



## Fifteen new *Andrena* species from little-visited arid, Mediterranean, and mountainous parts of the Old World (Hymenoptera: Andrenidae)

THOMAS JAMES WOOD<sup>1</sup><sup>1</sup>Laboratoire de Zoologie, Université de Mons, Mons, 7000, Belgium✉ [thomasjames.wood@umons.ac.be](mailto:thomasjames.wood@umons.ac.be); <https://orcid.org/0000-0001-5653-224X>

### Table of contents

Abstract	451
Introduction	452
Methods	452
Results	453
<i>Andrena</i> (? <i>Aciandrena</i> ) <i>badiyah</i> spec. nov.	453
<i>Andrena</i> (? <i>Aciandrena</i> ) <i>palmyriae</i> spec. nov.	456
<i>Andrena</i> ( <i>Aciandrena</i> ) <i>plumbea</i> spec. nov.	457
<i>Andrena</i> ( <i>Carandrena</i> ) <i>hoggara</i> spec. nov.	460
<i>Andrena</i> ( <i>Carandrena</i> ) <i>inflata</i> spec. nov.	463
<i>Andrena</i> ( <i>Chrysandrena</i> ) <i>rubricorpora</i> spec. nov.	463
<i>Andrena</i> ( <i>Graecandrena</i> ) <i>virguladivina</i> spec. nov.	466
<i>Andrena karia</i> , spec. nov. ( <i>incertae sedis</i> )	469
<i>Andrena</i> ( <i>Micrandrena</i> ) <i>atlantea</i> spec. nov.	474
<i>Andrena</i> ( <i>Micrandrena</i> ) <i>convexifrons</i> spec. nov.	476
<i>Andrena</i> ( <i>Orandrena</i> ) <i>densissima</i> spec. nov.	479
<i>Andrena</i> ( <i>Pallandrena</i> ) <i>persica</i> spec. nov.	481
<i>Andrena</i> ( <i>Pallandrena</i> ) <i>zagrosa</i> spec. nov.	483
<i>Andrena</i> ( <i>Suandrena</i> ) <i>inaquosa</i> spec. nov.	485
<i>Andrena</i> ( <i>Truncandrena</i> ) <i>syriensis</i> spec. nov.	486
Concluding remarks	491
Acknowledgements	491
References	491

### Abstract

*Andrena* is the second most speciose genus of bees, with around 1,500 species known globally. It is predominantly distributed through the Holarctic with severely limited diversity in other biogeographical regions, and with the greatest species richness in arid and Mediterranean areas. Despite a long history of study, many species remain undescribed. As part of an ongoing revision of undetermined Old World material, many new species have been discovered in museum collections. *Andrena* (*Micrandrena*) *atlantea* **spec. nov.** from Morocco, *Andrena* (*Carandrena*) *hoggara* **spec. nov.** from Algeria, *Andrena* (*Aciandrena*) *plumbea* **spec. nov.**, *Andrena* (*Carandrena*) *inflata* **spec. nov.**, *Andrena* (*Chrysandrena*) *rubricorpora* **spec. nov.**, *Andrena* (*Orandrena*) *densissima* **spec. nov.** from Tunisia, *Andrena* (?*Aciandrena*) *badiyah* **spec. nov.**, *Andrena* (*Micrandrena*) *convexifrons* **spec. nov.** from Jordan, *Andrena* (?*Aciandrena*) *palmyriae* **spec. nov.**, *Andrena* (*Graecandrena*) *virguladivina* **spec. nov.**, *Andrena* (*Suandrena*) *inaquosa* **spec. nov.**, *Andrena* (*Truncandrena*) *syriensis* **spec. nov.** from Syria, *Andrena karia* **spec. nov.** (*incertae sedis*) from Turkey, and *Andrena* (*Pallandrena*) *persica* **spec. nov.** and *Andrena* (*Pallandrena*) *zagrosa* **spec. nov.** from Iran are described. The description of these 15 new species confirms the extent to which our understanding of this genus remains incomplete in the arid, Mediterranean, and mountainous parts of the Old World.

**Key words:** desert, endemic, Hymenoptera, solitary bees, taxonomy

## Introduction

The genus *Andrena* is the second most species-rich amongst the bees, second only to *Lasioglossum*, with around 1,500 species listed in the most recent revisions (Gusenleitner and Schwarz 2002; Gusenleitner *et al.* 2005; Dubitzky *et al.* 2010). The genus is principally distributed throughout the Holarctic, with the greatest diversity in Mediterranean or arid regions, principally south-western North America, and in the Old World in the continuum that stretches across the Mediterranean basin, the Middle East, and Central Asia.

Part of this enormous species richness can be explained by the diversity of ecological niches that *Andrena* species occupy. Though all *Andrena* species are solitary (or more rarely communal) and nest in the ground (Michener 2007), across the genus they display a great deal of phenotypic and dietary variation (Westrich 1989; Larkin *et al.* 2008; Wood and Roberts 2018) that has allowed them to adapt themselves to many different niches, with changes in these two traits often going hand in hand. Though a majority of North American species are active in the spring, shifts to a summer emergence have facilitated the utilisation of autumn flowering plants, predominantly by specialist clades (Larkin *et al.* 2008). Old World species also show great variation, including winter-active species (Mavromoustakis 1952; 1958; Grünwaldt 1976) and a much higher incidence of bivoltine behaviour, including variation in voltinism between closely related species that facilitates the use of specific resources during distinct parts of the season, even within a generalist clade (Praz *et al.* 2019). The ultimate result of this phenotypical and dietary variation has been the development of species-rich faunas, individual members of which occupy distinct temporal and spatial niches. As a result, *Andrena* species are subject to being overlooked until they are searched for at both the right time, and in the right place during the season. When combined with the species-rich floras and high availability of bare ground nesting substrates characteristic of Mediterranean and arid habitats (Potts *et al.* 2005), many of which are physically difficult or dangerous to access, there is therefore a great potential for *Andrena* species to go undetected in these regions due to a lack of sampling effort.

The Oberösterreichs Landesmuseum in Linz, Austria is the principal repository for *Andrena* type material in Europe, being home to the Klaus Warncke collection, who was the leading Old World *Andrena* taxonomist. In addition, it also houses large quantities of undetermined *Andrena* specimens collected throughout the Old World that require revision. Examination of this material has revealed the presence of many undescribed species from a diverse range of countries from North Africa to the Middle East. Focused revisions targeted on countries, regions, subgenera, or species groups are the favoured approach for describing new *Andrena* species (Warncke 1965; 1975; Schwenninger 2015; Pisanty *et al.* 2016; 2018; Wood *et al.* 2020a; b), but because of the great species richness of this genus it is often necessary to compile descriptions of new species without a common theme into a single publication (e.g. Warncke 1967; Gusenleitner 1998; Grünwaldt *et al.* 2005; Dubitzky 2006; Scheuchl 2010), with this being the objective of the current work.

## Methods

Morphological terminology follows Michener (2007). Specimens were measured from the centre of the clypeus at the front of the head to the apical tip of the metasoma to the nearest 0.5 mm. Photographs were taken using an Olympus E-M1 Mark II with a 60 mm macro lens. Additional close-ups were taken with the addition of a Mitutoyo M Plan Apo 10X infinity corrected objective lens in combination with an Olympus M.Zuiko 2x teleconverter lens, a 10 mm Kenko DG extension tube, and a Meike MK-P-AF3B 10 mm extension tube. Photographs were stacked using Zerene Stacker 1.04 (Zerene Systems, USA) and plates were prepared in GNU Image Manipulation Program (GIMP) 2.10. Post-processing of some images was made in Photoshop Elements (Adobe Systems, USA) in order to improve lighting to highlight specific characters. Species are ordered alphabetically by subgenus. The following abbreviations are used in the species descriptions: A = antennal segments, S = metasomal sterna, and T = metasomal terga.

MSC = Maximilian Schwarz collection, Ansfelden, Austria

OÖLM = Oberösterreichs Landesmuseum, Linz, Austria

SMNHTAU = Steinhardt Museum of Natural History at Tel Aviv University, Israel

TJWC = Personal collection of Thomas J. Wood, Mons, Belgium

ZMHB = Museum für Naturkunde, Berlin, Germany

## Results

### *Andrena* (?*Aciandrena*) *badiyah* spec. nov.

urn:lsid:zoobank.org:act:7EED4526-5105-47EF-8EFB-102B70A7E89A

**HOLOTYPE: JORDAN:** Rawayshid [Ruwaished], 23.iv.1996, 1♀, leg. Marek Halada (OÖLM).

**PARATYPES: JORDAN:** Same as holotype, 1♂, 1♀ (OÖLM), 1♀ (TJWC), 1♀ (SMNHTAU).

**Description: Female:** Body length 7 mm (Figure 1). *Head:* Black, 1.3 times wider than long (Figure 2). Clypeus domed, irregularly punctate, punctures separated by 0.5–2 puncture diameters; longitudinal impunctate central line present, underlying surface weakly shagreened, stronger basally, becoming weaker apically. Process of labrum trapezoidal, corners rounded, shiny (Figure 3). Gena moderately broad, equalling width of compound eye; ocellocipital distance subequal to width of lateral ocellus. Fovea moderately broad, dorsally occupying ½ of area between lateral ocellus and compound eye, slightly narrowed below to level of antennal insertions, not separated from inner margin of compound eye. Gena, vertex, face, and scape with white hairs, longest not exceeding half of length of scape. Antenna dark, A3 apically, A4–12 lightened orange below, A3 slightly exceeds A4+5, shorter than A4+5+6. *Mesosoma:* Scutum and scutellum finely and regularly punctate, punctures separated by 2 puncture diameters, underlying surface completely smooth and strongly shining (Figure 4). Pronotum with weak humeral angle, dorsolaterally slightly angulate, inconspicuous. Episternum and propodeum finely reticulate, weakly shining, propodeal triangle granulose, indicated by change in reticulation, slightly duller, basally with very slight short rugosity, without ridges or rugae. Episternum and propodeum with moderately long white hairs, propodeal corbicula well-formed dorsally, lateral faces of propodeum regularly but sparsely haired, all hairs not exceeding length of scape. Scutum and scutellum with short, semi-squamous light brown hairs, very sparse centrally, dense along lateral margins of discs. Legs dark, apical tarsal segments and hind basitarsi lightened orange, pubescence whitish, scopa white. Hind tarsal claws without inner teeth. Wings hyaline, venation and stigma orange, nervulus strongly antefurcal. *Metasoma:* Terga dark, apical margins lightened yellow and broadly hyaline (Figure 5), tergal discs with sparse, fine, inconspicuous hair-bearing punctures, becoming denser laterally, here separated by 2–3 puncture diameters (Figure 6). Tergal discs with underlying surface microreticulate, weakly shining; T2–4 with thick white hair bands that obscure underlying surface, on T2 medially interrupted, T3–4 complete. Apical fringe of T5 and hairs flanking pygidial plate golden; pygidial plate flattened, centrally with fine mesh-like pattern.

