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A study on the braconid wasps (Hymenoptera: Braconidae) from Isfahan province, Iran

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Abstract

The braconid wasps (Hymenoptera: Braconidae) are one of the efficient natural enemies of agricultural and forest pests. The fauna of these beneficial insects is studied in Isfahan province of central Iran. Totally 49 species from 27 genera and subgenera and 12 subfamilies (Alysiinae, Brachistinae, Braconinae, Cardiochilinae, Cheloninae, Euphorinae, Exothecinae, Hormiinae, Meteorinae, Microgastrinae, Opiinae, Rogadinae) were collected and identified. Among the collected species three species including, *Rhysipolis decorator* (HALIDAY), *Rhysipolis similis* (SZÉPLIGETI) and *Aleiodes* (*Aleiodes*) *pallescens* HELLÉN are new records for Iran.

K e y w o r d s : Hymenoptera, Braconidae, Fauna, New record, Isfahan, Iran.

Zusammenfassung

Eine Untersuchung über die Brackwespen (Hymenoptera: Braconidae) der Provinz Isfahan, Iran. Die Braconiden-Wespen gehören zu den wirkungsvollsten natürlichen Feinde der Schädlinge von Ackerbau und Forstwirtschaft. Die Fauna dieser Nützlinge der Provinz Isfahan im mittleren Iran wurde studiert. Es wurden 49 Arten von 27

Gattungen und Untergattungen aus 12 Unterfamilien (Alysiinae, Brachistinae, Braconinae, Cardiochilinae, Cheloninae, Euphorinae, Exothecinae, Hormiinae, Meteorinae, Microgastrinae, Opiinae, Rogadinae) gesammelt und identifiziert. Drei Arten sind neu für die Fauna des Iran: *Rhysipolis decorator* (HALIDAY), *Rhysipolis similis* (SZÉPLIGETI) und *Aleiodes* (*Aleiodes*) *pallescens* HELLÉN.

Introduction

The braconids (Hymenoptera: Braconidae) are one of the powerful parasitoids which have efficient role in biological control of several agricultural pests (Wharton, 1993; GHAHARI et al. 2006). For successful in biological control program, determining the natural enemies is the first step. This is the main reason about some researches on Iranian Braconidae which were done lately (GHAHARI et al. 2009a, b, c, d, 2010).

Isfahan (or Esfahan) province is located in the center of the country and covers an area of approximately 107,027 square km and is situated in the center of Iran. It is located between the provinces Markazi, Qom and Semnan (north), Fars and Kohkiluyeh & Boyer-Ahmad (South), Yazd (East), Lurestan (West) and Chahar Mahal & Bakhtiyari (southwest). The province experiences a moderate and dry climate on the whole, ranging between 40.6 °C and 10.6 °C on a cold day in the winter season. The average annual temperature has been recorded as 16.7 °C and the annual rainfall on an average has been reported as 116.9 mm.

With attention to the importance of Braconidae in pest control, the fauna of these beneficial insects is studied in Isfahan province. The results of these small researches will be resulted to determining of braconids' fauna from different regions of Iran, and the identified lists are valuable for insect systematic science.

Materials and Methods

The materials were collected by malaise traps and sweeping net from different regions of Isfahan province during 2005 to 2008. The sampled regions of this research were Anarak, Aran-Bidgol, Ardestan, Bad Rood, Isfahan, Fereydoon Shahr, Golpayegan, Kashan, Khansar, Mobarakeh, Naeen, Semirom and Shahreza. Classification and nomenclature of Braconidae suggested by YU et al. (2006) have been followed.

Results

In a total 49 braconid species from 27 genera and subgenera and 12 subfamilies were collected from different regions of Isfahan province. The list of species is given below.

Subfamily A l y s i i n a e

***Asobara minuta* (NEES 1811)**

M a t e r i a l e x a m i n e d : Aran-Bidgol (917 m), 2♀♀, July 2005. Semirom (2457 m), 1♀, August 2008.

***Chorebus* (*Phaenolexis*) *fuscipennis* (NIXON 1937)**

M a t e r i a l e x a m i n e d : Isfahan (1592 m), 1♀, July 2006.

***Chorebus* (*Stiphrocera*) *lar* (MORLEY 1924)**

M a t e r i a l e x a m i n e d : Anarak (1432 m), 1♂, April 2006.

***Chorebus* (*Stiphrocera*) *venustus* (TOBIAS 1962)**

M a t e r i a l e x a m i n e d : Ardestan (1240 m), 1♀, September 2005.

***Dacnusa gentianae* GRIFFITHS 1967**

M a t e r i a l e x a m i n e d : Golpayegan (1827 m), 1♀, 1♂, September 2005. Isfahan (1592 m), 1♀, July 2006.

