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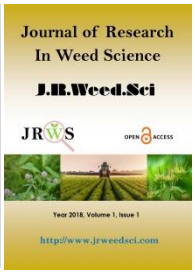

Biological control potential of *Spermophagus sericeus* Geoffroy, 1785 (Coleoptera: Chrysomelidae) against field bindweed as the first report from Iran

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Abstract

Compare other countries studies associated with field bindweed (*Convolvulus arvensis* L.) biological control is too short in Iran. Field bindweed is a major weed of several field crops. During a survey, we focus to finding natural enemies of this weed in Khorasan Razavi province for two years. This paper reports the presence of a seed beetle *Spermophagus sericeus* Geoffroy as a major natural enemy against field bindweed (*Convolvulus arvensis* L.) in northeast of Iran. Samples of field bindweeds capsules and seeds collected in tomato fields at two locations in that region. Results showed that the reproductive organs of field bindweed were severely damaged, where 76 and 62 percent of capsules and seeds were infested by *S. sericeus* respectively. Our findings showed the high level control of field bindweed by *S. sericeus* and this beetle can be considered as a proper bio control agent for this weed in Iran. However more studies about host specificity of this beetle should be performed.

Keywords: Bio control, capsule, invasive, perennial, seed beetle

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1. Introduction

Field bindweed is a problematic perennial weed in large number of crops (Vasilakoglou et al. 2013). These weeds is generally difficult to control by chemical method because of pesticides application in agro ecosystems causing serious risks including environmental safety, water sources pollution as well as human and animal health (Husak et al. 2016; Kroon, Hook et al. 2014). Also mechanical control methods are not a proper way for management of perennial weeds due to their roots and stem developed systems which can result in plant retrieval after applying mechanical control (Benefield et al. 1999). In recent years the effectiveness of biological control has been of interest to researchers in many countries. Different studies show that there are so many organisms that feed on field bindweed in agricultural systems. Rosenthal and Buckingham (1982) found that *Aceria malherbae* attack field bindweed and galls the leaves stem tips and petioles. Chessman, Horak and Nechols (1997) report a leaf-eating moth (*Tyta luctuosa*) on field bindweed. Some pathogenic fungi have been identified with potential to control field bindweed and be used as mycoherbicide components. *Phomops convolvulus* Ormeno and *Phoma proboscis* Heiny as fungal pathogens are so effective at leaf biomass reduction and cause high seedling mortality (Heiny, 1994). Tunali et al. (2009) studied the biological control on field bindweed with fungal pathogens and reported that *Colletotrichum linicola* produced the highest level of diseases on the inoculated test plants. Almost all the above-mentioned biological agents leading to a reduction in biomass of field bindweed and so far the biological agents that can effectively feeding the seeds of this weed are not reported. It seems that sequential feeding of vegetative structures by biological control agents cannot lead to perpetual control of perennial weeds. The aim of study was to evaluate *Spermophagus sericeus* beetle as an effective biological agent for control field bindweed as the first report from Iran.

2. Materials and Methods

2.1. Identification and morphological characterization

Field bindweed infested with different natural enemies was collected in several fields of the Agricultural research lands, Ferdowsi University of Mashhad, Khorasan Razavi province, Iran. After initial evaluation the amazing case of biological control in two tomato fields was observed and very small beetles that had a proper visual control level on field bindweed as destroyed the capsules and feed on the seeds was found. So collection and identification of beetles was considered. The identity of this beetle was determined and confirmed by A. Delobel as *Spermophagus sericeus* (Coleoptera: Chrysomelidae).

2.2. Determining the level of infestation by S. sericeus

Ten infested plants were collected and separately placed in Plexiglas boxes and monitored for 24 hours with temperatures between 25-30 °C and relative humidity of 70%. During this

monitoring, beetles that emerged from the capsules and seeds were collected separately from each box. Then, one hundred capsules and seeds were randomly taken from each box to count the destroyed capsules and perforated seeds and the level of field bindweed infestation was determined.

3. Results and Discussion

3.1. Morphological characterization

After a preliminary review, the beetles were thoroughly studied under a binocular microscope to identify the most representative morphological characteristics. The adult beetles was black with short head, eyes emarginated to 3/4 length (figure 1). Antennae were moderately long. Pronotum was 1.5-1.6 times wider than long and large punctures disposed almost uniformly on whole disc. Puncturation of pygidium was dense and punctures almost touching each other. Hind legs had no sexual characters and lateral carina was serrate. The male specimens were smaller and weighed less than females (figure 1). The males had an emarginated V shape sternum with moderately long median lobe and strongly modified spiculum. But in female specimens V shape sternum was not emarginated and ovipositor strongly sclerotized (Borowies, 1981) without pubescent oblique suture and circular pigmentation was completed. The main distributed for these beetles was reported at Palaearctic region, central Mongolia, northern China and Afghanistan (Borowies, 1991).

