

## New Data of the Genus *Opius* Wesmael (Hymenoptera: Braconidae, Opiinae) from Northern Iran

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### ABSTRACT

Species of the genus *Opius* Wesmael, 1835 (Hym.: Braconidae, Opiinae) was faunistically studied in northern provinces of Iran. Malaise traps were used to obtain adult specimens from various habitats during 2010–2011. A total of 17 species, belonging to 12 subgenera, were identified, of which six species including *O. (Hypocynodus) larissa* Fischer, 1968; *O. (Alloctypus) saevus* Haliday, 1837; *O. (Merotrachys) schmidti* Fischer, 1960; *O. (Misophthora) pulicariae* Fischer, 1969; *O. (Thoracosema) repentinus* Papp, 1980; and *O. (Nosopaeopius) ochrogaster* Wesmael, 1835 were recorded for the first time from Iran. A key for identification of the collected species is provided.

**Keywords:** Iranian fauna, Leaf miner, Parasitic wasps, Parasitoid.

### INTRODUCTION

Species of the subfamily Opiinae Blanchard, 1845 (Hym.: Braconidae) comprise one of the largest groups of parasitic wasps, with about 2,063 valid species in 39 genera, worldwide (Yu *et al.*, 2016). *Opius* Wesmael, 1835 is the largest genus of Opiinae with 34 subgenera and more than 1,000 described species (Yu *et al.*, 2016). The subfamily Opiinae is one of the important groups of parasitic wasps for biological control of Diptera. Most species of the genus *Opius* are endoparasitoids of leaf mining Agromyzidae, and to a lesser extent Anthomyiidae and Tephritidae (Shaw and Huddleston, 1991). Some species have great importance for biological control of agromyzid leaf miners (Belokobylskij *et al.*, 2004; Yu *et al.*, 2016).

The Iranian fauna of Braconidae includes 780 species in 141 genera and 26

subfamilies (Farahani *et al.*, 2016). Most of these species have been recorded within the last decade, resulting in a four-fold increase in the species number from 202 (Fallahzadeh and Saghaei, 2010) to 780 within only six years (Rakhshani *et al.*, 2007; Ameri *et al.*, 2013, 2015, Farahani *et al.*, 2014a, b, c; 2015; 2016). By 2010, only seven species of Opiinae, belonging to four genera, were known from Iran (Fallahzadeh and Saghaei, 2010). Recent taxonomic studies have led to discovery of many new records and species in this country (Farrar *et al.*, 2009; Talebi *et al.*, 2009; Lashkari *et al.*, 2011; Khajeh *et al.*, 2014; Ameri *et al.*, 2014; Peris-Felipo *et al.*, 2014; 2015; 2018). An updated checklist of Iranian Opiinae, including 101 species in 11 genera, was recently published by Gadallah *et al.* (2016), of which 66 species (65%) belonged to the genus *Opius*. This species number is much less than 182 species recorded from the

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neighboring country (Turkey) (Beyarslan and Fischer, 2013), indicating that further studies are required to better understand the real fauna of Opiinae in Iran. This paper presents a faunistic study on the genus *Opius* in the north of Iran, including six new species records.

## MATERIALS AND METHODS

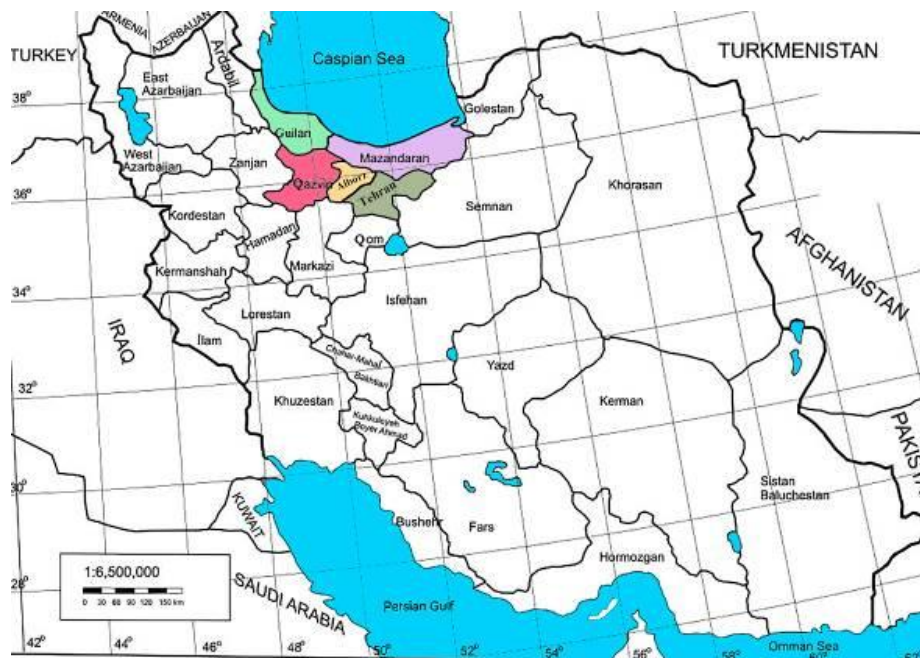
Adult wasps were collected using Malaise traps from various habitats (orchards, rangelands, field crops, and forests) with different altitudes in northern parts of Iran including Mazandaran, Guilan, Qazvin, Tehran and Alborz Provinces (Figure 1) during March-November 2010-2011.

The specimens were extracted from the Malaise traps weekly (Figure 2). They were then preserved in 70% ethanol. After drying on a filter paper, the specimens were card-mounted and labeled. Images from specimens were taken using an Olympus™ AX70 microscope and an Olympus™ SZX9 stereomicroscope equipped with a Canon (EOS 550D) digital camera. A series of 4–5

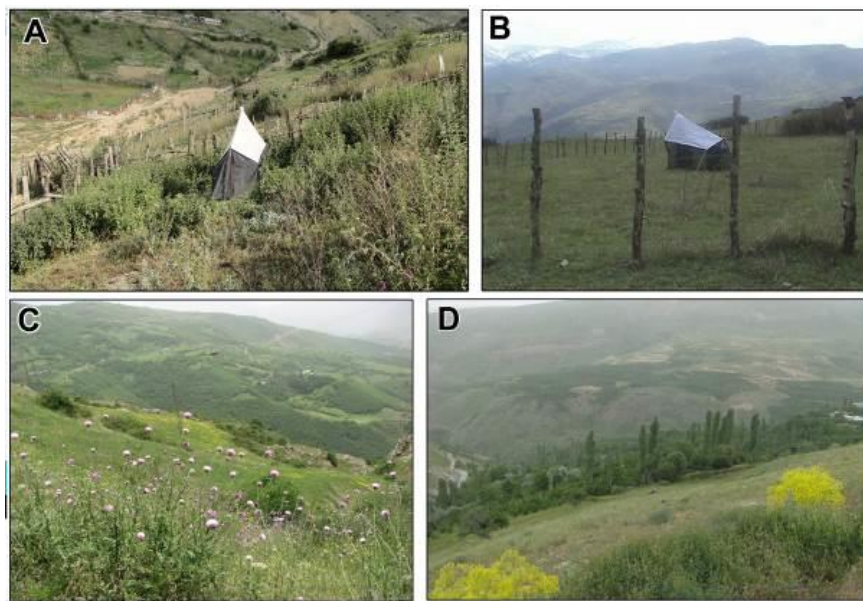
captured images were stacked into a single in-focus image using Combine ZP 1.0 software. The terminology for morphological characters and wing venations follows Sharkey and Wharton (1997) (Figure 3). The term precoxal sulcus is employed instead of sternaulus accordingly to Wharton (2006). The specimens were identified at species level using the keys provided by van Achterberg (1997), Fischer (1972, 1974, 1991, 1995, 1996, 1998, 1999), Fisher and Beyarslan (2005a, b), Papp (1978, 1979, 1982a), and Tobias and Jakimavicius (1986). The specimens were deposited in the insect collection of the Department of Entomology, Tarbiat Modares University, Tehran, Iran (TMUC).

