

# A survey on the tribes Phaeogenini and Platylabini (Ichneumonidae: Ichneumoninae) with two generic records for the fauna of Iran

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The tribes Phaeogenini Förster, 1869 and Platylabini Berthoumieu, 1904 (Hymenoptera: Ichneumonidae) were studied in Golestan province, Northeastern Iran, during 2015-2016. The specimens were collected using Malaise traps and sweeping nets. Totally, 8 species belonging to 6 genera were identified which among them, two genera including *Misetus* Wesmael, 1845 and *Stenodontus* Berthoumieu, 1897 from the tribe Phaeogenini were new records for the fauna of Iran. With this study, the number of Iranian recorded species of Phaeogenini increased to 24 (14 genera). An identification key to the collected genera of Phaeogenini is also provided. The descriptions of these new Iranian species of Phaeogenini, *Stenodontus marginellus*, *Stenodontus meridionator* and *Misetus oculatus* are provided along with morphological diagnostic characters for all of the collected species.

**Key words:** Hymenoptera, Iran, new records, fauna, *Misetus*, *Stenodontus*

## INTRODUCTION

The family Ichneumonidae is an extremely large insect family with 39 subfamilies and over 23000 described species worldwide (Quick, 2015). Among the subfamilies of the Ichneumonidae, the subfamily Ichneumoninae, with 4300 species, is ranked as the second largest one (Yu et al., 2016). Ichneumoninae members are pupal/larval-pupal endoparasitoids of Lepidopterans (Gauld & Bolton, 1988; Riedel & Aghadokht, 2017). The Phaeogenini Förster, 1869, with 32 genera and approximately 400 species, is a small tribe comprising nearly 10% of the species in the subfamily Ichneumoninae (Selfa & Diller, 1994; Yu et al., 2016; Rousse et al., 2013). The members of this tribe can be recognized with the circular spiracles on the propodeum as well as the usually flat scutellum which is at most partially carinate (Tereshkin, 2009). Like the remaining Ichneumoninae, the Phaeogenini are endoparasitoids of Lepidoptera (Rousse et al., 2013). According to Diller (1981), there are 6 subtribes in the Phaeogenini. In the past, the genus *Alomya* Panzer, 1806 was sometimes included in the Phaeogenini by some authors and the name of the tribe was changed into Alomyini (e.g. Selfa and Diller, 1994). Nowadays, the genus *Alomya* is placed in a separate subfamily, the Alomyinae. The Platylabini Berthoumieu, 1904 contains 37 genera and is especially characterized by the flattened first tergite. Other more or less typical characters are as follows: scutellum often carinate and convex, abdomen is amblypygous; long flagellum of females is bristle-shaped, usually

approximately as long as front wing or faintly shorter (Tereshkin, 2009). According to Barahoei et al. (2012), in the Phaeogenini 20 species belonging to 9 genera and in the Platylabini 6 species belonging to 3 genera have hitherto been recorded from Iran. Although studies on the fauna of parasitic hymenoptera of various regions are of great importance for effective pest control, there have been very few diagnostic studies on the fauna of Phaeogenini (Masnadi\_Yazdi and Jussila, 2008; Sarafi et al., 2015) and Platylabini (Shirzadegan et al., 2017; Shirzadegan et al., 2018) in Iran. The aim of this study is to improve our knowledge of this group of parasitoid wasps and to provide more information about the fauna of these two tribes in Golestan province, Northeastern Iran.

