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Short paper

First report of *Rhopalosiphum nymphaeae* (L.) (Hem.: Aphididae) on *Azolla filiculoides* from Iran and its male formation on secondary host plant

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Abstract: To determine the effective bio-control agents of water fern, *Azolla filiculoides*, adults and nymphs of water lily aphid, *Rhopalosiphum nymphaeae* (L.), were collected on *A. filiculoides* in Guilan Province, Iran, during October 2013. This aphid has been collected extensively from almost all water fern samples during 2013 and 2014. Although *R. nymphaeae* was reported from numerous host plants in Iran, this species was collected for the first time from water fern. This aphid is heteroecious holocyclic with a sexual phase on *Prunus* spp., but it is the first report of its sexual phase formation on water fern as secondary host plant.

Keywords: Aphid, Rice, Water fern, Guilan

Introduction

Water lily aphid, *Rhopalosiphum nymphaeae* (Linnaeus, 1761) (Hem.: Aphididae), as a polyphagous species is a heteroecious holocyclic aphid, living on a large variety of water plants. This aphid is able to survive underwater (Holman, 2009; Blackman and Eastop, 2015). In large colonies that develop on water lilies, the aphids aggregate along the leaf veins and infest flowers as well. The sexual forms have been reported on *Prunus* spp. (Blackman and Eastop, 1994; 2006). The rates of development, natality and survivorship of *R. nymphaeae* have been studied in relation to its potential for virus transmission on both crops and aquatic weeds (Ballou *et al.*, 1986). Recorded optimal temperature range for *R. nymphaeae*, is 21 to 27 °C (Hance *et al*., 1994).

Spring colonies of the aphid infest young twigs, leaf petioles and fruit stalks of various *Prunus* spp. which cause curling of host plant leaves (Blackman and Eastop, 1994; 2006). This aphid species is tended by ants. Spring migrant alatae fly to secondary hosts in May-June. *Rhopalosiphum nympheae* is almost cosmopolitan and its activity on *Azolla* spp. was reported frequently (Lumpkin and Plunkett, 1980; Rostron, 1983; Center *et al*., 2002). It has been recommended as a biological control agent for water weeds in rice as well (Yano *et al*., 1983; Calilung and Lit, 1986; Lu *et al*., 1991; Oraze and Grigarick, 1992; Hance *et al*., 1994; Center *et al*., 2002). Beside these, *R. nymphaeae* is vector for some viruses including abaca mosaic, cabbage black ringspot, cauliflower mosaic, cucumber mosaic, and onion yellow dwarf viruses (Kennedy *et al*., 1962; Chan *et al*., 1991). It caused die-back of water lettuce in Nigeria (Pettet and Pettet, 1970). Moreover, the aphid transmitted

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eggplant mosaic virus in India (Seth and Raychaudhuri, 1973).

Rhopalosiphum nymphaeae has already been reported in Iran on *Prunus domestica* and *Prunus divaricata* (Hodjat, 1993) and Mokhtari *et al*. (2012) reported this aphid on *Plantago lanceolata* from central Alborz. This Aphid has been reported as a host for parasitoids *Aphidius matricariae* Haliday, *Aphidius transcaspicus* Telenga, *Ephedrus cerasicola* Starý, *Lysiphlebus fabarum* Marshall and *Praon necans* Mackauer in Iran **(**Mokhtari *et al*., 2000; Nazari *et al*., 2012; Barahoei *et al*., 2014).

Results

We collected *R. nymphaeae* (Fig. 1) on water fern, *Azolla filiculoides* Lam. (Pteridophyta: Salviniaceae), for the first time in October 2013 from natural habitats. Alate males (Fig. 2) were found among the samples collected during the autumn and winter 2014. This is the first time to report the sexual form of this aphid on the secondary host plant. Decreasing of day length and temperature are the most important factors that trigger sexual morph production in aphids (Kawada, 1987). Biometric data of parthenogenetic and sexual morphs collected on water fern in Iran are presented in Table 1.

Materials examined: In the current study, the specimens were collected for the first time on *A. filiculoides* in Iran from Guilan Province, in the Rice Research Institute of Iran (RRII) (N 37°12′22.2″, E 049°38′40.7″, 80 m). Aphids were collected weekly from October 2014 until February 2015. Each time at least 30 individuals were collected and preserved in 70% ethanol. Slide mounted specimens are deposited in Aphid Collection of Aphidology Research Group, Institute of Science and High Technology and Environmental Sciences, Graduate University of Advanced Technology, Kerman, Iran and preserved samples in alcohol are deposited in the Plant Protection Research Department, Rice Research Institute of Iran (RRII), Rasht, Iran.

