DATA ON THE ABUNDANCE OF *ORIENTUS ISHIDAE* (MATSUMURA, 1902) AND *ACANALONIA CONICA* (SAY, 1830) IN SOUTH OF ROMANIA, TWO YEARS AFTER THE FIRST DETECTION

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KEYWORDS: insect invasive species, abundance, Romania.

ABSTRACT

Orientus ishidae (Matsumura, 1902) and *Acanalonia conica* (Say, 1830) are two of the latest invasive non-native insect species we detected in the northern Bucharest in 2016, representing the first record for Romania. Ornamental plants brought in the city were most probably the penetration pathway.

The data in 2017 and 2018 were compared with those from previous year.

The total captures on yellow sticky traps in the two years of research showed an increase in the adults' abundance of the two species comparated to 2016.

The results in this research can provide useful information on the biology and the increasing trend of their population in this area in the near future.

REZUMAT: Abundenţa cicadelor *Orientus ishidae* (Matsumura, 1902) şi *Acanalonia conica* (Say, 1830) în zona de sud a României, la doi ani după prima semnalare.

Orientus ishidae (Matsumura, 1902) și *Acanalonia conica* (Say, 1830) sunt două dintre cele mai recente specii invazive non-native detectate în zona de nord a orașului București, reprezentând prima semnalare pentru România, în anul 2016.

Plantele ornamentale aduse în oraș cu diferite scopuri au fost cel mai probabil calea de pătrundere a acestora.

În studiul de față, datele de colectare din 2017 și 2018 au fost comparate cu cele din anul precedent.

Rezultatele privind numarul de adulți capturați în cei doi ani de cercetare, cu ajutorul panourilor galbene lipicioase AtraCeras, au arătat o creștere a densității celor două specii față de anul 2016.

RESUMEN: La dinámica de las poblaciones de las cicadas *Orientus ishidae* (Matsumura, 1902) y *Acanalonia conica* (Say, 1830) en la zona del sur de Rumania, 2 años después de la primera señalación.

Las cicadas *Orientus ishidae* (Matsumura, 1902) y *Acanalonia conica* (Say, 1830) son dos de las especies invasoras no nativas que hemos detectado en la parte norte de la Bucarest en el año 2016.

Eso representa la primera señalación de tales especies en Rumania. Las plantas ornamentales llevadas a la ciudad con varios objetivos fueron, probablemente, la vía de introducción.

La colección de datos recogidas en 2017 y 2018 fue comparada con los datos de 2016.

Los resultados de la captura de los dos años mostraron un crecimiento de la densidad de la población de dichas especies. Los resultados de este estudio ofrecen informaciones valiosas sobre la biología de las dos especies y sobre la tendencia del crecimiento de sus poblaciones en esas zonas en el futuro próximo.

INTRODUCTION

The mosaic leafhopper *Orientus ishidae* (Matsumura, 1902) and the green cone-headed planthopper *Acanalonia conica* (Say, 1830) are two invasive insect species that were introduced in Europe during the last decade, from Asia and North America, respectively, the entry pathway being considered the plants eggs-infested (Mifsud et al., 2010). From entering points in North Italy, the two species continued to spread to other countries in South and southeastern Europe, including Romania, passively helped by human activities (such as transports or traveling on nursery stocks) and naturally by nymphs and adults movement. A faster spreading was observed in the case of *O. ishidae* (Koczor et al., 2013).

Both species are sap-feeding insects, members of the group of Auchenorrhyncha, Hemiptera Order. *O. ishidae* belongs to the Cicadellidae family (Cicadomorpha) and *A. conica* to the Flatidae family (Fulgoromorpha). They are considered important pest of palnts. The leafhopper *O. ishidae* rapidly became a serious pest of grapevine in Europe, since it has been detected to be infected with 16SrV phytoplasmas associated with the flavescence dorée quarantine disease (Mehle et al., 2010). The damages caused by the planthopper *A. conica* are given by the white waxy filaments and honeydew on branches and other organs of plants.