**Male:** Body length 6 mm (Figure 7). *Head:* Black, 1.4 times wider than long (Figure 8). Clypeus weakly domed, coloured yellow with exception of two lateral black marks, evenly punctate, punctures separated by 0.5–1 puncture diameter; weak longitudinal impunctate line present, underlying surface shagreened, weakly shining. Gena moderately broad, equalling width of compound eye; ocellocipital distance subequal to width of lateral ocellus. Gena, vertex, face, and scape with white hairs, longest not exceeding half of length of scape. Antenna dark, A4–12 lightened orange below, A3 longer than A4 which is clearly wider than long, A3 shorter than A4+5. *Mesosoma:* Scutum and scutellum sparsely and irregularly punctate, punctures separated by 2–3 puncture diameters, underlying surface smooth and strongly shining, shagreenation restricted to extreme disc margins (Figure 9).

Pronotum, episternum and propodeum as in female. Episternum, propodeum, scutum, and scutellum with long white hairs, longest equalling length of scape. Legs dark, apexes of tibiae and tarsi lightened orange. Wings hyaline, venation and stigma orange, nervulus strongly antefurcal. *Metasoma:* Terga structurally as in female, hair bands reduced (Figure 10). Genitalia simple, gonocoxae with weak teeth, gonostyli with straight outer margin, apically rounded, penis valve basally relatively broad and parallel-sided before narrowing apically (Figure 11).

**Diagnosis:** The placement of small black *Andrena* is highly challenging because of the variation within this group and the polyphyly of the existing subgeneric concepts (Pisanty *et al.* 2020). Recognising which characters can be used to consistently identify good monophyletic groups is therefore difficult. The distinctive characters of *A. badiyah* are the strongly shiny and sparsely punctate scutum, the presence of short semi-squamous hairs on the thoracic dorsum, the antefurcal nervulus, the absence of sculpturing on the propodeal triangle, the orange hind basitarsi, the simple male genitalia, and the domed and striation-free clypeus in the female and the yellow-marked clypeus in the male.

The sparsely punctate and shiny scutum in combination with short semi-squamous hairs in the female sex is highly suggestive of an association with the red-marked *A. arsinoe* Schmiedeknecht, 1900 and *A. amricula* Warncke, 1967 which were placed in the *Graecandrena* (Warncke 1968), but these have strongly different male genitalia (gonostyli with strongly constricted, finger-like apexes) and have been shown to fall far from the other clades of

small black *Andrena* (Pisanty *et al.* 2020). The granulose (lacking ridges or rugae) propodeal triangle in combination with the moderately broad foveae should place it in the true *Aciandrena* clade (the species around *A. aciculata* Morawitz, 1886) as it lacks a propodeal triangle well-marked by carinae or rugosity (*Micrandrena*, *Fumandrena*, *Proxiandrena*), a clypeus with longitudinal striations (*Distandrena* partim), or foveae narrowed below to the point of linearity (*Distandrena* partim), and it can be separated from the true *Graecandrena* by the absence of rugosity at the base of the propodeal triangle, by the yellow clypeus of the male, and by the male genitalia which do not have the typical *Graecandrena* form. However, because of the shiny scutal integument which is not known from other *Aciandrena* species, this placement should be considered provisional until further, preferably genetic, data are available.



**FIGURES 1–6.** *Andrena badiyah* **spec. nov.** 1. female profile, 2. female face, 3. female face detail, 4. female scutum, 5. female terga, 6. female terga detail.



**FIGURES 7–12.** *Andrena badiyah* **spec. nov.** 7. male profile, 8. male face, 9. male scutum, 10. male terga, 11. male genitalia. *Andrena spolata* Warncke, 1968; 12. male genitalia.

For direct species diagnosis, in the female sex the combination of an almost entirely shiny scutum and scutellum together with short semi-squamous hairs and without red-marked terga (excluding *A. arsinoe* and *A. amicula*) is distinctive, as similar *Aciandrena* species with similar short semi-squamous hairs have clear shagreenation on the scutal disc (e.g. *A. hillana* Warncke, 1968, *A. pavonia* Warncke, 1974, and *A. pellucida* Warncke, 1974), and where such shagreenation is weak (e.g. *A. pellucida*) it can be further separated by the broader foveae that are wider than the width of a flagellum (as wide as a flagellum in *A. pellucida*). It can be separated from *A. palmyriae* **spec. nov.** (see below) because the process of the labrum is entire (not apically notched), the hind tibiae are dark (not orange), the nervulus is antefurcal (interstitial), and the tergal hair bands are shorter and less dense. In the male sex, complete

diagnosis is difficult because many of the desert-living *Aciandrena* have been described only from the female sex, but the combination of yellow clypeus, granulate propodeal triangle, shiny scutum and scutellum, antefurcal nervulus, orange hind basitarsi, and genitalia with weakly produced gonocoxal teeth should be sufficient to facilitate identification, as most *Aciandrena* males have more strongly produced gonocoxal teeth such as *A. spolata* Warncke, 1968 (Figure 12, see also photographs and notes in Pisanty *et al.* 2016). The genitalia are extremely close to *A. pavonia*, but this species has a black clypeus (see Gusenleitner and Schwarz 2002).

**Etymology:** The name is derived from the Arabic name for the Syrian desert, the Badia (Arabic: Bâdiyah Ash-Shâm) that stretches over large parts of Syria, Jordan, Saudi Arabia, and Iraq.

***Andrena* (?*Aciandrena*) *palmyriae* spec. nov.**

urn:lsid:zoobank.org:act:5351670B-FC24-467B-9F09-FEF20BF7B27D

**HOLOTYPE: SYRIA:** Palmyra, 1.v.1995, 1♀, leg. K. Deneš (OÖLM).

**Description: Female:** Body length 7 mm (Figure 13). **Head:** Black, 1.3 times wider than long. Clypeus domed, irregularly punctate, punctures separated by 0.5–2 puncture diameters; longitudinal impunctate central line present, underlying surface weakly shagreened, stronger basally, becoming weaker apically. Process of labrum square, as long as broad, apical margin deeply emarginate (Figure 14). Gena slightly narrower than width of compound eye; ocellocapital distance subequal to width of lateral ocellus. Fovea moderately broad, dorsally occupying ½ of area between lateral ocellus and compound eye, slightly narrowed below to level of antennal insertions, not separated from inner margin of compound eye. Gena, vertex, face, and scape with white hairs, longest not exceeding half of length of scape. Scape dark, A2–12 almost entirely lightened orange, A3 slightly exceeds A4+5, shorter than A4+5+6. **Mesosoma:** Scutum and scutellum finely and regularly punctate, punctures separated by 1–1.5 puncture diameters, underlying surface completely smooth and strongly shining (Figure 15). Pronotum with weak humeral angle, dorsolaterally slightly angulate, inconspicuous. Episternum and propodeum finely reticulate, weakly shining, propodeal triangle granulate, indicated by change in reticulation, slightly duller, basally with very slight short rugosity. Episternum and propodeum with moderately long white hairs, propodeal corbicula well-formed dorsally, lateral faces of propodeum regularly but sparsely haired, all hairs not exceeding length of scape. Scutum and scutellum with short, semi-squamous light brown hairs, very sparse centrally, dense along lateral margins of discs; scutum with longer, projecting white hairs, 3–4 times longer (Figure 16). Legs basally dark, apexes of tibiae of first two pairs of legs, all tarsi, and hind tibiae orange, pubescence whitish, scopa white. Hind tarsal claws without inner teeth. Wings hyaline, venation and stigma orange, nervulus interstitial to slightly antefurcal. **Metasoma:** Terga dark, apical margins lightened yellow and broadly hyaline (Figure 17), intermediate areas between discs and margins and lateral areas viewed in profile lightened reddish-brown (Figure 16). Tergal discs almost impunctate, fine hair-bearing punctures sparse, predominantly found laterally, underlying surface microreticulate, weakly shining; T2–4 with long, thick white hair bands that obscure underlying surface, on T2 medially interrupted, T3–4 complete (Figure 18). Apical fringe of T5 and hairs flanking pygidial plate golden; pygidial plate elongate, flattened with slightly upturned margins, centrally shining.

**Male:** Unknown.

**Diagnosis:** This species is very similar to *A. badiyah* spec. nov., and can be provisionally placed in the subgenus *Aciandrena* following the same reasoning and with the same caveated degree of confidence. It is close to *A. pavonia* from Algeria and Tunisia, as both species share the short semi-squamous hairs on the scutum and scutellum, orange hind tibiae, and thick white hairbands covering the tergal margins. It can be separated by the completely shiny scutum (slightly but consistently and completely shagreened in *A. pavonia*), the narrow and deeply notched process of labrum (process of labrum trapezoidal, wider than long, slightly notched), and the interstitial nervulus (clearly antefurcal). As noted above, *A. palmyriae* can be separated from *A. badiyah* spec. nov. by the notched process of the labrum, the orange hind tibiae, the interstitial nervulus, the comparatively longer clypeus, and the longer and thicker tergal hairbands.

**Etymology:** This species is named after the ancient city of Palmyra in Syria.



**FIGURES 13–18.** *Andrena palmyriae* **spec. nov.** 13. female profile, 14. female face, 15. female scutum, 16. female terga lateral view, 17. female terga, 18. female terga detail.

