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Species of Cixiidae and Issidae (Hemiptera: Auchenorrhyncha: Fulgoromorpha) Distributed in Sinop and Kastamonu (North Turkey)

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Abstract

In this study, Cixiidae and Issidae (Hemiptera: Auchenorrhyncha) species collected from various localities in Sinop and Kastamonu between the years 2016-2018 were evaluated. 12 species belonging to 7 genera from Issidae and 4 species belonging to 4 genera from Cixiidae were determined. In addition, distributional data of the species in Turkey and in the world, and collection localities were given. Among the identified species, *Kervillea placophora*, *Mycterodus confusus* (Issidae) and *Reptalus panzeri* (Cixiidae) were recorded for the first time from the Black Sea Region of Turkey.

Keywords: Issidae, Cixiidae, Black Sea Region, Turkey

1. INTRODUCTION

According to Demir [1], Turkey Fulgoromorpha fauna is represented by 219 species belonging to 12 families. Families from Fulgoromorpha group located in Turkey are: Achilidae, Caliscelidae, Cixiidae, Delphacidae, Derbidae, Dictyopharidae, Flatidae, Issidae, Meenoplidae, Ricaniidae, Tettigometridae ve Tropiduchidae [2, 3].

Cixiidae Spinola, 1839 is represented worldwide with 2416 species belonging to 221 genera [4]. 22 genera and 212 species in the Palearctic Region [5, 6]. According to Kalkandelen [7], Cixiidae fauna of Turkey consist of 48 species belonging

to 12 genus. In the following years, this number increased to 51 with new records [8, 9, 10]

Issidae Spinola, 1839 is a large family of the Fulgoromorpha group, with more than 1000 species identified throughout the world [4]. Issidae family is examined under 3 tribus in modern classification: Issini, Haemisphaeriini and Parahiraciini. Issini forms the largest group with 755 species and subspecies belonging to 129 genera. It is a rich group that includes economically harmful species that distributed in all zoogeographical areas [11] Issidae has 445 species in the Palearctic Region and 102 species in Turkey. With this number, Turkey is the most rich country in the Palearctic Region [12].

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This study is carried out to determine the species of Cixiidae and Issidae which are known as potential vectors of phytopathogens in Sinop and Kastamonu. And also in order to contribute to Turkey's insect fauna and taxonomic status of detected species from the region.

2. MATERIAL AND METHODS

The specimens were collected by sweeping net and a hand aspirator over the plants during the daytime between May 2016 and October 2018 from different localities in Sinop and Kastamonu provinces. The collected samples were taken in insect killing jars, labeled and brought to the laboratory and placed in insect storage packages. The material to be prepared was taken from the insect storage packages and put in 5% acetic acid and softened a few hours. The genital capsule of males were separated from the body with the help of a dissecting needle. The remaining body part of the insects was attached to the rectangular insect preparation label with a needle attached to one end, from the ventral with the help of cellulosic adhesive. In the genital capsule, genital structures which have taxonomically reliable characteristics, aedeagus, stylus, connective, pygofer, genital plate, anal tube in males and pregenital sternite VII in females, were separated. From the materials prepared, shape, size, structure, color, patterning and features of the genital structures were examined under the microscope and they were identified by being compared with diagnosed museum materials and current literature.

Examples are stored at Sinop University, Faculty of Arts and Sciences, Department of Biology, Invertebrata Laboratory.

