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**A faunistic study on Braconidae (Hymenoptera: Ichneumonoidea) from Ardebil and East Azarbayjan provinces, Northwestern Iran**

**Najmeh, Samin<sup>1</sup>; Ahmet, Beyarslan<sup>2</sup>; Avunjikkattu, Parambil Ranjith<sup>3</sup>; Zubair, Ahmad<sup>4</sup>; Hamid Sakenin, Chelav<sup>5</sup> and Seyed, Afshin Hosseini Boldaji<sup>6</sup>**

<sup>1</sup>Young Researchers and Elites Club, Science and Research Branch, Islamic Azad University, Tehran, Iran.

<sup>2</sup>Department of Biology, Faculty of Arts and Science, Trakya University, Edrine, Turkey.

<sup>3</sup>Insect Ecology and Ethology Laboratory, Department of Zoology, University of Calicut, Kerala, Pin: 673635, India.

<sup>4</sup>Research Center for Advanced Materials Science / Unit of Bee Research and Honey Production / Biology Department, Faculty of Sciences and Arts, King Khalid University.

<sup>5</sup>Department of Plant Protection, Qaemshahr Branch, Islamic Azad University, Qaemshahr, Iran.

<sup>6</sup>Department of Biology, Yadegar- e- Imam Khomeini (RAH) Shahre Rey Branch, Islamic Azad University, Tehran, Iran.

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**Abstract:**

This paper deals with the fauna of braconid wasps (Hymenoptera: Braconidae) in Ardebil and East Azarbayjan provinces (Northwestern Iran). In total, 29 species spread over in 12 subfamilies viz., Agathidinae (Two species and two genera), Alysiinae (Three species and three genera), Aphidiinae (One species), Brachistinae (One species), Braconinae (One species), Doryctinae (One species), Ichneutinae (Two species and two genera), Macrocentrinae (One species), Microgasterinae (12 species and six genera), Rogadinae (Four species and one genus), and Opiinae (One species) were collected and identified. Thirteen species are newly recorded from the fauna of Iran. Data of reared species with host records are also provided.

**Introduction**

Braconid wasps (Hymenoptera, Braconidae) is a diverse group of parasitoids with a worldwide distribution (Wahl and Sharkey, 1993) which have an important role in biological control programs of many crop pests (Matthews, 1974 and Shaw, 1995). Most of the species are primary parasites, especially of larval instars of Coleoptera, Diptera and Lepidoptera. Other hosts include nymphs and adults of Hemiptera, Orthoptera, Psocoptera, adults of aculeate Hymenoptera, and

larvae of Symphyta (Tobias, 1967; Shaw and Huddleston, 1991; Wharton, 1993 and Whitfield and Wharton, 1997). Braconids are speciose with 21,223 described species belonging to 1071 genera, which represent nearly 20% of the total hymenopteran diversity worldwide (Yu *et al.*, 2016).

Faunistic knowledge of the family Braconidae in of Iran is largely incomplete due to the lack of regional studies and taxonomic complexity of this group in comparison with well-studied other western Palearctic

countries. Despite this lack, the fauna of Iranian Braconidae has been studied rather well (e.g., Gadallah and Ghahari, 2013a, 2013b, 2015, 2016, 2017; Barahoei *et al.*, 2014; Gadallah *et al.*, 2015a, 2015b, 2016a, 2016b; Farahani *et al.* 2016; Ghahari 2016; Beyarslan *et al.*, 2017; Samin *et al.* 2018a, b; Gadallah and Ghahari, 2019 and Gadallah *et al.*, 2019), but since Iran is a large country comprises with various agro-ecosystems, several new species are likely to be discovered in future. More than eight hundred species spread over to 151 genera of 28 subfamilies of Braconidae are recognized in Iran (Samin *et al.*, 2018a, b and Yu *et al.*, 2016).

The purpose of this paper is to record the species of Braconidae of the Ardebil and East Azarbayjan provinces as part of ongoing faunistic studies of

Braconidae in Iran. In the present study, totally 29 braconid species were collected, of which 13 species are recorded for the first time from Iran.

#### Materials and methods

The materials of the present study were collected during 2011-2017 by Malaise traps and sweeping net from different regions of Ardebil and East Azarbayjan provinces (Northwestern Iran) (Figure, 1). Some specimens were reared in optimum conditions at laboratory condition or incubator ( $26\pm 3$  °C;  $60\pm 10$  RH and 14: 10 L: D). Here we follow Yu *et al.* (2016) for nomenclature, classification and distributional data. For the following subfamilies, Microgastrinae and Rogadinae we followed the classification of Fernandez-Triana *et al.* (2020) and van Achterberg and Shaw (2016) respectively.



