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Taxonomic Studies on Osmiine Bees (Hymenoptera, Apoidea: Megachilidae) of Fars Province (Iran)

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Abstract

The Osmiini is a diverse and important tribe of bees in most regions of the Palaearctic, including Iran. Between January 2010 and August 2011, 3000 specimens of Apoidea were collected in Fars province, a vast area in southwest of Iran. Specimens of Osmiini were selected for further study and were identified to genus at the Plant Protection Group laboratory of Yasouj University, Iran, then sent to Dr. Andreas Müller (ETH Zürich, Switzerland) for specific determination. A total of 14 species in 4 genera were identified. Of these, *Heriades* sp. cf. *hissaricus*, *Hoplitis flabellifera*, *H. rufopicta*, *Osmia aeruginosa*, *O. caerulescens*, *O.* sp. cf. *dives* and *O. laticauda* are newly recorded for the Iranian fauna. The male of *Heriades* sp. cf. *hissaricus* is described here for the first time. Diagnoses with illustrations of species are presented.

Key words: Megachilidae, Osmiine, Iran, Fars Province.

Zusammenfassung

Im Zeitraum Jänner 2010 bis August 2011 wurden 3.000 Bienen (Hymenoptera: Apoidea) in der iranischen Provinz Fars aufgesammelt. Darunter befanden sich 14 Arten aus 4 Gattungen der Tribus Osmiini, die von Dr. Andreas Müller (ETH Zürich, Schweiz) bestimmt wurden. Als neu für den Iran stellten sich folgende Taxa heraus: *Heriades* sp. cf. *hissaricus*, *Hoplitis flabellifera*, *H. rufopicta*, *Osmia aeruginosa*, *O. caerulescens*, *O.* sp. cf. *dives* und *O. laticauda*.

Introduction

The osmiines are a group of long-tongued bees in the family Megachilidae. Non-parasitic species have the pollen scopa on the ventral terga of the metasoma (MICHENER 2007, EARDELY et al. 2010). In males the 7th tergum is often not visible from above. The Megachilidae includes the leaf-cutter bees (*Megachile* spp.), together with the many genera of mason and carder bees. Some species are sometimes called carpenters because they excavate nests in pithy stems, but should not be confused with the true carpenter bees which excavate in solid wood (Apidae: Xylocopini). The genera of the Osmiini and Anthidiini are notoriously difficult to separate (EARDLEY et al. 2010). Worldwide, the extant osmiines comprise 15 different genera and 71 non-nominotypical subgenera amounting to about 1160 species, plus many undescribed species (MICHENER 2007; PRAZ et al. 2008b; SEDIVY et al. 2008; UNGRICHT et al. 2008). In the Palaearctic there are 10 genera, 43 non-nominotypical subgenera, about 590 described species and at least 116 undescribed species (MÜLLER 2012). They are mostly small bees, some with narrow transverse bands of dense pale hairs on the posterior margins of the metasomal terga; the hairs forming the ventral scopa in females vary in colour according to species. In the males, the metasoma is often strongly down-curved.

Osmiines, which is comparatively large, burrow in the ground, make aerial nests out of mud or resin and nests in hollow sticks. The genera and subgenera are often difficult to separate (EARDLEY et al. 2010). Iran, a vast country with many mountainous regions, is famous for its diverse insect fauna (MONFARED et al. 2007). Most species of these bees have close relationships with flowering plants for food, in other words, many osmiine species are oligolectic, that is, they specialize on a restricted number of taxonomically related plant species, either at the generic or family level. Such bees are clearly very important in the reproductive biology of their host plants and osmiines in general are important pollinators of their local floras (DAFNI & O'TOOLE 1994, POTTS et al. 2003, MÜLLER et al. 1997, PRAZ et al. 2008a, SEDIVY et al. 2008, MÜLLER 2012).

Some species of *Osmia* (*Osmia*) are used commercially as managed pollinators of orchard crops (BOSCH & KEMP 2002). Osmiini occur on all continents except South America and Australia and are especially diverse in mediterranean and desertic climates, in Eurasia and southern Africa, as well as western North America (MICHENER 2007). Despite their importance as pollinators of both native floras and economically important crops, bees have always received less attention than plant pests. Although we have little data on the distribution of bees in Iran, recent research has shown that some bee species are declining (MONFARED et al. 2009).

In this study we focused on the bees of Fars province and are in the process of establishing a reference collection to meet the needs future taxonomic, ecological and other studies.

Materials and Methods

Bees were collected from suburban areas and mountainous regions of Fars province from January 2010 to Augest 2011. Some species, collected in 2009, were also represented by specimens in the Iran pollinator Insects Museum of Yasouj University. Altitude,

longitude and latitude data were recorded by GPS (Garmin Co. series eTrix Hc). Bees were collected by insect net, killed in ethyl acetate vapour and pinned in the laboratory. Data were recorded in an Excel file. All samples were identified to genus using keys in MICHENER (2007). Specific identifications were made by Dr. Andreas Müller (ETH, Zürich, Switzerland). All species identified by experts are deposited in the Iranian Pollinator Insect Museum, in the Plant Protection Group of the faculty of agriculture of Yasouj University.

All specimens deep frozen on return to Yasouj in order to avoid any infection. A stereomicroscope equipped with a drawing tube was used to draw key parts of the bees. In some cases, parts of specimens were dissected for illustration purposes. In order to draw hidden parts (e.g., genitalia and accessory sclerites), specimens were relaxed in a desiccator from 7 to 24 or more hours, depending on the degree of rigidity. Genitalia and accessory sclerites were removed with forceps or an insect pin modified for this purpose. More than 120 illustrations were drawn from all species.

Many diagnostic characters have been used to discriminate between osmiine taxa at both generic and specific levels. In this study we used the standard morphological characters well established by previous authors such as MICHENER (1941, 2007) and MÜLLER (2012).

This study is based on specimens collected in this research plus specimens borrowed from the Entomological Collection, ETH Zürich, Switzerland.

Results

The osmiine bees collected and identified in this study comprise 4 genera, 9 subgenera and 14 species. Of these, *Heriades* sp. cf. *hissaricus* POPOV 1955, *Hoplitis flabellifera* (MORICE 1901), *H. rufopicta* (MORAWITZ 1875), *Osmia aeruginosa* WARNCKE 1988, *Osmia caerulescens* (LINNAEUS 1758). *O.* sp. cf. *dives* MOCSÁRY 1877 and *O. laticauda* STANEK 1969 are new records for the Iranian fauna.

Heriades (*Michenerella*) sp. cf. *hissaricus* POPOV 1955

Material examined: Iran, Fars, Kazerun, Bidzard, 721m, 14 and 15.VI.2010, 8♂♂, 3♀♀; 14.VII.2010, 3♂♂, 8♀♀.

Food plant: *Vitex agnus-castus* (Lamiaceae).

♀: Length 5mm; Ground colour of body generally black; compound eyes yellow; Inter-antennal carina absent; antenna brown; clypeus convex; mandibles with tridentate, preapical tooth often small and inconspicuous; Preoccipital carina absent; hind tibial spurs hyaline.; Metasoma as in fig. 4; pubescence in general white and not dense, hairs at base of antenna pale, pubescence on clypeus sparse, on metasoma comprising strong apical white bands, hairs of scopa and metasoma sterna white. Body overall, densely punctured, the punctures generally coarse and separated, those on clypeus relatively sparse.

♂: size and ground colour of body as in the female; hairs on mesosomal venter, legs and metasomal sterna, white; mandibles bidentate; st3 - 6 hidden (figs 3b and 3c); st3 densely covered with long hairs, with and a tuft of hairs on median line distally (fig. 3d); st4 bilobed distally, with median carina and apically separated with wide angle (fig. 3e); st5 with pairs of large and small plates respectively along each (fig. 3f); st6 with deep notch anteriorly and bilobed apically (fig 3g); punctures in general coarse and separated, fine on clypeus; Genitalia as in figs 3h and 3i.

Hoplitis (*Hoplitis*) *flabellifera* (MORICE 1901)

Osmia conjuncta ALFKEN 1935 nec CRESSON 1864
Osmia stichi ALFKEN 1935

Material examined: Iran, Fars, Nurabad, Dalun, 2.IV.2010, 5♀♀ and 3♂♂; Eqlid, Dezhkord, Kharestan, 12.V.2011, 5♀♀ and 4♂♂; Abadeh, 14.V.2009, 1♂.

Food plant: *Vicia* (Asteraceae), *Borago officinalis* (Boraginaceae), *Centaurea* (Asteraceae).

♀: Mean length 12 mm (Fig. 5a); ground colour generally black; clypeus convex, apical margin of clypeus dentate (fig. 5b); mandibles tridentate, first tooth acute, third often reduced and with an oblique margin to apex (fig. 5e); mesosoma distinctly convex, black with scattered rather fine punctures, parapsidal line linear (fig. 5c) ; hind tibial spurs yellow and hyaline; hind leg as in fig 5d; pubescence of face white, hairs on dorsum of mesosoma, terga and legs surface white, those of terga in the form of apical bands; hairs of scopa sparse and pale; punctures fine and separate on terga, those on head and clypeus denser, coarser.

♂: Generally as in the female, but mandibles bidentate (fig. 6f); t6 a pointed tooth on each lateral margin (fig. 6d); t7 rounded, apical margin a U-shaped median incision as deep as it is wide (fig. 6d); Genitalia as in figs 6f & 6h; s4 in midline with a shallow median incision (fig. 6a), s5 trapezoid, with a wide convex proximal line (fig. 6b), s6, s7 and s8 connected to each other as in fig. 6g. s6 hyaline, glabrous; pubescence in general yellowish, dense around antennal bases and sides of clypeus dense, on median part of clypeus, sparse.

Hoplitis (*Pentadentosmia*) *rufopicta* (MORAWITZ 1875)

Osmia laeviscutum ALFKEN 1935

Material examined: Iran, Fars, Nurabad, Aalivand, 3.VII.2009, 2♀♀.

Food plant: *Centaurea* sp. (Asteraceae).

♀: Length 10 mm; head and thorax black, legs, antenna, mandible and metasoma are nonmetallic; antennal base clearly distant from nearest clypeal margin; clypeus large, flat, shining, lower margin narrow, strongly overlapping base of labrum; mandibles tridentate, in some specimens third tooth same shape as first, in others the first, apical tooth is longer than others (fig. 11); hind tibial spurs yellow; Pubescence in general pale, sparse on face, scopa white, on metasoma with apical bands; punctures in general coarse and rather dense, a small area on middle of clypeus smooth, impunctate, rest of clypeus with scattered, deep and coarse, punctures, those on thorax fine and distinct.

♂: No male specimens were collected from our study area, but we have been able to examine a single specimen from Jordan, borrowed from the ETH, Zürich. Generally as in female in appearance but with ground colour of body black.; supraclypeal area flat, not convex; mandibles bidentate; t6 with two acute teeth posterolaterally; t7 with 5 well developed teeth, the median larger than others (fig. 11b); Genitalia as in figs 11f and 11g; s3-6 with rows of long hairs, these longer laterally, the shortest medially (fig. 11a); , s5, s6 and s7 as in Figs 11c, 11d and 11e respectively; Pubescence in general, white, forming distinct apical bands on terga; punctures on terga rather oval.

Osmia (*Hoplosmia*) *ligurica* MORAWITZ 1868

Osmia detrita PÉREZ 1879

Material examined: Iran, Fars, Nurabad, Durahi, 23.III.2010, 1♂.

Food plant: *Medicago sativa* (Fabaceae), *Brassica* sp. (Brassicaceae).

♀: Length 9 mm; Ground colour generally black, and non-metallic; clypeus apical margin with a median, impunctate excavation, distal part of clypeus with a notch in the middle directed downward and no punctures, with tufts of orange hairs beneath the clypeal margin; mandibles distinctly tridentate; axillae with latero-dorsal spines as in fig.7b; hind tibial spurs brown; apex of t6 acute, as in fig. 8. Pubescence generally white, metasomal t1-3 with weak band, scopa white; Punctures generally coarse and dense, less dense on thorax.

