Flatid plant hopper (Metcalfa pruinosa Say) a new dangerous insect pest of ornamental and agricultural plants in…

Article *in* Journal of Food Agriculture and Environment · October 2013

4 authors:

Alina Gogan
Banat University of Agronomical Sciences an…

Ioana Grozea
Banat University of Agronomical Sciences an…

Ana - Maria Virteiu
Banat University of Agronomical Sciences an…

Narcis Gheorghe Baghina
Banat University of Agronomical Sciences an…

WFL Publisher
Science and Technology
Meri-Rastilantie 3 B, FI-00980
Helsinki, Finland
e-mail: info@world-food.net

Journal of Food, Agriculture & Environment Vol.11 (3&4): 2065-2070. 2013 *www.world-food.net*

Flatid plant hopper (*Metcalfa pruinosa* Say) a new dangerous insect pest of ornamental and agricultural plants in Romania

Gogan Alina [1], Ioana Grozea [1]*, Ana Maria Virteiu [1] and Narcis Baghina [2]

[1]Department of Biology and Plant Protection, Banat's University of Agricultural Sciences and Veterinary Medicine, Calea Aradului no.119, 300645, Timisoara, Romania. [2] Department of Sustainable Development and Environmental Engineering, Banat's University of Agricultural Sciences and Veterinary Medicine from Timisoara, Calea Aradului no.119, 300645, Timisoara, Romania. e-mail: ioana_entomol@yahoo.com, alinagogan_18@yahoo.com, anamaria.badea@gmail.com, chirita_ramona@yahoo.com, narcis_baghina@yahoo.com

Received 30 August 2013, accepted 2 October 2013.

Abstract

Metcalfa pruinosa Say (1830) (Insecta:Homoptera:Flatidae), most commonly known as flatid plant hopper, is a relatively new insect pest for Eastern Europe. In Romania, the first recorded of species was in 2009 in Constanta, in an isolated eastern area; the second recorded was in 2010 in Timisoara area at a long distance and opposite from the first point. The main purpose of this paper is to detect new areas infested and determine the range of the host plants. Researches made in the west part of Romania for over 2 years (2011 and 2012), and covered green spaces between buildings, public green parks, orchards and vineyards. Observation points have been established as the western border counties. Their choice has been taking into account of ecological preferences of pest and geographical coordinates of studied zone. Host plants of flatid vary from area to area including herbaceous or woody, ornamental or agricultural plants. The most visible damage were observed in follows plant species: *Acer* sp., *Tilia cordata, Rhus typhina, Carpinus betulus, Catalpa bignonioides, Ficus carica, Hibiscus syriacus, Juglans nigra, Ulmus minor, Rosa* sp, *Philadelphus* sp., *Cornus* sp., *Vitis vinifera, Prunus armeniaca, Prunus persica, Malus domestica.* Most plants affected are ornamentals species but agricultural plants from vineyards and orchards highlights a significant increase in both the level of damage and species. The colonies of adults and larvae are located usually on leaves and shoots, fruits and grapes clusters. The damage caused may directly and indirectly affect the growth and development of plants. Rapid expansion in the last two years and the poliphagous nature require attention from specialists for limiting their spread.

Key words: *Metcalfa pruinosa*, insect pest, invasive, host plants, colonies, damage, monitoring.

