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A taxonomic revision of the subgenus *Andrena (Brachyandrena)* (Hymenoptera: Andrenidae)

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Abstract

Species of the Palaearctic subgenus *Andrena (Brachyandrena)* are revised and an identification key to species is provided. Two new species, *Andrena alisadra* from Iran and *Andrena pinguis* from Turkey are herein described as new and assigned to this subgenus.

Key words: new species, Palaearctic, Iran, Turkey

Introduction

Andrena (Andrenidae: Andreninae) is the most diverse bee genus in the Holarctic (Michener 2007) and can be considered as one of the most important pollinators of spring-blooming crops and trees (Delaplane & Mayer 2000). This genus comprises more than 1400 valid species (Gusenleitner & Schwarz 2002; Gusenleitner *et al.* 2005). Considering the Andreninae as a relatively young group in the evolutionary history of bees (Osytshnjuk *et al.* 2005), its species have a worldwide distribution, except for South America, most of central Africa, Southeast Asia, and Australia (Dubitzky 2006).

Among the 68 described subgenera for this genus in the Palaearctic region (Schmid-Egger 2005; Michener 2007), *Brachyandrena* was described by Pittioni (1948) and *Andrena colletiformis* Morawitz was designated its type species. This subgenus is found from the southwest of the Palaearctic region to central Asia. Warncke (1968) listed two species, which grew to four following the work of Gusenleitner and Schwarz (2002). Osytshnjuk *et al.* (2005) provided an identification key for three of these four species of the subgenus, along with redescriptions of *A. colletiformis* Morawitz and *A. limonii* Osytshnjuk.

Diagnostic characteristics of *Andrena (Brachyandrena)*. Small bees (females: 7–8 mm, males: 5.5–7 mm); clypeus densely punctate; pronotum without humeral angle; mesoscutum densely and deeply punctate; propodeal enclosure coarsely rugose, with strong carina (Fig. 1A), dorsolateral area to enclosure more weakly rugose; metasomal terga densely and deeply punctate; fovea on lateral side of T2 narrow and elongated in female.

Based on the above-mentioned characteristics, we assigned the two newly described species of this paper to the *Andrena (Brachyandrena)* subgenus. One of them, *Andrena alisadra* **sp. n.**, has been found in Iran. The other one is a species formerly labeled as *Andrena punctatissima* Morawitz, 1866, and found in the Klaus Warncke's collection in the Biologiezentrum des Oberösterreichischen Landesmuseums in Linz, Austria. By

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comparing the morphological characteristics of the specimens in the Warncke's collection with the description of *Andrena punctatissima* Morawitz, 1866 (large body size, wrinkled surface of clypeus, lack of scale-like hairs on body and compared it with *A. incisa* and *A. combinata*, which belong to *Andrena (Campylogaster)*) it became clear that the two are different species. Osytshnjuk and Tadauchi have personally examined the type material of *A. punctatissima* at the Zoological Institute in St. Petersburg, and came to the same conclusion (O. Tadauchi, unpublished observations). It is worth noticing that Gusenleitner and Schwarz (2002) included the species mislabeled by Warncke as *Andrena punctatissima* Morawitz in their catalogue of palaearctic *Andrena*, but they were not aware that it did not correspond to *A. punctatissima* Morawitz.

Here, we provide descriptions of the species *Andrena pinguis* **sp. n.** and *Andrena alisadra* **sp. n.**, and redescriptions of the following three species of *Andrena* (*Brachyandrena*): *A. colletiformis* Morawitz, *A. miegiella* Dours and *A. limonii* Osytshnjuk.

Materials and methods

The specimens studied were obtained as loans from the following collections and museums: Biologiezentrum des Oberösterreichischen Landesmuseums (OLL), Linz, Austria; Klaus Warncke's collection in OLL (OLL-W); the private collection of Erwin Scheuchl, Ergolding, Germany; and the Zoological Institute, Russian Academy of Sciences, St. Petersburg 199034, Russia (ZISP).

Morphological terms used in this paper mainly follow Michener (2007) and Tadauchi (1995). Abbreviations used are as follows: **PP** = punctures, **Pd** = puncture diamenter; **IS** = ratio between diameter of a pucture and its distance to a nearby puncture ; $\mathbf{T_n}$, $\mathbf{S_n}$ = metasomal tergum and sternum; $\mathbf{FL_n}$ = flagellomere; **L**, **W** = maximum length and width; **BL** = body length (from antennal base to tip of pygidial plate); **WL** = length of forewing including tegula; **HL** = head length, from top of vertex to lower margin of clypeus excluding process of labrum; **HW** = head W (Fig. 1B); **FVL**, **FVW** = maximum length and width of facial fovea; **FL1**, **FL2** = length of first and second flagellomeres of male (measured on ventral surfaces of flagellomeres when antenna stretched forward); **EW** = maximum width of the compound eye; **CPL** = clypeal L (Fig. 1B); **MXP** = maxillary palpus; **GW** = width of genal area seen laterally; **OOD** = ocellocular distance (Fig. 1B); **POD** = postocellar distance (Fig. 1B); **OCD** = ocelloccipital distance (Fig. 1 B); **MsW** = mesosomal width (between outer rims of tegulae); **MtW** = metasomal width (maximum width of terga from dorsal view). All measurements were done using an ocular scale (reticule) coupled to a stereomicroscope.

To describe the size of propodeal enclosure (triangle area) the ratio of this area to its dorsolateral area was considered as follows: the area is assumed to be small, medium, or large if it is, respectively, less than, equal, or more than 1/3 of the whole propodeal area. For preparation of male genitalia, hidden male sterna and mouthparts, and repositioning of some appendages, like antenna and other body parts for better observation of their characters, Dubitzky's relaxing method was used (Dubitzky 2005; Plant & Dubitzky 2008). In this method, using hot steam water and high pressure in a tightly shut glass container, specimens could be relaxed more quickly than in a conventional relaxing chamber.

Key to the species of *Andrena (Brachyandrena)*

Females

1 Mesepisternum finely shagreened, sparsely punctate; facial fovea occupying more than 1/2 distance between eye and lateral ocellus; surface of propodeal corbicula smooth and shiny (Fig. 11)..... *A. limonii*

\- Mesepisternum reticulate (coarsely areolate), with strong and dense PP posteriorly; facial fovea occupying equal or less than 1/2 distance between eye and lateral ocellus; surface of propodeal corbicula with star-shaped wrinkles (Fig. 7G) 2

2 Process of labrum small, nearly pointed (Fig. 2B) ..... *A. miegiella*

\- Process of labrum large, trapezoidal and emarginated (Fig. 2A) 3

3 Pronotum with dorsolateral suture, not roughened by lateral rugulae; impunctate area next to the lateral ocelli present; OCD nearly equal to ocellar diameter (Fig. 7D)..... *A. alisadra*
- Pronotum without dorsolateral suture, laterally roughened by small wrinkles; impunctate area near lateral ocelli absent; OCD 1.5–2 times as wide as ocellar diameter..... 4
4 Dense punctures of surface above compound eyes without distinct gap; process of labrum strongly emarginated (Fig. 2A)..... *A. colletiformis*
- Dense punctures of surface above compound eyes with distinct gap; process of labrum weakly emarginated (Fig. 3A, 5A) .....*A. pinguis*

Males

1 Clypeus yellow, with fine and sparse punctures; dorsal lobe of gonocoxites broad and long, 1.5 times as long as the length of gonostyli (Fig. 10C) ..... *A. limonii*
- Clypeus black or dark brown, not yellow; dorsal lobe of gonocoxites not broad, (gonostyli nearly 1.5 times as long as the length of gonocoxites) 2
2 Clypeus with impunctate midline; fovea on T2 (in lateral side) not deep and elongated, relatively broadened (Fig. 4F) ..... *A. miegiella*
- Clypeus without distinct impunctate midline; fovea on T2 (in lateral side) deep and elongated, not broadened 3
3 Surface of area above compound eyes with dense punctures with distinct gap as in female.....*A. pinguis*
- Surface of area above compound eyes with dense punctures without distinct gap between them 4
4 Inner surface of S8 near the tip with nearly transversal carina (Fig. 10A) ..... *A. alisadra*
- Inner surface of S8 near the tip with angled carina (Fig. 10B) ..... *A. colletiformis*

Andrena (*Brachyandrena*) *miegiella* Dours, 1873

(Figs. 2B, 3B, 4)

Andrena Miegiella Dours, 1873: 276 (female).
Type location: Spain ("Esp."). *Type depository*: destroyed or in the Muséum National d'Histoire Naturelle, Paris, France.
Andrena Lojaconi Destefani, 1889: 206–207 (female). *Type location*: Sicily, Italy ("provincia di Catania"). *Type depository*: type probably destroyed.
Andrena tingitana Pérez, 1895: 48 (female). *Type location*: Morocco ("Tanger"). *Type depository*: Muséum National d'Histoire Naturelle, Paris, France (lectotype).

Female [Algeria, vi.1997 (Ammi Moussa), det. Dr. K. Warncke]. BL = 7.5 mm, WL = 5.8 mm.

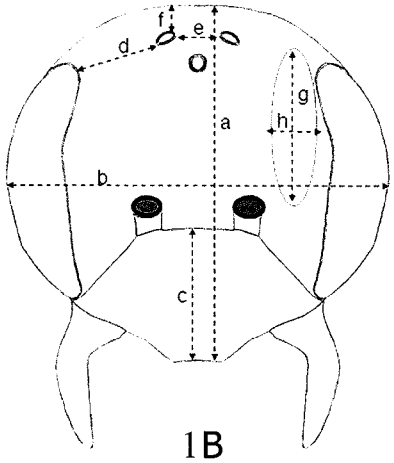
Color. Flagellum uniformly reddish brown; mandible with apical half reddened; wing membrane subhyaline; veins and pterostigma reddish brown; posterior part of tegula translucent, reddish brown, anterior part black; tarsomeres, reddish brown; the rest of body black.