The presence of *O. ishidae* and *A. conica* in Romania was confirmed for the first time in 2016 in the urban area of Bucharest (south part of the country) using yellow sticky traps set up on wild or cultivated trees and shrubs (Chireceanu et al., 2017). To our knowledge, they have not been recorded outside of this area.

We continued to monitor *O. ishidae* and *A. conica* in Băneasa area (Northern Bucharest) in 2017 and 2018, to evaluate their abundance two years after the initial detection in 2016, and improve our knowledge so far, and the results obtained are presented in this paper.

MATERIAL AND METHODS

The sampling of the *O. ishidae* and *A. conica* adults was performed with Romanian AtraCeras 20 x 30 cm yellow sticky traps in 2017 and 2018, in the urban area in the north part of Bucharest (Southern Romania), in three locations: the former fruit experimental field (now abandoned) of The Research-Development Institute for Plant Protection (RDIPP) and two experimental fruit fields, one of The Research-Development Station for Fruit Growing (RDSFG) and the other of The University of Agronomic Sciences and Veterinary Medicine (UASVM). The distance between the first two locations is one km, and about four km between the first two and the third one. The plant species in the collecting sites included cultivated fruit trees – *Prunus avium*, *Prunus armeniaca*, *Prunus domestica*, *Malus pumila*, *Pyrus communis*, *Juglans regia*, and *Ziziphus jujuba*; spontaneous trees and shrubs – *Quercus cerris*, *Q. robur*, *Morus* sp., *Crataegus monogyna*, *Rosa canina*, *Berberis vulgaris*, *Prunus spinosa*, *Ligustrum vulgare*, *Sambucus ebulus*, and herbaceous plants.

The traps were placed from early June to mid-October as follows: three traps at RDIPP on *M. pumila*, *C. monogyna* and *Q. cerris*, three traps at RDSFG on *M. pumila* (2) and *P. avium* (1), five traps at UASVM on *M. pumila*, *P. communis*, *P. armeniaca*, *C. monogyna* and *Z. jujuba*. The traps were replaced with new ones at 15 or more days interval. A total of 27 traps were used at RDIPP and RDSFG each year and 35 traps in 2017 and 24 traps in 2018 at UASVM.

Collecting living specimens, both nymphs and adults, for photos in the lab was done directly from the plants.

Contents of traps were examined and insects counted under a stereomicroscope Olympus SZ61 and the photos were taken using a digital compact camera attached to the microscope.

The material is deposited in the collection of the lab.

Total captures in 2017 and 2018 were compared with those from 2016 for both pest species.

The dynamics of the number of adults in 2017 was designed for the two species.

RESULTS AND DISCUSSION

The two species are easy to recognize due to their body size and very attractive coloration. Their morphological description is provided in the reports of Biedermann and Niedringhaus (2009), D'Urso and Uliana (2006) and Koczor et al. (2013). Adults of *O. ishidae* have a distinctive color model like a mosaic on the forewings, brighter in the summer season and darker in the autumn (Fig. 1). The nymphs are intensely colored in reddish-brown mottled with white and yellow patches (Fig. 2). Coxa, femur and part of the tibia are reddish with brown shades. Adults of *A. conica* are pastel green colored with a cone-shape head (Fig. 3a). Nymphs of whitish brown in color have a gregarious behavior (Fig. 3a-c). The nymphs of 5th instar present visible green wing buds (Fig. 3c). They bear long white waxy filaments that form a dangerous substance for plants when are combined with sticky honeydew also excreted by nymphs. The white waxy filaments, exuviae and honeydew secretions on the plants are evident signs of their feeding activity.

Figure 1: *Orientus ishidae* – adult:
(left) collected in August,
(right) collected in October.

Figure 2a: *Orientus ishidae* – 5th instar nymph.

