A contribution to the knowledge of Euphorinae (Hymenoptera: Braconidae), with six new records from Iran

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Abstract

A survey was conducted for identification of Euphorinae (Hymenoptera: Braconidae) in the northern provinces of Iran. The specimens were collected using Malaise traps during 2010-2011. In all, 9 species in four genera consisting of *Allurus* Förster, *Dinocampus* Förster, *Peristenus* Nees and *Perilitus* Nees were collected and identified. The genus *Allurus* is recorded for the first time from Iran. Six species are newly recorded for the Iranian fauna including *Allurus muricatus* (Haliday), *Peristenus pallipes* Curtis, *Peristenus relictus* (Ruthe), *Perilitus* (*Townesilitus*) *bicolor* (Wesmael), *Perilitus foveolatus* Reinhard and *Perilitus rutilus* (Nees). Morphological diagnostic characters and geographical distribution of the species are briefly discussed. A key is presented for identification of the genera and species in the studied area.

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Key words: Braconidae, Euphorinae, first records, Iran.

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Introduction

Euphorinae Förster, 1862 (Hymenoptera: Braconidae) is a rather large cosmopolitan subfamily of braconid wasps (van Achterberg & Quicke, 2000). This subfamily comprises 55 genera worldwide of which 30 genera were found in the Palaearctic region (Tobias, 1995; Yu *et al.*, 2012). van Achterberg (1994) recognized four tribes in this subfamily (Euphorini, Cosmophorini, Centistini, Meteorini), while Yu *et al.* (2012) listed 15 tribes (Centistini, Cosmophorini, Cryptoxilonini, Dinocampini, Euphorini, Helorimorphini, Mannokeraiini, Meteorini, Myiocephalini, Neoneurini, Oncometeorini, Perilitini, Proclithrophorini, Syntretini, and Tainitermini). A wide range of morphological variability within the subfamily Euphorinae, allow them to parasitize very different orders of insects including Coleoptera, Hemiptera, Psocoptera, Hymenoptera, Neuroptera and Orthoptera (Shaw & Huddleston, 1991). Members of Euphorinae develop as solitary or gregarious endoparasitoids on larvae and adults of other insects (Shaw & Huddleston, 1991; Belokobylskij, 2000b). This subfamily is readily recognizable by the following characters: having two submarginal cells in the forewing, first metasomal tergite distinctly petiolate (van Achterberg, 1993; Shaw & Huddleston, 1991), spiracles of first metasomal tergite usually located medially or behind middle of the tergite, vein CUlb of forewing absent or nearly so (van Achterberg, 1993).

The taxonomy of the subfamily Euphorinae was studied by various authors (Loan, 1974; Shaw, 1985, 1996; Belokobylskij, 1992; van Achterberg, 1994; Chen & van Achterberg, 1997; Haeselbarth, 1988, 1998, 1999; van Achterberg and Quicke, 2000; Shaw & Marsh, 2000; Belokobylskij, 2000b; van Achterberg & Haeselbarth, 2003; Boring, 2010; Stigenberg & Ronquist, 2011). Comparatively, a considerable amount of data have been published about the biology of Euphorinae (Loan, 1983; Chen & van Achterberg, 1997; Belokobylskij, 2000b; Maetô, 1988, 1990; Papp, 1994; Zijp & Blommers, 2002; Waloff, 1967; Phillips & Baird, 2001; Bilewicz-Pawinska, 1990).

The north of Iran is characterized by two different ecological zones that are separated by the Alborz Mountains: Hyrcanian (Caspian) (Figure 1) and Iran-o-Turanian zones. The Hyrcanian zone includes Alborz range forest steppe, Caspian mixed forest and Caspian lowland desert. The Iran-o-Turanian zone includes both mountains and plain areas dominated by a desert climate and a hot summer. These zones form diverse and vast regions of mountain, lush irrigated lowlands, wetland and desert with a great biodiversity, which is associated with the diverse flora, topographical irregularity and the xeric landscapes (Heshmati, 2007).

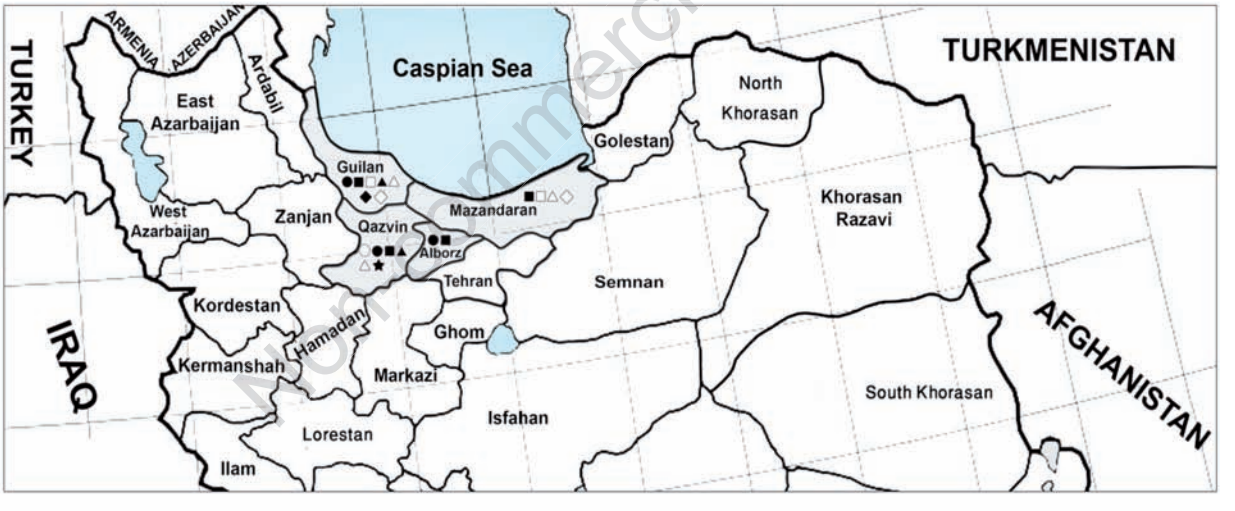
The subfamily Euphorinae in Iran is very poorly studied. Seven tribes and 20 species are listed (as genus-species) from Centistini (1-1), Dinocampini (1-1), Euphorini (3-5), Meteorini (2-6), Neoneurini (1-1), Perilitini (2-4) and Syntretini (1-2) (Fallahzadeh & Saghaei, 2010; Ghahari *et al*., 2009a, 2009b, 2010; Ghahari & Fischer, 2011;

Lashkari-Bod *et al*., 2011; Farahani *et al*., 2012). The objective of this study was to determine the species of the subfamily Euphorinae, as a primary step to understand the situation of this large and diverse group of insects in northern provinces of Iran and to provide a reference collection at Tarbiat Modares University.