***Andrena (Aciandrena) plumbea* **spec. nov.****

urn:lsid:zoobank.org:act:ABE593B6-D033-4723-8717-6A22EBD6636F

**HOLOTYPE: TUNISIA:** Ksar Hadada, 4–5.iv.1996, 1♂, leg. K. Deneš (OÖLM).

**PARATYPE: TUNISIA:** Same as holotype, 5♀ (OÖLM), 1♀ (TJWC), 1♀ (SMNHTAU); Tamerza [Tamaqzah], 30–31.iii.2006, 3♂, leg. J. Batelka & J. Straka (OÖLM), 1♂ (TJWC), 1♂ (SMNHTAU).

**Description: Female:** Body length 6.5 mm (Figure 19). *Head:* Black, 1.1 times wider than long. Clypeus

strongly flattened, regularly punctate, punctures separated by 2–3 puncture diameters; longitudinal impunctate line present, underlying surface shagreened, dull (Figure 21). Process of labrum trapezoidal, apical margin narrow, shiny. Gena subequal to width of compound eye; ocelloccipital distance very narrow, less than  $\frac{1}{2}$  width of lateral ocellus. Fovea moderately long, reaching level of antennal insertions, narrow, narrower than width of flagellum, dorsally occupying  $\frac{1}{3}$ <sup>rd</sup> distance between lateral ocellus and compound eye, imperceptibly narrowing below. Gena, vertex, face, and scape with white hairs, longest not exceeding length of scape. Antenna dark, A5–12 lightened orange below, A3 slightly exceeding A4+5, shorter than A4+5+6. *Mesosoma*: Scutum and scutellum, regularly punctate, punctures separated by 2–3 puncture diameters, underlying surface uniformly shagreened, weakly shining (Figure 20). Pronotum without humeral angle, dorsolaterally very slightly angulate, inconspicuous. Episternum and propodeum microreticulate, weakly shining, propodeal triangle broad, granulose, indicated by change in surface sculpture, internal surface finely microreticulate. Episternum and propodeum with long white hairs, not exceeding length of scape, propodeal corbicula well defined dorsally, scutum and scutellum essentially hairless. Legs dark, apical tarsal segments lightened brown-orange, pubescence whitish, scopa white with exception of some brown hairs on hind tibiae dorsally, adjacent to basitibial plate. Hind tarsal claws without inner teeth. Wings hyaline, venation and stigma orange, nervulus antefurcal. *Metasoma*: Terga dark, apical margins lightened orange-yellow-hyaline (Figure 23), tergal discs strongly microreticulate, essentially impunctate (Figure 24); T2–4 with apical margins slightly depressed, laterally with weak long white hair bands, those on T2–3 interrupted, on T4 weak but complete. Apical fringe of T5 and hairs flanking pygidial plate golden; pygidial plate triangular, weakly pointed, slightly domed, impunctate.

**Male:** Body length 6 mm (Figure 25). *Head*: Black, 1.3 times wider than long (Figure 26). Clypeus flattened, yellow with the presence of two small black marks laterally, these sometimes absent; regularly punctate, punctures separated by 1–2 puncture diameters, longitudinal impunctate line present, underlying surface shagreened, dull basally, weakly shining apically. Gena equals width of compound eye; ocelloccipital distance  $\frac{1}{2}$  width of lateral ocellus. Gena, vertex, face, and scape with long white hairs, longest exceeding length of scape. Antenna dark, A5–13 lightened orange below, A3 exceeds A4, shorter than A4+5. *Mesosoma*: Structurally as in female, episternum, propodeum, scutum, and scutellum with long white hairs, longest exceeding length of scape. Wings hyaline, venation dark brown, stigma brown, nervulus strongly antefurcal. *Metasoma*: Terga structurally as in female (Figures 27–28). Genital capsule elongate, gonocoxae with strong teeth, penis valve relatively broad for most of its visible length before narrowing apically; gonostyli elongate, apices pointed, inner margins diverging apically (Figure 29).

**Diagnosis:** *Andrena plumbea* can more easily be placed in the *Aciandrena* as it is closer to the classical concept, lacking a polished scutum, but with the other characters of a granulose propodeal triangle, narrow foveae, striation-free female clypeus, antefurcal nervulus, and yellow male clypeus. Structurally it is closest to *A. pratincola* Warncke, 1974 because of the flattened and shagreened clypeus in the female sex (also clearly punctate and without central concavity, therefore excluding *A. nitidilabris* Pérez, 1895) and the almost entirely yellow male clypeus (excluding *A. nitidilabris*, *A. pavonia*, *A. minima* Warncke, 1974). The scutum and scutellum are also almost hairless, excluding species like *A. hillana* and *A. pellucida* that have short semi-squamous hairs here.

*Andrena plumbea* differs most obviously from *A. pratincola* in the female sex by the absence of red colouration on the terga, *A. pratincola* having the majority of T2–3 coloured red, this colouration extending partially onto T1 and T4. Structurally, the two species can be separated by the punctation of the clypeus which in *A. plumbea* is regularly punctate, puncture separated by 2–3 puncture diameters, with an impunctate longitudinal central line, whereas *A. pratincola* has an irregularly punctate clypeus, punctures separated by 1–3 puncture diameters, without forming an impunctate central line. The process of the labrum is also trapezoidal with a narrow straight front edge in *A. plumbea* (Figure 21), but clearly triangular and pointed in *A. pratincola* (Figure 22).

In the male sex, the two species are best separated by genital construction. *Andrena plumbea* has a more elongate genital capsule, with more strongly pronounced gonocoxal teeth, a comparatively broader penis valve, and longer pointed gonostyli, their inner margins diverging apically (Figure 29), whereas in *A. pratincola* the overall capsule is shorter, with less pronounced gonocoxal teeth, a narrower penis valve, and with broad gonostyli without diverging apices (Figure 30). The clypeus of *A. plumbea* is also comparatively more shagreened and therefore duller in direct comparison.

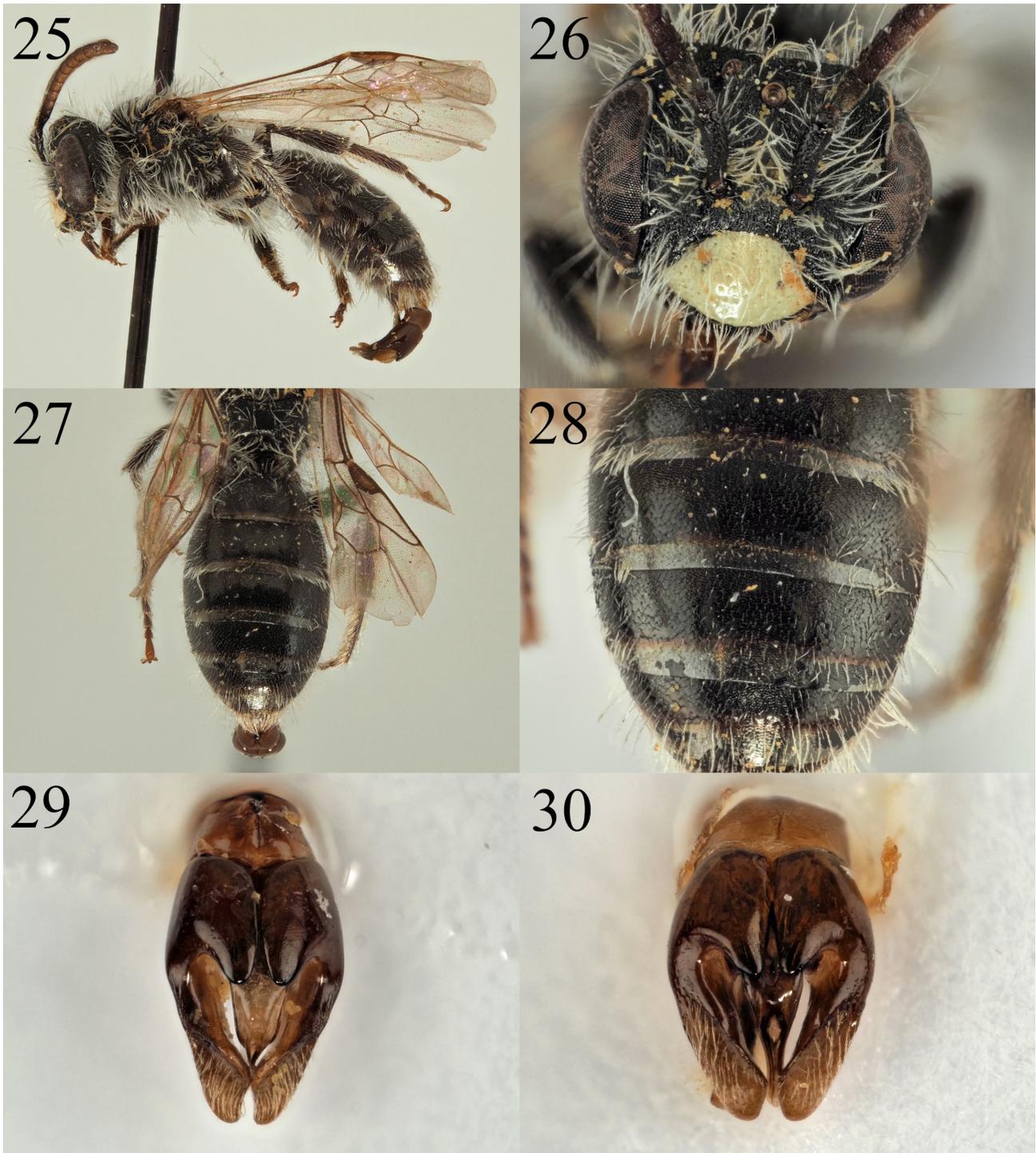
Both *A. pratincola* and *A. plumbea* were caught in sympatry at Ksar Hadada. The former shows typical tergal colouration and irregular clypeal punctation without character introgression with *A. plumbea*, so the latter is considered to be a good taxon.



FIGURES 19–24. *Andrena plumbea* spec. nov. 19. female profile, 20. female scutum, 21. female face, 23. female terga, 24. female terga detail. *Andrena pratincola* Warncke, 1974; 22. female face.

**Etymology:** The name is derived from the Latin *plumbeus* (of lead) because of the dull and leaden clypeus in both the male and the female when compared to similar *Aciandrena* species.