Figure 2a: *Orientus ishidae* – 5th instar nymph.

Figure 3: *Acanalonia conica*: (a) Nymphs on wild blackberry;
(b) Adult and nymphs on wild blackberry;
(c) – Nymphs last instars, drops of honeydew and nymph of *Metcalfa pruinosa*,
(d) Nymphs on walnut leaf.

In 2016, when O. *ishidae* and *A. conica* were detected in the North part of Bucharest for the first time, a total of 60, respectively 21 adults were collected using a total of 140 yellow sticky traps from July to October. During the two-year study after the first record of species, a total of 1,672 adults of *O. ishidae* (688 in 2017 and 984 in 2018) and 101 adults of *A. conica* (35 in 2017 and 66 in 2018) were collected in this area using a total of 89 traps in 2017 and 78 in 2018. Cumulative trap catches of each of the two insect pests in 2017 and 2018 compared with those of 2016 are shown in figures 4 and 5. O. *ishidae* was captured at all the three monitored locations in 2016 and in 2017 and 2018 as well (Fig 4). *A. conica* occurred only in two of the three collecting sites (RDIPP and RDSFG) and no individuals were collected at the UASVM (Fig. 5). Captures of *A. conica* were always lower than *O. ishidae* in the two points where both were present. Compared to the number of specimens collected in 2016, the two insect species continued to increase in abundance in the next two successive seasons (Figs. 4 and 5).

The highest abundance of *O. ishidae* adults was at RDIPP. At this site, the captures ranged from nine adults in 2016 to 409 adults in 2017 and to 650 adults in 2018. At UASVM, the captures ranged from 44 adults in 2016 to 185 adults in 2017 and to 207 adults in 2018. At RDSFG, the increase in the number of adults was smaller, from seven in 2016 to 94 adults in 2017 and to 127 adults in 2018. This result could be attributed to insecticide sprays used to fruit trees protection.

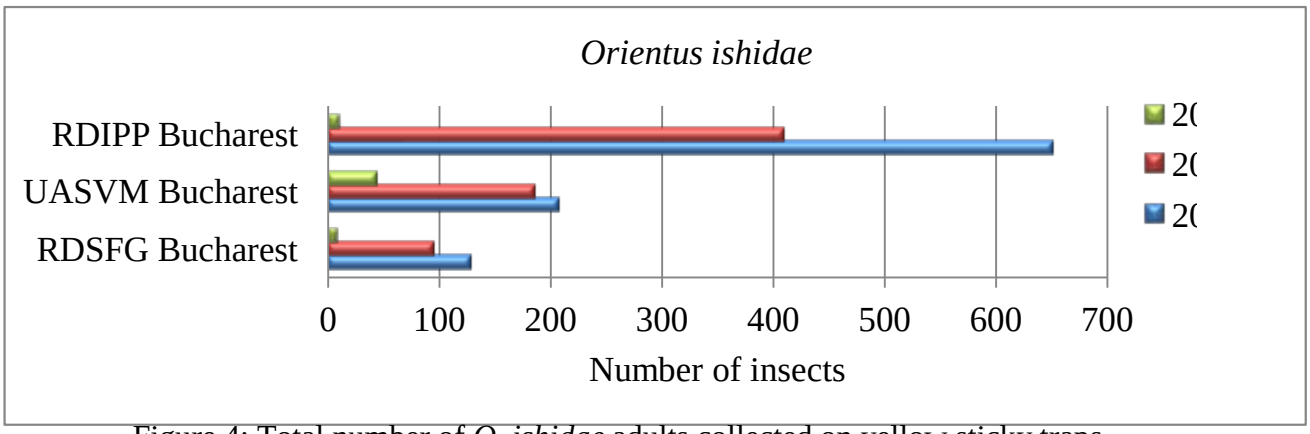

Figure 4: Total number of *O. ishidae* adults collected on yellow sticky traps in the Northern Bucharest area in 2016-2018.

