



THE ECONOMICALLY IMPORTANT ALIEN INVASIVE PLANTHOPPERS IN TURKEY (HEMIPTERA: FULGOROMORPHA)

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Abstract – Alien invasive Hemiptera species are insects of special interest in terms of their nutritional characteristics and their damage and potential effects on cultivated plants. In this study the available informations on the two planthopper species that are invasive in the western Palearctic region and are harmful polyphagically on the EPPO list are summarized and revised. The effects of *Metcalfa pruinosa* (Say, 1830) of the Flatidae family and *Orosanga japonica* (Melichar, 1898) of the Ricaniidae family are seen particularly intense in the Eastern Black Sea Region in Turkey. Host plants of these species, their possible effects, origins and geographical distribution are given.

KEY WORDS: alien invasive species, *Metcalfa pruinosa*, *Orosanga japonica*, host plants, Turkey.

Izveček – GOSPODARSKO POMEMBNI TUJERODNI INVAZIVNI ŠKRŽATKI V TURČIJI (HEMIPTERA: FULGOROMORPHA)

Tujerodne invazivne vrste reda Hemiptera so žuželke, ki nas še posebej zanimajo z vidika njihovih prehranjevalnih lastnosti in škode ter potencialnih učinkov na kulturne rastline. V tej študiji so povzete in revidirane razpoložljive informacije o dveh vrstah škržatkov, invazivnih v zahodni palearktični regiji in sta škodljivi, mnogogjedi, na seznamu EPPO. Učinki vrst *Metcalfa pruinosa* (Say, 1830) iz družine Flatidae in *Orosanga japonica* (Melichar, 1898) iz družine Ricaniidae so posebno izraziti v Vzhodni črnemorski regiji v Turčiji. Navedene so gostiteljske rastline teh vrst, njihovi možni učinki, izvor in geografska razširjenost.

KLJUČNE BESEDE: tujerodne invazivne vrste, *Metcalfa pruinosa*, *Orosanga japonica*, gostiteljske rastline, Turčija.

Introduction

Alien species are species that are distributed outside of their natural geographical distribution areas for various reasons. Most of these alien species are of great importance because they exert pressure on local biodiversity, invade cultural plants, cause great economic damage and even threaten human health. Today, the number of alien species in fauna and flora is increasing worldwide due to climate change, the increase in worldwide trade without serious pest controls, and the production of plants of foreign origin, etc.

Fulgoromorpha is a large group of phytophagous insects distributed around the world. At present 14,000 species belonging to 30 families, including fossils, have been identified (Bourgoin, 2017). Since all species suck plant fluids, the relationship with host plants is very important. Plant pathogens are carried to the plant during feeding. Several Fulgoromorpha species around the world are vectors of the most devastating pests of major agricultural products. More than 150 species in various planthopper families have been listed as harmful to large economic losses for 99 cultivated plants (Wilson & O'Brien, 1987, Bourgoin, 2017). For this reason, it is very important to monitor the population density of foreign invasive species and take the necessary precautions.

219 species belonging to 12 families of planthoppers are known from Turkey (Demir, 2008). Two of these species are invasive alien species. They have been attracting attention in recent years due to the damages caused in agricultural plants especially in Eastern Black Sea Region. These are *Metcalfa pruinosa* (Say, 1830) (Flatidae) from North America and *Orosanga japonica* (Melichar, 1898) (Ricaniidae) from East Asia.

According to the European and Mediterranean Plant Protection Organization (EPPO), *Orosanga japonica* is a major plant pest, occurring mostly in tropical regions and lower tropics in the eastern hemisphere. This species was recorded from Turkey (Black Sea coast) for the first time in 2007 and published by Demir (2009). In 2010, it was recorded in the mouth of the river Veleka at the Black Sea coast of Bulgaria (Gjonov, 2011; Gjonov and Shishiniova, 2014). It was recorded from the West Palearctic region in Georgia (Krasnodar province) and Ukraine (Gnezdilov and Suggoev, 2009). It was reported that this species is a vector of fungus pathogens in chestnut forests in the Abkhazian Research Forests Experiment Station of the Caucasus (Lukmazova and Selikhovkin, 2013). It was reported that it caused major damages in tea and kiwi garden in Turkey's eastern Black Sea coast (Ak et al., 2015). It was also recorded in the western Black Sea region by Oztemiz (2018).

