

***Metcalfa pruinosa* SAY 1830 (HOMOPTERA: FLATIDAE), AN ESTABLISHED ALIEN SPECIES IN CONTINUOUS EXPANSION IN ROMANIA**

Ionela DOBRIN¹, Valentin Marius CIONTU², Marga GRĂDILĂ², Andreea COȘOVEANU²

¹University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd,
District 1, 011464, Bucharest, Romania

²Research-Development Institute for Plant Protection, 8 Ion Ionescu de la Brad Blvd., 013813,
Bucharest, Romania

Corresponding author email: ioneladobrin@gmail.com

Abstract

The citrus flatid planthopper, Metcalfa pruinosa Say, 1830 (Homoptera: Flatidae) is a native planthopper originating on eastern North America. On the European continent it entered in 1979, is first mentioned in the northern part of Italy, after which it spread in most of European countries. The pest was reported in Romania by Preda and Skolka, in 2009, in the eastern part of the country, and in the next years was signaled both in the west and in the south of the country. This pest can be considered a slow expanding species, adapting easily from one area to another. Currently is encountered in parks and green areas, fruit and wine plantations, herbaceous plants and herbaceous species, almost everywhere in Romania. The current paper presents the findings of one recent survey in Didactic Farm Moara Domneasca, with emphasis on the pest host plant spectrum.

Key words: *Metcalfa pruinosa*, expansion, invasive pest.

INTRODUCTION

Honey cicada (*Metcalfa pruinosa*), included in the Flatidae family of planthoppers, is native to eastern North America. It was first mentioned by Tomas Say in 1830 as *Flata pruinosa* and identified as Poecilopecta, Ormenis and Melormenis by various authors. On the American continent, cicada had a rapid evolution, being present in almost all the United States of America and also in Canada. In Asia it was reported in the Peninsula Korea in 2009. In Europe it was first reported in 1979 in Italy where it was accidentally introduced (Zangheri and Donadini, 1980). Gradually it spread to the neighboring countries and then to the distant countries: Croatia, Switzerland, France, Spain, Slovakia, Austria, Greece, Serbia and Montenegro, Bulgaria, Bosnia and Herzegovina, Hungary, Turkey, Albania, Slovakia, Czech Republic, Sea UK, Russia etc. *Metcalfa pruinosa* populations were eradicated in Great Britain and Czech Republic using insecticides (Strauss, 2010). In 2009 was first mentioned in south-east Romania (Constanta) by Preda and Skolka (2009). In the

west of the country (Timisoara) was reported a year later by Gorgan et al. (2010) and in 2011 was also reported in Bucharest (Chireceanu and Gutue, 2011). During August-October 2011, the presence of *Metcalfa pruinosa* was detected on fruit trees, grapevines and different ornamental and shrubs plant species in private gardens, public institutions courts in Bucharest city and adjacent areas (Chireceanu and Gutue, 2011). At the Didactic Farm Moara Domneasca *Metcalfa pruinosa* was observed in 2014 on the fruit trees. The attack was initially confused with the woolly louse (*Eriosoma laringerum*) and later was considered for proper identification. The intensification of human activities at the Didactic Farm Moara Domneasca has generated changes in the structure of the biocenosis of the ecosystem, which requires careful monitoring and the need to take measures.

The main aims pursued in this study were: i) monitoring of the invasive species honeycomb cicada, *Metcalfa pruinosa*, on the territory of the Didactic Farm Moara Domneasca; ii) identification and establishment of the range of host plants; iii) identification of outbreaks,

areas infested with this invasive species; iv) assessing the degree of attack on spontaneous plants and crops on the farm's territory; v) test chemical treatments to reduce the attack.

MATERIALS AND METHODS

The design of the observations:

The Didactic Farm Moara Domnească has an area of 556 ha, organized in 8 soles some separated by the protective forest buffers, an administrative area with housing of about 24 ha - office buildings, parks and gardens. For the present study, a series of field routes have been established in order to find possible outbreaks with this species during 2017 and 2018:

- route 1 comprised the administrative area (green area around administrative buildings, parks and gardens);
- route 2, field crops (wheat, triticale, peas, sunflower, corn, rapeseed and alfalfa);
- route 3, fruit crops (orchards of apple, plum, apricot, cherry and walnut);
- route 4, the network of logs (forest protection curtains);
- route 5, the edge of the road that connects the village of Moara Domneasca with the European road 85.