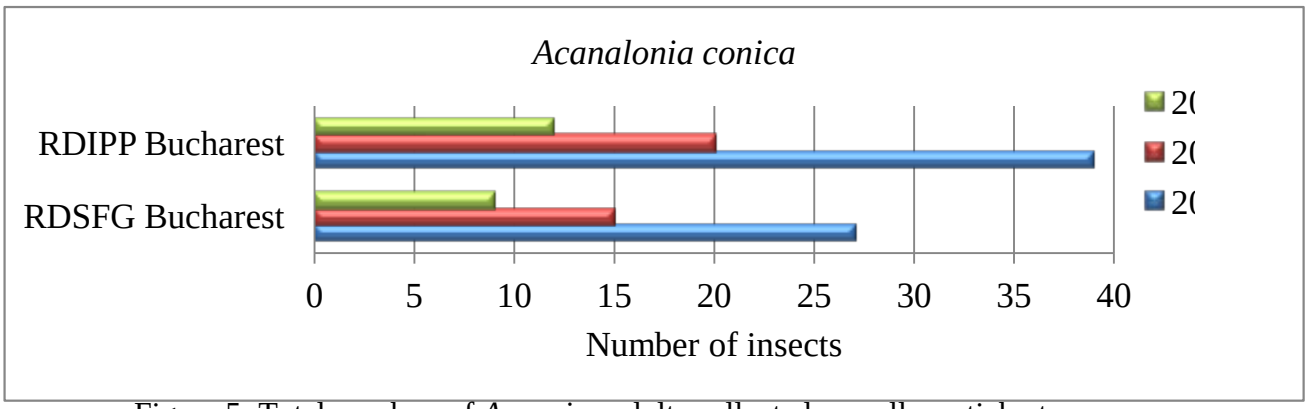

Figure 5: Total number of *A. conica* adults collected on yellow sticky traps in the Northern Bucharest area in 2016-2018.

Dynamics of the adult abundance of *O. ishidae* monitored in 2017 at RDIPP and UASVM with yellow traps is shown in figures 6 and 7. Our capturing data in 2017 showed that adult population of *O. ishidae* had a seasonal development in the south part of Romania similar to other parts of Central and Southern Europe (Lessio et al., 2016; Parise, 2017; Lešnik et al., 2017). The abundance of adults varied between the two monitored locations and followed a similar model, characteristic to insects with one generation per year. This increased gradually during the growing season and reached a peak in the last decade of July. The maximum number of adults in 2017 was recorded on 20th July at RDIPP and on 27th July at UASVM, after which a decline was observed. These results are in accordance with those of Lessio et al. (2016) and Parise (2017) in Northwest and Northern Italy and Lešnik et al. (2017) in Northeast Slovenia who reported that the adult population of *O. ishidae* reaches the flight peak at the middle and the end of July and even at the middle of August. O. *ishidae* is cited in the literature to develop one generation per year and overwinters as egg (Nickel, 2010; Lessio et al., 2016). The nymphs are present from the end of May until mid July (Lessio et al., 2016) or from mid May to early August (Parise, 2017), and adults are active from the beginning of July until the middle of October (Lessio et al., 2016) or late June to late September (Parise, 2017; Lešnik et al., 2017). The adults of *O. ishidae* in our monitoring were recorded between the last week of June and the third week of September at UASVM and in the first week of October at RDIPP. These findings also correspond to those of the authors above mentioned. In Europe, *O. ishidae* was characterized to possess a very polyphagous character, feeding on a wide range of trees and shrubs, in vineyard and fruit agro-ecosystems, forests, in gardens and parks in urban or suburban areas (Guglielmino, 2005; Nickel, 2010; Mehle et al., 2011; Koczor et al., 2013; Lessio et al., 2016).