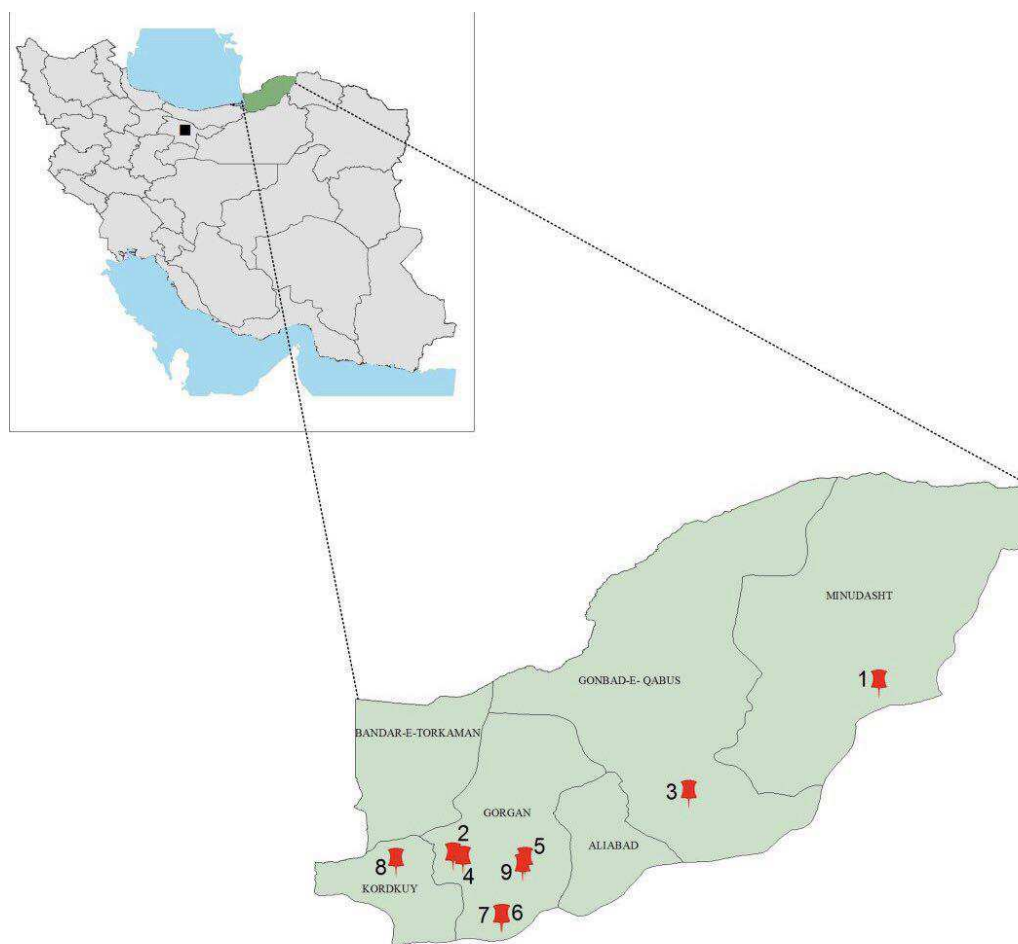
### MATERIAL AND METHODS

The ichneumonid wasps were collected using Malaise traps and a standard sweeping net at three climatic regions in Golestan province including forest, rangeland and garden ecosystems during 2015-2016. Totally, fifteen Malaise traps were run for two consecutive years (Table 1 and Figure 1). 70% ethanol was used as a preservative. The traps were set in a NW – SE direction with the collecting head towards the eastern Southeastern end. Co-workers serviced each trap throughout the period of flight activity twice in a month on average. The preparation and identification of specimens was carried out at the Zoologische Staatssammlung in Munich. The photographs of diagnostic characters were prepared at the state Museum of Natural History of Stuttgart with a KEYENCE (VHX- 5000) system. Terminology of the morphological characters followed Townes (1969) and Yu et al. (2016).

Examined specimens are deposited in Insect Museum of Ferdowsi University of Mashhad (IMFUM) and Insect Museum of Gorgan University (INGU).

**TABLE 1.** Localities of Malaise traps at Golestan province.

	Locality	No. of traps	Coordinate
<b>Forest</b>	Golestan forest	1	37°24'11.84"N55°47'38.70"E637m
	Ramian	1	37°01'01.27"N55°08'28.14"E219m
	Seid miran	1	36°47'50.47"N54°20'19.90"E158m
	Shas kola	2	36°47'22.06"N54°22'00.01"E242m
	Tuskestan	2	36°46'35.41"N54°34'59.11"E547m
<b>Rangeland</b>	Chahar bagh	2	36°36'00.47"N54°29'59.83"E2138m
	Haji kosh valley	2	36°35'25.46"N54°30'05.92"E2382m
<b>Orchard</b>	Kiwi orchard	2	36°47'06.78"N54°08'26.35"E13m
	Organic orchard	2	36°45'57.69"N54°34'31.40"E537m



**FIGURE 1.** Map of Malaise trap locations at Golestan Province. 1: Golestan forest; 2. Ramian; 3. Seid miran; 4. Shas kola; 5. Tuskestan; 6. Chahar bagh; 7. Haji kosh valley; 8. Kiwi orchard; 9. Organic orchard.

## RESULTS

Totally, eight species of Ichneumonids belonging to 6 genera were collected and identified which among them two genera and three species were new records for the fauna of Iran.

### Tribe Phaeogenini Förster, 1869

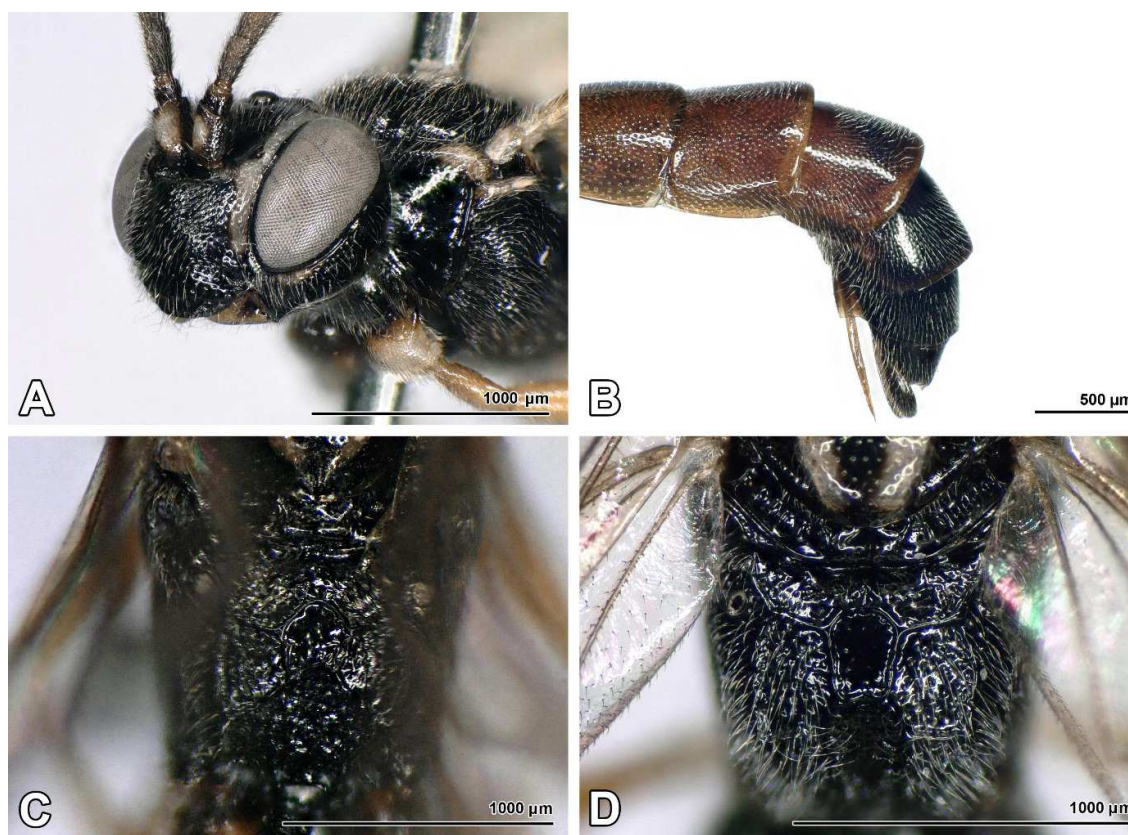
Five species belonging to five genera of Phaeogenini were collected and identified, of which two genera, *Misetus* Wesmael, 1845 and *Stenodontus* Berthoumieu, 1897, and 3 species were new for the fauna of Iran, which indicated by an asterisk (\*).

