



New records of Aphelinidae from Iran, and updated checklist of Iranian Aphelinidae, Azotidae and Eriaporidae (Hymenoptera: Chalcidoidea)

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ARTICLE INFO

Article History

Received: 24/1 / 2019

Accepted: 13 /3/2019

Keywords

Aphelinidae, distribution, parasitoids, new records, fauna, and Iran.

Abstract:

This paper deals with the faunistic data for 13 species of Aphelinidae (Hymenoptera) within nine genera, *Aphelinus* Dalman, 1820, *Aphytis* Howard, 1900, *Cales* Howard, 1907, *Centrodora* Förster, 1878, *Coccophagus* Westwood, 1833, *Encarsia* Förster, 1878, *Marietta* Motschulsky, 1863, *Proaphelinoides* Girault, 1917 and *Pteroptrix* Westwood, 1833.

Introduction

Aphelinid wasps (Hymenoptera: Chalcidoidea: Aphelinidae) are tiny parasitic wasps, with about 1,168 described species in about 33 genera (Noyes, 2018). These wasps are very unusual in that the males and females may have different ontogenies. The females of such species always develop as primary endoparasitoids of hemipterans hosts (usually Coccoidea), whilst the males have host relationships that differ from those of conspecific females - they may be primary ectoparasitoids of Hemiptera, hyperparasitoids of other chalcidoid larvae or pupae within their hemipterans hosts, or primary endoparasitoids of lepidopteran eggs (Viggiani, 1984 and Woolley, 1997). Aphelinid wasps are one of the most

important biocontrol agents and decrease significantly the population densities of several agricultural and forest pests. Even some species have been successfully used in classical biocontrol programs (Myartseva *et al.*, 2013).

The fauna of Iranian Aphelinidae was studied rather well, which totally 138 species within 13 genera [*Ablerus* (11), *Aphelinus* (14), *Aphytis* (11), *Centrodora* (0), *Coccobius* (16), *Coccophagoides* (1), *Coccophagus* (11), *Encarsia* (48), *Eretmocerus* (18), *Euryischia* (*Euryischia* sp.), *Marietta* (3), *Myiocnema* (1), *Pteroptrix* (4)] have been listed by Abd-Rabou *et al.* (2013). Of course, now the genus *Ablerus* is classified under the family Azotidae Nikolskaya and Yasnov, 1966

and the genera *Euryischia* and *Myiocnema* in Eriaporidae (Noyes, 2018), now with a total of 126 known species within 10 genera. Fifty-eight species of Aphelinidae are recorded to Iran in Noyes (2018), including seven species not registered in Abd-Rabou *et al.* (2013). The purpose of this paper is to introducing of 13 aphelinids as new records for the fauna of Iran.

Material and methods

The material of the present faunistic survey were obtained through the rearing of their hosts, Aleyrodidae, Aphididae, Coccidae, Diaspididae (Hemiptera) and Tettigoniidae (Orthoptera) in optimum conditions (25±1 °C, 60±5% RH, 14:10 L: D) in an incubator for emergence of parasitoids. The collected specimens were put in 75% ethanol after emergence and were examined by a stereoscopic binocular microscope. In this paper, classification, nomenclature and distributional data were taken from Noyes (2018).

Results and discussion

In this investigation, totally 13 species of Aphelinidae (Hymenoptera) within nine genera are represented as new records for the fauna of Iran: *Aphelinus* (one species), *Aphytis* (three spp.), *Cales* (one sp.), *Centrodora* (one sp.), *Coccophagus* (one sp.), *Encarsia* (two spp.), *Marietta* (one sp.), *Proaphelinoides* (one sp.) and *Pteroptrix* (two spp.). Additionally, two genera, *Cales* and *Proaphelinoides* are new country records too.

Family Aphelinidae Thomson, 1876

Genus *Aphelinus* Dalman, 1820

Aphelinus annulipes (Walker, 1851)

Material examined: Ardabil province, Germe (Damirchi), 3♀♀, September 2010, ex *Saltusaphis scirpus* (Theobald, 1915) (Hemiptera: Aphididae).

General distribution: Czech Republic, France, Germany, Hungary, Netherlands, Russia, Slovakia, Sweden, Ukraine and United Kingdom.

Genus *Aphytis* Howard, 1900

Aphytis abnormis (Howard, 1881)

Material examined: West Azarbaijan province: Khoy (Bilehvar), 4♀♀, 1♂, May 2012, ex *Lepidosaphes ulmi* (Linnaeus, 1758) (Hemiptera: Diaspididae).

General distribution: France, Greece, Hungary, Spain, Turkey and United States of America.

