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Short Communication

First Record of the Japanese Grape Leafhopper *Arboridia kakogawana* (Matsumura, 1932) (Homoptera: Cicadellidae, Erythroneurini) in Bulgaria

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Abstract: The Japanese grape leafhopper *Arboridia kakogawana* is reported as a new species to the fauna of Bulgaria. The leafhopper was detected on grapevines (*Vitis* sp.) at 16 out of the 65 localities investigated in Bulgaria, at altitudes from 15 to 350 m a.s.l. At present, *A. kakogawana* is still in the expansion phase of its invasion process in Bulgaria and has a limited distribution, mainly in the Northern Bulgaria and the Black Sea coast. Heavily infested plants were detected only in towns along the Danube River – Nikopol, Ruse, and Silistra, which shows that the leafhopper most probably has been introduced into Bulgaria unintentionally from Romania. The current distribution pattern of the species in Bulgaria suggests that its dispersal is human-mediated and the main pathways are the transport of contaminant nursery material and transport – stowaway. Further studies of the impact of this species on vineyards are needed.

Key words: Leafhopper, alien, pest on *Vitis* spp., distribution.

Introduction

Twenty species from the genus *Arboridia* Zachvatkin, 1946 (Hemiptera: Cicadellidae: Typhlocybinae) are recorded in Europe (JACH 2013), among which is the Japanese grape leafhopper *Arboridia kakogawana* (Matsumura, 1932). This species is reported as an important pest of cultivated grapevine in the areas of its native range in East Asia and in the invaded regions of Eastern Europe. For the first time it was discovered on the European territory in the Krasnodar region of Southern Russia in 1999 (GNEZDILOV 2000, GNEZDILOV et al. 2008). Since then, the species has continued to disperse rapidly, expanding its distribution in the Northern Caucasus (BALAKHNINA et al. 2009), in the Rostov region (ARTOKHIN 2009), in the Crimean Peninsula (RADIONOVSKAYA & DIDENKO 2015a) and in the Donbass region (MARTYNOV et al. 2019). *Arboridia kakogawana* has been identified for the first time in

Romania in 2018, in a vine plantation in the northern part of Bucharest, but a subsequent re-examination of yellow sticky traps used in 2016–2017 in this area showed that the leafhopper was present there at least since 2016 (CHIRECEANU et al. 2019).

According to JACH (2013), nine species from the genus *Arboridia* (Zachvatkin, 1946) have been reported in Bulgaria till now: *Arboridia parvula* (Boheman, 1845) (JOAKIMOV 1909, PELOV 1968, GJONOV 2004), *A. ribauti* (Ossiannilsson, 1937) (PELOV 1968, DWORAKOWSKA 1970), *A. velata* (Ribaut, 1952) (PELOV 1968), *A. pusilla* (Ribaut, 1936) (PELOV 1968, DWORAKOWSKA 1970), *A. cantoreanica* (Dworakowska, 1970) (DWORAKOWSKA 1970, GJONOV 2004), *A. expansa* (Zachvatkin, 1946) (DWORAKOWSKA 1970), *A. potentillae* (Moravskaja, 1948) (DWORAKOWSKA 1970), *A. vitisuga* (Dlabola, 1963) (DWORAKOWSKA 1970), and *A. strandjensis* Bayryamova, 1987 (BAYRYAMOVA 1987). The latter was later

synonymised with *Fagocyba carri* (Edwards, 1914) by EMELJANOV et al. (2002).

In the frame of a survey for early detection of alien species in Bulgaria, strong discolouration visible on the upper surface of grapevine leaves and heavy infestation by an unknown leafhopper was detected on 16 September 2019 in Nikopol, a town by the Danube River. This communication presents *A. kakogawana* as a new species to the fauna of Bulgaria.

Materials and Methods

The field surveys were conducted in the period September – November 2019 at 65 sites located in the following geographical zones of Bulgaria: the Black Sea coast, the Danube Plain, Predbalkana Mountains, Western Stara Planina Mountains, Zadbalkanski Kotlovini Plain, Sredna Gora Mountains, the Upper Thracian Plain, the Western Rhodope Mountains, the Middle Struma River Valley, and Pirin Mountains.

Visual observations of the *Vitis* sp. plants in the urban areas and vineyards were conducted. The insects were collected using a sweep net or by hand, picking the infested leaves. The nymphs found were reared under laboratory conditions. The adult insects were determined following DWORAKOWSKA (1970), GNEZDILOV et al. (2008) and CHIRECEANU et al. (2019). The males were dissected and their terminalia examined. The material was deposited in the author's collection at the University of Forestry in Sofia.