#### Genus *Stenodontus* Berthoumieu, 1897 (Figs 2A–D)\*

**Diagnosis:** Mandible with one tooth (Fig. 2A). Clypeus not separated from the face by a deep groove (Fig. 2A). Notauli hardly indented. Scutellum flat. Ovipositor short, hardly extending beyond apex of the gaster (Fig. 2B).

#### *Stenodontus marginellus* (Gravenhorst, 1829) (Fig. 2A, C) \*

**Material examined:** Iran, Golestan province, Tuskestan forest. 9-18 May 2015. 1 male.



**FIGURE 2.** *Stenodontus* spp.: A. *Stenodontus marginellus*, mandible, male; B. *Stenodontus meridionator*, gaster, lateral view, female; C. *Stenodontus marginellus*, propodeum, male; D. *Stenodontus meridionator*, propodeum, male.

**Diagnosis:** (male): Head smoothly shining; face punctated; black with lateral white lines. Clypeus not separated from the face by a groove, convex and punctate; mandibles with single tooth (Fig. 2A). Malar space shorter than base of mandible. Temple smoothly shining and weakly punctate. Genal carina meeting hypostomal carina far away from the base of the mandible. Flagellum 23-segmented; brownish red.

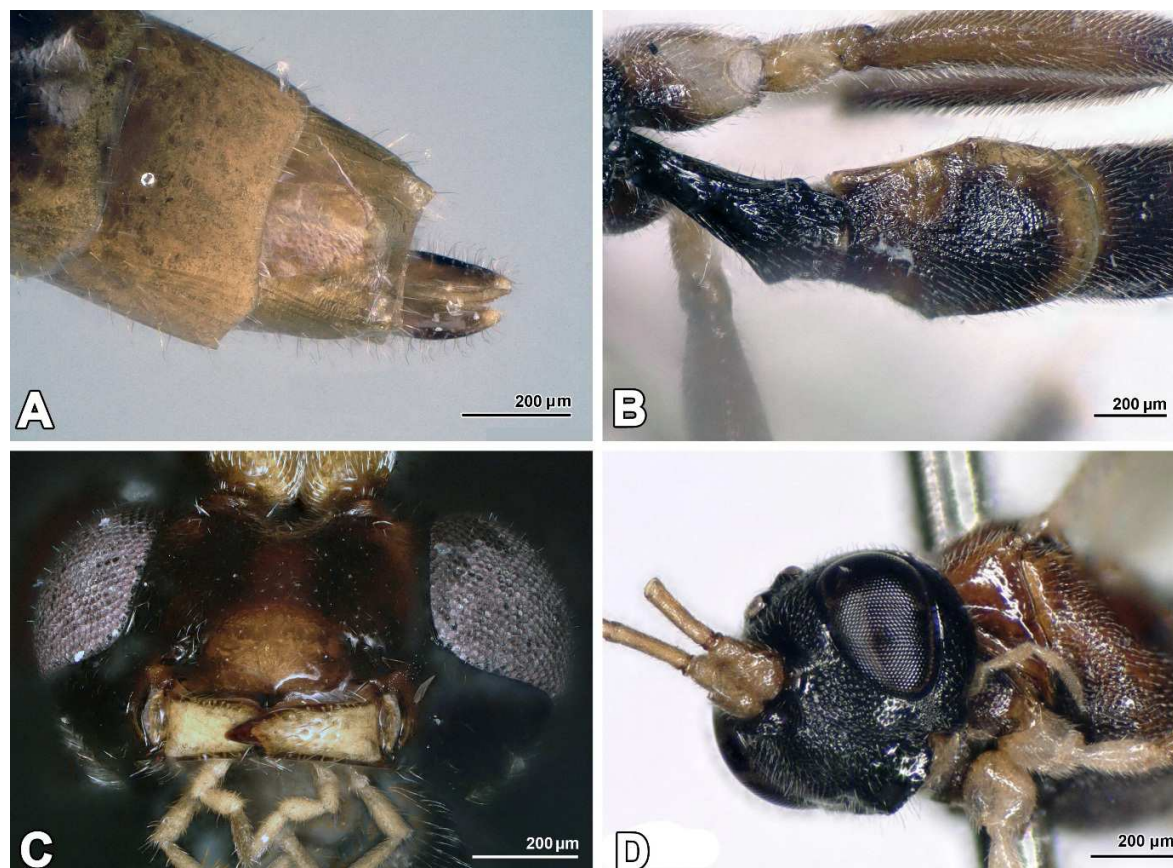
Thorax black. Pronotum shining and smooth. Mesoscutum smoothly shining and punctate. Notauli present. Scutellum black with two broad brownish yellow lateral lines; without lateral carina, weakly punctate. Mesopleura punctate. Specula smoothing shining. Sternauli absent. Fore wing with pentagonal areolet; nervellus of hind wing oppositus.