The mosaic leafhopper *O. ishidae* is described as a very important pest species. Symptoms of yellowing, necrosis and stunting of the leaves of plants were described as a consequence of nymphs feeding from plant sap (Lessio et al., 2016; Parise, 2017). Relevant studies conducted in the field showed that the most serious threat comes from the adults of *O. ishidae* in viticulture because of their implication in the epidemiology of flavescence dorée (FD). Adults of *O. ishidae* were defined as new natural vectors of phytoplasmas associated with FD disease in grapevines in Slovenia, Italy, Switzerland, and Serbia (Mehle et al., 2010; Gaffuri et al., 2011; Trivellone et al., 2015; Lessio et al., 2016). *O. ishidae* was found to display a high degree of similarity to *Scaphoideus titanus* (Ball), the major vector of phytoplasma causing FD disease in grapevine in Europe. Both are leafhoppers belonging to the Deltocephalinae Subfamily, the Cicadellidae Family and overwinter as eggs in grapevine (Lessio et al., 2016).

Captures of *A. conica* on traps were much less abundant than *O. ishidae* in the study area during the two years of monitoring. That is why it was difficult to achieve a dynamics. However, a preliminary graph of adult catches of *A. conica* on traps at RDIPP in 2017 was realized and it is shown in figure 8. The results in 2016 in the North part of Bucharest reported few adults captured, 12 at RDIPP and nine at RDSFG (Fig. 5) and no adults at UASVM. *A. conica* is a quite big insect, the adults are 10 mm long and move quite slowly (Aldini et al., 2008), characteristics that could reflect the small number of adults trapped.

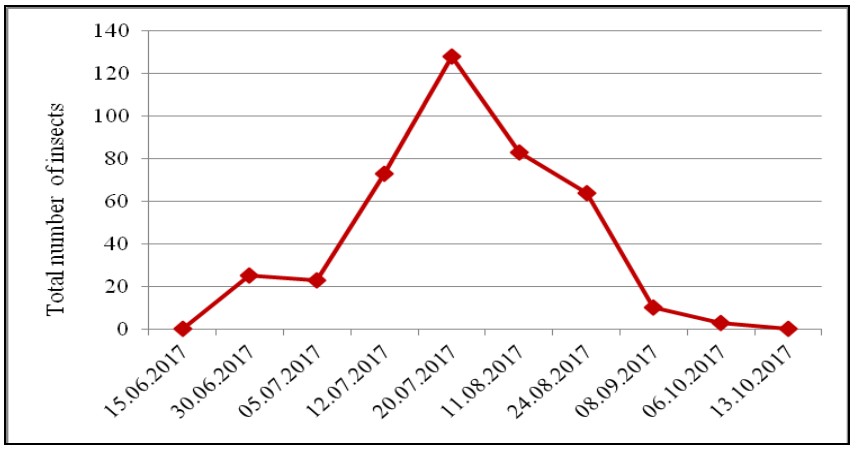

Figure 6: Dynamics of adults of *Orientus ishidae* collected on yellow sticky traps at RDIPP in 2017.

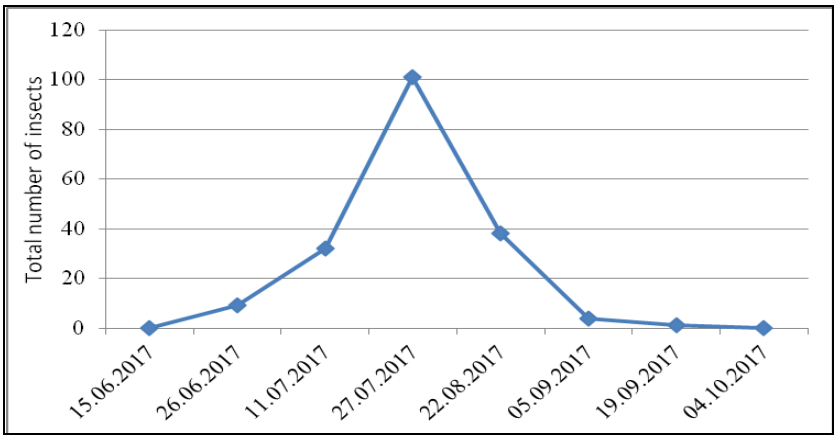

Figure 7: Dynamics of adults of *Orientus ishidae* collected on yellow sticky traps at UASVM in 2017.