Materials and methods

The present study was carried out in four northern provinces including, Guilan, Mazandaran, Alborz and Qazvin provinces. The specimens were collected using 32 Malaise traps; 16 traps were set up in northern slopes and 16 traps in southern slopes of the Alborz Mountains in both ecosystems, during 2010 and 2011 (Figure 2). The specimens were extracted from the Malaise traps and sorted weekly. They were then treated with 70% ethanol and finally placed on a paper plate for drying. The dried specimens were then mounted on triangular papers and labeled. The external morphology of specimens were studied using an Olympus SZX9 stereomicroscope. Identifications were performed based on Loan (1974), Tobias (1995) and Haeselbarth (1999). Illustrations were taken using an Olympus SZX9 stereomicroscope and Olympus AX70 microscope equipped with a Sony CCD digital camera. Morphological terminology follows van Achterberg (1993). All the materials were deposited in the insect collection of the Department of Entomology, Tarbiat Modares University, Tehran.

Figure 1. Habitats of Guilan province located in the northern slopes of the Alborz Mountain.



- ○ ***Allurus muricatus* (Haliday, 1833):** Qazvin province.
- ● ***Dinocampus coccinellae* (Schrank, 1802):** Alborz, Guilan and Qazvin provinces.
- ■ ***Perilitus aethiops* Nees, 1834:** Alborz, Guilan, Mazandaran and Qazvin provinces.
- □ ***Perilitus bicolor* (Wesmael 1835):** Guilan and Mazandaran provinces.
- ▲ ***Perilitus foveolatus* Reinhard 1862:** Guilan and Qazvin provinces.
- △ ***Perilitus rutilus* (Nees, 1811):** Guilan, Mazandaran and Qazvin provinces.
- ◆ ***Perilitus stelleri* (Loan, 1972):** Guilan province.
- ◇ ***Peristenus pallipes* Curtis, 1833:** Guilan and Mazandaran provinces.
- ★ ***Peristenus relictus* (Ruthe, 1856):** Qazvin province.

Figure 2. Iran-Alborz, Qazvin, Guilan and Mazandaran provinces, where the Euphorinae species were collected by Malaise trap.

Results

Four genera including nine species of Euphorinae (Hym.: Braconidae) were collected and identified from northern Iran. They include three previously reported species, *Perilitus aethiops* Nees, *Perilitus stelleri* (Loan) and *Dinocampus coccinellae* (Schrank), and six newly recorded species for the Iranian fauna, *Allurus muricatus* Haliday, *Peristenus pallipes* Curtis, *Peristenus relictus* (Ruthe), *Perilitus* (*Townesilitus*) *bicolor* (Wesmael), *Perilitus foveolatus* Reinhard, *Perilitus rutilus* (Nees), which are marked with an asterisk in the text.

***Allurus muricatus* (Haliday, 1833)** (Figures 3A-3E)

SYNONYMS: *Ancylus muricatus* Haliday, 1833; *Leiophron* (*Ancylus*) *muricatus* Haliday, 1835; *Leiophron muricatus* Reinhard, 1862; *Liophron muricatus* Marshall, 1872; *Centistes muricatus* Rudow, 1918; *Centistes* (*Allurus*) *muricatus* Hellen, 1958; *Allurus muricatus* Forster, 1862; *Leiophron armatus* Wesmael, 1835.

MATERIAL EXAMINED: Qazvin province, Zereshk road (36°21'39.72"N, 50°03'55.26"E, 1541 m a.s.l.), 24.5.2011, 1♀; 08.6.2011, 3♀; 21.6.2011, 1♂, leg. A. Nadimi.

DIAGNOSTIC CHARACTERS (FEMALE): Length of body 2.5-3.0 mm; antennae 30-31 segmented; length of fore wing 2.3-2.9 mm; pterostigma slightly shorter than vein 1-R1 (about 0.9×); marginal cell long; vein M+CU1 unsclerotized; 1-SR+M and 2-SR+M of fore wing present (Figure 3B); first abdominal tergite sessile; third abdominal sternite with 2 denticles (Figure 3C); hind coax with a large denticle (Figure 3D); claws cleft (Figure 3E).

COLORATION: Antennae dark brown; head, thorax and first abdominal tergite black; second and third abdominal tergites reddish brown but reminder tergites black; legs reddish brown.

GENERAL DISTRIBUTION: Europe, Eastern and Western Palaearctic (Yu *et al*., 2012). New record from Iran.

***Dinocampus coccinellae* (Schrank, 1802) (Figures 4A, 4B)**

SYNONYMS: *Dinocampus americanus* (Riley, 1888); *Dinocampus sculptus* (Cresson, 1872); *Dinocampus terminatus* (Nees, 1811).

MATERIAL EXAMINED: Alborz province, Shahriar (35°40'08.01"N, 50°56'56.64"E, 1168 m a.s.l.), 10.9.2010, 1♀; Guilan province, Roodsar, Orkom (36°45'44.34"N, 50°18'11.88"E, 1201 m a.s.l.), 24.10.2010, 1♀; Qazvin province, Zereshk road (36°21'39.72"N, 50°03'55.26"E, 1541 m a.s.l.), 09.5.2011, 1♀; leg. A. Mohammadi.