The larvae and adults of *Metcalfa pruinosa* were monitored and outbreaks within the attacked plants were noted. Photos were taken in different phases of vegetation. The frequency index (F), the intensity index (I) and the degree of attack (A) were established in the infested plants. Frequency (F%) = (number of attacked branches or plants / total number of branches) x 100; 10 plants or 10 branches were taken randomly to determine the index. Intensity (I%) = percentage of the attack taking into consideration the whole plant (observations on the surface of infested leaves or branches). The degree of attack (A%) = Frequency x Intensity / 100. In order to reduce the infestation with *Metcalfa pruinosa*, a series of treatments were applied with synthetic pesticides.

Characteristics of the Didactic Farm Moara Domneasca:

The Didactic Farm Moara Domneasca within the University of Agronomic Sciences and Veterinary Medicine of Bucharest is located in the NE part of the Bucharest. The activity in the farm is divided into 5 sectors: vegetable

farm, horticultural farm, cattle farm, palm farm and the cold storage under controlled conditions. The vegetable farm covers an area of about 250 ha where plants from the big crop are cultivated: wheat, triticale, peas, sunflower, corn, rapeseed and alfalfa. The horticultural farm covers an area of 65 ha and includes the collection of fruit species, native and foreign varieties of apple (22 ha), plum (7 ha), apricot (6 ha), cherry (5 ha) and walnut (5 ha), where monitoring activities (breeding, fruiting, production evaluation) are carried out on the soil type - red forest glove. From a geomorphological point of view, the landscape is characteristic to the Vlăsiei Plain, horizontal plane, with depressions of different shapes and sizes, with areas showing crows.

Vegetation and climate conditions of the location:

The Didactic Farm Moara Domneasca is located in the transition zone from the forest steppe to the plain forest area and the vegetation is characteristic of this transition as well as the forest area. The area has a pronounced steppe character due to the presence of characteristic species such as *Festuca valesiaca* and *Digitalis lanata*, together with species characteristic of the silvosteppe zone: *Poa bulbosa*, *Medicago sativa*, *Medicago falcata*, *Melilotus officinalis*, etc. The most common families are crucifers and grasses with numerous species, of which we can mention: *Sinapis arvensis*, *Thlaspi arvense*, *Capsella bursa pastoris*, *Agropyron repens*, *Cynodon dactylon*, *Setaria* sp., *Echinochloa crus galli* etc.

The natural vegetation of silvosteppe is strongly affected by the crops and thus it is found on restricted surfaces (on the lake shore, on the roadsides, drainage channels and in the protection ditches in the area). Hydrophilic plants are also present: *Phragmites communis*, *Typha latifolia*, *Equisetum arvense*, *Polygonum amphibium*, *Ranunculus arvensis* (Petcu, 2008; Mihalache et al., 2009).

Observations were made during the agricultural years 2016-2018.

Temperature and precipitation regime, as well as the multiannual averages were collected from the Afumati Meteorological Station, which is located approximately 4 km from the farm headquarters while rainfall is recorded at

the Moara Domneasca using the own rain gauge.

RESULTS AND DISCUSSIONS

The research carried out in 2017 (Figure 1) showed that the first larvae appeared in May and the larval activity lasted until August. Larvae at different stages were identified on the same plant.

Since July, adults have appeared until October. In July and August were noticed both larvae in different stages of development and adults on the same plant.

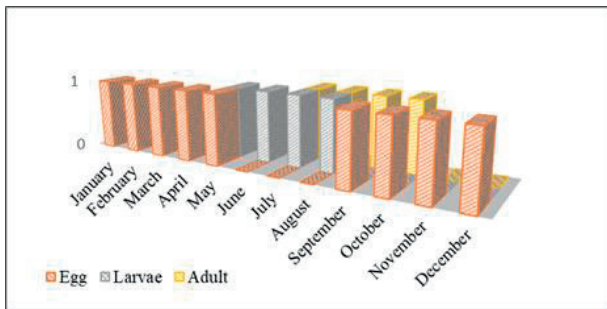


Figure 1. The presence or absence (1/0) of different developmental stages of *Metcalfa pruinosa* during 2017 at Moara Domneasca

The study conducted in 2018 on the phenology of *Metcalfa pruinosa* revealed that the species appeared later after one month and the attack was smaller than in the previous year. The species was highlighted in the administrative area - inhabited and along the tree line. The first larvae appeared in June and the larval activity lasted until August. Adults were active until September (Figure 2). Compared to 2017, the activity of the species was lower and this may be determined by the adverse climatic conditions. Between June 15 and July 31 it rained heavily (268 l/m²), which led to the registration of a lower degree of attack.

