

Contribution to the genus *Bruchophagus* Ashmead species (Hymenoptera, Eurytomidae) associated with *Astragalus brachydontus* (Fabaceae) in Iran

Ayad Kadhim Alsendi

Department of Plant Protection, College of Agriculture and natural resources, University of Tehran, Karaj, Iran.
✉ ayad.1072@gmail.com  <https://orcid.org/0000-0002-5142-7878>

Jamasb Nozari

Department of Plant Protection, College of Agriculture and natural resources, University of Tehran, Karaj, Iran.
✉ nozari@ut.ac.ir  <https://orcid.org/0000-0002-2649-7751>

Seyed Ebrahim Sadeghi

Research Institutes of Forests and Rangelands of Iran, P.O. Box:13185-116, Tehran, Iran.
✉ ebrasadeghi@gmail.com  <https://orcid.org/0000-0002-3073-991X>

Hamid Adelimansh

Departments of Entomology and Plant Pathology, College of Aburaihan, University of Tehran, Tehran, Iran.
✉ hghajar@ut.ac.ir  <https://orcid.org/0000-0001-9896-8797>

Marina Zerova†

Schmalhausen Institute of Zoology of National Academy of Science of Ukraine, Bogdan Khmelnytsky str., 15, Kyiv, 01030, Ukraine.
✉ ufensia@gmail.com  <https://orcid.org/0000-0003-4412-119X>

ABSTRACT. Seed-eater eurytomids of the genus *Bruchophagus* Ashmead, 1988 were collected from Ardabil and Qazvin provinces in northwest Iran. Various host plants were collected and their seeds were kept in laboratory conditions from 2007 to 2012. Scope of this paper focused on the *Bruchophagus* species reared from seeds of *Astragalus brachydontus* Boiss (Fabaceae). We obtained six species of *Bruchophagus* including *B. astragali* Fedoseeva. They were *B. saxatilis* Zerova; *B. mutabilis* Nikolaskaya; *B. nikolskayae* (Zerova); *B. turkestanicus* Zerova, and *B. robiniae* Zerova. Of which, *Bruchophagus saxatilis* Zerova, is a new record for the Iranian fauna. New host associations were found for all collected species and it seems a complex biological association that was recorded for the first time. Currently, 11 species of *Bruchophagus* are occurred in associated with seeds of *A. brachydontus*. All previously known species of the genus *Bruchophagus* in Iran are also tabulated.

Key words: Seed-eater, Eurytomidae, phytophagous, Host plants, Iran, checklist.

Received:
15 June, 2022

Accepted:
18 August, 2022

Published:
08 October, 2022

Subject Editor:
Hossein Lotfalizadeh

Citation: Alsendi, A.K., Nozari, J., Sadeghi, S.E., Adelimansh, H., Zerova, M. (2022) Contribution to the genus *Bruchophagus* Ashmead species (Hymenoptera, Eurytomidae) associated with *Astragalus brachydontus* (Fabaceae) in Iran. *Journal of Insect Biodiversity and Systematics*, 8 (4), 559–569.

INTRODUCTION

The phytophagous genera of the family Eurytomidae (Hymenoptera) have a wide range of plant hosts (Bouček, 1988) and play an important role in the damage of rangeland plants all over the world (Lotfalizadeh et al., 2007). Although members of this family have both phytophagous and parasitic

Corresponding author: Nozari, J., E-mail: nozari@ut.ac.ir

†Marina Zerova deceased at March 9, 2021

Copyright © 2022, Alsendi et al. This is an open access article distributed under the terms of the Creative Commons NonCommercial Attribution License (CC BY NC 4.0), which permits Share - copy and redistribute the material in any medium or format, and Adapt - remix, transform, and build upon the material, under the Attribution-NonCommercial terms.

behavior (Zeroval, 1978). Most phytophagous species in this family are seed-eaters, stem-eaters or gall-maker (Goulet & Huber, 1993). Because of the high damages caused by some Eurytomidae species (Alsendi et al., 2019), the settlement of infected plants is remarkably reduced in the pastures (Alsendi et al., 2019). Various researchers have studied the family Eurytomidae (Zeroval, 1995; Lotfalizadeh et al., 2007; Zeroval & Fursov, 2015, 2016; Fursov et al., 2017; Alsendi et al., 2019). The Palaearctic species of Eurytominae and Eudecatominae have been keyed by Zeroval (1995). The faunistic study of some Eurytomidae of Iran, including descriptions of some new species, was conducted recently (Zeroval et al., 2004; Madjzadeh et al., 2005; Lotfalizadeh et al., 2007). *Bruchophagus* Ashmead is a large genus, with 702 and 92 species worldwide and in the Palaearctic region, respectively (Noyes, 2019). So far, twenty-six *Bruchophagus* species are known to occur in various regions of Iran (Saghaei et al., 2018; Alizadeh et al., 2020, 2021). Many *Bruchophagus* species have recently been described or recorded from various regions of Iran (Zarnegar & Lotfalizadeh, 2014; Kalantary et al., 2017, 2019; Naghizadeh et al., 2017; Parsa et al., 2018, 2020; Zeroval et al., 2019; Alizadeh et al., 2020, 2021). Species of *Bruchophagus* are associated with legume plants of the family Fabaceae (genera *Astragalus*, *Caragana*, *Cladrastis*, *Coronilla*, *Dorycnium*, *Glycyrrhiza*, *Hedysarum*, *Hippocrepis*, *Lotus*, *Medicago*, *Onobrychis*, *Omonis*, *Oxytropis*, *Robinia*, *Sesbania*, *Sophora*, *Smirnovia*, *Trifolium*, *Trigonella*, *Vicia*, *Zosima*), family Apiaceae (genus *Prangos*) and Polygonaceae (genus *Rumex*), whereas species *Parabruchophagus* Zeroval, 1992 associated with the family Liliaceae (genus *Eremurus*) (Zeroval & Seryogina, 1994a; Zeroval, 2011).