## RESULTS

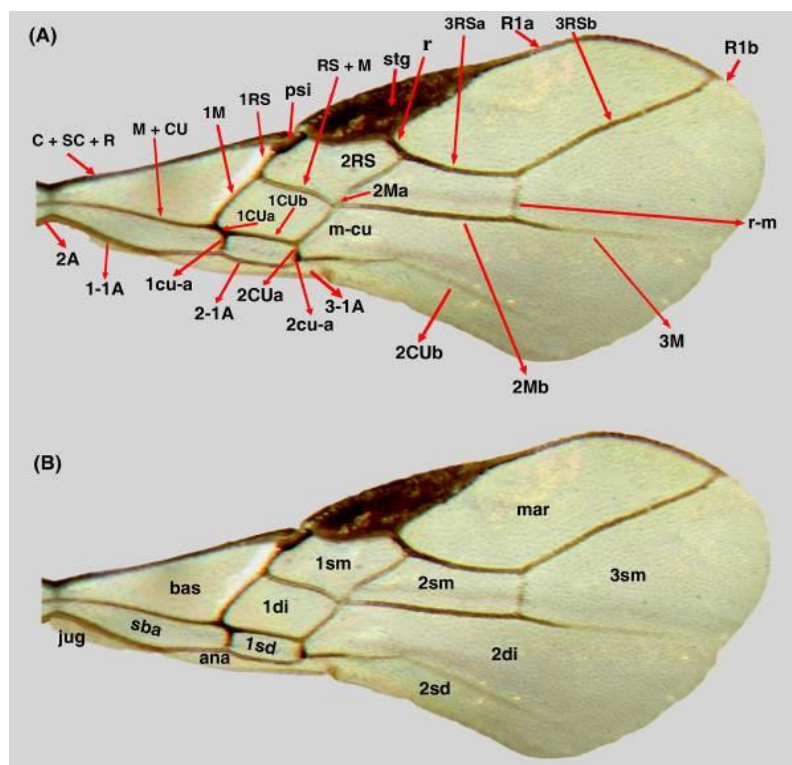
In this study, a total of 17 species of the genus *Opius* Wesmael were identified, of which six species, namely: *O. (Allotypus) saevus* Haliday, 1837, *O. (Hypocynodus) larissa* Fischer, 1968, *O. (Merotrachys)*



**Figure 1.** Geographical location of four provinces (Alborz, Tehran, Guilan, Mazandaran, and Qazvin) in northern region of Iran.



**Figure 2.** Habitats of northern Iran, where the braconid specimens were collected: (A) Gaznasara (Mazandaran Province), (B and C) Qazichak (Guilan Province), and (D) Zereshk Road (Qazvin Province).



**Figure 3.** Front wing of *Opius saevus* illustrating longitudinal and cross veins (A), and wing cells (B), parastigma (psi), stigma (stg), basal cell (bas), sub-basal cell (sba), 1<sup>st</sup> sub-marginal cell (1sm), 2<sup>nd</sup> sub-marginal cell (2sm), 3<sup>rd</sup> sub-marginal cell (3sm), marginal cell (mar), 1<sup>st</sup> discal cell (1di), 1<sup>st</sup> sub-discal cell (1sd), 2<sup>nd</sup> discal cell (2di), 2<sup>nd</sup> sub-discal cell (2sd), anal cell (ana), jugal lobe (jug).



*schmidti* Fischer, 1960, *O. (Misophthora) pulicariae* Fischer, 1969, *O. (Thoracosema) repentinus* Papp, 1980 and *O. (Nosopaeopus) ochrogaster* Wesmael, 1835 are reported for the first time from Iran. A key for the identification of the collected species as well as the general distribution of each species, either in the world or within Iran, are provided.

### Genus *Opius* Wesmael, 1835

#### Subgenus *Agnopius* Fischer, 1982

*O. (Agnopius) basirufus* Fischer, 1958 [Figures 12 (A-C) and 14-B]

Materials Examined: Iran, Alborz Province: Sarzariat (35° 55' 10" N, 51° 06' 51" E, 1,980 masl), 06.VII.2010, 2 ♀; leg. M. Khayrandish; Guilan Province: Orkom (36° 45' 44" N 50° 18' 11" E, 1,201 masl), 22.VI.2010, 1 ♀; leg. M. Khayrandish; Mazandaran Province: Chamestan, Gaznasara road (36° 18' 54" N, 52° 07' 48" E, 1,291 masl), 05.XI.2011, 1 ♀; leg. M. Khayrandish.

Distribution in Iran: Alborz, Guilan, and Mazandaran (current study), Golestan Province (Sakenin *et al.*, 2012), Lorestan Provinces (Farahani *et al.*, 2016).

General Distribution: Palaearctic Region (Yu *et al.*, 2016).

*O. (Agnopius) periclymenii* Fischer, 1964 [Figures 10 (D-F) and 15-E]

Materials Examined: Mazandaran Province: Chamestan, Gaznasara Road (36° 18' 54" N, 52° 07' 48" E, 1,291 masl), 28.VI.2011, 1 ♀; Chamestan, Gaznasara Road (36° 18' 54" N, 52° 07' 48" E, 1,291 masl), 07.VI.2011, 1 ♀; Chamestan, Gaznasara Road (36° 18' 54" N, 52° 07' 48" E, 1,291 masl), 16.VIII.2011, 1 ♀; Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 13.VII.2011, 1 ♀; Chamestan, Gaznasara Road (36° 18' 54" N, 52° 07' 48" E, 1,291 masl), 16.VIII.2011, 1 ♀; leg. M. Khayrandish.

Distribution in Iran: Golestan (Sakenin *et al.*, 2012), Lorestan (Farahani *et al.*, 2016) and Mazandaran Provinces (current study).

General Distribution: Palaearctic Region (Yu *et al.*, 2016).

*O. (Agnopius) tirolensis* Fischer, 1958 [Figures 11 (C-D) and 15-H]

Materials Examined: Iran, Guilan Province: Orkom (36° 45' 44" N, 50° 18' 11" E, 1,201 masl), 17.V.2010, 1 ♀; leg. M. Khayrandish.

Distribution in Iran: Guilan (Farahani *et al.*, 2016, current study) and Hormozgan Provinces (Queshm Island) (Ameri *et al.*, 2014).

General Distribution: Palaearctic Region (Yu *et al.*, 2016).

#### Subgenus *Allophlebus* Fischer, 1972

*O. (Allophlebus) singularis* Wesmael, 1835 (Figures 13-I and 14-H)

Materials examined: Guilan Province: Orkom (36° 45' 42" N, 50° 18' 12" E, 1,235 masl), 22.IV.2010, 1 ♀; Iran, Mazandaran Province: Tangehvaz (36° 21' 55" N, 52° 06' 10" E, 702 masl), 29.IV.2011, 1 ♀; leg. A. Nadimi.

Distribution in Iran: Guilan (Farahani *et al.*, 2016; current study) and Mazandaran Provinces (current study).

General Distribution: Palaearctic Region (Yu *et al.*, 2016).

