

Short Paper

First report of the exotic weevil *Stenopelmus rufinasus* (Coleoptera: Curculionidae) occurrence in Iran

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Abstract: The water fern weevil, *Stenopelmus rufinasus* Gyllenhal (Coleoptera: Curculionidae), is considered as the most important biological control agent of *Azolla* spp. in the world. *Azolla* spp. was introduced in Iran in 1986. In August 2017, two specimens of *S. rufinasus* were collected on *Azolla* spp. in waterways near Anzali lagoon and Rice Research Institute of Iran (RRII) in Guilan province for the first time. Identification was based on molecular sequencing. This is the first record of *S. rufinasus* from Iran.

Keywords: Biological control, *Azolla* spp., weevil, Guilan province

Introduction

The semi-aquatic weevil, *Stenopelmus rufinasus* Gyllenhal, 1836 (Coleoptera: Curculionidae), is native to the southern and western United States (LeConte, 1876). It was accidentally transported to Europe through the plant materials from Argentina and Paraguay at the beginning of twentieth century. The weevil was introduced into South Africa in 1997 for biological control of water fern, *Azolla filiculoides* Lamarck (Azollaceae) and controlled this invasive aquatic weed successfully (Winston *et al.*, 2014; Parys *et al.*, 2015). This weevil is known as one of the most successful biological control agents ever employed worldwide; however, there was no record of this weevil's occurrence on *Azolla* spp. in Asia until 2014 (Winston *et al.*, 2014). The first occurrence of *S. rufinasus* in Asia was reported in October 2017 (Friedman, 2017).

According to Centre for Agriculture and Bioscience International (CABI, 2018) databases, different species of *Azolla* spp. exists in Asia and some of them such as *Azolla pinnata* R. Brown have been reported as native species in India, China, Japan and many other areas. The water ferns were introduced to Iran in 1986 as green fertilizer for rice fields (Khoshravesh *et al.*, 2009). Due to poor management, *Azolla* spp. invaded important aquatic natural habitats, such as the Anzali and Amir-Kalayeh lagoons in northern regions of Iran, and have become problematic in some of the rice fields as well (Farahpour-Haghani *et al.*, 2016a). *Stenopelmus rufinasus* is known as a great biological control agent for water fern, *A. filiculoides*, worldwide. In addition, it has been demonstrated that this weevil can feed on mosquito fern, *A. pinnata*, and Carolina mosquito-fern, *Azolla cristata* Kaulf (previously known as *Azolla caroliniana*) as well (Winston *et al.*, 2014; Parys *et al.*, 2015). *Stenopelmus rufinasus* has not been reported from Iran and so far, *Rhopalosiphum nymphaeae* (Linnaeus) (Homoptera: Aphididae), *Diasemiopsis ramburialis*

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Duponchel (Lepidoptera: Crambidae), *Nomophila noctuella* Denis & Schiffermuller (Lepidoptera: Crambidae) and *Cataclysta lemnata* (Linnaeus) (Lepidoptera: Crambidae) have been recorded as the most important insects that feed on *Azolla* spp. in northern regions of Iran (Farahpour-Haghani *et al.*, 2015; 2016a; 2016b; 2017). This is the first record of *S. rufinasus* from Iran.

Materials and Methods

Stenopelmus rufinasus was collected from water fern, *Azolla* spp., in the Anzali lagoon and RRII water ways, in 2017. Males and females were released on fresh water fern in laboratory and eggs were collected after 3 days. A replicated rearing test (10 ×), was carried out with 1, 3 and 5 pairs (one male and female) in laboratory in order to confirm its feeding on *Azolla* spp. Transparent plastic cups (8.5 by 11cm, diameter by height) filled with 200ml of water and 10g of water fern and covered with net were used as rearing chambers. All life stages were photographed separately during the development time. Adults were examined by identification keys in RRII and after primary identification were sent to CABI for molecular identification by the second author of this paper.

Results

The weevil was collected for the first time in August 2017 from Anzali lagoon. Results of molecular identification indicated that the sequence of weevils collected from Iran were 100% identical with *S. rufinasus* sequence, KM440642 (NCBI database), originated from Germany (Neuburg an der Donau) that was published by Hendrich *et al.* (2015). Throughout the sampling site in Anzali lagoon, water ferns were damaged severely. Adults, pupae and last instar larvae were collected from water fern samples in laboratory in high density populations. Female laid eggs after 3 days in laboratory and after about 12 days water fern were almost wiped out, in some of the

replicates. Last instar larvae are reddish brown with black head capsule. Pupae are off brown and pupation usually occurs in pupal shelters made from feeding materials. Adults are dark brown to black, small in size and have shorter proboscis compared with other weevils.

Discussion

Stenopelmus Schönherr is a genus from Stenopelmi group. This group is monophyletic and placed within the tribe Erihrinini (Curculionidae) which is composed of mostly aquatic and semi aquatic weevils (LeConte, 1876). The presence of *S. rufinasus* is closely related to the occurrence of the *Azolla* spp. worldwide. In Guilan province, sampling sites were under regular monitoring for almost two years but damages caused by these weevils on *Azolla* spp. appeared in August 2017, and subsequently adults were collected upon careful examinations. Another population of weevil was found in a waterway in RRII at the same time. Therefore, apparently these weevils were imported to Iran recently. There is no information how the species was introduced to Iran. However, this would be an important beneficial factor for water fern biological control in Iran.

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