



## A contribution to the knowledge of Belytinae (Hymenoptera: Diapriidae) in Hyrcanian forests, with the first record of five genera and species from Iran

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**Abstract.** A faunistic survey of the subfamily Belytinae (Hymenoptera: Diaprioidea, Diapriidae) was carried out in northern Iran during 2010-2018. Based on the specimens collected from Golestan, Guilan, and Mazandaran provinces, five genera *Diphora* Foerster, 1856, *Acanosema* Kieffer, 1908, *Acanopsilus* Kieffer, 1908; *Psilomma* Foerster, 1856 and *Synacra* Foerster, 1856, are recorded for the first time from Iran. Each genus is represented by one newly recorded species. Diagnostic characters of the newly recorded taxa are provided along with illustrations. A key to the genera of the subfamily Belytinae from Iran is presented.

**Keywords:** diapriid wasps, Belytini, Pantolytini, Hyrcanian forests, Taxonomy

### Article History

*Received:*  
1 June 2023

*Accepted:*  
6 July 2023

*Subject Editor:*  
Hossein Lotfalizadeh

**Citation:** Izadizadeh, M., Talebi, A. A., Kolyada, V., Farahani, S., Kazerani, F., Ameri, A. (2023) A contribution to the knowledge of Belytinae (Hymenoptera: Diapriidae) in Hyrcanian forests, with the first record of five genera and species from Iran. *J. Entomol. Soc. Iran* 43 (2), 175-190.

## Introduction

Diapriidae is a diverse family of Diaprioidea with 190 genera and more than 2300 species described worldwide (Quadros & Brandao, 2017), of which about 70 genera and 850 species occurred in the Palaearctic region (Johnson, 1992). Traditionally, this family is divided into three well-defined subfamilies: Ambositrinae Masner, 1961, Belytinae Foerster, 1856 and Diapriinae Haliday, 1833 (Sharkey *et al.*, 2012). The subfamily Ambrosiinae is distributed in Australian and Neotropical regions (Masner, 1961; Johnson, 1992). Subfamilies Belytinae and Diapriinae are cosmopolitan with worldwide distribution (Quadros & Brandao, 2017). Members of the subfamily Belytinae can be separated from subfamily Diapriinae by the combination of the following characters: i) antenna with 14-15 antennomeres in females (in *Synacra* 12 antennomeres), ii) and 14 antennomeres in males, third antennomere almost always emarginated; iii) hind wing with closed basal cell (except in *Synacra*). In Diapriinae antenna with 11-13 antennomeres in females and 13-14 antennomeres in males, A4 almost always sexually modified; hind wing without a closed basal cell.



As far as is known, species of the subfamily Belytinae are larval and pupal endoparasitoids of Mycetophilidae and Sciaridae (Diptera) and some species have been determined in association with ant nests (Nixon, 1957; Huggert, 1979; Yoder, 2007).

The subfamily Belytinae is classified into three tribes: Belytini Foerster, 1856, Cinetini Macek, 1989 and Pantolytini Hellén, 1964 (Macek, 1989; Chemyreva, 2019). The genera of the tribe Pantolytini and some genera of the tribe Belytini are small and with few species. More recently, nine species of the subfamily Belytinae (*Pantolyta* Foerster, 1856, two species; *Belyta* Jurine, 1807, seven species) were reported from Iran (Izadzadeh *et al.*, 2021, 2023).

The genus *Diphora* consists of two species in the world, included *Diphora westwoodi* Foerster, 1856 from the Palearctic and *D. nearctica* Whittaker, 1930 from the Nearctic regions (Nixon, 1957). The genus *Psilomma* Foerster, 1856 consists of four species, with the highest diversity in the Palearctic region (Macek, 1990; Chemyreva & Kolyada, 2021). Kieffer (1916) listed eight species from this genus in Europe. However, some species were synonymized (Nixon, 1957; Wall, 1967; Kozlov, 1978), so at present, this genus in Europe consists of only three species (Chemyreva & Kolyada, 2021). The genus *Acanosema* consists of eight species in the world, e.g., six species in the Palearctic and two species in the Nearctic regions (Macek, 1990; Chemyreva & Kolyada, 2021). Nixon (1957) synonymized *Cardiopsilus* and *Acanopsilus* under *Acanosema*. However, *Acanopsilus* is treated as a valid genus by Hellén (1964) and Wall (1967), and *Acanosema* and *Cardiopsilus* had been listed as synonyms under *Cardiopsilus*. Subsequently, Kozlov (1978) removed these genera from synonymy and reported two species for each genus in the European part of the USSR. Recently, Chemyreva & Kolyada (2021) designated *Cardiopsilus* and *Acanosema* as subgenera of *Acanosema* and described three new species from the subgenus *Cardiopsilus*. The biology of *Acanosema* is poorly known, adults inhabiting humid, shady situations in forests prefer beach associations and fragmented data suggested they are endoparasitoids of Sciaridae and Mycetophilidae (Diptera) (Nixon, 1957; Macek, 1990). The genus *Acanopsilus* is known from the Palearctic region with three species (Chemyreva & Kolyada, 2021). Hellén (1964) separated this genus from *Acanosema* and *Cardiopsilus* based on the different number of female antennomeres. Recently, two new species of this genus were described in Russia (Chemyreva & Kolyada, 2021). The genus *Synacra* includes 14 species in the world, of which 11 species are recorded from the Palearctic region (Chemyreva & Kolyada, 2019b). Macek (1995) revised this genus in Europe, recorded six species and established several new synonymies. He classified six European species of *Synacra* into three subgenera: *Synacra* s. str., *Sundholmiella* Hedqvist, 1975 and *Paratelopsilus* Whittaker, 1930. Recently, Chemyreva & Kolyada (2019b) revised *Synacra* in the Palearctic region, described four new species and provided a key to the Palearctic species. Members of the genus *Synacra* are endoparasitoids of Sciaridae (Diptera) and probably Agromyzidae (Diptera) and some species have been reported in association with ant nests (Nixon, 1957; Macek, 1995; Chemyreva & Kolyada, 2019b).