#### Subgenus *Allotypus* Forster, 1862

*O. (Allotypus) saevus* Haliday, 1837 [Figure 4 (A-I) and 14-G]

Materials Examined: Iran, Mazandaran Province: Nour (36° 34' 52" N, 52° 02' 45" E, 14 masl l.), 12.IV.2011, 1 ♀; leg. A. Nadimi.

Distribution in Iran: Mazandaran Province (current study), new record in Iran.

General Distribution: Palaearctic Region (Yu *et al.*, 2016).

Diagnosis: Body 2.8 mm; antennae 1.5 times as long as body, with 28 segments in females, flagellar segments short; oral cavity not developed (Figure 4-A); mandibles basally uniformly broadened (Figure 4-A); temples behind eyes roundly narrowed (Figure 4-C); thorax 1.2 times as long as high (Figure 4-D); postero-median area of the mesoscutum with rounded midpit (Figure 4-E); propodeum rugose or with granulate sculpture (Figure 4-F); precoxal

sulcus absolutely smooth (Figure 4-D); mcu vein on forewing interstitial (Figure 4-I); 3-1A vein directed obliquely outward; marginal cell on forewing reaching apex (Figure 4-I); 3RSa vein longer than 2RS vein (Figure 4-I); stigma cuneate (Figure 4-D); hind femur 4.5 times as long as wide (Figure 4-H); metasoma monochromatic, dark (Figure 4-G); first metasomal tergite longer than its width at apex, lacking distinct spiracular tubercle (Figure 4-G); ovipositor exerted to 1/3 length of abdomen.

**Subgenus *Cryptonastes* Forster, 1862**

*O. (Cryptonastes) gracilis* Fischer, 1957  
[Figures 11 (E-F) and 15-B]

Materials Examined: Alborz Province: Karaj (35° 46' 20" N, 50° 56' 44" E, 1,278 masl), 13.X.2010, 1 ♀; Guilan Province: Ziaz (36° 52' 27" N, 50° 13' 24" E, 490

masl), 29.VIII.2010, 1 ♀; Tehran Province: Shahriar (35° 40' 03" N, 50° 56' 52" E, 1,168 masl), 01.VI.2010, 1 ♀; leg. M. Khayrandish.

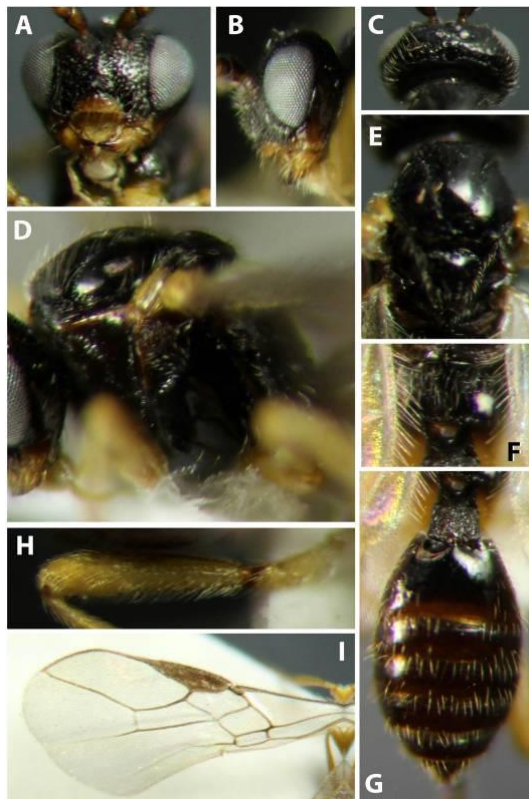
Distribution in Iran: Kerman (Safahani *et al.*, 2018), Alborz, Guilan and Tehran Provinces (current study).

General Distribution: Palaearctic Region (Yu *et al.*, 2016).

**Subgenus *Gastrosema* Fischer, 1972**

*O. (Gastrosema) docilis* Haliday, 1837  
[Figures 13 (E-F) and 14-C]

Materials Examined: Mazandaran Province: Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 05.XI.2011, 1 ♀; Nour (36° 34' 54" N, 52° 02' 48" E, -14 masl), 10.X.2011, 1 ♀; Jourband (36° 26' 18" N, 52° 07' 12" E, 275 masl), 26.V.2011, 1 ♀; Tangehvaz (36° 21' 54" N, 52° 06' 12" E,



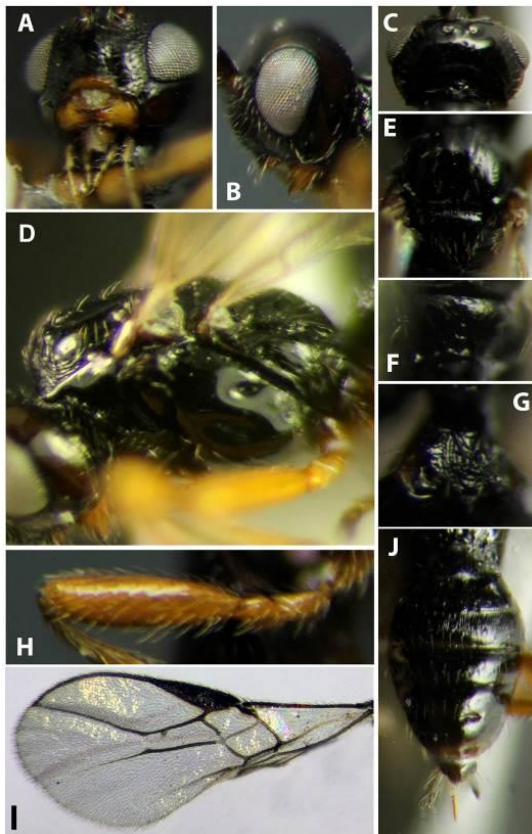
**Figure 4.** *Opius saevus*: (A) Frontal aspect of head, (B) Lateral aspect of head and compound eye, (C) Dorsal aspect of head, (D) Lateral aspect of mesosoma, (E) Dorsal aspect of mesosoma, (F) Propodeum, (G) Dorsal aspect of abdomen, (H) Hind leg, and (I) Fore wing.



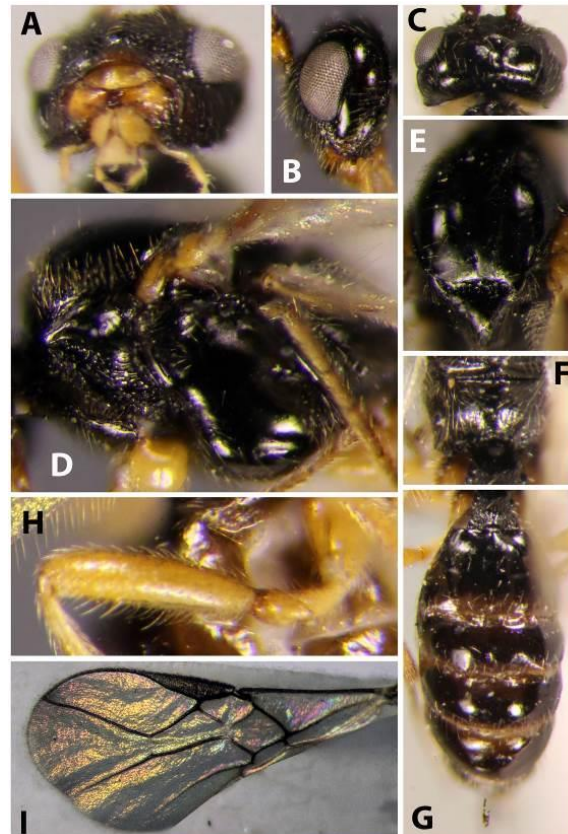
**Figure 5.** *Opius larissa*: (A) Frontal aspect of head, (B) Lateral aspect of head and compound eye, (C) Dorsal aspect of head, (D) Lateral aspect of mesosoma, (E) Dorsal aspect of mesosoma, (F) Propodeum, (G) Dorsal aspect of abdomen, (H) Hind leg, and (I) Fore wing.

