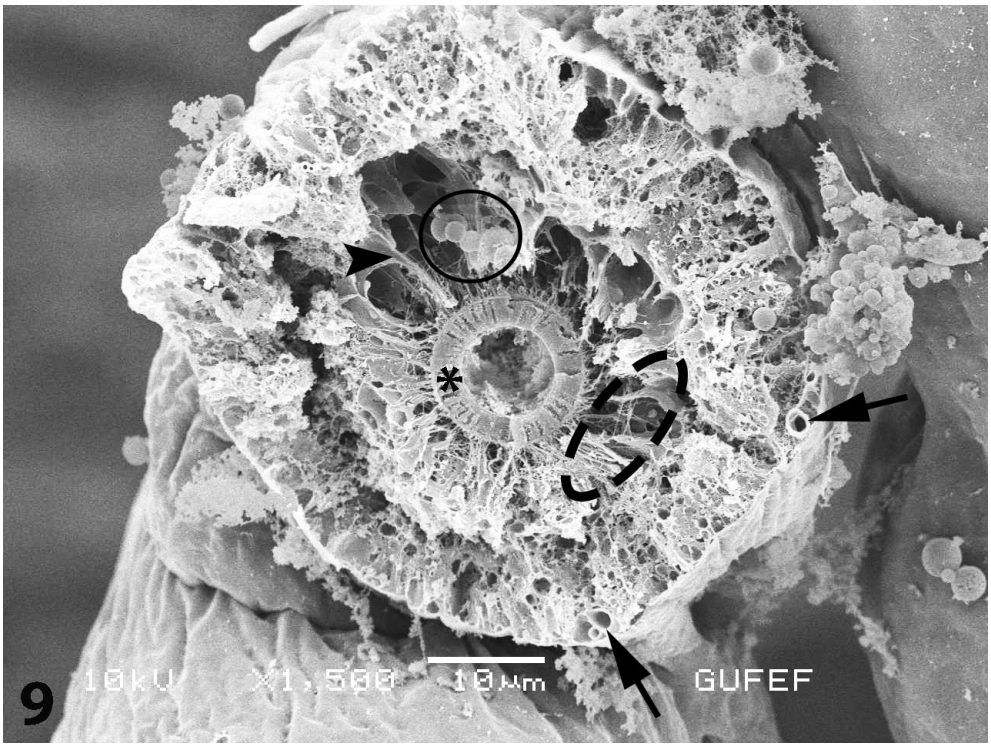


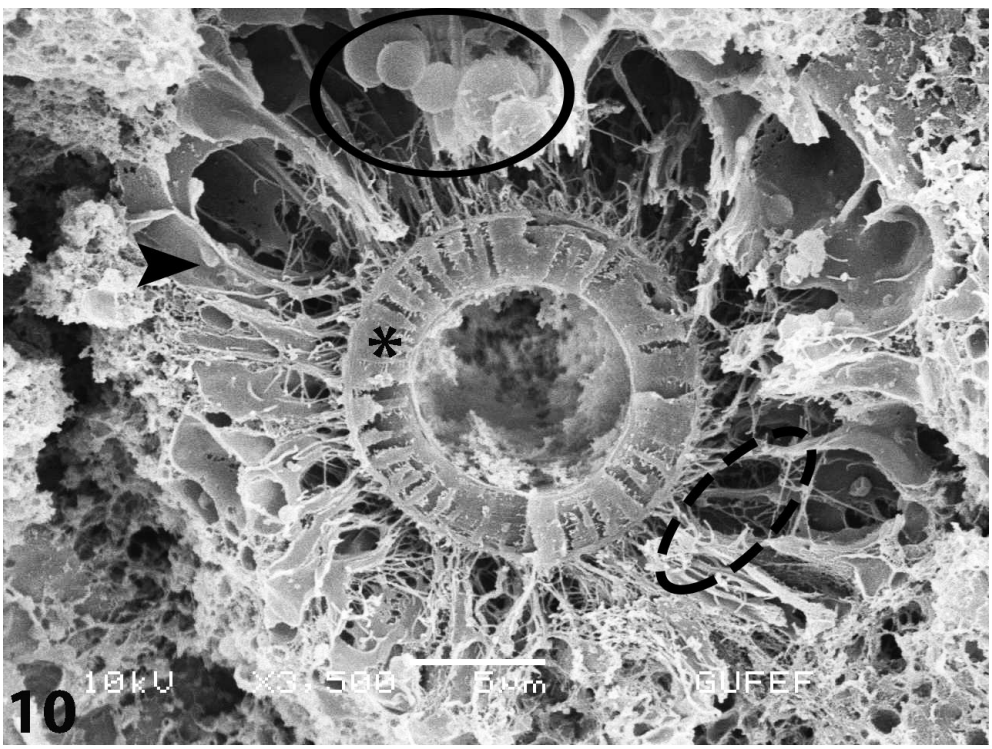
Şekil 7. Yardımcı tükürük bezinin taramalı elektron mikroskobundaki (SEM) görüntüsü. Trake (►).