Figure (1): Map of Iran with boundaries of provinces.

#### Results and discussion

Totally, 29 species within 12 subfamilies Agathidinae, Alysiinae, Aphidiinae, Brachistinae, Braconinae,

Doryctinae, Ichneutinae, Macrocentrinae, Microgasterinae, Rogadinae and Opiinae were collected and identified from some regions of

Ardebil and East Azarbaijan provinces. Thirteen species are new records for Iran: *Aleiodes cruentus* (Nees, 1834), *Aleiodes praetor* (Reinhard, 1863), *Atanycolus initiator* (Fabricius, 1793), *Dolichogenidea gagates* (Nees, 1834), *Dolichogenidea ultor* (Reinhard, 1880), *Glyptapanteles inclusus* Ratzeburg, 1844, *Microgaster hospes* Marshall, 1885, *Microplitis tuberculatus* (Bouché, 1834), *Pachysema discolor* (Förster, 1863), *Phaenolexis senilis* (Nees, 1812), *Praon longicorne* Marshall, 1896, *Proterops nigripennis* Wesmael, 1835, and *Psytalia carinata* (Thomson, 1895). The list of species is given below alphabetically under each subfamily.

### 1. Subfamily Agathidinae Haliday, 1833

#### 1.1. *Cremonops dessertor* Linnaeus, 1758

**Material examined:** East Azarbayjan province, Azarshahr, 3♀♀, ex *Cydia pomonella* (Linnaeus, 1758) (Lepidoptera Tortricidae), 8.viii.2014.

**General distribution:** Armenia, Austria, Azerbaijan, Belgium, Bulgaria, Canada, China, Croatia, former Czechoslovakia, Finland, France, Germany, Hungary, India, Indonesia, Iran, Italy, Japan, Korea, Latvia, Lithuania, Malaysia, Moldova, Myanmar, Nepal, Netherlands, Norway, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Thailand, Turkey, United States of America, Ukraine, United Kingdom, Vietnam, and former Yugoslavia.

#### 1.2. *Earinus elator* (Fabricius, 1804)

**Material examined:** East Azarbayjan province, Horand, 3♀♀, ex *Caloptilia rufipennella* (Hübner, 1796) (Lepidoptera: Gracillariidae), 24.viii.2016.

**General distribution:** Austria, Azerbaijan, Belgium, Croatia, former

Czechoslovakia, Finland, France, Germany, Hungary, Ireland, Italy, Japan, Korea, Latvia, Lithuania, Moldova, Netherlands, Norway, Poland, Russia, Serbia, Slovakia, Sweden, Switzerland, Turkey, United Kingdom, and former Yugoslavia.

### 2. Subfamily Alysiinae Leach, 1815

#### 2.1. *Dacnusa adducta* (Haliday, 1839)

**Material examined:** Ardebil province, Namin, 1♀, 17.vi.2015.

**General distribution:** Austria, Azerbaijan, Bulgaria, former Czechoslovakia, Denmark, Germany, Hungary, Ireland, Italy, Korea, Poland, Russia, Serbia, Spain, Sweden, Switzerland, Ukraine, United Kingdom, and former Yugoslavia.

#### 2.2. *Pachysema discolor* (Förster, 1863)

**Material examined:** Ardebil province, Aslanduz, 3♀♀, 2♂♂, ex *Phytomyza plantaginis* Goureau, 1851 (Diptera: Agromyzidae), 14.vi.2015.

**General distribution:** Austria, Azerbaijan, former Czechoslovakia, Denmark, Germany, Ireland, Italy, Norway, Poland, Russia, Serbia, Spain, Sweden, Switzerland, United Kingdom, and former Yugoslavia.

**Notes:** This species is newly reported from Iran.

#### 2.3. *Phaenolexis senilis* (Nees, 1812)

**Material examined:** East Azarbayjan province, Absh-Ahmad, 2♂♂, 21.v.2016.

**General distribution:** Austria, Azerbaijan, Belgium, Faeroe Islands, Finland, France, Germany, Hungary, Ireland, Italy, Netherlands, Poland, Russia, Serbia, Spain, Sweden, Switzerland, Ukraine, United Kingdom, and former Yugoslavia.

**Notes:** This species is newly reported from Iran.

**3. Subfamily Aphidiinae Haliday, 1833**

**3.1. *Praon longicorne* Marshall, 1896**

**Material examined:** Ardebil province, Meshginshahr, 3♀♀, ex *Macrosiphum euphorbiae* (Thomas) (Hemiptera: Aphididae) on *Euphorbia pulcherrima* (Euphorbiaceae), 17.vii.2013.