Like the previous species, *Metcalfa pruinosa* is listed among the major plant pests by the European and Mediterranean Plant Protection Organization (EPPO). This species was recorded by Karsavuran & Güçlü (2004) for the first time from Turkey in 2004 in Izmir (Aegean Coast). It has been identified firstly in North America (Canada, Brazil and Caribbean Islands) and seen first in Italy in Europe (1979) and later reported to cause damage in Italy, France, Switzerland and Slovenia (EPPO). It has also been reported from and to cause significant damage in Croatia (Čuljak et al,

2007), Austria (Strauss, 2010) and Romania (Preda and Skolka, 2011; Grozea et al., 2011; Ciceoi et al., 2017). Grozea et al. (2015) tried to provide biological control against this species by using Coccinellid species in ornamental plants in Romania. Camerini (2017) conducted a research on spider species to provide biological control against this species which is common in trees in the northern part of Italy. By using CLIMEX modeling software, Byeon et al. (2018) estimated that the globally predictable worldwide distribution of this species would expand in the north-eastern direction and reported that a controlled prevention system was needed. Chkhaidze et al. (2016) suggested that *M. pruinosa* could be a phytoplasma vector in Georgian vineyards; Donati et al. (2017) reported that this species may be the *Pseudomonas syringae* vector, which produces bacterial cancer in kiwi orchards in Italy. In Turkey Hantaş et al (2014) reported this species from Sakarya and Yalova; it was found on quince. This species is distributed in the Mediterranean and the Black Sea regions and has been reported to cause damage especially in kiwi gardens in agricultural areas in the Eastern Black Sea Region (Günçan, 2014). Göktürk (2017) conducted biopesticide experiments to establish a struggle strategy against this species in Artvin in the Eastern Black Sea Region.

Materials and Methods

The samples examined in this study were collected with aspirator in the hazelnut and walnut gardens in Akçakoca and Konuralp in Düzce from Western Black Sea Region. After conversion to standard museum material in the laboratory, the specimens were identified. Samples are kept in the author's collection.

Results

The locality, distribution and host plant information of the examined specimens are given below.

Orosanga japonica (Melichar, 1898)

Family: Ricaniidae Amyot & Audinet-Serville, 1843

Synonymy: *Ricania japonica* Melichar, 1898 previous combination of *Orosanga japonica* (Melichar, 1898) according to Hayashi & Fujinuma (2016): 354.

Material: Düzce, Akçakoca, Ceneviz Castle, 14.08.2017, 13♂7♀. These planthoppers were collected from the border of hazelnut gardens. On *Platanus orientalis*, *Rubus* sp., *Clematis vitalba* and *Corylus avallena*. A large number of specimens were observed on the plants (Figures 1-6).

Zoogeographic range: China, India, Japan (Honshu, Kyushu, Shikoku), Nansei-shoto (Ryukyu Islands), Taiwan, Ukraine, Turkey, Georgia (Krasnodar), Bulgarian, Abkhazia (Hoch, 2013; Bourgoïn, 2017).

Distribution in Turkey: Rize prov.: Center, (Demir, 2009), Artvin prov.: Arhavi, Hopa, Kemalpaşa, Rize prov.: Ardeşen, Çayeli, Derepaşarı, Fındıklı, Pazar, Trabzon

prov.: Araklı, Of, Sürmene (Ak et al., 2015); Düzce prov.: Akçakoca (Öztemiz, 2018).

Host plants: Demir (2009) reported this species from *Vitis vinifera*, *Rubus* sp., *Camelia sinensis*, *Ficus carica*, *Phaseolus vulgaris*, *Cucumis sativus*, *Lycopersicum esculentum* and weeds. Ak and others (2015) gave a large number of host plants - see table 1.