Şekil 8. Yardımcı tükürük bezinin taramalı elektron mikroskobundaki (SEM) görüntüsü.



Şekil 9. Yardımcı tükürük bezinin taramalı elektron mikroskobundaki (SEM) kesit görüntüsü. Salgı granülleri (O), kitin tabakası (*), mikrovillüsler (○), hücre uzantıları (►) ve trakeol



Şekil 10. Yardımcı tükürük bezinin taramalı elektron mikroskobundaki (SEM) kesit görüntü sü. Salgı granülleri (O), kitin tabakası (*), mikrovillüsler (○), hücre uzantıları (►).

TARTIŞMA

Tükürük bezlerinden salgılanan tükürüğün böceklerdeki en temel işlevi, ağız parçalarının nemlendirilmesi, besinlerin kısmen sindirimi ve besinlerin ön bağırsak boyunca taşınmasına yardımcı olmaktır (Walker, 2009). İncelenen en karmaşık böcek tükürük bezleri Heteroptera'da görülür. Bu karmaşıklık, bu taksondaki türlerin beslenmesinin delici emici ağız tipine sahip olmasıyla ilgilidir (Miles, 1972; Terra & Ferreira, 1994; Cohen, 1995; Zeng & Cohen, 2000, Amutkan ve diğerleri, 2015, 2017). Heteroptera'da sindirim enzimleri direk besine enjekte edildiğinden dolayı sindirim olayı çok erken başlar. Bu beslenme tarzı büyük ölçüde farklı işlevler sunan çok sayıda tükürük içeriğine dayanır (Walker, 2009).

Tükürük bezlerinin büyüklüğü ve şekli böcek taksonlarında oldukça değişkendir. Bezler genellikle toraks hizasında, ön bağırsağın iki tarafında konumlanırlar, fakat bazen kafaya doğru, bazen de karın içine doğru uzanabilir. Nispeten basit veya karmaşık bir şekilde dallanmış ve kıvrılmış olabilirler (Baptist, 1941). Genel olarak, Hemiptera takımına ait türlerin tükürük bezleri esas ve yardımcı tükürük bezleri olmak üzere iki ana bölüme ayrılır. Esas tükürük bezi genellikle iki veya daha fazla loba ayrılır. Yardımcı tükürük bezi genellikle uzun kanal şeklindedir. Heteroptera türleri arasında tükürük bezlerinde önemli farklılıklar vardır (Baptist, 1941; Walker, 2009; Chapman, 2013; De Castro ve diğerleri, 2013; Martínez ve diğerleri, 2014). *V. fischeri*'nin esas tükürük bezleri tüp şeklinde bir yapıya sahiptir. Buna karşılık, *Solubea pugnax*'ın tükürük bezlerinin posterior kısmı (Heteroptera: Pentatomidae) (Hamner, 1936) parmak benzeri çıkıntılar göstermektedir. *Cimex hemipterus*'ta (Hemiptera: Cimicidae), esas tükürük bezi oval, yardımcı tükürük bezleri yuvarlak şekildedir (Serrão ve diğerleri, 2008). Buna karşın, *Brontocoris tabidus*'un (Heteroptera, Pentatomidae) (Azevedo ve diğerleri, 2007) tükürük bezlerinin yapısının, *Podisus nigrispinus*'un (Heteroptera: Pentatomidae) (Oliveira ve diğerleri, 2006) tükürük bezlerinin yapısına benzer şekilde iki loblu olduğu bildirilmiştir. Bu farklılıkların, böceklerin yaşları ve farklı beslenme şekillerinin bir sonucu olabileceği vurgulanmıştır (Baptist, 1941; Serrão ve diğerleri, 2008; Kumar & Sahayaraj, 2012).

