Scientific Papers. Series B, Horticulture. Vol. LXI, 2017
Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

NEW INVASIVE INSECT PESTS RECENTLY REPORTED IN SOUTHERN ROMANIA

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Abstract

This work presents the results of the field survey in 2016 referring to invasive insect pests newly recorded from the Southern Romania. Five non-European insect species, belonging to Hemiptera and Lepidoptera Orders damaging diverse plants were identified, as follows: three polyphagous species in Auchenorrhyncha group, Orientus ishidae, Phlogotettix cyclops and Acanalonia conica; one true bug species Leptoglossus occidentalis harmful to conifer seeds, and one leaf miner species Phyllocnistis vitegenella pest to grapevine. In this work we included summarized data related to some aspects of species origins, distribution in Europe and Romania and preference to the host plants.

Key words*: invasive species, insect pests, Southern Romania***.**

INTRODUCTION

Phytophagous insects form a very important category of invasive species with a great rate of penetration in European territory. They are well represented by a wide spectrum of species belonging to numerous different taxonomic groups. According to Roques (2016), since 2000s the number of new phytophages that enter Europe is about 11.5 species per year. The same author reported that most of the exotic phytophagous species that established in Europe by 2014 are associated with woody plants, out of which insects represent 83.5%. Unintentionally introduced species have a greater velocity of spreading comparative to those deliberately introduced (Roques et al., 2016). Global costs associated with invasive insects reached a minimum of US $ 70.0 billion per year, and costs related to the health sector exceeded US $ 6.9 billion per year (Bradshaw et al., 2016).

Favored by natural factors (i.e. global warming, food chain) as well as intense human activities (i.e. commercial exchange, travel, tourism), the alien invasive species penetrate at a rapid pace from year to year in Romania as in other countries around the globe. In an attempt to detect the new exotic invasive species that entered Romania as soon as possible, and put together new accumulated data for a better understanding of the species distribution and richness, many research communities in institutions from different parts of the country were involved in issues related to invasive species.

The purpose of our research was to collect, identify and disseminate useful information on the new allochthonous invasive insect pests recorded in the Southern Romania in 2016, in order to bring an essential contribution to improve the available knowledge on this field to the country. Within our work, five invasive insect species, new for South part of Romania were detected, two of them being considered as the first report for Romanian pest fauna.

MATERIALS AND METHODS

The collecting of insects was performed in 2016 within the framework of the fields' survey program conducted by the Research-Development Institute for Plant Protection Bucharest in order to discover untimely pest insects having the status of invasive species. The sampling in 2016 was carried out in urban areas in Bucharest and rural areas in Ilfov and Giurgiu counties from the South part of Romania. Insects were captured with yellow sticky traps and by direct collection. To identify the insects in our samples we used the morphological features and illustrations describing adult specimens in relevant

references in the literature. Using an Olympus camera connected to a TSZ 61 stereomicroscope we were able to take pictures of collected insects.
Geographical coordinate data for the sampling points were taken using the application Convertor online coordinate GPS: (http://www.calculatoare.ha-ha.ro/convertor_coordonate_gps_adresa.php; WGS84).

RESULTS AND DISCUSSIONS

The phytophagous insect species classified as invasive species, alien to Romania, that we encountered in the Southern Romania, during the vegetative season in 2016, are presented in Table 1.

Orientus ishidae (Matsumura, 1902) (Hemiptera: Cicadomorpha, Cicadellidae, Deltocephalinae) - the mosaic leafhopper species (Figure 1);

This species has East Asian origins. It has been recorded in the Northern Italy since 1998 (Guglielmino, 2005), and after that it rapidly spread to other European countries (EPPO, 2015).

In Romania, the first adults of *O. ishidae* have been described from the South part of the country (Bucharest) in 2016, by Chireceanu et al. (2017).

Table 1. Taxonomic position of invasive insect species detected in the Southern Romania in 2016; plant species on which the insects were found or traps were placed

Order	Family	Species	Common name	Host plants
Hemiptera	Cicadellidae	*Orientus ishidae* (Matsumura, 1902)	The mosaic leafhopper	Woody plants (*Crataegus monogyna*, *Malus domestica*, *Prunus avium*, *Ziziphus jujube*)
		Phlogotettix cyclops (Mulsant & Rey, 1855)		Woody plants (*Crataegus monogyna*, *Ziziphus jujube*, *Juglans regia*)
	Acanaloniidae	*Acanalonia conica* (Say, 1830)	The green cone-headed planthopper	Woody plants (*Crataegus monogyna*, *Malus domestica*)
	Coreidae	*Leptoglossus occidentalis* (Heidemann, 1910)	The western conifer seed bug	Building balcony
Lepidoptera	Gracillariidae	*Phyllocnistis vitegenella* (Clemens, 1859)	Grape leaf miner	Wild grapevine Hybrid *Vitis* sp.

