

Short Paper

Distribution and oviposition characteristics of *Orosanga japonica* Melichar (Hemiptera: Ricaniidae) in Guilan province, Iran

Seyedeh Elham Yazdani Badabi* and Ahad Sahragard

Department of Plant Protection, Faculty of Agricultural Sciences, Guilan University, Rasht, Iran.

Abstract: This study aimed to investigate the oviposition behavior, distribution, and host plants of *Orosanga japonica* (Hemiptera: Ricaniidae) in Guilan province, Iran. Random sampling was conducted across various locations within Guilan province. Adult insects typically emerge in late July and deposit their eggs from early August to mid-September. This species prefers laying eggs on young shoots and leaf midribs of various plants, from annual herbaceous species to shrubs. This oviposition behavior can lead to stem desiccation. Additionally, the females' oviposition behavior, sap-sucking activities on stems, and the potential transmission of pathogenic fungi can cause substantial damage to host plants. This research provides information regarding the distribution of pest egg masses across several host plants. Our findings revealed that the mean number of egg masses per twig was higher on chinaberry, averaging 13.75, than on bitter orange, elm trees, and mulberry. The longest average egg mass length, measuring 16.1 mm, was observed on mulberry. Furthermore, this study confirmed the presence of *O. japonica* in 13 cities within Guilan province, including Rasht, Anzali, Amlash, Astaneh, Lahijan, Langroud, Rezvanshahr, Rudsar, Rudbar, Sowme'eh Sara, Siahkal, Shaft, and Fouman. The insect was predominantly found infesting kiwi, tea, beans, corn, eggplants, peppers, elm leaf blackberries, chinaberries, mulberries, Japanese spindles, cucumbers, citrus plants, fig-trees, rice, cabbage, and grapes.

Keywords: *Orosanga japonica*, Fulgoromorpha, egg masses, distribution, oviposition characteristics, Guilan

Introduction

The planthopper family, Ricaniidae (Hemiptera: Auchenorrhyncha), consists of 67 genera (2.7% of the Fulgoromorpha) and covers 437 species (3.2% of the Fulgoromorpha) (Bourgoin, 2021).

The Family Ricaniidae is mainly distributed in Tropical regions. This family is represented only by the genus *Ricania* in the Palaearctic

region. *Orosanga japonica* (Melichar) (Hemiptera: Ricaniidae) is an invasive species in the western Palearctic region and widespread in the Black Sea area countries. It is a common species in Eastern Asian countries, including Korea and China, and the species has been spread in Ukraine, Russia, Georgia, Turkey, and Azerbaijan (Dlabola, 1967; Nast, 1972, 1987; Gjonov, 2011; EPPO, 2017; Bourgoin, 2017; Demir, 2009, 2018; Ismaylova, 2021).

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* Corresponding author: elyazd2020@gmail.com

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It was reported that it caused major damage in tea plantations and kiwi gardens in Turkey's eastern Black Sea coast (Demir, 2009; Ak *et al.*, 2015; Akiner *et al.*, 2019). In Iran, for the first time, this species was recorded in northern Iran (Mazandaran province) in 2010 (Mozaffarian, 2018). Recorded distribution in Iran is in the North, along the shores of the Caspian Sea (Mozaffarian, 2018). The large populations of the nymphs and adults of *O. japonica* cause serious damage to plants. When the females lay their eggs, let them dry. Nymphs and adults cause fumagine by taking the sap of the plant, and it dries out the plant. Furthermore, they cause indirect damage by weakening the plant. This situation makes the plant vulnerable to the fungal pathogen *Pestalotiopsis quepinii* (Eken *et al.*, 2013).

According to the studies conducted in Iran and Turkey, The planthopper overwinters in the egg stage and has five nymphal stages. Depending on climatic conditions, the nymphs emerge from early to late May. The nymphal duration was 41.39 and 38.13 days on *R. ulmifolius* and *M. azedarach*, respectively (Akiner *et al.*, 2019; Altas and Ak, 2019; Karatas *et al.*, 2020; Abbaszadeh *et al.*, 2021). Based on the findings of Ismaylova in Azerbaijan, pest development from the egg to adult stage takes about 2-2.5 months. In late August, females lay eggs under the bark of thin branches and stems (Ismaylova, 2021).