Introduction

The cicada known as *Metcalfa pruinosa* Say, came to attention of specialists in Europe with the first report, in 1979 in northern part of Italy [1]. This species was first mentioned as *Flata pruinosa*, in the eastern United States by Thomas Say, in 1830, and it was classified in the Metcalfa [2] genus. This insect was also mentioned in Asia, Korea in 2009 [3]. The occurrence in Romania was highlighted through points in two opposing areas: Constanta (2009) [4] and Timisoara (2010) [5]. The eastern North America and a part of a few countries in Europe (Italy, Croatia, Hungary, Slovenia, Austria and Czech Republic) are considered to be very favourable areas for development of this planthopper [6]. It prefers regions with high humidity, where the average annual rainfall is between 600 and 1625 mm [6], but it can surpass this barrier, so it can occupy new habitats [7], also in areas considered inappropriate, such as in Italy and southern France [8]. The insect has one generation per year and during winter it stays in the egg stage in woody tissues or under the bark of trees [9]. *Metcalfa pruinosa* is a species with a pronounced polifagism. In the native country, North America, there are mentioned about 120 host plant species belonging to 50 families [8]. In Europe there are mentioned 330 species of 78 families [10]. In Asia, a total of 74 species belonging to 41 families were confirmed as host plants in Korea [3]. The cicada causes both direct and indirect damage. There are various hypotheses relating to the effects produced, some negative and some positive. For direct damages, characteristic of the insects that are fed by sap extraction causes stagnation in the development of the plant. Most damages are indirect, esthetical, and it is a real problem for the urban environment, gardens and parks, due to its whitish secretion present on leaves and sprouts [11, 12]. Immature stages produce this secretion (wax) that covers its body and which is also present on the plant [13]. Most often, the symptoms are confused with secondary symptoms, such as the presence of waxy filaments on the plant or the honey dew, which are considered the main symptoms in the recognition of the species attack [14]. Larval exuvia and nymph are also considered indirect damages. They can inhibit metabolic processes important to the plant, such as breathing and photosynthesis [15]. Range of plants attacked, which are considered host plants for cicada *Metcalfa pruinosa*, are different from a geographical area to another, country or location [3, 9, 16-19]. The study of insect herbivores is a key to improving our ability to effectively manage agro-ecosystems [24].

Materials and Methods

Research area: The researches which make the subject of the study were carried out in the western part of Romania in: Timis, Arad, Bihor, Satu Mare, Caras Severin, Mehedinti, Hunedoara counties. During 2011 and 2012, movements were made at

observation points from areas situated along the border with Hungary and Serbia. The survey included June, July, August and September periods coinciding with the active phase of the life cycle of *Metcalfa pruinosa* species. In choosing the study areas, there have been taken into account its preferences and living places, which is why, there were established several observation points compared to the studied counties (Fig. 1, Table 1).

For OPgrsp observation points, there were chosen several target areas on the grounds of the first signaling point of *Metcalfa pruinosa* species in the north-west country. In vineyards and orchards points (OPvin and OPor), observations were made according to two criteria: I. on large-areas, readings were performed every two diagonal rows; II. in small areas, readings were performed on each row, from 50 m to 50 m.

Identifying places were established using a GPS and we marked the places through stakes or directly marking (in case of fruit trees and vine stocks).

Monitoring: Each OP was under observation through larval and nymph colonies present on leaves or young shoots of host plants mentioned in literature or in autochthon range given by researched green spaces, parks, orchard and vineyard. The monitoring of juvenile stages was carried out using the method of Tomoioagă *et al.* [20]. In the case of vine and trees, there were harvested 25 leaves per reading/area. For bushes, the harvesting method followed Trifan's model [21] according to which it is necessary to harvest shoots with 30 cm length from each area. Thus, from each OP there were harvested 10 shoots of 30 cm length. To monitor *Metcalfa pruinosa* adults an important role had the model [22] , which states as a means of attracting and catching Homoptera insects, the yellow sticky type Csalomon® trap.

Establish host plants through the presence of symptoms and colonies: The first evaluation of host plants was accomplished in 2011 during the first movement to assess the first reports of larval colonies in the western part of Romania, after a preliminary establishment of the main OP. During the first observation, uninfected plant species could not be quantified in the consecrated host plants list, following to be introduced later as finding attractiveness for this invasive cicada. The plants that have been submitted to the study, but did not show larval forms or other stages were placed in the list of monitored plants. In 2012, these observations were continued after the same protocol, except for the observations which established the first area of the host plants. It has been achieved the first area of the attacked plants, then, through evaluative periodic observations, new host plants were added.

For a more accurate identification of host plant species, it is necessary to know the general and specific symptoms. Literature provides numerous information for the recognition of host plants through the presence of larval colonies and white waxy secretion on the underside of leaves and branches also [23].

The presence of characteristic secretion on vegetative organs is another clue to identify host plants.