This study aimed to identify *Bruchophagus* species associated with *Astragalus brachyodontus* in some parts of North-western provinces, as a widely distributed host plant of *Bruchophagus*. As healthy plant seeds are inevitable need for plant regeneration in the rangeland of the country, the results of this study can be directly used for collecting healthy seeds from uninfected zones in the country (Alsendi et al., 2019, Parsa et al., 2020). At the same way, the determination geographical distribution and host domain of each of these species as a prelude to developing a control program in the rangeland plants in Iran.

MATERIAL AND METHODS

A sampling of *Astragalus brachyodontus* seeds, were carried out in 16 and 6 stations in Ardabil and Qazvin provinces, respectively (Fig. 1). Sampling localities are enclosed areas that were less affected by grazing, destruction, and spraying. Sampling period was based on climatic and vegetative conditions of plants and from the beginning of the dough being a stage to seed development every week from 2007 to 2012. The collection data for each infected seeds are provided. The collected samples were kept in rearing containers for several months. The specimens were inspected at least once a week and in case of complete emergence, the rearing boxes containing the specimens were kept in the refrigerator for half an hour. The anesthetized wasps were then collected with a brush and transferred to jars containing 70% ethanol. Simultaneously with the collection of seed pods from nature, a complete herbarium specimen of plants was also collected. Plant samples were placed on a pressboard and a defined sample code similar to the collected seed code was installed on it. Herbarium specimens along with sample information were identified by botanists in the botany section of the Forests and Rangelands Research Institute. In the present study the species *Astragalus* spp. were identified by Dr. A.A. Masoumiand and Dr V. Mozafarian (Research Institute of Forests & Rangelands, Iran). Finally, the wasps were studied and identified by the the fifth author using reliable identification keys (Szelényi, 1961, 1976; Zeroval & Seryogina, 1994b; Zeroval, 1978, 1995). The samples collected from the current research will be kept in the bio-systematic laboratory of insects in the college of agriculture and natural resources located at the University of Tehran, Karaj, Iran.

RESULTS

We reared six species of *Bruchophagus* from *Astragalus brachyodontus* at 22 different sampling localities in two provinces. In addition, previously reported species on *A. brachyodontus* from Iran are also reviewed. The below list presents 11 species of *Bruchophagus* reared from seeds of *A. brachyodontus* in Iran which are arranged alphabetically. This is the first review of seed-eaters of this plant.

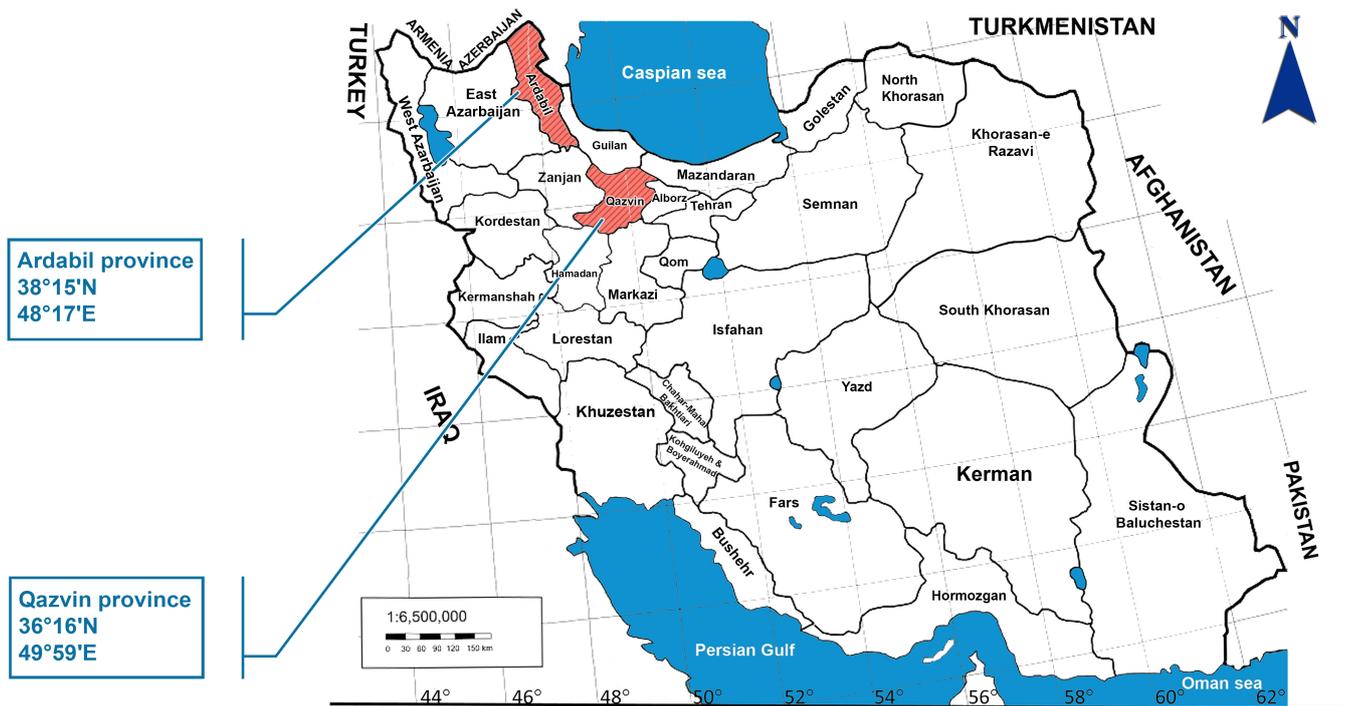


Figure 1. Sampling stations for collecting the *Bruchophagus* species in the northwest of Iran.