O. japonica is a polyphagous species, and it is found on many plants wherever it is distributed e.g., hazelnut, wild blackberry, chestnut, kiwi, cherry, pineapple, tea, mulberry, common bean, corn, tomatoes, eggplant, cabbage, peppers, cucumbers, citrus plants, common grape vine, apple tree, pear tree, peach tree, fig tree, strawberry, etc. (Gokturk and Aksu, 2014).

So far, several studies have been conducted on the characteristics of spawning of this genus (Choi *et al.*, 2012; Kim *et al.*, 2016; Yu *et al.*, 2016). Ismaylova (2021) photographed eggs of *O. japonica* under an electron microscope and recorded dimensions. However, so far, there is no report about the oviposition characteristics of *O. japonica*. Therefore, this study aims to

investigate females spawning behavior, such as the number and length of egg mass per laying unit (twig, leaf, thorn). This planthopper has quickly spread since the first report of its occurrence in Iran (Mazandaran Province) in 2010. Therefore, this study was carried out to find the current distribution of the pest in Guilan province.

Materials and Methods

To investigate the spawning characteristics of *O. japonica* in the area of Rasht and Anzali, which occurred from August to December of 2021, four host plants, bitter orange, elm tree, chinaberry, and mulberry with egg masses, were selected.

Branches, leaf midribs, and thorns with clutches of eggs were randomly cut with scissors and brought to the laboratory, and number of egg masses and length of egg mass on the substrate were observed in ten replicates. Statistical analysis was performed using descriptive statistics.

To determine the pest distribution in Guilan province, gardens and fields were observed randomly, and each developmental stage of the planthopper was recorded.

Results and Discussion

Results of examining four host plant species of four families indicated that the length of the egg masses laid by the females differed depending on the substrate host. Average length of egg masses was 16.1 mm on mulberry and 11.06 mm on chinaberry, respectively. The number of egg masses per twig of chinaberry was 13.75, the highest compared to other trees, while it was the least, 3.4, on mulberry (Table 1).

Maximum and minimum diameter of twigs were 21.6 and 4 mm on the chinaberry and Elm tree, respectively. The length of the egg mass of *Ricania* spp. Investigated by Choi *et al.* (2012) was 15.2 to 18.0 mm between host plants, which is similar to the result of this study. They reported the number of egg mass 2.2 to 14.5 per twig, which was 3.4 to 13.75 in this study.

Table 1 Oviposition characteristics of *Orosanga japonica* on several kinds of host plants.

Family	Host plants	Mean length of twig/ leaf midrib /thorn (cm)	Mean no. of egg mass per twig/ leaf midrib / thorn	Length of egg mass per twig/ leaf midrib / thorn (mm, Mean $\pm$ SD)	Diameter of twig/thorn where egg mass is counted (mm, Mean $\pm$ SD) ²
Rutaceae	<i>Citrus aurantium</i>	25.3/15.5/4.98	5.5/1.5/1.5	11.6 $\pm$ 1.66	11.9 $\pm$ 1.87
				15.5 $\pm$ 1.88	6.2 $\pm$ 0.34
				12.4 $\pm$ 0.49	
Meliaceae	<i>Melia azedarach</i> ¹	26.0	13.8	11.1 $\pm$ 1.86	21.6 $\pm$ 1.86
Ulmaceae	<i>Ulmus minor</i> ¹	15.5	4.1	14.8 $\pm$ 5.07	4.0 $\pm$ 0.95
Moraceae	<i>Morus alba</i> ¹	28.0	3.4	16.1 $\pm$ 1.34	17.8 $\pm$ 2.23

¹. The data presented in the table refer to twigs.² Diameter of the twig/thorn at the location where the egg mass is counted.