**Other material examined:** (*Andrena pratincola*): **EGYPT:** Ikingi Mariout, 18.iii.1935, 1♀, leg. W. Wittmer, OÖLM (holotype); Dekhela, 20.ii.1917, 1♂, leg. Storey, OÖLM (paratype); **TUNISIA:** Ksar Hadada, 4–5.iv.1996, 4♀, leg. K. Deneš, OÖLM; Chenini, 4.iv.1996, 1♀, leg. K. Deneš, OÖLM.



FIGURES 25–30. *Andrena plumbea* spec. nov. 25. male profile, 26. male face, 27. male terga, 28. male terga detail, 29. male genitalia. *Andrena pratincola* Warncke, 1974; 30. male genitalia.

***Andrena (Carandrena) hoggara* spec. nov.**

urn:lsid:zoobank.org:act:59C8DBB2-4217-4A86-AAEC-655B827C9D04

**HOLOTYPE:** ALGERIA: Amsel, 30 km S Tamanrasset, 1.iv.1989, 1♀, leg. M. Schwarz (OÖLM).

**PARATYPE:** ALGERIA: Tamrit [rest of locality information handwritten, illegible, presumed to be somewhere in south-eastern Algeria], 4.v.1987, 1♀, leg. Dr. Strejček (OÖLM).

**Description:** **Female:** Body length 9 mm (Figure 31). **Head:** Black, 1.2 times wider than long (Figure 32).

Clypeus slightly domed, weakly flattened centrally and apically, irregularly punctate, punctures separated by 0.5–3 puncture diameters; weak impunctate longitudinal central line present, underlying surface shagreened basally, dull, becoming weaker centrally, smooth and shining over majority of centre and apex (Figure 33). Process of labrum trapezoidal, apical margin slightly compressed, forming weak emargination and kerb-like structure, shiny, basal half of process of labrum transversely striate, weakly shining. Gena moderately broad, slightly exceeding width of compound eye; ocelloccipital distance subequal to width of lateral ocellus. Fovea relatively broad, dorsally occupying  $\frac{3}{4}$  space between lateral ocellus and compound eye, slightly narrowed below, reaching just below level of antennal insertions. Gena, face, and scape with white hairs, vertex to ocellar triangle with light brown hairs, none exceeding length of scape. Antenna dark, A4–12 lightened orange below, A3 slightly exceeds A4+5. *Mesosoma*: Scutum and scutellum predominantly densely punctate, punctures separated by 0.5–1 puncture diameters over majority of disc except centrally where a circular impunctate area is formed, underlying surface laterally shagreened, weakly shining, becoming smooth and shining centrally. Pronotum with weak humeral angle, dorsolaterally slightly angulate. Episternum and propodeum microreticulate, weakly shining, propodeal triangle marked by change in surface sculpture, internal surface finely shagreened, basally with weak rugosity. Episternum and propodeum with white hair, becoming light brown on scutum and scutellum (Figure 34), not exceeding length of scape. Legs dark, apical tarsal segments lightened brown, pubescence whitish to light brownish, scopa white. Wings hyaline, venation and stigma dark orange, nervulus antefurcal. *Metasoma*: Terga dark, apical margins slightly depressed, lightened orange-yellow, hyaline (Figure 35). Tergal discs very finely and inconspicuously punctate, punctures separated by 2 puncture diameters, obscure against underlying surface which is finely microreticulate, weakly shining. T1–4 with complete, dense white hair bands that obscure underlying surface (Figure 36). Apical fringe of T5 and hairs flanking pygidial plate golden; pygidial plate broadly triangular, apical margin truncate, surface very weakly domed centrally, impunctate.

**Male:** Unknown.

**Diagnosis:** The subgenus *Carandrena* is difficult to define precisely in the female sex, *Carandrena* species generally being more clearly united using male characters, but can be generally recognised by the combination of a broad labral process, head compact and generally slightly broader than long, integument often with metallic tints, terga impunctate to very finely and inconspicuously punctate, usually with clear hair bands, pronotum usually with a clear humeral angle and carina, and most clearly with propodeal triangle finely shagreened, with faint weak rugosity at base. Importantly, the distinction between the subgenera *Carandrena* and *Notandrena* is not clear, each rendering the other polyphyletic, and the two may potentially be synonymised in the future (Pisanty *et al.* 2020). At least one *Carandrena* lineage (containing *A. eremobia* Guiglia, 1933 and *A. euzona* Pérez, 1895) falls elsewhere, but resolving this issue will require extensive taxon sampling (Pisanty *et al.* 2020). For now, species are best diagnosed with reference to related taxa.

*Andrena hoggara* falls in the group of non-metallic *Carandrena* and is closest to *A. eddaensis* Gusenleitner, 1998 because of the non-metallic integument, apically shiny clypeus, relatively broad foveae, antefurcal nervulus, dark terga with lightened apical margins, and whitish pubescence laterally, light brown pubescence dorsally. It can easily be separated (*A. eddaensis* character state in parentheses) by the process of the labrum which is trapezoidal and weakly emarginate with a kerb-like ridge apically (broadly semi-circular, lacking emargination or apical ridge), the more strongly punctate clypeus with longitudinal impunctate line (clypeus largely impunctate in apical half, without impunctate line), the centrally smooth and shiny scutum (more extensively shagreened, without clear smooth and shiny area), and the tergal hair bands that are restricted to the apical margins (tergal discs covered with thick hair that obscures the underlying surface in addition to those covering the tergal margins).

**Discussion:** The holotype female was collected on a joint expedition between Maximilian Schwarz and Klaus Warncke that led to the description of *Hoplitis hoggara* (Warncke, 1992) from the Hoggara mountain range (Warncke 1992). This species has a disjunct distribution is known only from the Hoggara mountains in southern Algeria and the Drâa valley in southern Morocco. The *Andrena* fauna of the Hoggara is extremely interesting, and examined material comprised the recently described *A. breviceps* Wood, 2020 (known from the Drâa valley in southern Morocco), *A. amacula* (Egypt), and *A. helouanensis* Friese, 1899 (Egypt, Israel, United Arab Emirates, see Pisanty *et al.* 2018), all of which are newly reported from Algeria. The *Andrena breviceps* specimen was collected from the *locus typicus* of *H. hoggara*, further emphasising the biogeographic link between the Hoggara mountain range and the Drâa valley of southern Morocco. *Andrena amacula* and *A. helouanensis* have more eastern distributions, the latter also newly reported here from Jordan and Oman, providing a more complete picture of its distribution. The presence of both

eastern and western *Andrena* species that are seemingly restricted to desert environments suggests that the Hoggar mountains retain a relictual *Andrena* fauna that was once more widespread; indeed, relictual vertebrate populations persist or have persisted in this region including crocodiles (Brito *et al.* 2011), so the presence of such a bee fauna is not unexpected but has not been studied in detail to date.

**Etymology:** The name comes from the Hoggar mountains (Berber: idurar n Ahaggar) in southern Algeria, the *locus typicus*.



**FIGURES 31–36.** *Andrena hoggara* **spec. nov.** 31. female profile, 32. female face, 33. female face detail, 34. female scutum, 35. female terga, 36. female terga detail.

**Other material examined:** (*Andrena amicula*): **ALGERIA:** 60 km E of Tamanrasset, 31.iii.1989, 1♀, leg. M. Schwarz, OÖLM; (*Andrena breviceps*): **ALGERIA:** Hoggar Guelta, near Llamane, 1900 m, 29.iii.1989, 1♀,

leg. M. Schwarz, OÖLM; (*Andrena helouanensis*): **ALGERIA**: 20 km E Tamanrasset, 1400 m, 30.iii.1989, 1♀, leg. M. Schwarz, OÖLM; 60 km E of Tamanrasset, 31.iii.1989, 1♀, leg. K. Warncke, OÖLM; Assekrem, 2300 m, 27.iii.1989, 6♂, leg. M. Schwarz, OÖLM; Mt. Tahat, S. Hoggar, 2400 m, 28.iii.1989, 1♀, leg. K. Warncke, OÖLM; Tamanrasset, Guelta, 52 km NE, 26.iii.1989, 1♂, leg. M. Schwarz, OÖLM; **JORDAN**: Wadi Rum, Al Ghal env., 3.iv.2013, 1♀, leg. M. Snižek, OÖLM; **OMAN**: NW of Bahla, Al Ayshi, 6.iii.2017, 1♀, leg. M. Snižek, OÖLM.