Taxonomic hierarchy

Class Insecta Linnaeus, 1758

Order Hymenoptera Linnaeus, 1758

Superfamily Chalcidoidea Latreille, 1817

Family Eurytomidae Walker, 1832

Genus *Bruchophagus* Ashmead, 1988

Bruchophagus astragali Fedoseeva, 1954

Material examined. 3♀ 2♂, IRAN, Ardabil province, Khalkhal (37°37'8"N, 48°31'33"E), 23-VII-2009, *Astragalus brachydontus*.

Distribution in Iran. Ardabil (new records), Chaharmahal-Bakhtiari (Haghighian, 2004), East Azarbaijan (Naghizadeh et al., 2017), Hamedan (Alsendi et al., 2019), Qazvin (Lotfalizadeh & Zarnegar, 2014), Qom (Parsa et al., 2018), and West-Azarbaijan (Zerova et al., 2008) provinces.

Note. This species was reared from seeds of different species of *Astragalus* such as *A. albcaulis* DC., *A. cicer* L., *A. glycyphyllos* L., *A. davuricus* DC. (Zerova & Seryogina, 1994a), *A. alyssoides* Lam., *A. podocarpus* C.A.Mey., *A. onobrychis* L. (Naghizadeh et al., 2017), *A. angustiflorus* and *A. echinops* (Alsendi et al., 2019); *A. corrugatus*, *A. faciculifolius*, *A. chrysostachus*, *A. melanagrama*, *A. podolobus*, *A. meridionalis*, *A. annularius*, *A. squarosus*, *A. arbusculus* *A. hamosus* and *Cicr* sp. (Frozani, et al., 2021). Its association with *Astragalus brachydontus* was reported by Lotfalizadeh and Zarnegar (2014) and Parsa et al. (2018).

Bruchophagus dahuricus (Zerova, 1992)

Distribution in Iran. East-Azarbaijan (Naghizadeh et al., 2017), North-Khorasan (Kalantary et al., 2017), Qazvin (Lotfalizadeh & Zarnegar, 2014), and Qom (Parsa et al., 2018) provinces.

Note. This species reared from seeds of *Oxytropis immersa* (Baker) and *Astragalus brachydontus* (Lotfalizadeh & Zarnegar, 2014); *Dorema ammoniacum* (D. Don.) and *A. oxyglottis* (Kalantary et al., 2017), and *Dorema ammoniacum* (Parsa et al., 2018).

***Bruchophagus gibbus* (Boheman, 1836)**

Distribution in Iran. East-Azarbaijan (Naghizadeh et al., 2017), Khuzestan (Eslamizadeh & Ebrahimi, 2002, Eslamizadeh et al., 2008), Qazvin (Lotfalizadeh & Zarnegar, 2014), and Qom (Parsa et al., 2018) provinces.

Note. Lotfalizadeh and Zarnegar (2014) reported this species as seed-eater of *A. brachyodontus*.

***Bruchophagus kononovae* Zerova, 1994**

Distribution in Iran. East-Azarbaijan (Naghizadeh et al., 2017), Hamedan (Alsendi et al., 2019), North-Khorasan (Kalantary et al., 2017), and Qom (Parsa et al., 2018) provinces.

Note. Association of this species with *A. brachyodontus* was reported by (Parsa et al., 2018). Furthermore, *B. kononovae* was reared from seeds of *A. angustiflorus*, *A. patrius*, *A. vegetus* in Hamedan province (Alsendi et al., 2019); *Astragalus iranicus* (Kalantary et al., 2017); *A. brachyodontus* L. and *A. compylorrhynchus* Fisch. & C. Mey. (Parsa et al., 2018); *A. refractus* Boiss. & Buhse (Naghizadeh et al., 2017), *A. meridionalis* and *Medicago sativa* (Frozani et al., 2021).

***Bruchophagus mutabilis* Nikolaskaya, 1952**

Material examined. 6♀ 5♂, IRAN, Ardabil province, Khalkhal (37°37'8"N, 48°31'33"E), 23-VII-2009, *Astragalus brachyodontus*.

Distribution in Iran. Ardabil (**new records**), East-Azarbaijan (Naghizadeh et al., 2017), Hamedan (Alsendi et al., 2019), Qazvin (Arbab, 2004; Lotfalizadeh & Zarnegar, 2014), and Qom (Parsa et al., 2018) provinces.

Note. This species was reared from *A. brachyodontus* seeds in this research. This association was reported by Lotfalizadeh and Zarnegar (2014). The following plant species were reported as hosts of *B. mutabilis*: *A. singarensis*, *A. angustiflorus*, *A. vegetus* and *A. echinops* (Alsendi et al., 2019); *Glycyrrhiza glabra* L. (Arbab, 2004); *A. brachyodontus* and *A. avicennus* (Lotfalizadeh & Zarnegar, 2014); *A. oxyglottis* (Parsa et al., 2018); *Astragalus chrysostachys*, *A. onobrychioides* M. Bieb., *A. persicus* (DC.) Fisch. and C.A.Mey., *A. tricholobus* DC., *A. macrorus* Fisch. and C.A.Mey. and *Prangos scabra* Nabelek (Naghizadeh et al., 2017); *A. persicus* and *Robinia pseudoacacia* L. (Alizadeh et al., 2020); *A. camptoceros*, *A. hamosus*, *A. annularius*, *A. arbusculus*, *A. crusiatus*, *A. calliphysa*, *A. effosus*, *Trigonella elliptica*, *Onobrychis* sp. and *Cicer* sp. (Frozani et al., 2021).