687 masl), 16.VIII.2011, 1 ♀; (36° 26' 18" N, 52° 07' 12" E, 275 masl), 13.VII.2011, 1 ♀; (36° 26' 18" N, 52° 07' 12" E, 275 masl), 25.IV.2011, 1 ♀; Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 13.VII.2011, 1 ♀; Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 22.IV.2011, 1 ♀; (36° 26' 18" N, 52° 07' 12" E, 275 masl), 26.X.2011, 1 ♀; (36° 26' 18" N, 52° 07' 12" E, 275 masl), 26.IX.2011, 1 ♀; Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 26.V.2011, 1 ♀; Nour (36° 34' 54" N, 52° 02' 48" E, -14 masl), 25.IX.2011, 1 ♀; Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 28.VI.2011, 1 ♀; Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 13.VII.2011, 2 ♀; Tangehvaz (36° 21' 54" N, 52° 06' 12" E,

687 masl), 26.VII.2011, 1 ♀; (36° 26' 18" N, 52° 07' 12" E, 275 masl), 07.VI.2011, 1 ♀; Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 07.VI.2011, 1 ♀; Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 13.VII.2011, 1 ♀; (36° 26' 18" N, 52° 07' 12" E, 275 masl), 10.X.2011, 1 ♀; 26-05-2011, 1 ♀; Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 03.VII.2011, 3 ♀; Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 26.VII.2011, 1 ♀; Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 13.VII.2011, 1 ♀; (36° 26' 18" N, 52° 07' 12" E, 275 masl), 05.XI.2011, 1 ♀; Nour (36° 34' 54" N, 52° 02' 48" E, -14 masl), 05.XI.2011, 1 ♀; Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 13.VII.2011, 1 ♀; (36° 26' 18" N, 52°



**Figure 6.** *Opilus schmidti*: (A) Frontal aspect of head, (B) Lateral aspect of head and compound eye, (C) Dorsal aspect of head, (D) Lateral aspect of mesosoma, (E) Dorsal aspect of mesosoma, (F) Propodeum, (G) Dorsal aspect of first metasomal tergite, (H) Hind leg, (I) Fore wing, and (J) Dorsal aspect of abdomen.



**Figure 7.** *Opilus pulicariae*: (A) Frontal aspect of head, (B) Lateral aspect of head and compound eye, (C) Dorsal aspect of head, (D) Lateral aspect of mesosoma, (E) Dorsal aspect of mesosoma, (F) Propodeum, (G) Dorsal aspect of abdomen, (H) Hind leg, and (I) Fore wing.

07' 12" E, 275 masl), 26.V.2011, 1 ♀; leg. M. Khayrandish.

Distribution in Iran: Kermanshah (Farahani *et al.*, 2016) and Mazandaran Provinces (current study).

General Distribution: Palaearctic Region (Yu *et al.*, 2016).

**Subgenus *Hypocynodus* Forster, 1862**

***O. (Hypocynodus) larissa* Fischer, 1968**

[Figures 5 (A-I) and 14-D]

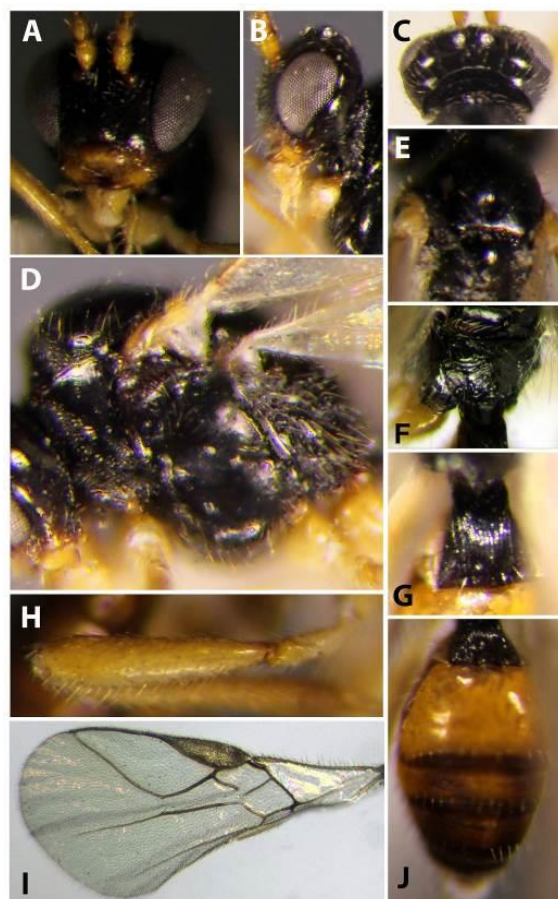
Materials Examined: Iran, Alborz Province: Sarziarat (35° 55' 10" N, 51° 06' 51" E, 1,980 masl), 15.VI.2010, 2 ♀; 22.VI.2010, 3 ♀; 28.VII.2010, 1 ♀; Guilan Province: Ziaz (36° 52' 27" N, 50° 13' 24"

E, 490 masl), 21.XI.2010, 1 ♀; leg. M. Khayrandish.

Distribution in Iran: Alborz and Guilan Provinces (current study), new record for Iran.

General Distribution: Palaearctic Region (Papp, 1982b).

Diagnosis: Body 1.5-1.9 mm; clypeus narrow, falcate (Figure 5-A); antennae barely longer than body, 23-25 segmented; oral cavity developed (Figure 5-A); mandibles basally distinctly broadened (Figure 5-A), thorax 1.3-1.4 times as long as high (Figure 5-D); postero-median area of mesoscutum without midpit (Figure 5-E);



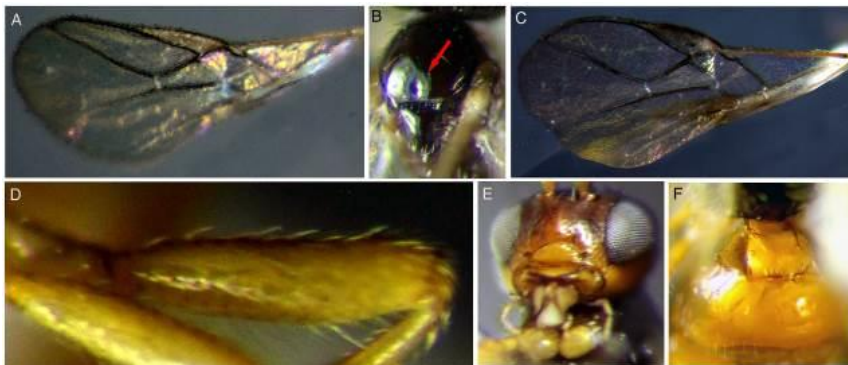
**Figure 8.** *Opius ochrogaster*: (A) Frontal aspect of head, (B) Lateral aspect of head and compound eye, (C) Dorsal aspect of head, (D) Lateral aspect of mesosoma, (E) Dorsal aspect of mesosoma, (F) propodeum, (G) Dorsal aspect of first metasomal tergite, (H) Hind leg, (I) Fore wing, and (J) Dorsal aspect of abdomen.



**Figure 9.** *Opius repentinus*: (A) Frontal aspect of head, (B) Lateral aspect of head and compound eye, (C) Dorsal aspect of head, (D) Lateral aspect of mesosoma, (E) Dorsal aspect of mesosoma, (F) Propodeum, (G) Dorsal aspect of first metasomal tergite, (H) Hind leg, (I) Fore wing, and (J) Dorsal aspect of abdomen.