Pubescence. Hairs on head and thorax short, not dense; those on clypeus 300–400µm long, dull white; those on antennal area of face dense, dull white; those on vertex 250–300µm, yellowish; those on genal area short (100–200 µm), yellowish; facial fovea brown. Hairs on mesoscutum and scutellum short (200–300µm), tawny, longer peripherally; those on mesepisternum longer (300–500µm), yellowish; propodeal corbicula well developed, with pale yellowish long plumose dorsal fringes, internal area with simple hairs, without anterior fringes; trochanteral flocculus perfect, white; femoral flocculus perfect, dull white; tibial scopa relatively short, with more or less loose simple hairs; dull white. Hairs on metasomal terga scanty, $T_{1–2}$ with broadly incomplete hair bands, $T_{3–4}$ with complete whitish hair bands. Caudal fimbria brownish, $S_{2–5}$ with whitish short subapical fimbriae.

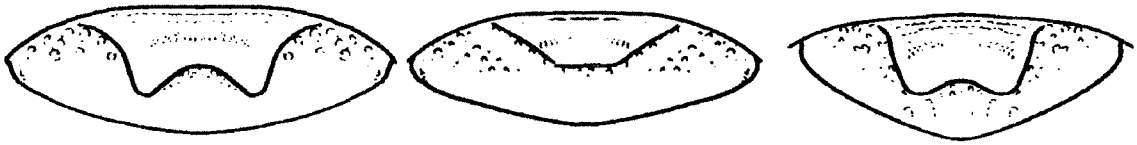
Structure. *Head*: HL/HW = 0.8, HW:MsW:MtW = 1.1:1:1.1. Vertex narrow, as wide as ocellar diameter, densely punctate; surface above compound eyes with dense punctures without interval area between them; OOD:POD:OCD = 3:2:1; FL1 = FL2+FL3, FL2 = FL3; inner margin of eyes subparallel; facial fovea in upper part occupying 1/2 of distance between compound eye and lateral ocellus, not exceeding the lower level of antennal socket, FVL = 0.8 mm, FVW = 0.3 mm, facial quadrangle wider than long (nearly 1.1:1). Face above antennal fossae reticulate without longitudinal rugulae, interrugal space smooth and shiny. Clypeus slightly convex, with slanting shallow PP (Pd = 30 µm), IS = 0.1, without impunctate median line, shiny and smooth;

CPL = 0.8 mm. Process of labrum short, nearly pointed, shiny; lower paraocular area with very dense irregular, coarse PP (Pd = 55 µm), IS<0.1. Malar space linear. Genal area narrower than eye, (2:2.5), surface smooth and shiny with very dense and irregular, nearly large PP (Pd = 30 µm), IS<0.1 near eye.

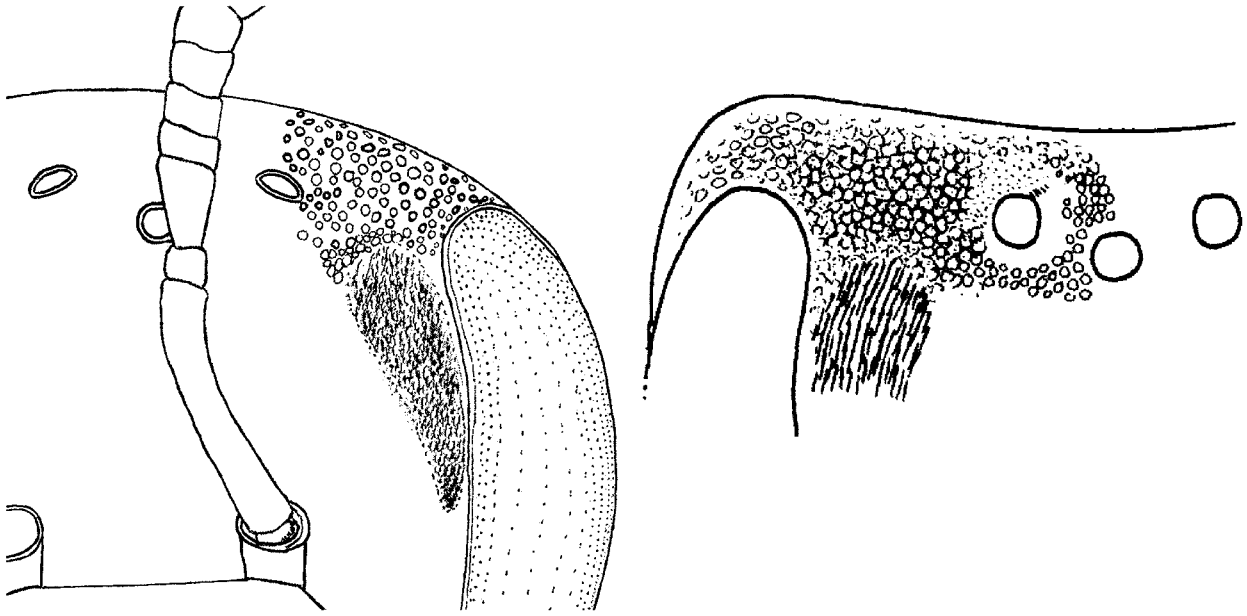
1A



1B



2A 2B 2C



3A 3B

FIGURE 1. (A) Rugose surface of propodeal triangle area with strong carina in species of the subgenus *Andrena (Brachyandrena)*; (B) diagrammatic frontal view of a bee's head: a = HL, b = HW, c = CPL, d = OOD, e = POD, f = OCD, g = FVL, h = FVW. See the Material and Methods section for more details.

FIGURE 2. Process of the labrum of female: (A) *Andrena colletiformis* Morawitz; (B) *A. miegiella* Dours; and (C) *A. limonii* Osytshnjuk.

FIGURE 3. Visible distance among punctures of area above facial fovea and compound eye, with smooth and shiny surface: (A) *Andrena pinguis* **sp.n.**, female; (B) larger punctures without visible gap among punctures on the same area of face in *Andrena miegiella* Dours.

Mesosoma: Pronotum without humeral angle, with weak lateral ridge and dorsolateral suture, surface tessellate with scattered PP. Mesoscutum and scutellum smooth and shiny with dense PP (Pd = 10 µm), IS<0.1. Propodeal enclosure medium sized, not well indicated by lateral boundary line, strongly rugose with posterior carina, interrugal surface smooth and shiny, dorsolateral area to enclosure similar but with weaker rugulae. Mesepisternum with dense PP, anterior part reticulate, posterior part with coarse PP, surface smooth and shiny; anterior part of tegula smooth, with PP.

Metasoma: Metasomal terga with dense, small PP (Pd = 20 µm), IS<0.1, smooth and shiny; posterior depression of T_{2-4} distinct, with smaller PP; pygidial plate V-shaped, with microscopic PP, without internal raised area; S_{2-5} smooth and shiny with fine and deep PP.

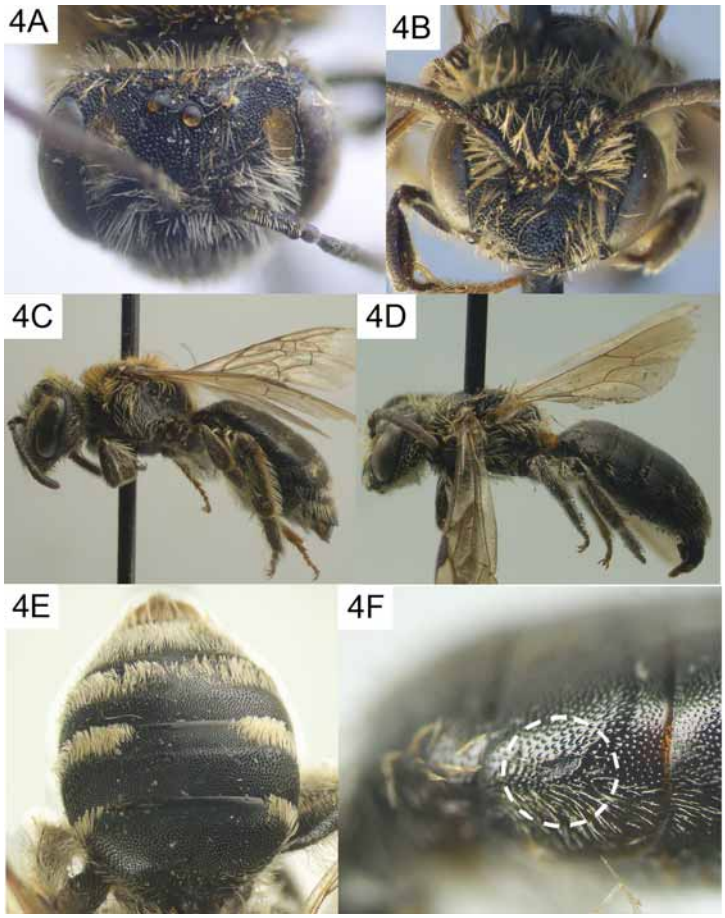


FIGURE 4. *Andrena miegiella* Dours: (A) head of female, frontal view; (B) head of male, frontal view; (C) lateral habitus of female; (D) lateral habitus of male; (E) dorsal view of metasoma of female; (F) lateral view of metasoma of male (dotted circle shows fovea on T2).

Male [Spain, Spanien Loja (=Loja city, Granada Prov.), 09.v.1957 (W. Gross)]: BL = 5.7 mm, WL = 5.2 mm.

Color. Flagellum reddish brown; mandible nearly black; wing membrane as in female, veins and pterostigma dark brown; posterior part of tegula translucent, brown, anterior part black; the rest of body black.

Pubescence. Hairs on head and thorax and antennal area as in female; those on clypeus 100–200 µm, yellowish; those on vertex pale yellowish, short (300 µm); those on genal area yellowish; hairs on mesoscutum and scutellum short 400 µm, yellowish, not scale-like; those on mesepisternum dull whitish and relatively longer. Hairs on metasomal terga and sterna as in female.