***Andrena (Carandrena) inflata spec. nov.***

urn:lsid:zoobank.org:act:6540AA31-2556-4637-86EE-43E47E31CF4E

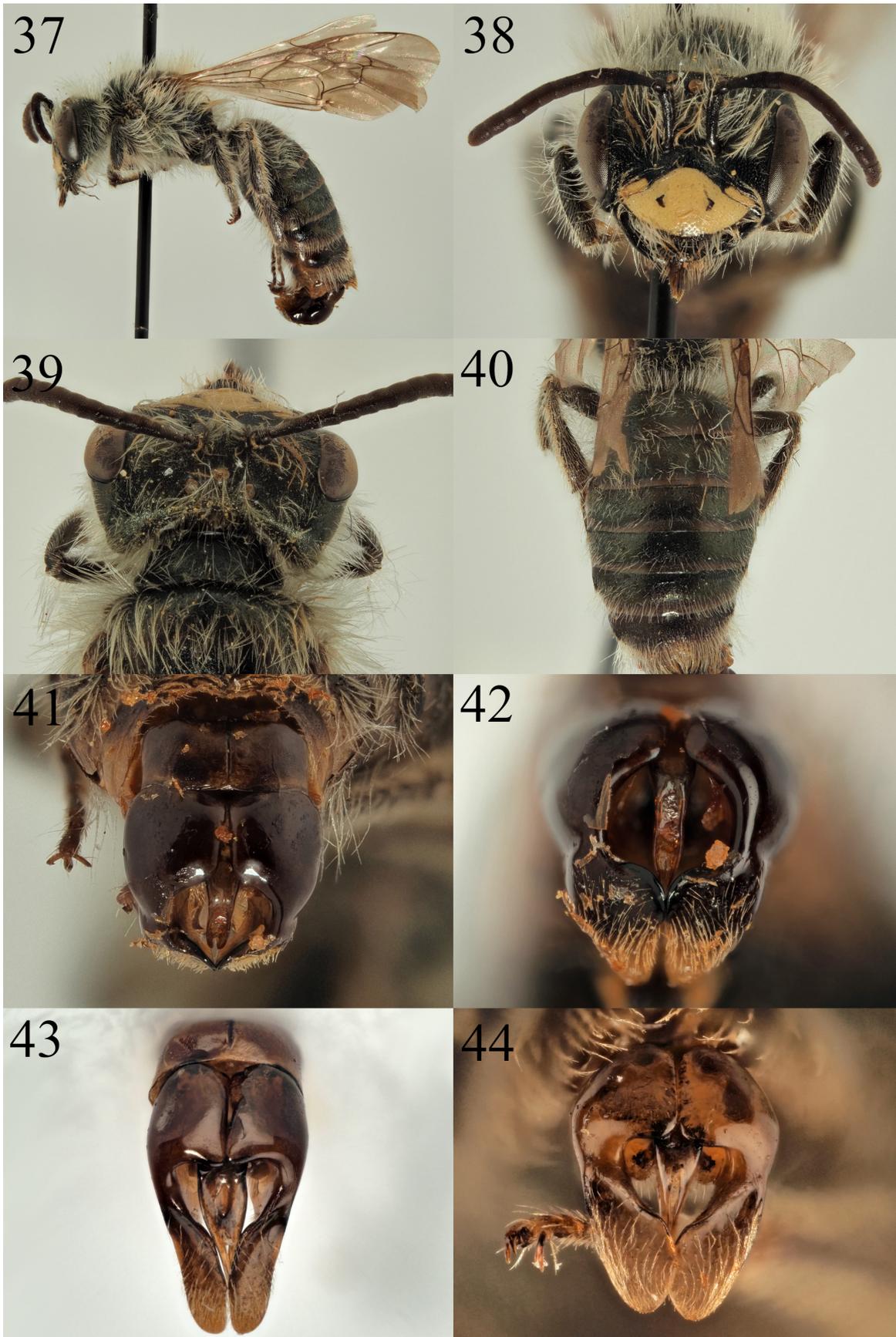
**HOLOTYPE: TUNISIA:** Ksar Hadada, 4–5.iv.1996, 1♂, leg. K. Deneš (OÖLM).

**Description: Female:** Unknown.

**Male:** Body length 11 mm (Figure 37). *Head:* Dark metallic green, 1.3 times wider than long (Figure 38). Clypeus broad, yellow with exception of two small black marks centrally, yellow colouration extending onto lower paraocular areas forming linear maculae parallel to clypeal margin. Clypeus evenly punctate, puncture separated by 2 puncture diameters, underlying surface shagreened, weakly shining. Process of labrum short and broad, slightly longitudinally compressed, shiny. Gena strongly broadened, 1.5 times width of compound eye (Figure 39), dorsal margin faintly carinate; ocelloccipital distance 2/3rds width of lateral ocellus. Gena, vertex, face, and scape with long white hairs, not exceeding length of scape. Antenna dark, A5–13 slightly lightened grey-brown below, A3 exceeding A4+5, shorter than A4+5+6. *Mesosoma:* Scutum shallowly and irregularly punctate, puncture separated by 1–3 puncture diameters, underlying surface shagreened, anterior part densely so, dull, shagreenation becoming weaker centrally, weakly shining; integument with metallic green-purple reflections. Scutellum very weakly shagreened, shining, sparsely punctate centrally. Episternum and propodeum finely microreticulate, weakly shining, propodeal triangle indicated by change in grain of microreticulation, becoming noticeably finer. Pronotum with strong humeral angle, laterally carinate. Episternum, propodeum, scutum, and scutellum with abundant long whitish hair exceeding length of scape. Legs dark, pubescence whitish. Wings hyaline, venation dark orange-brown, stigma orange, nervulus interstitial. *Metasoma:* Terga weakly metallic green, apical margins lightened brownish-yellow, finely and inconspicuously punctate, punctures separated by 2–3 puncture diameters, underlying surface shagreened, weakly shining (Figure 40). Terga covered with sparse whitish hairs, not obscuring underlying surface. Genitalia large, gonocoxae broad, lacking apical teeth, with obtuse inner angle (Figure 41). Gonostyli broadened, inner margin flattened and rounded, outer surface with plumose hairs, penis valve narrow, long, and parallel sided, occupying 1/5<sup>th</sup> of space between gonostyli (Figure 42).

**Diagnosis:** *Andrena inflata* can easily be recognised as a *Carandrena* in the male sex because of the wider than long head, yellow marked clypeus, and strongly broadened but with a gena that is only weakly and inconspicuously carinate dorsally. The integument is metallic green, placing it with similar metallic green-coloured species including *A. aerinifrons* Dours, 1873, *A. deserta* Warncke, 1974, *A. nigroviridula* Dours, 1873, and *A. reperta* Warncke, 1974. However, it can easily be separated from almost all of these species by its large size, with all species other than *A. aerinifrons* averaging 6–7 mm in length. *Andrena inflata* can be structurally separated by the shagreenation of the scutum which is consistent, whereas in *A. aerinifrons* it becomes weaker and disappears centrally, leaving a circular shiny patch. However, the clearest difference is in genital structure which is aberrant within the *Carandrena*, with gonocoxae laterally widened, without teeth, gonostyli apically short and broadened, and penis valve comparatively extremely narrow, occupying a small part of the space between the gonostyli (Figures 41–42), whereas *A. aerinifrons* has elongate genitalia with weakly produced gonocoxal teeth and gonostyli that are apically longer than broad (Figure 43). The genitalia in *A. inflata* are more like an enlarged and distorted form of those found in smaller metallic green *Carandrena* like *A. reperta*, but with broadened gonostyli, further reduced gonocoxal teeth, and a narrower penis valve (Figure 44).

**Etymology:** The name is derived from the Latin *inflatus* (inflated) because the genitalia of this species are noticeably larger and broader than other related *Carandrena* species.

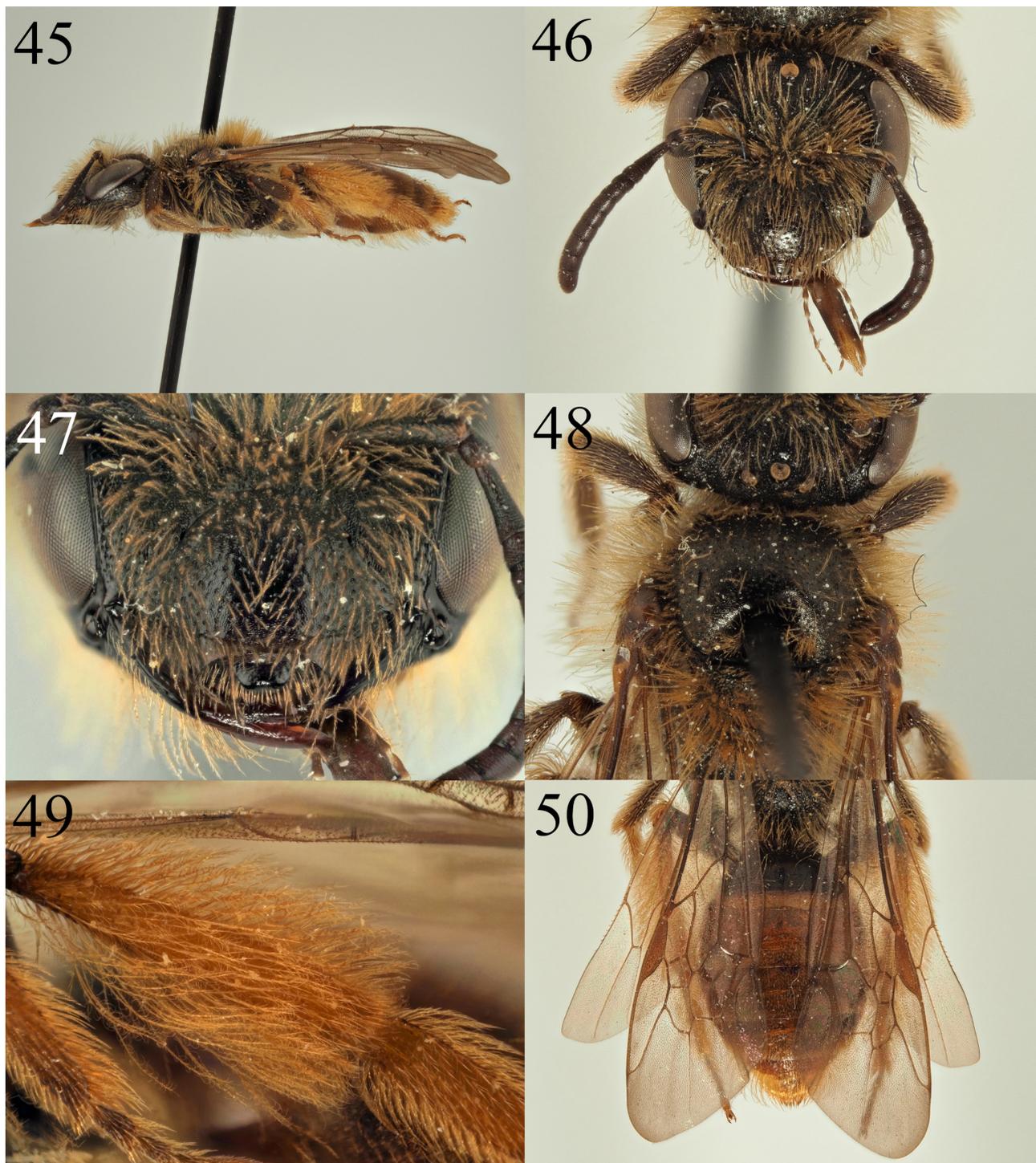


**FIGURES 37–44.** *Andrena inflata* **spec. nov.** 37. male profile, 38. male face, 39. male vertex, 40. male terga, 41. male genitalia dorsal view, 42. male genitalia direct view. *Andrena aerinifrons* Dours, 1873; 43. male genitalia. *Andrena reperta* Warncke, 1974; 44. male genitalia.