**Figure 10.** (A-C) *Opius wachsmanni*: (A) Frontal aspect of head, (B) Fore wing, (C) Dorsal aspect of first metasomal tergite; (D-F) *Opius periclymenii*: (D) Dorsal aspect of mesosoma, (E) Dorsal aspect of first metasomal tergite, (F) Lateral aspect of mesosoma.



**Figure 11.** (A-B) *Opius basalis*: (A) Front wing, (B) Dorsal aspect of mesosoma; (C-D) *Opius tirolensis*: (C) Front wing, (D) hind leg; (E-F) *Opius gracilis*: (E) Frontal aspect of head, (F) dorsal aspect of first metasomal tergite.

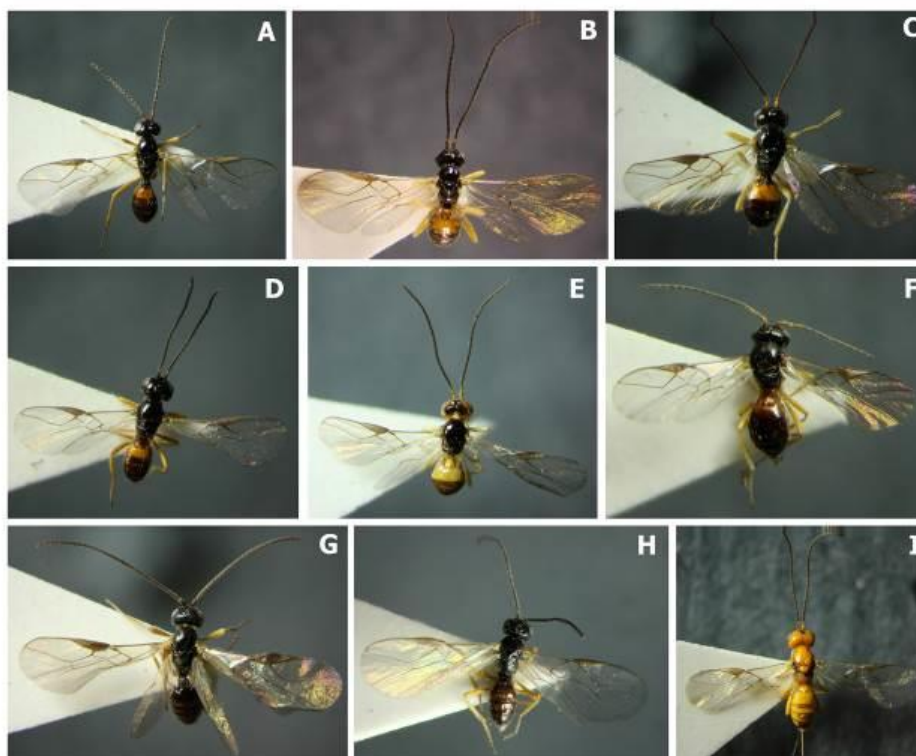


**Figure 12.** (A-C) *Opius basirufus*: (A) Frontal aspect of head, (B) Dorsal aspect of abdomen, (C) Dorsal aspect of first metasomal tergite; (D-F) *Opius maculipes*: (D) Dorsal aspect of mesosoma, (E) Dorsal aspect of head, (F) Lateral aspect of mesosoma.





**Figure 13.** (A-D) *Opius ambiguus*: (A) Dorsal aspect of mesosoma, (B) Dorsal aspect of abdomen, (C) Fore wing, (D) Frontal aspect of head; (E-F) *Opius docilis*: (E) Propodeum, (F) Fore wing; (G-H) *Opius propodealis*: (G) Propodeum, (H) Frontal aspect of head; (I) *Opius singularis*: (I) Fore wing.



**Figure 14.** Dorsal habitus of female: (A) *Opius ambiguus*, (B) *Opius basirufus*, (C) *Opius docilis*, (D) *Opius larissa*, (E) *Opius propodealis*, (F) *Opius repentinus*, (G) *Opius saevus*, (H) *Opius singularis*, and (I) *Opius wachsmanni*.

precoxal sulcus smooth or not developed (Figure 5-D); marginal cell on forewing terminating apical wing; r vein originating from basal third of stigma, 3RSa 1.5 times as long as 2RS vein, 3RSb curved, 3 times as long as 3RSa (Figure 5-I); legs light yellow, hind femur 3-3.5 times as long as wide (Figure 5-H); propodeum smooth (Figure 5-F); metasoma red (Figure 5-G); metasomal posterior to 1<sup>st</sup> tergite smooth; first metasomal tergite as long as its width at apex (Figure 5-G); ovipositor slightly exerted.

**Subgenus *Merotrachys* Fischer, 1972**

***O. (Merotrachys) schmidti* Fischer, 1960**

[Figures 6 (A-J) and 15-G]

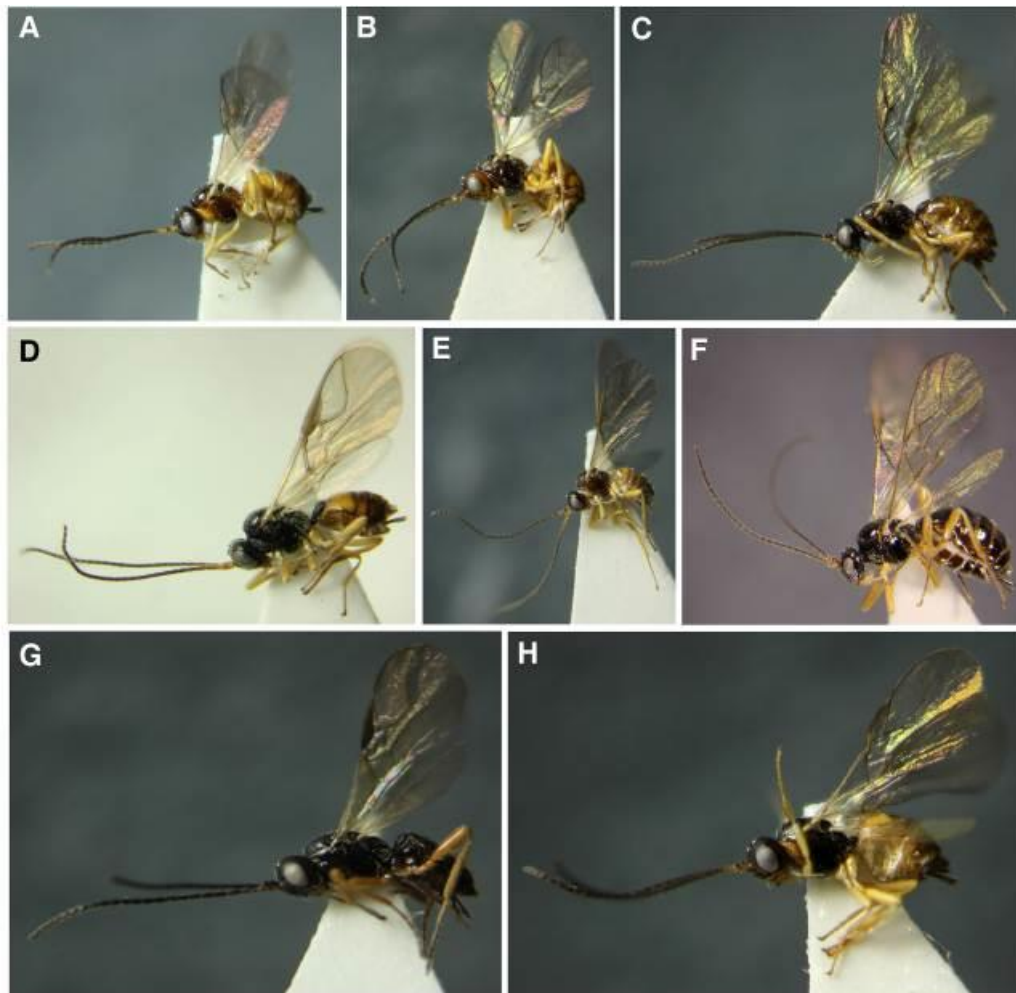
**Materials Examined:** Iran, Guilan Province: Orkom (36° 45' 44" N, 50° 18' 11" E, 1,201 masl), 07.VI.2010, 1 ♀; leg. A. Nadimi.