DIAGNOSTIC CHARACTERS (FEMALE): Length of body 4.0 mm; antennae 22-23 segmented; length of fore wing 3.2 mm; pterostigma longer than vein 1-R1 (1.5×); marginal cell short; vein M+CU1 sclerotized; 1-SR+M and 2-SR+M of fore wing present (Figure 4B); first abdominal tergite sessile; dorsope and laterope absent; ovipositor slender, about as long as first abdominal tergite; claws simple.

COLORATION: Antennae dark brown; head and fore legs reddish brown; thorax, first abdominal tergite, middle and hind legs black.

GENERAL DISTRIBUTION: Australasian, Europe, Nearectic, Neotropical, Oceanic, Oriental, Eastern and Western Palaearctic (Yu *et al*., 2012).

REMARKS: *Dinocampus* is small cosmopolitan genus with one species in the Palaearctic region, *e.g. D. coccinellae* (Chen & van Achterberg, 1997).

***Perilitus aethiops* Nees, 1834** (Figures 5A, 6A, 7A, 8A)

SYNONYMS: *Perilitus aethiopoides* (Loan, 1975); *Perilitus brevispina* (Thomson, 1892); *Perilitus spurius* (Ruthe, 1856).

MATERIAL EXAMINED: Alborz province, Chalous Road, Shahrestanak (35°58'16.26"N, 51°21'25.80"E, 2225 m a.s.l.), 17.5.2010, 1♀; 13.6.2010, 1♂; 21.6.2010, 1♂; Guilan province, Roodsar, Ghazichak (36°45'57.54"N, 50°19'35.22"E, 1803 m a.s.l.), 16.5.2010, 1♂; 23.5.2010, 2♂; 06.6.2010, 1♀; 13.6.2010, 2♀, 1♂; 21.6.2010, 1♀; 27.6.2010, 2♀, 1♂; 05.7.2010, 2♀, 1♂; 24.7.2010, 1♀; 01.8.2010, 2♀; 15.8.2010, 1♀; 21.8.2010, 2♀, 1♂; 03.10.2010, 1♀, 1♂; 10.10.2010, 3♂; 17.10.2010, 1♀, 3♂; 24.10.2010, 2♂; Guilan province, Roodsar, Orkom (36°45'44.34"N, 50°18'11.88"E, 1201 m a.s.l.), 23.5.2010, 1♀; 05.7.2010, 1♀; 24.10.2010, 2♀; 31.10.2010, 1♂; Mazandaran province, Noor, Gaznasara (36°21'55.02"N, 52°06'10.74"E, 692 m a.s.l.), 06.6.2011, 1♀; 15.8.2011, 1♀; 04.9.2011, 1♂; Qazvin province, Zereshk road (36°21'39.72"N, 50°03'55.26"E, 1541 m a.s.l.), 24.5.2011, 2♀; 3♂; 08.6.2011, 1♀, 2♂; 21.6.2011, 2♂; leg. M. Khayrandish.

DIAGNOSTIC CHARACTERS (FEMALE): Length of body 1.9-3.0 mm; antennae 19-24 segmented, first flagellar segment 2.5× as long as wide (Figure 7A), second flagellar segment 2.0× as long as wide; face 1.3× wider than height (Figure 6A); length of fore wing 2.0-2.5 mm; pterostigma longer than vein 1-R1 (2.0×); marginal cell short; vein M+CU1 sclerotized; 1-SR+M and 2-SR+M of fore wing absent (Figure 8A); first abdominal tergite petiolate, its length about 1.8× as long as apical width; ovipositor slender and equal or longer than first abdominal tergite; claws simple.

COLORATION: Antennae dark brown; head reddish brown, thorax and first abdominal tergite dark brown, occasionally reddish brown; legs reddish brown.

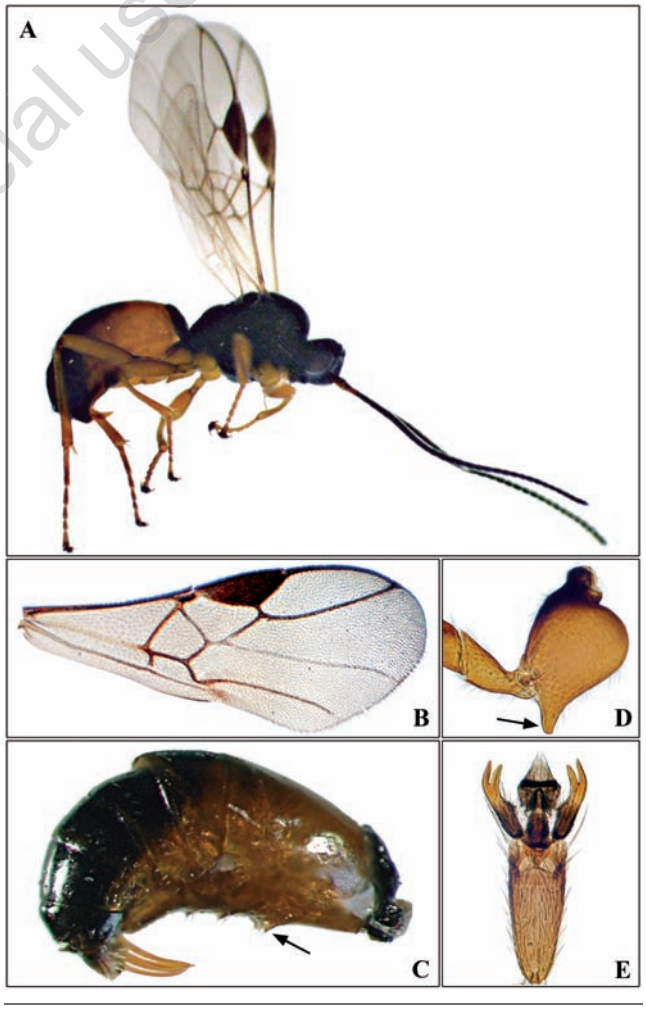


Figure 3. ***Allurus muricatus*** **(Haliday, 1833), female: (A) lateral habitus; (B) fore wing; (C) abdomen (arrow); (D) hind coxa (arrow); (E) claw.**

GENERAL DISTRIBUTION: Ethiopian, Europe, Nearctic (introduced), Oriental, Eastern and Western Palaearctic (Yu *et al.*, 2012).