**General distribution:** Bulgaria, Czech Republic, Finland, France, Germany, Hungary, India, Italy, Moldova, Montenegro, Netherlands, Poland, Russia, Serbia, Slovakia, Spain, Tajikistan, Turkey, and United Kingdom.

**Notes:** This species is newly reported from Iran.

**4. Subfamily Brachistinae Förster, 1863**

**4.1. *Blacus (Ganychorus) tripudians* Haliday, 1835**

**Material examined:** Ardebil province, Germe, 1♀, 1♂, 18.vi.2015.

**General distribution:** Austria, Azerbaijan, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, France, Georgia, Germany, Greece, Hungary, Ireland, Netherlands, Poland, Romania, Serbia, Sweden, Switzerland, Tunisia, United Kingdom, and former Yugoslavia.

**5. Subfamily Braconinae Nees, 1811**

**5.1. *Atanycolus initiator* (Fabricius, 1793)**

**Material examined:** Ardebil province, Germe, 3♀♀, 1♂, ex *Chrysobothris affinis* (Fabricius, 1794) (Coleoptera: Buprestidae), 18.vi.2015.

**General distribution:** Austria, Azerbaijan, Belgium, China, Croatia, Czech Republic, former Czechoslovakia, Finland, France, Germany, Hungary, Italy, Japan, Latvia, Lithuania, Mongolia, Norway, Poland, Russia, Slovakia, Spain, Sweden, Switzerland, Turkey, Turkmenistan, Ukraine, and United Kingdom.

**Notes:** This species is newly reported from Iran.

**6. Subfamily Doryctinae Foerster, 1863**

**6.1. *Spathius exarator* Chao, 1978**

**Material examined:** East Azarbayjan province, Kaleybar, 4♀♀, ex. *Ips typographus* (Linnaeus, 1758) (Coleoptera: Curculionidae), 11.viii.2014.

**General distribution:** Armenia, Azerbaijan, Belgium, Bulgaria, Czech Republic, China, Croatia, former Czechoslovakia, Finland, France, Germany, Greece, Greenland, Hungary, Italy, Japan, Korea, Latvia, Lithuania, Moldova, Mongolia, Netherlands, New Zealand, Norway, Poland, Romania, Russia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, and former Yugoslavia.

**7. Subfamily Ichneutinae Förster, 1863**

**7.1. *Ichneutes brevis* Wesmael, 1835**

**Material examined:** Ardebil province, Germe, 2♀♀, ex *Nematus fagi* Zaddach, 1876 (Hymenoptera: Tenthredinidae), 19.vi.2015.

**General distribution:** Austria, Belgium, Czechoslovakia, Finland, France, Germany, Hungary, Ireland, Italy, Kazakhstan, Korea, Mongolia, Poland, Russia, Switzerland, and United Kingdom.

**7.2. *Proterops nigripennis* Wesmael, 1835**

**Material examined:** Semnan province, Shahrud (Jangal-e Abr), 3♀♀, July 2011, ex *Arge ochropus* (Gmelin in Linnaeus, 1790) (Hymenoptera: Argidae).

**General distribution:** Austria, Azerbaijan, Belgium, China, Czech Republic, Denmark, Finland, France, Georgia, Germany, Hungary, Ireland, Italy, Japan, Kazakhstan, Korea, Mongolia, Netherlands, Norway,

Poland, Russia, Sweden, Switzerland, and United Kingdom.

**Notes:** This species is newly reported from Iran.

## 8. Subfamily Macrocentrinae Förster, 1863

### 8.1. *Macrocentrus infirmus* (Nees, 1834)

**Material examined:** East Azarbayjan province, Absh-Ahmad, 3♀♀, ex *Zeuzera pyrina* (Linnaeus, 1761) (Lepidoptera: Cossidae), 21.v.2016.

**General distribution:** Austria, Belarus, Belgium, Bulgaria, China, Croatia, former Czechoslovakia, Faeroe Islands, Finland, France, Germany, Hungary, Ireland, Italy, Kazakhstan, Korea, Lithuania, Moldova, Mongolia, Netherlands, Norway, Poland, Romania, Russia, Sweden, Switzerland, United Kingdom, and former Yugoslavia.

## 9. Subfamily Microgastrinae Foerster, 1862

### 9.1. *Cotesia affinis* (Nees, 1834)

**Material examined:** East Azarbayjan province, Azarshahr, 1♀, 8.viii.2014.

**General distribution:** Armenia, Austria, Cape Verde Islands, China, former Czechoslovakia, France, Germany, Hungary, Italy, Japan, Kazakhstan, Korea, Latvia, Poland, Romania, Russia, Slovakia, Spain, Sweden, Switzerland, Ukraine, and United Kingdom.