Structure. *Head*: HL/HW = 0.8, HW:MsW:MtW = 8:7:7. Vertex as in female; OOD:POD:OCD = 4:3:1; FL1<FL2+FL3, FL2<FL3; inner margins of eyes parallel; facial quadrangle quadrate. Face above antennal fossae as in female. Clypeus as in female but with impunctate median line; CPL = 0.7 mm. Process of labrum

quadrangle, apically rounded and weakly emarginate; lower paraocular area with very dense, irregular PP (Pd = 10–50 µm), IS<0.1. Malar space as in female. GW<EW = 2:3, surface with dense PP (Pd = 10 µm), IS<0.1 near eye. Mandibles not crossing at rest.

Mesosoma: Pronotum, Mesoscutum, scutellum, Mesepisternum and tegula as in female. Propodeal enclosure small, not indicated by boundary line, strongly rugose with carina, interrugal surface smooth and shiny.

Metasoma: Metasomal terga and sterna as in female; posterior margins of terga narrowly impunctate; genitalia and $S_{7–8}$ similar to *A. alisadra* **sp. n.** as shown in Fig. 8.

Specimens examined: 1 female, Algeria, vi.1997 (Ammi Moussa), det. Dr. K. Warncke; 1 male, Sardinien (= Sardinia), Italy, 25.iv.1960 (Nora Pula), leg. E. Priesner; 2 females, Italy, Sicily, 870 m, Randazzo-Lago di Gurrida, 11.vi.1999 (B. Merz); 1 female, Italy, Italia, Napoli (=Naples), 24.vi.1965 (W. Schläfle); 1 female, Italy, Sizilien, Linguaglossa, ca. 40 km N. Catania (= Catania Prov.), 13–25.vi.1999 (Tischendorf); 1 female, Italy, Toscana, Grosseto, Principina a Mare, 09.vi.1991 (E. Scheuchl); 1 male, Malta, Malta, St. Paul's Bay, Bugibba town, 07.vi.1993 (E. Scheuchl); 1 female, Spain, Chiclana, Chiclana de la Frontera/Provinz Cádiz (= Cádiz Province), 9.v.1957 (W. Gross); 3 males, Spain, Spanien Loja (= Loja city, Granada Prov.), 09.v.1957 (W. Gross).

Variation. This species shows weak differences in coloration of flagellum, particularly from flagellomeres 4 to 12. Sculpture of enclosure area and pubescence of body show weak variation, too.

Remarks. This new species is very similar to *Andrena alisadra* **sp. n** but is separated by small and pointed shape of the process of labrum in the female, the tawny hairs on thorax and denser punctures on the scutellum.

Distribution. Gusenleitner and Schwarz (2002) provide a distribution map for this species.

***Andrena* (*Brachyandrena*) *pinguis* sp. n.**
(Figs. 3A, 5, 6)

Female (holotype). BL= 8 mm, WL= 7 mm

Color. Flagellum pale reddish brown; mandible with apical half reddened; wing membrane subhyaline; veins and pterostigma reddish brown; posterior part of tegula translucent, reddish brown, anterior part black; tarsomeres except of basitarsi, reddish brown; the rest of body black.

Pubescence. Hairs on head and thorax short, not dense; those on clypeus 300–500 µm long, white; those on antennal area dense, dull white; those on vertex 300–400 µm, pale brownish; those on genal area short (100–200 µm), dull white; facial fovea light brown. Hairs on mesoscutum and scutellum very short (50–100 µm), yellowish, peripherally with longer scale-like hairs; those on mesepisternum longer (150–200 µm), dull white; propodeal corbicula not well developed, with dull white long plumose dorsal fringes, internal area with simple hairs, without anterior fringes; trochanteral flocculus not perfect, whitish; femoral flocculus perfect; tibial scopa relatively short, with more or less loose simple hairs; whitish. Hairs on metasomal terga scanty, $T_{1–2}$ with broadly incomplete hair bands, $T_{3–4}$ with complete whitish hair bands. Caudal fimbria yellowish brown, $S_{2–5}$ with whitish subapical fimbriae.

Structure. *Head*: HL/HW = 0.8, HW:MsW:MtW = 1.1:1:1.2. Vertex nearly wide, 1.5 times as wide as ocellar diameter, densely punctate; surface above compound eyes with dense punctures but the interval area is visible; OOD:POD:OCD = 2:1.5:0.5; FL1 = FL2+FL3, FL2 = FL3; inner margin of eyes subparallel; facial fovea in upper part occupying 1/2 of distance between compound eye and lateral ocellus, not exceeding the lower level of antennal socket, FVL = 1 mm, FVW = 0.25 mm, facial quadrangle as long as broad (nearly 1:1). Face above antennal fossae reticulate without longitudinal rugulae, interrugal space smooth and shiny. Clypeus slightly convex, with slanting PP (Pd = 55 µm), IS<0.1, without clear impunctate median line, shiny and smooth; CPL = 0.8 mm. Process of labrum moderate, emarginated, shiny; galea truncate, weakly

tessellate and without distinct PP; the last maxillary palpi ($MXP_{3–6}$) distinctly protruding beyond apex of galea; lower paraocular area with very dense irregular, coarse PP (Pd = 55 µm), IS<0.1. Malar space linear. Genal area narrower than eye (2:2.5), surface smooth and shiny with very dense and irregular, nearly coarse PP (Pd = 35 µm, IS<0.1 near eye.

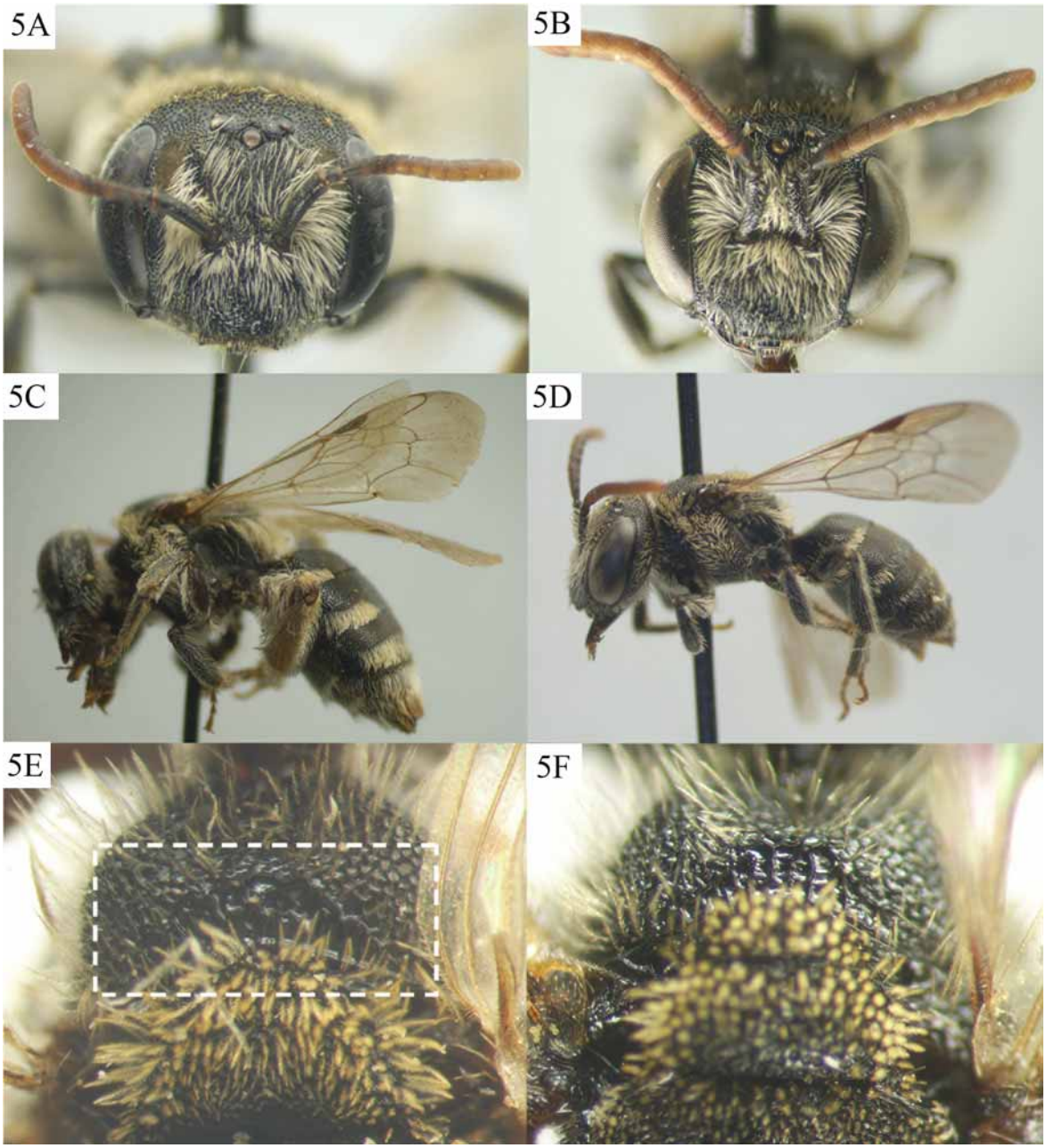


FIGURE 5. *Andrena pinguis* **sp.n.**: Portrait of head (A: female, B: male); lateral view of body (C: female, D: male); propodeum (dashed square shows triangle area) (E: female, F: male).

Mesosoma: Pronotum without humeral angle, with lateral ridge, laterally roughened by small rugulae, the rest smooth and shiny with scattered PP. Mesoscutum and scutellum smooth and shiny with dense PP (Pd = 20 µm), IS<0.1. Propodeal enclosure medium size, not well indicated by boundary line, strongly rugose with carina, interrugal surface smooth and shiny, dorsal area similar but with weaker rugose. Mesepisternum with dense PP, anterior part reticulate, posterior part with coarse PP, surface smooth and shiny; anterior part of tegula smooth, with PP.

Metasoma: Metasomal terga with dense, small PP (Pd = 20 µm), IS<0.1, smooth and shiny; posterior

depression of $T_{1–4}$ distinct, with smaller PP; pygidial plate V-shaped, with microscopic PP, without internal raised area; $S_{2–5}$ smooth and shiny with fine and deep PP.