Prior to this study, eight species of subfamily Diapriinae (Amini *et al.*, 2014; Samin *et al.*, 2018; Izadzadeh *et al.*, 2020) and nine species of subfamily Belytinae (Izadzadeh *et al.*, 2021, 2023) were reported from Iran. Iran is a large country comprising various agroecosystems (Kiani *et al.*, 2017); therefore, the present study aims to increase our knowledge about this important group of parasitic wasps in Iran. Here, we record five genera and five species of Belytinae for the first time for the Iranian fauna as a part of ongoing faunistic and taxonomic studies on Diapriidae.

## Materials and methods

Material for this study was collected from Golestan, Guilan and Mazandaran provinces in northern Iran using Malaise traps (Figs. 1–4). The specimens were extracted from the traps and sorted monthly, transferred to 70% ethyl alcohol, and then stored in a freezer for further studies. A total of 33 specimens of Belytinae were collected. For the preparation of samples, the specimen was placed on a piece of absorbing paper for drying. The dried specimens were card-mounted and labeled. Illustrations were done using an Olympus AX70 microscope and an Olympus SZX9 stereomicroscope equipped with a BMZ-04-DZ digital imaging system (Behin Pajouhesh Co., Iran). A series of four or five captured images were merged into a single in-focus image using the image-stacking software Combine ZP1.0. Morphological terminology follows Nixon (1957), Masner & García (2002) and



Quadros & Brandao (2017). A map of the distribution of species is created using SimpleMapp (Shorthouse, 2010). Specimens are deposited in the insect collection of the Department of Entomology, Tarbiat Modares University, Tehran (TMUC) and the Research Institute of Forests and Rangelands, Tehran (RIFR).

The following abbreviations are used for the morphological characters: A1–A15 = Antennomeres; they are numbered from the scape (A1) to the apical antennomere (A15), F1= first flagellomere, OOL = ocular ocellar line: the shortest distance between the posterior ocellus and the eye, POL = posterior ocellar line: the shortest distance between the posterior ocelli.

## Results

In this research, five genera are recorded from Iran for the first time.

### Taxonomy

#### Family Diapriidae

#### Subfamily Belytinae

#### Genus *Acanosema* Kieffer, 1908

#### Type species: *Acanosema rufum* Kieffer, 1908



**Fig. 1–4.** Habitats of northern Iran where the specimens were collected. 1. Guilan, Ghazichak; 2. Guilan, Shafa Rud forest; 3. Mazandaran, Neka forest; 4. Golestan, Aliabad, Zarringol.

## Diagnosis

Head globular with antennal sockets, mandibles shortly crossing at tips (Fig. 6); scape short, stout, with developed apical rim; antenna of the female with 15 antennomeres (Fig. 7), of male with 14 antennomeres; eye bare (Fig. 6), pronotum divided into the distinct neck and broad collar area; mesoscutum covered with long sparse setae; radial cell open, stigmal vein short, marginal vein 0.6-1.0 times as long as its distance from basal vein (Fig. 8); hind femur short and stout, with short femoral stalk; petiole subhexagonal (Fig. 9); the base of sternite II in female more or less right angle (Fig. 5); metasoma of female fusiform, sharply pointed and compressed towards the apex (Fig. 5).

For a detailed description and key to species of the genus *Acanosema*, see Chemyreva & Kolyada (2021).

### *Acanosema nervosum* (Thomson, 1858)

#### Material examined

Guilan province, Astaneh Ashrafiyeh, Eshman kamachal (37°21'10.50" N, 49°57'56.16" E, 2m a.s.l.), 26.IV.2010, 2♀♀ (TMUC); Mazandaran province, Noor, Chamestan, Tangehvaz (36°18'51.42" N, 52°07'48.00" E, 1359 m a.s.l.), 28.VI.2011, 4♂♂ (TMUC), leg.: M. Khayrandish. Golestan province, Shast kola forest (36°45'29" N, 54°23'12" E, 424m a.s.l.), 15.VI.2017, 2♂♂ (TMUC); Golestan province, Aliabad, Zarringol (36°48'58" N, 55°02'13" E, 694 m a.s.l.), 14.V.2016, 3♂♂ (RIFR); Mazandaran province: Sari, Pahne Kola, Salar Darreh (36°27'11" N, 53°06'00" E, 184m a.s.l.), 25.IV.2016, 1♂ (RIFR), leg.: S. Farahani. Galanderoud (36°26'56" N, 51°51'20" E, 1407 m), 24.VII.2018, 1♂ (TMUC); Neka forest (36°21'43.03" N, 53°32'56.7" E, 1495 m), 27.VI.2018, 2♂♂ (RIFR); (36°30'00.4" N, 53°27'14.2" E, 828 m), 24.VII.2018, 1♂ (RIFR); Guilan province, Rezvan Shahr (37°31'00" N, 49°2'7" E, 199 m), 13.V.2018, 1♀ (RIFR); Guilan province, Shafa Rud forest (37°28'18" N, 48°49'23" E, 1114 m a.s.l.), 25.VI.2018, 1♂, 1♀ (TMUC), leg.: F. Kazerani.

#### Diagnosis: Female

Body length 2.8–3.5 mm (Fig. 5); fore wing length 2.1–2.6mm; head slightly wider than long in dorsal view, OOL 1.4 times as long as POL; vertex and frons with sparse setae; genae 2.0 times longer than eye; clypeus prominent (Fig. 6); antenna with short dense setae; scape short, stout, with raised apical rim projecting to two tiny lateral denticles (Fig. 7); scape as long as four following antennomeres together (Fig. 7); mesoscutum convex, with sparse long setae; notauli complete; mesoscutellum smooth, covered with sparse long setae; propodeum a little wider than long (Fig. 9); marginal vein long, 0.5-0.8 times as long as its distance from the basal vein (Fig. 8); hind leg with short femoral stalk; petiole subhexagonal, in dorsal view smooth (Fig. 9). Scape in male not more than 4.0 times as long as wide, with apical rim raised to the flange armed with the blunt tooth at each side (Fig. 18).

#### Distribution (Fig. 37)

Abkhazia, Azerbaijan, Czech Republic, England, Finland, Germany, Herzegovina, Hungary, Italy, Moldova, Norway, Poland, Russia, Scotland, Slovakia, Sweden, Ukraine (Hellén, 1964; Macek, 1990; Chemyreva & Kolyada, 2021) and Iran (new record).