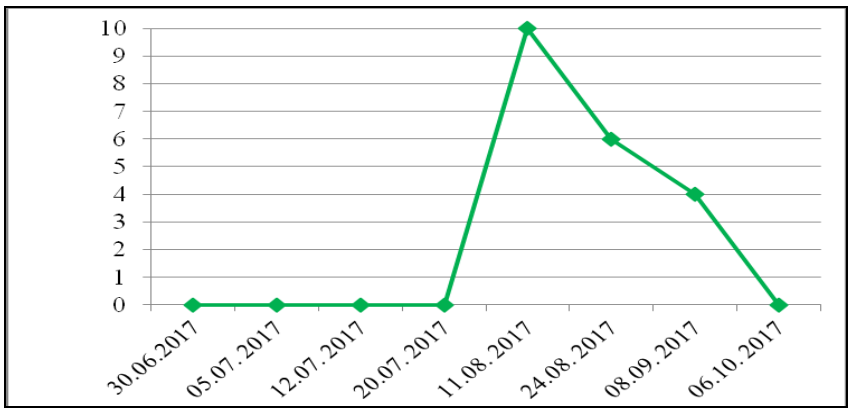

Figure 8: Graph of total captures of *Acanalonia conica* adults at RDIPP in 2017.

The graph of the number of *A. conica* adults in 2017, like *O. ishidae*, followed the trend of monovoltine species. Our preliminary data showed that the first adults of *A. conica* on yellow sticky traps were on 11th August 2017 (corresponding to the maximum number), although at the end of July we collected with entomological net living adults for pictures from wild blackberry. A decline of captures followed in the next weeks until the first decade of September. Similar results were reported by D'Urso and Uliana (2006) for a population of *A. conica* larger than in our study, monitored in the Northeast of Italy in 2004. The adults were found to be present from

June to September and the highest density of insects was in the first half of August. According to several studies, the hopper *A. conica* is a very polyphagous species with one generation per year that overwinters as eggs laid in the woody tissue of the host plant (D'Urso and Uliana, 2006; Jucker, 2008; Aldini et al., 2008). Nymphs are present by the end of June, but also after that. *A. conica* is resembled to the citrus flatid planthopper *Metcalfa pruinosa* (D'Urso and Uliana, 2006; Jucker et al., 2008), another invasive species that has spread rapidly in Europe after its first detection in Italy in 1979 (Zangheri and Donadini, 1980). Both planthoppers are native to North America and have similar life cycle and behavior and are commonly found in mixed populations on numerous plant species causing severe injuries. Some of these plants (*Vitis* genus and ornamentals) are of economic importance. *A. conica*, similar to *M. pruinosa*, damages plants by sucking their juices and by producing of great amounts of honeydew that cover leaves and fruit.

CONCLUSIONS

Our study results of the adults of *O. ishidae* and *A. conica* in the urban area of northern Bucharest (Southern Romania) two successive years (2017 and 2018) after the first detection in 2016, showed the fact that the two hopper species have survived in the climatic condition of the area, reproduced and increased in abundance.

Considering these results and also the presence of a wide range of suitable host plants in the investigated area, we anticipate that these species posses a potential to develop in the coming years and to spread naturally to new zones from Romania, if proper management measures are not taken.

The monitored area in this research could act as source of insects for the trees and shrubs from parks, gardens and others green spaces in the urban area. Human activity dealing with propagation of different parts of plant could be a major factor contributing to the spread of the two hemipterans at long distance in the country.

The climatic conditions associated with warmer temperature are among other important favourable factors.

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