REMARKS: This species seems to be nearest to *P. stelleri*, a form that can be distinguished by the apical width of the first abdominal tergite in the female (0.27-0.32) and width of the pterostigma (0.15-0.18), while the width of the first abdominal tergite (0.30-0.43) and the width of the pterostigma (0.18-0.24) of the female in *P. stelleri* are relatively longer (Tobias, 1995).

***Perilitus* (*Townesilitus*) *bicolor* (Wesmael 1835)** (Figures 5B, 6B, 7B, 8B)

SYNONYMS: *Perilitus* (*Townesilitus*) *breviradialis* (Tobias, 1976).

MATERIAL EXAMINED: Guilan province, Roodsar, Ghazichak (36°45'57.54"N, 50°19'35.22"E, 1803 m a.s.l.), 04.7.2010, 1♀; 10.7.2010, 1♀; Guilan province, Roodsar, Orkom (36°45'44.34"N, 50°18'11.88"E, 1201 m a.s.l.), 16.5.2010, Mazandaran province, Noor, Gaznasara (36°21'55.02"N, 52°06'10.74"E, 692 m a.s.l.), 09.10.2011, 1♀; 1♀; leg. A. Nadimi.

DIAGNOSTIC CHARACTERS (FEMALE): Length of body 1.8-2.2 mm; antennae 18-21 segmented, flagellum long and slender, first flagellar segment 4.0-5.0× as long as wide (Figure 7B), second flagellar segment 4.0× as long as wide; face 1.1× wider than height (Figure 6B); length of fore wing 1.5-2.0 mm; pterostigma longer than vein 1-R1 (2.0×); marginal cell short; vein M+CU1 sclerotized; 1-SR+M and 2-SR+M of fore wing absent (Figure 8B); first abdominal tergite petiolate, its length about 3.0× as long as apical width; ovipositor slender and longer than first abdominal tergite; claws simple.

COLORATION: Antennae dark brown (basal of flagellum yellowish); head, thorax and first abdominal tergite reddish brown, occasionally dorsal part of thorax black; legs reddish brown.

GENERAL DISTRIBUTION: Europe, Eastern and Western Palaearctic (Yu *et al*., 2012). New record from Iran.

REMARKS: This species is easily recognized by the length of the first and second flagellar segment compared to their width, and antennae 18-21-segmented in the female (Tobias, 1995).

***Perilitus foveolatus* Reinhard 1862** (Figures 5C, 6C, 7C, 8C)

SYNONYMS: *Perilitus sicheli* Giard, 1895.

MATERIAL EXAMINED: Guilan province, Roodsar, Orkom (36°45'44.34"N, 50°18'11.88"E, 1201 m a.s.l.), 03.10.2010, 1♀; 17.10.2010, 1♀; Guilan province, Roodsar, Ziaz (36°52'27.18"N, 50°13'24.78"E, 490 m a.s.l.), 30.5.2010, 1♀; Guilan province, Roodsar, Ghazichak (36°45'57.54"N, 50°19'35.22"E, 1803 m a.s.l.), 17.10.2010, 1♀; Qazvin province, Zereshk road (36°21'39.72"N, 50°03'55.26"E, 1541 m a.s.l.), 24.5.2011, 12♀, 1♂; 08.6.2011, 1♀; leg. M. Khayrandish.

DIAGNOSTIC CHARACTERS (FEMALE): Length of body 2.5-3.0 mm; antennae 22-23 segmented, first flagellar segment 3.5× as long as wide (Figure 7C), longer than second flagellar segment (1.2×); face 1.1× wider than height (Figure 6C); length of fore wing 2.2-2.5 mm; pterostigma longer than vein 1-R1 (2×); marginal cell short; vein M+CU1 sclerotized; 1-SR+M of fore wing present and 2-SR+M absent (Figure 8C); apical area between notaulices distinctly punctuate; first abdominal tergite petiolate, its length about 1.9× as long as apical width; ovipositor slender and longer than first abdominal tergite; claws simple.

COLORATION: Antennae very dark brown; head lighter than thorax and reddish brown; thorax and first abdominal tergite black; legs reddish brown.

GENERAL DISTRIBUTION: Europe, Eastern and Western Palaearctic (Yu *et al.*, 2012).

REMARKS: This species seems to be nearest to *P. cornelii* Haeselearth from which it can be recognized by length of ovipositor sheath, which is shorter than the hind tibia (Haeselbarth, 1999).

***Perilitus rutilus* (Nees, 1811)** (Figures 5D, 6D, 7D, 8D)

SYNONYMS: *Perilitus luteus* Herrich-Schaffer, 1838; *Perilitus pyri* (Viereck, 1917); *Perilitus ruralis* Herrich-Schaffer, 1838; *Perilitus strenuus* Marshall, 1887; *Perilitus tuberculus* Zaykov, 1981.

MATERIAL EXAMINED: Guilan province, Roodsar, Orkom (36°45'44.34"N, 50°18'11.88"E, 1201 m a.s.l.), 06.6.2010, 2♂; 13.6.2010, 3♂; 21.6.2010, 1♀; 05.7.2010, 1♀; Guilan province, Roodsar, Ziaz (36°52'27.18"N, 50°13'24.78"E, 490 m a.s.l.), 23.5.2010, 1♂; 06.6.2010, 1♀; Mazandaran province, Noor, Gaznasara (36°21'55.02"N, 52°06'10.74"E, 692 m a.s.l.), 27.6.2011, 1♂; Qazvin province, Zereshk road (36°21'39.72"N, 50°03'55.26"E, 1541 m a.s.l.), 24.5.2011, 2♂; 08.6.2011, 4♀, 17♂; 21.6.2011, 4♀, 4♂; leg. M. Khayrandish.