#### Biology

Hosts are larvae of Sciaridae and Mycetophilidae living in rotten Wood (Nixon, 1957).

### Genus *Acanopsilus* Kieffer, 1908

**Type species:** *Acanopsilus clavatus* Kieffer, 1908 (= *Belyta heterocera* Haliday, 1857)

#### Diagnosis

Mandibles nearly symmetrical; scape long, slender, with apical margin simple (Fig. 12, 16); antenna of the female (Fig. 12) and male with 14 antennomeres; eye bare (Fig. 11), pronotum cervicoid; mesoscutum covered with long sparse setae; radial cell open, marginal vein short, 0.4-0.6 times as long as its distance from basal vein (Fig. 13); hind femur long and slender, with long femoral stalk; petiole subcylindrical; base of sternite II in female simple (Fig. 10); metasoma of female fusiform, pointed towards apex (Fig. 10).



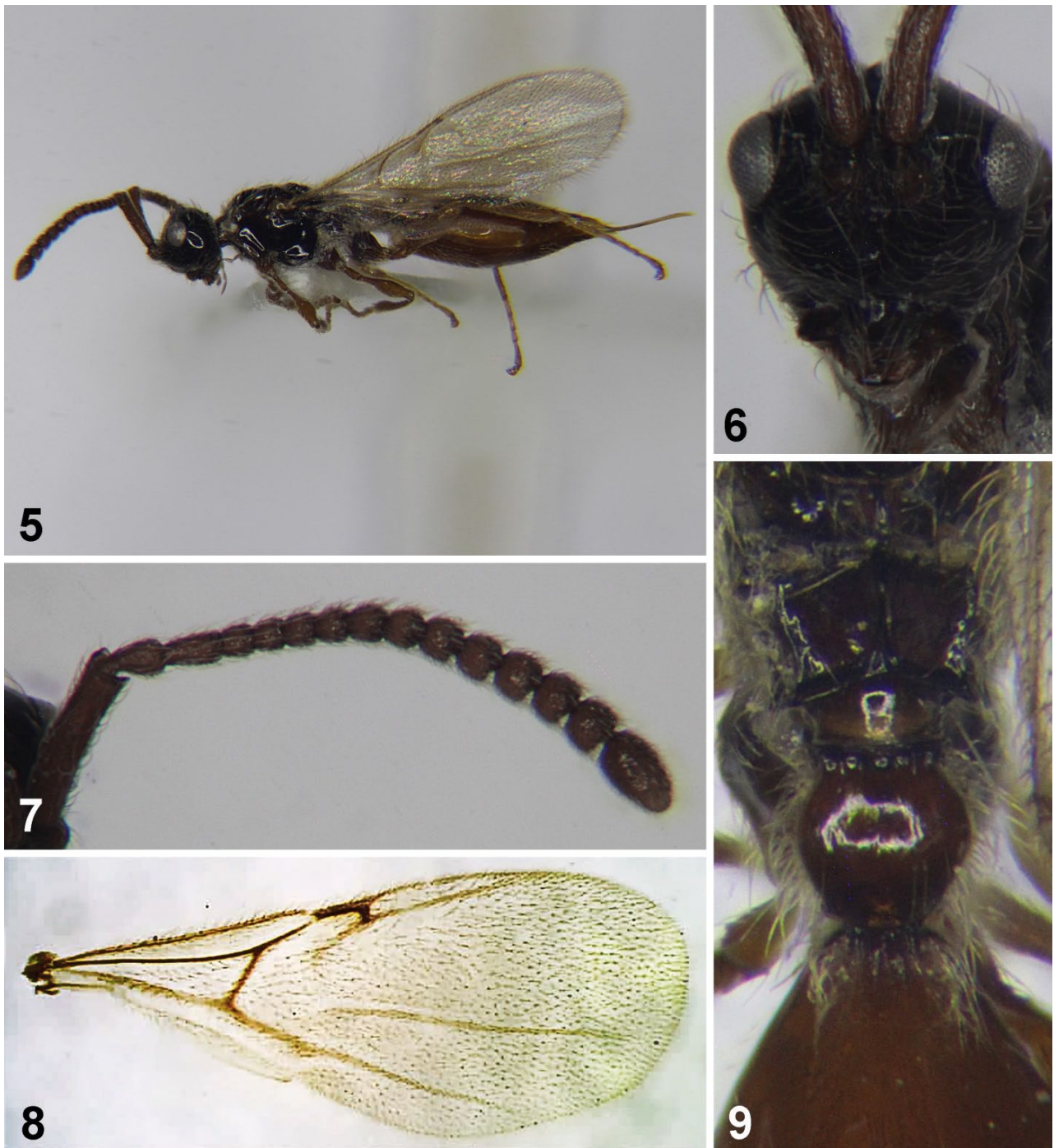


Fig. 5–9. *Acanosema nervosum* (Thomson, 1858), 5. Lateral habitus, 6. Head in frontal view, 7. Antenna, 8. Fore wing, 9. Propodeum and basal segment of metasoma.

*Acanopsilus heterocerus* (Haliday, 1857)

**Material examined**

Mazandaran province, Noor, Chamestan, Tangehvaz (36°18'51.42" N, 52°07'48.00" E, 1359m a.s.l.), 13.VII.2011, 2♂♂ (TMUC), leg.: M. Khayrandish; Golestan province: Aliabad, Zarringol (36°48'58" N, 55°02'13" E, 694m a.s.l.), 15.VII.2016, 1♂ (TMUC); Loveh forest (37°20'43" N, 55°40'40" E, 753m a.s.l.), 04.VII.2016, 1♂ (TMUC), leg.: S. Farahani. Mazandaran province: Kheyroud Kenar (36°34'36.23" N, 51°34'37.94" E, 722m a.s.l.), 26.VI.2018, 1♂ (TMUC); 24.VII.2018, 2♂♂ (TMUC); 28.VIII.2018, 1♀ (TMUC); Neka forest (36°21'43.03" N, 53°32'56.7" E, 1495 m a.s.l.), 27.VI.2018, 1♂ (RIFR); Guilan province: Rezvan Shahr (37°31'00" N, 49°02'7" E, 199m a.s.l.), 13.V.2018, 1♂ (RIFR); Shafa Rud forest (37°28'18" N, 48°49'23" E, 1114m a.s.l.), 19.X.2018, 1♀, 1♂ (RIFR), leg.: F. Kazerani.