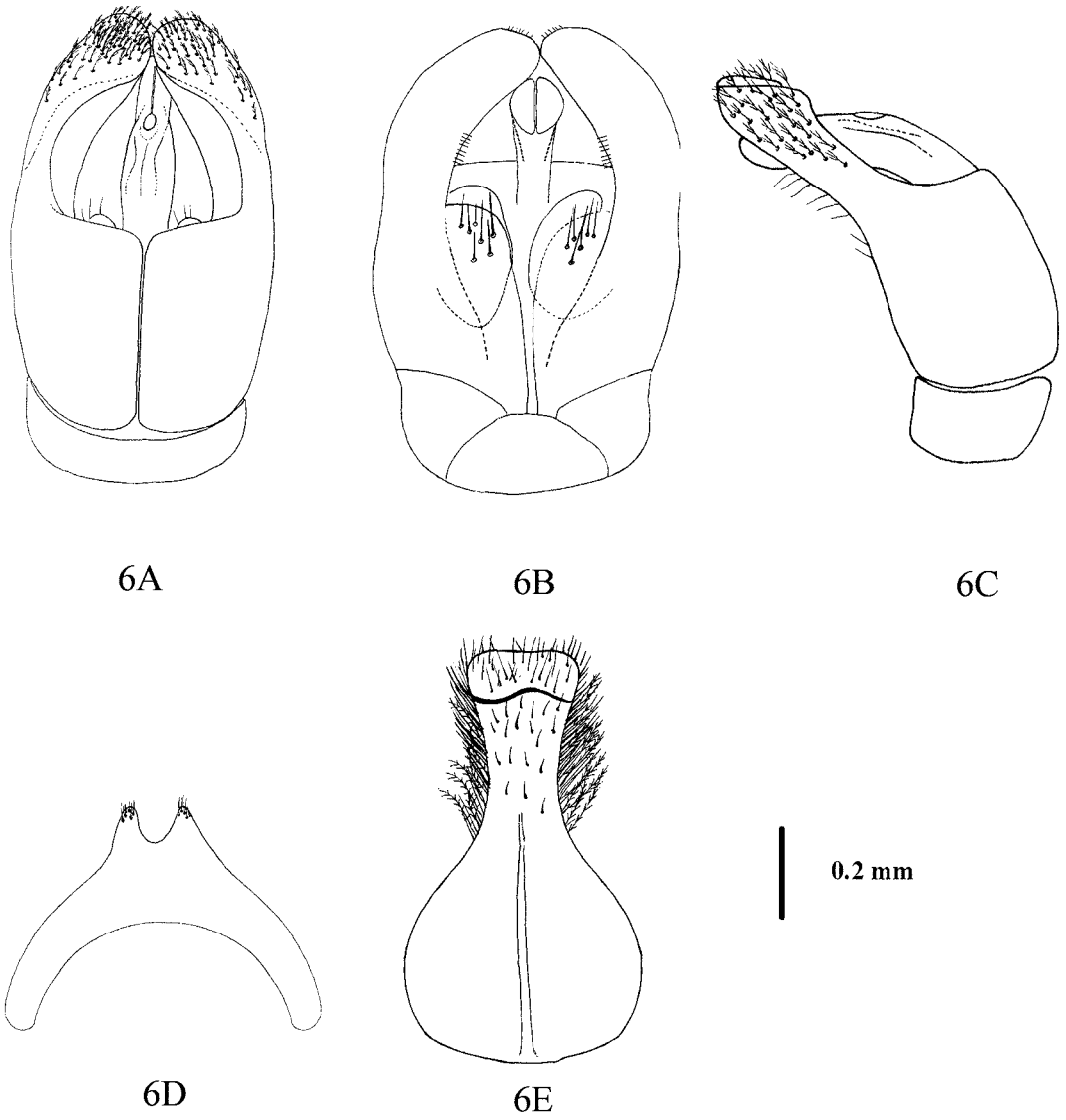


FIGURE 6. Male terminalia of *Andrena pinguis* **sp. n.**: (A) genital capsule, dorsal view, (B) genital capsule, ventral view, (C) genital capsule, lateral view; (D) S7, (E) S8.

Male [Turkey, Konya, 20 km SO Seydisehir 1000m, 5.viii.1991 (M. Halada)]: BL = 5.7 mm, WL = 5.2 mm.

Color. Flagellum reddish brown beneath; mandible with apical third reddened; wing membrane subhyaline, veins and pterostigma brown; posterior part of tegula translucent, brown, anterior part black; the rest of body black.

Pubescence. Hairs on head and thorax short, not dense; those on clypeus 100–200 µm, dull whitish; those on antennal area dense, dull whitish; those on vertex yellowish, very short (100 µm); those on genal area pale yellowish; Hairs on mesoscutum and scutellum, mesepisternum, metasomal and sternal terga as in female but hair bands on metasomal terga yellowish.

Structure. *Head*: HL/HW = 0.8, HW:MsW:MtW = 5.6:5:5.3. Vertex wide, two times as wide as ocellar diameter, densely punctate; OOD:POD:OCD = 1.5:1.5:1; FL1<FL2+FL3, FL2<FL3; inner margins of eyes as in female; facial quadrangle longer than wide. Face above antennal fossae reticulate without longitudinal

rugulae, interrugal space smooth and shiny. Clypeus as in female; CPL = 0.6 mm. Process of labrum quadrangle, apically rounded and crescent-shaped; galea and last three maxillary palpi ($MXP_{3–6}$) as in female; lower paraocular area and Malar space as in female. Genal area as in female but PP (Pd = 10–20 µm). Mandibles not crossing at rest.

Mesosoma: Pronotum, Mesoscutum and scutellum as in female. Propodeal enclosure small, indicated by boundary line, strongly rugose with carina, interrugal surface smooth and shiny; mesepisternum with dense PP, anterior part reticulate, posterior part with coarse PP, surface smooth and shiny; tegula smooth, anterior part with PP.

Metasoma: Metasomal terga and sterna as in female; genitalia and $S_{7–8}$ as shown in Fig. 6.

Variation. Ventral side of flagellum shows weak differences in the extension of the red color. Flagellum 4 is completely black in some specimens, in others it also has a red spot. The notch or emargination of the process of labrum is deeper in some specimens than the others. The variation in sculpture is rather weak. The length of impunctate margin of terga differs from a width of 4 to 6 puncture diameters.

Etymology. The name given to this species refers to the strong punctuation of the tergites; “pinguis” is a Latin term for rough and strong.

Type material: Holotype: female, Turkey, Siirt, 15 km W. Siirt, 6.vi.1980, leg. Max. Schwarz. Depository: Biologiezentrum des Oberösterreichischen Landesmuseums (OLL), Linz, Austria.

Paratypes: 1 male, Turkey, Konya, 20 km SO Seydisehir 1000m, 5.viii.1991 (M. Halada); 1 females, Turkey, Konya, sille b., 8.vi.1972 (J. Heinrich); 1 female, Akbes,(? Syria); 1 female, Turkey, Antalya, between Gölova and Korkuteli, 36°48’31"N, 30°00’50"E, 1143m, 07.06.2006, leg. E. Scheuchl; 2 females, Turkey, Antalya, between Korkuteli and Tefenni, 37°09’30"N, 30°01’53"E, 1445m, 08.06.2006, leg. E. Scheuchl; 1 female, Turkey, Burdur, around Tefenni, 37°10’54"N, 29°59’13E, 1487m, 08.06.2006, leg. E. Scheuchl; 5 females, 2 males, Turkey, Ankara, Hacettepe University, Beytepe Campus, 16.06.2006, leg. E. Scheuchl; 2 females, Turkey, Amasia, 30 km Amasya-Mecitzu, 3.000', 01.08.1960, leg. K. Guichard & D.H. Harvey; 1 female, Turkey, Ankara, Temelli c. 800 m, 27.07.1992, leg. K. Guichard & D.H. Harvey.

Remarks: This new species is very similar to *Andrena colletiformis* Morawitz but is separated by larger distance among punctures in the upper area of compound eye in both sexes, the occiput area less concave, the stronger punctuation of the terga and the broader hair bands on them, which are complete on $T_{3–4}$, and the posterior depressions, which are clearly visible at the middle.

Distribution: Turkey, Syria.

***Andrena* (*Brachyandrena*) *alisadra* sp.n.**
(Figs. 7, 8, 10A)

Female (holotype). BL = 7.6 mm, WL = 6.6 mm.

Color. Flagellum brown, paler beneath; mandible with apical half reddened; wing membrane subhyaline, darker at apical area; veins and pterostigma brown to dark brown; posterior part of tegula translucent, reddish brown, anterior part black; the rest of body black.

Pubescence. Hairs on head and thorax short, moderately dense; those on clypeus 200–300 µm long, white; those on antennal area dense, white; those on vertex pale brownish, short (300 µm); those on genal area white; facial fovea light brown. Hairs on mesoscutum and scutellum short (100–200 µm), anterior margin of mesoscutum with scale-like hairs, whitish; those on mesepisternum longer, white; propodeal corbicula not well developed, with dull white long plumose dorsal fringes, internal area with simple hairs, without anterior fringes; trochanteral flocculus nearly perfect, white; femoral flocculus perfect; tibial scopa relatively short, with loose simple hairs; whitish. Hairs on metasomal terga scanty, $T_{1–3}$ with broadly incomplete hair bands, $T_{4–5}$ with complete whitish hair bands. Caudal fimbriae brownish, $S_{2–5}$ with white subapical fimbriae.