Data analysis: The recorded data were statistically interpreted using the ANOVA method.

Results and Discussion

Monitoring: The first mentioning of its presence in the western part of Romania was established in 2010 in the Resort Park of Young Naturalists in Timisoara (OP1grsp). This is actually the reference point for the addressed topic in the present paper.

Further research carried out in 2011 revealed the signaling of the first individuals also in other observation points: OP2vinor, OP6grsp, PO7grsp, PO8grsp, PO13grsp. Observation points in which the species was first reported in 2012 were: PO12grsp and PO17grsp. The species was not yet reported in: OP8vin, OP10vinor, OP11vin, OP14vin, OP15grsp, PO16grsp, PO18grsp.

Comparing the recorded values in 2 years of study in Timisoara city (Table 2), observation point OP1 (green space), it was observed that the ratio Fcrit = 4.13 > F = 0.11 does not affect the frequency of individuals; the test accepts the null hypothesis that the means are equivalent. The p value (0.73) is greater than the significance level (0.05). In the same city, but in other location, namely OP2 (orchard) based on the same analysis of the ratio $F_{crit} = 5.31 > F = 0.81$, the test cannot reject the null hypothesis. OP2 (vineyard) situation is different, as the test is significant ($p = 0.005 < 0.05$), through the ratio $F_{crit} = 5.31 < F = 14.11$.

The analysis of the average values of *Metcalfa pruinosa* individuals, present on host plants in Lugoj city (OP6grsp) (Table 3), shows that in the two years of research, 2011 and 2012, respectively, F-test is insignificant, with the probability of 95.0% - significance level (0.05), (therefore $p = 0.47 > 0.05$). The ratio $F_{crit} = 5.31 > F = 0.56$ shows that there was not any statistically significant influence on these values.

Analyzing the data obtained during observation of the points in the cities situated in the northern Arad, Oradea and Satu Mare (OP7grsp, OP9grsp and OP12grsp) (Table 4), it can be said that the situation was someway similar, with F-test

Table 1. Details of study area by presenting observation points and target area.

Zone/County	No. of observation point	Locality	Target area [1]	Point identification [2]
Timis	1	Timişoara	Green space + park	OP1grsp
	2	Timisoara	Vineyard + orchard	OP2vinor
	3	Periam	Orchard	OP3or
	4	Recas	Vineyard	OP4vin
	5	Buzias	Vineyard	OP5or
	6	Lugoj	Green space + park	OP6grsp
Arad	7	Arad	Green space + park	OP 7grsp
	8	Miniş	Vineyard	OP 8vin
Bihor	9	Oradea	Green space + park	OP 9grsp
	10	Diosig	Vineyard + orchard	OP10vinor
	11	Valea lui Mihai	Vineyard	OP11vin
Satu Mare	12	Satu Mare	Green space + park	OP12grsp
Caras Severin	13	Resita	Green space + park	OP13grsp
	14	Tirol	Vineyard	OP14vin
	15	Carnsebes	Green space + park	OP 15grsp
	16	Domasnea	Orchard	OP16or
Mehedinti	17	Drobeta-Turnu Severin	Green space + park	OP17grsp
Hunedoara	18	Deva	Green space + park	OP18grsp

[1] Area comprising plants preferred by *Metcalfa pruinosa*; [2] Abbreviated name of the observation point.

Figure 1. Research area in western Romania (along the Hungary and Serbia borders) with observation within and outside built-up areas.

Table 2. Analysis of the average values of *Metcalfa pruinosa* S. individuals present on the host plants in Timisoara (OP1grsp, OP2vinor).

	Source of variation	SS	df	MS	F	P-value	F crit
OP1grsp	Between groups	519.84	1	519.84	0.113879	0.737845	4.130018
	Within groups	155205	34	4564.852			
	Total	155724.8	35				
OP2or	Between groups	432.964	1	432.964	0.813637	0.393394	5.317655
	Within groups	4257.072	8	532.134			
	Total	4690.036	9				
OP2vin	Between groups	120.409	1	120.409	14.1176	0.005565	5.317655
	Within groups	68.232	8	8.529			
	Total	188.641	9				

Df - degree of freedom, SS - Sum of Squares, MS - Mean Square/ANOVA.