*Andrena (Chrysandrena) rubricorpora* spec. nov.

urn:lsid:zoobank.org:act:97B1EC77-DC6A-4524-9407-19B452D037B2

**HOLOTYPE:** TUNISIA: Zaghouan Mts. [probably Parc National Djebel Zaghouan], 14.v.1993, 1♀, leg. J. Batelka (OÖLM).



**FIGURES 45–50.** *Andrena rubricorpora* spec. nov. 45. female profile, 46. female face, 47. female face detail, 48. female scutum, 49. female tibial scopa, 50. female terga.

**PARATYPE:** TUNISIA: Same as holotype, 1♀ (OÖLM).

**Description:** Female: Body length 10 mm (Figure 45). *Head:* Black, 1.1 times longer than wide (Figure 46).

Clypeus domed, shallowly punctate, punctures separated by <0.5 puncture diameters basally and laterally, becoming sparser centrally, here separated by 1 puncture diameter; underlying surface shagreened, weakly shining (Figure 47). Process of labrum weakly trapezoidal, corners rounded. Gena normal, as wide as compound eye; ocelloccipital distance equals width of lateral ocellus. Fovea short, ventrally not reaching level of antennal insertions, moderately broad, occupying ½ of area between lateral ocellus and compound eye, not separated from internal margin of compound eye. Gena, vertex, face, and scape with long, orange-brown plumose hairs, not exceeding width of scape. Antenna uniformly dark, A3 subequal to A4+5+6. *Mesosoma*: Scutum shallowly, weakly, and irregularly punctate, punctures separated by 0.5–2 puncture diameters, not clearly differentiated from underlying surface, this shagreened and weakly shining (Figure 48). Scutellum densely and strongly punctured, punctures separated by <0.5 puncture diameters. Pronotum rounded, without humeral angle. Episternum and propodeum weakly rugose, underlying surface shagreened, weakly shining, propodeal triangle narrow, poorly differentiated, basal half with weak rugosity. Episternum, propodeum, scutum, and scutellum with long, orange-brown plumose hairs, not exceeding length of scape. Legs basally dark, apical tarsal segments of front legs, all tarsal segments of mid legs, and tibiae and tarsi of hind legs orange, pubescence golden-orange. Hind legs with floccus, femoral and tibial scopa composed of strongly plumose golden-orange hairs (Figure 49). Wings hyaline, venation and stigma orange, nervulus slightly antefurcal. *Metasoma*: Tergum 1 basally black, apical margin red, T2–5 entirely red, apical margins slightly lightened golden; tergal surface shagreened, weakly shining (Figure 50). Terga finely and inconspicuously punctate with shallow punctures, punctures separated by 1–2 puncture diameters. Apical fringe of T5 and hairs flanking pygidial plate golden; pygidial plate narrow with upturned margins, centrally densely punctate.

**Male:** Unknown.

**Diagnosis:** *Andrena rubricorpora* is easily recognisable as a *Chrysandrena* because of its short, drop-shaped foveae, strongly plumose scopa, absence of a carina or projecting teeth on the hind face of the hind femur, and entire (non-emarginate) process of the labrum. It is the only known *Chrysandrena* species with a red marked abdomen, but it can also be separated structurally. It can be placed close to the species with orange hind tibiae (*A. hesperia* Smith, 1853, *A. fulvago* (Christ, 1791), and *A. fertoni* Pérez, 1895), but can be separated by the punctation of the clypeus which is sparsely punctate and weakly shining (densely punctate, dull in *A. hesperia*), and because it lacks apical tergal hairbands, and the scutum and terga are much less densely punctate, the discs of the terga in particular are almost impunctate, all punctures fine, weak and difficult to see (hair bands present, scutum and terga strongly and deeply punctate in *A. fulvago* and *A. fertoni*).

**Discussion:** The subgenus *Chrysandrena* Hedicke, 1933 is polyphyletic, with the true *Chrysandrena* (species around *Andrena fulvago*) strongly separated from the species around *A. aegyptiaca* Friese, 1899 (Pisanty *et al.* 2020). This second group can easily be separated in the female sex by their weaker tergal punctation, smoother integument, and much longer, more elongate abdominal shape. *Andrena rubricorpora* is therefore found within the true *Chrysandrena* as it lacks this characteristic elongate body shape.

**Etymology:** The name is composed of *rubri* (*ruber*, red) + *corpora* (*corpus*, body) because of the red-coloured abdominal segments that immediately separate it from other *Chrysandrena* species.

### *Andrena (Graecandrena) virguladivina* spec. nov.

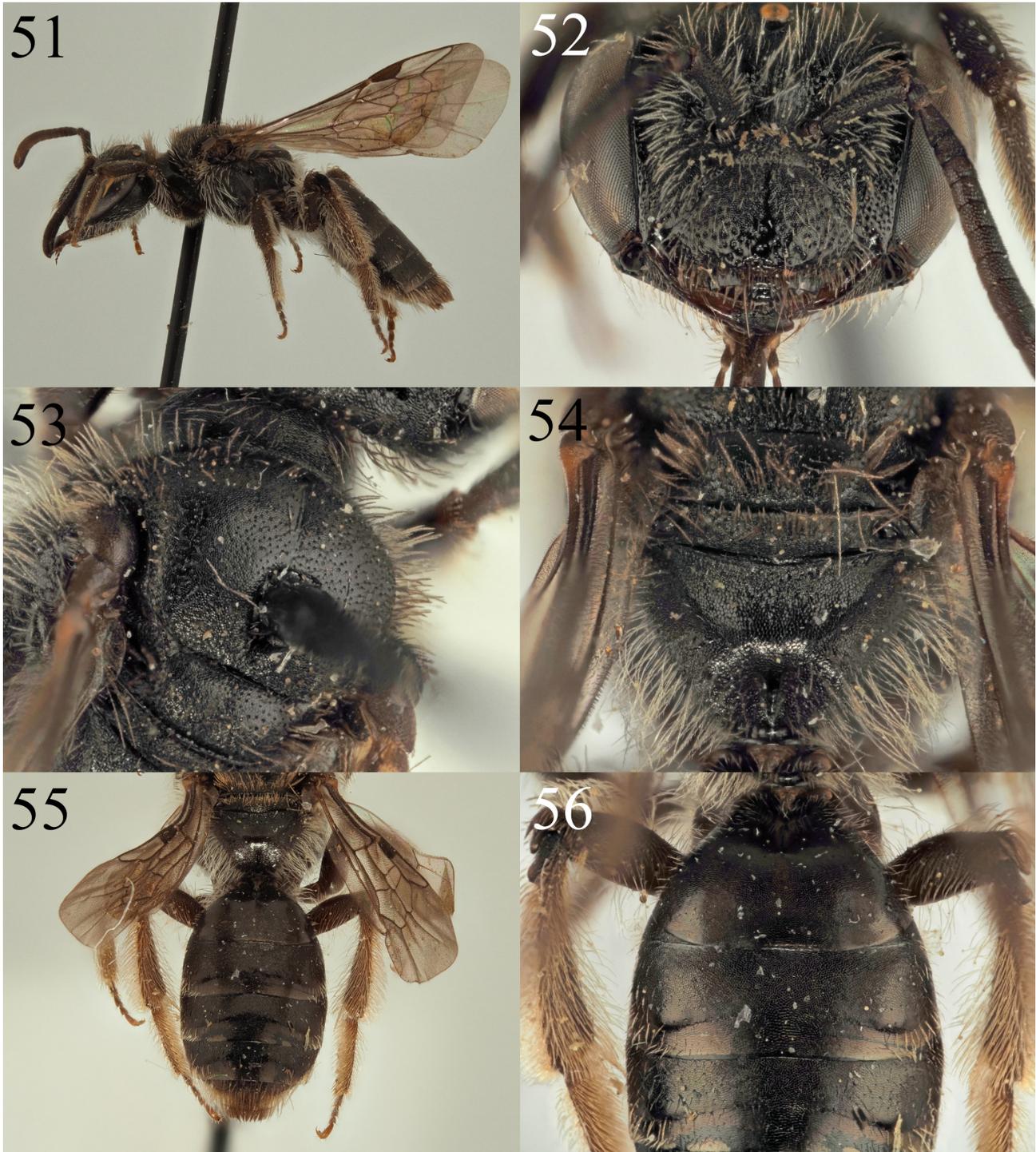
urn:lsid:zoobank.org:act:5124F4A3-EA43-40E9-A8FE-E0180CEF4CF1