3. RESULTS

3.1. Familya: Cixiidae Spinola, 1839

Genus: *Hyalesthes* Signoret, 1865

***Hyalesthes obsoletus* Signoret, 1865**

Material examined: Sinop: 13.06.2017, 41° 45' 40.7" N 34° 58' 32.4" E (7 ♀♀), 06.08.2017, 41°

49' 54.0" N 35° 05' 21.1" E (6 ♂♂, 1 ♀), 12.08.2017, 41° 25' 13.1" N 34° 58' 44.2" E (2 ♂♂, 5 ♀♀), 17.08.2017, 41° 46' 17.8" N 35° 12' 20.4" E (1 ♀), 42° 01' 04.8" N 35° 05' 30.0" E (1 ♀); Kastamonu: 19.07.2018, 41° 46' 38.3" N 33° 43' 05.8" E (2 ♂♂, 2 ♀♀)

Distribution in Turkey: Adana, Adapazarı, Adıyaman, Afyon, Ağrı, Ankara, Antalya, Aydın, Balıkesir, Bolu, Burdur, Bursa, Çanakkale, Çankırı, Çorum, Diyarbakır, Düzce, Edirne, Erzincan, Elazığ, Erzurum, Eskişehir, Gaziantep, Giresun, Hakkâri, Iğdır, Isparta, İstanbul, Kahramanmaraş, Kars, Konya, Malatya, Mardin, Manisa, Mardin, Mersin, Muğla, Nevşehir, Ordu, Rize, Sakarya, Sinop, Sivas, Şanlıurfa, Tokat, Trabzon, Van [1, 2, 3]

Zoogeographic distribution: Albania, Austria, Balearic Islands, Bosnia and Herzegovina, Bulgaria, Corsica, Crete Croatia, Cyprus, Czech Republic, Dodakenes Islands, East Palearctic, France, Germany, Greece, Hungary, Italy, Kiklades Islands, Macedonia, Malta, Near East, North Aegean Islands, North Africa, Portugal, Romania, Russia (Central Europe), Russia (Southern Europe), Sardinia, Sicily, Slovakia, Slovenia, Spain, Switzerland, Turkey, Ukraine, Yugoslavia [13]

Genus: *Reptalus* Emeljanov, 1971

***Reptalus (Reptalus) panzeri* (Löw, 1883)**

Material examined: Sinop: 17.08.2017, 41° 46' 02.5" N 35° 12' 11.0" E (1 ♂, 1 ♀)

Distribution in Turkey: Ankara, Çankırı [3]

Zoogeographic distribution: Algeria, Armenia, Austria, Azerbaijan, Belgium, Bulgaria, Czechoslovakia, England, France, Germany, Georgia, Italy, Kazakhstan, Poland, Romania, Spain, Tunisia, Turkey, Ukraine, Yugoslavia [13]

Genus: *Setapius* Dlabola, 1988

***Setapius barajus* (Dlabola, 1957)**

Material examined: Sinop: 17.08.2017, 41° 46' 02.5" N 35° 12' 11.0" E (1 ♂)

Distribution in Turkey: Adana, Ağrı, Ankara, Bursa, Denizli, Diyarbakır, Elazığ, Erzincan, Erzurum, Gümüşhane, İzmir, Iğdır, Kars, Malatya, Mardin, Muş, Nevşehir, Samsun, Sinop, Siirt, Sivas, Uşak [14].

Zoogeographic distribution: Afghanistan, Armenia, Iran, Russia, Turkey [3, 15]

Genus: *Tachycixius* Wagner, 1939

Tachycixius (Eupalame) desertorum (Fieber, 1876)

Material examined: Sinop: 12.08.2017, 41° 36' 03.5" N 34° 51' 28.3" E (1 ♀), 17.08.2017 42° 01' 04.8" N 35° 05' 30.0" E (2 ♂♂)

Distribution in Turkey: Ankara, Adıyaman, Antalya, Artvin, Diyarbakır, Edirne, Eskişehir, Gaziantep, Hakkari, İstanbul, İzmir, Kastamonu, Konya, Mersin, Manisa, Mardin, Muğla, Nevşehir, Sakarya, Sinop, Uşak [3]

Zoogeographic distribution: Albania, Bulgaria, Cyprus, Czech Republic, Greece, Hungary, Italy, Near East, Romania, Russia (Southern Europe), Sicily, Slovakia, Turkey, Ukraine, Yugoslavia [13]