♂: Length 7 mm; Ground colour generally non metallic, black; mandibles bidentate (fig. 7a); clypeus convex, distally part of clypeus with a middle furrow and two paired foveae; hind tibial spurs light brown; t6 with numerous teeth distally (fig. 7c); t7 with median incision inside with a small teeth fig. 7c; genitalia as in fig. 9c & 9d; Metasomal sterna and S5, S6, S7 and S8 as in figs 7d, 9a, 9b & 9c; Pubescence in general white and some parts pale, around antenna and on clypeus dense, long, white and plumose, that of mesosoma pale and sparse, that of metasoma white but without apical bands, the sterna scarce and white; Punctures on frons, coarse and distinct, on mesosoma, fine and separate, on the metasoma medium-sized and sparse.

Osmia (*Helicosmia*) *aeruginosa* WARNCKE 1988

Material examined: Iran, Fars, Kharestan. 12.V.2011, 1♂.

Food plant: of male specimen: *Vicia* sp. (Fabaceae), *Borago officinalis* (Boraginaceae).

♀: No females were collected in this study; a female from Turkey was borrowed from ETH Museum, Zürich. Length 13 mm; Ground colour generally black, non-metallic. Head large in comparison with mesosoma and metasoma, the latter compact; clypeus weakly convex, lower margin thickened and overhanging the labrum, with tufts of orange hairs beneath the clypeal margin (fig. 12a); mandibles quadridentate, robust, innermost smallest (fig12b); basal mandibular groove less deep; propodeum dull; hind basitarsus with a row of long hairs well developed (Penicillius); hind spurs black and piceus; basitarsus brown; Pubescence around antenna and clypeus white and plumose, on thorax pale, plumose and scarce, metasoma white, with weak bands scopa black; Punctures in general coarse and close.

♂: Length 12 mm; Ground colour of body generally metallic and dark green; mandibles two-toothed; clypeus convex; hind spurs black and piceus; T6 with a notch medially and concave two lateral aspects (fig. 13a); T7 with a small midapical emargination or bidentate (fig. 13a); genitalia, gonostylus pipe like distally turn outward, penis valve pointed distally, volsella rather long but smaller than penis valve (fig. 13c and 13d); S4 with two apical carinae, between which a narrow groove at least laterally, as in Diceratosmia (fig. 13b), S5 and S6 as in figs 13e and 13f; Pubescence in general pale and plumose, apical of metasoma tergal with rows of white hairs; punctures in general fine and close, on thorax fine and separated.

Osmia (*Helicosmia*) *caerulescens* (LINNAEUS 1758)

Apis aenea LINNAEUS 1761
Apis superbus HARRIS 1776
Apis muraria RETZIUS 1783
Apis cuprea FOURCROY & GEOFFROY 1785
Andrena cupraria WALCKENAER 1802
Osmia purpurea CRESSON 1864
Osmia rustica CRESSON 1864

Material examined: Iran, Fars, Eqlid, Kharestan, 12.V.2011. 1♂; Sepidan, 4.VIII.2010, 1♀; Abadeh. 26.III.2011, 1♀.

Food plant: *Medicago sativa*, *Vicia* sp., (Fabaceae); Asteraceae sp.; *Borago officinalis* (Boraginaceae); *Euphorbia* sp.; *Epilobium hirsutum* (Onagraceae).

♀: Length 10 mm; ground colour blue and metallic, antenna black, clypeus convex, lower margin thickened and overhanging labrum, with tufts of orange hairs beneath the clypeus margin; mandibles tridentate, apical tooth developed and longer than others, basal part of clypeus with coarse punctures, no much narrower medially than base, mandibular base not much deep; legs black, hind tibial spurs black and shiny; Pubescence white, scopa black; mesonotal punctures coarse, dense, on metasoma, a mixture of fine and coarse.

♂: Length 10 mm; ground colour in general metallic and olive-green; clypeus convex, tufts of pale hairs beneath the clypeal margin; mandibles bidentate; parapsidal line punctiform, conspicuous; legs black, hind tibial spurs black and shiny; T7 bidentate, without lateral tooth (fig. 14b); T6 apically sinuate (fig. 14b); genitalia, gonostylus cylindrical, distally bent inward, distal part of penis valve spoon like (figs 14f and 14g); metasomal sterna as in fig. 14a; S4-S6 as in figs 14a, 14d and 14e respectively; Pubescence in general pale; punctures on face and mesosoma medium and close, on metasoma fine and completely separated.

Osmia (*Pyrosmia*) *cephalotes* MORAWITZ 1870

Osmia bacillus PÉREZ 1879
Osmia pulsata BUYSSON 1899

Material examined: Iran, Fars, Kharestan. 12.V.2011, 1♀.

Food plant: *Vicia* (Fabaceae), *Borago officinalis* L. (Boraginaceae).

♀: Length 12 mm; Ground colour of body generally dark blue and metallic, antenna black; head oval, face elongate; median part of clypeus convex, between antennal sockets and below median ocellus convex, lower margin of clypeus thickened and overhanging the labrum; internal margin of antennal sucket with a process; mandibles three-toothed, tooth close to clypeus with three dents, robust; legs black, hind spurs brown; Pubescence in general scarce and white, on metasoma no form apical bands but small marginal bands; pubescence on 3 and 4 Metasomal sterna white and on 5,6 and 7 black; Punctures on face coarse and separated, on thorax medial and separated with common boundaries, metasoma fine, completely separated and scarce.

♂: Length 9 mm; Ground colour of body generally metallic and green, antenna and legs black; head almost spherical, face not elongate; mandibles two-toothed; clypeus convex; hind spurs brown; T6 with a developed notch medially (fig. 15a); T7 trifids, median tooth distally circled and lied outward while two lateral dents lied ventral aspect, lateral ones pointed at internal margin (fig. 15a); genitalia as in figs 15d and 15g, volsella narrow median and (dagger) plate like distally; S3-S6 as in figs 15b, 15c, 15e and 15f; Pubescence in general pale, on clypeus dense, on thorax yellow and scarce; Punctures on head medium and separated, on metasoma completely separated and scarce.

Osmia (*Osmia*) *cerinthidis* MORAWITZ 1876

Material examined: Iran, Fars, Sepidan, Bahrghan. 8.IV.2010, 1♀.

Food plant: *Brassica napus* L. (Brassicaceae).

♀: Length 12 mm (fig. 16a); robust specimens with hairy body; Ground colour of body generally metallic and olive- blue, antenna black; lateral parts of the clypeus with strong angles or horns, even longer and thickened than scape (fig. 16b); clypeus truncate and overhanging, the base of the labrum no hidden; mandibles three-toothed, but third tooth often very small and inconspicuous; parapsidal lines punctiform (fig. 16a); legs black, hind spurs light brown; Metasoma as in fig 16c; Pubescence, in general long and white, on clypeus mix of white and black, on apical band of T4, whole of T5 and T6 black, on Metasomal sterna and scopa orange and shagreen, on basitarsus orange; Punctures in general medium and close.

♂: Length 10 mm; Ground colour of body generally metallic and greenish; scape in male shorter than female; lateral parts of the clypeus without strong angles or horns (fig. 17a); mandibles two-toothed (fig. 17b); parapsidal lines punctiform; legs black, hind spurs light brown; T6 and T7 simple (without tooth), T6 without lateral tooth (fig. 17c); genitalia as in figs 18a and 18b, gonostylus beak like distally; Metasomal sterna as in fig. 17d; S3-S6 as in figs 17e, 17f, 17g and 17h; Pubescence, between antenna and on clypeus white, on Metasomal sterna white, on basitarsus orange; Punctures in general fine and close.

Osmia (*Helicosmia*) *dives* MOCSARY 1877

Osmia medanae MAGRETTI 1890
Osmia subintegra PÉREZ 1902
Osmia hierosolomita BENOIST 1934

Material examined: Iran, Fars, Abadeh. 26.IV.2011, 1♂; Iran, Kohgiluyeh & Boyer Ahmad Province, Yasouj, Tangetamoradi. 4.VI.2010, 1♀.

Food plant: unknown.

♀: (A specimen out of Fars province described here); Length 13 mm; Ground colour of body generally black and non-metallic; clypeus weakly convex than previous species, lower margin thickend and overhanging the labrum, two tufts of orange hairs beneath the clypeus margin (fig. 19); mandibles three-toothed, robust, no much narrower medially than at the base, basal mandibular less deep; propodeum less dull; hind spurs black and piceus; Pubescence, on vertex orange and scarce, around antenna and on clypeus pale and dense, on thorax orange, on metasoma with orange bands, on scopa orange, on tibia and basitarsus pale; Punctures on metasoma medium and fine scattered.

♂: Length 12 mm; Ground colour of body generally dark; clypeus convex, without tufts; hind spurs black and piceus; middle of hind basitarsus with a small spin between hairs; T6 laterally with two process (fig. 20g); T7 with a big invagination in median part and two tooth laterally (fig. 20g); genitalia, similar to *O.* (*H.*) *aeruginosa* but gonostylus in this species narrower in middle and distal part than *O. aeruginosa* (figs 20c and 20e); S3-S6 as in figs 20a, 20b, 20d and 20f; Pubescence, on vertex pale, around antenna and on clypeus white, on thorax pale, on Metasomal sterna and legs pale; punctures on metasoma medium, fine and close.

Osmia (*Hemiosmia*) *difficilis* MORAWITZ 1875

Osmia falcata MORAWITZ 1875
Osmia alborufa ALFKEN 1935

Material examined: Iran, Fars, Kharestan. 12.V.2011, 3♀♀ and 16♂♂; Iran, Fars, Abadeh, 4.V.2009, 1♂.

Food plant: *Vicia* (Fabaceae), *Borago officinalis* L. (Boraginaceae).

♀: Length 11 mm; Ground colour of body generally black and non-metallic; clypeus convex, below concavity a flat area; mandibles robust with four-toothed, apical tooth well developed and others well distinct (fig. 21b); hind spurs light brown; dwarf not elongate (fig. 21a); Pubescence in general pale, on Metasomal sterna and scopa orange, on bisitarsus and tarsi white; metasoma; Punctures in general coarse and close.

♂: Length 13 mm; Ground colour of body generally black and non-metallic; mandibles three-toothed (fig. 23h); hind spurs light brown; T6 with two lateral teeth and a median one, median teeth longer than two lateral ones (fig. 23a); T7 distally semicircle (fig. 23g); Metasomal sterna as in fig. 23b; S5-S7 as in fig 23e, 23f and 23g; genitalia, with gonostylus head very wide, dagger shape distally, penis valve as in figs 23c and 23d; Pubescence around antenna and on clypeus dense, tall and white, on thorax yellowish, on legs white; Punctures in general coarse and close.

Osmia (*Helicosmia*) *fasciata* LATREILLE 1811

Osmia atro-alba MORAWITZ 1875
Osmia (*Acanthosmia*) *sita* NURSE 1904
Osmia kuznetzovi COCKERELL 1930
Osmia bucharica POPOV 1935

Material examined: Iran, Fars, Shiraz, 7.V.2011, 1♂; Iran, Fars, Nurabad, Zirdu. Tolekohneh, 31.III.2011, 1♂; Iran, khuzestan, Shadegan, 22.III.2009, 1♀.

F o o d p l a n t : *Astragalus* (Fabaceae), *Amygdalus eburnean* L. (Rosaceae), *Amygdalus* (Rosaceae).

♀: (A specimen out of Fars province described here). Length 12 mm; Ground colour of body generally black and non-metallic; clypeus convex, clypeus with broad median furrow distally over the labrum (figs 22b and 22a); lower margin with wide process; mandibles three-toothed, robust (fig. 22c); basal mandibular groove less deep; hind spurs dark brown; T6 curved distally; Pubescence in general white, on scopa white; Punctures, on head and thorax coarse.