The mean length of egg masses of *Ricania* sp. recorded on apples and plums was 12.35 and 11.45 mm, respectively (Choi *et al.*, 2011). The mean number of egg masses on mulberry twigs was 3.4, but the length of egg masses was greater (16.1 mm) than on other trees. In Bitter orange, in addition to spawning on branches, it was also observed on leaf midribs and thorns. The length of the egg mass on the leaf midrib was 15.5 mm, while it was 11.6 and 12.4mm on twig and thorn, respectively. The number of egg masses per twig, leaf midrib, and thorn were 5.5, 1.5 and 1.5, respectively. Accordingly, the number of egg masses per leaf midrib and thorn is lower than on twig.

In *Ricania speculum*, eggs are laid in clusters inside the young twig tissues with a diameter rarely

larger than 3 mm or in the leaf midrib (Lucchi and Rossi, 2016). Because the first-year-old branches of chinaberry are less lignified and have a larger twig diameter than other trees, they exhibit a higher mean number of egg masses than the other plants. These results indicate that the degree of tenderness of the host plants affects spawning behavior. The pest was observed in 13 cities, and it was mostly found on kiwi, tea, bean, corn, eggplant, peppers, elm leaf blackberry, chinaberry, mulberry, Japanese spindle, cucumbers, citrus plants, fig-trees, rice, cabbage, and grape. The planthopper has been introduced from Mazandaran to the east of Guilan (Roudsar). It is spreading outwards in all directions to cover a larger area and is dispersing towards the west of Guilan (Fig. 1).

**Figure 1** Distribution of *Orosanga japonica* in Guilan province.

Since chinaberry has the highest number of egg masses per twig compared to the other studied trees, these plants can be trap plants. These results are expected to help manage *O. japonica* by plants that would attract adults and prevent its dispersion.

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پراکنش و ویژگی‌های تخم‌گذاری *Orosanga japonica* Melichar (Hemiptera: Ricaniidae) در استان گیلان

سیده الهام یزدانی‌بدابی و احد صحراگرد

گروه گیاه‌پزشکی، دانشکده علوم کشاورزی، دانشگاه گیلان، رشت، ایران.
پست الکترونیکی نویسنده مسئول مکاتبه: elyazd2020@gmail.com
دریافت: ۸ اسفند ۱۴۰۰؛ پذیرش: ۸ شهریور ۱۴۰۲

چکیده: این مطالعه به منظور تعیین ویژگی‌های تخم‌گذاری، پراکنش و میزبان‌های زنجبرک *Orosanga japonica* (Hemiptera: Ricaniidae) در استان گیلان انجام شد. از مناطق مختلف استان گیلان به صورت تصادفی نمونه برداری انجام شد. بالغین در اواخر خرداد ظاهر شده و در اوایل مرداد تا اواسط شهریور تخم‌های خود را می‌گذارند. این گونه روی شاخه‌های جوان، رگبرگ‌های میانی گیاهان مختلف شامل گیاهان علفی یکساله و درختچه‌ها تخم‌گذاری می‌کند که موجب خشکیدگی شاخه‌ها می‌شود. بنابراین رفتار تخم‌گذاری ماده‌ها و نیز مکیدن شیره ساقه‌ها و انتقال قارچ‌های بیماری‌زا موجب آسیب جدی به گیاهان میزبان می‌شود. این تحقیق جزئیاتی از توده‌های تخم روی چند گیاه میزبان را فراهم می‌کند. نتایج نشان داد که میانگین تعداد توده تخم در هر شاخه زیتون تلخ ۱۳/۷۵ بوده که نسبت به نارنج، نارون و توت بالاتر می‌باشد. بیشترین طول توده تخم ۱۶/۱ میلی‌متر روی توت بود. حضور *O. japonica* در ۱۱ شهر از استان گیلان شامل رشت، انزلی، املش، آستانه، لاهیجان، لنگرود، رضوان‌شهر، رودسر، رودبار، صومعه‌سرا، سیاهکل، شفت و فومن تأیید شد و بیشتر روی کیوی، چای، لوبیا، ذرت، بادمجان، فلفل، زیتون تلخ، تمشک، توت، شمشاد زینتی، خیار، مرکبات، انجیر، برنج و انگور مشاهده شد.

واژگان کلیدی: *Orosanga japonica*، Fulgoromorpha، توده تخم، پراکنش، ویژگی‌های تخم‌گذاری، گیلان