### 9.2. *Dolichogenidea ensiformis* (Ratzeburg, 1844)

**Material examined:** East Azarbayjan province, Azarshahr, 2♀♀, ex *Plutella xylostella* (Linnaeus, 1758) (Lepidoptera: Plutellidae), 8.viii.2014.

**General distribution:** Germany, Hungary, Italy, Latvia, Mongolia, Poland, Romania, Russia, Slovakia, Spain, and Tunisia.

### 9.3. *Dolichogenidea gagates* (Nees, 1834)

**Material examined:** Guilan province, Talesh, 2♀♀, August 2014, ex *Pandemis corylana* (Fabricius, 1794) (Lepidoptera: Tortricidae).

**General distribution:** Austria, Belgium, Bulgaria, Estonia, Finland, France, Georgia, Germany, Hungary, Italy, Latvia, Lithuania, Poland, Romania, Russia, Spain, Sweden, Switzerland, and United Kingdom.

**Notes:** This species is newly reported from Iran.

### 9.4. *Dolichogenidea praetor* (Marshall, 1885)

**Material examined:** Ardebil province, Aslanduz, 2♂♂, 13.vi.2015.

**General distribution:** Armenia, Finland, France, Hungary, Mongolia, Romania, Russia, Slovakia, Sweden, Switzerland, and United Kingdom.

### 9.5. *Dolichogenidea ultor* (Reinhard, 1880)

**Material examined:** East Azarbayjan province, Kaleybar, 2♀♀, 11.viii.2014, ex *Malacosoma neustria* (Linnaeus, 1758) (Lepidoptera: Lasiocampidae).

**General distribution:** Azerbaijan, Czech Republic, Georgia, Germany, Hungary, Italy, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Switzerland, Ukraine, and United Kingdom.

**Notes:** This species is newly reported from Iran.

### 9.6. *Glyptapanteles inclusus* Ratzeburg, 1844

**Material examined:** Ardebil province, Meshginshahr, 3♀♀, ex *Euproctis Euproctis chrysorrhoea* (Linnaeus, 1758) (Lepidoptera: Erebiidae), 17.vii.2013.

**General distribution:** Austria, Azerbaijan, Bulgaria, Cape Verde Islands, China, former Czechoslovakia, Denmark, France, Germany, Ireland,

Italy, Japan, Kazakhstan, Korea, Mongolia, Poland, Romania, Russia, Slovakia, Switzerland, Ukraine, and United Kingdom.

**Notes:** This species is newly reported from Iran.

**9.7. *Microgaster hospes* Marshall, 1885**

**Material examined:** East Azarbayjan province, Bostan-Abad, 2♀♀, ex *Archips rosana* (Linnaeus, 1758) (Lepidoptera: Tortricidae), 10.viii.2014.

**General distribution:** Bulgaria, Canada, Czech Republic, Finland, Georgia, Germany, Hungary, Ireland, Italy, Lithuania, Moldova, Mongolia, Netherlands, Poland, Romania, Russia, Slovakia, Switzerland, United Kingdom, United States of America, and Uzbekistan.

**Notes:** This species is newly reported from Iran.

**9.8. *Microgaster luctuosa* Haliday, 1834**

**Material examined:** East Azarbayjan province, Absh-Ahmad, 2♀♀, 21.v.2016.

**General distribution:** Austria, Azerbaijan, Bulgaria, Croatia, Finland, Germany, Greece, Hungary, Ireland, Israel, Moldova, Mongolia, Poland, Romania, Russia, Serbia, Sweden, Switzerland, Tunisia, Turkey, Turkmenistan, United Kingdom, and Uzbekistan.

**9.9. *Microgaster rufipes* Nees, 1834**

**Material examined:** Ardebil province, Aslanduz, 1♀, 14.vi.2015.

**General distribution:** Albania, Armenia, Austria, Azerbaijan, Belgium, Bulgaria, Canary, Islands, China, Croatia, Czech Republic, Finland, France, Georgia, Germany, Greece, Hungary, Iran, Ireland, Italy, Japan, Kazakhstan, Korea, Latvia, Lithuania, Moldova, Mongolia,

Montenegro, Netherlands, Norway, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Turkmenistan, Ukraine, and United Kingdom.,

**9.10. *Microplitis stigmaticus* (Ratzeburg, 1844)**

**Material examined:** Ardebil province, Germe, 2♀♀, 1♂, *Yponomeuta padella* (Linnaeus, 1758) (Lepidoptera: Yponomeutidae), 18.vi.2015.