**HOLOTYPE: SYRIA:** Jisr ash Shughur [Jisr al-Shughur], 26.v.1996, 1♂, leg. Marek Halada (OÖLM).

**PARATYPES: SYRIA:** Same as holotype, 1♂, 2♀ (OÖLM), 1♀ (SMNHTAU).

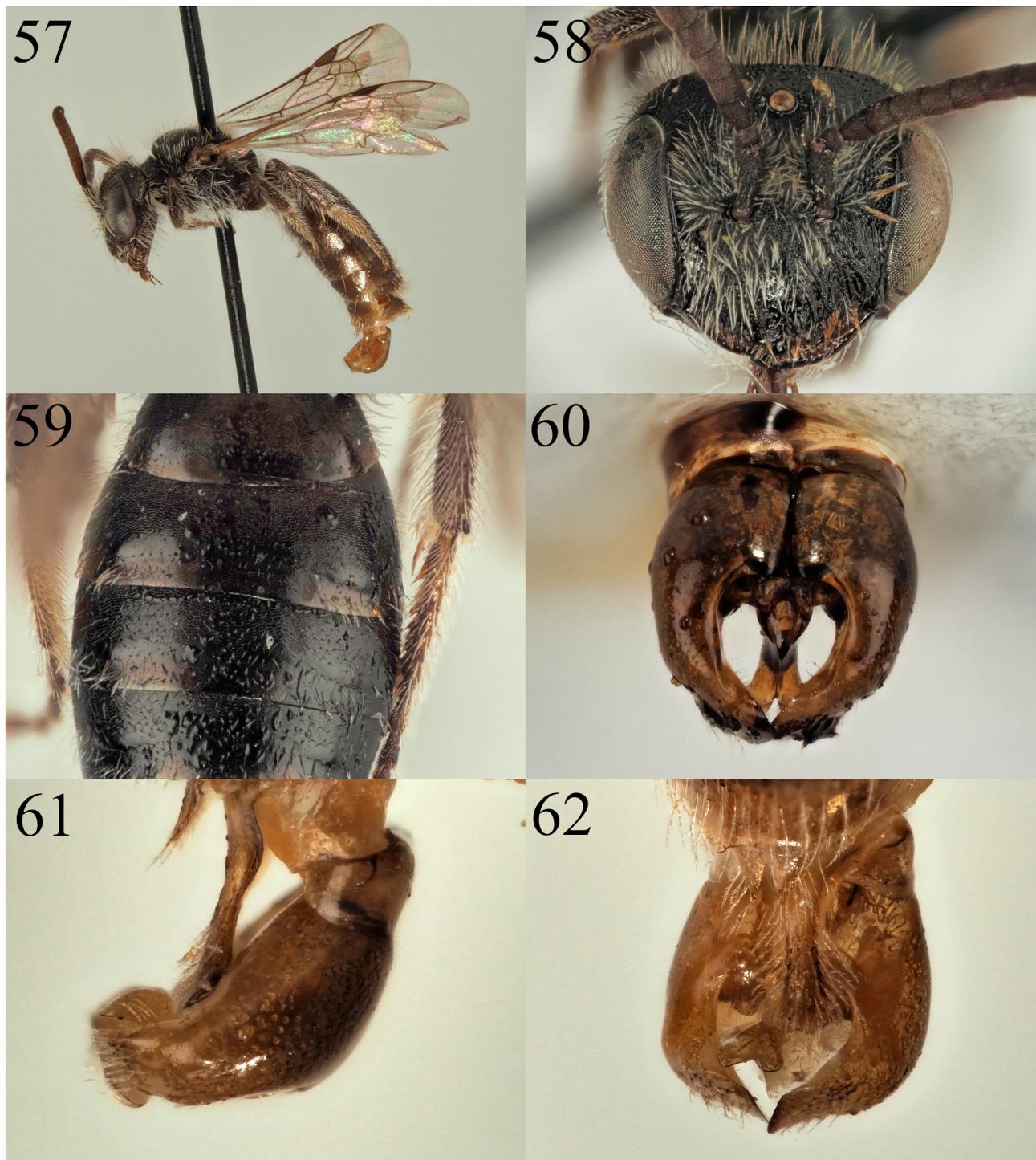
**Description: Female:** Body length 7 mm (Figure 51). *Head:* Black, 1.2 times wider than long. Clypeus domed, centrally broadly flattened, strongly punctate, punctures separated by 0.5–1 puncture diameter basally, becoming more densely punctate apically, strength of punctures increasing; underlying surface deformed, irregular, uneven (Figure 52). Clypeus in basal half with central, longitudinal, raised impunctate line, apically disappearing; underlying surface strongly shagreened in basal 2/3rds, dull, becoming weaker in apical 1/3<sup>rd</sup>, weakly shining. Process of labrum narrowly trapezoidal, apical margin straight, with slight raised shiny ridge. Gena equalling width of compound eye; ocelloccipital distance broad, 1.5 times width of lateral ocellus. Fovea narrow, subequal to width of flagellum, extending ventrally to level of antennal insertion, here separated from inner margin of compound eye by distance subequal to own width. Gena, face, and scape with short white hairs, vertex with longer brown hairs, not exceeding length of scape. Antenna dark, A5–12 lightened orange below, A3 exceeding A4, shorter than A4+5. *Mesosoma*: Scutum and scutellum regularly and evenly punctate, punctures separated by 2 puncture diameters, underlying surface shagreened, weakly shining (Figure 53). Pronotum rounded, without humeral angle. Episternum and propodeum finely microreticulate, weakly shining, propodeal triangle clearly marked by change in surface

sculpture, finely shagreened with weak basal rugosity (Figure 54). Episternum and propodeum with moderately long white hairs, scutum and scutellum with short brown to light brown hairs. Legs dark, apical tarsal segments and hind basitarsi lightened brown to dark orange, pubescence whitish to light brown, scopa white. Hind tarsal claws without inner teeth. Wings hyaline, venation dark brown, stigma dark orange, nervulus interstitial. *Metasoma*: Terga dark, apical margins slightly depressed, occupying 2/5ths of segment, faintly lightened dark brown (Figure 55). Tergal discs finely microreticulate, essentially impunctate, weakly shining; T2–3 with very weak hair fringes laterally (Figure 56). Apical fringe of T5 and hairs flanking pygidial plate light to dark brown; pygidial plate triangular, apically weakly pointed, flattened, dull.



**FIGURES 51–56.** *Andrena virguladivina* spec. nov. 51. female profile, 52. female face, 53. female scutum, 54. female propodeum, 55. female terga, 56. female terga detail.

**Male:** Body length 6 mm (Figure 57). *Head:* Black, 1.2 times wider than long (Figure 58). Clypeus evenly domed, regularly punctate, punctures separated by 1 puncture diameter, underlying surface shiny. Process of labrum narrowly rounded trapezoidal. Gena subequal to width of compound eye; ocelloccipital distance broad, 1.5 times width of lateral ocellus. Gena, face, and scape with long white hairs, vertex with long light brown hairs, exceeding length of scape. Antenna dark, A4–13 brown below, A3 equals A4. *Mesosoma:* Structurally as in female, though propodeal triangle with more extensive basal rugosity, all basitarsi more clearly lightened orange. *Metasoma:* Terga structurally as in female (Figure 59). Genitalia rounded (Figure 60), in profile compact (Figure 61), gonocoxae with small, weakly produced apical teeth, gonostyli evenly arched, apically truncate, inner margin slightly thickened; penis valve with base narrowly triangular in dorsal view, extending ventrally, long, apically strongly bifurcate (Figure 62).



**FIGURES 57–62.** *Andrena virguladivina* **spec. nov.** 57. male profile, 58. male face, 59. male terga, 60. male genitalia dorsal view, 61. male genitalia profile, 62. male genitalia ventral view.

**Diagnosis:** Subgeneric placement of *A. virguladivina* faces the same challenges as the previously described *Aciandrena* species because of deep problems in subgeneric classification for small black Old World *Andrena* species (Pisanty *et al.* 2020). In the female sex, the combination of small body size, finely shagreened propodeal triangle (though with basal rugosity more typically found in *Graecandrena*), and narrow facial foveae could suggest *Aciandrena*, but the structure of the male genitalia combined with a black clypeus (typically yellow in *Aciandrena* but this can be intra- and interspecifically variable) suggests a much stronger affinity with the true *Graecandrena* (species around *A. graecella* Warncke, 1965), which have a genital capsule that is rounded, the inner margin of the gonostyli creating a broadly circular area, without gonocoxal teeth, and with a penis valve that is comparatively broad basally, narrowing apically (e.g. *A. butea* Warncke, 1965, *A. hyemala* Warncke, 1973, *A. pelopa* Warncke, 1975, excluding the clearly divergent structure seen in *A. arsinoe* and *A. amricula* that do not fall within the true *Graecandrena*, Pisanty *et al.* 2020, see above). *Andrena virguladivina* deviates from this structure by the presence of very slight gonocoxal teeth (though these are also present in *A. butea* Warncke, 1965) but overall construction is similar.

Males can be instantly diagnosed from all other *Aciandrena*/*Graecandrena* species by the genital constriction, specifically the structure of the penis valve which is apically bifurcate, a unique character. Females can be diagnosed by the combination of a finely shagreened propodeal triangle, narrow facial foveae, and the sculpturing of the clypeus which is domed, slightly flattened centrally, and strongly and coarsely punctate, leading to an uneven, misshapen, and partially deformed apical third, with punctures separated by less than half a puncture diameter.

**Etymology:** The name is Latin for divining rod (or dowsing rod) because of the shape of the male penis valve which is apically bifurcate, thus resembling a divining rod.

***Andrena karia*, spec. nov. (*incertae sedis*)**

urn:lsid:zoobank.org:act:6E7CD3B1-F6D7-4C59-A43A-CE9BB64CC685

**HOLOTYPE: TURKEY:** SW, Muğla, University campus, 710 m, N37°09'39", E28°22'20", stony steppe with pines, xi.2012–iii.2013, 1♂ [no collector information] (OÖLM).

**PARATYPES: TURKEY:** Same as holotype, 10♂, 12♀ (OÖLM), 1♂, 1♀, (TJWC), 1♂, 1♀, (SMNHATAU).

**Description: Female:** Body length 10.5–12 mm (Figure 63). **Head:** Black, as wide as long (Figure 64). Clypeus domed, more or less flattened in apical half, apical margin straight, lateral corners forming right angles. Clypeus with clear, large, and shallow punctures, basally separated by 0.5–1 puncture diameter, becoming sparser centrally and apically, separated by 0.5–2 puncture diameters; clear impunctate longitudinal central line present, underlying clypeal surface basally shagreened, dull, becoming weaker centrally and apically, weakly shining. Process of labrum rounded trapezoidal, basally with transverse striations, becoming weaker apically, shiny (Figure 65). Palpi elongate, maxillary palpi with 6 segments, labial palpi with 4 segments (Figure 66). Gena broadened, broader than width of compound eye; ocelloccipital distance equals width of lateral ocellus. Fovea poorly defined dorsally, occupying 1/3<sup>rd</sup> of area between lateral ocellus and compound eye, long, clearly extending below level of antennal insertions, not separated from inner margin of compound eye. Gena, vertex, face, and scape with moderately long black hairs, longest equalling length of scape, hind face of vertex with few scattered long white hairs. Antenna dark, A5 apically, A6–12 lightened grey below, A3 equals A4+5+6. **Mesosoma:** Scutum and scutellum strongly shagreened, dull, faintly and irregularly punctate, punctures separated by 1–3 puncture diameters (Figure 67). Pronotum with faint humeral angle, dorsolaterally slightly angulate, almost imperceptible. Episternum and propodeum shagreened, weakly shining, propodeal triangle indicated by slight weakening of shagreenation, basally with weak rugosity. Episternum, and propodeum with long black hairs, scutum and scutellum with shorter intermixed black and white hairs, white hairs restricted to scutellum and anterior margin of scutum. Legs uniformly dark, pubescence mostly black to dark brown. Floccus and femoral scopa white, tibial scopa white ventrally, dark brown above. Wings hyaline, venation black, stigma dark brown, nervulus postfurcal. **Metasoma:** T1 black basally, red apically, T2–3 entirely red, T4 red basally (can be restricted to small lateral maculations), black apically, T5 entirely black (Figure 68). Terga finely and regularly punctate, punctures separated by 1–1.5 puncture diameters, each bearing a short black hair, underlying tergal surface shagreened, weakly shining. Apical fringe of T5 and hairs flanking pygidial plate dark brown; pygidial plate flattened, entire surface with exception of narrow upturned margins with dense network of punctures, interspaces forming mesh-like network.