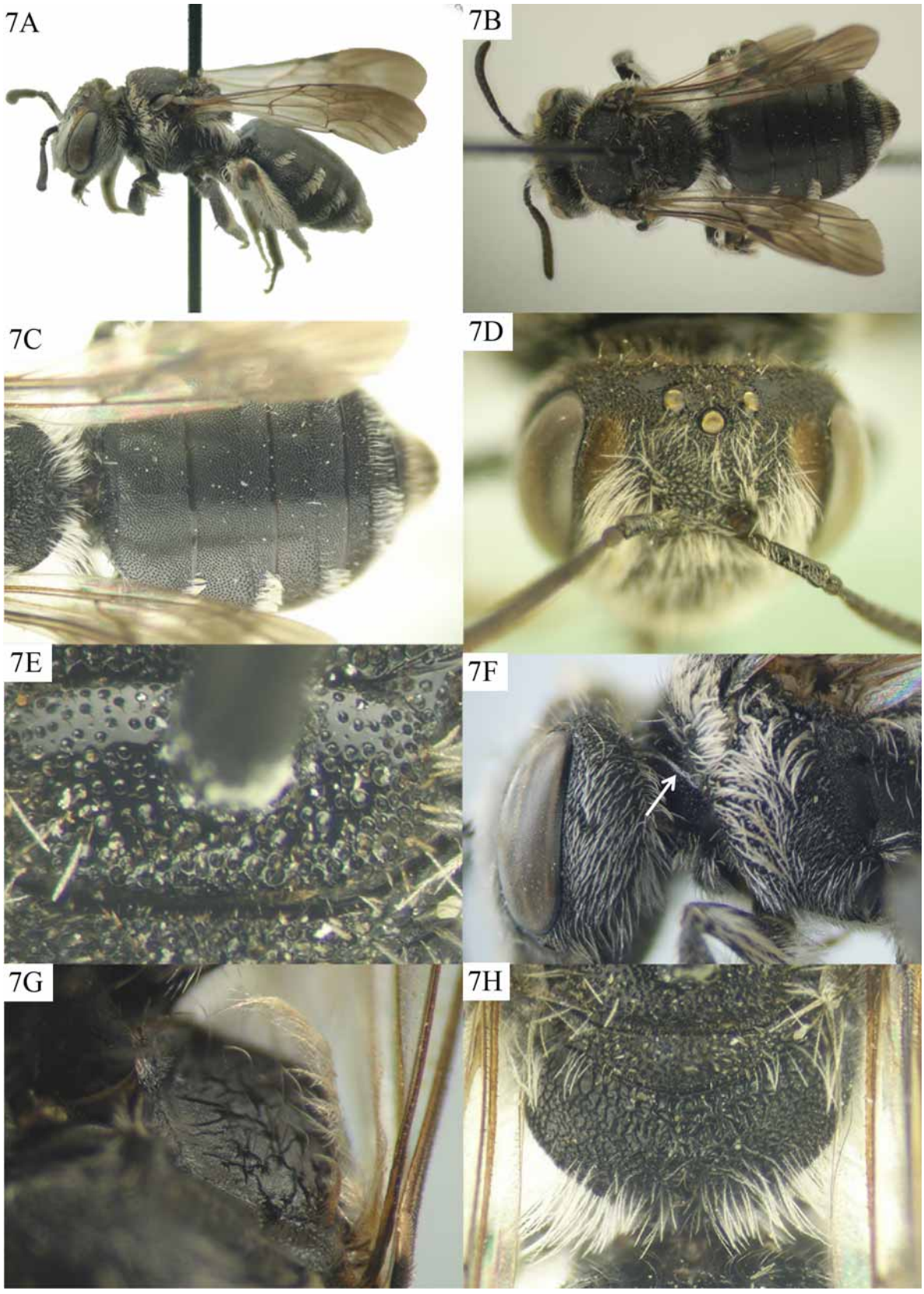


FIGURE 7. *Andrena alisadra* **sp.n.**, female: (A, B) lateral and dorsal view of body; (C) metasoma; (D) portrait of head with small spots near lateral ocelli; (E) scutellum; (F) pronotum with dorsolateral suture and mesepisternum; (G) star-shaped wrinkles of the surface of propodeal corbicula; (H) propodeum (propodeal triangle area not well delimited).

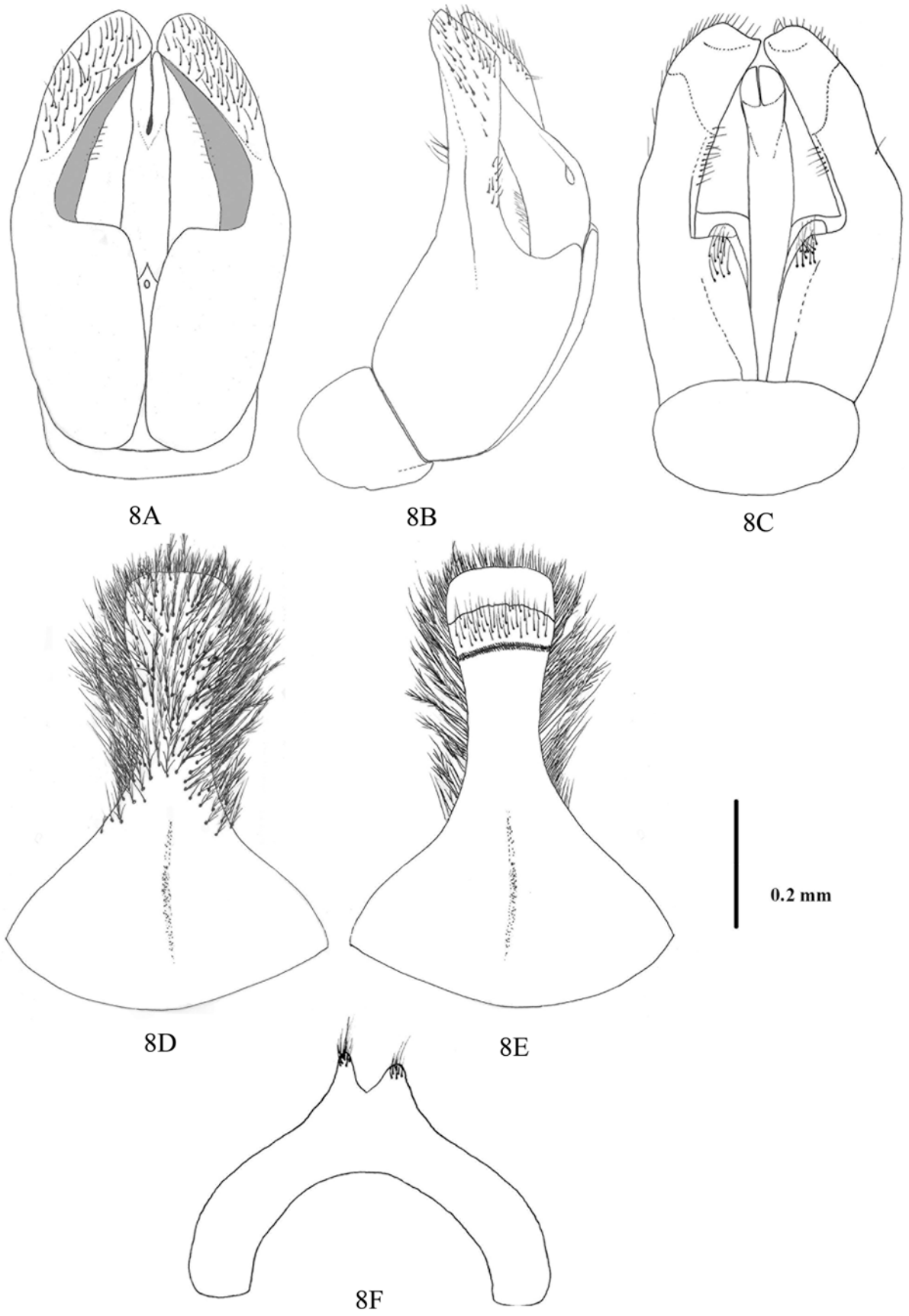


FIGURE 8. Male of *Andrena alisadra* **sp.n.**, male: (A–C) dorsal, lateral, and ventral views of genitalia; (D, E) dorsal and ventral views of S8; (F) dorsal view of S7.

Structure. *Head*: HL/HW = 0.78, HW:MsW:MtW = 3:2.9:3. Vertex narrow, as wide as ocellar diameter, densely punctate; distinct smooth and shiny impunctate area in outer side of lateral ocellus, OOD:POD:OCD = 2:1.5:0.5; FL1 = FL2+FL3, FL2 = FL3; inner margin of eyes subparallel; facial fovea in upper part occupying 1/2 of distance between compound eye and lateral ocellus, not exceeding the lower level of antennal socket, FVL = 0.88 mm, FVW = 0.26 mm, facial quadrangle broader than long. Face above antennal fossae reticulate without longitudinal rugulae, interrugal space smooth and shiny. Clypeus slightly convex, with large shallow punctures (Pd = 55 µm, IS<0.1), without impunctate median line, shiny and smooth; CPL = 0.7 mm. Process of labrum emarginated; galea truncate, weakly tessellate and without distinct PP; the last maxillary palpi (MXP_{3-6}) distinctly protruding beyond apex of galea; lower paraocular area with very dense, coarse shallow PP (Pd = 60 µm), IS<0.1. Malar space linear. Genal area equal to eye, surface with very dense and nearly coarse PP (Pd = 35 µm), IS<0.1 near eye.

Mesosoma: Pronotum without humeral angle, with deep dorsolateral suture, smooth and shiny with scattered PP, median part of dorsal area with dense and smaller PP. Mesoscutum with dense and irregular punctures in size, surface smooth and shiny, scutellum similar to mesoscutum but with sparser PP. Propodeal enclosure medium sized, not well indicated by boundary line, strongly rugose with strong carina, interrugal surface smooth and shiny. Mesepisternum with dense PP, anterior part reticulate, posterior part with coarse PP, surface smooth and shiny; anterior part of tegula smooth, with PP.

Metasoma: Metasomal terga with dense, small PP, completely smooth and shiny; posterior depression of T_{2-5} distinct; pygidial plate U-shaped, tessellate, without internal raised area; S_{2-5} smooth and shiny with fine and deep PP.

Male [West Alisadr env., Hamedan Prov., Iran, 14.v.1999 (K. Deneš sen.)]: BL = 6.5 mm, WL = 5 mm.

Color. Flagellum reddish brown beneath; mandible with apical third reddened; wing membrane subhyaline, veins and pterostigma brown; posterior part of tegula translucent, yellowish, anterior part dark brown; legs and metasomal terga brown; rest of body black.