***Bruchophagus nikolskayae* (Zerova, 1968)**

Material examined. 1♀, IRAN, Qazvin province, Flar (36°24'61"N, 50°05'58"E), 11-VI-2009, *Astragalus brachyodontus*.

Distribution in Iran. East-Azarbaijan (Naghizadeh et al., 2017), Khorasan-Razavi (Dashti & Lotfalizadeh, 2008), and Qazvin (**new records**) provinces.

Note. We reared *B. nikolskayae* from seeds of *Astragalus brachyodontus* for the first time; *Glycyrrhiza glabra*, *G. hirsute* and *G. echinoides* were reported as hosts of this species (Alsendi et al., 2019).

***Bruchophagus saxatilis* Zerova, 1975**

Material examined. 3♀, IRAN, Ardabil province, Arshagh (38°36'76"N, 47°51'40"E), 17-VI-2010, *Astragalus brachyodontus*.

Distribution in Iran. Ardabil province (**new record**).

Note. This species characterizes with following features: head and mesosoma with superficial wrinkles, sometimes coriaceous on interspaces; head and mesosoma densely setose; antenna shortly setose, setae



Figure 2. *Bruchophagus saxatilis* Zerova, 1975, female. **A.** Lateral habitus; **B.** Antenna; **C.** Forewing veins.

evenly distributed; marginal vein as long as the stigma vein; postmarginal vein hardly longer than, sometimes as long as, the stigma (Fig. 2). The color of the body is black, the chest is the color of the body, and the base of the antenna is yellow. The color of the antenna is usually brown and this is because the color of the legs is lighter. The femur (especially the back part) is yellow to brown in color, which is clearly visible, especially in the middle of the leg. The terminal part of the abdomen in adults with scattered marginal vein hairs as long as the stigma. Post marginal vein thickened and hardened and sometimes as big as the stigma (Zerova & Seryogina, 1994a). This species was reported from *Eremurus olgae* Regel. (Liliaceae) (Zerova, 1995), and its association with *Astragalus brachydontus* (Fabaceae) is new.

***Bruchophagus turkestanicus* Zerova, 1994**

Material examined. 7♀ 6♂, IRAN: Ardabil province, Khalkhal (37°37'8"N, 48°31'33"E), 23-VII-2009, *Astragalus brachydontus*; 4♀ 3♂, IRAN, Qazvin province, Flar (36°24'61"N, 50°05'58"E), 11-VI-2009, *Astragalus brachydontus*.

Distribution in Iran. Ardabil (**new record**), East-Azarbaijan (Naghizadeh et al., 2017), Hamedan (Alsendi et al., 2019), Qazvin (Lotfalizadeh & Zarnegar, 2014), and Qom (Parsa et al., 2018) provinces.

Note. We reared it from *A. brachydontus* seeds but this association was already reported by Lotfalizadeh and Zarnegar (2014). *Bruchophagus turkestanicus* was also recorded in association with *A. angustiflorus*, *A. vegetusand* and *A. macropelmatus* (Alsendi et al., 2019); *Dorema ammoniacum* (D. Don.) (Parsa et al., 2018); *A. alyssoides* Lam, *A. chrysostachys*, *A. macrourus*, *A. neo-mobayenii* Massoumi, *A. podocarpus*, and *Trifolium pretense* L. (Naghizadeh et al., 2017).

Bruchophagus platypterus (Walker, 1834)

Distribution in Iran. Ardabil (Alizadeh et al., 2020), Fars, Hamedan, (Alsendi et al., 2019), and Qazvin (Alizadeh et al., 2020) provinces.

Note. It was reported from Hamedan province, on *Lotus corniculatus*, and *Medicago rigidula* as host plants and from Fars province on *L. corniculatus* (Alsendi et al., 2019), from Ardabil and Fars provinces on *A. brachydonatus* (Alizadeh et al., 2020) and *Lotus corniculatus* (Frozani et al., 2021), respectively.

Bruchophagus robiniae Zerova, 1970

Material examined. 3♀ 3♂, IRAN, Ardabil province, Khalkhal (37°37'8"N, 48°31'33"E), 23-VII-2009, *Astragalus brachydontus*.

Distribution in Iran. Ardabil (**new record**), East-Azarbaijan (Alizadeh et al., 2020), and Tehran (Rakhshani et al., 2005) provinces.

Note. Our finding of *B. robiniae* - *A. brachydontus* association is new. *Bruchophagus robiniae* was reported on *Robinia pseudoacacia* L. (Fabaceae) from East-Azarbaijan (Alizadeh et al., 2020), and Tehran (Rakhshani et al., 2005).

Bruchophagus verbasci (Erdös, 1969)

Distribution in Iran. East-Azarbaijan, Isfahan, Qazvin and Qom provinces (Alizadeh et al., 2021).

Note. This recently reported species from Iran (Alizadeh et al., 2021), was reported for first time as a seed-eater of *A. brachydontus*.

DISCUSSION

This is the first effort to know the *Bruchophagus* species associated with *A. brachydontus*. We reared six species of *Bruchophagus* in this research including: *B. astragali* Fedoseeva, 1954; *B. mutabilis* Nikolaskaya, 1952; *B. nikolskayae* (Zerova, 1968); *B. robiniae* Zerova, 1970; *B. saxatilis* Zerova, 1975 and *B. turkestanicus* Zerova, 1994. Of which, *B. saxatilis* Zerova, 1975 is a new record for the Iranian fauna. A review of previously reported species of *Bruchophagus* associated with *A. brachydontus*, included six other species (Table 1) (Kalantary et al., 2017; Naghizadeh et al., 2017; Parsa et al., 2018; Alsendi et al., 2019; Alizadeh et al., 2020, 2021). Therefore, 11 species of *Bruchophagus* are known from the seeds of *A. brachydontus* in Iran; that all of these associations are new. Based on the reporters, Saghaei et al. (2018) believe about 90% of reported phytophagous species of the family Eurytomidae belong to the seed-eaters. *Astragalus brachydontus* as a broadly distributed in the most limited area of Iran is one of the main nutritive origins of livestock. Therefore, the infestation of seeds with different species of *Bruchophagus* and other seedeater insects can affect its presence in the rangelands. This study can be used as a base for future eco-biological studies of *Bruchophagus*-*Astragalus* association.