DIAGNOSTIC CHARACTERS (FEMALE): Length of body 2.5-3.0 mm; antennae 25-26 segmented, first flagellar segment 4.0× as long as wide (Figure 7D), first flagellar segment as long as or slightly shorter than second segment; face 1.4× wider than height (Figure 6D); length of fore wing 2.2-2.5 mm; pterostigma longer than vein 1-R1 (1.3×); marginal cell short and pointed apically; vein M+CU1 sclerotized; 1-SR+M of fore wing present and 2-SR+M absent (Figure 8D); first abdominal tergite petiolate, its length about 2.5× as long as apical width; ovipositor slender and longer than first abdominal tergite; posterior area of hind coxa distinctly transverse striate; claws simple.

COLORATION: Antennae dark brown, occasionally basal segments of antennae lighter; body yellowish brown; propodeum black; first abdominal tergite at the base pale; legs yellowish brown.

GENERAL DISTRIBUTION: Europe, Nearctic (introduced), Eastern and Western Palaearctic (Yu *et al*., 2012).

REMARKS: This species is taxonomically similar to *P. longiradialis*, from which it can be separated by the basal felagellar segments, which are thin and yellowish; antennae 23-27-segmented (28-segmented in *P. longiradialis*) (Haeselbarth, 1999).

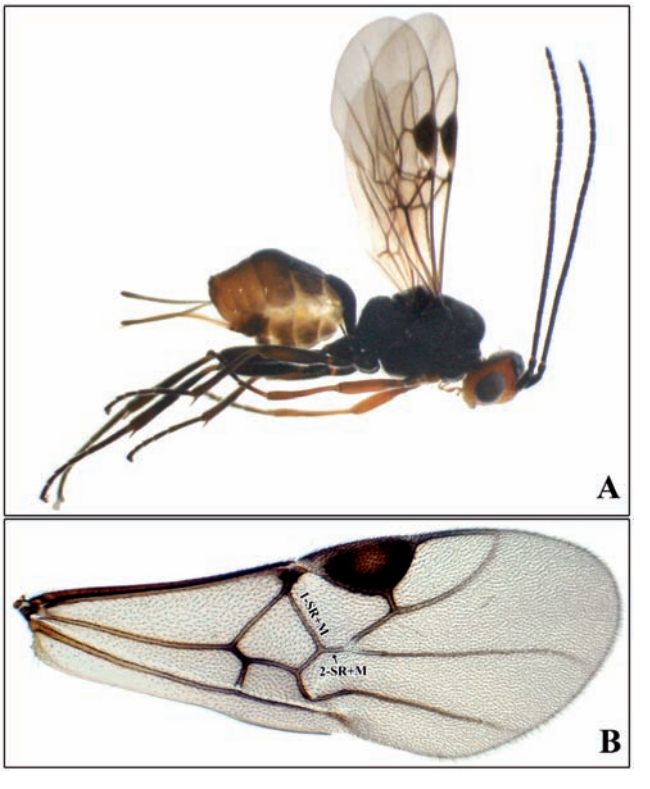


Figure 4. *Dinocampus coccinellae* (Schrank 1802), female: (A) lateral habitus; (B) fore wing.

***Perilitus stelleri* (Loan, 1972)** (Figures 5E, 6E, 7E, 8E)

MATERIAL EXAMINED: Guilan province, Roodsar, Orkom (36°45'44.34"N, 50°18'11.88"E, 1201 m a.s.l.), 09.5.2010, 1♀; 16.5.2011, 1♂; leg. A. Nadimi.

DIAGNOSTIC CHARACTERS (FEMALE): Length of body 3.4 mm; antennae 25 segmented, length of first flagellar segment 3.0× as long as wide (Figure 7E), first segment about 1.3× as long as second segment; face 1.4× wider than height (Figure 6E); length of fore wing 3.1 mm; pterostigma longer than vein 1-R1 (1.6×); marginal cell short and pointed; vein M+CU1 sclerotized; 1-SR+M and 2-SR+M of fore wing absent (Figure 8E); first abdominal tergite petiolate; ovipositor slender and longer than first abdominal tergite; claws simple.

COLORATION: Body very dark brown; antennae dark brown, legs and ovipositor reddish brown.

GENERAL DISTRIBUTION: Europe, Western Palaearctic and introduced into USA (Yu *et al*., 2012).

****Peristenus pallipes* Curtis, 1833** (Figures 9A, 9B)

SYNONYMS: *Peristenus barbiger* (Wesmael, 1835); *Peristenus pallipes* (Herrich-Schaffer, 1838); *Peristenu punctata* (Provancher, 1883); *Peristenus tuberculifer* (Marshall, 1887).

MATERIAL EXAMINED: Guilan province, Roodsar, Orkom (36°45'44.34"N, 50°18'11.88"E, 1201 m a.s.l.), 16.5.2010, 1♀, 6♂; 06.6.2010, 1♀; Guilan province, Roodsar, Ghazichak (36°45'52.62"N, 50°20'10.80"E, 1787 m a.s.l.), 16.5.2010, 1♂; Guilan province, Roodsar, Ziaz (36°52'27.18"N, 50°13'24.78"E, 490 m a.s.l.), 30.5.2010, 1♀; Mazandaran province, Noor, Gaznasara (36°16'58.08"N, 52°10'55.62"E, 2013 m a.s.l.), 28.4.2011, 3♂; 09.5.2011, 9♀, 21♂; 25.5.2011, 7♀, 7♂; leg. M. Khayrandish.

DIAGNOSTIC CHARACTERS (FEMALE): Length of body 2.7-3.0 mm; antennae 23-segmented; occipital carina complete dorsally; frons densely punctuate; mesoscutum mostly punctated; fore wing vein 1-R1 0.8× as long as width of pterostigma, pterostigma 2.2× as long as width; vein M+CU1 of fore wing unsclerotized, basal cell of fore wing densely setose, distinctly similar to first subdiscal cell (Figure 9B); first abdominal tergite 1.7× as long as wide at apex; ovipositor shorter than first abdominal tergite and hardly visible.

COLORATION: Head and thorax uniformely black; antennae reddish brown; legs yellowish.

GENERAL DISTRIBUTION: Europe, Nearctic (Introduced), Oriental, Eastern and Western Palaearctic (Yu *et al.*, 2012). New record from Iran.