**Distribution in Iran:** Guilan Province (current study), new record for Iran.

**General Distribution:** Hungary and Turkey (Yu et al., 2016).

**Remark:** *Opius schmidti* has very narrow distribution range in the Palearctic Region, so far known from Hungary and Turkey, and Iran is added in the current study.

**Diagnosis:** Body length 1.5 mm; antennae 1.5 times as long as body, 24 segmented; oral cavity developed (Figure 6-A); temples shorter than eyes (Figure 6-C); postero-



**Figure 15.** Lateral habitus of female: (A) *Opius basalis*, (B) *Opius gracilis*, (C) *Opius maculipes*, (D) *Opius ochrogaster*, (E) *Opius perichlymenii*, (F) *Opius pulicariae*, (G) *Opius schmidti*, and (H) *Opius tirolensis*.

median area of mesoscutum without midpit (Figure 6-E); precoxal sulcus smooth (Figure 6-D); m-cu vein on forewing interstitial, 3RSa vein longer than 2RS vein (Figure 5-I); 1cu-a slightly postfurcal (Figure 6-I); hind femur 5 times as long as wide (Figure 6-H); propodeum sculptured (Figure 6-F); spiracles on propodeum and first metasomal tergite distinctly raised on tubercles (Figure 6-G); metasoma posterior to 1<sup>st</sup> tergite sculptured (Figure 6-J); body black (Figure 6).

**Subgenus *Misophthora* Forster, 1862**

***O. (Misophthora) basalis* Fischer, 1958**

[Figures 11 (A-B) and 15-A]

Materials Examined: Iran, Alborz Province: Karaj (35° 46' 08" N, 50° 56' 55" E, 1277 masl), 24.IX.2010, 1 ♀; Mazandaran Province: (36° 26' 18" N, 52° 07' 12" E, 275 masl), 10.X.2011, 1 ♀; leg. M. Khayrandish.

Distribution in Iran: Mazandaran (Khajeh *et al.*, 2014) and Alborz Provinces (current study).

General Distribution: Palaearctic Region (Yu *et al.*, 2016).

***O. (Misophthora) pulicariae* Fischer, 1969** [Figures 7 (A-I) and 15-F]

Materials Examined: Iran, Guilan Province: Ziaz (36° 52' 27" N, 50° 13' 24" E, 490 masl), 08.XI.2010, 3 ♀; 26.IX.2010, 2 ♀; 18.X.2010, 1 ♀; 19.IV.2010, 2 ♀; 19.IX.2010, 1 ♀; 04.X.2010, 3 ♀; 25.IV.2010, 1 ♀; Orkom (36° 45' 44" N, 50° 18' 11" E, 1,201 masl), 04.X.2010, 4 ♀; 31.V.2010, 1 ♀; Qazichak (36° 45' 57" N, 50° 19' 35" E, 1,803 masl), 06.VI.2010, 3 ♀; 28.V.2010, 2 ♀; leg. M. Khayrandish.

Distribution in Iran: Guilan Province (current study), new record for Iran.

General Distribution: Palaearctic Region (Yu *et al.*, 2016).

Diagnosis: Body 1.9-2.2 mm; head more than 2.0 times as wide as long (Figure 7-C); oral cavity not developed (Figure 7-A); mandibles basally steplike broadened (Figure 7-A); antennae 1.4-1.5 times as long as body, 24-27 segmented; mesosoma lacking red coloration, 1.3 times as long as high (Figure 7-D); notaulus distinct only in

middle (Figure 7-E); precoxal sulcus absolutely smooth or not developed (Figure 7-D); postero-median area of mesoscutum with elongated midpit (Figure 7-E); stigma cuneate (Figure 7-I); hind wing lacking stigma thickening; 3RSa vein longer than 2RS vein (Figure 7-I); 3RSb of radial vein terminating or almost terminating at wing apex (Figure 7-I); propodeum at least in anterior part smooth or only with ridges (Figure 7-F); first metasomal tergite rugose, 1.3 times as long as its width at apex (Figure 7-G); ovipositor barely exerted from abdominal apex (Figure 7-G).

***O. (Misophthora) wachsmanni* Szepligeti, 1898** [Figures 10 (A-C) and 14-I]

Materials Examined: Alborz Province: Arangeh (35° 55' 07" N, 51° 05' 09" E, 1,891 masl), 31.VIII.2010, 1 ♀; Guilan Province: Orkom (36° 45' 44" N, 50° 18' 11" E, 1,201 masl), 07.VI.2010, 1 ♀; 17.V.2010, 1 ♀; Qazvin Province: Zereshk (36° 25' 42" N, 50° 06' 36" E, 2,035 masl), 04.IV.2011, 1 ♀; leg. M. Khayrandish.

Distribution in Iran: Lorestan (Farahani *et al.*, 2016), Alborz, Guilan, and Qazvin Provinces (current study).

General Distribution: Palaearctic Region (Yu *et al.*, 2016).

**Subgenus *Nosopoea* Forster, 1862**

***O. (Nosopoea) ambiguus* Wesmael, 1835** [Figures 13 (A-D) and 14-A]

Materials Examined: Mazandaran Province: Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 07.VI.2011, 1 ♀; leg. M. Khayrandish.

Distribution in Iran: Isfahan (Farahani *et al.*, 2016) and Mazandaran Provinces (current study).

General distribution: Palaearctic region (Yu *et al.*, 2016).

***O. (Nosopoea) maculipes* Wesmael, 1835** [Figures 12 (D-F) and 15-C]

Materials Examined: Guilan Province: Orkom (36° 45' 44" N, 50° 18' 11" E, 1,201 masl), 07.VI.2010, 1 ♀; Ziaz (36° 52' 27" N, 50° 13' 24" E, 490 masl), 17.V.2010, 1 ♀; Mazandaran Province: (36° 26' 18" N, 52° 07' 12" E, 275 masl), 26.IX.2011, 1 ♀; leg. A. Nadimi.



Distribution in Iran: East Azarbaijan, Guilan, and Tehran (Gadallah *et al.*, 2016), and Mazandaran Provinces (current study).

General distribution: Palaearctic Region (Yu *et al.*, 2016).

#### **Subgenus *Nosopaeopus* Fischer, 1972**

***O. (Nosopaeopus) ochrogaster* Wesmael, 1835** [Figures 8 (A-J) and 15-D]

Materials Examined: Alborz Province: Arangeh (35° 55' 07" N, 51° 05' 09" E, 1,891 masl), 16.VIII.2010, 1 ♀; 17.IX.2010, 1 ♀; Sarzirat (35° 55' 10" N, 51° 06' 51" E, 1,980 masl), 08.VI.2010, 1 ♀; Guilan Province: Orkom (36° 45' 44" N, 50° 18' 11" E, 1,201 masl), 31.V.2010, 2 ♀; 07.VI.2010, 1 ♀; Qazichak (36° 45' 52" N, 50° 20' 01" E, 1,787 masl), 17.V.2010, 1 ♀; Mazandaran Province: Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 10.X.2011, 1 ♀; (36° 26' 18" N, 52° 07' 12" E, 275 masl), 03.X.2011, 1 ♀; Gaznasara (36° 16' 54" N, 52° 10' 54" E, 2,031 masl), 26.VII.2011, 1 ♀; (36° 26' 18" N, 52° 07' 12" E, 275 masl), 10.X.2011, 1 ♀; (36° 26' 18" N, 52° 07' 12" E, 275 masl), 05.XI.2011, 1 ♀; leg. M. Khayrandish.