Propodeum shining, rounded. Area basalis present Area supermedia semi- oval and smoothly wrinkled (Fig. 2C). Costulae reaching about the middle of area supermedia. Area petiolaris almost limited by significant lateral carina, not concave and wrinkled. Area superoexternae punctate and smoothing wrinkled. Area dentipara smoothly wrinkled. Area spiraculifera wrinkled. Spiracle small, circle. Area metapleurales smooth. Legs punctate. Hind coxa larger than fore and middle coxa. Fore and middle coxa white; Hind coxa black and red.

Metasoma shining. The first tergite smooth and black; the rest of the tergites black with some yellow at apex. Postpetiolus without carina and strongly smooth. Thyridia present.

**General distribution:** Andorra; Bulgaria; France; Greece; Italy; Poland; Portugal; Romania; Spain; (Yu et al., 2016).





**FIGURE 3.** *Misetus oculatus* (A–C), and *Diadromus collaris* (D): A. Ovipositor; B. Dorsal view of first abdominal terga, male; C. Clypeus and mouth parts, ♀; D. Head, fronto-lateral view.

***Stenodontus meridionator* Aubert, 1959 (Fig. 2B, D)\***

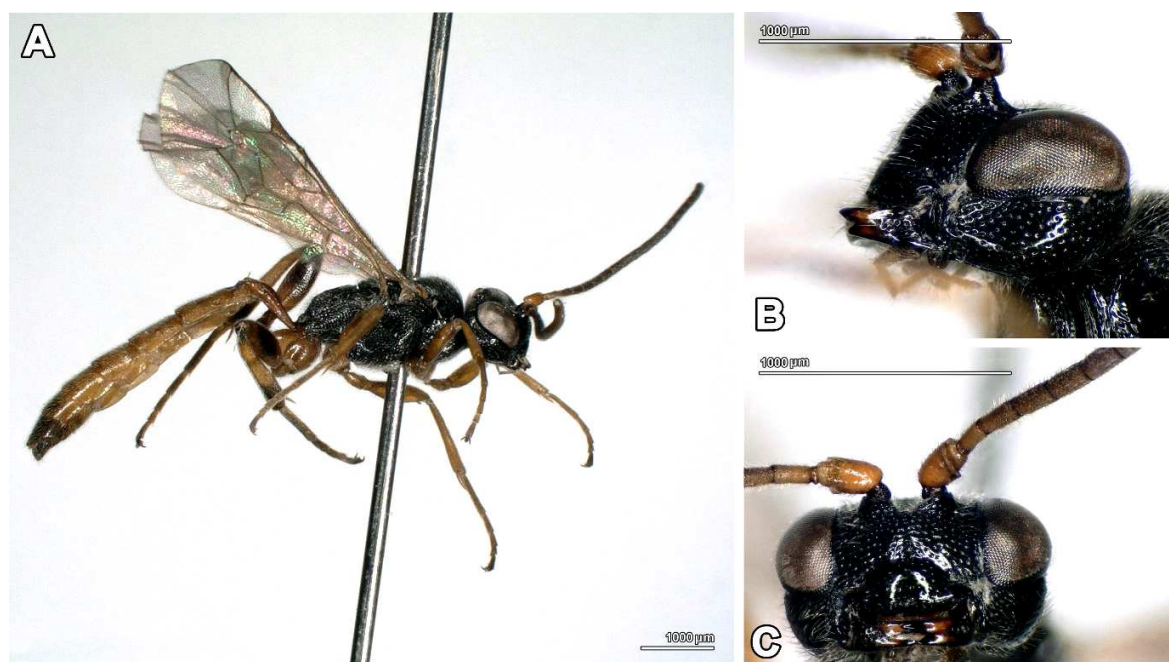
**Material examined:** Iran, Golestan province, Shastkola forest. 1-20.Sep.2015. 1 male, 4- 21 Jun.2016. 1 females, 4 Sept–06 Oct. 2016. 1 male.

**Female:**

**Diagnosis:** Head smoothly shining. Face punctate, black. Clypeus not separated from the face by a groove. Clypeus convex and scarcely punctate. Mandibles with one tooth, strongly slender on apex. Malar space as long as base of mandible. Vertex punctate. Temple punctate. Genal carina meeting hypostomal carina far away from the base of the mandible and below the mandible. Flagellum 21 segmented, black, white in the middle.

Thorax black. Pronotum strongly punctate. Pronotal collar long and shining. Mesoscutum shining, punctate. Notauli absent. Scutellum without lateral carina, weakly punctate, black with two broad red lateral lines. Mesopleura punctate. Speculum smoothly shining. Stermauli absent.

Propodeum shining. Area basalis exists. Area supermedia strongly smooth, length more than width. Costulae reaching about the middle of area supermedia. Area petiolaris not bounded by lateral carinae, shallowly concave, laterally wrinkled, in the middle weakly smooth. Area superoexteranae wrinkled. Area dentipara with transverse striate. Area spiraculifera strongly transversely striate and wrinkled. Spiracle small, circular area metapleurales punctate. Wings with areolet pentagonal. Nervellus of hind wing oppositus. Legs punctate. Hind coxa stronger than fore and middle coxa. Hind coxa black.