♂: Length 9 mm; Ground colour of body generally black; mandibles two-toothed; clypeus weakly convex; distal margin over the labrum with 5 dents in the middle, hind spurs black; T6 with numerous small teeth (fig. 24b); T7 with two later- distal teeth (fig. 24e); genitalia as in figs 24f and 24g, S5 and S6 as in figs 24c and 24d; Metasomal sterna as in fig 24a; Pubescence in general white, around antenna and on clypeus dense, on metasoma forms bands; Punctures in general coarse and close.

Osmia (*Helicosmia*) *gutturalis* WARNCKE 1988

Osmia (*Chalcosmia*) *milenae* TKALCŮ 1992

M a t e r i a l e x a m i n e d : Iran, Fars, Shiraz. 7.V.2011, 1♀.

F o o d p l a n t s : unknown.

♀: Length 9 mm; Ground colour of body generally black and non-metallic; clypeus convex, lower margin thickend and overhanging the labrum, with tufts of orange hairs beneath the clypeus margin (fig. 25a); mandibles three-toothed, Apical tooth well developed, second one smaller than apical and more developed than third, third tooth well developed and conspicuous than previous species (fig. 25b); no much narrower medially than at the base, basal mandibular not much deep; propodeum dull; hind spurs black; Pubescence, on face not dense and scarce, on clypeus pale, on basal part of mandible white and on middle dense and yellow; thorax scarce and orange, metasomal tergites 4, 5 and 6 with strong white bands, Metasomal sterna and scopa black; Punctures in general coarse and separated, on metasoma scarce.

♂: (A specimen out of Fars province described here), Length 9 mm; Ground colour of body generally green and metallic; clypeus well convex, with tufts of orange hairs beneath the clypeus margin, distal margin over the labrum with 5 dents in the middle; mandibles two-toothed; hind spurs dark-brown; T5 and T6 rounded distally with two lateral wide angles as in fig. 26c; genitalia as in fig. 26b; S5 and S6 as in figs 26d and 26e; Abominal sternites as in fig. 26a; Pubescence in general pale, on metasoma pale and weak bands; Punctures on vertex medium and close, on clypeus coarse and mixed, on metasoma coarse.

Osmia (*Pyrosmia*) *laticauda* STANĚK 1969

Osmia tichodroma WARNCKE 1992

M a t e r i a l e x a m i n e d : Iran, Fars, kharestan, 12.V.2011, 1989m, 2♀♀.

F o o d p l a n t : unknown.

♀: Length 8 mm; Ground colour of body generally dark blue and metallic, legs black; clypeus convex, with tufts of yellow hairs beneath the clypeus margin, clypeus truncate, lower margin thickend and overhanging the labrum; mandibles three-toothed, robust; hind spurs black and piceus; Pubescence in general white, around antenna and clypeus white and plumose, on lower part of its with yellow hair, on mandible orange, metasoma white and with stronge band, scopa white; Punctures on face large, coarse and separated, thorax mediaum and separated, on metasoma medium and separated.

♂: (A specimen out of Fars province described here). Length 6 mm; Ground colour of body generally metallic and green; clypeus convex, with tufts of pale hairs beneath the clypeus margin; Mandible two- toothed; hind spurs black and piceus; T6 bent inward, medially without punctures as fig. 27c; T7 with a median wide dent (fig. 27c); genitalia as in fig. 27b; Metasomal sterna as in fig 27a; Pubescence in general white, on face white and dense; Punctures on face coarse and separated, thorax medium and close, metasoma medium and separate.

Osmia (*Helicosmia*) *niveata* (FABRICIUS 1804)

Apis fulviventris PANZER 1798
Anthophora niveata FABRICIUS 1804
Osmia fulvicornis LATREILLE 1809
Osmia minuta BRAMSON 1879
Osmia sieversi MORAWITZ 1886
Osmia carneiventris DOURS 1887
Osmia fulviventris albiscopa ALFKEN 1914

Material examined: Iran, Fars, Shiraz. 8.IV.2009, 1♂.

Food plants: Unknown.

♀: Length 13 mm; Ground colour of body generally black and non-metallic; compound eyes large; antenna 12 segments; clypeus, truncate, lower margin thickened and overhanging the labrum, with tufts of orange hairs beneath the clypeus margin; mandibles three-toothed, but third tooth often inconspicuous (fig. 28a), robust, no much narrower medially than at the base, basal mandibular less deep; propodeum dull less; hind spurs dark brown; Pubescence in general orange, scopa orange; Punctures in general fine and close, on clypeus coarse and separated; clypeus distally with a pointed process in the middle, antenna, clypeus, tuft hairs and mandible as in fig. 28a; metasoma dorsal view as in fig. 28b.

♂: Length 8 mm; Ground colour of body generally metallic and green; clypeus convex with tufts; tarsal hind spurs black and piceus; Mandible two toothed; clypeus distal margin with small dents; T6 and T7 bidentate and coincidence (figs 29c and 29d, dorsal and lateral view); genitalia from dorsal and ventral view as in figs 29f and 29g; Metasomal sterna as in fig. 29e; Pubescence in general yellow, on face dense and tall and yellow, basitarsus yellow and Other parts of the leg white; punctures in general fine and close.

Discussion

With the exception of *Heriadess hissaricus*, which was collected from warm localities, all species of Osmiine, dealt with here regions, were collected in the cooler regions of Fars province. This area comprises about 133.299 km², and accounts for 8.1 percent of Iran. The Research Centre for Agriculture and Natural Resources of Fars Province has recorded the mean elevation of Fars Province as 1.350m above the sea level (RCANR, 2011). It is the third largest province in Iran and is larger than some European countries such as Belgium. TAVAKKOLI et al. (2003) recorded seven species of the Osmiini in the Gilan region of this province. These seven species were: *Osmia rufa*, *Osmia atrocaerulea*, *Osmia pedicornis*, *Osmia niveata*, *Osmia aurulenta*, *Osmia* sp. aff *cerinthidis*, *Osmia* (*Hoplosmia*) sp. aff *ligurica.* According to MÜLLER (2012), *Hoplitis* (*Pentadentosmia*) *laeviscutum* (ALFKEN) is a junior synonym of *Hoplitis* (*Pentadentosmia*) *rufopicta* (MORAWITZ) which we collected from Fars province. He stated that several males and females of *Pentadentosmia* from Central Asia, identified by V. B. Popov as *Hoplitis rufopicta*, are morphologically identical with typical specimens of *Hoplitis laeviscutum* from Turkey and Palestine (A. Müller, unpublished). The extent of red cuticular pigment is highly variable intraspecifically: specimens from Turkey, Palestine and Jordan are virtually devoid of red, while in some specimens from Central Asia and Pakistan the metasoma is entirely red. Even individuals from the same locality, vary from purely black to individuals with differing amounts of red, as exemplified by a series of *Hoplitis rufopicta* recently collected by C. Praz, C. Sedivy and A. Monfared in Iran.

IZADI et al. (1998) recorded three species, *Osmia corniforns*, *O. taurus* and *O. uncinata* in the North of Fars Province, which we did not find.

There have been few recent studies on the nesting biology and nest architecture of these bees in Iran but in June 2009, C. Praz, C. Sedivy, A. Monfared and A. Talebi found the first nests of *Osmia* (*Hemiosmia*) *difficilis*, *O.* (*Ozbekosmia*) *avosetta* (ROZEN et al. 2010), *O.* (*Pyrosmia*) *oramara* and *Hoplitis* (*Chlidoplitis*) *heinrichi* (MÜLLER 2012).

Acknowledgments

The authors thank Dr. Andreas Müller for their valued help with the identification of specimens. We also thank Dr. Chris O'Toole for his valued helps on correcting language and scientific comments. Also, to Dr. Ashkbus Dehdari for making facilities in the Yasouj University available for this study and Dr. Mohammad Abdollahi for his valued advice in preparing drawings.

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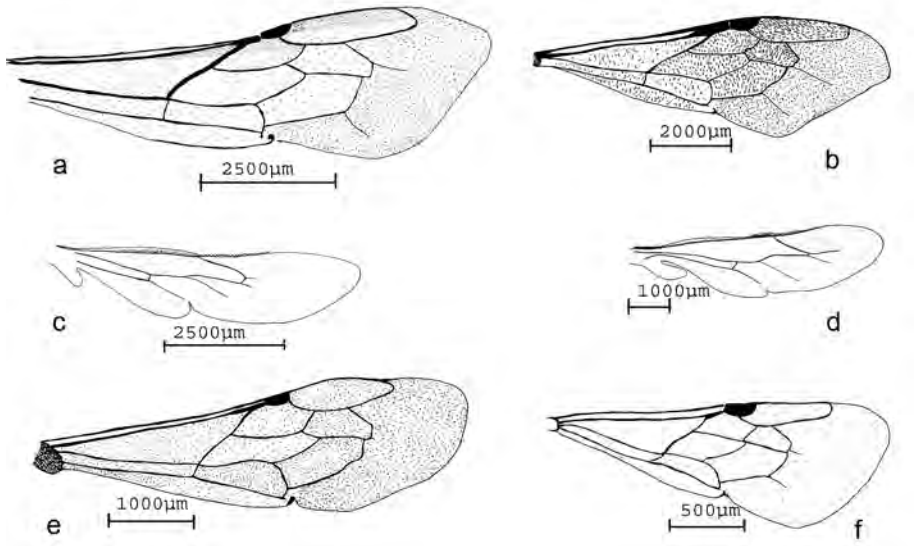

Fig. 1: Structure of wings in Osmiini. a, c, *Osmia cerinthidis* (♀). e, *Hoplitis rufopicta* (♀). f, *Heriades hissaricus* (♂). b, d, *Hoplitis flabellifera* (♀).

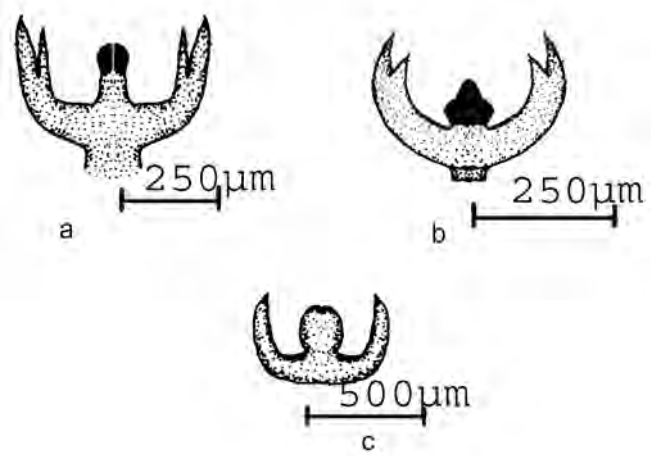

Fig. 2: Structure of claw in Osmiini. a, *Hoplitis flabellifera*. c, *Hoplitis rufopicta* (♀). b, *Osmia cerinthidis* (♂).