3.2. Familya: Issidae Spinola, 1839

Genus: *Agalmatium* Emeljenov, 1971

Agalmatium bilobum (Fieber, 1877)

Material examined: Sinop: 12.08.2016 41° 45' 40.7" N 34° 58' 32.6" E (4 ♂, 1 ♀)

Distribution in Turkey: Adapazarı, Adıyaman, Afyon, Ankara, Antalya, Alanya, Aydın, Balıkesir, Bilecik, Burdur, Bursa, Çanakkale, Çorum, Denizli, Eskişehir, Gaziantep, Gümüşhane, İzmir, Kütahya, Konya, Malatya, Manisa, Muğla, Tekirdağ, Tokat, Uşak [1, 3]

Zoogeographic distribution: Bulgaria, France, Germany, Greece, Italy, Moldova, Near East, North Africa, Portugal, Russia (Southern Europe), Sardinia, Spain, Turkey, Yugoslavia [13]

Agalmatium flavescens (Olivier, 1791)

Material examined: Sinop: 12.08.2016, 41° 45' 40.7" N 34° 58' 32.6" E (1 ♂, 1 ♀); 30.07.2017, 41° 38' 30.8" N 34° 36' 42.7" E (18 ♂♂, 12 ♀♀); 06.08.2017, 41° 49' 54.0" N 35° 05' 21.1" E (25 ♂♂, 24 ♀♀); Kastamonu: 19.07.2017, 41° 37' 07.0" N 34° 37' 32.0" E (34 ♂♂, 37 ♀♀).

Distribution in Turkey: Ankara, Bursa, Çorum, Edirne, İstanbul, Kastamonu, Konya, Tekirdağ, Van, Zonguldak [1, 3]

Zoogeographic distribution: Africa, Albania, Austria, Bulgaria, Canary Islands, Cyprus Czech Republic, France, Greece, Hungary, Italy, Moldova, Near East, Northern Poland, Portugal, Romania, Sardinia, Sicily, Spain, Switzerland, Turkey, Yugoslavia [13]

Genus: *Kervillea* de Bergevin, 1918

Kervillea (Kervillea) placophora Horváth, 1905

Material examined: Kastamonu: 12.08.2016, 41° 40' 27.6" N 33° 55' 48" E (1 ♂, 1 ♀)

Distribution in Turkey: Eskişehir- Ilgın arası, Yozgat [16]

Zoogeographic distribution: Israel, Russia, Turkey [3]

Genus: *Latilica* Emelyanov, 1971

Latilica antalyica (Dlabola, 1986)

Material examined: Sinop: 17.08.2017, 41° 46' 02.5" N 35° 12' 11.0" E (17 ♂♂, 21 ♀♀)

Distribution in Turkey: Amasya, Antalya, Hatay, Muğla, Samsun [9, 17]

Zoogeographic distribution: Greece, Turkey [12]

Genus: *Mycterodus* Spinola, 1839

Mycterodus (Mycterodus) confusus Stal, 1861

Material examined: Sinop: 27.05.2017, 41° 44' 52.0" N 34° 57' 40.9" E (16 ♂♂, 20 ♀♀), 41° 47'

38.7' N 35° 09' 46.8" E (14 ♂♂, 18 ♀♀); 01.06.2017, 41° 52' 31.3" N 34°51'0.95"E (10 ♂♂, 10 ♀♀); 18.06.2017, 42° 00' 505" N 34° 56' 906" E (12 ♂♂, 6 ♀♀); 07.06.2017, 42° 03' 22.8" N 34°59'32.2" E (2 ♂♂, 2 ♀♀); Kastamonu: 20.05.2017, 41° 52' 48.9" N 33° 42' 38.0" E (24 ♂♂, 14 ♀♀); 16.06.2017, 41° 39' 33.3" N 33° 08' 01.9" E (12 ♂♂, 5 ♀♀); 15.06.2017, 41° 52' 49.0" N 33° 42' 38.1" E (8 ♂♂, 10 ♀♀)