Figure 1. Adult of *Orientus ishidae*

A number of 63 adult specimens were trapped in the course of the year 2016, on yellow sticky traps settled on apple (*Malus sylvestris*), sweet cherry *(Prunus avium),* Chinese date (*Ziziphus jujube*) and common hawthorn (*Crataegus monogyna*) trees present in urban areas of Bucharest.

The species of *M. sylvestris* (N44°30'05"/E26°4'35") and *P. avium* (N44°30'02"/E26°4'37") composed two research orchards of the Research-Development Station for Fruit Growing (RDSFG) in the Northern part of Bucharest; *Z. jujube* trees were enclosed in the experimental field of the USAMV Bucharest in the Northern part of Bucharest (N44°28'11"/E26°04'12") and in the 'D. Brândză' botanical garden of Bucharest in the central part of the capital (N44°26'17"/E26°03'52"); the shrubs of *C. monogyna* were present in a non-managed area (N44°30'15"/E26°04'02") near to the Research-Development Institute for Plant Protection and in the botanical garden of the USAMV Bucharest (N44°26'17"/ E26°03'52"), both institutions being situated in the North part of Bucharest.

O. ishidae is a polyphagous pest that lives on various plant species from woody plants and deciduous trees groups and feeds on the plant phloem. By reason of its strategy for feeding, the *O. ishidae* leafhopper is considered of great economic importance, because this was found to be associated to the spreading of some phytopathogenic microorganisms such as phytoplasmas (pathogens that live as obligate parasites in the phloem sieve tubes of plants and in insect vectors) to grapevine. The insect is a common presence in the vineyards in countries from West and Central Europe. Adults of O. *ishidae* collected in grapevine affected by yellows - type diseases, have been found infected with pathogens of the disease *Grapevine flavescence dorée* (GFD) (Mehle et al., 2011; Trivellone et al., 2015). Recent studies conducted in Italy (Lessio et al., 2016) have shown that *O. ishidae* was competent to transmit the GFD phytoplasma to grapevine. As regards the risk of FD to be spread by *O. ishidae* to grapevine, is believed to be real. This is because, in many references in the literature, *O. ishidae* is compared with *Scaphoideus titanus*, the main natural vector known to spread the GFD disease. Both species are Deltocephalinae leafhoppers belonging to the same family of Cicadellidae, and it is expected that *O. ishidae* to have the model of life cycle and behavior similar to *S. titanus*.

Phlogotettix cyclops **(**Mulsant & Rey, 1855) **(**Hemiptera: Cicadomorpha, Cicadellidae, Deltocephalinae); Syn. *Jassus cyclops* Mulsant & Rey, 1855 (Figure 2).

Figure 2. Adult of *Phlogotettix cyclops*

This leafhopper species is originally from Asian and Russian regions, spread in countries from Central and South East Europe on various plant species such as raspberry, fruit trees and grapevine (Chuche et al., 2010), this being known as a polyphagous species. The leafhopper has one generation per year and overwinters as eggs laid into plant tissues. First knowledge with regard to description of the presence of *P. cyclops* on grapevine was provided by Chuche et al. (2010) on Bordeaux vineyards. Like majority of the species in the Cicadellidae family, *P. cyclops* leafhopper is specialized in feeding on the phloem tissue of plants. From this reason, many scientists suspected this species as a possible new vector that may spread the phytoplasma pathogens to cultivated plants. The fruit trees and grapevine, crops of high economic importance, are mainly considered vulnerable to the risk of this insect. Wuu-Yang Chen et al. (2011) in East Asia has diagnosed the *P. cyclops* species as a serious vector with potential to transmit a strain of phytoplasma belonging to the 16SrI group. Reisenzein (2015) in Austria has found this cicadellid to be infected with phytoplasma of the *Flavescence dorée* disease, a grave systemic disease of grapevine in Europe. *P. cyclops* is cited in many reports in the European literature as present in Romania, based on the reports of Dlabola from 1977 and 1981 (www.faunaeur.org). After these reports, no article has been published on this species in Romania so far. In our field survey, 170 specimens of *P. cyclops* have been caught on yellow sticky traps settled on shrubs of common hawthorn (*Crataegus monogyna*) present in the area situated near the Plant Protection Institute (Northern Bucharest) (N44°30'15"/E26°04'02"), on trees of Chinese date (*Ziziphus jujube*) (N44°26'17"/E26°03'52") planted in the national Botanical Garden 'D. Branza' (Central part of Bucharest) and in the walnut (*Juglans regia*) orchard (N44°30'12"/ E26°15'49") in the Didactic Farm of USAMV Bucharest in Ilfov County at 15 km away from Bucharest.