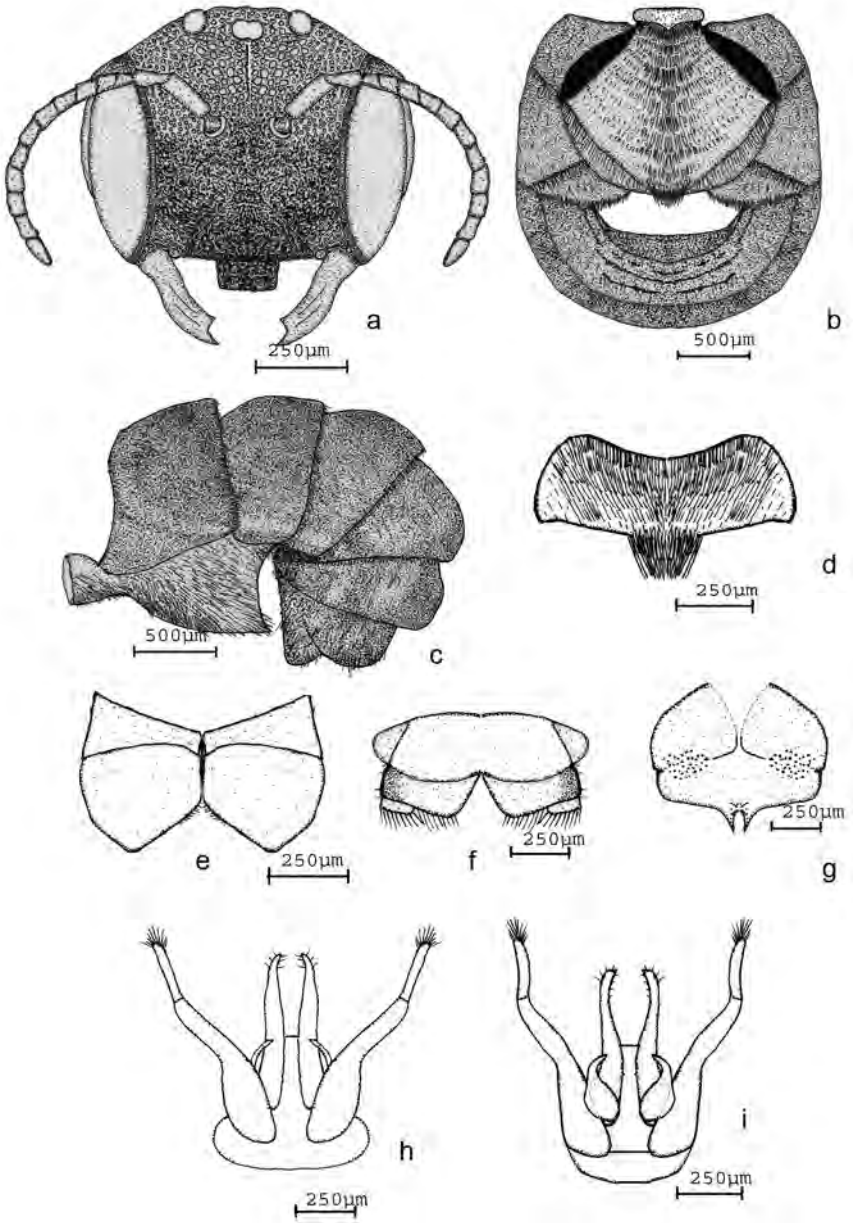

Fig. 3: Structure of *Heriades* cf *hissaricus* (♂). a, Face. b, Metasomal sterna. c, Metasoma (Laterally). d, S3. e, S4. f, S5. g, S6. Genital capsule, h, dorsal. i, ventral.

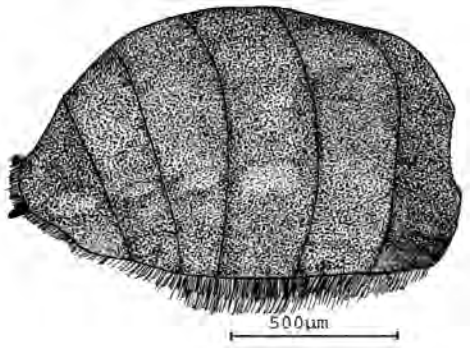

Fig. 4: Metasoma of *Heriades hissaricus* (♀).

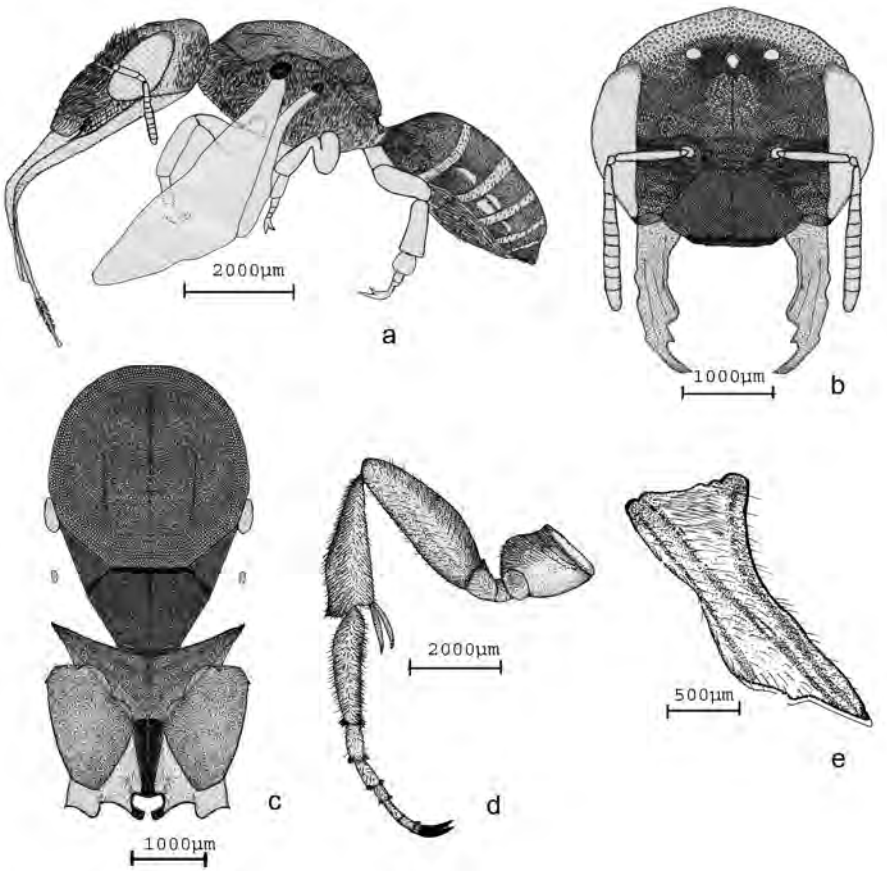

Fig. 5: Structure of *Hoplitis flabellifera* (♀). a, Full body shape. b, Face. c, Thorax. d, Hind leg. e, Mandible.

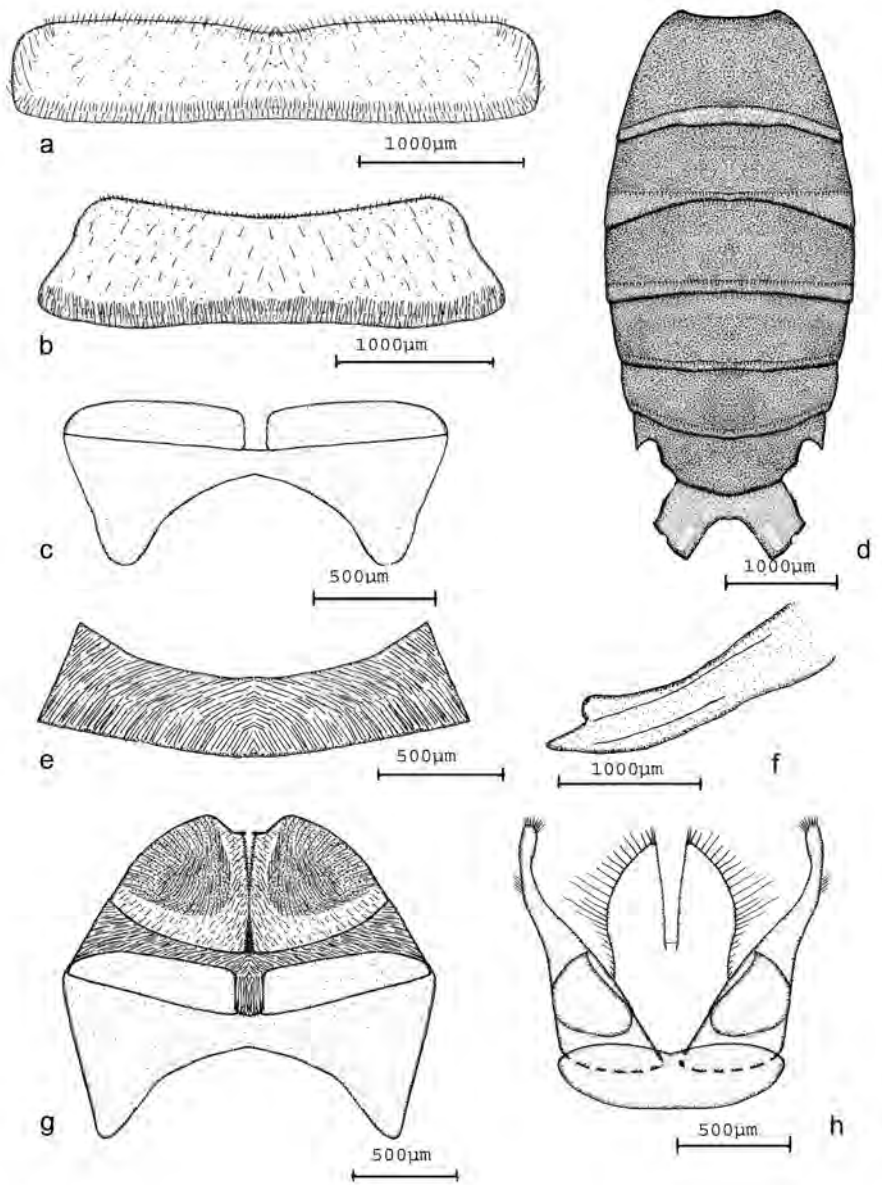

Fig. 6: Structure of *Hoplitis flabellifera* (♂). a, S4. b, S5. C, S6. d, Metasoma. e, S7. f, Mandible. g, S6, S7, S8. H, Genitalia ventral view.

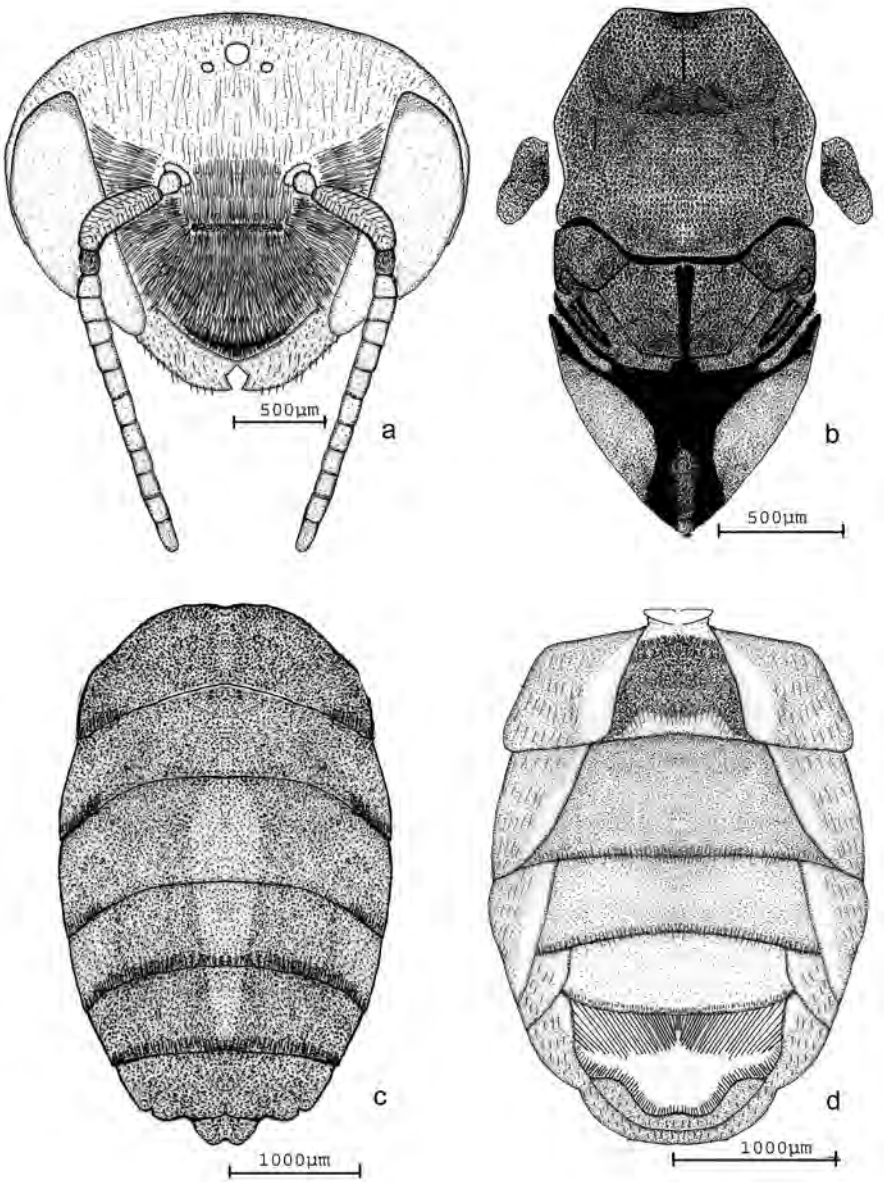

Fig. 7: *Hoplosmia ligurica* (♂). a, Face. b, Thorax. c, Metasoma. d, Masomal sterna.