Distribution in Turkey: İstanbul, Karaman [18]

Zoogeographic distribution: Near East, Turkey, Ukraine, Yugoslavia [13]

Mycterodus (*Mycterodus*) *rostratulus*
Emelyanov, 1964

Material examined: Sinop: 01.06.2016, 41° 84' 42.6" N 35° 09' 06.68" E (1 ♂, 1 ♀); 08.06.2017, 42° 01' 21.6" N 35° 12' 06.8" E (26 ♂♂, 29 ♀♀); Kastamonu: 20.05.2017, 41° 58' 10.7" N 34° 05' 22.7" E (22 ♂♂, 12 ♀♀); 16.06.2017, 41° 38' 29.7" N 33° 07' 05.1" E (11 ♂♂, 6 ♀♀); 15.06.2017, 41° 46' 38.3" N 33° 43' 05.8" E (9 ♂♂, 10 ♀♀)

Distribution in Turkey: Ankara, Samsun, Ordu [9, 17]

Zoogeographic distribution: Caucasia, Russia (Southern Europe) [13, 17]

Genus: *Scorlupella* Emelyanov, 1971

Scorlupella assimilis (Horvath, 1905)

Material examined: Kastamonu: 19.05.2017, 41° 38' 35.8" N 33° 07' 13.9" E (10 ♂♂)

Distribution in Turkey: Manisa, Konya-Kayseri arası, Tokat [3, 19]

Zoogeographic distribution: Turkey [3]

Scorlupella discolor Germar, 1821

Material examined: Sinop: 13.06.2017, 41° 36' 10.0" N 34° 51' 12.5" E (6 ♂♂, 2 ♀♀); Kastamonu: 19.05.2017, 41° 36' 45.4" N 33° 07' 02.9" E (25 ♂♂, 20 ♀♀), 41° 38' 35.8" N 33° 07' 13.9" E (6 ♂♂, 2 ♀♀); 20.05.2017, 41° 52' 48.9" N 33° 42' 38.0" E (24 ♂♂, 20 ♀♀), 14.06.2017, 41° 14' 03.9"

N 34° 00' 45.6" E (12 ♂♂, 20 ♀♀); 16.06.2017, 41° 42' 09.1" N 33° 26' 41.9" E (6 ♂♂, 2 ♀♀)

Distribution in Turkey: Ankara, Amasya, Edirne, Erzincan, Samsun, Yozgat [14, 17, 19, 20]

Zoogeographic distribution: Bulgaria, İtalian, Near East, Romania, Turkey, Ukraine [13]

Scorlupella montana (Becker, 1865)

Material examined: Sinop: 27.05.2017, 41° 32' 45.1" N 34° 47' 0.01" E (6 ♂♂)

Distribution in Turkey: Ankara, Amasya, Erzincan, Kars, Konya, Samsun, Tokat [1, 3, 19]

Zoogeographic distribution: Azerbaijan, Armenia, Georgia (?), Greece Iran, Kazakhstan, Kyrgyzstan, Moldavia, Romania, Russia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan [12]

Genus: *Tshurtshurnella* Kusnezov, 1927

Tshurtshurnella extrema (Dlabola, 1980)

Material examined: Sinop: 12.08.2017, 41° 36' 03.5" N 34° 51' 28.3" E (1 ♂, 1 ♀)

Distribution in Turkey: Ankara, Çorum [17, 21]

Zoogeographic distribution: Turkey

Tshurtshurnella yozgatica Kartal, 1985

Material examined: Kastamonu: 19.07.2017, 41° 37' 07.0" N 34° 37' 32.0" E (4 ♂♂, 5 ♀♀)

Distribution in Turkey: Amasya, Çorum, Samsun, Yozgat [17, 19]