REMARKS: This species is taxonomically nearest to *P. nitidus*, from which it can be recognized by its punctuated frons and roughened mesepisternum (Loan, 1974).

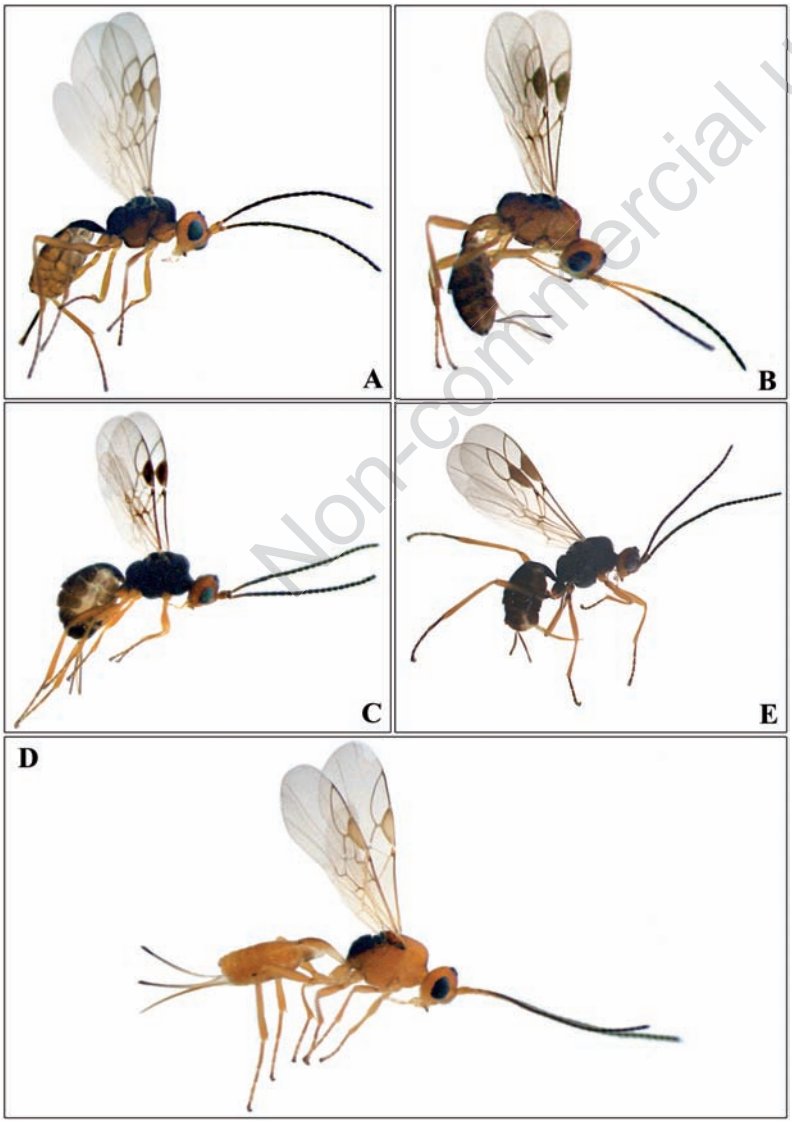


Figure 5. Lateral habitus of adult *Perilitus* species, females: (A) *P. aethiops*; (B) *P. bicolor*; (C) *P. foveolatus*; (D) *P. rutilus*; (E) *P. stelleri*.

***Peristenus relictus* (Ruthe, 1856)** (Figures 9C, 9D)

SYNONYMS: *Perilitus stygicus* Loan, 1973.

MATERIAL EXAMINED: Qazvin province, Zereshk Road (36°25'23.88"N, 50°06'37.68"E, 1926 m a.s.l.), 06.7.2011, 2♀; leg. A. Mohammadi.

DIAGNOSTIC CHARACTERS (FEMALE): Length of body 2.7 mm; antennae 19 segmented; occipital carina complete, thin and weak dorsally; frons punctate; mesoscutum smooth, notaulices of mesonotum sharply impressed, finely foveolatus; fore wing vein 1-R1 0.6× as long as width of pterostigma, pterostigma 2.0× its width; vein M+CU1 of fore wing unsclerotized, basal cell of fore wing sparsely setose or largely glabrous, distinctly less setose than first subdiscal cell (Figure 9D); first abdominal tergite 2.0× as long as wide at apex; ovipositor shorter than first abdominal tergite and hardly visible.

COLORATION: Body black; scape, pedicel and flagellomeres 1 and 2 usually reddish brown; fore leg reddish brown, mid and hind legs brownish black with base of tibia reddish brown.

GENERAL DISTRIBUTION: Europe, Western palaearctic and introduced in to Nearectic (Yu *et al*., 2012).

REMARKS: *Peristenus relictus* and *P. stygicus* were described as two

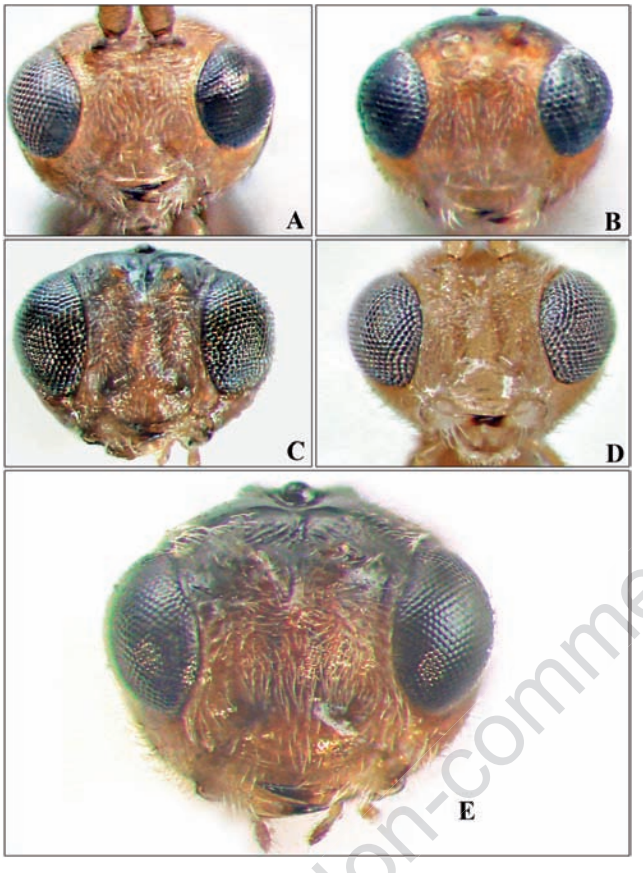


Figure 6. Frontal view of head in *Perilitus* species, females: (A) *P. aethiops*, (B) *P. bicolor*, (C) *P. foveolatus*, (D) *P. rutilus*, (E) *P. stelleri*.