Results

Material examined: /1/ the Black Sea coast: Aytos, UTM NH22, 88 m, 12.10.2019, 3♀, 1♂; Obzor, UTM NH74, 35 m, 12.10.2019, 2♀, 7♂; Staro Oryahovo, UTM NH65, 15 m, 11.10.2019, 2♀, 3♂; Byala (Varna) UTM NH74, 42 m, 11.10.2019, 1♀; /2/ the Danube Plain: Targovishte, UTM MH68, 180 m, 11.10.2019, 10♀, 7♂; Kozloduy, UTM GP15, 36 m, 24.10.2019, 6♀, 9♂; Dulovo, UTM NJ15, 230 m, 11.10.2019, 1♀; Borovan, UTM GP21, 162 m, 24.10.2019, 1♀; Mizia, UTM GP34, 36 m, 24.10.2019, 1♂; Nikopol, UTM LJ34, 36 m, 16.09.2019, 5♀, 5♂; Ruse, UTM MJ15, 46 m, 4.10.2019, 51♀, 53♂; Silistra, UTM NJ28, 48 m, 11.10.2019, 11♀, 11♂; Shumen, UTM MH99, 213 m, 11.10.2019, 4♂; /3/ Prebalkana Mountains: Botevgrad, UTM GN25, 350 m, 24.10.2019, 1♂; Lukovit, UTM KH68, 129 m, 16.09.2019 19♀, 14♂; and /4/ Zadbalkanski Kotlovini Plain: Karnobat,

UTM MH92, 262 m, 12.10.2019, 1♂.

The adult specimens were identified as *Arboridia kakogawana* (Fig. 1a). The morphological characteristics of the genitalia of the male of *A. kakogawana* are illustrated in Fig. 1b. The adults and nymphs were found on the lower surface of the grapevine leaves (Fig. 1a). Heavily infested grapevine leaves had discoloured zones visible on the upper surface (Fig. 1c).

The Japanese grape leafhopper *A. kakogawana* was detected on grape plants (*Vitis* sp.) at 16 localities in Bulgaria at altitudes from 15 to 350 m a.s.l. (Fig. 2).

The species was not found at 49 of the surveyed localities: /i/ the Black Sea coast: Varna, 11.10.2019, Burgas, 12.10.2019, Byala, 11.10.2019, Banya, 11.10.2019; /ii/ the Danube Plain: Byala (Ruse), 5.10.2019, Gorni Dubnik, 5.10.2019, Gabrovnitsa, 24.10.2019; Lom, 50 m, 24.10.2019, Pleven, 16.09.2019, Dobrich, 11.10.2019, Dolna Mitropoliya, 16.09.2019, Gulyantsi, 16.09.2019, Borovo, 5.10.2019, Podem, 16.09.2019, Balgarene, 5.10.2019, Obnova, 5.10.2019, Volovo, 5.10.2019, Branichevo, 11.10.2019, Pishurka, 24.10.2019, Yasen, 16.09.2019; /iii/ Predbalkana Mountains: Montana, 150 m, 24.10.2019, Veliko Turnovo, 11.10.2019, Vratsa, 24.10.2019, Troyan, 10.10.2019; Sevlievo, 190 m, 10.10.2019, Veliki Preslav, 10.10.2019; /iv/ the Western Stara Planina Mountains: Barzia, 24.10.2019, Berkovitsa, 24.10.2019, Pravets, 24.10.2019; /v/ Zadbalkanski Kotlovini Plain: Sofia, 22.10.2019, Karlovo, 21.11.2019, Kliment, 21.11.2019, Kostinbrod, 24.10.2019; Sliven, 12.10.2019; /vi/ Sredna Gora Mountains: Ihtiman, 14.10.2019, Borika, 14.10.2019; /vii/ the Upper Thracian Plain: Karabunar, 17.10.2019, Plovdiv, 17.10.2019, Kaloyanovo, 21.11.2019; Septemvri, 17.10.2019, Pazardzhik, 17.10.2019, Vinogradets, 17.10.2019, Vetren, 31 m, 12.10.2019; /viii/ the Western Rhodope Mountains: Asenovgrad, 17.10.2019; Velingrad, 6.11.2019; /ix/ the Middle Struma River Valley: Blagoevgrad, 7.11.2019, Simitli, 7.11.2019; and /x/ Pirin Mountains: Bansko, 7.11.2019 (Fig. 2).