***Orthostigma maculipes* (HALIDAY 1838)**

M a t e r i a l e x a m i n e d : Isfahan (1551 m), 1♀, August 2006.

***Synaldis distracta* (NEES 1834)**

M a t e r i a l e x a m i n e d : Isfahan (1592 m), 1♂, July 2006. Shahreza (1846 m), 2♀♀, 1♂, September 2008.

Subfamily B r a c h i s t i n a e

***Schizoprymnus obscurus* (NEES 1816)**

M a t e r i a l e x a m i n e d : Fereydoon Shahr (2532 m), 1♀, 1♂, June 2006.

***Schyzoprymnus parvus* (THOMSON 1892)**

M a t e r i a l e x a m i n e d : Golpayegan (1827 m), 1♂, September 2005.

***Triaspis floricola* (WESMAEL 1835)**

M a t e r i a l e x a m i n e d : Aran-Bidgol (917 m), 2♀♀, July 2005.

***Triaspis obscurellus* (NEES 1816)**

M a t e r i a l e x a m i n e d : Khansar (2253 m), 2♀♀, April 2005. Ardestan (1240 m), 2♀♀, September 2005. Naeen (1544 m), 1♀, July 2008.

Subfamily B r a c o n i n a e

***Bracon* (*Bracon*) *pectoralis* WESMAEL 1838**

M a t e r i a l e x a m i n e d : Semirom (2457 m), 1♂, August 2008.

***Bracon* (*Cyanopterobracon*) *illyricus* MARSHALL 1888**

M a t e r i a l e x a m i n e d : Kashan (894 m), 1♀, August 2007.

***Bracon* (*Glabrobracon*) *epitriptus* MARSHALL 1885**

M a t e r i a l e x a m i n e d : Isfahan (1592 m), 2♂♂, July 2006. Mobarakeh (1682 m), 1♂, June 2008.

***Bracon* (*Glabrobracon*) *minutator* (FABRICIUS 1798)**

M a t e r i a l e x a m i n e d : Shahreza (1846 m), 1♀, September 2008.

***Bracon* (*Glabrobracon*) *tekkensis* TELENGA 1936**

M a t e r i a l e x a m i n e d : Fereydoon Shahr (2532 m), 1♂, June 2006.

***Bracon* (*Glabrobracon*) *variator* var. *maculiger* (WESMAEL 1838)**

M a t e r i a l e x a m i n e d : Isfahan (1551 m), 1♀, August 2006.

Subfamily C a r d i o c h i l i n a e

***Cardiochiles saltator* (FABRICIUS 1781)**

M a t e r i a l e x a m i n e d : Aran-Bidgol (917 m), 1♀, July 2005.

Subfamily C h e l o n i n a e

***Ascogaster bicarinata* HERRICH-SCHÄFFER 1838**

M a t e r i a l e x a m i n e d : Khansar (2253 m), 1♀, April 2005.

***Chelonus carbonator* MARSHALL 1885**

M a t e r i a l e x a m i n e d : Kashan (894 m), 1♂, August 2007.

***Chelonus productus* HERRICH-SCHÄFFER 1838**

M a t e r i a l e x a m i n e d : Anarak (1432 m), 2♀♀, April 2006.

Subfamily E u p h o r i n a e

***Townesilitus bicolor* (WESMAEL 1835)**

M a t e r i a l e x a m i n e d : Ardestan (1240 m), 1♀, September 2005.

Subfamily E x o t h e c i n a e

***Cerophanes kerzhneri* TOBIAS 1971**

M a t e r i a l e x a m i n e d : Isfahan (1592 m), 1♂, July 2006.

***Rhysipolis decorator* (HALIDAY 1836)**

M a t e r i a l e x a m i n e d : Semirom (2457 m), 1♀, August 2008. **New record for Iran.**

***Rhysipolis similis* (SZÉPLIGETI 1896)**

M a t e r i a l e x a m i n e d : Isfahan (1592 m), 1♀, July 2006. **New record for Iran.**

Subfamily H o r m i i n a e

***Clinocentrus exsertor* (NEES 1811)**

M a t e r i a l e x a m i n e d : Fereydoon Shahr (2532 m), 3♀♀, 1♂, June 2006. Naeen (1544 m), 2♀♀, July 2008. Shahreza (1846 m), 2♀♀, 2♂♂, September 2008.

***Hormius moniliatus* (NEES 1811)**

M a t e r i a l e x a m i n e d : Aran-Bidgol (917 m), 1♀, July 2005.