V. fischeri'nin tükürük bezlerinin anatomisinin *Pentatoma rufipes* (Baptist, 1941), *Supputius cincticeps* (De Castro ve diğerleri, 2013), *P. nigrispinus* (Martínez ve diğerleri, 2014), *B. tabidus* (Azevedo ve diğerleri 2007) ve diğer Pentatomidae türlerine (Heteroptera) (Baptist, 1941; Amutkan ve diğerleri, 2015) benzerlik gösterdiği görülmüştür. Bununla birlikte, *Belostoma lutarium* (Hemiptera, Belostomatidae) (Swart & Felgenhauer, 2003), *C. hemipterus* (Hemiptera: Cimicidae) (Serrão ve diğerleri, 2008) ve *Karenia caelatata* (Homoptera: Cicadidae) (Zhong ve diğerleri, 2013) ve *Mahanarva posticata* (Homoptera: Cercopidae) (Roma ve diğerleri, 2003) gibi diğer bazı Hemiptera türleri ile farklılıklar bildirilmiştir. Tükürük bezlerinin yapısındaki bu benzerlikler ve farklılıklar, bezlerin fonksiyonlarını ve türlerin beslenme şekillerinin anlaşılmasına katkı sağlamaktadır. Ayrıca, bu çalışma tükürük bezleri ile ilgili gelecekteki araştırmalar için önemli bilgiler sunmaktadır.

TEŞEKKÜRLER

Türün teşhis edilmesindeki yardımlarından dolayı Prof. Dr. Suat KIYAK'a (Gazi Üniversitesi, Fen Fakültesi, Biyoloji Bölümü) teşekkürlerimizi sunarız.

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AUTHOR GUIDELINES

Aims & Scope

The *Journal of the Heteroptera of Turkey* is a biannual peer reviewed international journal that publishes original articles, review articles, and short communication on all aspects of Heteroptera.

The *Journal of the Heteroptera of Turkey* publishes qualified research articles on the systematics, taxonomy, faunistical and ecology of heteroptera suborder. The topic of the research may include a wide range of heteropteran fields. Detailed studies on systematics, morphology, ecology, and phenology of heteroptera, and the biological, ecological, and faunistic formation of heteroptera taxons.

In this Journal full-papers and short communications containing original researches on any aspect of heteropteran in palaearctic region and Turkey will be considered as publication.

The *Journal of the Heteroptera of Turkey* welcomes review articles in the field of heteropteran.

The *Journal of the Heteroptera of Turkey* also published short notes on heteropteran topics. Information of the heteropteran specialists and book reviews will also be published.

We would like to make an open invitation to all potential contributors. We have a fast publishing process to process and evaluate.

Taxonomic revisions and descriptions of individual species will be accepted especially if additional information is included on habitat preferences, behavior, phenology etc. Descriptions of single specimens are discouraged.

For submitted article there are restrictions on the subject, author, geographic area, and so on of any submission (palaearctic only). For our journal mission all fields of heteroptera studies are suitable.

All papers being peer-reviewed by two referees, and under rapid publication process.

Preparation of Manuscript

All manuscripts should be written in the Turkish or English languages to be published only in the Journal of the Heteroptera and should be prepared with Microsoft Word.

Manuscripts should be written on A4 (21 cm x 29.7 cm) paper with margins of at least 2 cm in width.

All pages should be numbered consecutively. Manuscripts should be organized in the following order: Title, abstract, brief introduction, materials and methods, results, discussion, acknowledgments, references, tables and figure legends.

Parts of the Manuscript should be:

Arrange manuscripts in this order: title; name(s), address(es) and e-mail address(es) of the corresponding author(s) who will receive and approve the page proofs (research articles only); keywords; text; acknowledgments; references; tables and figure legends.

Title: The title of the manuscript should be informative and clear, not exceed 15-20 words. Just under the title full name(s) of author(s); (surname(s) in capital letters; full address(es); e-mail address(es); if available, ORCID numbers for all authors, Corresponding Author contact information should be give (each on a separate line).

Abstract: The abstract should not exceed 250-300 words (maximum), should be one paragraph.

Keywords: For subject indexing, up to 6 topical keywords in English are required (for Turkish articles).

Text: Introduction, Materials and Methods, Results, Conclusion and Discussion, Acknowledgments, References, Figure and table legends.

Use italics for Scientific names of genera, species, and subspecific taxa.
Do not use italics for abbreviations such as “spp.”, “sp.”, “ssp.”, ”var.”, ”gen.nov.”, “sp.n.”, “ssp.nov.”, “stat.n.”, “comb.n.”, “s.l.”, “s. str.”, “et al.”, and names of taxa of rank higher than genus.
For faunistic research follow this order: Taxon name, Material examined, Habitat, Host plant(s), Distribution. Example:
Miridae Hahn, 1831
Deraeocoris rutilus (Herrich-Schaeffer, 1838)
Habitat: The specimens belonging to *D. rutilus* (H.,-S., 1838) were found on *Carduus pycnocephalus* subsp. *albidus* (Bieb) Kazmi.
Materials examined: 1 male, 24.6.1996 (Loc. 1), 1 female, 24.6.1996 (Loc.6).