Table 1. The list of Iranian species of the genus *Bruchophagus*.

Species	Provincial distribution	References
<i>B. abnormis</i> Zerova, 1984	Chaharmahal-Bakhtiari	Haghighian et al. (2011)
	Qazvin	Lotfalizadeh & Zarnegar (2014)
<i>B. astragali</i> Fedoseeva, 1954	Chaharmahal-Bakhtiari	Haghighian et al. (2004)
	Qazvin	Lotfalizadeh & Zarnegar (2014)
	West-Azarbaijan	Zerova et al. (2008); Parsa et al. (2018)
	East-Azarbaijan	Naghizadeh et al. (2017)
<i>B. bajarii</i> (Erdős, 1957)	East-Azarbaijan	Lotfalizadeh et al. (2007), Naghizadeh et al. (2017)
<i>B. caucasicus</i> Zerova, 1992	North-Khorasan	Kalantary et al. (2017)
	Bushehr	Alizadeh et al. (2020)
<i>B. coluteae</i> (Bouček, 1954)	East-Azarbaijan	Naghizadeh et al. (2017)
<i>B. dahuricus</i> (Zerova, 1992)	North-Khorasan	Kalantary et al. (2017)
	Qom	Parsa et al. (2018)
	East-Azarbaijan	Naghizadeh et al. (2017)
<i>B. evolans</i> Szelenyi, 1961	North-Khorasan	Kalantary et al. (2017)
	East-Azarbaijan	Naghizadeh et al. (2017)
<i>B. gibbus</i> (Boheman, 1836)	Khuzestan	Eslamizadeh & Ebrahimi (2002); Eslamizadeh et al. (2008)
	Qazvin	Lotfalizadeh & Zarnegar (2014)
	Qom	Parsa et al. (2018)
	East-Azarbaijan	Naghizadeh et al. (2017)
<i>B. glycyrrhizae</i> (Nikolaskaya, 1952)	Qazvin	Arbab (2004)
	Qazvin	Alizadeh et al. (2020)
<i>B. iranicus</i> Özdikmen, 2011	West-Azarbaijan	Zerova et al. (2008)
<i>B. kononovae</i> Zerova, 1994	North-Khorasan	Kalantary et al. (2017)
	Qom	Parsa et al. (2018)
	East-Azarbaijan	Naghizadeh et al. (2017)
<i>B. macromycis</i> Fedoseeva, 1956	East-Azarbaijan	Naghizadeh et al. (2017)
<i>B. medicaginis</i> Zerova, 1992	Qom	Parsa et al. (2018)
	North-Khorasan	Kalantary et al. (2017)
<i>B. mutabilis</i> Nikolaskaya, 1952	Qazvin	Arbab (2004); Lotfalizadeh & Zarnegar (2014)
	Qom	Parsa et al. (2018)
	East-Azarbaijan	Naghizadeh et al. (2017)
<i>B. nikolskayae</i> (Zerova, 1968)	Khorasan-Razavi	Dashti & Lotfalizadeh (2008)
	East-Azarbaijan	Naghizadeh et al. (2017)
<i>B. parvulus</i> Zerova, 1994	East-Azarbaijan	Naghizadeh et al. (2017)
<i>B. platypterus</i> (Walker, 1834)	Ardabil	Alizadeh et al. (2020)
	Qazvin	Alizadeh et al. (2020)
<i>B. ponticus</i> Zerova, 1994	East-Azarbaijan	Naghizadeh et al. (2017)
<i>B. robiniae</i> Zerova, 1970	East-Azarbaijan	Alizadeh et al. (2020)
	Tehran	Rakhshani et al. (2005)
	East-Azarbaijan	Azmayeshfard & Esmaili (1974)
<i>B. roddi</i> Gussakovsky, 1933	West-Azarbaijan	Azmayeshfard & Esmaili (1974)
	Kermanshah	Arbab (2006)
	Kordestan	Khanjani & Kalafchi (2003)
	Zanjan	Mohammadbeigi (2014)
	Tehran	Mohammadbeigi (2014)
	Qom	Parsa et al. (2018)
	Ardabil	Current study
<i>Bruchophagus saxatilis</i> Zerova, 1975	Ardabil	Current study
<i>B. shohadae</i> (Zerova, 2008)	West-Azarbaijan	Zerova et al. (2008)
<i>B. smirnoviae</i> Nikol'skaya, 1955	Alborz	Alizadeh et al. (2020)
<i>B. trigonellae</i> Zerova, 1970	Qazvin	Zarnegar & Lotfalizadeh (2014)
	Qom	Parsa et al. (2018)
	East-Azarbaijan	Naghizadeh et al. (2017)
<i>B. turkestanicus</i> Zerova, 1994	Qazvin	Zarnegar & Lotfalizadeh (2014)
	Qom	Parsa et al. (2018)
	East-Azarbaijan	Naghizadeh et al. (2017)
<i>B. verbasci</i> (Erdős, 1969)	East-Azarbaijan	Alizadeh et al. (2020)
	Qazvin	Alizadeh et al. (2020)

AUTHOR'S CONTRIBUTION

The authors confirm contributions to the paper as follows: A.K. Alsendi: Performed the project as PhD thesis; J. Nozari: As project leader and research supervisor; S.E. Sadegh: To investigate [a specific aspect], supervised the project and justified the findings of this work, H. Adelimansh & M. Zerova were the scientific advisors. All authors approved the final version of the manuscript.