Acanalonia conica (Say 1830) (Hemiptera: Fulgoromorpha, Acanaloniidae) - the green cone-headed planthopper (Figure 3).

This species that originates from North America was found for the first time in Europe in 2002, in Switzerland (Günther and Mühlethaler, 2002). In our field survey conducted in 2016, the adults of *A. conica*

captured on yellow sticky traps accounted 21 specimens. The yellow sticky traps were placed on trees of common hawthorn occurring in the non-administered area (N44°30'15"/E26°04'02") around the court of the Plant Protection Institute and on an apple orchard (N44°30'05"/E26°04'35") that belongs to the experimental field of the Research Station in Pomiculture. Both sampling locations are situated in the North part of Bucharest.Within the captures of *A. conica* during this survey activity, we revealed for the first time the presence of this species in the Bucharest zone and in Romania as well (Chireceanu et al., 2017). In the examination of the traps, we noticed that the adults of *A. conica* captured were associated with those of another invasive planthopper species, the flatid *Metcalfa pruinosa*. *A. conica* is a univoltine species and overwinters as egg stage. Adults are bright green in color and measure 10 mm long. A typical feature of this species is the conical vertex of the head; they can be found during June-September (Aldini et al., 2008).

Figure 3. Adult of *Acanalonia conica*

In many reports in the European literature, *A. conica* is not considered a severe pest of cultivated plants because this generally develops small populations that are not able to produce essential damages. However, the grapevine and ornamental plants are indicated among the host plants with economic importance that are affected by this insect (D'Urso and Uliana, 2006).

Phyllocnistis vitegenella **(**Clemens, 1859) (Lepidoptera: Gracillariidae) - grape leaf miner (Figure 4b).

This is a North American species, reported in Europe for the first time in 1995, in the north-east of Italy (Cara and Jermini, 2011). Then, it has also been confirmed in Slovenia (2004), Switzerland (2009) and Hungary (2014) (Cara and Jermini, 2011; Szabóky and Takács, 2014). Adult of 3 mm, is distinguished by a brilliant white color with characteristic brown stripes very finely and two black dots on the apex of the wing. Larva produces visible injuries on leaves consisting in distinctive galleries (mines), very long and sinuous on the upper side of the leaves of plants belonging to Vitaceae family (Figure 4a). The average number of mines per leaf is maximum 4 (Lips and Jermini, 2013). The micromoth miner has 3-5 generations per year and spends the winter as adult.

For Romania, the first detection of the pest was on grapevine in Moldova region in 2013 (Ureche, 2016).

Research conducted in Switzerland focused on the grape leaf miner behavior, showed its preference for leaves of the shoots laterally disposed on vine plants. At the *Merlot* cultivar, the leaves of lateral shoots were mined over 3 times more than those of main shots (Lips and Jermini, 2013). The same authors regarded *P. vitegenella* as a minor pest of grapevine because this did not induce considerable negative effects and accordingly the control measures against its population are not necessary.

In our study conducted in the Southern Romania in 2016, we obtained *P. vitegenella* adults from mined leaves sampled from the grapevine rootstocks in a field previously planted with vine plants for research proposes within framework of the RIDPP Bucharest, and also from mined leaves sampled from two plots of hybrid grapevines in house gardens (Naipu village, Giurgiu County). In addition, we gathered *P. vitegenella* adults from leaves with mines collected from wild vines found in spontaneous flora around some vineyards in Vrancea County, on which we investigated in 2016 with regard to the presence of the American grapevine leafhopper *Scaphoideus titanus*. We have not discovered any sign of the attack of *P. vitegenella* on vine plants in the noble vineyards that we have monitored.

From the samples collected in the south part of the country and maintained in laboratory conditions, some parasitoids (Figure 4c) belonging to the Eulophidae family have resulted.

European research focused on parasitoids of the grape leaf miner *P. vitegenella* have indicated a parasitic rate of the pest up to 33%.The parasitoids associated with this species are framed to Eulophidae and Ichneumonidae families.

