

## ALIEN AUCHENORRYNCHA (INSECTA, HEMIPTERA: FULGOROMORPHA AND CICADOMORPHA) TO BULGARIA

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### Abstract

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Based on feeding characteristic as well as existing and possible impacts on the plant crops, non-native Auchenorrhyncha are insects of special interest. In this study, we update the previously available knowledge about 6 Auchenorrhyncha species alien to Bulgaria with recent field data and distribution throughout the country. We provide summarized information about feeding preferences and possible impacts, origins and general distribution in Europe. Three of the species belong to the family Cicadellidae, as the richest one within Auchenorrhyncha. The other three species are representatives of families: Membracidae, Flatidae and Ricaniidae.

*Key words:* alien species; Auchenorrhyncha; Cicadomorpha; Fulgoromorpha; Bulgaria

### Introduction

Alien (also called introduced, non-indigenous, non-native) species are distributed outside their natural range, often causing impacts on native species communities, the economy and even human health (Roques et al., 2009; Inghilesi et al., 2013). Based on biological characteristics, insects constitute a significant role in the increasing impact of invasive processes.

Auchenorrhyncha is an extremely diverse insect group comprising nearly 42 000 described species worldwide. It is likely paraphyletic, composed of two monophyletic clades in Hemiptera: Fulgoromorpha (planthoppers) and Cicadomorpha (leafhoppers, treehoppers, spittlebugs and cicadas) (Mifsud et al., 2010; Cryan and Urban, 2011). Almost all of these are plant sap feeders, using sucking mouthparts, and thereby they could be involved in the transmission of pathogens or substantially damage plant tissues. In addition to their economic impact to native vegetation and crops, alien species are one of the main targets in assessing threats to native biodiversity (Roques et al., 2009).

The Auchenorrhyncha species that are non-native to Europe were recently summarized by Mifsud et al. (2010) and, according to this review, a total of 12 species introduced from North America and East Asia have been established in Europe. An additional Asian species, *Ricania japonica* Melichar, 1898, from Georgia, the Ukraine and Bulgaria (Nast, 1987; Gjonov, 2011), could be added to this list, as well as two cicadellids, *Erasmoneura vulnerata* (Fitch, 1851) and *Penthimiola bella* (Stål, 1855) (Seljak, 2011; Gjonov, 2011; Zina et al., 2013). It is not surprising that 10 of all alien species belong to the family Cicadellidae, which is the richest family in the Auchenorrhyncha.

In this study, we update the previously available knowledge about alien Auchenorrhyncha to the Bulgarian entomofauna with recent field data on the list of species, and distribution throughout the country and feeding preferences.

### Materials and Methods

The material used in this study was collected during an extensive faunistic survey of Auchenorrhyncha, conducted

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across Bulgaria between 1997 and 2013. The studied species were sampled using the following methods: sweeping, light traps and by hand, after visual observations on the host plants. If not stated otherwise, the specimens were collected by Ilija Gjonov. They were extracted by a hand-held aspirator and were dry-mounted, including the prepared male genitalia. The material was stored in the first author's collection, and the results were provided as a list of species with corresponding information for the new collection data from Bulgaria, with comments on previous reports from the country, as well as host plants and possible impacts, origins and general distribution in Europe, based on literature sources.

## Results

### Family Cicadellidae

*Scaphoideus titanus* Ball, 1932 (Figure 1)

New data: 06.08.2011, Russe region, Bozhichen vill., on a light trap.

Origin: North America

Comments: *S. titanus* is a monophagous species of *Vitis vinifera* L., and it is known as a vector of the phytoplasma disease, *flavescence dorée*, of grape vines, with the potential to threaten vineyards. No particular collection data were presented in the only previously noted literature on this species in Bulgaria (Avramov et al., 2011), referring to 6 regions in the northern part of the country.



Fig. 1. *Scaphoideus titanus* Ball, 1932. (Gernot Kunz)

Distribution in Europe: The first record of the distribution of this species is from France (Bonfils and Chvester, 1960), and a range of records of this species throughout Southern Europe have been made: Italy (Vidano, 1964), Switzerland (Baggiolini et al., 1968), Slovenia (Seljak, 1985 and 2008), Spain (Battle et al., 1997), Portugal (Quartau et al., 2001), Austria (Zeisner, 2005), Serbia (Magud and Toševski, 2004), Croatia (Budinišćak et al., 2005) and Hungary (Dér et al., 2007).



Fig. 2. *Japananus hyalinus* (Osborn, 1900)

*Japananus hyalinus* (Osborn, 1900) (Figure 2)

New data: 03.08.2000, East Rhodopes Mts., Svetulka vill. 561 m; 03.08.2006, Strandzha Mt., Sinemorec vill., 64 m; 10.09.2006 Sofia, Pancharevsko ezero; 22.07.2009, East Rhodopes, Chajka vill., 277 m; 27.07.2010, Ruse, Lipnik, 150 m; 24.09.2010, Strandzha Mt., Indzhe Vojevoda vill., 134 m; 25.07.2011, Stara Planina Mts., Goren chiflik vill., 102 m; 28.07.2011, Stara Planina Mts., Nejkovo vill., 563 m.