Table 3. Analysis of the average values of *Metcalfa pruinosa* S. individuals present on host plants in Lugoj (OP6grsp).

Source of variation	SS	df	MS	F	P-value	F crit
Between groups	0.169	1	0.169	0.565217	0.4737012	5.317655
Within groups	2.392	8	0.299			
Total	2.561	9				

Df - degree of freedom, SS - Sum of Squares, MS - Mean Square/ANOVA.

Table 4. Analysis of average values of *Metcalfa pruinosa* S. individuals present on host plants in Arad, Oradea and Satu Mare (OP7grsp, OP9grsp and OP12grsp).

	Source of variation	SS	df	MS	F	P-value	F crit
OP7	Between groups	332.2314286	1	332.2314	0.510187	0.48872	4.747225
	Within groups	7814.342857	12	651.1952			
	Total	8146.574286	13				
OP9	Between groups	0.026667	1	0.026667	0.010309	0.924012	7.708647
	Within groups	10.34667	4	2.586667			
	Total	10.37333	5				
OP12	Between groups	0.049	1	0.049	1	0.346594	5.317655
	Within groups	0.392	8	0.049			
	Total	0.441	9				

Df - degree of freedom, SS - Sum of Squares, MS - Mean Square/ANOVA.

being insignificant, the probability of 95.0% - significance level (0.05). For OP7grsp ratio $F_{crit} = 5.31 > F = 0.56$ shows that for the gathered data during the compared years, there was not a statistically significant influence ($p = 0.47 > 0.05$). The same in OP9grsp case, which ratio was $F_{crit} = 7.70 > F = 0.01$, shows an insignificant influence on the number of present individuals ($p = 0.92 > 0.05$). The ratio $F_{crit} = 5.31 > F = 1$ assigned to OP12grsp is directly associated with insignificant influence upon the average values of individuals ($p = 0.34 > 0.05$).

Table 5 shows a differentiation of the two observation points (OP13grsp, OP17grsp) through the obtained values and analyzed data. Thus, for OP13grsp the F-test was insignificant with 95.0% probability, (significance level) ($p = 0.75 > 0.05$), because of the ratio $F_{crit} = 18.51 > F = 0.13$. For OP17grsp, the F-test was significant ($p = 0.0009 < 0.05$), with ratio $F_{crit} = 4.74 < F = 19.01$ showing significant differences of averages. In the following observation points: OP 3, OP4, OP5, OP8, OP10, OP11, OP14, OP15, OP16 and OP18, the cicada was not present.

Table 5. Analysis of average values of *Metcalfa pruinosa* S. individuals present on host plants in Resita and Drobeta Turnu Severin (OP13grsp, OP17grsp).

	Source of variation	SS	df	MS	F	P-value	F crit
OP13	Between groups	9.61	1	9.61	0.131195	0.751889	18.51282
	Within groups	146.5	2	73.25			
	Total	156.11	3				
OP17	Between groups	3351.111	1	3351.111	19.01252	0.000928	4.747225
	Within groups	2115.097	12	176.2581			
	Total	5466.209	13				

Df - degree of freedom, SS - Sum of Squares, MS - Mean Square/ANOVA.

The host plants through the symptoms and the present colonies: The host plants were easily identified through direct visualization. The presence of larvae and nymph (or larva colonies) on young shoots or leaves (in some cases on tendrils also) was visible even from several meters distance due to white waxy secretions and the shining leaves covered with honey dew.