FUNDING

This project has been funded by the research credits of the University of Tehran.

AVAILABILITY OF DATA AND MATERIAL

Not applicable.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this paper.

ACKNOWLEDGMENTS

The authors appreciate the support of the Research Institute of Forests and Rangelands, Iran (RIFR) and the University of Tehran. Our sincere thanks to Dr. A.A. Masoumiand and Dr V. Mozafarian (RIFR) for their great helps in the identification of *Astragalus* species. The authors also thank Dr. H. Lotfalizadeh (Agricultural and Natural Resources Center of East Azarbaijan, Iran) for identification and/or confirmation of specimens, as well as for his comments and revising the manuscript.

REFERENCES

- Alizadeh, Z., Bagheri, M., Lotfalizadeh, H. & Eivazian-Kary, N. (2020) Review of two seed wasps genera (Hymenoptera: Eurytomidae) in Iran with description of a new species. *North-western Journal of Zoology*, 16 (1), 29–35.
- Alizadeh, Z., Lotfalizadeh, H., Bagheri, M., Delvare, G., Eivazian-Kary, N. & Mehrvar, A. (2021) New taxonomic position for a recently collected eurytomid species (Hymenoptera: Chalcidoidea) from Iran. *Journal of Crop Protection*, 10 (2), 271–279.
- Alsendi, A., Adelimaneshy, H. & Sadeghi, S.E. (2019) Report of some eurytomid wasps (Hymenoptera: Eurytomidae) and their associated host plants from two provinces of Iran. *IOP Conference Series: Earth and Environmental Science*, 388 (1), 1–6. <https://doi.org/10.1088/1755-1315/388/1/012018>
- Arbab, A. (2004) Report of three species of Chalcidoidea from Iran. *Journal of the Entomological Society of Iran*, 24, 129–130.
- Arbab, A. (2006) Spatial distribution pattern of immature stages of alfalfa seed weevil, *Tychius aureolus* (Keiswetter) (Col. Curculionidae), and alfalfa seed wasp, *Brochophagus roddi* (Hym. Eurytomidae) (Gussakovski) in alfalfa seed fields. *Journal of Agricultural Sciences-Islamic Azad University*, 12 (2), 263–269.
- Azmayeshfard, P. & Esmaili, M. (1974) The alfalfa seed chalcid *Bruchophagus roddi* (Gussakovsky) a potential pest in Iran. In *Proceedings of the 5th Iranian Plant Protection Congress, September 1974, Tabriz, Iran*, pp. 7–8.
- Bouček, Z. (1988) Australasian Chalcidoidea (Hymenoptera). *A biosystematic revision of genera of fourteen families, with a reclassification of species*. CAB International Institute of Entomology, Wallingford, Oxon, UK. 832 p.