**FIGURE 4.** *Phaeogenes* sp. male: **A.** Adult male, lateral view; **B.** Head, lateral view; **C.** Head, anterior view.

Metasoma shining, Punctate. Tergites 2-4 red. Tergites 5-7 black. Postpetiolus convex, scarcely punctate, without carina. Thyridia present. Hypopygium not reaching the apex of the ovipositor (Fig. 2B).

#### **Male:**

Similar to female in general sculpture. Malar space shorter than base of mandible. 25- 26 flagellar segments, basal segments of flagellum longer. Antenna more slender than in the female. Area supermedia strongly smooth, length more than width (Fig. 2D). Face and middle coxa and trochanter white. Abdomen paler.

**General distribution:** Andorra; Bulgaria; France; Greece; Italy; Poland; Portugal; Romania; Spain (Yu et al., 2016).

#### **Genus *Misetus* Wesmael, 1845 (Fig. 3A-C)\***

**Diagnosis:** Ovipositor very curved upwards (Fig. 3A). Large thyridiae placed far from the base of the second tergite (Fig. 3B). Vertex without spots. Clypeus with a strong median apical tooth (Fig. 3C). Propodeum with a very small spiracles.

#### ***Misetus oculatus* Wesmael, 1845\***

**Material examined:** Iran, Golestan province, 16 -24 Apr.2015., 1 male, Tuskestan forest, 1- 11 Jun.2016., 1 female, Tuskestan- organic garden- near the forest, 22 Jun- 10 Jul.2016., 1 female.

#### **Female:**

**Diagnosis:** Head shining. Face brown and punctate. Vertex black. Clypeus yellowish brown, convex and smooth with a strong median tooth, not separated from the face by a groove. Median field of face convex. Mandibles with two teeth. Malar space longer than base of mandible. Vertex black and smooth. Temple weakly punctate. Genal carina meeting hypostomal carina at the base of the

mandible. Flagellum 27- 28 segmented. Segments 1, 2 and 3 elongate; 4 or 5 basal segments yellow, up to 9 or 10 segments white, the remaining segments black.

Pronotum shining and smooth. Pronotal collar long. Mesoscutum brown, weakly shining and punctate. Notauli strongly present. Scutellum without lateral carina. Mesopleur shining and striate. Speculum polished. Sternauli present. Prepectus and propleurum shining.

Propodeum black, weakly shining. Area basalis very short. Area supermedia elongate with length more than width. Costulae weakly present. Area petiolaris not bounded by lateral carinae, shallowly concave with transverse striate. Area superoxternae and Area dentipara wrinkled. Area spiraculifera punctate. Spiracle small, circular. Area metapleurales smooth anteriorly and irregularly striate posteriorly. Wings with areolet pentagonal. Nervellus of hind wing oppositus. Hind coxa larger than fore and middle coxa. Fore and middle coxa punctate. Hind coxa transversely striate. All coxae white.

Metasoma yellow and weakly shining; some tergites brownish. Postpetiolus striate. Thyridia present, placed far from the base of second tergite. The last gastral tergite at hind edge concave. Ovipositor very short and bent upward (Fig. 3A).

#### **Male:**

Similar to female in general sculpture and colour. Flagellum with 1- 2 segments less than male, basal segments longer than the rest. Prepectus and propleuron weakly shining. Area petiolaris weakly limited by lateral carina. Face brown with two white lateral lines. Flagellar segments reddish brown. The first tergite black and the rest brown.

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

#### **Genus *Diadromus* Wesmael, 1845**

**Diagnosis:** Mandible bidentate, triangular and evenly narrowed toward apex. Face transverse, wider than high. Clypeus distinctly transverse. Occipital carina complete, joining to hypostomal carina at mandibular base. Propodeum moderately short. Forewing with areolet pentagonal, closed, 3Rs-m non tubular and faintly pigmented (Rousse et al., 2013).

#### ***Diadromus collaris* (Gravenhorst, 1829) (Fig. 3D)**

**Material examined:** Iran, Golestan province, chaharbagh rangelands, 11- 30 Jun. 2016, 2 males.

**Diagnosis:** Head black, body reddish-orange, mesosoma black apically, base and apex of metasoma black. Clypeus smooth, convex and the ridge with a small  $\Lambda$ - shaped excision centrally. Antennae with 23-30 flagellomeres, slightly widened from basal third. Mesosoma totally polished and moderately setose, Scutellum carinate to mid length.