Aphytis holoxanthus DeBach, 1960

Material examined: Zanjan province, Tarom (Gilvan), 2♀♀, 1♂, August 2014, ex *Lepidosaphes beckii* (Newman, 1869) (Hemiptera: Diaspididae).

General distribution: Argentina, Australia, Brazil, Caribbean, China, Cuba, Cyprus, Dominican, El Salvador, Hong Kong, India, Israel, Lebanon, Mexico, Peru, South Africa, Taiwan, Trinidad and Tobago and United States of America.

Aphytis neuter Yasnosh and Myartseva, 1971

Material examined: North Khorasan province: Bojnord (Emamdarreh), 2♀♀, May 2011, ex *Quadraspidiotus perniciosus* (Comstock, 1881) (Hemiptera: Diaspididae).

General distribution: Tadjikistan, Turkey, Turkmenistan, former USSR¹ and Uzbekistan.

Genus *Cales* Howard, 1907

Cales noacki Howard, 1907

Material examined: Mazandaran province, Savadkooch (Shirgah), 2♀♀, 16.vii.2013, ex *Parabemisia myricae* (Kuwana) (Hemiptera: Aleyrodidae).

General distribution: Argentina, Azores, Brazil, Canary Islands, Chile, El Salvador, France, Greece, Haiti, Israel, Italy, Madeira, Malta, Mexico, Morocco, Peru, Reunion, Spain, Tunisia, Turkey, United States of America and Uruguay.

Genus *Centrodora* Förster, 1878

Centrodora amoena Förster, 1878

1- Union of Soviet Socialist Republics: Extending across the entirety of Northern Asia and much of Eastern Europe. The Soviet Union had spanned eleven time zones and incorporated a wide range of environments and landforms. Counter-clockwise from northwest to southeast, the Soviet Union shared land borders with Norway, Finland, Poland, Czechoslovakia, Hungary, Romania, Turkey, Iran, Afghanistan, China, Mongolia, and North Korea.

Material examined: Kordestan province, Saqez (Kakeh Siab), 1♀, 1♂, June 2011, ex *Conocephalus* sp. nr. *fuscus* (Fabricius, 1793) (Orthoptera: Tettigoniidae).

General distribution: Azerbaijan, Czech Republic, Georgia, Germany, Hungary, Russia, Slovakia, Spain, Sweden, Ukraine and United Kingdom.

Genus *Coccophagus* Westwood, 1833

***Coccophagus pulchellus* Westwood, 1833**

Material examined: East Azarbaijan province, Horand (Avalan), 2♀♀, September 2013, ex *Eulecanium tiliae* (Linnaeus, 1758) (Hemiptera: Coccidae).

General distribution: Czech Republic, France, Germany, Greece, Hungary, Italy, Montenegro, Poland, Serbia, Spain and United Kingdom.

Genus *Encarsia* Förster, 1878

***Encarsia diaspidicola* (Silvestri, 1909)**

Material examined: Golestan province, Gorgan (Naharkhoran Park), 3♀♀, 1♂, August 2012, ex *Quadraspidotus perniciosus* (Comstock) (Hemiptera: Diaspididae) on *Populus* sp. (Salicaceae).

General distribution: Bermuda, Brazil, Haiti, India, Italy, Japan, Puerto Rico, Reunion, South Africa, United States of America, former USSR and Western Samoa.

***Encarsia intermedia* (Ferriere, 1961)**

Material examined: Ardabil province, Pars-Abad (Aslanduz), 3♀♀, July 2015, ex *Leucaspis pusilla* Löw (Hemiptera: Diaspididae).

General distribution: Caucasus¹, France, Germany, Sweden, Switzerland and Transcaucasus.

Genus *Marietta* Motschulsky, 1863

***Marietta carnesi* (Howard, 1910)**

Material examined: Qazvin province, Alamut (Juladeh), 2♀♀, 1♂, June 2012, ex *Parlatoria pergandii* Comstock, 1881 (Hemiptera: Diaspididae).

General distribution: Australia, China, Egypt, Hawaii, India, Italy, Japan,

Mauritius, Micronesia, New Caledonia, Russia, South Korea, Spain, United States of America and former USSR.

Genus *Proaphelinoides* Girault, 1917

***Proaphelinoides elongatiformis* Girault, 1917**

Material examined: Mazandaran province, Ramsar (Sarlimak), 2♀♀, 2♂♂, September 2013, ex *Odonaspis secreta* (Cockerell, 1896) (Hemiptera: Diaspididae).

General distribution: Caucasus, China, Georgia, Guam, Japan, Sri Lanka, Transcaucasus and former USSR.