The presence of cicada was observed on 26 species of host plants in 2017, while in 2018 it was observed on only 10 species of the host plants. The evolution of the species regarding the host plants infested in Romania is visible through the analysis over time. In 2009 the invasive species *Metcalfa pruinosa* was first reported in the south-eastern extremity of Romania, and at that time the cicada attacked six plant species (Preda and Skolka, 2009). In 2010 it is reported on 16 species grassy and

woody (Grozea et al., 2011), later in the west of the country, 50 host plants are identified (Gogan, 2013). In parallel with the observations from the west, in Bucharest, the cicada attacks 33 plant species (Chireceanu and Gutue, 2011). Observations made by Vlad and Grozea (2016a) in 2014 and 2015 showed that the invasive species evolved attacking 66 plant species with most attacked *Prunus*, *Buxus*, *Rosa*, *Hibiscus*, *Acer* and *Ligustrum*. The most attacked species of plants, but also with a higher frequency in the observation points were the following: *Hibiscus syriacus*, *Acer negundo* followed by *Prunus* sp. with the same intensity, *Ligustrum vulgare* and *Rosa* sp. *Buxus sempervirens* with a very high presence in Timiș county was also attacked in 2 other counties - Arad and Bihor. Gymnosperms were less frequently attacked, possibly due to the morphological characteristics of luxuries and leaves, often acicular or scaly, with thick, hard and waxy epidermis (Vlad and Grozea, 2016).

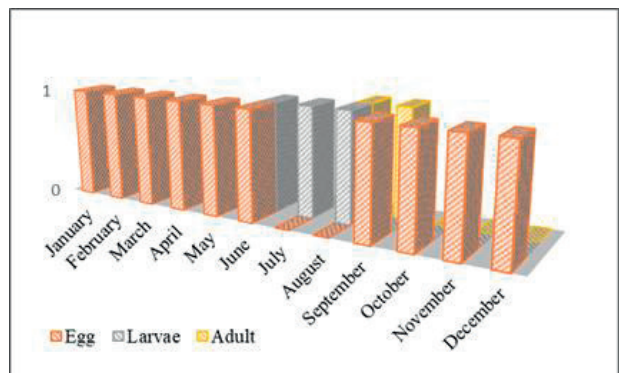


Figure 2. The presence or absence (1/0) of different developmental stages of *Metcalfa pruinosa* during 2018 at Moara Domneasca

The year 2017 was less favorable to the evolution of the pest due to adverse climatic conditions. The highest level of attack was registered in 2017 (IA = 10.0%; Figure 3) on *Acer negundo*. The cicada may be considered as especially attracted to this species. It has rich foliage creating a favorable microclimate. The leaves are heavily invaded by the larvae to absorb the sap they feed on and the woody tissues are soft in texture and are preferred by adults for laying eggs.

The degree of attack was lower in other woody species: mulberry, apple, peach and walnut, between 0.1-3.0% and generally the larvae were present on greedy shoots.

Table 1. Plant hosts infested by *Metcalfa pruinosa* during 2017 and 2018 at Moara Domneasca

<i>A. negundo</i> *	<i>M. alba</i> *	<i>M. nigra</i> *	<i>M. domestica</i> *	<i>P. persica</i> *	<i>R. ideus</i> *
<i>R. fruticosus</i> *	<i>L. esculentum</i> *	<i>C. sativus</i> *	<i>L. officinale</i> *	<i>P. vulgaris</i> *	<i>B. vulgaris</i> *
<i>H. esculentus</i> *	<i>M. sativa</i> *	<i>C. arvense</i> *	<i>T. officinale</i> *	<i>D. carota</i> *	<i>P. communis</i>
<i>J. regia</i>	<i>A. alba</i>	<i>P. strobus</i>	<i>V. vinifera</i>	<i>C. annuum</i>	<i>S. tuberosum</i>
<i>A. retroflexus</i>	<i>X. italicum</i>	<i>C. album</i>			

*species were infested during both years

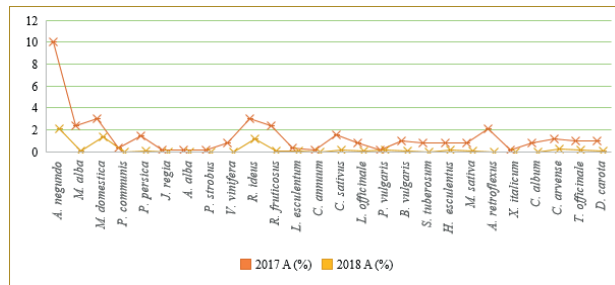


Figure 3. The intensity of the attack caused by *Metcalfa pruinosa* in 2017 and 2018 on different host plants