J.Het.Turk., 1(1-2), Nov 2019 (eISSN 2687-3249)

Distribution in Turkey: The Aegean, the Marmara, and the Anatolia regions (18,10,8,13,29).
Distribution in the world: Israel, Sardinia, Syria, Cyprus, Poland, the Balkans, Russia, and Turkey (18,25).

References: References should be prepared according to "*The Guidelines to Authors*".

The complete reference list should appear alphabetically by name at the end of the paper. A sample of the most common entries in reference lists appears below. Please note that a DOI should be provided for all references where available.

References must be cited in the text as (Dursun, 2013), Fent & Dursun (2005) or Fent et al. (1997), or in a parenthesis (Dursun, 2013; Fent & Dursun, 2005; or Fent et al. ,1997).

Journal article: Abbreviate names of periodicals basically according to the World List of Scientific Periodicals, 4th Edition, Butterworths, London, 1964–1965. (If you are not certain about the correct abbreviation, give the journal's name in full).

Fent, M., Kment, P., Elipek-Çamur, B., Kırgız, T., 2011, Annotated catalogue of Enicocephalomorpha, Dipsocoromorpha, Nepomorpha, Gerromorpha and Leptopodomorpha (Hemiptera: Heteroptera) of Turkey with new records, *Zootaxa*, 2856:1-84.

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No Author Given: (USDA) U.S. Department of Agriculture. 2001. Title. USDA, Beltsville, MD. (IRRI) International Rice Research Institute. 2001. Title. IRRI, City, State or Country.

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Online Citations/ Websites: Rabitsch, W., 2005, Spezialpraktikum aquatische und semiaquatische Heteroptera; (Web page: http: homepage.univie.ac.at/wolfgang.rabitsch).(Date accessed: May 2010).

Using the DOI (Digital Object Identifier) Number: Nestel D., Papadopoulos N. T. & Miranda Chueca M. A. (2008). Current advances in the study of the ecology of fruit flies from Europe, Africa and the Middle East. *Journal of Applied Entomology*, DOI: 10.1111/j.1439-0418.2008.01378.x

Please note on the illustrations, figure, table, and photographs legends: Illustrations should be arranged into blocks or plates by the author(s). Figures should be provided electronically in either JPG or TIFF format. JPG images should be the highest resolution possible. TIFF images should be at 300 dpi resolution.

Morphological illustrations (if not schematic) and **photographs/** electron microscope micrographs should include scale bars. Photographs and electron microscope micrographs must be in JPEG file format (300 dpi).

Images pasted into Word become low-resolution and cannot be used in print.

Photographs should be high-contrast, black and white or color. Lettering should be typed and legible. All papers should be accompanied by information on the credited photographer or copyright holder. If the photographer or copyright holder is not an author on the paper, then permission must be granted by the copyright holder.

Tables should be numbered consecutively and include headings and explanations. References in the text to illustrations (schematic, photographs) and tables into parenthesis: e.g.(Fig.1) (Figs.1–4) (Table 1.) (Table 1., Figs.1-4). Morphological illustrations should be provided with scale bars.

Taxonomic papers in *JHT* must follow the *requirements below:* Follow all requirements of the current *International Code of Zoological Nomenclature* (4th edition 1999), and be followed the recommendations of the Code.

A holotype should always be designated for each newly described species-level taxon and at least holotypes should be deposited in public collections that provide long-term care and access for study (note that such deposition is mandatory for neotypes). For this reason, two particular recommendations (73A and 16C) should be observed in JHT.

In the Abstract must be listed new combinations, new status, new taxa, new synonyms, etc. in. The list of synonymized names must indicate their disposition. For newly should be described taxa included for all newly synonymized or combined names. Use "sp. n.", "gen. n." etc.. **Important note:** Descriptions based on single specimens are discouraged.

The standard order of sections for description a species is: "Diagnosis", "Description", "Material", "Type locality", "Etymology", "Distribution", "Biology", and other comments if appropriate. Author(s) of species name must be provided when the scientific name of any animal species is first mentioned. (The year of publication is not compulsory. ıf you give it, then provide a full reference of this in the reference list.)

It is the *author's responsibility* to know the group, both material and literature, well enough (preferably on a worldwide basis) to be able to ensure that all relevant taxa were taken into account and that any new taxa proposed have not already been described from elsewhere.

Accepted manuscripts are published online and in two issues at the end of May and December.