3.2. Infestation assessment

Results showed that the most frequently associated insect with reproductive structures of field bindweed in northeast of Iran was *Spermophagus sericeus*. This finding was confirmed by other researchers in different countries (Decelle, 1983; Toth and Cagan, 2005). The large number of field bindweed plants has been infested by this beetles in tomato fields, however infestation in other fields was observed at lower levels. The capsules of infested plants was severely destroyed (figure 4), where 76 percent of capsules were attacked by beetles. After destruction of capsules, the seeds were perforated by beetles. The damage severity on seeds presented in figure 3. The infestation for seeds was 62 percent and whole infested seeds lose their viability. Seed feeding agents provides high potential for classical biological control of invasive weeds and these agents have proven to be good candidates in weed integrated pest management (IPM) programs. This study represented a proper understanding of this Chrysomelidae beetle and our findings showed the high level control of field bindweed by *S. sericeus* and this beetle can be considered as a proper bio control agent for this weed in Iran.

Figure 1- Male (right) and female (left) adult specimen of *S. sericeus.*

Figure 2- Destroyed field bindweed capsule by *S. sericeus.*

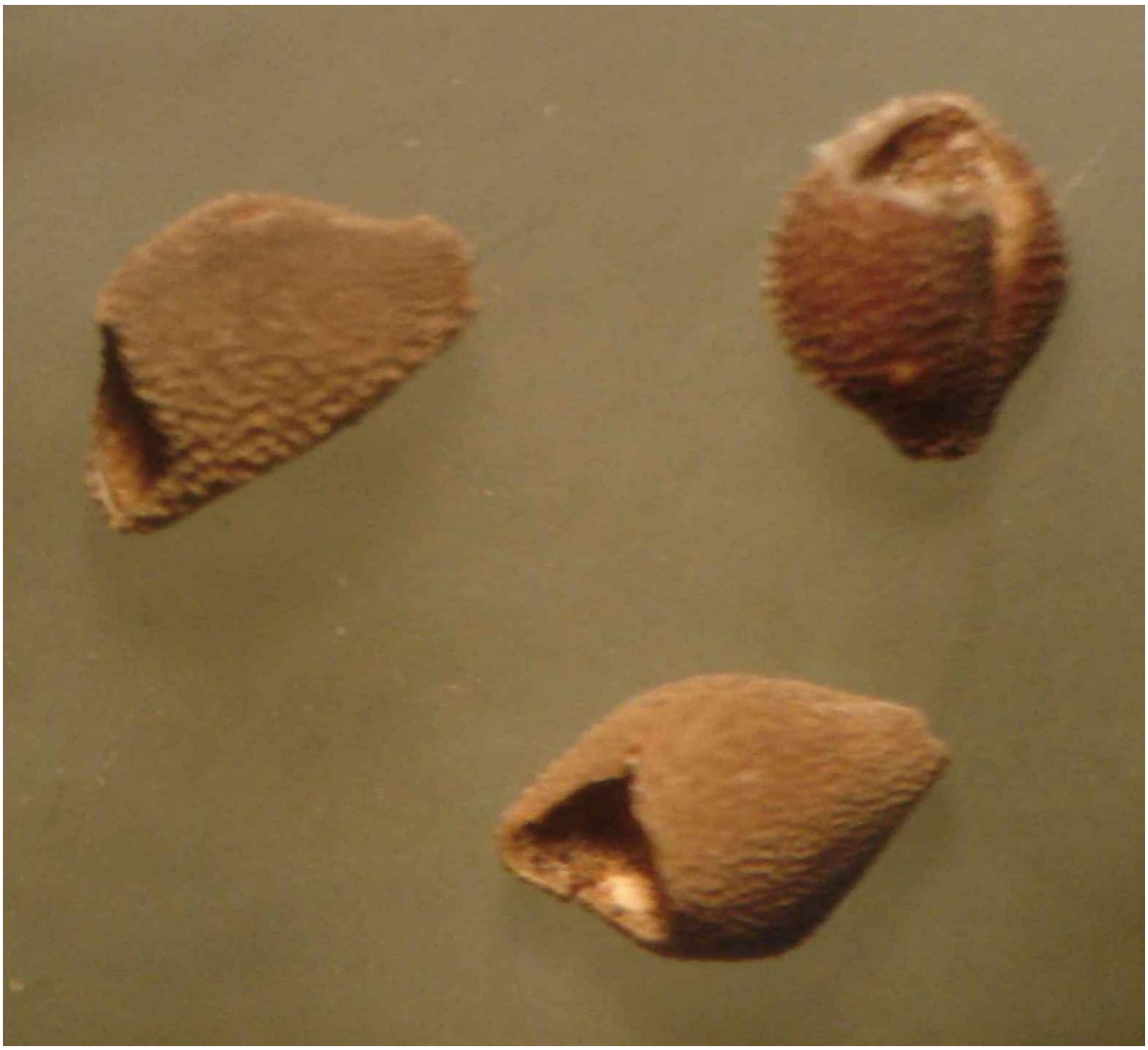

Figure 3- The perforated seeds by *S. sericeus.*

Figure 4- Sever damage of *S. sericeus* on reproductive parts of field bindweed.

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Conflict of interest

The authors confirm that there are no known conflicts of interest associated with this study and there has been no significant financial support for this work that could have influenced its outcome.

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