Table 1. Host plants of *Orosanga japonica* in Turkey. Abbreviation of province names in the table: AR: Artvin, DU: Düzce, RI: Rize, TR: Trabzon.

Family	Species	Province	Reference
Platanaceae	<i>Platanus orientalis</i> (plane)	DU	This study
Rosaceae	<i>Rubus</i> sp. (blackberry)	AR, DU, RI, TR	This study; Demir,2009; Ak et al,2015
Betulaceae	<i>Corylus avellana</i> (hazelnut)	AR, DU, RI, TR	This study; Ak et al, 2015; Öztemiz, 2018
Ranunculaceae	<i>Clematis vitalba</i>	DU	This study
Vitaceae	<i>Vitis vinifera</i> (grape)	AR, RI, TR	Demir, 2009; Ak et al, 2015
Theaceae	<i>Camelia sinensis</i> (tea)	AR, RI, TR	Demir, 2009; Ak et al, 2015
Moraceae	<i>Ficus carica</i> (fig)	AR, RI, TR	Demir, 2009; Ak et al, 2015
Fabaceae	<i>Phaseolus vulgaris</i> (beans)	RI	Demir, 2009
Cucurbitaceae	<i>Cucumis sativus</i> (cucumber)	AR, RI, TR	Demir, 2009; Ak et al, 2015
Solanaceae	<i>Lycopersicum esculentum</i> (tomato)	RI	Demir, 2009
Adoxaceae	<i>Sambucus</i> sp. (elder-berry)	AR, RI, TR	Ak et al, 2015
Grossulariaceae	<i>Actinidia deliciosa</i> (kiwifruit)	AR, RI, TR	Ak et al, 2015
Hydrangeaceae	<i>Hydrangea macrophylla</i>	AR, RI, TR	Ak et al, 2015
Betulaceae	<i>Alnus</i> sp (alder tree)	AR, RI, TR	Ak et al, 2015
Rosaceae	<i>Laurocerasus officinalis</i>	AR, RI, TR	Ak et al, 2015
Urticaceae	<i>Urtica</i> sp. (nettle)	AR, RI, TR	Ak et al, 2015
Fabaceae	<i>Robinia pseudoacacia</i>	AR, RI, TR	Ak et al, 2015
Asteraceae	<i>Artemisia absinthium</i> (wormwood)	AR, RI, TR	Ak et al, 2015
Rosaceae	<i>Eriobotrya japonica</i> (japanese plum)	AR, RI, TR	Ak et al, 2015
Lamiaceae	<i>Lavandula</i> sp. (lavender)	AR, RI, TR	Ak et al, 2015
Rutaceae	<i>Poncirus trifoliata</i>	AR, RI, TR	Ak et al, 2015
Juglandaceae	<i>Juglans regia</i> (walnut)	AR, RI, TR	Ak et al, 2015
Ebenaceae	<i>Diospyros lotus</i>	AR, RI, TR	Ak et al, 2015
Rosaceae	<i>Malus</i> sp. (apple)	AR, RI, TR	Ak et al, 2015
Rutaceae	<i>Citrus reticulata</i> (mandarin)	AR, RI, TR	Ak et al, 2015
Fagaceae	<i>Castanea sativa</i> (chestnut)	AR, RI, TR	Ak et al, 2015
Solanaceae	<i>Solanum melongena</i> (eggplant)	AR, RI, TR	Ak et al, 2015

Metcalfa pruinosa (Say, 1830)

Family: Flatidae Spinola, 1839

Material: Düzce, Akçakoca, Ceneviz Castle, 14.08.2017, 6 ♂♀; Konuralp, Bağlık Location, 2 ♂♀, Çiftepınarlar 4 ♂♀. These planthoppers were collected from the border of hazelnut and walnut gardens. On *Corylus avellana*, *Juglans regia*, *Ficus carica*, *Laurocerasus officinalis*, *Platanus orientalis*, *Rubus* sp., *Clematis vitalba*. A large number of specimens were observed on the plants (figures 7-11).