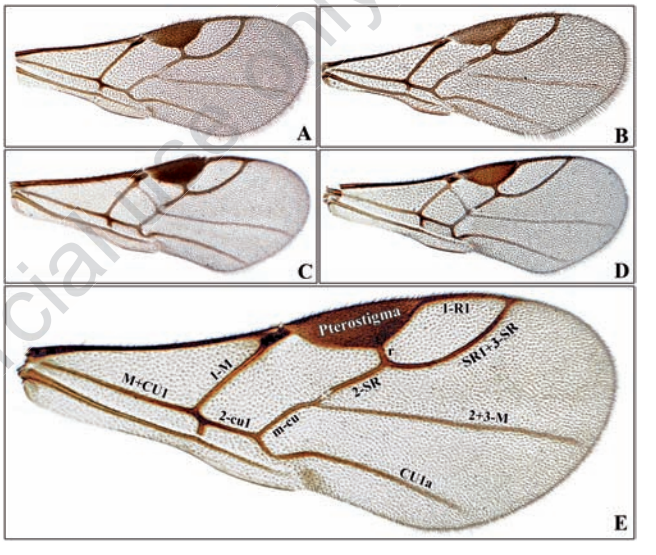


Figure 8. Fore wing in *Perilitus* species: (A) *P. aethiops*; (B) *P. bicolor*; (C) *P. foveolatus*; (D) *P. rutilus*; (E) *P. stelleri*.

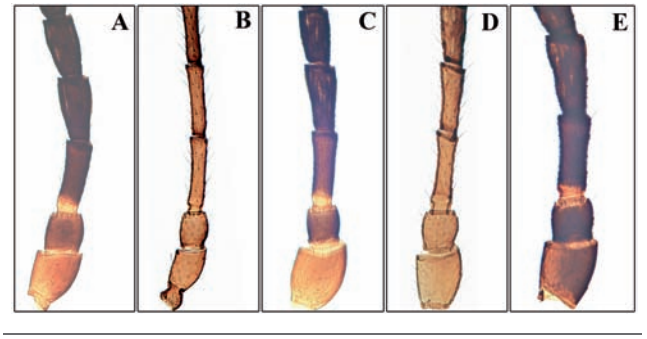


Figure 7. Basal antennal segments in *Perilitus* species: (A) *P. aethiops*; (B) *P. bicolor*; (C) *P. foveolatus*; (D) *P. rutilus*; (E) *P. stelleri*.

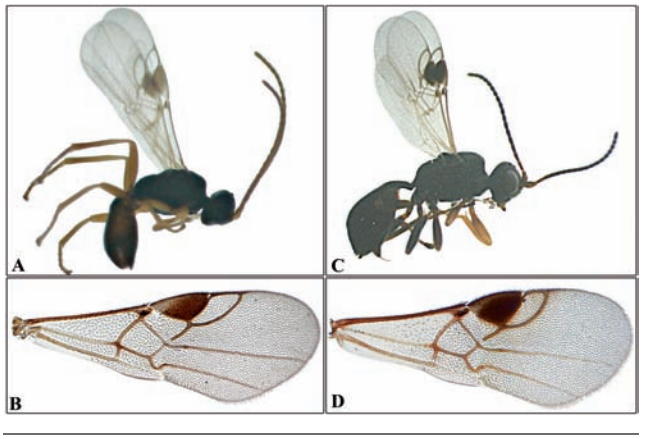


Figure 9. Lateral habitus of adult female and fore wing in *Peristenus* species: (A, B) *P. pallipes*; (C, D) *P. relictus*.

valid species by Loan (1974), however, Varis & van Achterberg (2001) have mentioned *P. stygicus* as a junior synonym of *P. relictus*. *Perlitus relictus* is taxonomically nearest to *P. picipes*, from which it can be separated by its punctuated frons and strong notaulices (Loan, 1974).

Key to the genera and species

Keys to the genera and species are the following:

i)
- Vein 1-R1 of fore wing longer than pterostigma (Figure 3B); claws cleft (Figure 3E); third abdominal sternite with 2 denticles (Figure 3C); denticles on hind coxae large (Figure 3D): *Allurus muricatus*.
- Vein 1-R1 of fore wing shorter than pterostigma (Figure 4B, 8A–8E, 9B, 9D); claws simple; third abdominal sternite and hind coxae without denticles: 2.

ii)
- Vein M+CU1 of fore wing distinctly unsclerotized (Figure 9B, 9D); ovipositor shorter than first abdominal tergite and hardly visible (genus *Peristenus* Nees): 3.
- Vein M+CU1 of fore wing distinctly sclerotized (Figure 4B; 8A-8E); ovipositor longer than first abdominal tergite: 4.

iii)
- Vein 1-R1 of fore wing 0.8× as long as width of pterostigma (Figure 9B); antennae of female 23 segmented; antennae and legs yellowish brown: *Peristenus pallipes*.
- Vein 1-R1 of fore wing 0.5× as long as width of pterostigma (Figure 9D); antennae of female 19 segmented; antennae, mid and hind legs brownish black: *Peristenus relictus*.

iv)
- Scutellum largely rugose; occipital carina complete, ventrally separated from hypostomal carina: *Dinocampus coccinellae*.
- Scutellum largely smooth; occipital carina complete, ventrally joined hypostomal carina (genus *Perilitus* Nees): 5.