**Diagnosis: Female**

Body length 2.6–3.1 mm (Fig. 10); fore wing length 2.1–2.4mm; head in dorsal view slightly wider than long, OOL 1.7 times as long as POL; vertex and frons smooth with sparse setae; gena rounded off, rather longer than eye; clypeus smooth and convex (Fig. 11); antenna with short dense setae; scape slender with simple apical margin (Fig. 12); mesoscutum convex and covered with long setae; notauli complete; mesoscutellum smooth, covered with long sparse setae; propodeum transverse; marginal vein short, 0.45 times as long as its distance from the basal vein (Fig. 13); hind leg with long femoral stalk; petiole cylindrical in dorsal view, smooth and with irregular longitudinal keels (Fig. 14). Scape in male more than 5.0 times as long as wide, with apical rim simple (Fig. 16).

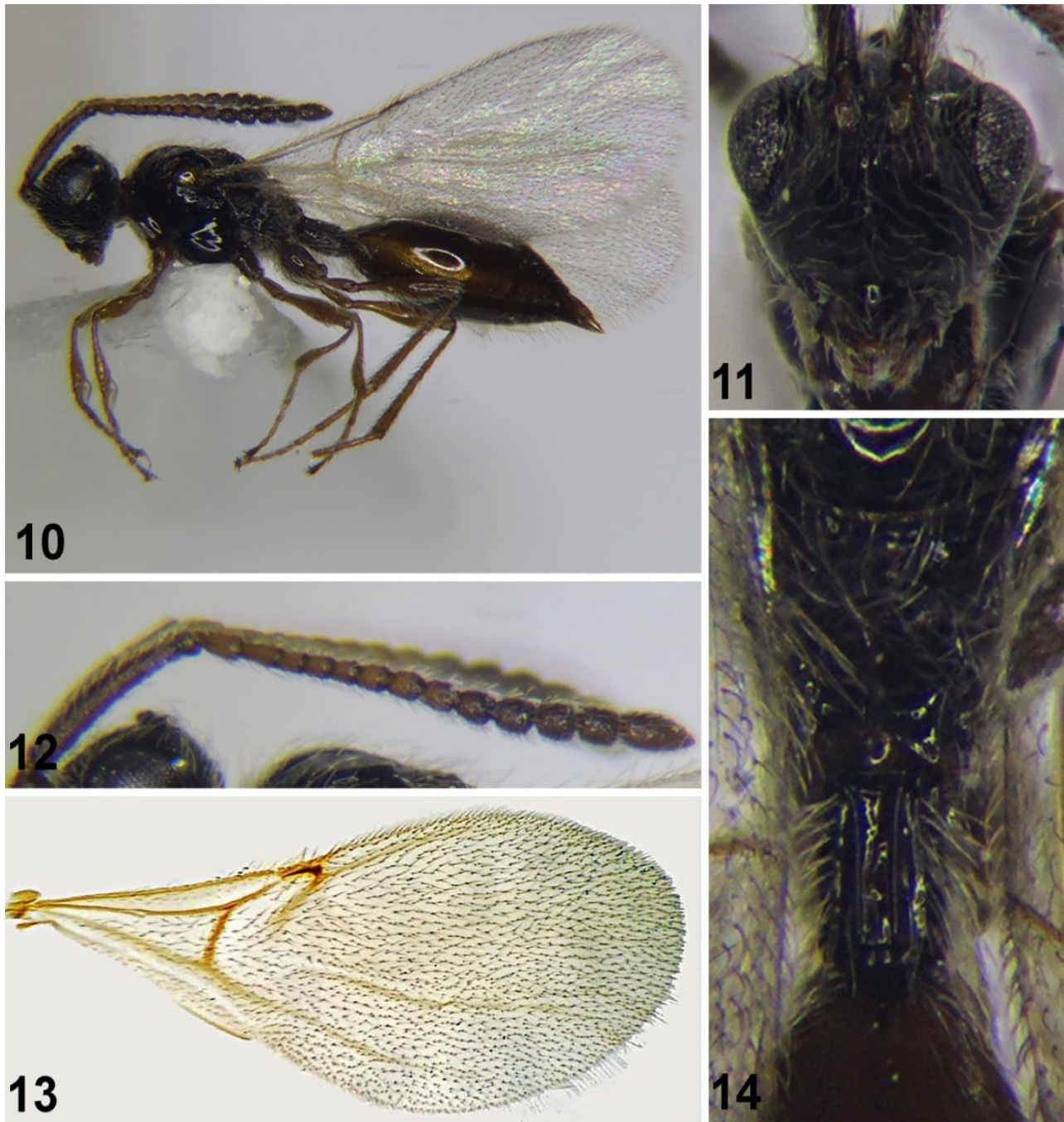


Fig.10–14. *Acanopsilus heterocerus* (Haliday, 1857), 10. Lateral habitus, 11. Head in frontal view, 12. Antenna, 13. Fore wing, 14. Propodeum and basal segment of metasoma.





**Fig. 15–18.** 15, 16 *Acanopsilus heterocerus* (Haliday, 1857) male, 15. Lateral habitus, 16. Basal antennomeres; 17, 18 *Acanosema nervosum* (Thomson, 1858) male, 17. Lateral habitus, 18. Basal antennomeres.

#### Distribution (Fig. 37)

Austria, Azerbaijan, China, Czech Republic, England, Finland, Georgia, Germany, Greece, Hungary, Italy, Russia, South Korea, Sweden, Turkmenistan, Ukraine, Uzbekistan (Hellén, 1964; Macek, 1990; Kim & Lee, 2016; Chemyreva & Kolyada, 2021) and Iran (new record).

#### Biology

Unknown.