Genus *Pteroptrix* Westwood, 1833

***Pteroptrix maritima* Nikols'kaya, 1952**

Material examined: Kurdistan province: Kamyaran (Qaleh-Kumaein), 3♀♀, July 2007, ex *Lepidosaphes ulmi* (Linnaeus, 1758) (Hemiptera: Diaspididae).

General distribution: Armenia, Caucasus, Hungary, Italy, Russia, Ukraine and former USSR.

***Pteroptrix smithi* (Compere, 1953)**

Material examined: North Khorasan province: Bojnord (Aladagh), 4♀♀, 2♂♂, April 2009, ex *Aonidiella aurantii* (Maskell, 1879) (Hemiptera: Diaspididae).

General distribution: China, Egypt, Israel, Italy, Mexico, Philippines, Taiwan and United States of America.

Now, with the 13 new country records, 141 species of Aphelinidae within 12 genera, 11 species of Azotidae and two species of Eriaporidae are known from Iran. Among the different genera, *Encarsia* with 50 recorded species is the most diverse. The list of Iranian Aphelinidae, Azotidae and Eriaporidae is given on the basis of Abd-Rabou *et al.* (2013), with the new records represented with (*) and the species listed in Noyes (2018) by (○) and the records not included in Abd-Rabou *et al.* (2013) by (●).

List of Iranian Aphelinidae, Azotidae and Eriaporidae

I. Genus *Aphelinus* Dalman, 1820

- 1) *Aphelinus abdominalis* (Dalman, 1820)
- 2) *Aphelinus albipodus* Hayat & Fatima, 1992
- 3) *Aphelinus annulipes* (Walker, 1851)*
- 4) *Aphelinus argiope* Walker, 1839
- 5) *Aphelinus asychis* (Walker, 1839) ○
- 6) *Aphelinus desantisi* Hayat, 1972

1- Caucasus: A region located at the border of Europe and Asia, between Black Sea and Caspian Sea, includes also portions of northwestern Iran and northeastern Turkey.