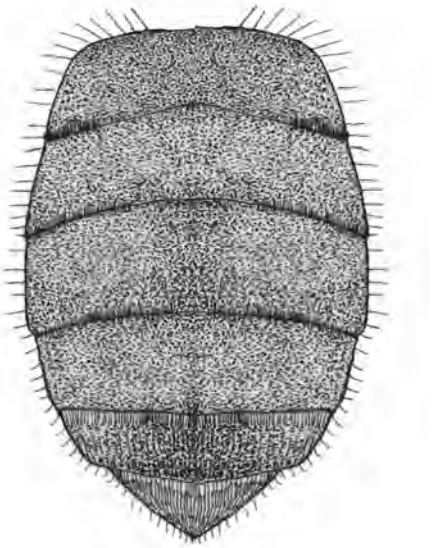

Fig. 8: Metasoma of *Hoplosmia ligurica* (♀)**,** dorsal view.

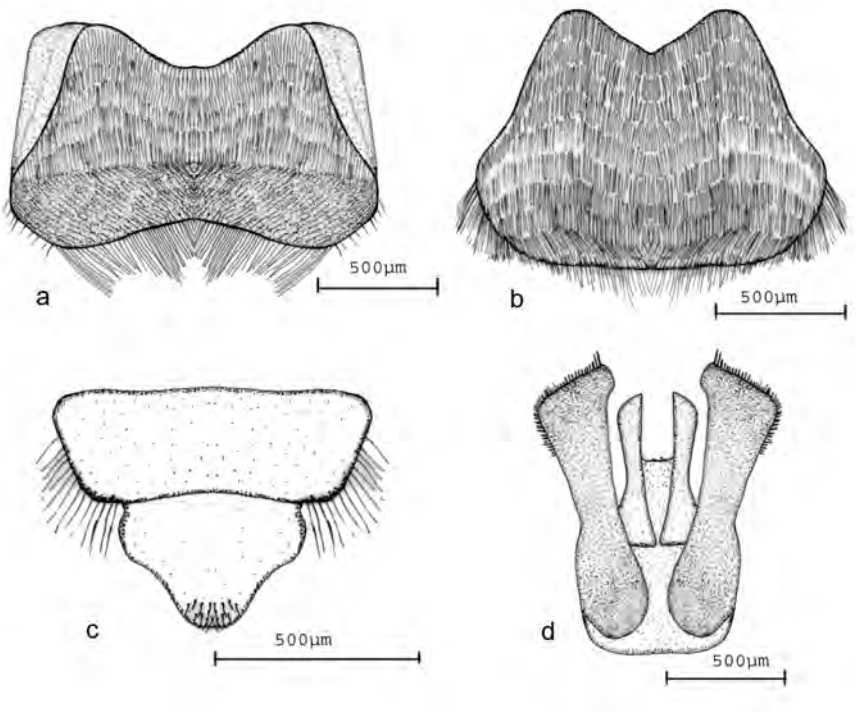

Fig. 9: *Hoplosmia ligurica* (♂). a,st5. b, st6. c, st7, st8. d, Genitalia. dorsal view.

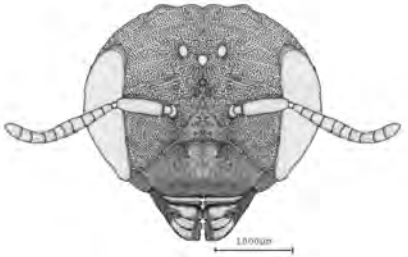

Fig. 10: *Hoplitis rufopicta* (♀).

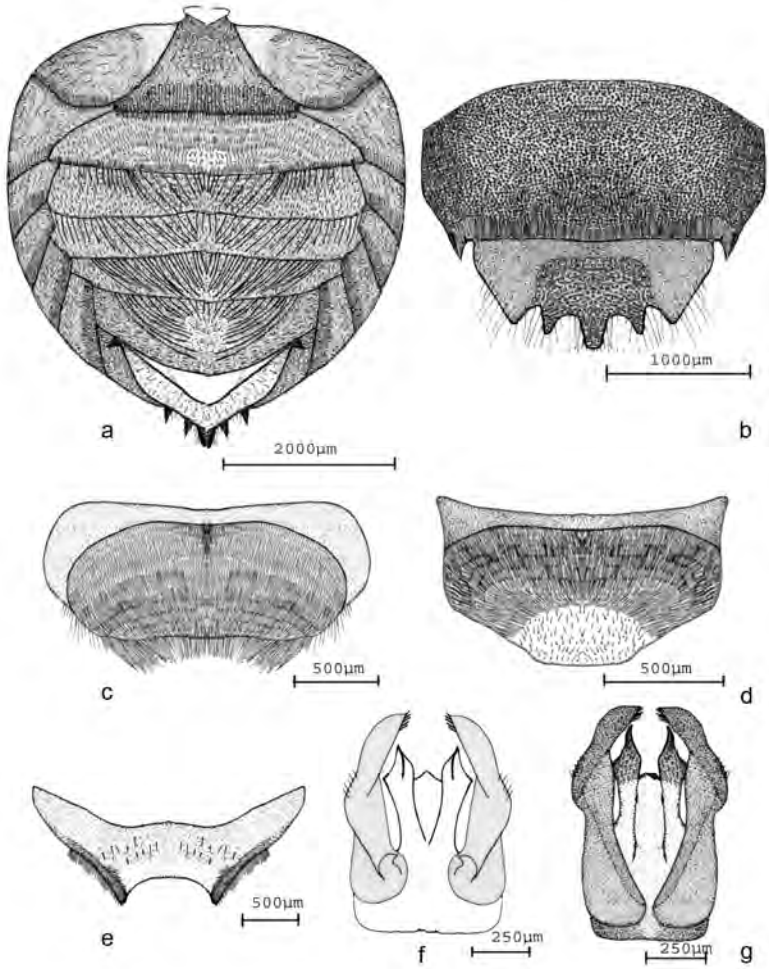

Fig. 11: Structure of *Hoplitis rufopicta* (♂). a, Metasomal sterna. b, t6 and t7. c, st5. d, st6. e, st7. Genital capsule: f: ventral, g: dorsal.

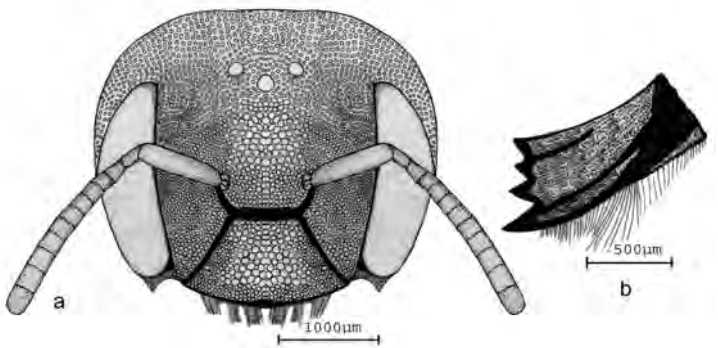

Fig. 12: *Osmia aeruginosa* (♀). a, Face. b, Mandible.

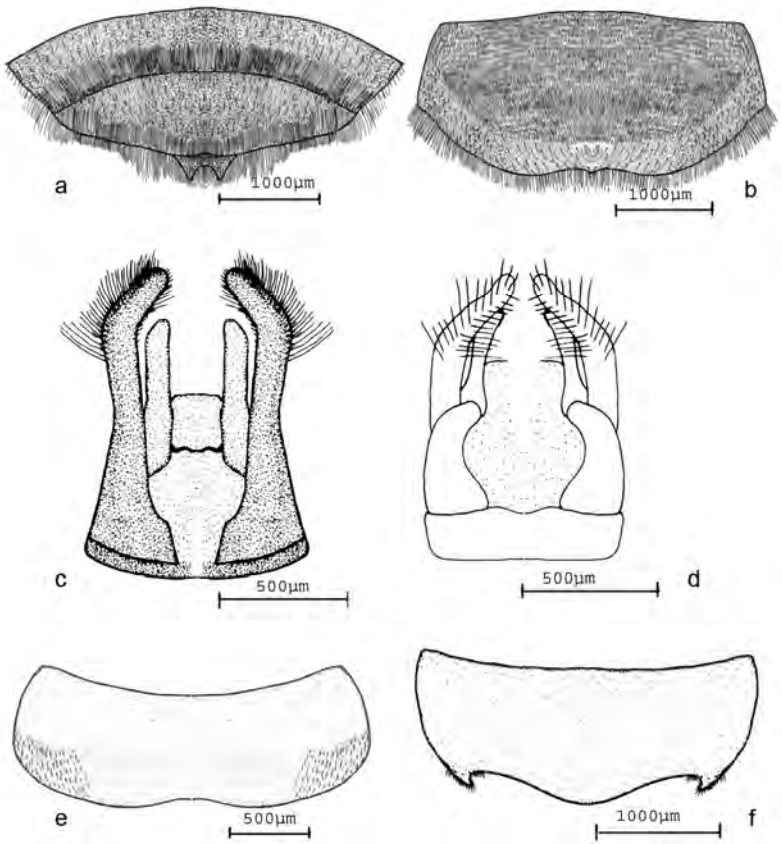

Fig. 13: Structure of *Osmia aeruginosa* (♂). a, t5, t6, t7. b, st4. Genital capsule: c, dorsal, d, ventral; e, st5. f, st6. It is normal to place figs of genital capsule after those of other metasomal segments as in Fig. 14.

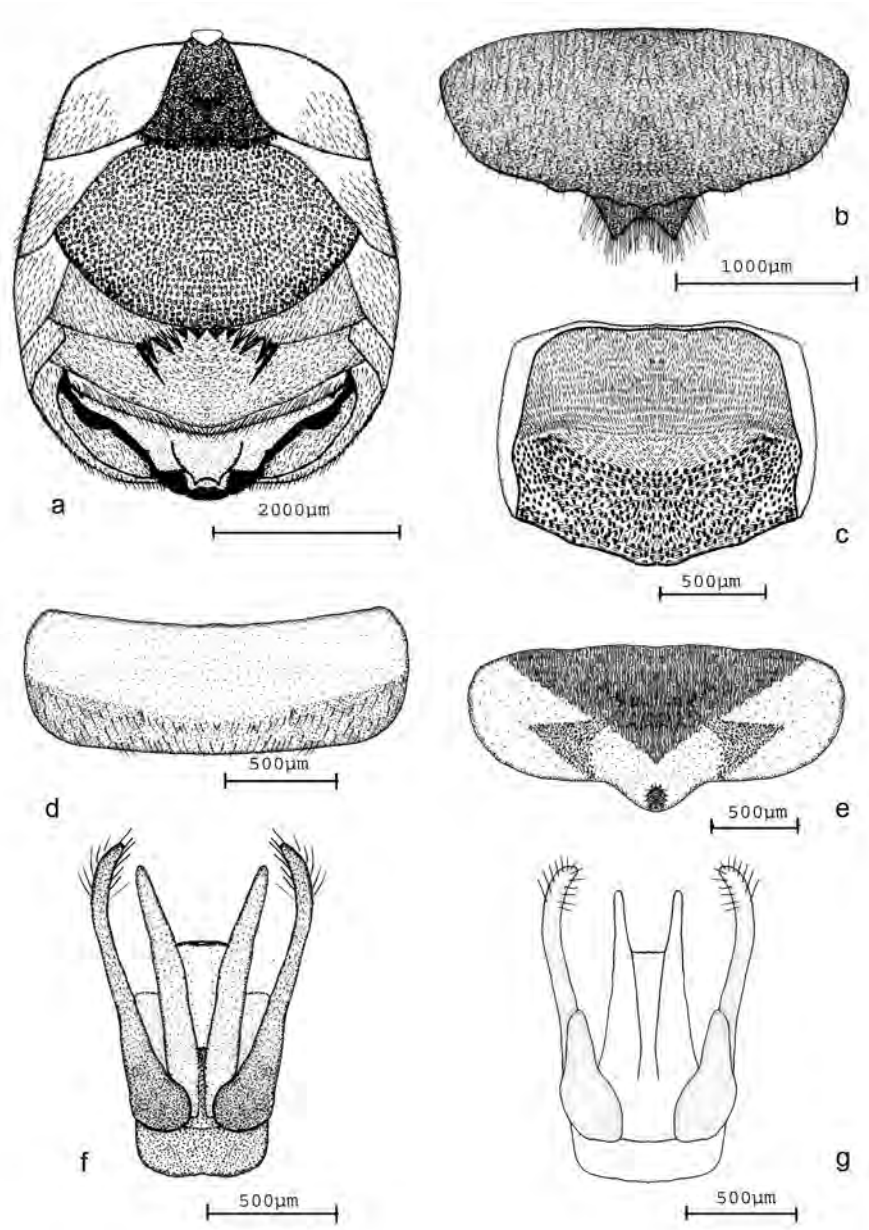

Fig. 14: Structre of *Osmia caerulescens* (♂). a, Metasomal sterna. b, t6,t7. c, st4. d, st5 . e, st6. Genital capsule: f, dorsal, g, ventral.