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

#### **Genus *Phaeogenes* Wesmael, 1845**

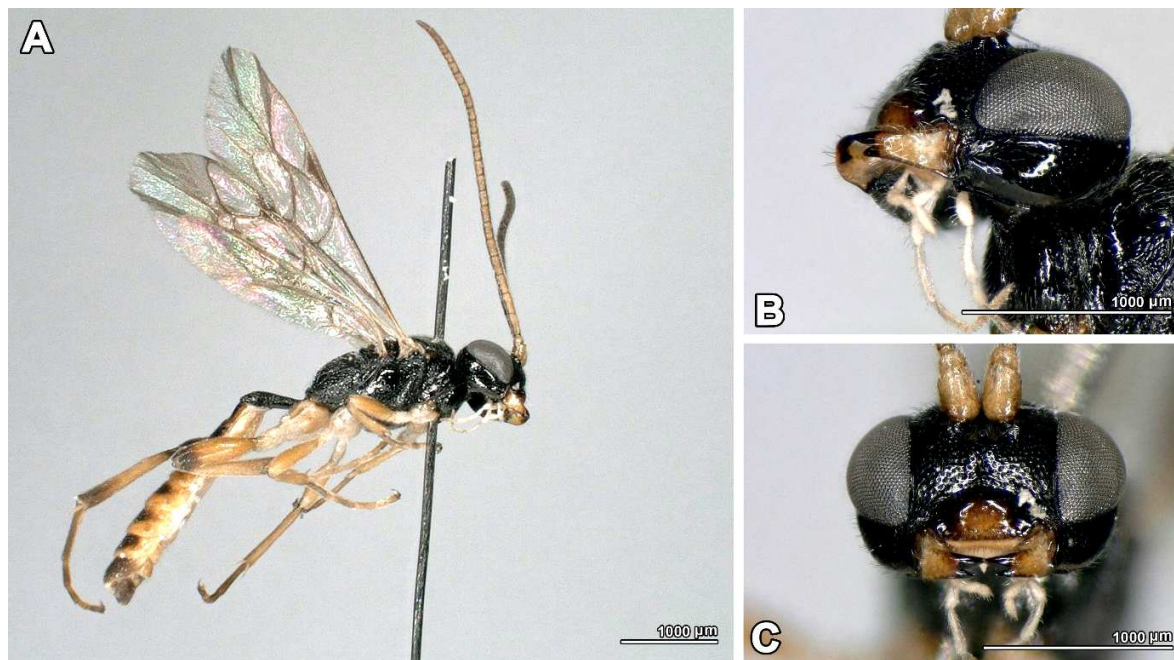
##### ***Phaeogenes* sp. (Fig 4A–C)**

**Material examined:** Iran, Golestan province, Tukestan forest, 7-15 Jun 2015, 1 male.

**Diagnosis:** Vein 3rm present. Clypeus separated from face, apex of clypeus not concave, apical edge of clypeus very thick and coarsely punctate, mandibles broad (Fig. 4C). Rounded apophysis distinct at the apex of the genal carina under the mandibular base (Fig. 4B).

**General distribution:** Nearctic, oriental and palaeartic regions (Yu et al., 2016).





**Figure 5.** *Tycherus* sp. male: A. Adult male, lateral view; B. Head, lateral view; C. Head, anterior view.

**Genus *Tycherus* Forster, 1869** (Fig. 5A–C)

*Tycherus* sp. (Fig. 5A–C)

**Material examined:** Iran, Golestan province, Tukestan forest, 12 Aug.-1 Sep. 2015, 1 male; Sakht kola forest, 4 Sep.- 6 Oct. 2016, 1 male.

**Diagnosis: (male):** Vein 3<sub>rm</sub> present. Clypeus separated from face, apex of clypeus not concave, apical edge of clypeus almost thick, and smooth or almost smooth, rarely puctate but not coarsely. (Fig. 5C). No apophysis at the apex of the genal carina, at most with a small tooth at the apex of the genal carina under mandibular base (Fig. 5B).

**Tribe Platylabini Berthoumieu, 1904**

One Genus and two species from the tribe Platylabini was collected and identified. *Apaeleticus bellicosus* Wesmael, 1848 and *Apaeleticus inimicus* (Gravenhorst, 1820) were previously recorded from Lorestan province and these are first records of these species from Golestan province.

**Genus *Apaeleticus* Wesmael, 1845**

**Diagnosis:** Head narrowing posteriorly. Small specimens with circular or roundish spiracles on the propodeum. Upper mandibular tooth distinctly longer than lower tooth. Middle field of face convex. Thorax densely punctate. Scutellum convex. Sternauli strong. Propodeum with irregularly wrinkled sculpture and with well-developed teeth (Fig. 7A). Area superomedia pentagonal. Thyridia present. Apex of abdomen of ♀ blunt (Fig. 7B).