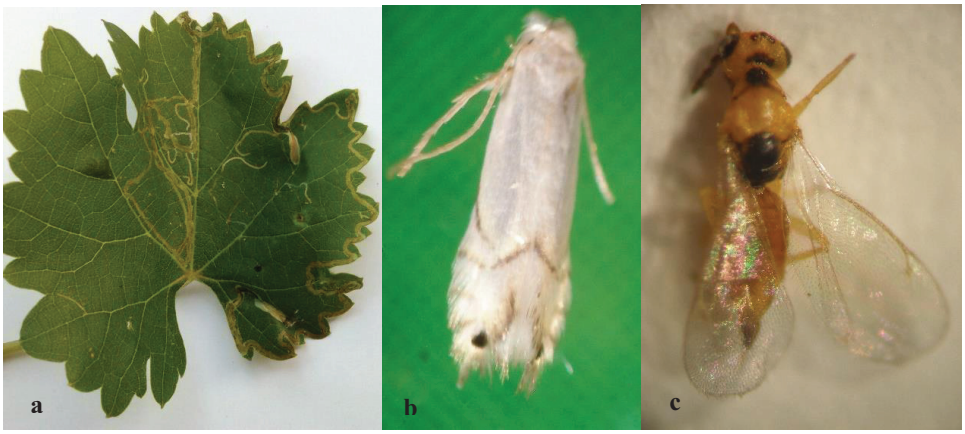

Figure 4. (a) Mined grapevine leaf; (b) Adult of *Phyllocnistis vitegenella*; (c) Parasitoid wasp from the Eulophidae family

Leptoglossus occidentalis **(**Heidemann, 1910) (Hemiptera: Heteroptera: Coreidae) - the western conifer seed bug (Figure 5).

L. occidentalis is a plant-feeding bug commonly called "leaf-footed bugs" or "squash bugs". It is a pest from North America, observed for the first time in Europe (Northern Italy) in 1999 (Taylor et al., 2001), from where this rapidly spread across the European continent, reaching up to Sweden and Ireland and even to Ukraine and Russia (Putchkov, 2013).

Figure 5. Adult of *Leptoglossus occidentalis*

It is a large true bug of approx 20 mm long (adults), easily recognizable by the hind legs strongly developed with a characteristic enlargement zone on the hind tibiae and long femurs serrated on the inside; thin visible white lines in the shape of inverted 'W' in the middle of the wings (Ruicănescu, 2009); the first segment of antennas is thicker, slightly curved, orange-brown with a black longitudinal line inwards. *L. occidentalis* has one or two generations annually depending on the altitude of area where it is living (Tamburini et al., 2012), and survives the winter conditions as adult, commonly in large groups, under coniferous trees bark, but also in people's homes and other buildings, from where they emerge in the spring season giving birth to the summer generation. It is a polyphagous insect on conifer species in the Pinaceae family (Tamburini et al., 2012). To date, the western seed bug has not been reported to produce important damage to conifers in Europe, but some overwintering adults of this species were detected to bear spores of the fungus *Diplodia pinea*, and from this point of view they are suspected to play a role in spreading of this pathogen (Tamburini et al., 2012). Instead, it is considered a nuisance pest to people, as the overwintering form enters into people's homes and walk unhindered on the walls (Rabitsch, 2008). In the Romanian territory, the presence of *L. occidentalis* (two females) was for the

first time reported in the central part of the country, in 2008 and 2009 by Ruicănescu (2009). In the following years, the seed bug was reported in several other Romanian regions, in the Southeastern (Şerban, 2011), the Northwestern (Rădac and Petrovich, 2016), the Northeastern, Central and Southern parts (Olenici and Duduman, 2016) of the country. The pest had a low density, and the collecting points have always been associated with the conifer trees present around.

In our research, *L. occidentalis* (one male) was collected on October 28th, 2016, by the first author of this paper, on geranium plants in the balcony of her bloc apartment in the Southern area of Bucharest (44°23′34″/ 26°6′42″).

The presence of *L. occidentalis* inside of buildings in urban areas does not appear to be unusual because all Romanian papers on this subject previously published indicated the cover spaces as common collecting places for this species.Our results in this study confirm the presence of *L. occidentalis* in the Southern Romania and it may be considered the second record of this pest for this area and the first record for Bucharest so far. Capturing of the adults of the *L. occidentalis* bug during the October and December months is explained by the fact that the insects are seeking shelter for wintering (Olenici and Duduman, 2016).

CONCLUSIONS

The field survey and sample evaluation performed by us in areas from the Southern Romania in 2016, led to obtaining relevant knowledge on the presence of five non-European important insect species, belonging to the Hemiptera and Lepidoptera Orders, such as: three polyphagous species in Auchenorrhyncha group, *Orientus ishidae, Phlogotettix cyclops* and *Acanalonia conica;* one true bug species *Leptoglossus occidentalis* harmful to conifer seeds, and one leaf miner species *Phyllocnistis vitegenella* pest to grapevine.

The results obtained within this work suggest that the activities of the field survey are critical for the early detection of alien invasive species that could unexpectedly penetrate into new territories, unaffected by them until then. Further data on the spreading in other areas as well as the incidence on plants for the new detected invasive species will be essential for the Romanian territory in the near future, so that the surveys in the field would be extended to many other crops, mainly those of economic importance, such as fruit trees, grapevine, ornamentals and conifers.

ACKNOWLEDGEMENTS

The study was performed in the framework of the project PN 16-29-01-01, financial support by the Ministry of Research and Innovation.

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