v)
- Vein 1-SR+M of fore wing absent (Figure 8A, 8B, 8E): 6.
- Vein 1-SR+M of fore wing present (Figure 8C, 8D): 8.

vi)
- Basal segments of flagellum slender and 4.0-5.0× as long as width (Figure 7B), lighter than rest of flagellum (Figure 5B); antennae 18-21 segmented: *Perilitus bicolor*.
- Basal segments of flagellum normal and almost 3.0× as long as width (Figure 7A, 7C, 7D, 7E); antennae 19-25 segmented: 7.

vii)
- Antenna of female 25 segmented (31 segmented of ♂); length of pterostigma 1.6× as long as 1-R1 (Figure 8E); length of first abdominal tergite 2.5× as long as apical width: *Perilitus stelleri.*
- Antenna of female 19-24 segmented (27-28 segmented in ♂); length of pterostigma 2.5× as long as 1-R1 (Figure 8A); length of first abdominal tergite 1.8× as long as apical width: *Perilitus aethiops*.

viii)
- Color of body ligth; first flagellar segment as long as second flagellar segment (Figure 7D); antennal of female 25-26 segmented; marginal cell pointed and apex of marginal cell closer to wing apex than stigma or their middle (Figure 8D): *Perilitus rutilus.*
- Color of body derk; first flagellar segment 1.2× as long as second flagellar segment (Figure 7C); antennal of female 22-23 segmented; marginal cell rounded and apex of marginal cell much closer to stigma than wing apex (Figure 8C): *Perilitus foveolatus.*

Discussion and conclusions

Nine species of Euphorinae were found in this study from northern provinces of Iran; of these, six species were newly recorded, which increased the number of known Euphorinae in Iran from 20 to 26. The first records of *Perilitus* from Iran were made by Hedwig (1957). Other researchers who studied the *Perilitus* fauna of Iran are Bartlett *et al.* (1978), Arbab and McNeill (2001) and Ghahari *et al*. (2010). Arbab and McNeill (2001) reported *P. aethiops* as a parasitoid that attacks adult alfalfa weevil (*Hypera positica*) from Qazvin and Hamadan provinces and Ghahari *et al*. (2010) has recorded *P. stelleri* from Isfahan province (cornfield). Mirab-balou *et al.* (2008) has reported one undetermined species of the genus *Peristenus* for the first time from Iran (Hamadan province). Lashkari-Bod *et al.* (2011) has recorded *Peristenus picipes* (Curtis) from Fars province. Fallahzadeh and Saghaei (2010) erroneously reported *P. rubricollis* (Thomson) with reference to Khanjani (2004).

The genus *Allurus* of the tribe Centistini is recorded here for the first time from Iran. Among the neighboring countries, *Allurus muricatus* has already been recorded from Kazakhstan (Tobias, 1995), while another species, *A. lituralis* (Haliday, 1835) has been recorded from Turkey (Yilmaz *et al*., 2010). The specimens were collected using Malaise traps in this study, therefore the biology of the recorded species are unknown. However, according to the previous studies, *Allurus muricatus* is considered as an adult parasitoid of *Sitona* sp. (Coleoptera: Curculionidae) and *Stigmella* sp. (Lepidoptera: Nepticulidae) species (Aeschlimann, 1980; Yu *et al*., 2012), but these records have been placed in doubtful hosts until they are confirmed by further investigations. This species is known to oviposit in adults and emerge from adult stages of the hosts (Aeschlimann, 1980). It was found only in Qazvin province from late May to late June 2011.

Dinocampus coccinellae is a solitary koinobiont endoparasitoid on Coccinellidae but it has also been recorded as attacking Chrysomelidae and Curculionidae (Yu *et al.*, 2012). It parasitizes larvae, pupae and adults but only emerges from adults. Bagheri (1998) has reported *Dinocampus coccinellae* on *Coccinella septempunctata* L. (Coleoptera: Coccinellidae) from Isfahan. We also received some specimens of *D. coccinellae* from Yazd province as an endoparasitoid of *C. septempunctata* in April 2010.

Belokobylskij (2000a; 2000b) introduced *Townesilitus* as a subgenus of *Perilitus*. Many species of the genus *Perilitus* are recorded as parasitoids of Curculionoidea and Chrysomeloidea. *Perilitus aethiops* and *P. stelleri* are most commonly recorded as parasitoids of Curculionoidea (Yu *et al.*, 2012). But *Perilitus bicolor* and *P. foveolatus* are commonly recorded as parasitoids of Chrysomeloidea. *Perilitus rutilus* is a solitary endoparasitoid and emerges from the adult stage of various genera of Coleoptera, such as *Hylobius*, *Hypera*, *Pityokteines*, *Sitona* and *Tytthaspis*. Many species of the genus *Perilitus*, as well as some other genera like *Syntretus* Forster, are gregarious parasitoids (Shaw and Huddleston, 1991). *Perilitus foveolatus* is a gregarious endoparasitoid on *Timarcha* Latreille (Coleoptera: Chrysomelidae) (Haeselbarth, 1999).

The genus *Peristenus* is most commonly recorded as a parasitoid of Miridae nymphs, but also rarely on Chrysomelidae, Cicadellidae, Melandryidae and Nitidulidae (Loan, 1980; Yu *et al.*, 2012).

Some species of the genus *Peristenus* have been used as a biological control agent against some species of the genus *Lygus* and alfalfa plant bugs, *Adelphocoris lineolatus* (Hemiptera: Pentatomidae) (Clancy, 1968; Coulson, 1994), whereas most host records of the genus *Perilitus* involve coleopteran families (Chrysomelidae, Curculionidae, Coccinellidae and Tenebrionidae). Some species of the genus *Peristenus* have been used as biological control agents of *Sitona* and *Hypera* (Coleoptera: Curculionidae) and *Phyllotreta* (Coleoptera: Chrysomelidae) (Yu *et al.*, 2012). Moreover, increasing cases of their regulatory impact on important plant pests have been reported, making the members of the genus *Perilitus* important biological control agents (Coulson, 1987; Haye, 2004).

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