Favorable conditions for shelter and development of the invasive species are created by vines, raspberries and blackberries, registering an attack degree up to 3.0%, depending on the host plant and the year of observation. The invasive species was present on a large number of annual plants, vegetables and weeds and it appears that the insect reached these annual species due to a source of the infestation in the proximity. The adult was not reported on annual plants but only on woody plants and especially on the growth tips. Frequency high values were registered for *A. retroflexus* and *A. negundo* in 2017 and *V. vinifera* in 2018 (Figure 4).

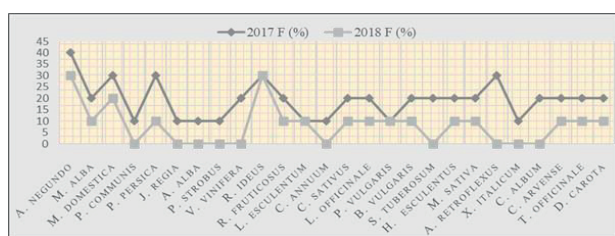


Figure 4. The frequency of *Metcalfa pruinosa* in 2017 and 2018 on different host plants

CONCLUSIONS

At the Didactic Farm Moara Domneasca, *M. pruinosa* was found to feed on 26 plants species. The year 2017 was favorable for the development of the cicada compared to 2018 when the first stages of development were delayed. The attack of the cicada on the infested plant species determined inferior fruit quality due to waxy substances secreted.

ACKNOWLEDGEMENTS

The authors would like to thank to the colleagues from Moara Domneasca for their support.

REFERENCES

- Chireceanu, C., Gutue, C. (2011). *Metcalfa pruinosa* (Say) (Homoptera: Flatidae) identified in a new south eastern area of Romania (Bucharest area). *Romanian Journal of Plant Protection*, 4, 28-34.
- Gogan, A., Grozea, I., Vîrteiu, A.M. (2010). *Metcalfa pruinosa* Say (Insecta. Homoptera: Flatidae)-first occurrence in western part of Romania. *Research Journal of Agricultural Sciences*, 42(4), 63-67.
- Gogan A., Grozea, I. (2013). *Metcalfa pruinosa*. Ed. Eurobit, Timișoara, 114-116.
- Grozea I., Gogan, A., Vîrteiu, A.M., Ștef, R., Molnar, R., Cărăbeș, A. and Dinnesen, S. (2011) *Metcalfa pruinosa* Say (Insecta: Homoptera: Flatidae) A new pest in Romania. *African Journal of Agricultural Research*, 6(27), 5870-5877.
- Metcalf, Z.P. (1957). Fascicle IV, Fulgoroidea, Part 13, Flatidae ad Hypochthonellidae, In: General catalogue of the Homoptera, China W.E., Metcalf Z.P. (Eds.), North Carolina State College, Raleigh, N.C., U.S.A., 283-351.
- Mihalache, M., Ilie, L., Marin, D.I. (2009). Research concerning the effect of management systems on physical and chemical properties of reddish preluvosoil from Moara Domneasca experimental field. The International Scientific Conference „Durable agriculture - Agriculture of the future”, 20-21 November, University of Craiova, 428-432.
- Petcu, G. (2008). Evaluation of agricultural land in the Moara Domneasca area using pedologic and economic criteria. PhD thesis, U.S.A.M.V. Bucharest.
- Strauss, G. (2010). Pest risk analysis of *Metcalfa pruinosa*. *Journal of Pest Science*, 83, 381-390.
- Zangheri, S., Donadini, P. (1980). Comparsa nel Veneto di un omottero neartico *Metcalfa pruinosa* Say (Homoptera, Flatidae). *Redia*, 63, 301-3015.
- Vlad, M.M., Grozea, I. (2016). Host plant species of the cicada *Metcalfa pruinosa* in Romania. *Buletin USAMV*, series Agriculture, 73(1), 131-137.
- Vlad, M.M., Grozea, I. (2016a). Predictive models of spread of invasive species *Metcalfa pruinosa* in Romania. PhD thesis, U.S.A.M.V.B. “King Mihai I of Romania” from Timișoara.