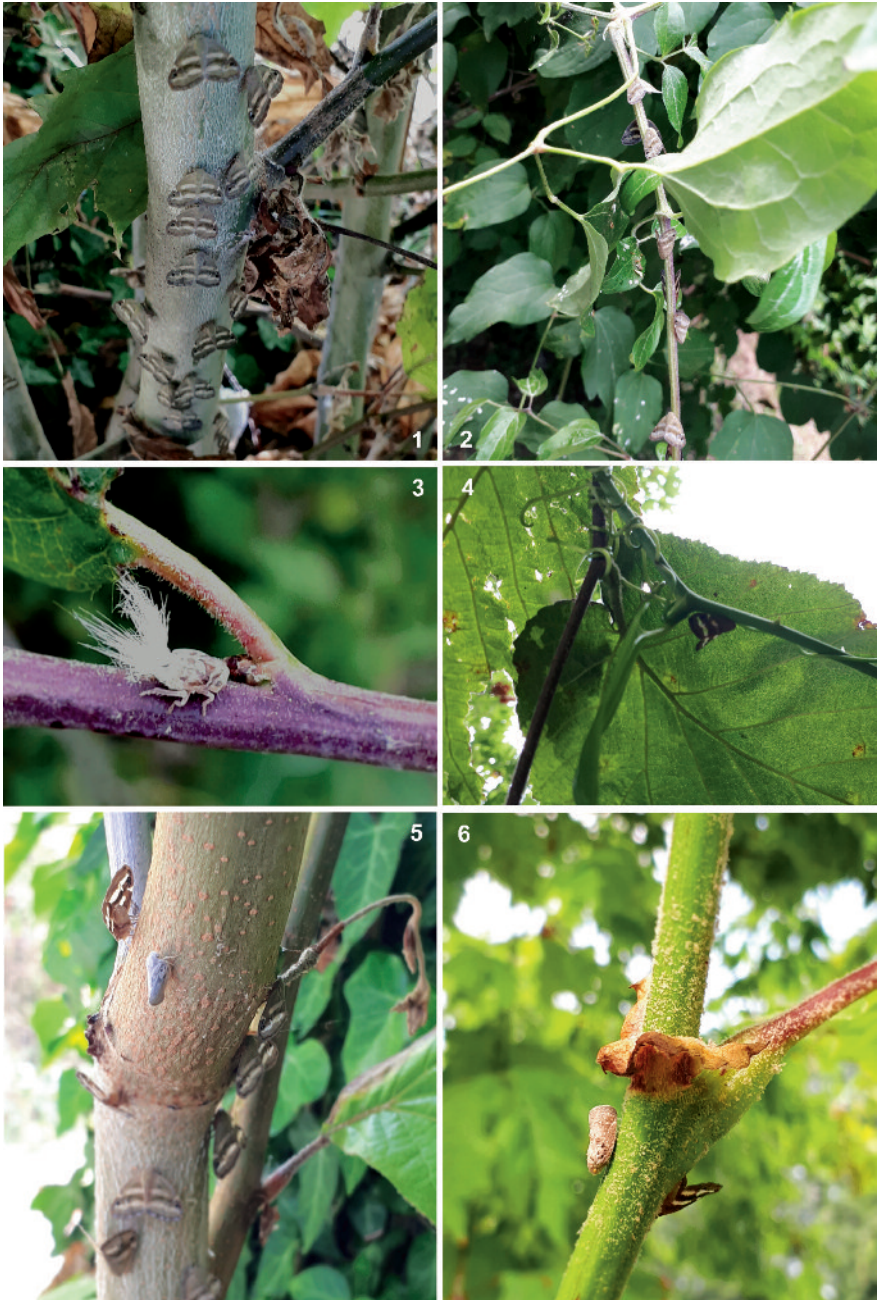


Fig. 1-6: *Orosanga japonica* on various host plants in hazelnut gardens. 1. on *Platanus orientalis*, 2., 4. on *Clematis vitalba*, 3. a nymph on *Platanus orientalis*, 5., 6. specimens of *O. japonica* and *M. pruinosa* on the same plant.