- Dashti, M. & Lotfalizadeh, H. (2008) On the occurrence of *Bruchophagus nikolskajae* Zerova, 1975 (Hym.: Eurytomidae): a seed-eater wasp of *Eremurus spectabilis* in Iran. In: Zafari, D. (ed.) *Proceedings of the 18th Iranian Plant Protection Congress, 24–27 August 2008*, Hamadan, Iran, Bu Ali sina University, Vol. 1, p. 106.
- Eslamizadeh, R. & Ebrahimi, E. (2002) Biology and damage level of alfalfa seed wasp *Bruchophagus gibbus* (Boheman)(Eurytomidae) in Khuzestan province. In: Hidjat Jalali, A.A. (ed.) *Proceeding of the 15th Iranian Plant Protection Congress, 7–11 September 2002*, Kermanshah, Iran, Vol. 1, pp. 7-11.
- Eslamizadeh, R., Barzkar, M., Shooshidezfuli, A.A. & Karami Nejad, M. (2008) Investigation on the effect of last cutting time on damage rate of *Bruchophagus gibbus* on Baghdad alfalfa seed yield in Khuzestan In: Zafari, D. (ed.) *Proceedings of the 18th Iranian Plant Protection Congress, 24–27 August 2008*, Hamadan, Iran, Bu Ali sina University, Vol. 1, p. 388.
- Frozani, S., Adeli-Manesh, H., Sadeghi, S.E., Alsendi, A., Farar, N., Golestaneh, R., Saadati, H., Haghshenas, A.R., Haghghian, F., Zerova, M. & Fursov, V. (2021) Identification, distribution and host-plant associations of seed-feeding wasps (Hymenoptera: Eurytomidae) of some rangelands in the central and southern Iran. *Iranian Journal of Forest and Range Protection Research*, 18 (2), 165–178.
- Fursov, V., Zerova, M. & Kodan, M. (2017) The first record of *Bruchophagus sophorae* (Hymenoptera: Eurytomidae) developing in seeds of *Styphnolobium* and *Sophora* (Fabaceae) in Turkey, France, and Kazakhstan. *Turkish Journal of Zoology*, 41 (3), 587–591. <https://doi.org/10.3906/zoo-1608-14>
- Goulet, H. & Huber, J.T. (1993) *Hymenoptera of the world: an identification guide to families*. Research Branch, Agriculture Canada Publication 1894/E., Ottawa. 668 p.
- Haghghian, F. (2004) *Bruchophagus astragali* (Hymenoptera: Eurytomidae) as a pest of rangeland legumes in Chaharmahal and Bakhtiary province. In: Niknam, Gh. (ed.) *Proceeding of the 16th Iranian Plant Protection Congress, 28 August–1 September, 2004*, Tabriz, Iran. University of Tabriz, Vol. ., p. 135.
- Haghghian, F., Yarmand, H., Sadeghi, S.E., Delvare, G., Shirmardi, H.A., Lotfalizadeh, H. & Moniri, V.R. (2011) Report of *Bruchophagus abnormis* Zerova, 1984 (Hym.: Eurytomidae) from Iran. *Iranian Journal of Forest and Range Protection Research*, 9 (3), 78–79.
- Kalantary, S.A.A., Safaralizadeh, M.H., Lotfalizadeh, H., Sadeghi, E., Aramideh, Sh. & Mirfakhraei, Sh. (2017) Identification and introduction of Fabaceae seed-eating eurytomids (Hym.: Eurytomidae) in North-Khorasan province. In Saboori, A. (ed.) *Proceedings of 2nd Iranian International Congress of Entomology, 2–4 September 2017*, Karadj, Iran, University of Tehran, p. 181.
- Kalantary, S.A.A., Safaralizadeh, M.H., Lotfalizadeh, H., Aramideh, Sh., Mirfakhraei, Sh. & Sadeghi, E. (2019) Identification and species diversity of seed feeding insects of rangelands Legumes (Fabaceae) in the North Khorasan province. *Iranian Journal of Forest and Range Protection Research*, 17 (1), 82–95.
- Khanjani, M. & Kalafchi, M. (2003) Preliminary investigation on identification of seed alfalfa pests and life history studies of dominant destructive species in Hamadan. *Agricultural Science, Tabriz*, 13 (2), 89–101.
- Lotfalizadeh, H., Delvare, G. & Rasplus, J.Y. (2007) *Eurytoma caninae* sp. n. (Hymenoptera, Eurytomidae), a common species previously overlooked with *E. rosae*. *Zootaxa*, 1640, 55–68. <https://doi.org/10.11646/zootaxa.1640.1.3>
- Lotfalizadeh, H. & Zarnegar, A. (2014) A study of the family Eurytomidae (Hym.: Chalcidoidea) reared on rangeland *Astragalus* in Qazvin province. In: Aminian, H. (ed.) *Proceedings of 21th Iranian Plant Protection Congress, 23–26 August 2014*, Urmia, Iran, University of Urmia, Vol. 1, p. 702.
- Madjdzadeh, M., Zerova, M. & Dawah, H. (2005) A new species of *Tetramesa* (Hymenoptera, Eurytomidae) from Iran. *Vestnik Zoologii*, 39 (1), 65–66.
- Mohammadbeigi, A. (2014) Studying on susceptibility of some alfalfa varieties to alfalfa seed chalcid (*Bruchophagus roddi* Guss.). *Iranian Journal of Forest and Range Protection Research*, 12 (1), 44–54.
- Naghizadeh, A., Lotfalizadeh, H., Nikdel, M. & Sadeghi, S.E. (2017) Fauna of the genus *Bruchophagus* (Hym.: Eurytomidae) in East-Azarbaijan province, Iran. *Journal of Entomological Research*, 4 (9), 373–392.
- Noyes, J.S. (2019) Universal Chalcidoidea Database. The Natural History Museum. <http://www.nhm.ac.uk/research-curation/projects/chalcidoids/> [accessed at: 2020.01.20]
- Parsa, M., Adeli-Manesh, H., Sadeghi, S.E., Lotfalizadeh, H., Al-Sendi, A. Mohammadpour, A., Zerova, M. & Fursov, V. (2018) New trophic associations for some *Bruchophagus* species (Hym.: Eurytomidae) in Iran. *Iranian Journal of Forest and Range Protection Research*, 16 (1), 107–117.