For now, a hierarchy of host plants can be made according to the preferences of the species. Thus, in the observation points established in green spaces and parks, larva colonies were signaled on the following plants: *Acer platanoides, Acer negundo, Tilia cordata, Catalpa bignonioides, Hibiscus syriacus, Rosa* sp., *Acer campestre, Acer pseudoplatanus, Cotinus coggygria*, *Rhus typhina*, *Hedera helix*, *Sambucus nigra*, *Viburnum lantana*, *Berberis thunbergii, Buxus microphylla*, *Carpinus betulus*, *Corylus avellana*, *Cornus* sp., *Heptacodium miconioides, Humulus lupulus, Robinia pseudoacacia, Philadelphus* sp., *Morus* sp., *Juglans regia, Juglans nigra, Ficus carica, Fraxinus excelsior, Ligustrum vulgare, Plantago major, Prunus cerasifera, Spiraea vanhouttei, Aesculus hippocastanum, Ulmus minor, Parthenocissus quinquefolia, Yucca* sp., *Althaea officinalis, Syringa vulgaris, Acer* sp., *Albizia julibrissin, Pyrus communis, Magnolia kobus, Helianthus annuus, Glycine max* and *Quercus robur.*

In marked orchards, *Metcalfa pruinosa* species was signaled on the next fruit trees: *Prunus armeniaca*, *Prunus piersica*, *Malus domestica, Persica vulgaris* and *Prunus domestica.*

Vine can also be considered as a host plant for cicada, which is signaled in both years of the study, 2011 and 2012. The most affected plants were ornamental species of *Acer* genus, especially *A. platanoides* and *A. negundo,* while the least affected proved to be *Philadelphus* sp. and *Cornus* sp. (Fig. 2). Other two ornamental plants which can be included in the favourite category are *Tilia cordata* and *Catalpa bignonioides*. Of the fruit tree species, *Prunus armeniaca, Prunus persica* and *Malus domestica* were by far the preferred ones (Fig. 3). Vine from studied vineyards was most affected in the second year of study compared to the first one (Fig. 4), which highlights the continued extension and numerical increase of affected plant from one year to another.

Discussion

Currently, *Metcalfa pruinosa* is present in six counties in the western part of Romania and two other in the south-east, with the possibility of expanding the invasion in new Romanian counties. It affects more ornamental plants, but also agricultural ones from vineyards and orchards.

The most visible damage were observed in the following plant species: *Acer* sp., *Tilia cordata,*

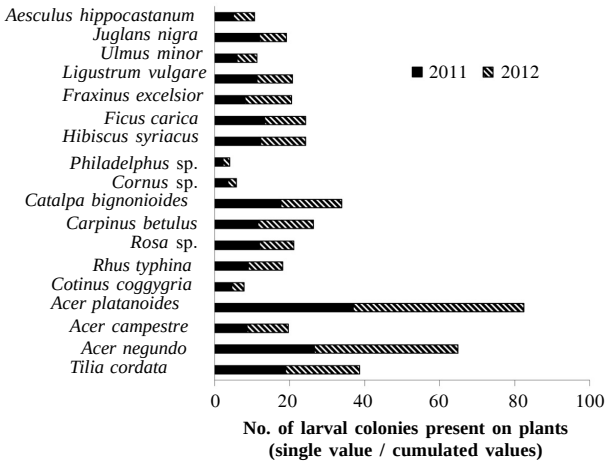

Figure 2. Establishing of host plants, through frequency of larval colonies by *M. pruinosa,* in all green spaces and parks, from studied localities.

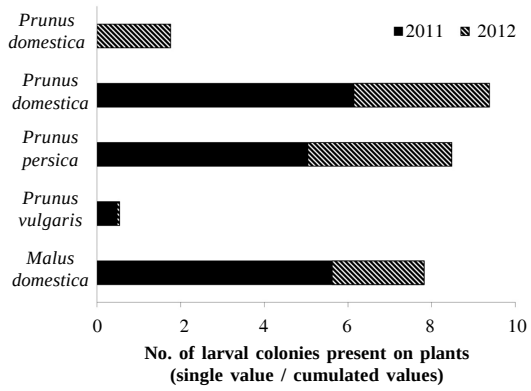

Figure 3. Establishing of host plants, through frequency of larval colonies by *M. pruinosa,* in all studied orchards.

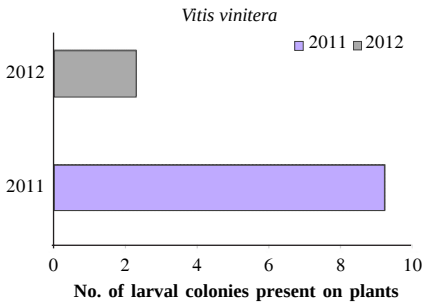

Figure 4. Establishing of host plants, through frequency of larval colonies by *M. pruinosa,* in all studied vineyards.