***Hormius radialis* TELENGA 1941**

M a t e r i a l e x a m i n e d : Golpayegan (1827 m), 3♂♂, September 2005.

Subfamily M e t e o r i n a e

***Meteorus gyrator* (THUNBERG 1822)**

M a t e r i a l e x a m i n e d : Kashan (894 m), 1♂, August 2007.

Subfamily M i c r o g a s t r i n a e

***Apanteles carpatus* (SAY 1836)**

M a t e r i a l e x a m i n e d : Isfahan (1551 m), 2♀♀, August 2006.

***Cotesia ancilla* (NIXON 1974)**

M a t e r i a l e x a m i n e d : Aran-Bidgol (917 m), 1♂, July 2005.

***Cotesia plutellae* (KURDJUMOV 1912)**

M a t e r i a l e x a m i n e d : Naeen (1544 m), 3♀♀, July 2008.

***Deuterixys rimulosa* (NIEZABITOWSKI 1910)**

M a t e r i a l e x a m i n e d : Shahreza (1846 m), 3♂♂, September 2008.

***Dolichogenidea halidayi* (MARSHALL 1885)**

M a t e r i a l e x a m i n e d : Golpayegan (1827 m), 2♀♀, September 2005.

***Illidops naso* (MARSHALL 1885)**

M a t e r i a l e x a m i n e d : Khansar (2253 m), 1♀, April 2005.

***Microgaster globata* (LINNAEUS 1758)**

M a t e r i a l e x a m i n e d : Isfahan (1592 m), 1♀, July 2006. Mobarakeh (1682 m), 1♀, June 2008.

***Microplitis scrophulariae* SZÉPLIGETI 1898**

M a t e r i a l e x a m i n e d : Kashan (894 m), 1♀, August 2007.

***Microplitis spectabilis* (HALIDAY 1834)**

M a t e r i a l e x a m i n e d : Aran-Bidgol (917 m), 1♀, July 2005.

Subfamily M i r a c i n a e

***Mirax dryochares* MARSHALL 1898**

M a t e r i a l e x a m i n e d : Fereydoon Shahr (2532 m), 1♀, June 2006.

Subfamily O p i i n a e

***Opius* (*Nosopoea*) *ambiguus* WESMAEL 1835**

M a t e r i a l e x a m i n e d : Semirom (2457 m), 1♀, August 2008.

***Opius* (*Phaedrotoma*) *crassipes* WESMAEL 1835**

M a t e r i a l e x a m i n e d : Kashan (894 m), 1♂, August 2007.

***Opius* (*Opiothorax*) *levis* WESMAEL 1835**

M a t e r i a l e x a m i n e d : Anarak (1432 m), 2♀♀, April 2006. Bad Rood (1014 m), 1♀, October 2007.

***Opius* (*Misophthora*) *seductus* FISCHER 1959**

M a t e r i a l e x a m i n e d : Semirom (2457 m), 1♂, August 2008.

***Opius* (*Cryptognathopius*) *uttoisimilis* FISCHER 1999**

Material examined: Aran-Bidgol (917 m), 1♀, July 2005.

Subfamily Rogadinae

***Aleiodes* (*Aleiodes*) *bicolor* (SPINOLA 1808)**

Material examined: Naeen (1544 m), 1♀, July 2008.

***Aleiodes* (*Aleiodes*) *crassipes* (THOMSON 1891)**

Material examined: Isfahan (1551 m), 1♂, August 2006.

***Aleiodes* (*Aleiodes*) *pallescens* HELLÉN 1927**

Material examined: Bad Rood (1014 m), 1♂, October 2007. **New record for Iran.**

***Aleiodes* (*Chelonorhogas*) *ductor* (THUNBERG 1824)**

Material examined: Isfahan (1592 m), 1♂, July 2006.

***Aleiodes* (*Chelonorhogas*) *gasterator* (JURINE 1807)**

Material examined: Isfahan (1551 m), 1♂, August 2006. Kashan (894 m), 2♂♂, August 2007.