Zoogeographic range: North America inc. Cuba and Mexico. Introduced to many countries of the Mediterranean region and also Central Europe (see Hoch, 2013; Bourgoïn, 2017).

Distribution in Turkey: İzmir prov.: Balçova (Karsavuran and Güçlü, 2004); Sakarya prov.: Gevye, Yalova prov.: Center (Hantaş et al., 2014); Ordu prov.: Altınordu, Perşembe, Fatsa, Ünye (Güncan, 2014).

Host plants: According to EPPO, it is a highly polyphagous insect that can attack fruit trees, forest trees, ornamental plants and weeds. 173 host plants were recorded in Italy. Damage to citrus fruits, grapevines, fig trees, blackberries, apples, pears, olives, apricots, walnuts, plums, sunflower, soybean have been reported. Examples of species were collected in Turkey in the Aegean region mandarin trees (Karsavuran and Strong, 2004). Hantaş et al. (2014) found it in quince gardens in Sakarya and Yalova. Güncan (2014) reported that this species was the cause of the damages in the kiwi gardens in the Black Sea Region (table 2).

Table 2. Host plants of *Metcalfa pruinosa* in Turkey.

Family	Species	Province	Reference
Juglandaceae	<i>Juglans regia</i> (walnut)	Düzce	This study
Platanaceae	<i>Platanus orientalis</i> (plane)	Düzce	This study
Rosaceae	<i>Rubus</i> sp. (blackberry)	Düzce	This study
Betulaceae	<i>Corylus avallena</i> (hazelnut)	Düzce	This study
Ranunculaceae	<i>Clematis vitalba</i>	Düzce	This study
Moraceae	<i>Ficus carica</i> (fig)	Düzce	This study
Rosaceae	<i>Laurocerasus officinalis</i> (cherry laurel)	Düzce	This study
Rutaceae	<i>Citrus reticulata</i>	İzmir	Karsavuran and Güçlü, 2004
Grossulariaceae	<i>Actinidia deliciosa</i> (kiwifruit)	Ordu	Güncan, 2014

Discussion

Orosanga japonica has been recorded from Turkey first in Rize by Demir (2009). In subsequent years many *Ricania simulans* (Walker, 1851) records were given by Güçlü et al. (2010), Göktürk and Mihli (2015) and Ak et al. (2015). I think that the specimens recorded in these studies as *Ricania simulans* (Walker, 1851) are in fact *Orosanga japonica* since *R. simulans* is distributed only in China (Fujian, Jiangxi, Zhejiang), India, Japan and Taiwan (Bourgoïn, 2017).

O. japonica is distributed in the Black Sea Region in the west up to Akçakoca province (Öztemiz, 2018). It is stated that this species causes great economic problems for tea and kiwi gardens (Güçlü et al., 2010, Göktürk and Mihli, 2015, Ak et al., 2015). This study proves that it is also widespread in hazelnut gardens in the West Black Sea and distributed all over the Black Sea coast. In order to prevent a situation similar to tea gardens in hazelnut gardens, it is necessary to control the population continuously and take necessary precautions. In addition, the risk of being a vector for viral and fungal pathogens should be considered.

Metcalfa pruinosa has spread in western and northern Anatolia after recorded in İzmir Balçova by 2003 (Karsavuran and Güçlü, 2004). Also stated that it caused eco-