#### Genus *Diphora* Foerster, 1856

**Type species:** *Diphora westwoodi* Foerster, 1856

### Diagnosis

Head transverse and triangle, eye hairy; first flagellomere at least as long as 8 following flagellomeres together (Fig. 20); A4–A14 transverse or spherical (Fig. 20); notauli complete; mesoscutellum elongated, separated from the mesonotum by a straight transverse suture; propodeum wrinkled (Fig. 23); radial cell closed and long; petiole striped or with longitudinal ridges; the rest of the abdomen somewhat flattened, almost spindle-shaped.

*Diphora westwoodi* Foerster, 1856

### Material examined

Mazandaran province, Galanderoud (36°26'56" N, 51°51'20" E, 1407m a.s.l.), 24.VII.2018, 1♀ (TMUC); Guilan province, Shafa Rud forest (37°28'18" N, 48°49'23" E, 1114m a.s.l.), 26.VI.2018, 1♂ (TMUC); 26.VIII.2018, 1♂ (RIFR); Golestan province, Shast kola forest (36°44'10.83" N, 54°24'11.23" E, 754m a.s.l.), 28.VII.2018, 1♀ (RIFR), leg.: F. Kazerani.

### Diagnosis: Female

Body length 2.7–2.9 mm (Fig. 19); fore wing length 2.1–2.3 mm; head in dorsal view slightly wider than long (6:4.3) (Fig. 22), OOL 1.2 times as long as POL; clypeus smooth and convex (Fig. 21); antenna with short dense setae; F1 about as long as all the following flagellomeres together (Fig. 20); notauli complete; dorsal area of propodeum with 2–3 secondary keel (Fig. 23); marginal vein short, 0.25 times as long as its distance from the basal vein; Petiole in dorsal view 1.2 times as long as wide, with irregular longitudinal keels (Fig. 23).

### Distribution (Fig. 37)

Austria, England, France, Germany, Romania, Scotland, Switzerland -(Kieffer, 1916; Wall, 1967; Fabritius, 1980) and Iran (new record).

### Biology

Unknown.

**Genus** *Psilomma* Foerster, 1856

**Type species:** *Psilomma fusciscapis* Foerster, 1861

### Diagnosis

Mandibles sickle shape, overcrossing apically with inner tooth; scape with simple apical rim (Fig. 27); antenna of the female with 15 antennomeres (Fig. 27), of male with 14 antennomeres, filiform, A3 modified (Fig. 31); eye bare or with very sparse pubescent; epomia absent; pronotal collar with contiguous greyish pubescence; radial cell reduced (Fig. 28); mesonotum slightly convex; notauli complete; radial vein obliterated or absent; hind femur slender with long femoral stalk (Fig. 24); petiole cylindrical (Fig. 29); base of sternite II in female simple (Fig. 24); metasoma of female fusiform, sharply pointed towards apex (Fig. 24).

For detailed description and key to species of the genus *Psilomma*, see Chemyreva & Kolyada (2021).

*Psilomma fusciscapis* Foerster, 1861

### Material examined

Guilan province, Roodsar, Rahim abad, Ghazichak (36°45'57.54" N, 50°19'35.22" E, 1803m a.s.l.), 31.V.2010, 1♂ (TMU), leg.: M. Khayrandish; Shafa Rud forest (37°28'18" N, 48°49'23" E, 1114m a.s.l.), 25.VI.2018, 6♂♂ (RIFR), leg.: F. Kazerani. Golestan province: Aliabad, Zarringol (36°48'58" N, 55°02'13" E, 694 m a.s.l.), 03.XII.2016, 1♀ (TMU), leg.: S. Farahani; Mazandaran province, Neka forest (36°21'43.03" N, 53°32'56.7" E, 1495m a.s.l.), 25.VII.2018, 1♂ (TMU), leg.: F. Kazerani.