Pubescence. Hairs on head and thorax short, not dense; those on clypeus 200–300 µm, dull whitish; those on antennal area sparse, dull whitish; those on vertex dull whitish, short, 300 µm; those on genal area dull whitish; hairs on mesoscutum and scutellum as in female, peripherally longer, 350–450 µm; those on mesepisternum with the same color and size. Hairs on metasomal terga and sterna as in female.

Structure. *Head*: HL/HW = 0.8, HW:MsW:MtW = 4.5:4:4.3. Vertex as in female; OOD:POD:OCD = 1.4:1.3:0.6; FL1 = FL2+FL3, FL2<FL3; inner margins of eyes as in female; facial quadrangle quadrate. Face above antennal fossae as in female. Clypeus as in female; CPL = 0.5 mm. Process of labrum quadrangle, apically rounded; galea and Malar space as in female. Genal area narrower than eye (2:2.5), surface with very dense PP (Pd = 10–20 µm), IS<0.1 near eye. Mandibles not crossing at rest.

Mesosoma: Pronotum without humeral angle, smooth and shiny with scattered PP, laterally with weak wrinkles. Mesoscutum and scutellum with dense deep PP (Pd = 10–20 µm), IS<0.1, surface as in female. Propodeal enclosure, mesepisternum and tegula as in female.

Metasoma: Metasomal terga as in female; genitalia and S_{7-8} as shown in Fig. 8; S_{2-5} smooth and shiny with distinct and shallow PP.

Type material: Holotype: female, West Alisadr env., Hamedan Prov., Iran, 14.v.1999 (K. Deneš sen.). Depository: Oberösterreichische Landesmuseen/Biologiezentrum, Linz, Austria.

Paratypes: 4 females and 1 male, West Alisadr env., Hamedan Prov., Iran, 14.v.1999 (K. Deneš sen.); 1 male, Chalus-Karaj, Marzanabad, Mazandaran Prov., Iran, 1.vi.1997 (M. Kafka); 1 female, Selmish, 1600m, 25km NW Khoramabad, Lurestan Prov., Iran, 14.v.1975 (leg. C. Holzschuh and F. Ressl); 1 female, 1700m, 50km S. Khoramabad, Lurestan Prov., Iran, 15.v.1975 (leg. C. Holzschuh and F. Ressl), 1 male, 1700m, Khoramabad, Lurestan Prov., Iran, 16.v.1976 (leg. C. Holzschuh and F. Ressl); 1 male Minudasht, 50–70 km östl., Golestan Forest, 450–700 m, Nord-IRAN, 27.v.1975 (leg. C. Holzschuh and F. Ressl).

Remarks: This new species is very similar to *Andrena colletiformis* Morawitz, but is separated by the small smooth and shiny impunctate area in outer side of lateral ocelli, the pronotum with dorsolateral suture,

the smooth and shiny area without lateral roughened surface in female and straight line in inner side of S8, near the tip (Fig. 10A).

Distribution: Iran (West and North).

Variation: The impunctate region of vertex near lateral ocelli differs in area. Pygidial plate in female shows variation from V-shaped with microscopic PP to concave U-shaped with larger PP. In male, color of metasoma and legs differe from brown to completely black, process of labrum entire to weakly emarginated.

Etymology: This species is named based on its collecting area where possesses the most famous cave, Ali Sadr cave, in Iran.

Andrena colletiformis Morawitz, 1874

(Figs. 2A, 9, 10B)

Colletes parvula Morawitz, 1871: 226–227 (female, male). *Type location*: Southern Italy ("Calabria"), Greece ("Corfu"). *Type depository*: Zoological Institute, Russian Academy of Sciences, St. Petersburg 199034, Russia.

Andrena colletiformis Morawitz, 1874: 159–160, nom. nov. pro *Colletes parvulus* Morawitz 1871.

Andrena colletiformis ab. *gandzhensis* Lebedev, 1933: 64 (female). *Type location*: Caucasus ("Umgegend von Gandzha (Elisavethpol) in Azerbaidzhan"). *Type depository*: Zoological Museum, Kiev, Ukraine.

Andrena colletiformis ssp. *insulana* Pittioni, 1950: 52–53 (male, female). *Type location*: Cyprus ("Kouklia"). *Type depository*: Probably Natural History Museum, London, UK.

Andrena nanana Strand 1915b: 152–153 (female, male). *Type location*: Crete ("Canea"). *Type depository*: Deutsches Entomologisches Institut Müncheberg, Germany.

Andrena colletiformis var. *sardinica* Strand 1915a: 126 (female). *Type location*: Sardinia ("Asuni"). *Type depository*: Deutsches Entomologisches Institut Müncheberg, Germany.

Andrena subsquamularis Noskiewicz 1960: 85–89 (female). *Type location*: Bulgaria ("Sandansky"). *Type depository*: Universität von Wrocław, Poland.

Female [Cyprus, Limassol (=Lemesos), 12.iv.1958 (Mavromoustakis)]: BL = 7.5 mm, WL = 6 mm.

Color. Flagellum pale reddish brown; mandible with apical third reddened; wing membrane subhyaline; veins and pterostigma brown; posterior part of tegula translucent, reddish brown, anterior part black; the rest of body black.

Pubescence. Hairs on head and thorax short, not dense; those on clypeus 200–300 µm long, pale yellowish to white; those on antennal area dense, dull white; those on vertex 200–300 µm, yellowish; those on genal area short, scale-like (100–200 µm), pale yellowish; facial fovea light brown. Hairs on mesoscutum and scutellum short (100–200 µm), pale yellowish; those on mesepisternum longer (150–200 µm), dull white; propodeal corbicula well developed, with dull white long plumose dorsal fringes, internal area with simple hairs, without anterior fringes; trochanteral flocculus not perfect, whitish; femoral flocculus perfect, whitish; tibial scopa short, with more or less loose simple hairs; whitish. Hairs on metasomal terga scanty, $T_{1–2}$ with broadly incomplete hair bands, $T_{3–4}$ with complete whitish hair bands. Caudal fimbria with superficial whitish hairs, brown beneath; $S_{2–5}$ with whitish subapical fimbriae.

Structure. *Head*: HL/HW = 0.8, HW:MsW:MtW = 1.1:1:1.1. Vertex narrow, nearly as wide as ocellar diameter, densely punctate; surface above compound eyes with dense punctures, interval area is not visible; OOD:POD:OCD = 4:3:2; FL1 = FL2+FL3, FL2 = FL3; inner margin of eyes subparallel; facial fovea in upper part occupying 1/2 of distance between compound eye and lateral ocellus, not exceeding the lower level of antennal socket, FVL = 1 mm, FVW = 0.25 mm, facial quadrangle quadrate (nearly 1:1). Face above antennal fossae reticulate without longitudinal rugulae, interrugal space smooth and shiny. Clypeus slightly convex, with slanting PP (Pd = 55 µm), IS<0.1, without clear impunctate median line, shiny and smooth; CPL = 0.8 mm. Process of labrum moderate, emarginated, shiny; lower paraocular area with very dense irregular, large PP (Pd = 55 µm), IS<0.1. Malar space linear. GW<EW (2.5:3), surface smooth and shiny with very dense and ununiform, PP (Pd = 15 µm), IS<0.1 near eye.

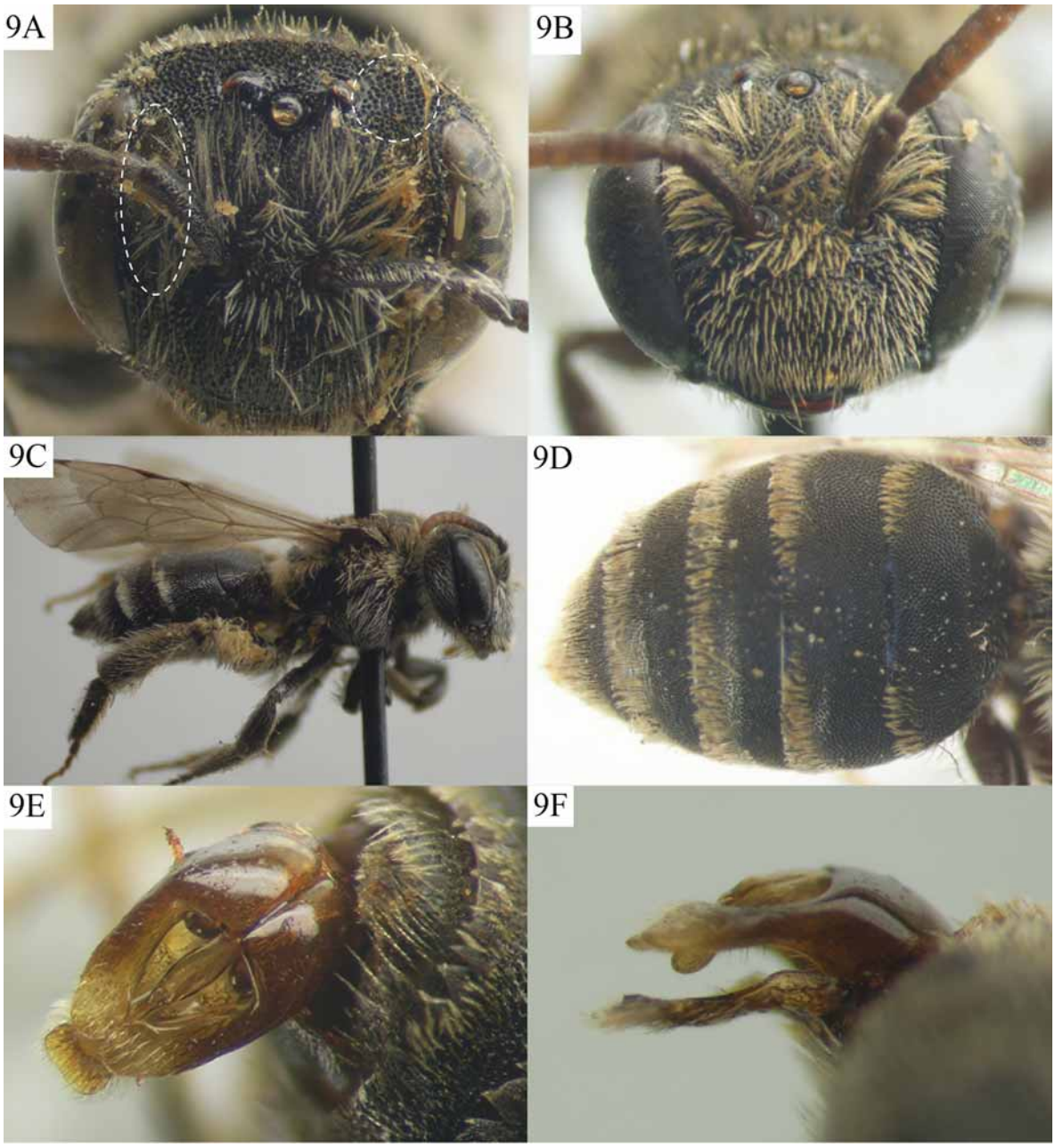


FIGURE 9. *Andrena colletiformis* Morawitz: portrait of head (A: female, B: male), dotted area indicates the location of facial fovea (left) and punctate area above compound eye; (C) lateral view of body of female; (D) dorsal view of metasoma of female; (E) dorsal view of male genital capsule; (F) lateral view of male genital capsule and S8.