- 7) *Aphelinus flaviventris* Kurdjumov, 1913
 8) *Aphelinus gossypii* Timberlake, 1924
 9) *Aphelinus humilis* Mercet, 1927
 10) *Aphelinus maidis* Timberlake, 1924
 11) *Aphelinus mali* Haldeman, 1851
 12) *Aphelinus paramali* Zehavi & Rosen, 1989 ○
 13) *Aphelinus perpallidus* (Gahan, 1924)
 14) *Aphelinus semiflavus* Howard, 1908 ○
 15) *Aphelinus varipes* (Förster, 1841)
II. Genus *Aphytis* Howard, 1900
 16) *Aphytis abnormis* (Howard, 1881) *
 17) *Aphytis africanus* Quednau, 1964
 18) *Aphytis aonidiae* (Mercet, 1911) ○
 19) *Aphytis chrysomphali* (Mercet, 1912) ○
 20) *Aphytis diaspidis* (Howard, 1881) ●
 21) *Aphytis hispanicus* (Mercet, 1912)
 22) *Aphytis holoxanthus* DeBach, 1960*
 23) *Aphytis lepidosaphes* Compere, 1955
 24) *Aphytis libanicus* Traboulsi, 1969 ○
 25) *Aphytis lingnanensis* Compere, 1955
 26) *Aphytis maculicornis* (Masi, 1911) ○
 27) *Aphytis melinus* DeBach, 1959
 28) *Aphytis mytilaspidis* (Le Baron, 1870) ○
 29) *Aphytis neuter* Yasnosh and Myartseva, 1971*
 30) *Aphytis paramaculicornis* DeBach & Rosen, 1976●
 31) *Aphytis proclia* (Walker, 1839) ○
III. Genus *Cales* Howard, 1907*
 32) *Cales noacki* Howard, 1907*
IV. Genus *Centrodora* Förster, 1878
 33) *Centrodora amoena*, Förster, 1878*
V. Genus *Coccobius* Ratzeburg, 1852
 34) *Coccobius annulicornis* (Ratzeburg, 1852) ○
 35) *Coccobius contigaspidis* (Yasnosh, 1968)
 36) *Coccobius danzigae* (Yasnosh, 1977)
 37) *Coccobius diaspidis* (Howard, 1907)
 38) *Coccobius flaviceps* (Girault & Dodd, 1915)
 39) *Coccobius flaviventris* (Howard, 1910)
 40) *Coccobius fulvus* (Compere & Annecke, 1961)
 41) *Coccobius fusciventris* (Girault, 1913)
 42) *Coccobius indefinitus* (Yasnosh & Myartseva, 1972)
 43) *Coccobius mesasiaticus* (Yasnosh & Myartseva, 1971) ●
 44) *Coccobius multicolor* (Girault, 1915)
 45) *Coccobius nigriceps* (Girault, 1913)
 46) *Coccobius pullus* Prinsloo, 1995
 47) *Coccobius reticulatus* (Compere & Annecke, 1961)
 48) *Coccobius testaceus* Masi, 1909
 49) *Coccobius viggianii* (Yasnosh, 1974)
 50) *Coccobius varicornis* (Howard, 1881)
VI. Genus *Coccophagoides* Girault, 1915
 51) *Coccophagoides similis* (Masi, 1908)
VII. Genus *Coccophagus* Westwood, 1833
 52) *Coccophagus bivittatus* Compere, 1931
 53) *Coccophagus ceroplastae* (Howard, 1895)
 54) *Coccophagus cowperi* Girault, 1917
 55) *Coccophagus differens* Yasnosh, 1966
 56) *Coccophagus lutescens* Compère, 1931
 57) *Coccophagus lycimnia* (Walker, 1839)
 58) *Coccophagus proximus* Yasnosh, 1966
 59) *Coccophagus pseudococci* Compere, 1933
 60) *Coccophagus pulchellus* Westwood, 1833*
 61) *Coccophagus rusti* Compère, 1928
 62) *Coccophagus scutellaris* (Dalman, 1825) ○
 63) *Coccophagus semicircularis* (Förster, 1841) ●
 64) *Coccophagus silvestrii* Compere, 1931
VIII. Genus *Encarsia* Förster, 1878
 65) *Encarsia acaudaleyrodis* Hayat, 1976 ○
 66) *Encarsia alemansoori* Rasekh & Polaszek, 2010 ○
 67) *Encarsia aleurochitonis* (Mercet, 1931)
 68) *Encarsia aurantii* (Howard, 1894) ○
 69) *Encarsia axacaliae* Abd-Rabou & Ghahari, 2007 ○
 70) *Encarsia azimi* Hayat, 1980 ○
 71) *Encarsia bennetti* Hayat, 1984
 72) *Encarsia berleseii* (Howard, 1906) ○
 73) *Encarsia bimaculata* Heraty & Polaszek, 2000
 74) *Encarsia brimblecombei* (Girault, 1933) ●
 75) *Encarsia cibcensis* Lopez Avila, 1987 ○
 76) *Encarsia citrina* (Craw, 1891) ○
 77) *Encarsia clypealis* (Silvestri, 1928)
 78) *Encarsia dialeurodis* Hayat, 1989
 79) *Encarsia dialeuroporae* Viggiani, 1985
 80) *Encarsia diaspidicola* (Silvestri, 1909)*
 81) *Encarsia elegans* Masi, 1911 ○
 82) *Encarsia elongata* (Dozier, 1937)
 83) *Encarsia fasciata* (Malenotti, 1917) ○
 84) *Encarsia formosa* Gahan, 1924 ○
 85) *Encarsia gautieri* (Mercet, 1928)
 86) *Encarsia gigas* (Chumakova, 1957)
 87) *Encarsia hamata* Huang & Polaszek, 1998 ○
 88) *Encarsia inaron* (Walker, 1839) ○
 89) *Encarsia indigoferae* Polaszek & Manzari, 2008 ○
 90) *Encarsia inquirenda* (Silvestri, 1931)
 91) *Encarsia intermedia* (Ferriere, 1961) *
 92) *Encarsia lahorensis* (Howard, 1911) ○
 93) *Encarsia lehri* Yasnosh, 1989
 94) *Encarsia lipaleyrodes* Krishnan & David, 1996
 95) *Encarsia longifasciata* Subba Rao, 1984
 96) *Encarsia longivalvula* Viggiani, 1985
 97) *Encarsia lounsburyi* (Berlese & Paoli, 1916) ○
 98) *Encarsia lutea* (Masi, 1909) ○
 99) *Encarsia luteola* Howard, 1895
 100) *Encarsia macoensis* Abd-Rabou & Ghahari, 2007 ○
 101) *Encarsia macroptera* Viggiani, 1985
 102) *Encarsia margaritiventris* (Mercet, 1931)
 103) *Encarsia maritima* Jasnosh, 1989
 104) *Encarsia mineoi* Viggiani, 1982 ○
 105) *Encarsia mohyuddini* Shafee & Rizvi, 1982
 106) *Encarsia opulenta* (Silvestri, 1928)
 107) *Encarsia* sp. (nr. *perflava* Hayat, 1989)
 108) *Encarsia pergandiella* Howard, 1907 ○