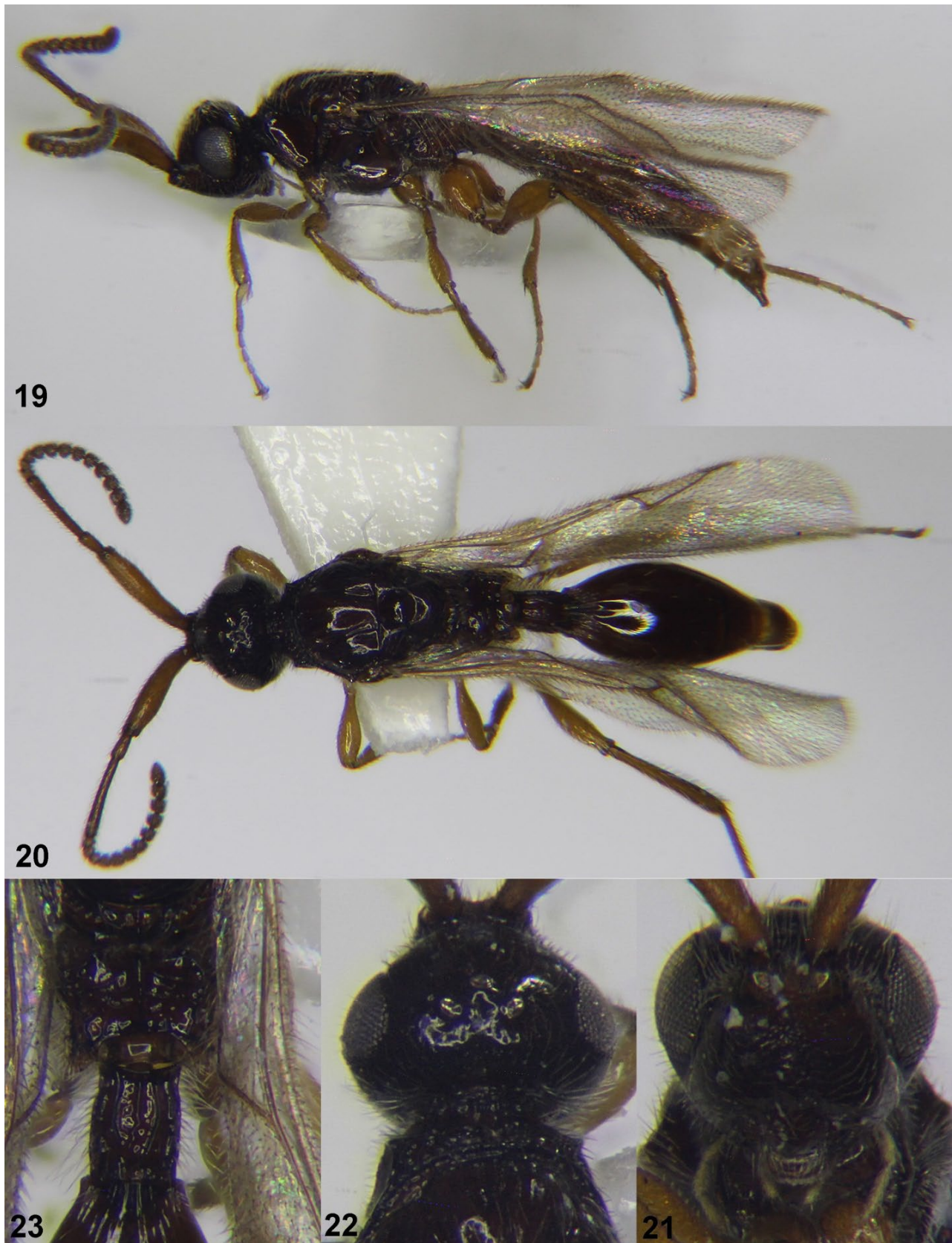


Fig. 19–23. *Diphora westwoodi* Foerster, 1856, 19. General habitus in lateral view, 20. General habitus in dorsal view, 21. Head in frontal view, 22. Head in dorsal view, 23. Propodeum and basal segment of metasoma.

**Diagnosis: Female**

Body length 3.5 mm (Fig. 24); fore wing length 3.0 mm; head in dorsal view transverse, with dense pubescence (Fig. 26); OOL 1.45 times as long as POL; vertex and frons with dense setae (Fig. 26); malar space slightly

rounded off; clypeus slightly rounded off (Fig. 25); antenna dark brown (Fig. 27); A3 4.0 times as long as wide; A14 1.2 times longer than wide; mesoscutum covered with dense pubescence; notauli complete; propodeum with median keel; its posterior margin concave (Fig. 29); marginal vein short, 0.5-0.6 times as long as its distance from the basal vein (Fig. 28); hind leg with long femoral stalk; petiole cylindrical, in dorsal view with longitudinal keels (Fig. 29); scape in male shorter than A3 (Figs. 30, 31).

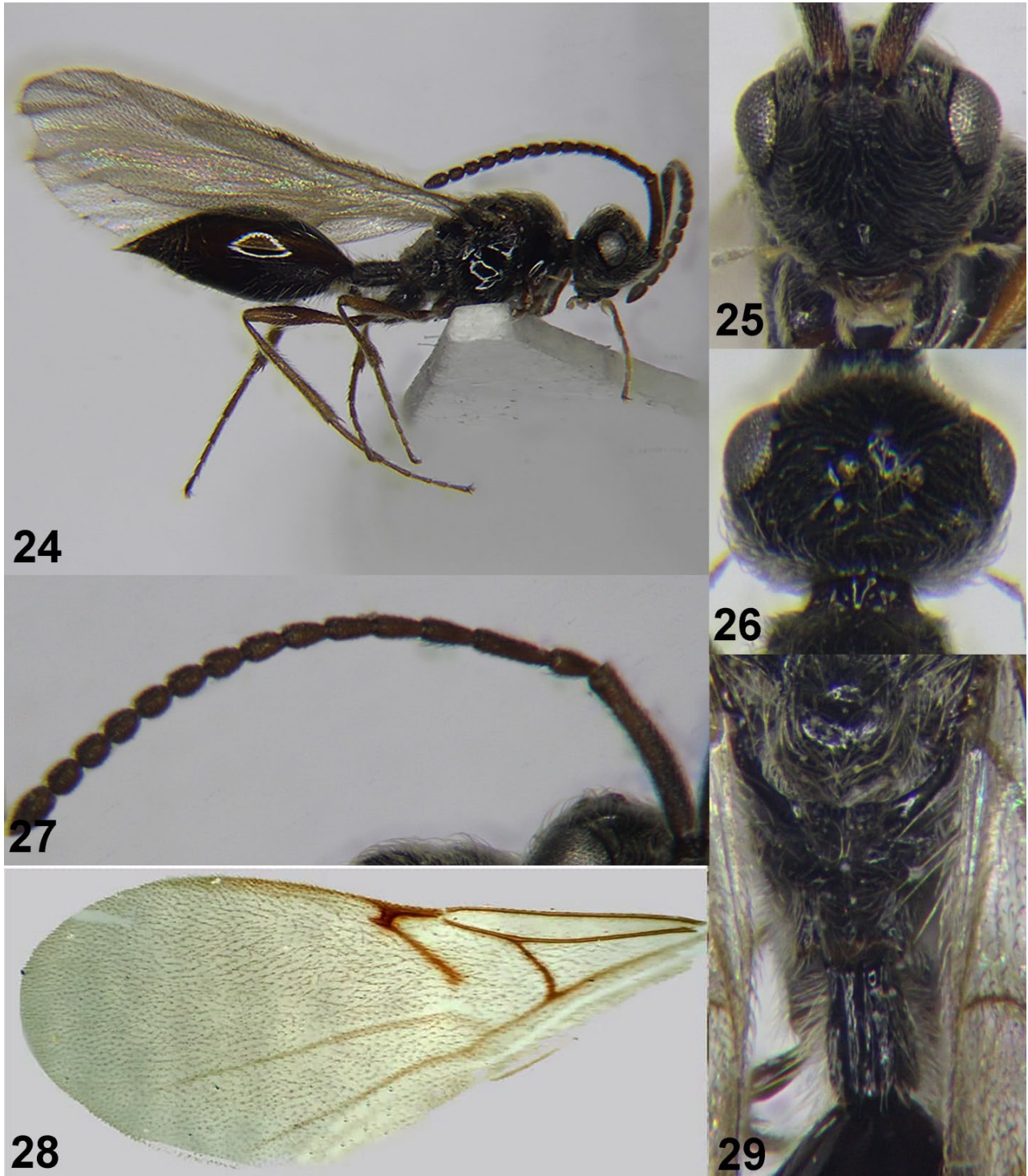


Fig. 24–29. *Psilomma fusciscapis* Foerster, 1861, 24. Lateral habitus, 25. Head in frontal view, 26. Head in dorsal view, 27. Antenna, 28. Fore wing, 29. Propodeum and basal segment of metasoma.