- Parsa, M., Adeli-Manesh, H., Sadeghi, S.E., Lotfalizadeh, H., Al-Sendi, A., Mohammadpour, A., Zerova, M. & Fursov, V. (2020) New records of seed-feeding and parasitic chalcid wasps of the family Eurytomidae (Hymenoptera, Chalcidoidea) from Iran. *Journal of Entomological Society of Iran*, 39 (4), 367–381.
- Rakhshani, E., Talebi, A.A., Narendran, T.C. (2005) Report of *Bruchophagus robiniae* (Hym.: Eurytomidae) from Iran. *Journal of Entomological Society of Iran*, 25 (1), 81–82.
- Saghaei, N., Fallahzadeh, M. & Lotfalizadeh, H. (2018) Annotated catalog of Eurytomidae (Hymenoptera: Chalcidoidea) from Iran. *Transactions of the American Entomological Society*, 144, 263–293.
<https://doi.org/10.3157/061.144.0212>
- Szelényi, G. (1961) Die in Leguminosensamen lebenden *Eurytoma* (*Bruchophagus*)-Arten Ungarns (Hym. Chalcidoidea). *Növénytermelés Kutató Intézet Évkönyve*, Budapest, 8, 131–138.
- Szelényi, G. (1976) Mongolian Eurytomidae (Hym., Chalcidoidea). ii. *Acta Zoologica Academiae Scientiarum Hungaricae*, 22, 173–187.
- Zarnegar, A. & Lotfalizadeh, H. (2014) New record of *Bruchophagus trigonellae* Zerova (Hym.: Eurytomidae) from Iran. In: Aminian, H. (ed.) *Proceedings of 21th Iranian Plant Protection Congress, 23–26 August 2014, Urmia, Iran*, University of Urmia, Vol. 1, p. 783.
- Zerova, M.D. (1978) Chalcidoidea 8. Eurytomidae. In: Medvedev, G.S. (ed.) *Opredelitel Nasekomykh Evropeyskoy Chasti SSSR; Vol. III; Hymenoptera II*. Nauka, Leningrad, pp. 328–358.
- Zerova, M.D. (1995) *Parasitic Hymenoptera-Eurytominae and Eudecatominae of Palaearctics*. National Academy of Sciences of Ukraine, Kiev, 460 p. [in Russian]
- Zerova, M.D. (2011) A new status of the subgenus *Parabruchophagus* Zerova, 1992 (Hymenoptera: Eurytomidae) and its composition. *Russian Entomological Journal*, 20 (3), 345–350. <https://doi.org/10.15298/rusentj.20.3.21>
- Zerova, M.D. & Fursov, V. (2015) A new species of the genus *Eurytoma* (Hymenoptera, Chalcidoidea, Eurytomidae) from the seeds of Honey Locust *Gleditsia triacanthos* (Caesalpiniaceae) in Ukraine. *Vestnik Zoologii*, 49 (4), 369–372.
- Zerova, M.D. & Fursov, V.N. (2016) A redescription and New data on the distribution of *Tetramesa phragmitis* (Hymenoptera, Eurytomidae). *Vestnik Zoologii*, 50 (1), 85–88. <https://doi.org/10.1515/vzoo-2016-0010>
- Zerova, M.D., Mehrnejad, M.R., Gharaei, B. & Seryogina, L.Y. (2004) Two new species of the genus *Eurytoma* (Hymenoptera, Eurytomidae) from Iran. *Vestnik Zoologii*, 38 (1), 81–84.
- Zerova, M.D. & Seryogina, L.Y. (1994a) New chalcid species of the families Eurytomidae and Torymidae (Hymenoptera, Chalcidoidea). *Zoologicheskyy Zhurnal*, 73 (5), 120–125.
- Zerova, M.D. & Seregina, L.Y. (1994b) *The seed-eating Chalcidoidea of Palaearctics*. Institute of Zoology, National Academy of Sciences of Ukraine, Kiev. 234 p.
- Zerova, M.D., Seryogina, L.Y. & Karimpour, Y. (2008) New species of the chalcidoid wasps of the families Eurytomidae and Torymidae (Hymenoptera, Chalcidoidea) from Iran. *Vestnik Zoologii*, 42 (6), 491–492.
<https://doi.org/10.2478/v10058-008-0016-0>
- Zerova, M.D., Al-Sendi, A., Fursov, V.N., Adelmanesh, H., Sadeghi, S.E. & Pirouzi, F. (2019) The description of a new *Bruchophagus* species (Hymenoptera, Chalcidoidea, Eurytomidae) developing in seeds of *Melilotus officinalis* (L.) Descr. (Fabaceae) in Iran. *Ukrainian Entomological Journal*, (1), 12–15.

مطالعه گونه‌های جنس *Bruchophagus* Ashmead (Hymenoptera, Eurytomidae) مرتبط با *Astragalus brachydontus* (Fabaceae) در ایران

ایاد کاظم السندي^۱، جاماسب نوذری^{۱*}، سید ابراهیم صادقی^۲، حمید عادل‌ی منش^۳، مارینا زروا^۴

۱. گروه گیاهپزشکی، دانشکده کشاورزی و منابع طبیعی، دانشگاه تهران، کرج، ایران.

۲. مؤسسه تحقیقات جنگل‌ها و مراتع ایران، تهران، ایران.

۳. گروه حشره‌شناسی و بیماری‌های گیاهی، دانشکده‌گان ابوریحان، پاکدشت، تهران.

۴. موسسه جانورشناسی اشماله‌اوزن، آکادمی ملی علوم اوکراین، بوگدان خملنیتسکی، کیف، ۰۱۰۳۰، اوکراین.

* پست الکترونیک نویسنده مسئول مکاتبه: nozari@ut.ac.ir

ا تاریخ دریافت: ۲۵ خرداد ۱۴۰۱ | تاریخ پذیرش: ۲۷ مرداد ۱۴۰۱ | تاریخ انتشار: ۱۶ مهر ۱۴۰۱

چکیده: زنبورهای بذرخوار متعلق به جنس *Bruchophagus* Ashmead, 1988 از استان‌های اردبیل و قزوین در شمال غرب ایران جمع‌آوری شد. بدین منظور گیاهان میزبان مختلف جمع‌آوری و بذره‌های آن‌ها از سال ۱۳۸۶ تا ۱۳۹۱ در شرایط آزمایشگاهی نگهداری شدند. این پژوهش روی گونه‌های جمع‌آوری شده از روی میزبان *Astragalus brachydontus* Boiss (Fabaceae) تمرکز نموده است. در این پژوهش شش گونه از *Bruchophagus* از جمله *B. mutabilis*، *B. astragali* Fedoseeva، *B. saxatilis*، *B. robiniae* Zerova، *B. nikolskayae* (Zerova) Nikolaskaya و *B. turkestanicus* Zerova به دست آمد که از این میان *Bruchophagus saxatilis* Zerova یک رکورد جدید برای فون ایران است. میزبان‌های جدید مرتبط برای همه گونه‌های جمع‌آوری شده پیدا شد و به نظر می‌رسد یک ارتباط بیولوژیک پیچیده در این میان وجود داشته باشد که برای اولین بار مورد بررسی قرار گرفت. پژوهش حاضر ۱۱ گونه *Bruchophagus* مرتبط با بذور *A. brachydontus* در ایران را مورد بررسی قرار داد. به علاوه، سایر گونه‌های قبلاً شناخته شده از جنس *Bruchophagus* به صورت جدول مرور شدند.

واژگان کلیدی: بذرخوار، Eurytomidae، گیاه‌خوار، گیاه میزبان، ایران، چک‌لیست.