Distribution in Iran: Alborz, Guilan and Mazandaran Provinces (current study), new record for Iran.

General Distribution: Palaearctic Region (Yu *et al.*, 2016).

Diagnosis: Body 1.8-2.3 mm; oral cavity not developed (Figure 8-A); antennae 1.5 times as long as body, 24-29 segmented; mesonotum with midpit (Figure 8-E); scutellum smooth or pubescent or posteriorly finely rugose (Figure 8-E); midpit somewhat elongate (Figure 8-E); propodeum sculptured, rugose or granulate (Figure 8-F); precoxal sulcus absolutely smooth or not developed (Figure 8-D); 3RSa vein up to 1.5 times as long as 2RS vein, 3RSb straight or sometimes arcuate, terminating preapically (Figure 8-I); m-cu vein postfurcal (Figure 8-I); first metasomal tergite longitudinally rugose and black (Figure 8-G), other tergites yellow or dark brown (Figure 8-J), apical tergites often with black transverse stripes (Figure 8-J), in males sometimes entirely black.

#### **Subgenus *Opiognathus* Fischer, 1972**

***O. (Opiognathus) propodealis* Fischer, 1958** [Figures 13 (G-H) and 14-E]

Materials Examined: Guilan Province: Ziaz (36° 52' 27" N, 50° 13' 24" E, 490 masl), 10.V.2010, 1 ♀; Mazandaran Province: Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 05.IX.2011, 1 ♀; (36° 26' 18" N, 52° 07' 12" E, 275 masl), 05.XI.2011, 1 ♀; (36° 26' 18" N, 52° 07' 12" E, 275 masl), 26.IX.2011, 1 ♀; Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 05.IX.2011, 1 ♀; (36° 26' 18" N, 52° 07' 12" E, 275 masl), 26.IX.2011, 1 ♀; Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 16.VIII.2011, 1 ♀; (36° 26' 18" N, 52° 07' 12" E, 275 masl), 26.IX.2011, 1 ♀; (36° 26' 18" N, 52° 07' 12" E, 275 masl), 05.IX.2011, 1 ♀; (36° 26' 18" N, 52° 07' 12" E, 275 masl), 16.VIII.2011, 1 ♀; leg. M. Khayrandish.

Distribution in Iran: Kermanshah (Farahani *et al.*, 2016), Guilan and Mazandaran Provinces (current study).

General Distribution: Palaearctic Region (Yu *et al.*, 2016).

#### **Subgenus *Thoracosema* Fischer, 1972**

***O. (Thoracosema) repentinus* Papp, 1980** [Figures 9 (A-J) and 14-F]

Materials Examined: Mazandaran Province: Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 16.VIII.2011, 1 ♀; Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 16.VIII.2011, 1 ♀; Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 16.VIII.2011, 1 ♀; Chamestan-Gaznasara road (36° 18' 54" N, 52° 07' 48" E, 1,291 masl), 12.VII.2011, 1 ♀; Chamestan-Gaznasara road (36° 18' 54" N, 52° 07' 48" E, 1,291 masl), 16.VIII.2011, 1 ♀; Tangehvaz (36° 21' 54" N, 52° 06' 12" E, 687 masl), 16.VIII.2011, 1 ♀; leg. M. Khayrandish.

Distribution in Iran: Mazandaran Province (current study), new record for Iran.

General Distribution: Palaearctic Region (Yu *et al.*, 2016).

Diagnosis: Body 1.2-1.5 mm, very dark brown (Figure 9); head dorsally smooth, 2 times as wide as long (Figure 9-C); clypeus 3 times as wide as high (Figure 9-A); antennae longer than body, 15-16 segmented; oral cavity developed (Figure 9-A); mandibles

basally steplike broadened (Figure 9-A); thorax slightly longer than high; postero-median area of mesoscutum without midpit (Figure 9-E); notaulus distinct only anteriorly (Figure 9-E); precoxal sulcus sculptured (Figure 9-D); stigma cuneate (Figure 9-I); r vein short, 3RSa 1.7-1.8 times as long as 2RS vein (Figure 9-I); legs yellow; hind femur 4-5 times as long as wide (Figure 9-H); propodeum lacking transverse ridge, smooth or only on posterior margin slightly sculptured, finely rugose in posterior margin (Figure 9-F); first metasomal tergite slightly longer than its width at apex, smooth or with slightly wrinkles in apical part, with slightly developed light colored patterns (Figure 9-G); ovipositor slightly exerted.

Key to the Species of the Genus *Opius* Collected from Northern Iran

1- Postero-median area of mesoscutum with rounded or elongated midpit (Figures 4-E, 7-E, 8-E,) .....

2- Postero-median area of mesoscutum without midpit (Figures 5-E, 6-E, 9-E) .... 12

2 (1)- Oral cavity not developed, absent (Figure 8-A); [mandibles basally broadened steplike (Figure 8A); 3RSa vein up to 1.5 times as long as 2RS vein, 3RSb straight or sometimes arcuate (Figure 8-I)] .....

..... *Opius (Nosopaeopus) ochrogaster*

- Oral cavity fully developed (Figures 4-A and 7-A,) .....

3 (2)- Propodeum at least in anterior part smooth or only with ridges (Figure 7-F); [midpit is rounded (Figure 4E, 8E); mesosoma usually 1.3 times as long as high (Figures 4-D and 7D); stigma cuneate (Figures 4-I and 7-I)] .....

..... 4

- Propodeum rugose or with granulose sculpture (Figure 4-F) .....

..... 10

4 (3)- Hind wings of males with pterostigma thickening between costal and radial veins; mandibles basally uniformly broadened (Figure 10-A); [antennae with 24-26 segments; marginal cell on forewing almost reaching its apex (Figure 10B); first metasomal tergite somewhat longer than its width at apex (Figure 10-C)] .....

..... *Opius (Misophthora) wachsmanni*

- Hind wings of male without pterostigma thickening between costal and radial veins .. 5

5 (4)- Mesosoma with reddish dark brown patterns (Figure 10-F); [hind wings lacking pterostigma thickening ; ovipositor sheath not longer than 1<sup>st</sup> metasomal tergite; antennae 1.5 times as long as body, with 24 segments; first metasomal tergite as long as its width at apex (Figure 10-E); mesosoma dark brown (Figure 10-D), pronotum light colored] .....

..... *Opius (Agnopius) periclymenii*

- Mesosoma without red coloration or only prothorax sometimes reddish (Figure 7-E)

..... 6

6 (5)- First metasomal tergite coarsely sculptured, 1.3 times as long as its width at apex (Figure 7-G); [antennae 24-27 segmented].....

..... *Opius (Misophthora) pulicariae*

- First metasomal tergite softly sculptured, longitudinally striate .....

..... 7

7 (6)- Radial vein on forewing not reaching its apex (Figure 11-A); [3RSa vein 1.7 times as long as 2RS vein, 3RSb 2.4 times as long as 3RSa (Figure 11-A); midpit punctiform (Figure 11-B)] *Opius (Misophthora) basalis*

- Radial vein terminating at wing apex or closer to it. ....