Oraze and Grigarick (1992) recommended this aphid as a bio-control agent for duck salad (*Heteranthera limosa*) in rice fields. However, we could not find any report concerning successful biological control of a weed by this aphid. It seems that despite of wide distribution, having a board host range makes it less favorable as a bio-control agent for weeds due to probable damage on non-target plants. Nevertheless, at areas that use of water fern as green fertilizer in rice fields this aphid known as a considerable pest for water fern (Lumpkin and Plunkett, 1980).

Figure 1 *Rhopalosiphum nymphaeae* on Water fern.

Figure 2 Alate male of *Rhopalosiphum nymphaeae* on Water fern.

Table 1 Biometric data of *Rhopalosiphum nymphaeae* collected on *Azolla filiculoides* in Iran.

Morph	Character length	Biometric data	Ratio	Biometric data
Apterous viviparae (n = 24)	Body	1.36-1.59	PT/ANTVIb	3.50-4.00
	PT	0.33-0.35	URS/2HT	1.36-1.45
	ANTVIb	0.08-0.10	URS/Cauda	1.00-1.33
	URS	0.14-0.15	SIPH/Body length	0.19-0.21
	2HT	0.11-0.12	SIPH/Cauda	2.07-2.50
	SIPH	0.27-0.31	Rhin. on ANTIII	0
	Cauda	0.11-0.14		
Alate viviparae (n = 6)	Body	1.73-1.76	URS/2HT	1.25-1.36
	PT	0.26-0.27	URS/Cauda	1.15
	ANTVIb	0.12-0.13	SIPH/Body length	0.14-0.15
	URS	0.14	SIPH/Cauda	1.92
	2HT	0.11-0.12	Rhin. on ANTIII	12-16
	SIPH	0.24-0.26	Rhin. on ANTIV	2-6
	Cauda	0.12	Rhin. on ANTV	0-1
Alate males (n = 18)	Body	1.48-1.61	PT/ANTVIb	3.76
	PT	0.26-0.45	URS/2HT	1.30-1.50
	ANTVIb	0.10-0.12	SIPH/Body length	0.13-0.16
	URS	0.12-0.14	SIPH/Cauda	2.22-2.78
	2HT	0.10-0.11	URS /Cauda	1.56-1.67
	SIPH	0.18-0.24	Rhin. on ANTIII	28-40
	Cauda	0.08-0.09	Rhin. on ANTIV	12-22
			Rhin. on ANTV	7-10

Abbreviations: ANTIII, ANTIV, ANTV, ANTVIb, antennal segments III, IV, V, and the base of antennal segment VI, respectively; PT, processus terminalis; Rhin, Rhinaria; URS, ultimate rostral segment; 2HT, second segment of hind tarsus; and SIPH, siphunculus. Lengths are given in mm.

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اولین گزارش شته *Rhopalosiphum nymphaeae* (L.) (Hem.: Aphididae) روی آزولا در ایران و ایجاد فرم نر آن روی میزبان دوم

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چکیده: به‌منظور یافتن عوامل کنترل بیولوژیک مؤثر از حشرات فعال روی گیاه آزولا *Azolla filiculoides*، در پاییز ۱۳۹۱ نمونه‌برداری‌هایی صورت گرفت. پوره‌ها و حشرات کامل شته‌ی *Rhopalosiphum nymphaeae* (L.) از روی این گیاه آبزی در استان گیلان جمع‌آوری شدند. این شته به‌طور گسترده‌ای از روی کلیه‌ی نمونه‌های آزولا در سال‌های ۱۳۹۲ و ۱۳۹۳ جمع‌آوری شد. با وجود این‌که تاکنون این شته از روی بسیاری از گیاهان میزبان در ایران جمع‌آوری شده است، اما این اولین گزارش از این شته روی گیاه آزولا می‌باشد. این شته، دارای تناوب میزبانی و با چرخه‌ی زندگی کامل بوده و مرحله‌ی جنسی آن روی گونه‌های مختلف گیاه *Prunus* spp. ایجاد می‌شود اما این اولین گزارش تشکیل مرحله‌ی جنسی آن روی آزولا به‌عنوان میزبان دوم است.

واژگان کلیدی: شته، برنج، آزولا،گیلان