- 109) *Encarsia perniciosi* (Tower, 1913) ○
 110) *Encarsia porteri* (Mercet, 1927)
 111) *Encarsia protransvena* Viggiani, 1985 ○
 112) *Encarsia shutovae* Yasnosh, 1973
 113) *Encarsia smithi* (Silvestri, 1926)
 114) *Encarsia sophia* (Girault & Dodd, 1915) ○
 115) *Encarsia tricolor* Förster, 1878

IX. Genus *Eretmocerus* Haldeman, 1850

- 116) *Eretmocerus adustiscutum* Krishnan & David, 1996 ○
 117) *Eretmocerus aleuroviggianus* Abd-Rabou & Ghahari, 2011 ●
 118) *Eretmocerus breviclavus* Subba Rao, 1984 ○
 119) *Eretmocerus cadabae* Viggiani, 1982 ○
 120) *Eretmocerus corni* Haldeman, 1850
 121) *Eretmocerus debachi* Rose & Rosen, 1992 ○
 122) *Eretmocerus* sp. nr. *delhiensis* Mani, 1941
 123) *Eretmocerus diversiciliatus* Silvestri, 1928 ○
 124) *Eretmocerus eremicus* Rose & Zolnerowich, 1997
 125) *Eretmocerus flavus* Krishnan & David, 1996 ○
 126) *Eretmocerus hederæ* Abd-Rabou & Ghahari, 2011 ●
 127) *Eretmocerus longiscapus* Hayat, 1972 ○
 128) *Eretmocerus mundus* Mercet, 1931 ○
 129) *Eretmocerus neobemisiae* Yasnosh, 1974 ○
 130) *Eretmocerus neomaskelliae* Abd-Rabou & Ghahari, 2005 ○
 131) *Eretmocerus nikolskajae* Myartseva, 1973 ○
 132) *Eretmocerus ostovani* Ghahari & Abd-Rabou, 2005 ○
 133) *Eretmocerus persiangulfus* Abd-Rabou & Ghahari, 2011 ○
 134) *Eretmocerus serius* Silvestri, 1927 ○
 135) *Eretmocerus trialeurodis* Hayat, 1998 ○

X. Genus *Marietta* Motschulsky, 1863

- 136) *Marietta carnesi* (Howard, 1910) *
 137) *Marietta leopardina* Motschulsky, 1863
 138) *Marietta picta* (André, 1878) ○
 139) *Marietta zebrata* (Mercet, 1916)

XI. Genus *Proaphelinoides* Girault, 1917*

- 140) *Proaphelinoides elongatiformis* Girault, 1917*

XII. Genus *Pteroptrix* Westwood, 1833

- 141) *Pteroptrix bicolor* Howard, 1898
 142) *Pteroptrix bicolor* (Howard, 1898) ○
 143) *Pteroptrix lauri* (Mercet, 1911)
 144) *Pteroptrix macropedicellata* (Malac, 1947)
 145) *Pteroptrix maritima* Nikols'kaya, 1952*
 146) *Pteroptrix smithi* (Compere, 1953) *

Family Azotidae Nikols'kaya and Yasnosh, 1966

I. Genus *Ablerus* Howard, 1894

- 1) *Ablerus aleuroides* (Hussain & Agarwal, 1994)
 2) *Ablerus amarantus* Girault, 1932
 3) *Ablerus aonidiellae* Hayat, 1974
 4) *Ablerus atomon* Walker, 1847
 5) *Ablerus bharathius* Subba Rao, 1984
 6) *Ablerus bifasciatus* Girault, 1913
 7) *Ablerus celsus* (Walker, 1839)

- 8) *Ablerus chionaspidis* (Howard, 1914)
 9) *Ablerus chrysomphali* (Ghesquière, 1960)
 10) *Ablerus perspiciosus* Girault, 1916
 11) *Ablerus promacchiae* Viggiani & Ren, 1993

Family Eriaporidae Ghesquiere, 1955

I. Genus *Euryischia* Riley, 1889

Euryischia sp.

II. Genus *Myiocnema* Ashmead, 1900

- 1) *Myiocnema comperei* Ashmead, 1900

Acknowledgments

The authors are grateful to Dr. M. Hayat (India) and two anonymous reviewers for editing and insightful comments, M. Shojai (Iran) for loaning some specimens. This research was supported by Islamic Azad University (Young Researchers and Elite Club, Science and Research Branch), Ministry of Agriculture, Dokki-Giza (Egypt) and Universidad Autónoma de Tamaulipas (Mexico).

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