Discussion

Collecting of 49 braconid species as a partial faunistic survey in some regions indicates that there is a diverse fauna of this taxon in this area of Iran. This paper deals with only 12 subfamilies, while several other specimens from other subfamilies were collected from many un-sampled regions of Isfahan which identifying of them will show the real braconid diversity in Isfahan province. As we mentioned in introduction of this paper, braconids are powerful parasitoids with undeniable role in biological control. Biological control of insects is the use of natural enemies to reduce or maintain insect pest populations below an economic, action or aesthetic threshold (DEBACH & ROSEN 1991; BELLOWS & FISHER 1999). Two main terms in biological control system are conservation and augmentation. The goal of conservation biological control is to modify the environmental factor(s) that may limit the control effectiveness of natural enemies. In general, conservation of natural enemies involves reducing factors that interfere with natural enemies or providing resources that natural enemies need in their environment (RABB et al. 1976; BARBOSA 1998). Many factors can interfere with the ecological requirements of natural enemies and reduce their effectiveness as control agents. Pesticide applications may directly kill natural enemies or have indirect effects through reduction in the numbers or availability of hosts (CROFT 1990). Various cultural practices such as tillage or burning of crop debris can kill natural enemies or make the crop habitat unsuitable (GURR et al. 2000). In orchards, repeated cultivation for weed control may create dust deposits on leaves, killing small natural enemies and causing increases in

certain pests (DEBACH & ROSEN 1991). Finally, host plant effects such as chemical or physical defenses may reduce the effectiveness of natural enemies by altering their search efficiencies or life history characteristics (KOGAN et al. 1999). The goals and approaches of conservation biological control closely match those of IPM. In both, a fundamental understanding of the ecological mechanisms driving pest dynamics is key to success (HUFFAKER 1980). Conserving natural enemies often requires modification of production practices that are similar to changes in practices recommended by IPM principles (e.g. increase diversification of crops, reduction in pesticide use, etc.). The use of thresholds to make decisions, common to IPM systems, is closely tied to the impact of natural enemies whose density, composition and impact on pest dynamics (and damage) are dependent on the crop cultivation practices and environmental milieu. The interdependence of farming practices, pest dynamics and the impact of natural enemies often requires farmers to modify practices. As such, farmer education is key to success. Examples of farmer education span a number of extension approaches that include bulletins, field days, grower meetings, electronic media and farmer field schools. Two case studies illustrate the importance of farmer education in conservation biological control, as well as the opportunities to use this method in pest management in subsistence crops (MAREDIA et al. 2003).

Augmentation is the direct manipulation of natural enemy populations to increase their effectiveness as biological control agents (DEBACH & ROSEN 1991). In augmentation, natural enemies are typically reared in insectaries then released into the target environment where pest suppression is desired (RIDGWAY et al. 1998). There are two ways in which such periodic colonization is conducted; inundative and inoculative releases. In inoculative releases, the natural enemy is intended to establish and reproduce on the pest population with future generations of the natural enemy essential in achieving pest control. Alternatively, inundative releases involve the initial release of large numbers of a natural enemy such that the released population overwhelms the pest. In inundative releases reproduction and persistence of the natural enemy is not required. Genetic enhancement of natural enemies to improve their survival or effectiveness has also become an important component of some modern augmentation efforts (WHITTEN & HOY 1999). As with other methods of biological control, an understanding of the basic biology of the natural enemy is key to the effectiveness of any given program (WAJNBERG & HASSAN 1994). Also, genetic enhancement of natural enemies has proven to be an important key to success in several augmentation programs (WHITTEN & HOY 1999; MAREDIA et al. 2003). With attention to the mentioned above discussion about the biological control system, after faunistic survey of natural enemies in every area, we must try to find the host-parasitoid relationships. Finding these interactions will help us to conserve the efficient natural enemies of key pests and therefore suppressing the pest under the economic injury level.

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Buchbesprechung

RENTZ D.: **A Guide to the Katydids of Australia.** – CSIRO Publishing, Collingwood, 2010. 214 S.

Katydids oder Laubheuschrecken (Tettigoniidae) können bis zu 13cm groß werden, die kleinsten beginnen bei etwa 5mm. In Australien sieht man sie nahezu überall, von den höchsten Bergen bis zur Küste, auch auf ozeanischen Inseln. Von den 19 weltweit vorkommenden Unterfamilien sind 14 in Australien beheimatet, 5 Unterfamilien sind endemisch – insgesamt kommen über 1.000 Arten in Australien vor. Alle Gattungen der Unterfamilie Tettigoniinae sind in Australien endemisch.

Die Einführung informiert ausführlich über die Biologie der Laubheuschrecken, Lauterzeugung und Hören, wie man Laubheuschrecken fängt und studiert sowie über Habitate und Naturschutz. Im Bestimmungsteil werden die wesentlichen Arten der 14 Unterfamilien anhand von Farbfotos und weiteren Details zur Lebensweise vorgestellt. Für den Laien ist die Bestimmung sicher nicht einfach, eine Hilfe bietet der Einstieg über einen Bestimmungsschlüssel zu den Unterfamilien, der aber gute morphologische Kenntnisse verlangt.

Eine kompakte, sehr empfehlenswerte Einführung und Übersicht in die Welt der australischen Laubheuschrecken.

R. Gerstmeier

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