Mesosoma: Pronotum without humeral angle, with lateral ridge, laterally roughened by small rugulae, the rest smooth and shiny with scattered PP, weakly tessellate. Mesoscutum and scutellum smooth and shiny with dense PP (Pd = 20 µm), IS<0.1. Propodeal enclosure medium size, not well indicated by boundary line, strongly rugose with carina, interrugal surface smooth and shiny, dorsal area similar but with weaker rugose. Mesepisternum with dense PP, anterior part reticulate, posterior part with coarse PP, surface smooth and shiny; anterior part of tegula smooth, with PP.

Metasoma: Metasomal terga with dense, small PP (Pd = 20 µm), IS<0.1, smooth and shiny; posterior depression of $T_{2–4}$ laterally distinct, with smaller PP; pygidial plate V-shaped, without internal raised area; $S_{2–5}$ smooth and shiny with fine and deep PP.

Male [Florya region, Istanbul, Turkey, 21.v.1964 (W. Grünwaldt)]: BL = 6.5 mm, WL = 5 mm.

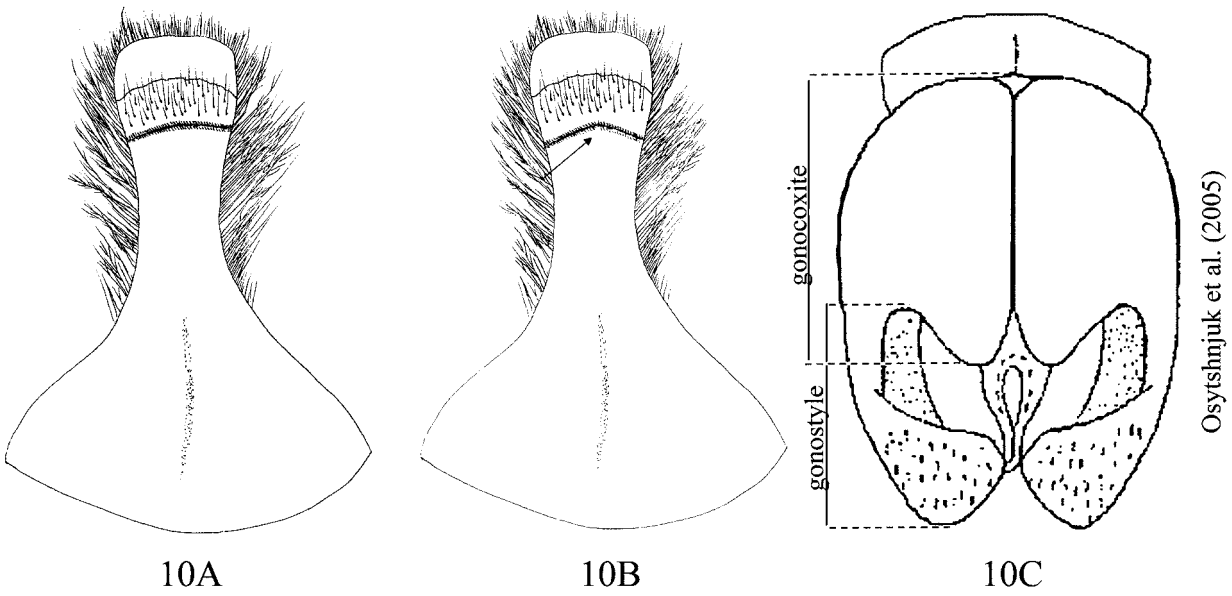


FIGURE 10. (A) Ventral view of S8 of *Andrena alisadra* **sp.n.** (B) Ventral view of S8 of *A. colletiformis* Morawitz. (C) Dorsal view of male genitalia of *A. limonii* Osytshnjuk (from Osytshnjuk *et al*. 2005, reproduced with permission granted by the authors and the publisher).

Color. Flagellum reddish brown beneath; mandible, wing membrane , veins and pterostigma as in female; posterior part of tegula translucent, reddish brown, anterior part dark brown. Rest of body black.

Pubescence. Hairs on head, thorax and clypeus as in female; those on vertex dull whitish, short, 300 µm; those on genal area yellowish; hairs on mesoscutum short (100–250 µm), on scutellum longer (500 µm); those on mesepisternum with the same color and size. Hairs on metasomal terga as in female, $T_{3–5}$ with complete yellowish hair bands, $S_{2–5}$ as in female.

Structure. *Head*: HL/HW = 0.9, HW:MsW:MtW and Vertex as in female; OOD:POD:OCD = 2:2:1; FL1<FL2+FL3, FL2<FL3; inner margins of eyes subparallel; facial quadrangle as in female. Face above antennal fossae reticulate without longitudinal rugulae, interrugal space smooth and shiny. Clypeus as in female; CPL = 0.5 mm. Process of labrum quadrangle, apically rounded; lower paraocular area with very dense, large punctures (Pd = 60 µm, IS<0.1). Malar space linear. Genal area narrower than eye (3:4), surface with very dense PP (Pd = 35 µm), IS<0.1 near eye. Mandibles not crossing at rest.

Mesosoma: Pronotum without humeral angle, weakly tessellate with scattered PP, dorsally with dense PP at middle, laterally with weak wrinkles. Mesoscutum, scutellum, propodeal enclosure, mesepisternum and tegula as in female.

Metasoma: Metasomal terga with dense small PP, smooth and shiny; posterior depressions of $T_{2–5}$ not well indicated; genitalia and S_8 as in Fig. 9E,F; $S_{2–5}$ smooth and shiny with very shallow PP.

Remarks. This species is similar to *A. miegiella* Dours, but is separated by the emarginated process of labrum, the pronotum without dorsolateral suture and the thorax without tawny hairs.

Variation. The first generation is characterized by having longer and thinner hairs and darker antennae than the second generation.

Sculpture of enclosure area shows wide rande of variability (rectangular fovea to irregular rugose). Also, punctuation of terga, impunctate area of marginal zones of terga 2–4 and length of fovea on T2 show variation.

Specimen examined: 1 female, Karakala, Turkmenistan, 31.v.1952 (Kiryakova Vira); 2 males, Florya region, Istanbul, Turkey, 21.v.1964 (W. Grünwaldt); 1 male, Delinsan, Armenia, 15.v.1952 (K. Gusakovskov); 1 female , Cyprus, Limassol (=Lemesos), 12.iv.1958 (Mavromoustakis); 1 female, Macedonia, Litochoro,

Plaka area, 10.–28.vii.88 (Risch); 1 female, Greece, Platania-Volos GR (=Volos area), 20.v.2002, (L. Standfuss); 1 female, Italy, Toscana (=Tuscany), Grosseto, Principina a Mare, 09.vi.1991 (E. Scheuchl); 1 female, Greece, Graecia Olympia (=Olympia), 30.iv.1970 (E. Grünwaldt);1 female, Greece, Graecia Olympia (=Olympia), 25.vi.1964 (W. Grünwaldt); 1 male, Greece, Griechenland, Böotien, Topolia, 09.vii.1974 (A. W. Ebmer); 1 male, Slovenia, Portoroz, Jugosl., 24.vi.–5.viii.1961 (leg. J. Heinrich); 1 male, Turkey, TR-Aksaray (=Aksarary Prov.), 38°38.224N 33°44.309E, 930m, 05.vi.2005 (E. Scheuchl); 1 female, Turkey, TR-Ankara, between Kurtbogazi and Kizilcahamam [Ankara Prov.], 40°19’36"N, 32°42’12"E, 993m, 17.vi.2006 (E. Scheuchl); 3 females, Turkey, TR-Ankara, Hacettepe University, Beytepe Campus, 29.v.2005 (E. Scheuchl). 8 males, Turkey, TR-Ankara, Hacettepe University, Beytepe Campus, 29.v.2005 (E. Scheuchl); 4 males, Turkey, TR-Ankara, Hacettepe University, Beytepe Campus, 03.vi.2005 (E. Scheuchl); 3 females, Turkey, TR-Ankara, Hacettepe University, Beytepe Campus, 07.vi.2005 (E. Scheuchl); 1 female, Turkey,TR-Ankara, Hacettepe University, Beytepe Campus, 16.vi.2006 (E. Scheuchl); 1 female, Turkey, Aydin, Adnan Menderes University, Campus, 04.vi.2006, (E. Scheuchl); 1 female, Turkey, Kusadasi, olive plantation, 7.vi.2006 (E. Scheuchl); 4 females, Turkey, Kusadasi, olive plantation, 28.vi.2006 (E. Scheuchl); 1 male, Turkey, Kusadasi, olive plantation, 28.vi.2006 (E. Scheuchl); 5 females, Turkey, Kusadasi, olive plantation, 29.vi.2006 (E. Scheuchl); 1 male, Turkey, Kusadasi, olive plantation, 29.vi.2006 (E. Scheuchl).