..... 8

8 (7)- 3RSa vein distinctly less than 2 times as long as 2RS vein (Figure 11-C); hind femur 3.5 times as long as wide (Figure 11-D); [ovipositor as long as 1<sup>st</sup> metasomal tergite; antennae 23-28 segmented] .....

..... *Opius (Agnopius) tirolensis*

- 3RSa vein 2 times or more as long as 2RS vein; hind femur 5 times as long as wide .

..... 9

9 (8) Mandibles basally steplike (Figure 11-E); first metasomal tergite as long as its width at apex, yellow or yellowish dark brown (Figure 11-F); [clypeus 2.5 times as wide as high (Figure 11-E); Ovipositor as long as 1<sup>st</sup> metasomal tergite or longer] .....

..... *Opius (Cryptonastes) gracilis*

- Mandibles basally uniformly broadened (Figure 12-A); [metasoma dark brownish red (Figure 12-B); antennae almost 2 times as long as body, with 24-27 segments; first metasomal tergite 1.5 times as long as its width at apex (Figure 12-C); ovipositor as long as 1<sup>st</sup>



- abdominal tergite] .....  
 ..... *Opius (Agnopius) basirufus*  
 10 (3)- m-cu vein interstitial; 3-1A vein directed obliquely outward (Figure 4-I); [first metasomal tergite without distinct specular tubercles (Figure 4-G); ovipositor 1/3 as long as of abdomen; antennae 28-31 segmented] .....  
 ..... *Opius (Allotypus) saevus*  
 - m-cu vein postfurcal, if sometimes interstitial, then ovipositor as long as abdomen ..... 11  
 11 (10)- Mesonotum fairly densely pilose (Figure 12-D); [antennae slightly longer than body, with 25-35 segments; head behind eyes slightly narrowed (Figure 12-E); mesosoma 1.3 as long as high (Figure 12-F); ovipositor slightly extends beyond the apex of metasoma or concealed] ... *Opius (Nosopoea) maculipes*  
 - Mesonotum absolutely glabrous or with hairs mostly on anterior sloping part (Figure 13-A); [metasoma black (Figure 13-B); 3RSa vein usually 2 times as long as 2RS vein, 3RSb 1.7-1.8 times as long as 3RSa (Figure 13-C); antennae longer than body, with 26-31 segments; face smooth (Figure 13-D)] .....  
*Opius (Nosopoea) ambiguous* ..... 12  
 (1)- Precoxal sulcus sculptured (Figure 9-D) ..... 13  
 - Precoxal sulcus smooth or not developed (Figures 5-D and 6-D) ..... 15  
 13 (12)- Propodeum smooth, sometimes only on posterior margin slightly sculptured or almost smooth (Figure 9-F) ..... 14  
 - Propodeum sculptured (Figure 13E); stigma large, triangular (Figure 13-F) .....  
 ..... *Opius (Gastrosema) docilis*  
 14 (13)- Propodeum with transverse ridge (Figure 13-G); [face with reddish pattern (Figure 13H)] .....  
 ..... *Opius (Opiognathus) propodealis*  
 - Propodeum without transverse ridge; smooth or only on posterior margin slightly sculptured (Figure 9-F); [head 2.0 times as wide as long (Figure 9-C); body dark brown; legs yellow (Figure 9-H)] .....  
 ..... *Opius (Thoracosema) repentinus*  
 15 (12)- Metasoma posterior to 1<sup>st</sup> tergite sculptured (Figure 6-G); [propodeum sculptured (Figure 6-F); temples shorter than eye (Figure 6-C); fore wing with m-cu vein interstitial (Figure 6-I); antennae 1.5 times as long as body, with 24 segments; body black.] ..... *Opius (Merotrachys) schmidti*  
 - Metasoma posterior to 1<sup>st</sup> tergite smooth (Figure 5-G) ..... 16  
 16 (15)- 3RSa vein in fore wing 2 times as long as 2RS vein (Figure 13-I); Ovipositor barely exerted; antennae 27-32 segmented .....  
 ..... *Opius (Allophlebus) singularis*  
 - 3RSa vein in fore wing 1.5 times as long as 2RS vein, 3RSb curved, 2 times as long as 3RSa (Figure 5-I); [legs light yellow (Figure 5-H); r vein originating from basal third of stigma (Figure 5-I); metasoma red (Figure 5-G); mandibles basally distinctly broadened (Figure 5-A); ovipositor slightly exerted] ..... *Opius (Hypocynodus) larissa*

## DISCUSSION

According to the previous studies and current research, a total of 107 species of Opiinae are known from Iran, of which 72 species belong to the cosmopolitan genus *Opius*. Our investigations in northern parts of Iran resulted in collection of 17 species of the genus *Opius*, of which six species are new records for the fauna of Iran: *O. (Allotypus) saevus* Haliday, 1837, *O. (Hypocynodus) larissa* Fischer, 1968, *O. (Merotrachys) schmidti* Fischer, 1960, *O. (Misophthora) pulicariae* Fischer, 1969, *O. (Thoracosema) repentinus* Papp, 1980, and *O. (Nosopaeopius) ochrogaster* Wesmael, 1835. Apart from this, five species (i.e., *O. (Cryptonastes) gracilis*, *O. (Agnopius) periclymenii*, *O. (Gastrosema) docilis*, *O. (Nosopoea) ambiguous*, and *O. (Opiognathus) propodealis*) are reported from the studied area for the first time. The geographical distribution of all species is limited to the Palearctic region, especially the West Palearctic and the Middle East (Tobias, 1995). According to the literature (Shaw and Huddleston, 1991; Tobias, 1995), most species of the genus, including those reported in this study, are associated with phytophagous cyclorrhaphan Diptera, especially leaf miner flies in the family Agromyzidae. At least, some species within the identified genera of host flies, such

as *Amauromyza*, *Nemorimyza*, *Ophiomyza*, *Liriomyza*, *Agromyza*, *Cerodontha*, and *Phytomyza*, are known to associate with agricultural and forest plants, giving *Opius* a relatively high status in term of pest biological control (Shaw and Huddleston, 1991). Further studies may evaluate the potential of these parasitic wasps for applied biological control of leaf miner flies on agricultural and greenhouse products. Additionally, further faunistic investigations are needed to improve our understanding of biodiversity and geographical distribution of Opiine parasitic wasps in Iran.

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### اطلاعات جدید از گونه‌های جنس *Opius* Wesmael (Hymenoptera: Braconidae, Opiinae) در شمال ایران

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#### چکیده

در این مطالعه، فون گونه‌های جنس *Opius* Wesmael (Hymenoptera: Braconidae) در استان‌های شمالی ایران مورد بررسی قرار گرفت. حشرات بالغ زنبورها در طول سال‌های ۱۳۸۹ تا ۱۳۹۱ با استفاده از تله مالیز از زیستگاه‌های مختلف جمع‌آوری شدند. در مجموع، ۱۷ گونه متعلق به ۱۲ زیرجنس جمع‌آوری و شناسایی شدند که از این تعداد، شش گونه شامل *O. (Hypocynodus)*، *O. (Allotypus) saevus* Haliday, 1837، *Jarissa* Fischer, 1968، *O. (Misophthora) pulicariae (Merotrachys) schmidtii* Fischer, 1960، *O. (Thoracosema) repentinus* Papp, 1980، Fischer, 1969 و *O. (Nosopaeopus) ochrogaster* Wesmael, 1835 برای اولین بار از ایران گزارش می‌شوند. کلید شناسایی برای گونه‌های جمع‌آوری شده در این مطالعه تهیه شده است.