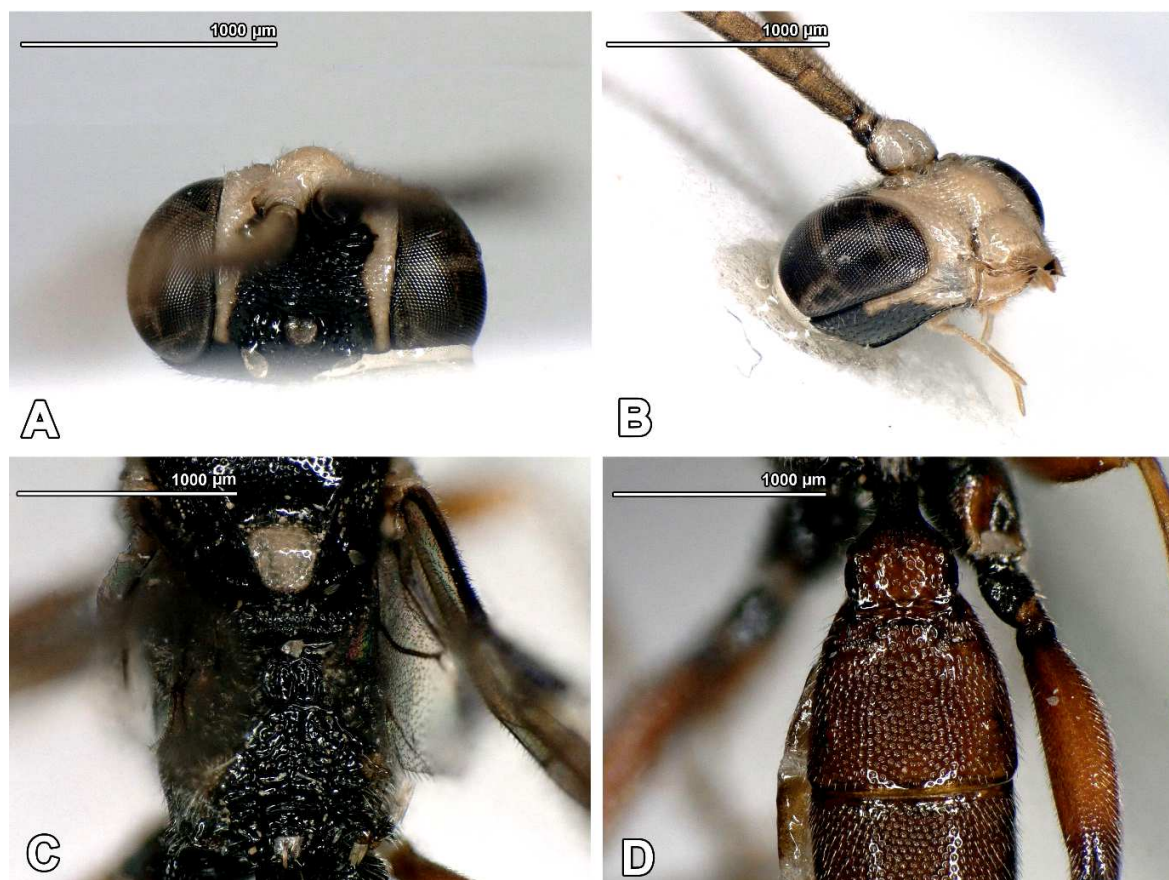


FIGURE 6. *Apaeleticus bellicosus* male: **A.** Head, dorsal view; **B.** Head, fronto-lateral view; **C.** Propodeum, dorsal view; **D.** Petiole and gaster, Dorsal view.

***Apaeleticus bellicosus* Wesmael, 1848** (Fig. 6A-D)

**Material examined:** Iran, Golestan province, Chaharbagh rangelands, 15 Jul- 5 Aug. 2016, 1 male.

**Diagnosis: (male):** Face punctate and white. Clypeus separated from median field by a groove. Clypeus convex. Median field strongly convex (Fig. 6B). Vertex punctate with white lateral lines (Fig. 6A). Flagellum Bristle- shaped (Fig. 6B). Scutellum white with lateral carina, area supermedia short, width more than length with strong striate (Fig. 6C). Postpetiolus convex and punctate, Apex of tergite 2 broader than base and punctate, Thyridia present (Fig. 6D).

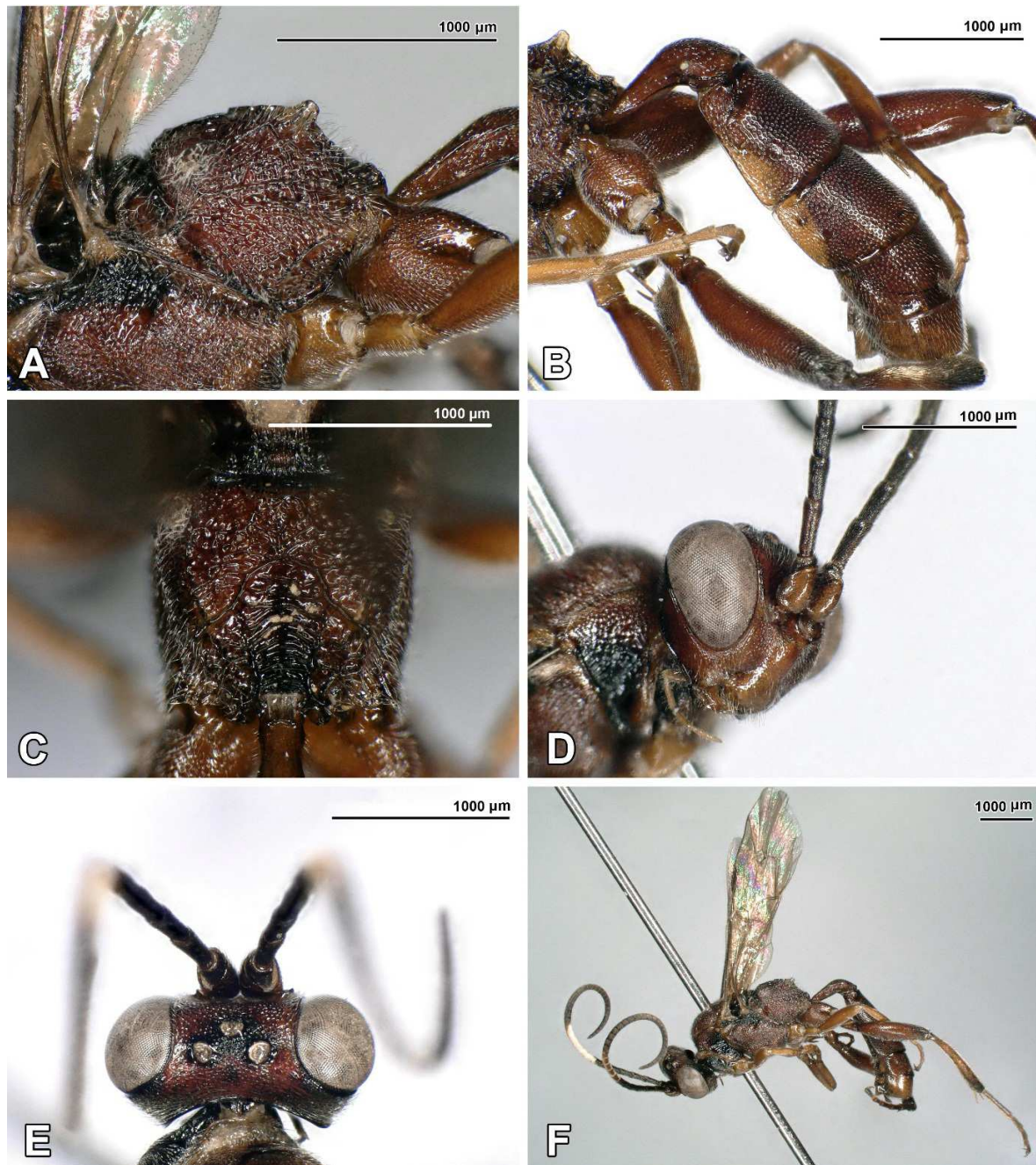
**General distribution:** Western palaeartic region (Yu et al., 2016).