Origin: Eastern Asia

Comments: *J. hyalinus* uses certain *Acer* species as host plants, and it is widely distributed in Bulgaria, established in Varna and the Pleven districts (Lauterer, 1989); the Vitosha, Vlahina and Zemenska mountains; the Danube plane (Emeljanov et al., 2001); and in the Eastern Rhodopes (Gjonov, 2004).

Distribution in Europe: The first occurrence in Europe was noted by Wagner and Franz in 1961; however the species has been found in many European countries: Czechoslovakia, Austria, Romania and Yugoslavia (Nast, 1987); France and again Czechoslovakia as *J. meridionalis* Bonf. (Nast, 1987); Germany (Heller, 1987), Bulgaria, Hungary (Lauterer, 1989), France, Spain, Northern Italy (Remane and Fröhlich, 1994; Della Giustina and Remane, 2001; Gebicki and Bednarczyk, 2003 after Walczak et al., 2012); the European part of Russia (Gnezdilov, 1999), Slovenia (Seljak, 2002), Luxembourg (Niedringhaus et al., 2010); and finally, in Poland (Walczak et al., 2013).

*Macropsis elaeagni* Emeljanov, 1964 (Figure 3)

New data: 28.06.2011, Black Sea coast, Burgas salts; 08.07.2012, Sredna gora Mt., Vakarel vill., 830 m.

Origin: Central Asia

Comments: *M. elaeagni* is a monophagous species of the host plant, *Elaeagnus angustifolia* L., originating in Central Asia. No data about this species was added after the first





**Fig. 3. *Macropsis elaeagni* Emeljanov, 1964**

records by Lauterer (1984) from Sozopol and Burgas (near South Black Sea coast) in Bulgaria.

Distribution in Europe: This species has been described from Tajikistan and is known from other Central Asian countries. Lauterer noted it to be introduced in the Ukraine in 1984, and the same author recorded it as having occurred in Czechoslovakia, Hungary, Romania and Bulgaria (Lauterer, 1984). Later, *M. elaeagni* was established in Austria (Holzinger and Remane, 1994) and Germany (Nickel, 2003).



**Fig. 4. *Stictocephala bisonia* Kopp & Yonke, 1977**

### Family Membracidae

*Stictocephala bisonia* Kopp & Yonke, 1977 (Figure 4)

New data: 19.08.1997, Veliko Tarnovo district, Nova Varbovka vill., 310 m; 10.08.1998, Stara Planina Mts., Chelopek vill., leg. R. Milcheva, 700 m; 24.08.2004, Pirin Mt., Gospodinci vill., 538 m; 22.07.2009, East Rhodopes, Chajka vill., 277 m; 24.07.2009 and 06.09.2010, East Rhodopes, Meden buk vill., near Bjala reka river, 125 m; 27.07.2010, Rusenski Lom, Cherven vill., 69 m; 27.07.2010, Ruse, Lipnik, 150 m; 14.08.2010, Black Sea Coast, Sine-morec vill., the mouth of Veleka river; 22.09.2010, Sakar Mt., Svilengrad, Matochina vill., road to Varnik vill., 77 m; 23.09.2010, Sakar Mt., Svilengrad, Ustrem vill., Sv. Troitsa monastery, 121 m; 23.09.2010, Tundzha valley, Svilengrad, Srem vill., 90 m; 24.09.2010, Strandzha Mt., Indzhe Voevoda vill., 134 m; 24.09.2010, Strandzha Mt., Varovnik vill., Fakijska river, 125 m; 07.08.2011, Ruse, Pet kladenci vill., Vineyards, 308 m; 06.08.2011, Ruse, Mechka vill., 18 m; 11.09.2011, Montana, Vasilovci vill., 34 m; 12.09.2011, Vidin, Lagoshevcı vill., 95 m; 13.09.2011, Vidin, Bojnica vill., 175 m; 14.09.2011, Vidin, Archar vill., Archar river mouth, 42 m; 27.07.2011, Stara Planina Mts., Bardarevo vill., 72 m; 12.08.2011, Mesta valley, Bukovo vill., 581 m; 24.08.2012, Stara Planina Mts., Katunishte vill., 385 m; 27.08.2012, Stara Planina Mts., Kotel, Radinka vill., 471 m.

Origin: North America

Comments: *S. bisonia*, widely distributed in the lower parts of the country, is a polyphagous species, known to occur for the first time in Bulgaria, in alfalfa fields from many locations (Josifov, 1957). Since then it has been recorded many times in all lowland countries (Dirimanow and Harizanow, 1962; Cantoreanu and Gruev, 1967; Bajrjamova, 1976 and 1990). The earliest records were made under the name *Ceresa bublaus* F. due to misidentification.