Zoogeographic distribution: Turkey

Genus: *Issus* Fabricius, 1803

Issus muscaeriformes (Von Schrank, 1781)

Material examined: Sinop: 12.08.2016, 41° 45' 40.7" N 34° 58' 32.6" E (1♂)

Distribution in Turkey: Samsun, Giresun [17]

Zoogeographic distribution: Austria, Bulgaria, Czech Republic, Denmark, France, Germany, Greece, Hungary, Italy, Netherlands, Norway, Poland, Romania, Slovakia, Sweden, Switzerland, Yugoslavia [13]

4. DISCUSSION

Turkey is considered as one of the main centres for diversification of Issidae taxa, with 102 species and 4 subspecies recorded so far [12].

In the study, 12 species of Issidae were determined: *Agalmatium flavescens*, *A. bilobum*, *Issus muscaeriformis*, *Kervillea placophora*, *Latilica antalyica*, *Mycterodus confusus*, *M. rostratulus*, *Scorlupella assimilis*, *S. discolor*, *S. montana*, *Tshurtshurnella extrema* and *T. yozgatica* from research area. It has been found that they are generally found in thorny plants and vegetation in bush form. Among the identified species, *K. placophora* and *M. confusus* were recorded for the first time from the Black Sea Region of Turkey.

Agalmatium flavescens has a wide distribution area and it is one of the best known Issidae species that has no taxonomic problems. Highest population density was determined in the research area. Lodos and Kalkandelen [22] reported that *A. flavescens* caused damage by feeding and laying eggs on young branches and shoots of *Olea europea* L. and *Ficus cerica* L., and the damage was not economically significant.

The type locality of *K. placophora* is between Eskişehir and Ilgın. And also recorded from Yozgat [16]. The specimens examined in this study were collected from Kastamonu.

L. antalyica is a species of Mediterranean origin. It was collected from a single locality from Sinop.

3 species belonging to the genus *Scorlupella* were identified in the study area. It has been determined that there is variation the structure of light colored membranized structure with small teeth on the tip of the aedeagus. In addition, a high rate of variation in wing veins was detected in *S. discolor* specimens. In some individuals of the same taxon,

the wing veins are light and distinct, while in others the veins are less pronounced and pale.

Scorlupella assimilis, *Tshurtshurnella extrema* and *Tshurtshurnella yozgatica* are endemic species known from Turkey. *Mycterodus rostratulus*, *Kervillea placophora*, *Latilica antalyica* and *Scorlupella discolor* species are species with narrow zoogeographic range. The region is important for endemism and more detailed studies are needed.

In the study, 4 species of Cixiidae: *Hyalesthes obsoletus*, *Reptalus panzeri*, *Setapius barajus* and *Tachycixius desertorum* were determined. It was observed that the number of individuals evaluated in this study belonging to Cixiidae was quite low. This is thought to be due to the specialization of host plants. It was concluded that more comprehensive studies focusing only on the species of this family should be conducted in order to determine the distribution, population density and host plants of the Cixiidae species distributed in the region. It is known that *R. panzeri* causes infection in the maize [23]. At the end of the study, specimens of *R. panzeri* which is distributed in Ankara and Çankırı were collected from Sinop. This record is the first from the Black Sea Region of Turkey for this taxon.

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The Declaration of Conflict of Interest/ Common Interest

"No conflict of interest or common interest has been declared by the authors".

Authors' Contribution

"The authors contributed equally to the study"

The Declaration of Research and Publication Ethics

"The authors of the paper declare that they comply with the scientific, ethical and quotation rules of SAUJS in all processes of the paper and that they do not make any falsification on the data collected. In addition, they declare that Sakarya University Journal of Science and its editorial board have no responsibility for any ethical violations that may be encountered, and that this study has not been evaluated in any academic publication environment other than Sakarya University Journal of Science."

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