Fig. 30–31. *Psilomma fusciscapis* Foerster, 1861 male, 30. Lateral habitus, 31. Basal antennomeres.

#### Distribution (Fig. 37)

Austria, Azerbaijan, Czech Republic, Hungary, Poland, Russia, Sweden (Macek, 1990; Chemyreva & Kolyada, 2021) and Iran (new record).

#### Biology

Unknown.

#### Genus *Synacra* Foerster, 1856

**Type species:** *Diapria brachialis* Nees, 1834

#### Diagnosis

Head with mouthparts hypognathous; mandibles beak-shaped, bidentate, with apices weakly crossing; clypeus convex, weakly transverse; antenna of the female with 12 antennomeres (Fig. 34), of male with 14 antennomeres, filiform, A3 modified. Pronotum with distinct cervix and epomia, with pubescent outer pronotal pits. Mesonotum slightly convex; notauli complete or totally absent; mesoscutellum with a large anterior mesoscutellar pit; mesopleuron without mesopleural pit; propodeum with median keel (simple or bifurcate), plicae, and transverse keel along the posterior margin in the ancestral state to almost smooth in the derived state. Wing venation reduced (Fig. 35); costal, subcostal, marginal and reduced stigmal veins tubular; postmarginal and radial veins nebulous to absent; basal vein nebulous; marginal vein as long as its distance from the basal vein or distinctly longer. Petiole subcylindrical, with striate sculpture to swollen and smooth in derived states (Fig. 36). Metasoma of female fusiform, compressed, sharply pointed posteriorly.

For detailed description and key to species of the genus *Synacra*, see Chemyreva & Kolyada (2019b).

#### *Synacra sociabilis* (Kieffer, 1904)

#### Material examined

Guilan province, Roodsar, Rahim abad, Ghazichak (36°45'57.54" N, 50°19'35.22" E, 1803m a.s.l.), 10.VIII.2010, 1♀ (TMUC), leg.: M. Khayrandish.

#### Diagnosis: Female

Body length 1.8 mm (Fig. 32); fore wing length 1.5 mm (Fig. 35); mandible beak-like (Fig. 33), slightly prominent; clypeus compressed; antenna incrassate (Fig. 34); scape short; eye bare (Fig. 33); notauli present; propodeum smooth (Fig. 36); petiole transverse; side of propodeum, petiole and anterior part of S2 with dense cushion-like pubescence (Fig. 36).

#### Distribution (Fig. 37)

Austria, Bulgaria, Czech Republic, England, Finland, France, Germany, Hungary, Luxembourg, Mongolia, Netherland, Russia, Slovakia, Ukraine (Macek, 1995; Chemyreva & Kolyada, 2019b) and Iran (new record).

#### Biology

This species is associated with ants of the genera *Formica* Linnaeus, 1758 and *Lasius* Fabricius, 1804 (Hymenoptera: Formicidae); some specimens were reared from sciarid flies larvae of mushroom (Macek, 1995). Macek (1995) collected this species in yellow pan-traps placed in rotten tree hollows colonized by *Lasius brunneus* (Latreille) (Formicidae). Chemyreva & Kolyada (2019b) collected two specimens from nests of *Formica rufa* L.



Fig. 32–36. *Synacra sociabilis* (Kieffer, 1904), 32. Lateral habitus, 33. Head in frontal view, 34. Antenna, 35. Fore wing, 36. Propodeum and basal segment of metasoma.



### Identification key to the genera of Belytinae in northern Iran (females and males)

- 1- Radial cell closed, marginal vein short, about 0.25 times as long as its distance from the basal vein (Fig. 20) .....  
*Diphora* Foerster
- Radial cell open (Figs 8, 13, 28, 35), marginal vein long, at least 0.5 times as long as its distance from the basal vein..... 2
- 2- Mandibles, in frontal view, forming a beak (Fig. 33), female with 12 antennomeres (Fig. 34), marginal vein at least as long as its distance from the basal vein (Fig. 35).....*Synacra* Foerster
- Mandibles not forming a beak, female with 14-15 antennomeres (Figs 7, 12, 27), marginal vein at most as long as its distance from the basal vein (Figs 8, 13, 28) ..... 3
- 3- Head and mesosoma very hairy (Figs. 24, 26, 29), mandibles sickle-shaped, with inner tooth reaching to the tip of mandible ..... *Psilomma* Foerster
- Head and mesosoma with sparse setae (Figs. 5, 10), mandibles pincer-shaped, with inner tooth not reaching to the tip of mandible ..... 4
- 4- Scape short and stout, in male not more than 4.0 times as long as wide, its apical rim armed with one latero-apical tooth on each side (Figs. 7, 18); female with 15 antennomeres (Fig. 7), petiole subhexagonal (Fig. 9), hind femur short and stout ..... *Acanosema* Kieffer
- Scape long, slender, in male more than 5.0 times as long as wide, its apical rim simple (Figs. 12, 16); female with 14 antennomeres (Fig. 12), petiole cylindrical (Fig. 14), hind femur slender ..... *Acanopsilus* Kieffer

### Discussion

The global distribution map of the five newly recorded species of Belytinae, which have been collected from Hyrcanian forests in northern Iran, is presented in Fig 37. Including our findings, and previously published literature (Izadizadeh *et al.*, 2020, 2021, 2023), the number of species of Diapriidae has now increased to 22 species in Iran, which can be compared to adjacent countries as follows: 152 species in Russia (Chemyreva, 2019), two species in Tajikistan, two species in Turkmenistan and five species from Azerbaijan (Chemyreva & Kolyada, 2019a, 2019b, 2021) and none yet recorded from Afghanistan, Pakistan and Türkiye. *Acanosema nervosum* and *Acanopsilus heterocerus* are very common species in the West Palaearctic region (Nixon, 1957; Hellén, 1964; Wall, 1967; Kozlov, 1978; Macek, 1990) and in the north of Iran (current study). The genus *Acanopsilus*, is represented by three species, of which *Acanopsilus heterocerus*, is distributed from Europe (Western Palaearctic) to South Korea and China (Eastern Palaearctic) (Kim & Lee, 2016), and northern Iran (Current study). Also, two species (*Acanopsilus comadensis* and *A. minimus*) have been described from the south-eastern part of Russia (Chemyreva & Kolyada, 2021). Although *Diphora westwoodi* is widely distributed in NW Europe, but it is not common (Nixon, 1957). Accordingly, in this study, we found only four specimens of this genus in northern Iran. The genus *Synacra* is common in Europe; however, *Synacra gigantea* Chemyreva and Kolyada, 2019 has recently been described from the East Palaearctic region (Chemyreva & Kolyada, 2019b). From this genus, 11 species were recorded from Russia (Chemyreva & Kolyada, 2019b).