**General distribution:** Armenia, Azerbaijan, Finland, Germany, Italy, Kazakhstan, Latvia, Poland, Romania, Russia, Serbia, Turkmenistan, Ukraine, and Uzbekistan.

**9.11. *Microplitis tuberculatus* (Bouché, 1834)**

**Material examined:** Ardebil province, Bilehsavar, 3♀♀, ex. *Euproctis chrysorrhoea* (Linnaeus, 1758) (Lepidoptera: Noctuoidea), 3.vii.2017.

**General distribution:** Armenia, Azerbaijan, Finland, Georgia, Germany, Hungary, Ireland, Israel, Italy, Moldova, Mongolia, Poland, Romania, Russia, Slovakia, Sweden, Switzerland, Ukraine, and United Kingdom.

**Notes:** This species is newly reported from Iran.

**9.12. *Microplitis varipes* (Ruthe, 1860)**

**Material examined:** East Azarbayjan province, Maragheh, 2♀♀, 1♂, ex *Noctua pronuba* (Linnaeus, 1758) (Lepidoptera: Noctuidae), 38.viii.2016.

**General distribution:** Austria, Azerbaijan, China, Finland, Georgia, Germany, Hungary, Italy, Kazakhstan, Malta, Moldova, Mongolia, Montenegro, Netherlands, Poland, Russia, Serbia, Slovakia, Switzerland, Turkey, and Ukraine.

**10. Subfamily Rogadinae Foerster, 1863**

**10.1. *Aleiodes compressor* (Herrich-Schäffer, 1838)**

**Material examined:** East Azarbayjan province, Kaleybar, 2♀♀, ex *Archips rosana* (Linnaeus, 1758) (Lepidoptera: Tortricidae), 11.viii.2014.

**General distribution:** Austria, Belgium, Bulgaria, China, Croatia, Czech Republic, former Czechoslovakia, Finland, France, Georgia, Germany, Hungary, Kazakhstan, Korea, Lithuania, Netherlands, Norway, Poland, Russia, Slovakia, Serbia, Spain, Sweden, Switzerland, United Kingdom, and former Yugoslavia.

**10.2. *Aleiodes cruentus* (Nees, 1834)**

**Material examined:** East Azarbayjan province, Horand, 2♀♀, 2♂♂, 24.viii.2016.

**General distribution:** Azerbaijan, Bulgaria, China, Croatia, Czech Republic, former Czechoslovakia, Finland, France, Georgia, Germany, Hungary, Italy, Latvia, Lithuania, Mongolia, Norway, Poland, Russia, Slovakia, Spain, Sweden, Switzerland, Ukraine, United Kingdom, and former Yugoslavia,

**Notes:** This species is newly reported from Iran.

**10.3. *Aleiodes miniatus* (Herrich-Schäffer, 1838)**

**Material examined:** Ardebil province, Aslanduz, 1♀, 14.vi.2015.

**General distribution:** Austria, Czech Republic, former Czechoslovakia, Finland, Germany, Hungary, Italy, Kazakhstan, Lithuania, Mongolia, Poland, Russia, Slovakia, Sweden, Syria, and Turkey.

**10.4. *Aleiodes praetor* (Reinhard, 1863)**

**Material examined:** Ardebil province, Tazeh Kandi, 2♀♀, ex *Euproctis similis* (Füssli, 1775) (Lepidoptera: Erebidae), 19.vi.2015.

**General distribution:** Austria, Belgium, Bulgaria, China, Croatia, Finland, France, Germany, Hungary, Italy, Japan, Korea, Netherlands, Norway, Romania, Russia, Serbia, Spain, Sweden, Switzerland, Turkey, United Kingdom, and former Yugoslavia.

**Notes:** This species is newly reported from Iran.

**11. Subfamily Opiinae Blanchard, 1845**

**11.1. *Psytalia carinata* (Thomson, 1895)**

**Material examined:** Ardebil province, Meshginshahr, 2♀♀, 1♂, ex *Rhagoletis cerasi* (Linnaeus, 1758), 17.vii.2013.

**General distribution:** Armenia, Austria, Bulgaria, former Czechoslovakia, Finland, France, Germany, Hungary, Italy, Kazakhstan, Kyrgyzstan, Lithuania, Malta, Moldova, Poland, Sweden, Switzerland, Uzbekistan, and former Yugoslavia.

**Notes:** This species is newly reported from Iran.

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