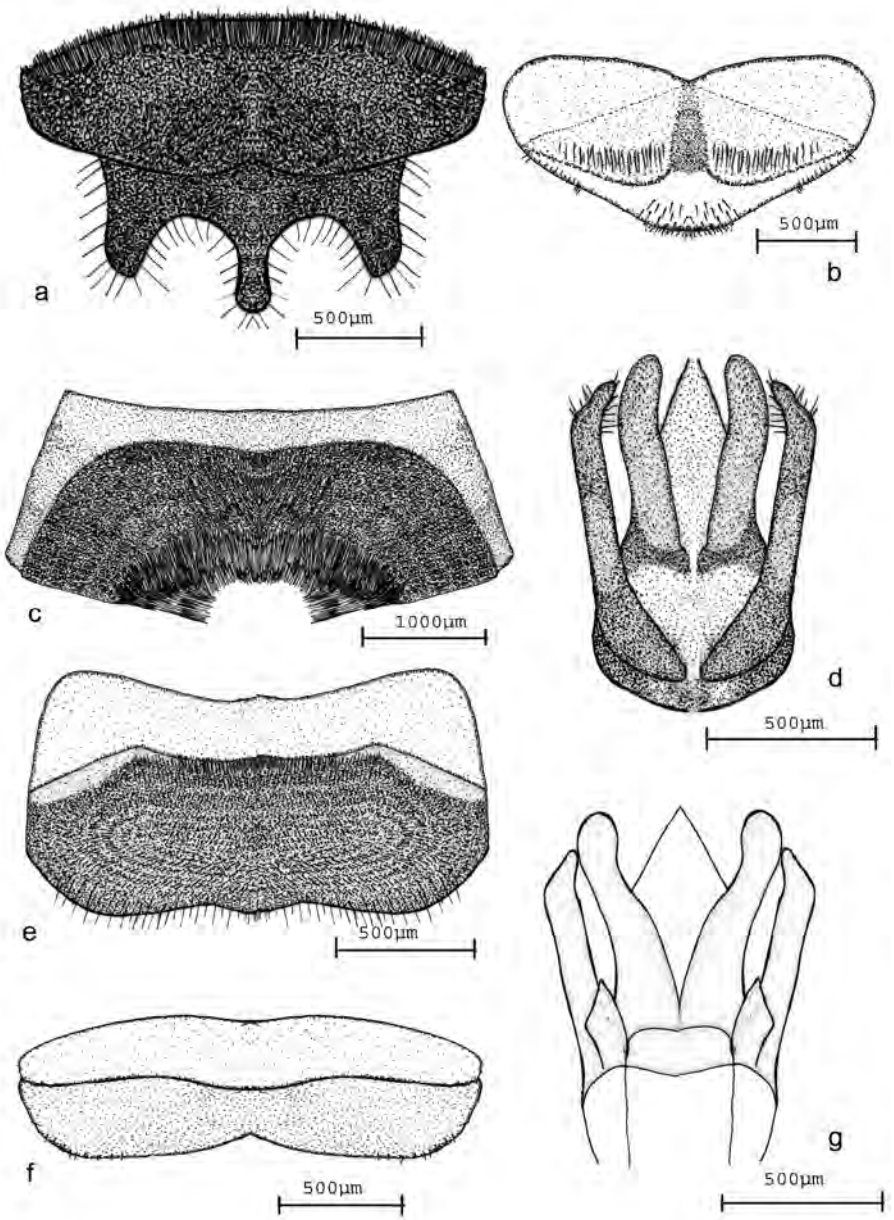

Fig. 15: *Osmia cephalotes* (♂). a, T6, T7. b, S3. c, S4. Genital capsule, d, dorsal view, g, ventral view. e, S5. f, S6.

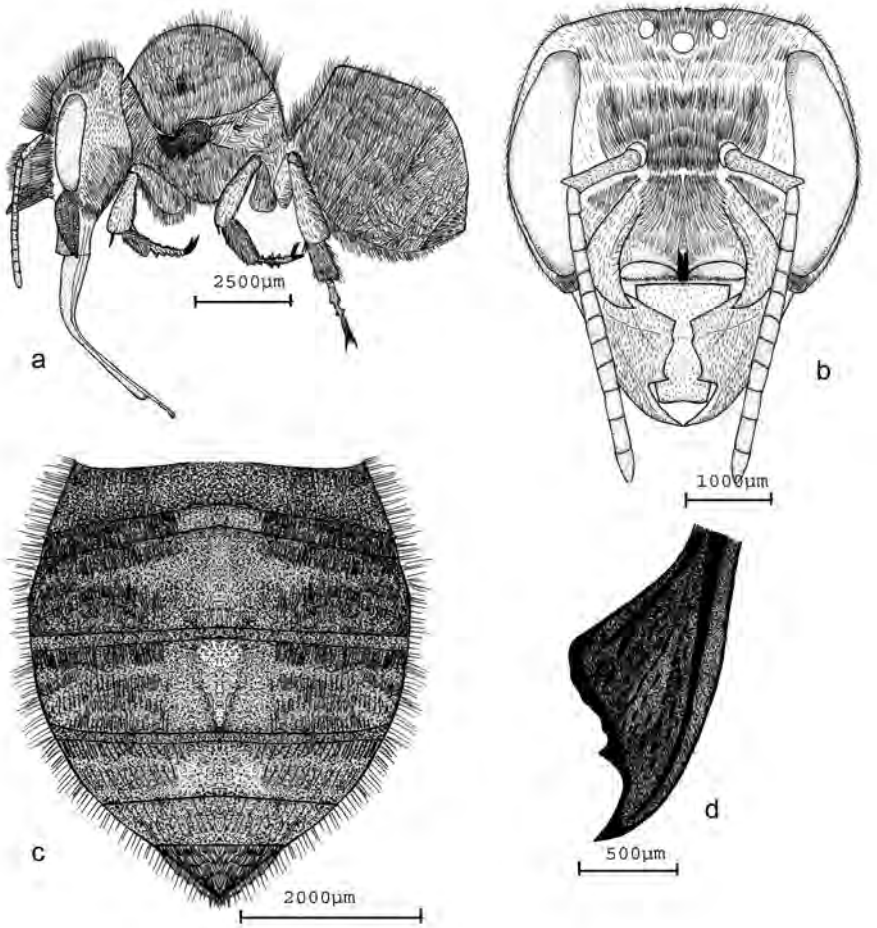

Fig. 16: Structure of *Osmia cerinthidis* (♀). a, Full body shape. b, Face. c, Metasoma. d, Mandible

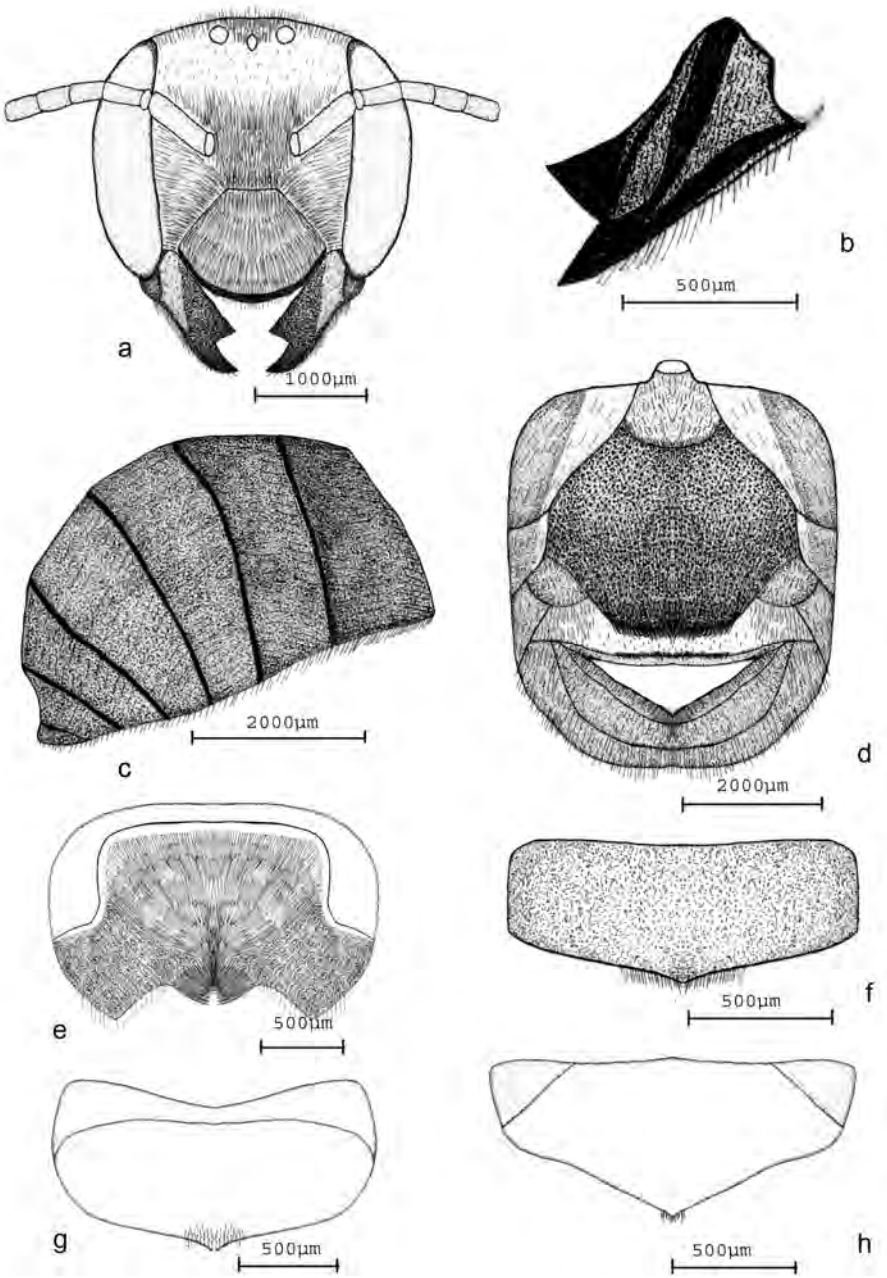

Fig. 17: Structure of *Osmia cerinthidis*(♂). a, Face. b, Mandible. c, Metasoma. d, Metasomal sterna. e, S3. f, S4. g, S5. h, S6.