Rhus typhina, Carpinus betulus, Catalpa bignonioides, Ficus carica, Hibiscus syriacus, Juglans nigra, Ulmus minor, Rosa sp., *Philadelphus* sp., *Cornus* sp., *Vitis vinifera, Prunus armeniaca, Prunus persica* and *Malus domestica.*

On ornamental plants, the first larvae appeared on *Acer platanoides, Acer negundo* and *Tilia cordata* specias, but shortly after hatching, *Metcalfa pruinosa* larvae migrated on other plants: *Catalpa bignonioides, Hibiscus syriacus, Rosa* sp., *Acer campestre,* etc.

In orchards, the first hatched larvae were observed on *Prunus armeniaca* and *Prunus piersica,* later infesting other fruit tree species *Malus domestica, Persica vulgaris* and *Prunus domestica.*

We expect that in coming years the insect population will increase in number and range of host plants will get richer. This massive presence in green spaces between buildings and relaxing parks makes it hard to control this species, so special attention to non toxic possibilities of limiting expansion should be paid.

Conclusions

An analysis of results show the flatid was present on different plants. Not in all points under observation, the pest was signaled. Most plants affected are ornamentals species but agricultural plants from vineyards and orchards highlights a significant increase in both the level of damage and species. Plant species of Acer genus (*A. platanoides, A. negundo*) were most affected while the least affected proved to be *Philadelphus* sp. and *Cornus* sp. In orchards, on *Prunus armeniaca, Prunus persica* and *Malus domestica* were present most larval colonies.

Acknowledgements

We want to thank the town halls from each studied city for allowing us to explore our target areas. This research had as material support the project Doctoral studies for research training (FOR-CE), contract no. POSDRU/ CPP107/ DMI1.5/ S/ 80127 and it is a part of the doctoral thesis of the first author. Part of the cost was provided in the project Doctoral and Postdoctoral studies in Agricultural and Veterinary Medicine (POSDRU/89/1.5/S/62371).

References

[1]Zangheri, S. and Donadini, P. 1980. Appearance of nearctic homopterous *Metcalfa pruinosa* Say (Homoptera, Flatidae) in Veneto region. Redia **63**:301-305.

[2]Metcalf, Z. P. 1957. General Catalogue of the Homoptera. Fasc. IV. Fulgoroidae, Part 13. Flatidae an Hypochthonellidae, 574 p.

[3]Kim, Y., Kim, M., Hong, K. J. and Lee, S. 2011. Outbreak of an exotic flatid, *Metcalfa pruinosa* (Say) (Hemiptera: Flatidae), in the capital region of Korea. J. As. Pac. Entomol. **14**:473-78.

[4]Preda, C. and Skolka, M. 2011. Range expansion of *Metcalfa pruinosa* (Homoptera: Fulgoroidea) in Southeastern Europe. Ecol. Balk. **3**:79-87.

[5]Gogan, A., Grozea, I. and Vîrteiu, A. M. 2010. *Metcalfa Pruinosa* Say (Insecta: Homoptera: Flatidae) first occurrence in western part of Romania. Res. J. Agric. Sci. **42**(4):63-67.

[6]Strauss, G. 2010. Pest risk analysis of *Metcalfa pruinosa* in Austria. J. Pest Sci. **83**:381-390.

[7]Grozea, I., Gogan, A., Vîrteiu, A. M., Grozea, A., Ştef, R., Molnar, L., Cărăbeţ, A. and Dinnesen, S. 2011. *Metcalfa pruinosa* Say (Insecta: Homoptera: Flatidae): A new pest in Romania. Afr. J. Agr.Res. **6**(27):5870-5877.

[8]Wilson, S. W. and Lucchi, A. 2000. Systematic, chronologic and ecologic aspects. In Lucchi, A. (ed.). Metcalfa in Italian Ecosystems. Regional Agency of Development and Innovation in Agro-Forestry, Firenze, Italy. **1**:13-28.