Distribution in Europe: The first occurrence of *S. bisonia* in Europe was from Hungary (Horváth, 1912); but currently, the species is found in almost all European countries. Details on its distribution have been given by Świerczewski and Stroiński (2011).

### Family Flatidae

*Metcalfa pruinosa* (Say, 1830) (Figure 5)

New data: 25.07.2011, Black Sea coast, Balchik, Botanical Garden; 26.07.2011, Black Sea coast, Varna, Sv. Konstantin & Elena.

Origin: North America

Comments: *M. pruinosa* is a polyphagous species, recorded for the first time in the Plovdiv district on the host plant, *Tuja occidentalis* L. in 2007, near an ornamental plant garden (Trenchev et al., 2007). The occurrence of this spe-



Fig. 5. *Metcalfa pruinosa* (Say, 1830)

cies near the Black Sea coast in Bulgaria corresponds very well with the suggestion of a new expansion range of *M. pruinosa* in Southeastern Europe (Preda and Skolka, 2011).

Distribution in Europe: *M. pruinosa* was found in Italy (Zangheri and Donadini, 1980) and is now known to be widely distributed in all Southern parts of Europe (Gnezdilov and Sugonyaev, 2009; Preda and Skolka, 2011).

#### Family Ricaniidae

*Ricania japonica* Melichar, 1898 (Figure 6)

New data: 14.08.2010, South Black Sea coast, Veleka river mouth; 28.07.2013, South Black Sea coast, Veleka river mouth (Stoyan Beshkov leg.)

Origin: Eastern Asia

Comments: *R. japonica* is a polyphagous species, introduced to the Caucasus a long time ago (Gnezdilov and Sugo-



Fig. 6. *Ricania japonica* Melichar, 1898

nyaev, 2009), ending up in the Ukraine (Nast, 1987, Dlabola, 1967) and the Black Sea coast in Turkey (Demir, 2009). Apparently the spread of this species reaches near by the Black Sea coast.

Distribution in Europe: Southern parts of Russia (after Gnezdilov and Sugonyaev, 2009) and the Ukraine (Nast, 1987).

#### Discussion

For the current study, we summarized the data of 6 Auchenorrhyncha species alien to Bulgaria, compared to 16 in Europe (Mifsud et al., 2010; Nast, 1987; Nickel et al., 2013). However, three of them (*S. titanus*, *J. hyalinus* and *M. elaeagni*) are cicadellids, corresponding to the diversity of the family Cicadellidae, as the richest species family within Auchenorrhyncha. The other three species are representatives of three other families: Membracidae, Flatidae and Ricaniidae.

The genus *Scaphoideus* is diverse in North America, but only one, *S. titanus*, was introduced in Europe. Tracking the spread of this species is important because of its high economic impact as a vector of *flavescence dorée*.

Six species from the genus *Japananus* were described in Eastern Asia, and only *J. hyalinus* spread rapidly in Europe on *Acer* plants (Walczak et al., 2012); however, no detailed studies on the ecological or economic impacts have been carried out.

The genus *Macropsis* is rich in species, but only *M. elaeagni* feeds on the host plant *Elaeagnus angustifolia* L.; and its invasion is closely related to the distribution of its host plant.

The family Membracidae is represented by only three species in continental Europe, with two of the being native, *Centrotus cornutus* (Linnaeus, 1758) and *Gargara genistae* (Fabricius, 1775). At the beginning of the last century, *S. bisonia* was introduced to Europe, and it is widespread throughout central and southern Europe. Repeatedly, *S. bisonia* was reported as a pest on various crops.

From another large group in Auchenorrhyncha, Fulgoro-morpha, two alien species to Bulgaria, are known to occur: *Metcalfa pruinosa* and *Ricania japonica*. *M. pruinosa* is the second member of the family Flatidae, together with *Phantia subquadrata* (Herrich-Schäffer, 1838), in Bulgaria. The family Ricaniidae is comprised only by *Ricania japonica* and *R. hedenborgi* Stål, 1865 in Europe. However, the second species is found only in Greece for Europe. In the review of alien Auchenorrhyncha in Europe by Mifsud et al. (2010), this species is not mentioned, probably because of its local distribution in the most eastern part of Europe.



Apart from the already six alien Auchenorrhyncha species in Bulgaria, a few more are expected, such as the mosaic leafhopper, *Orientus ishidae* (Matsumura, 1902) and the Rhododendron leafhopper *Graphocephala fennahi* Young, 1977.

## Conclusion

Tracking the expansion range of alien Auchenorrhyncha species in Europe implies possible invasion of other species in Bulgaria and increasing the effect of the potentially harmful. Thus requires regular collection of information about the species composition, scope and impact of these species in the country.

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