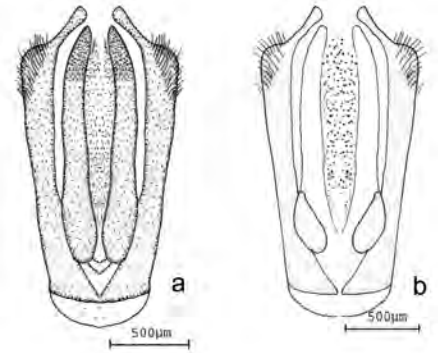

Fig. 18: a,b, Genitalia of *Osmia cerinthidis*

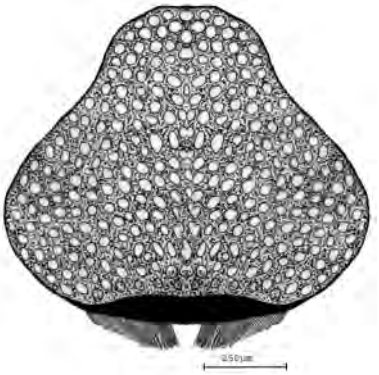

Fig. 19: Clypeus of *Osmia* cf *dives* (♀)

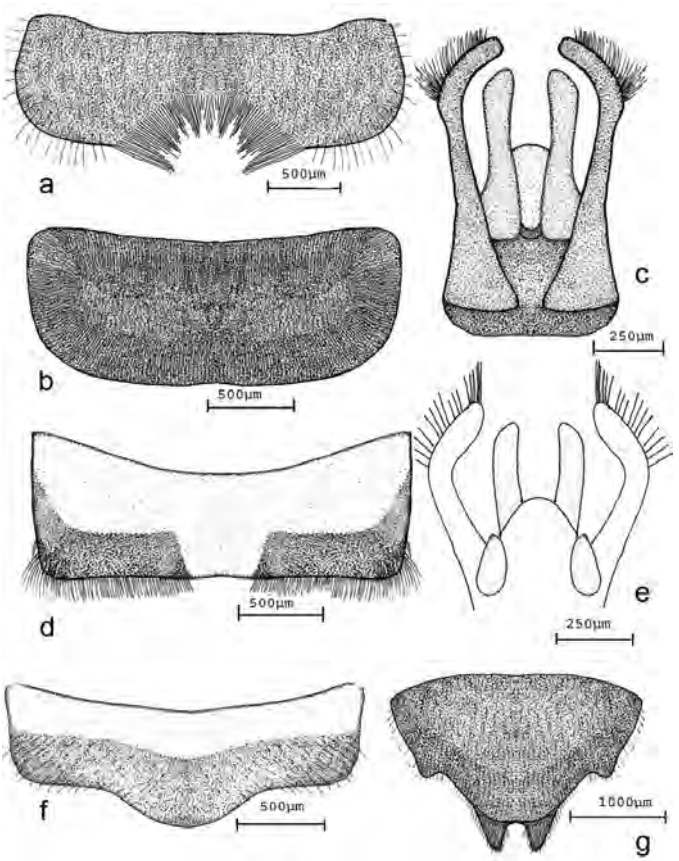

Fig. 20: Structure of *Osmia* cf *divis*. a, S3. b, S4. Genital capsule, c, dorsal, e, ventral. d, S5. f, S6. g, T6 and T7.

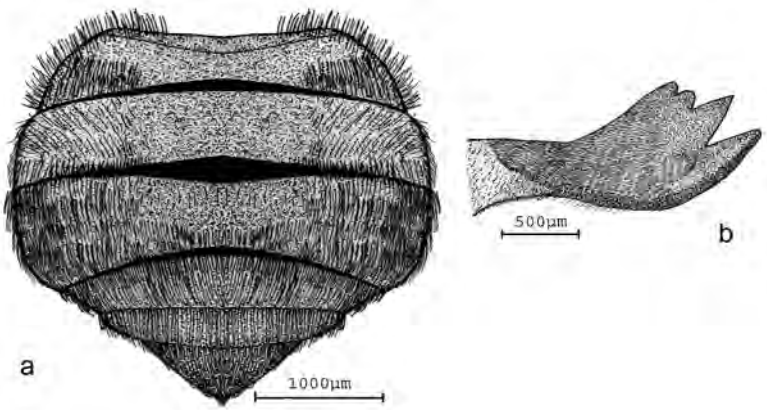

Fig. 21: *Osmia difficilis* (♀). a, Metasoma. b, Mandible

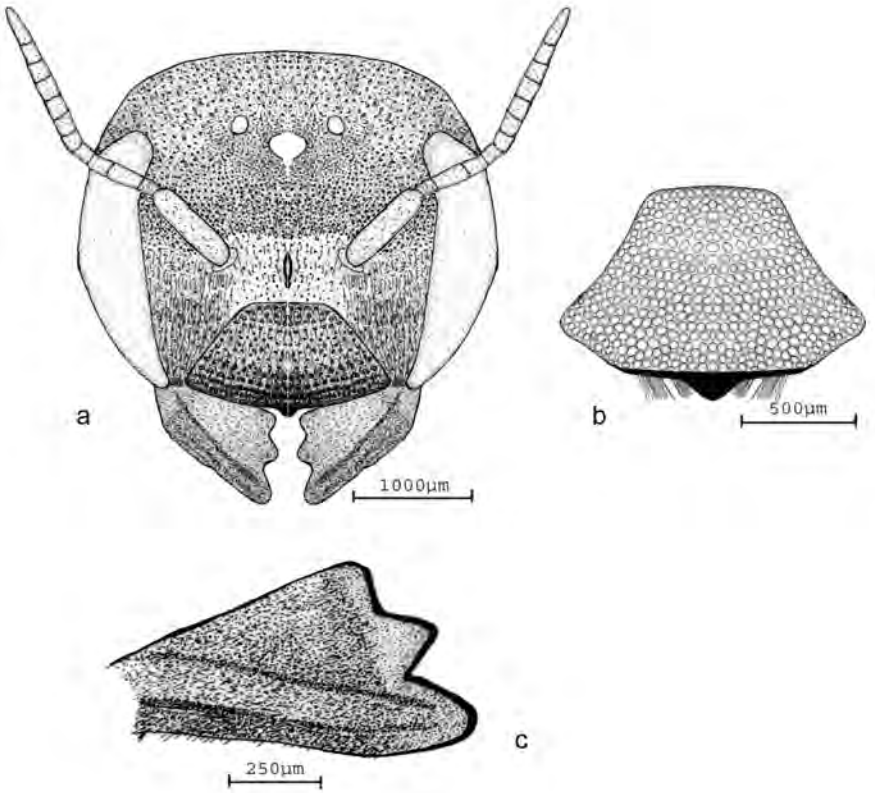

Fig. 22: *Osmia fasciata*. a, Face. b, Clypeus and tufts of ♀. c, Mandible.

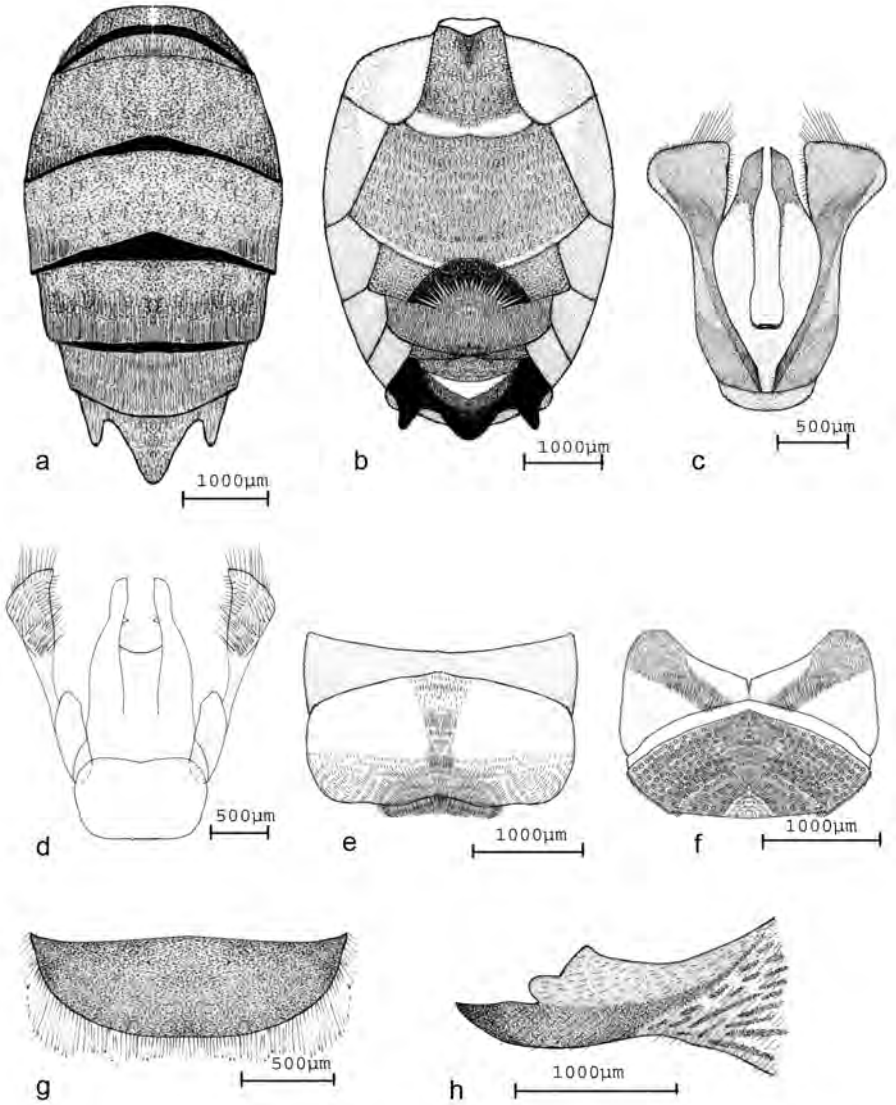

Fig. 23: Structure of *Osmia difficilis* (♂). a, Metasoma. b, Metasomal sterna. Genital capsule, c, dorsal, d, ventral . e, S5. f, S6. g, S7. h, Mandible.