[9]Wilson, S. W. and Mcpherson, J. E. 1981. Life histories of *Anormenis septentrionalis, Metcalfa pruinosa*, and *Ormenoides venusta* with descriptions of immature stages. Ann. Entomol. Soc. America **74**(3):299-311.

[10]Alma, A., Ferracini, C. and Burgio, G. 2005. Development of sequential plan to evaluate *Neodryinus typhlocybae* (Ashmead) (Hymenoptera: Drynidae) population associated with *Metcalfa pruinosa* (Say) (Homoptera: Flatidae) infestation in Northwester Italy. Biol. Contr. Paras. Predat. **34**(4):819-824.

[11]Rossi, E., Lucchi, A. and Molco, A. 2000. Urban IPM and G.I.S. (Geographical Information System): A promising meeting. Informatore Fitopatologico **50**:12, 26-32.

[12]Pons, X., Lumbierres, B., Garcia, S. and Manetti, P. L. 2002. *Metcalfa*

pruinosa (Say) (Homoptera: Flatidae), a potential pests of ornamental plants in green urban spaces of Catalonia? Boletin de Sanidad Vegetal Plagas **28**(2):217-222.

[13]Lucchi, A. and Santini, L. 2001. Physiological and morpho-functional aspects of *Metcalfa pruinosa* (Homoptera: Fulgoroidea) referring on agricutural and ornamental production. Italian National Academy of Entomol. Proceedings **50**:131-147.

[14]Kahrer, A., Strauss, G., Stolz, M. and Moosbeckhofer, R. 2009. Recently observations of the biology and fauna of Austria after entrained of *Metcalfa pruinosa*. Entomofaunistik **10**:17-30.

[15]Ciampolini, M., Grossi, A. and Zottarelli, G. 1987. Damage to soybean through attack by *Metcalfa pruinosa*. Informatore Agrario **43**(15):101-103.

[16]Lauterer, P. 2002. Citrus flatid planthopper - *Metcalfa pruinosa* (Hemiptera: Flatidae), a new pest of ornamental horticulture in the Czech Republic. Plant Protect. Sci. **38**:145-14.

[17]Della Giustina, W. 1986. *Metcalfa pruinosa* (SAY 1830), new for French fauna (Hom.: Flatidae). Bulletin de la Societe Entomologique de France **91**(3-4):89-92.

[18]Orosz, A. and Der, Z. 2004. Beware of the spread of the leafhopper species *Metcalfa pruinosa* (Say 1830). Novenyvedelem **40**:137-141.

[19]Souliotis, C., Papanikolaou, N. E., Papachristos, D. and Fatouros, N. 2008. Host plants of the planthopper *Metcalfa pruinosa* (Say) (Hemiptera: Flatidae) and observation on its phenology in Greece. Hellenic Plant Prot. J. **1**:39-41.

[20]Tomoioagă, L. L, Comşa, M. and Cudur, C. 2011. Research on the dynamics of *Empoasca vitis* species in vineyards located in central Transylvania. Scientific papers USAMV Bucureşti, Seria B Horticulture **LV**:578-582.

[21]Trifan, G. A. 2009. Researches of biology, ecology and control of pest of some shrubs (*Spiraea* spp., *Hibiscus* spp.) and ornamental trees (*Aesculus hippocastanum).*Thesis Summary **1**:35.

[22]Chirceanu, C. and Gutue, C. 2011. *Metcalfa pruinosa* (Say) (Hemiptera: Flatidae) identified in a new South Eastern area of Romania (Bucharest area). Romanian Journal of Plant Protection **4**:28-34.

[23]Mihajlović, L. 2007. *Metcalfa pruinosa* (Homoptera: Auchenorrhyncha) a new harmful species for entomofauna of Serbia. Bull. Fac. For. **95**:127-134.

[24]Dminić, I., Kozina, A., Bažok, R. and Barčić, J. I. 2010. Geographic information systems (GIS) and entomological research: A review. Journal of Food Agriculture & Environment **8**(2):1193-1198.