Arboridia kakogawana is a leafhopper with a body length of 2.6–3.1 mm (GNEZDILOV et al. 2008). General colouration of the adults is light yellow, with brown or orange spots on the fore wings, the vertex and upper angles of scutellum with a pair of black spots (Fig. 1). A good description of *A. kakogawana* with drawings of the male genitalia details is given by GNEZDILOV et al. (2008). The aedeagal shaft flattened laterally, with two teeth apically, the aedeagal base with one median tooth.

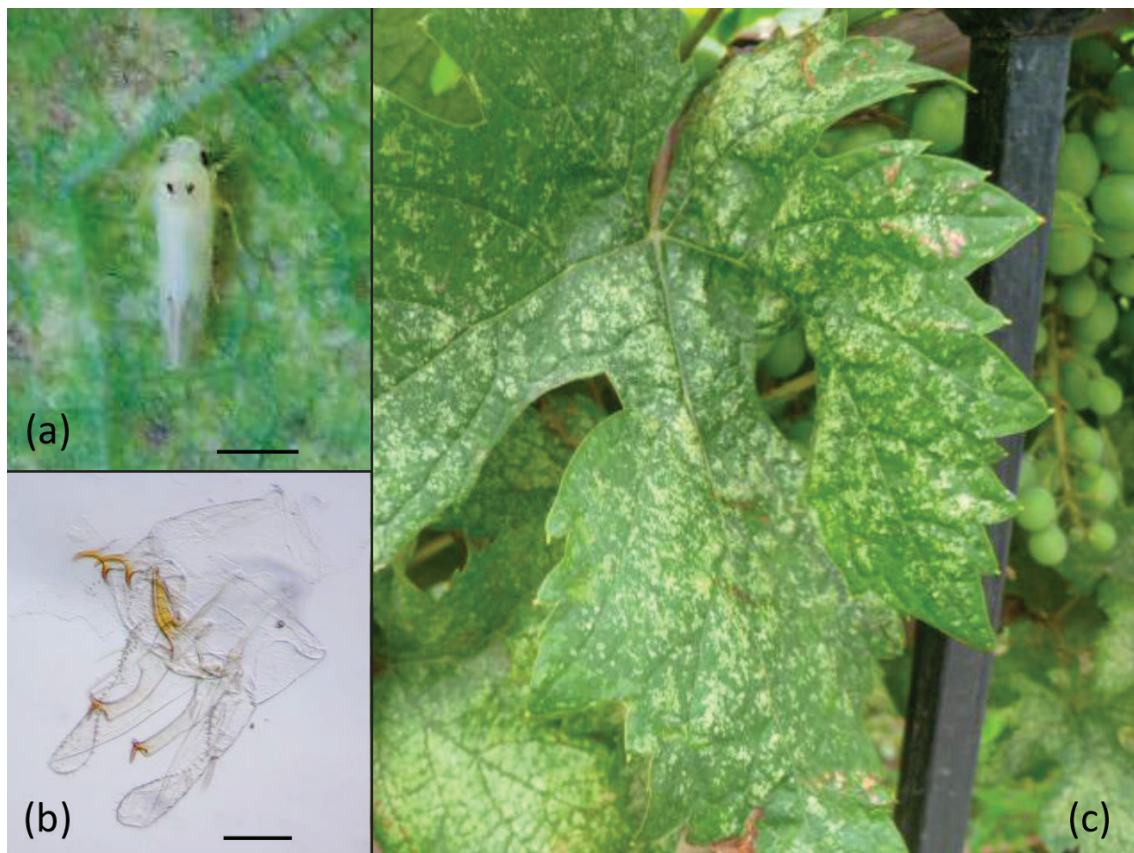


Fig. 1 *Arboridia kakogawana* (Bulgaria, 2019): (a) Adult, scale bar 1 mm; (b) Male genitalia, scale bar 100 µm; (c) Discolouration on the upper grapevine leaf surface.