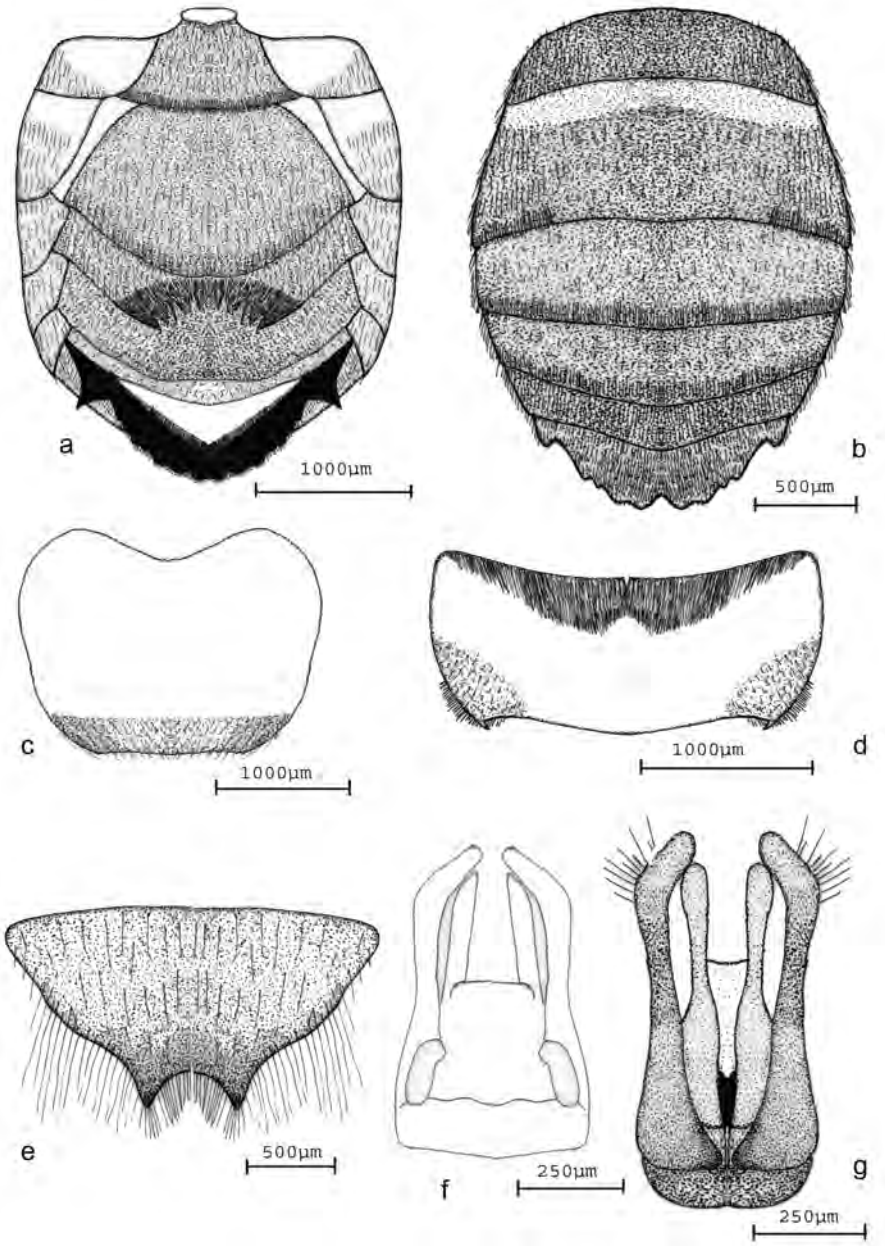

Fig. 24: Structure of *Osmia fasciata* (♂). a, Metasomal sterna. b, Metasoma. c, S5. d, S6. e, T7. Genital capsule, f, ventral, g, dorsal.

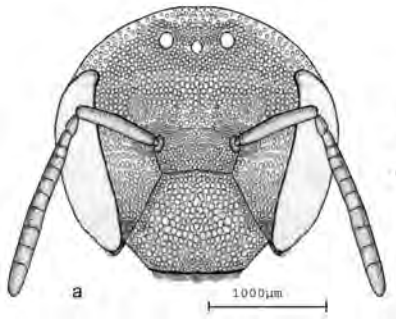

Fig. 25: *Osmia gutturalis* (♀). a, Face. b, Mandible.

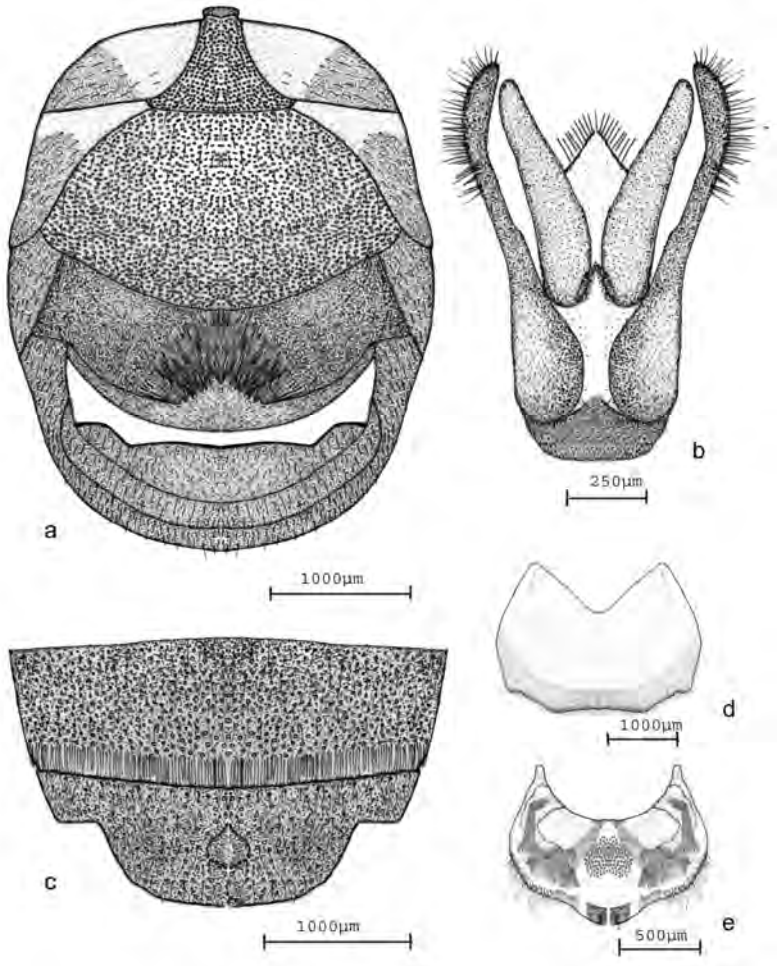

Fig. 26: Structure of *Osmia gutturalis* (♂). a, Metasomal sterna. b, Genital capsule dorsal. C, T5 and T6 d, S5. e, S6.

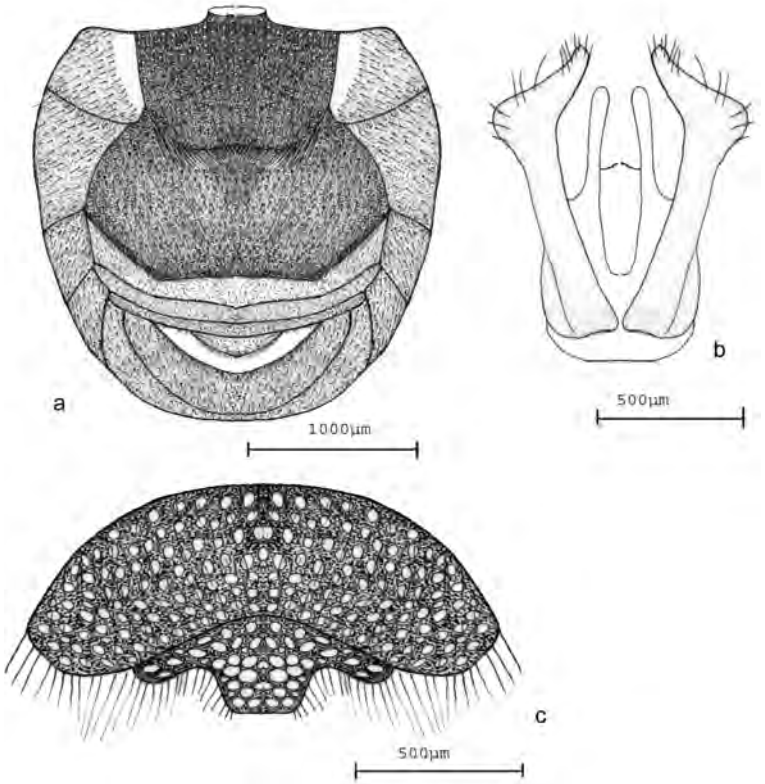

Fig. 27: *Osmia laticauda* (♂). a, Metasomal sterna. b, Genital capsule dorsal. C, T6 and T7

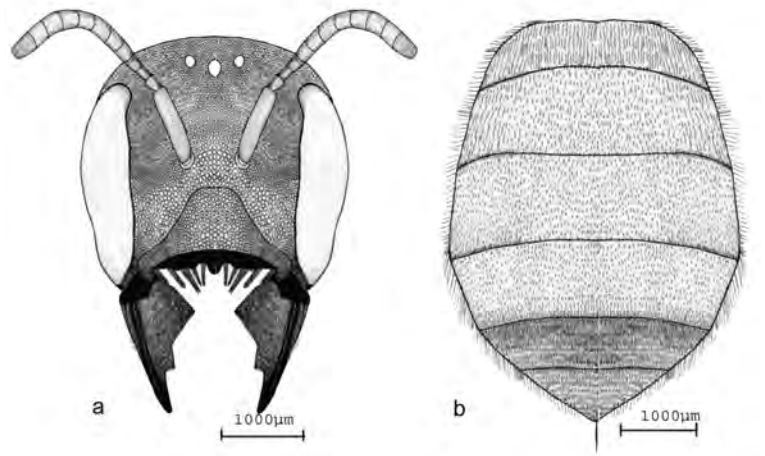

Fig. 28: *Osmia niveata* (♀). a, Face. b, Metasoma.

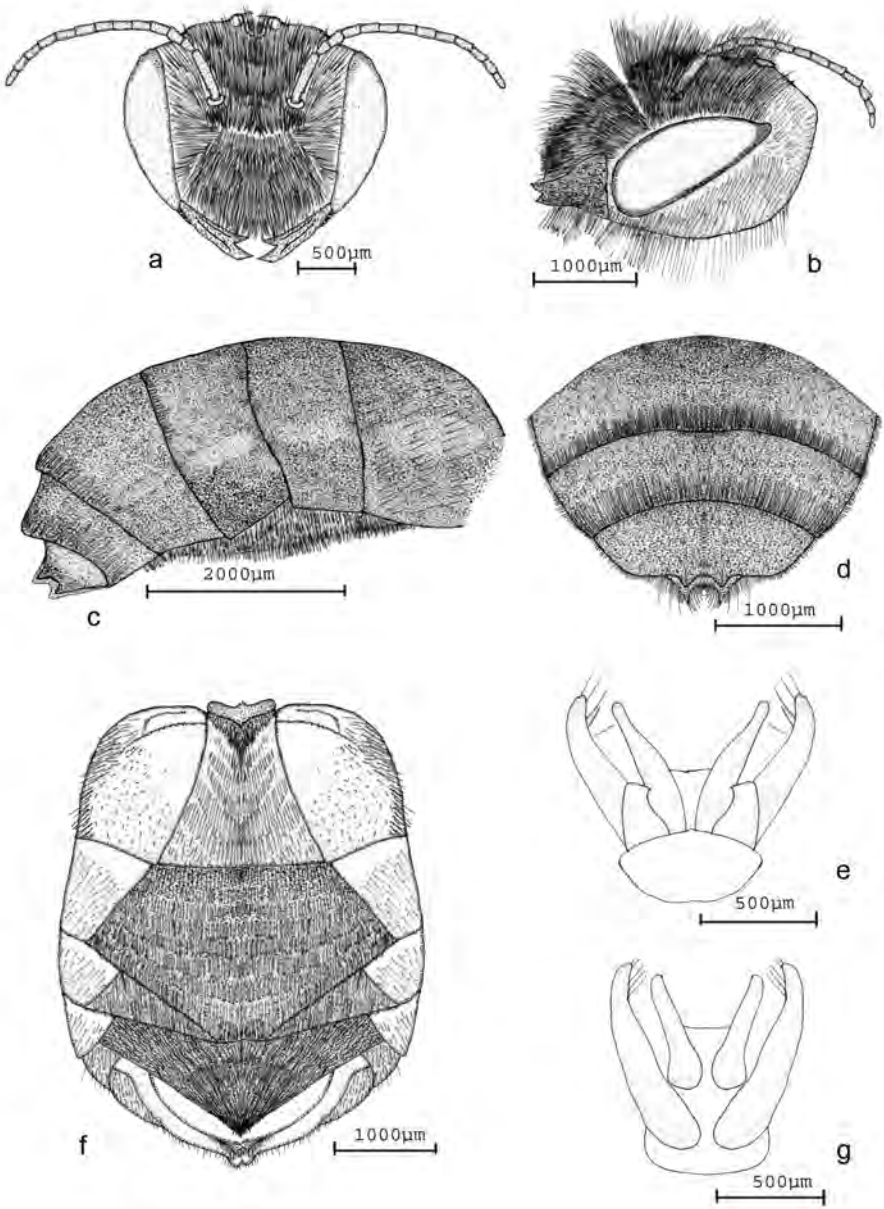

Fig. 29: *Osmia niveata* (♂). a,b, Face. c, Metasoma. d, T4, T5, T6, T7. e, Metasomal sterna. Genital capsule e, ventral, g, dorsal.