***Apaeleticus inimicus* (Gravenhorst, 1820)** (Fig. 7A-F)

**Material examined:** Iran, Golestan province, Tuskestan- organic garden- near the forest, 18 Aug- 12.Sep.2016., 1 female.

**Diagnosis:** Face punctate. Clypeus convex. Median field strongly convex (Fig.7D). Face red (Fig. 7 D). Vertex black and red (Fig. 7E). Flagellum 35 segments, black and six segments of flagella in middle with white spot (Fig. 7F). Propodeum Strongly transverse striate with developed teeth, area Supermedia wrinkled, longer than broad (Fig.7A, C). Thyridia distinctly present, Tergites 6 and 7 hidden under fifth tergite. Apex of tergite 5 blunt (Fig. 7 B).

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



**FIGURE 7.** *Apaeleticus inimicus*, ♀: A. Propodeum and metapleuron, lateral view; B. Petiole and gaster, lateral view; C. Propodeum, dorsal view; D. Head, fronto-lateral view; E. Head, Dorsal view; F. Adult female, lateral view.

#### DISCUSSION

As an enormous country in Southwest Asia, Iran is an area with special significance linking the Palearctic, Oriental, and Afrotropical regions (Abivardi 2001); hence, it is one of the most fascinating countries to investigate the diversity as well as taxonomy of various insect orders including Hymenoptera.

Currently, 32 genera of Phaeogenini have been reported all around the world of which 23 have been reported from Palearctic region (Yu et al., 2016). 11 genera and 18 species of this tribe were previously reported from Iran (Barahoei et al., 2012).

In the current study, the genus *Stenodontus* is recorded from Iran for the first time. *Stenodontus marginellus* is previously reported from Europe (Andorra; Austria; Belgium; Bulgaria; Czechoslovakia; Denmark; Finland; France; Germany; Greece; Hungary; Ireland; Italy; Lithuania; Netherlands; Norway; Poland; Romania; Russia; Scotland, Spain; Sweden, Switzerland; United Kingdom) and Asia (Japan) (Diller & Shaw, 2014; Yu et al., 2016).

The species *Stenodontus meridionator* previously reported from Europe (Andorra; Bulgaria; France; France-Corsica; France-main; Greece; Italy; Poland; Portugal; Romania and Spain) (Selfa & Anento, 1998; Yu et al., 2016), but not from Asia. Hence, this is the first record of this species from this region.

The genus *Misetus* is firstly recorded from Iran, in this study. *Misetus oculatus* was previously reported from Europe (Austria; Belgium; Bulgaria; Czech Republic; Czech Republic; Slovakia; Finland; France; Germany; Ireland; Italy; Latvia; Netherlands; Norway; Poland; Romania; Russia; Spain; Sweden and United Kingdom) (Yu et al., 2016). Hence, this is the first record of this species from Asia.

Until now, four species of the genus *Diadromus* have been reported from Iran. The species *Diadromus collaris* had been previously recorded from Golestan and Semnan Provinces (Barahoei et al., 2012). The species was collected in this study from Golestan province, either.

*Apaeticus bellicosus* has been reported from Europe (Belarus; Belgium; Bulgaria; Croatia; Finland; France; Germany; Ireland; Italy; Latvia; Netherlands; Poland; Portugal; Romania; Russia; Russia-Novgorod Oblast; Russia-Sankt Petersburg; Spain; Turkey; Ukraine; United Kingdom; Serbia). This species had been reported from Lorestan province (Ghahari & Gadallah, 2015), so, this is the first record of the species from Golestan province.

The tribe Platylabini includes 38 genera of which 19 have been recorded from Palearctic region (Yu et al., 2016). 4 genera and 7 species of the tribe previously reported from Iran (Barahoui et al., 2012).

*Apaeticus inimicus* has previously been reported from Europe (Andorra; Belgium; Bulgaria; Croatia; Czech Republic, Slovakia; Finland; France; Germany; Hungary; Italy; Madeira Islands; Netherlands; Poland; Romania; Russia; Spain; Sweden; Switzerland; United Kingdom and Serbia) (Yu et al., 2016) and also from Iran.

Currently, the number of Iranian Ichneumonine species is 207 (Yu et al., 2016; Riedel & Aghadokht, 2017). Considering this publication, the number of Ichneumoninae of Iran is increased to 210, which is in congruous with adjacent countries such as Turkey with 218 Ichneumoninae species (Yu et al., 2016). However, considering the size, landscape richness and botanical diversity of Iran as well as its rich fauna of Lepidoptera, there is very chance that further species will be discovered (Riedel & Aghadokht, 2017); hence, further studies, in particular targeted field work, in different parts of Iran are requisite to enhance our knowledge on the taxonomy and biogeography of the Iranian Ichneumonine.

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