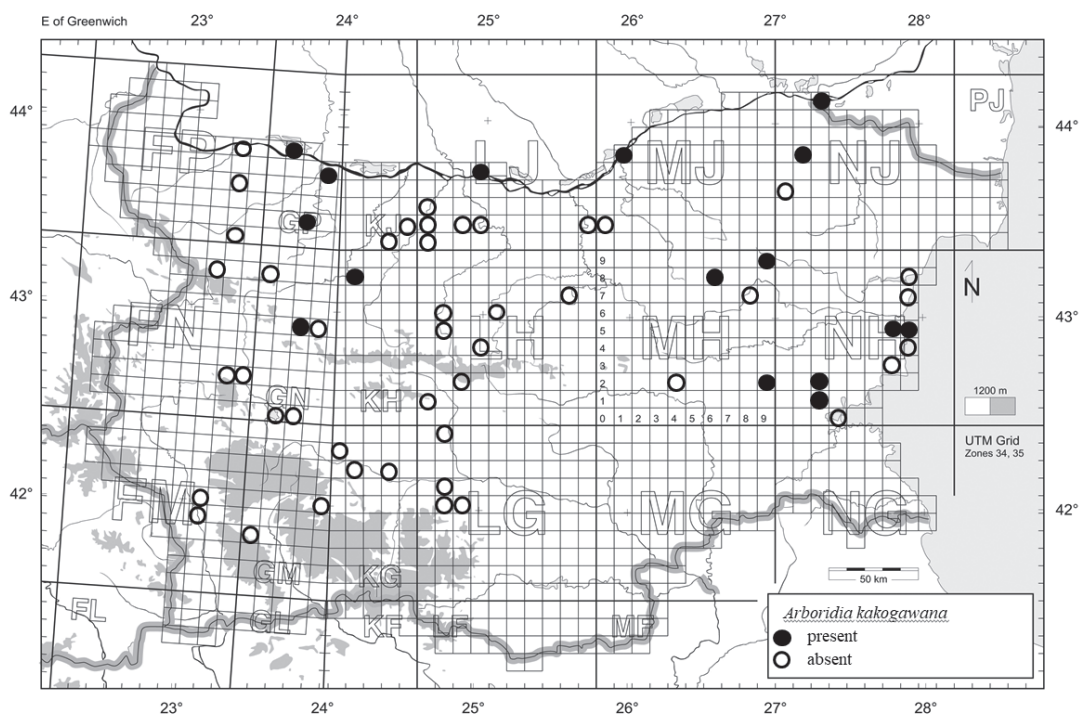


Fig. 2. Distribution of *Arboridia kakogawana* in Bulgaria (2019), UTM Grid. The black circles indicate the localities, in which the species was recorded, while the white circles indicate the localities, where the species was not found. The UTM Grid template used is after ABADJIEV (2001).

The pygofer with bifurcated processes. The genital plates concaved laterally, each plate with three macrochetae. Styles with two teeth apically.

According to GNEZDILOV et al. (2008) and CHIRECEANU et al. (2019), the damages caused by *A. kakogawana* are due to the feeding activities of the nymphs and adults. Both of them feed by piercing and sucking the lower side of the leaves, and the affected tissue becomes chlorotic due to the loss of photosynthetic green pigments. With an increased population of the leafhopper, the spots merge, forming large chlorotic zones with a negative effect on the physiological processes of the leaves.

Discussion

The survey showed that *A. kakogawana* is still in the expansion phase of its invasion process in Bulgaria and has limited distribution, mainly in the Northern Bulgaria and the Black Sea coast. Heavily infested plants were detected only in towns along the Danube River as Nikopol, Ruse, and Silistra; therefore, most probably the leafhopper has been introduced in Bulgaria unintentionally from Romania. Low infestation rates were observed at the rest of the localities and only a few specimens were collected at several of them. The survey was conducted in autumn (September – November) when according to GNEZDILOV et al. (2008), the number of adults is decreasing continuously as a result of their migration for wintering. Hence, it could be expected that the species is distributed in more localities in Bulgaria than the ones investigated.

The current distribution pattern of *A. kakogawana* suggests that its dispersal in Bulgaria is most probably human-mediated and the main pathways are the transport of contaminant nursery material and transport – stowaway. The species was detected on plants in private gardens and plantations in urban and suburban areas only. The towns and villages where *A. kakogawana* was detected are located next to major roads. Natural dispersal of the species is less probable, since the sites with the presence of the species were surrounded by large areas where the species was not detected, despite the fact that planting of grape plants in private gardens is very common in Bulgaria.

In Rostov Province *A. kakogawana* has damaged about 70 different grapevine varieties (GNEZDILOV et al. 2008). Very high density of the species in a vine plantation in the northern area of Bucharest was observed in 2018 (CHIRECEANU et al. 2019). Having in mind the fact that *A. kakogawana* has between two and four generations annually in

the southern coast of the Crimea (RADIONOVSKAYA & DIDENKO 2014, 2015b) and in South Romania (CHIRECEANU et al. 2019), it could be presumed that there are from two to four generations annually in Bulgaria as well. Considering the damages on the grapevine, caused in Southern Russia, Ukraine and Romania, we may expect that *A. kakogawana* can pose a serious threat to grapevine production in Bulgaria. Therefore, further studies of the impact of this species on vineyards should be carried out.

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