In summary, Belytinae is a diverse taxon of hymenopteran parasitoids reared from Dipteran larvae worldwide (Huggert, 1979; Yoder, 2007). However, our knowledge is still poor, as most species have no host association records. The studied area in this research belongs to the Caucasus biological diversity hotspot (Kiani *et al.*, 2017), which is expected to have the highest biodiversity in Iran.

Considerable effort will be needed about the host/parasitoid associations of most species of Belytinae. Also, further studies on the taxonomy and biology of Iranian Diapriidae could have important implications for the conservation of these parasitic wasps.

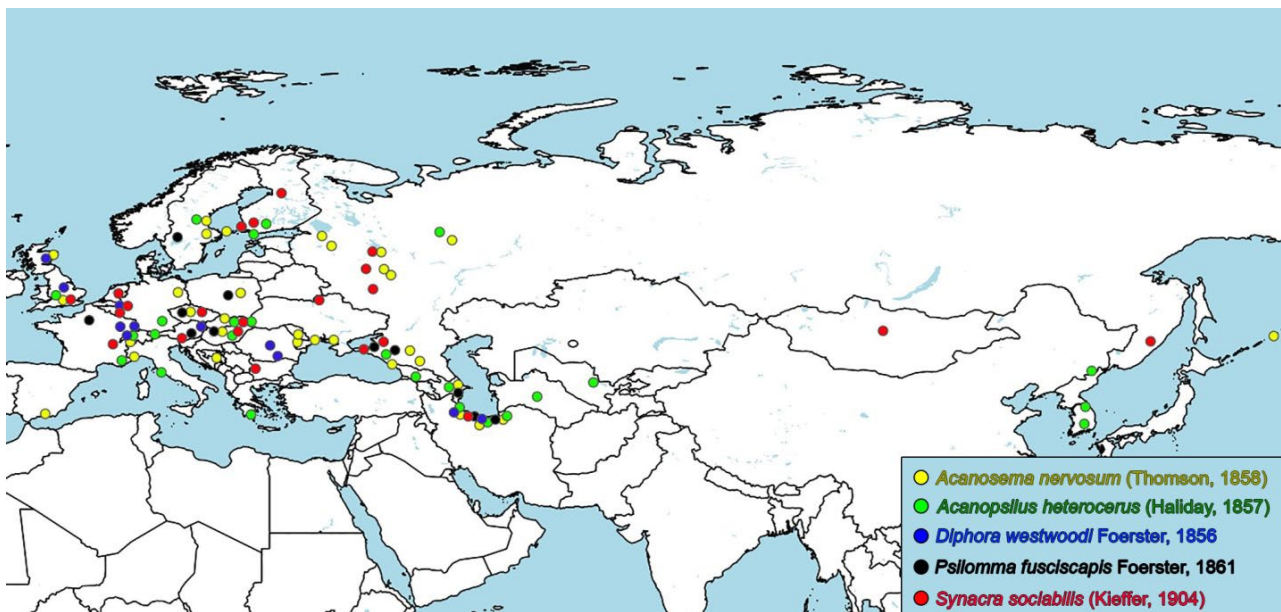


Fig. 37. Worldwide distribution map of five newly recorded species of the subfamily Belytinae (Hymenoptera: Diapriidae) from Iran.

## Acknowledgments

We cordially thank the subject editor and three anonymous reviewers for their valuable comments and recommendations, on the earlier version of this paper.

## Funding

This work is financially supported by the Department of Entomology, Tarbiat Modares University and the Research Institute of Forests and Rangelands (Iran).

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## مروری بر زنبورهای زیرخانواده Belytinae (Hymenoptera: Diapriidae) در جنگل‌های هیرکانی، به همراه گزارش جدید پنج جنس و گونه از ایران

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تاریخچه مقاله

دریافت: ۱۴۰۲/۰۳/۱۱ | پذیرش: ۱۴۰۲/۰۴/۱۰ | دبیر تخصصی: حسین لطفعلی زاده

### پیکیده

بررسی فونستیک زنبورهای زیرخانواده Belytinae (Hymenoptera: Diaprioidea: Diapriidae) طی سال‌های ۱۳۸۸ تا ۱۳۹۷ در شمال ایران انجام شد. براساس نمونه‌های جمع‌آوری شده از استان‌های گلستان، گیلان و مازندران، پنج جنس *Diphora* Foerster, 1856، *Acanosema* Kieffer, 1908، *Acanopsilus* Kieffer, 1908، *Synacra* Foerster, 1856 و *Psilomma* Foerster, 1856 برای اولین بار از ایران گزارش می‌شوند. هر جنس توسط یک گونه به عنوان گزارش جدید، معرفی می‌شود. خصوصیات افتراقی جنس‌ها و گونه‌هایی که برای اولین بار از ایران گزارش می‌شوند به همراه تصاویر مربوطه و کلید شناسایی جنس‌های زیرخانواده Belytinae در ایران ارائه شده است.

**کلمات کلیدی:** زنبورهای diapriid، Belytini، Pantolytini، جنگل‌های هیرکانی، رده بندی

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**Citation:** Izadizadeh, M., Talebi, A. A., Kolyada, V., Farahani, S., Kazerani, F., Ameri, A. (2023) A contribution to the knowledge of Belytinae (Hymenoptera: Diapriidae) in Hyrcanian forests, with the first record of five genera and species from Iran. *J. Entomol. Soc. Iran* 43 (2), 175-190. <https://doi.org/10.52547/jesi.43.2.8>