Andrena (Brachyandrena) limonii Osytshnjuk, 1983

(Figs. 2C, 10C, 11)

Andrena limonii Osytshnjuk, 1983: 21–24 (female, male). *Type location*: Southern Russia ("Volgograd"), Kazakhstan ("Karaganda reg."). *Type depository*: Zoological Museum of the Moscow Lomonosov State University, Russia.

Female (holotype): BL = 8 mm, WL = 5.7 mm.

Color. Flagellum brown; mandible nearly reddened; clypeus with feebly yellow spot around midline; wing membrane subhyaline; veins and pterostigma brown; posterior part of tegula translucent, pale brown, anterior part dark brown; the rest of body dark brown to black.

Pubescence. Hairs on head and thorax short, moderately dense; those on clypeus 200–300 µm, transparent white; those on antennal area dense, white; those on vertex pale yellow, short (300 µm); those on genal area white; facial fovea white, with sparse hairs. Hairs on mesoscutum and scutellum short (200–300 µm), with scale-like hairs, whitish; those on mesepisternum simple, long and white; propodeal corbicula not well developed, with dull white long plumose dorsal fringes, internal area with simple hairs, without anterior fringes; trochanteral flocculus perfect, white; femoral flocculus perfect; tibial scopa relatively short, with simple hairs; whitish. Hairs on metasomal terga scanty, T_1 with incomplete hair bands, $T_{2–4}$ with complete whitish hair bands. Caudal fimbriae brown, $S_{2–5}$ with white short subapical fimbriae.

Structure. *Head*: HL/HW = 0.78, HW:MsW:MtW = 1.4:1.3:15. Vertex narrow, less than ocellar diameter, sparsely punctate; surface smooth and shiny, OOD:POD:OCD = 3:2:1; FL1<FL2+FL3, FL2 = FL3; inner margin of eyes subparallel; Facial fovea in upper part occupying 1/2 or more of distance between compound eye and lateral ocellus, exceeding the lower level of antennal socket, FVL = 1.2 mm, FVW = 0.3 mm in upper part, FVW = 0.15 mm in lower part, facial quadrangle longer than wide. Face above antennal fossae with small punctures, with longitudinal rugulae, interrugal space smooth and shiny. Clypeus strongly convex, with sparse small shallow punctures (Pd = 10 µm, IS<0.1), without impunctate median line, shiny and smooth; CPL = 0.9 mm. Process of labrum weakly emarginated; lower paraocular area with sparse irregular shallow PP (Pd = 5–20 µm, IS = 0.1). Malar space linear. Genal area smaller than eye (5:3), surface with very dense and small PP (Pd = 10 µm, IS<0.1) near eye.

Mesosoma: Pronotum without humeral angle, with dorsolateral suture, smooth and shiny with scattered PP, median part of dorsal area with dense and smaller PP, lateral side tessellate. Mesoscutum with dense punctures, surface smooth and shiny, scutellum similar to mesoscutum. Propodeal enclosure medium size,

well indicated by boundary line, strongly rugose with strong carina, interrugal surface smooth and shiny. Mesepisternum with sparse PP, posterior part with small PP, surface tessellate to nearly shagreened with bigger PP; anterior part of tegula with PP.

Metasoma: Metasomal terga with dense, small PP, completely smooth and shiny; posterior depression of $T_{2–5}$ distinct; pygidial plate large, U-shaped, tessellate, with internal raised area; $S_{2–5}$ tessellate with very small and shallow PP, anterior margin without PP.

Male [Stalingr. Obl., Tinguta (=Volgograd, Russia), 3. viii. 1954; I. Razumova]: BL = 7 mm.

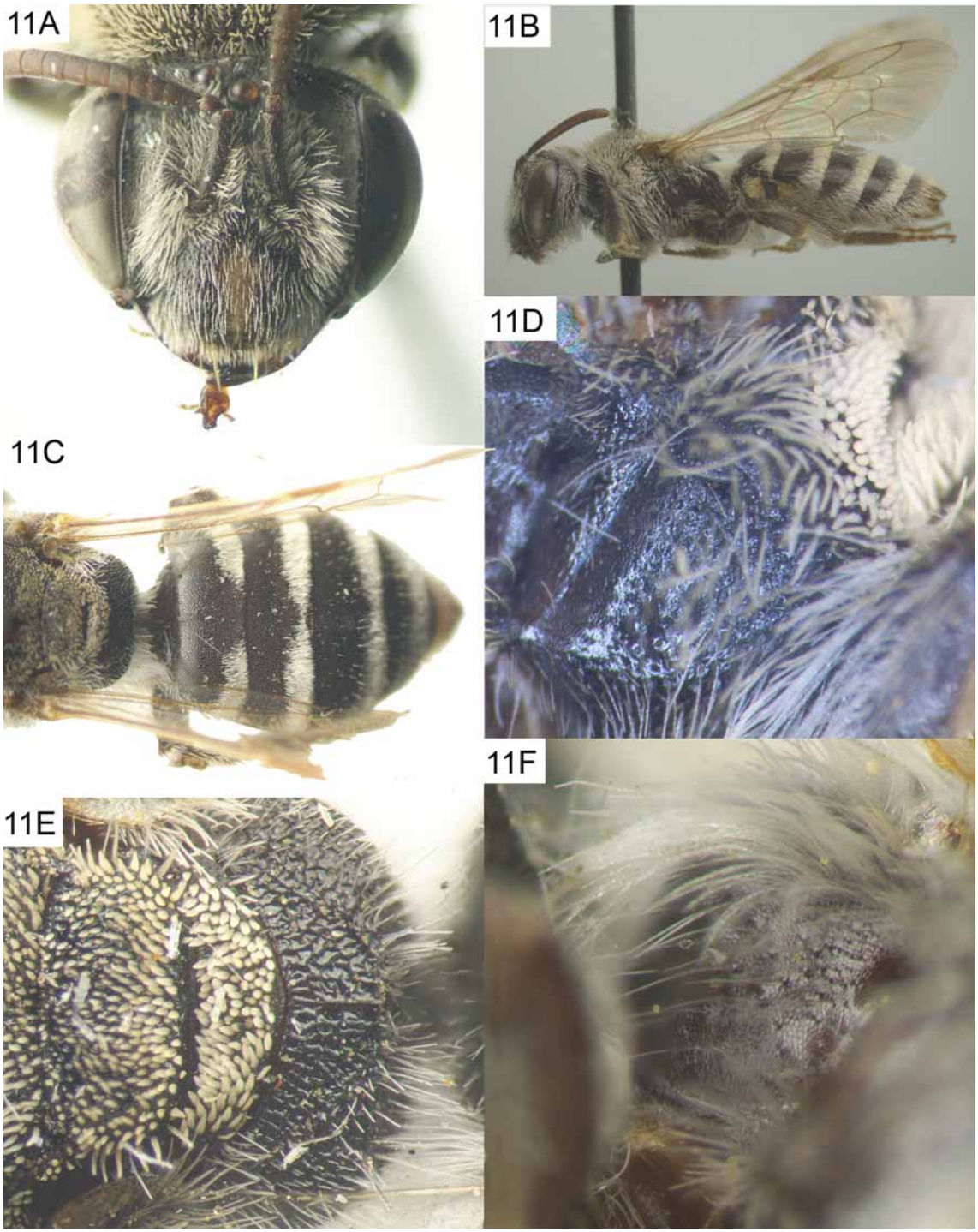


FIGURE 11. *Andrena limonii* Osytshnjuk, female: (A) frontal view, with yellow spot on clypeus; (B) lateral view of body; (C) dorsal view of metasoma; (D) mesepisternum and metepisternum; (E) scutellum, metanotum, and propodeum; (F) propodeal corbicula with smooth surface.

Color. Flagellum reddish brown; clypeus whitish yellow; mandible nearly black darkened above; wing membrane subhyaline, veins and pterostigma dark brown; the rest of body black.

Pubescence. Hairs on head and thorax short, but not scale-like, whitish to yellowish-white; hairs on mesoscutum, scutellum and metanotum simple, whitish. $T_{1–4}$ with dense, whitish hairbands, interrupted on $T_{1–3}$. $S_{2–5}$ with sparse, whitish subapical fimbriae.

Structure. *Head*: Vertex narrow, as wide as ocellar diameter, punctures sparse to moderately dense. FL1<FL2+FL3, FL2 = FL3; inner margins of eyes parallel; facial quadrangle quadrate. Clypeus with dense punctures, with indistinct impunctate median line, surface shagreened superficially, smooth and shiny medioapically. Process of labrum trapezoidal, apical margin thickened and emarginated. Malar space linear.

Mesosoma: Pronotum without humeral angle. Mesoscutum with moderately dense PP, (IS = 1), scutellum with dense PP (IS<1), surface of both smooth and shiny. Propodeal enclosure small, strongly rugose with median carina, interrugal surface smooth and shiny. Mesepisternum with moderately dense PP posteriorly, and very dense PP anteriorly, surface shagreened very superficially, shiny.

Metasoma: Metasomal terga smooth and shiny, T_1 with moderately dense PP, dense on posterior margin; $T_{2–5}$ including posterior depressions with dense PP (IS = 1–2); $S_{2–5}$ smooth and shiny, with scattered PP.

Variation. Extent of yellow spot on the clypeus is variable among females. Surface of process of labrum varies from weak transversal wrinkles to smooth. Enclosure area differs in height and shape of longitudinal and transversal carinae.

Remarks. This species is clearly different from the other known species of this subgenus. Some important differences are as follows: the facial fovea occupying more than 1/2 distance between the eye and lateral ocellus, the mesepisternum finely shagreened, sparsely punctate and without fovea, surface of the propodeal corbicula smooth and shiny without any wrinkles.

Specimens examined: 1 female, Karagandinsk (=Karaganda, Kazakhstan), Russia, 8.viii.1959 (Zhana-Arka Konseng), det. Rudolph; 1 female, Koksengir [Karaganda Prov., Kazakhstan], 20.vii.1951 (Zhana-Arka Konseng), det. Ponomareva; 1 male, Stalingr. Obl., Tinguta (=Volgograd, Russia), 3. viii. 1954 (I. Razumova).

Acknowledgements

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