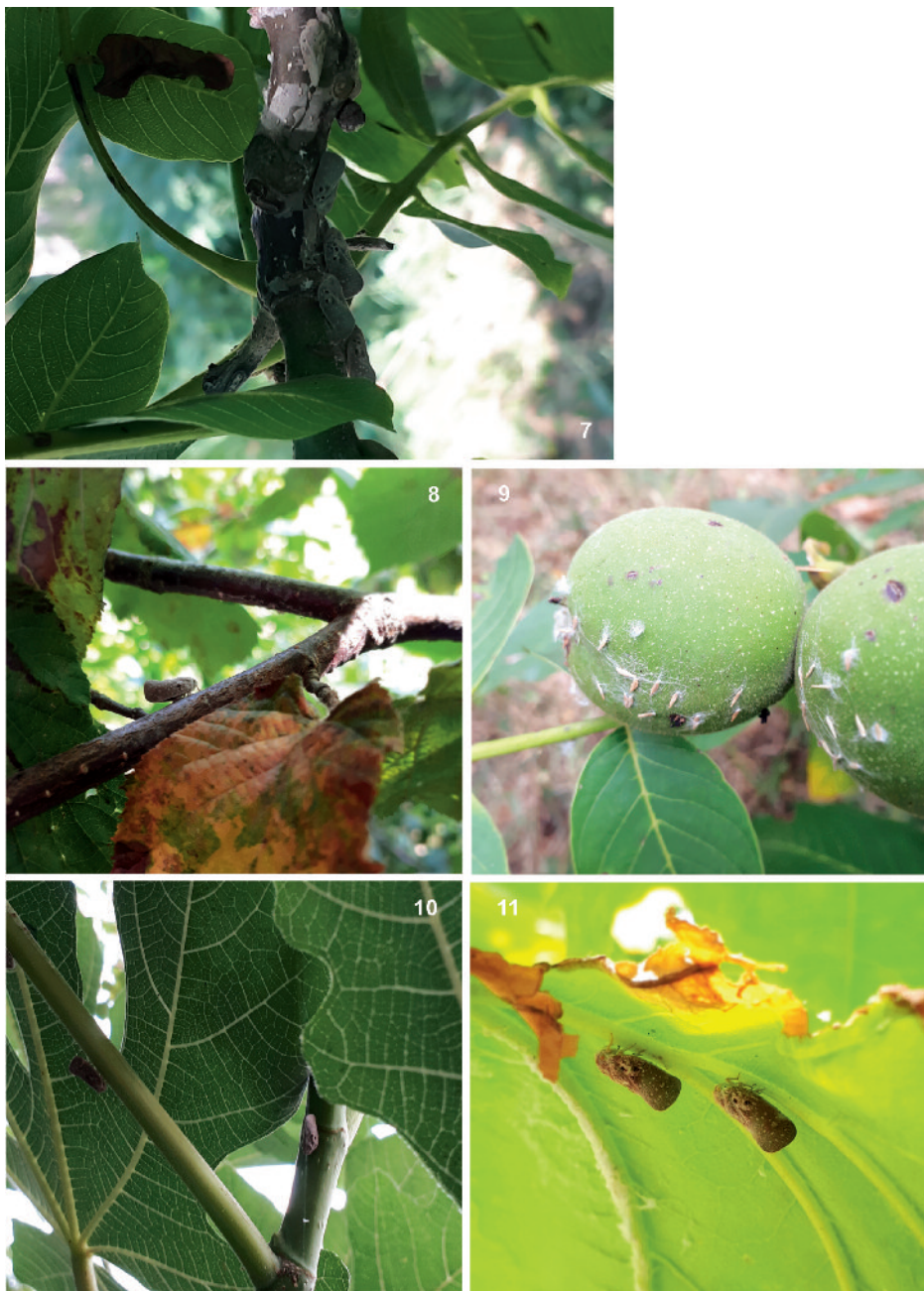


Fig. 7 - 11: *Metcalfa pruinosa* on various host plants in walnut and hazelnut gardens. 7. on *Junglans regia*, 8. *Corylus avellana*, 9. *M. pruinosa* secretions on walnut fruit, 10. on *Ficus carica*, 11. on leaf of plane.

onomic damages especially in the Eastern Black Sea region (Hantaş et al, 2014; Güncan, 2014; Göktürk, 2017).

M. pruinosa causes loss of nutritional value in plants, because saprophyte fungus (fumagine) grows on the sweet substance released in abundant amounts, aesthetical harm to ornamental plants and loss in market value (Della Giustina & Navarro, 1993; Lucchi & Santini, 2002). On the other hand, the species can carry disease agents such as viruses, bacteria and phytoplasmas in grapevines and other hosts. It is important to control populations of this species, which are abundantly found in Düzce especially in walnut, hazelnut, fig and cherry laurel trees.

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