**Male:** Body length 8–9.5 mm (Figure 69). **Head:** Black, 1.1 times wider than long (Figure 70). Clypeus domed,

more or less flattened in apical half, apical margin straight, lateral corners forming right angles. Clypeus with shallow punctures, basally separated by 0.5–1 puncture diameter, becoming very sparse centrally and apically, leaving a large puncture-free area, underlying clypeal surface basally strongly shagreened, dull, becoming weak centrally and apically, shining. Process of labrum rounded rectangular. Mandibles large, robust, long, strongly crossing apically, subapical tooth clearly pronounced on inner margin, basally broadened to 2/3rds width of compound eye, lacking any tooth projecting from ventral surface. Gena strongly broadened, equalling twice width of compound eye (Figure 71), dorsal margin carinate; ocelloccipital distance slightly exceeding width of lateral ocellus (Figure 72). Gena, vertex, face, and scape with long black hairs, some exceeding length of scape, hind face of vertex with several scattered long white hairs. Antenna dark, A5–13 lightened grey below, A3 exceeds A4+5, shorter than A4+5+6. *Mesosoma*: As in female (Figure 73). *Metasoma*: As in female (Figure 74). Genitalia simple, gonocoxae with weakly produced and rounded teeth, gonostyli produced to broad scoops apically, internal margin reflexed and raised, dorsal face with brown, plumose hairs (Figure 75). Penis valve broad, occupying majority of space between gonostyli, with broad projecting lateral triangular extensions.

**Diagnosis:** Placement of *A. karia* into the existing subgeneric system is highly challenging. Most directly, it can be recognised in the female sex as part of the group of species with elongate palpi, and in the male sex as part of the group with a broadened gena, elongate mandibles that cross apically, and genitalia with a broadened penis valve with projecting lateral triangular extensions. This places it close to a group of species that have hitherto been placed in the subgenera *Margandrena* and *Ptilandrena* (Table 1). Problems with subgeneric classification are discussed below, and diagnosis is made here by direct comparison to morphologically similar species.

Female material can be separated from most of these species by its red-marked terga and by the predominantly black pubescence of the face and mesosoma, placing it closest to *A. krausiella* Gusenleitner, 1998 and *A. menahemella* Scheuchl & Pisanty, 2016. It can be separated from *A. krausiella* (alternative character state in parentheses) by the more extensively red marked terga, covering all of T2–3 (T2–3 at least partly black on discs), the entirely black pubescence of the face (facial hairs mostly black but with concentration of white hairs centrally around the antennal insertions), strongly postfurcal nervulus (weakly postfurcal, almost interstitial), and the strongly basally striate labrum (with only one or two striations, predominantly shiny). It can be separated from *A. menahemella* by the strongly shagreened scutum and scutellum (scutellum partially shiny centrally, scutellum extensively shiny), the more extensively red marked terga, covering all of T2–3 (Israeli *A. menahemella* T2–3 at least partly black on discs, note that in Moroccan *A. menahemella* T2–3 are entirely red, Wood *et al.* 2020a), and the strongly basally striate labrum (without striations, predominantly shiny).

Male material can also be placed close to the same two species through the combination of red-marked terga and predominantly dark pubescence. It can be separated from *A. krausiella* by the pubescence of the face which is entirely black (facial hairs mostly black but with concentration of white hairs centrally around the antennal insertions) and by the strongly postfurcal nervulus (weakly postfurcal to interstitial). Separation from *A. menahemella* is simple, as the penis valve has clear projecting lateral triangular extensions (penis valve broad but with weak lateral extensions).

**Discussion:** The molecular phylogeny of *Andrena* of Pisanty *et al.* (2020) identified numerous instances of polyphyletic subgenera. One particularly troublesome subgenus has been *Ptilandrena* (type species, the Nearctic *Andrena erigeniae* Robertson, 1902), which should be the senior name for the large Holarctic group that have traditionally been predominantly referred to as *Euandrena* (see also Praz *et al.* 2019), but has been applied to several groups in which the males have a widened gena combined with elongate mandibles. One group includes East Mediterranean species that fly during the autumn through the winter, including *A. grossella* Grünwaldt, 1976, *A. muscaria* Warncke, 1965, and *A. crocusella* (Table 1). However, the phylogeny of Pisanty *et al.* identifies this group as i) present in the same broad clade (Clade 32) but not falling directly in the true *Ptilandrena* and ii) mixed together with some of the species placed in the subgenus *Margandrena*.

The phylogeny inferred by Pisanty *et al.* (2020) consistently placed *A. crocusella* together with *A. (Margandrena) krausiella*, and separate from *A. (Margandrena) marginata* Fabricius, 1776 (type species for the subgenus) and *A. (Margandrena) quinquepalpa* Warncke, 1980. Study of material from the *crocusella+krausiella* group suggests that the morphology of the male penis valve is potentially a common character that can be used to identify this clade, specifically the presence of a strongly widened penis valve that occupies the majority of the space between the gonostyli, normally but not always with pronounced lateral triangular extensions. This can be seen in six taxa, specifically *A. crocusella* (with extensions, illustrated in Pisanty *et al.* 2016), *Andrena grossella* (with extensions,

Figure 76, see also Grünwaldt 1976), *A. karia* (with extensions, Figure 75), *A. krausiella* (with extensions, illustrated in Scheuchl 2010), *A. menahemella* (with weak extensions, illustrated in Pisanty *et al.* 2016), and *A. sibthorpi* Mavromoustakis, 1952 (with extensions, illustrated in Scheuchl 2010). In contrast, species around *A. marginata* appear to have a narrow penis valve with clear space between itself and the gonostyli (see illustrations in Scheuchl 2010). However, the males of *A. (M.) elsei* Scheuchl & Gusenleitner, 2009 and *A. muscaria* are unknown making their placement impossible using this character, and COI barcode data from *A. (M.) hyacinthina* (G. Pisanty *in litt.*) suggests placement closer to the *crocusella*+*krausiella* group rather than *A. marginata*, and therefore rendering the genital character of lateral extensions to the penis valve of limited value for group diagnosis as these are not present in *A. hyacinthina* (see illustrations in Scheuchl 2010).



**FIGURES 63–68.** *Andrena karia* **spec. nov.** 63. female profile, 64. female face, 65. female labrum detail, 66. female glossa detail, 67. female scutum, 68. female terga.

**TABLE 1.** *Andrena* species close to *A. karia* **spec. nov.** that show at least some similar characters of elongate labial palpi, enlarged male gena and mandibles, and/or and male genitalia with a conspicuously widened penis valve, along with their global distributions and known pollen preferences. (*M.*) and (*P.*) indicate the subgenera *Margandrena* and *Ptilandrena*, respectively.

Species	Distribution	Flight period	Floral associations	References
<i>Andrena (P.) crocusella</i> Pisanty & Scheuchl, 2016	Israel	November–December	<i>Crocus</i> (Iridaceae)	Pisanty <i>et al.</i> (2016)
<i>Andrena (M.) elsei</i> Scheuchl & Gusenleitner, 2009	Turkey	April	<i>Crocus</i> (Iridaceae)	Scheuchl & Gusenleitner (2009)
<i>Andrena (P.) grossella</i> Grünwaldt, 1976	Greece	October–November	<i>Crocus</i> (Iridaceae)	Grünwaldt (1976)
<i>Andrena (M.) hyacinthina</i> Mavromoustakis, 1958	Cyprus, Israel, Turkey	February–April	<i>Belhvalia trifoliata</i> (Asparagaceae, as <i>Hyacinthus trifoliatius</i> )	Mavromoustakis (1958)
<i>Andrena karia</i> <b>spec. nov.</b> ( <i>incertae sedis</i> )	Turkey	December–March	Unknown	Current publication
<i>Andrena (M.) krausiella</i> Gusenleitner, 1998	Israel, Jordan, Lebanon	January–March	<i>Prunus dulcis</i> (Rosaceae), <i>Mandragora autumnalis</i> (Solanaceae), <i>Anemone coronaria</i> (Ranunculaceae), <i>Leontodon tuberosus</i> (Asteraceae), <i>Romulea phoenicia</i> (Iridaceae)	Gusenleitner (1998); Wood <i>et al.</i> (2020b); G. Pisanty, <i>in litt.</i>
<i>Andrena (M.) menahemella</i> Scheuchl & Pisanty, 2016	Israel and Morocco	January–April	Unknown	Pisanty <i>et al.</i> (2016); Wood <i>et al.</i> (2020a)
<i>Andrena (P.) muscaria</i> Warneke, 1965	Greece	April	<i>Muscaria</i> (Asparagaceae)	Warneke (1965)
<i>Andrena (M.) sibthorpi</i> Mavromoustakis, 1952	Cyprus	November–December	<i>Colchium</i> (Colchiaceae)	Mavromoustakis (1952)



**FIGURES 69–76.** *Andrena karia* **spec. nov.** 69. male profile, 70. male face, 71. male gena, 72. male vertex, 73. male scutum, 74. male terga, 75. male genitalia. *Andrena grossella* Grünwaldt, 1976; 76. male genitalia.

Female material in the *crocusella+krausiella* group cannot currently be consistently morphologically separated from *Margandrena*. This group has been identified as possessing elongate maxillary (MP) and labral palps (LP), and some species (*A. grossella* and an undescribed species from Crete, Pisanty *et al.* 2016) have additional segments in both the MP and LP. However, all other species have six MP and four LP segments (the typical ratio in *Andrena*), so this character is not distinctive. Both groups share a pronotum with a weak lateral carina, fovea that are not noticeably narrowed or widened above or below, the clypeus can be long or short, and the process of the labrum is broad.

The lack of clarity reflects the difficulty of morphological classification in these derived groups (arising 5–10 million years ago, see Pisanty *et al.* 2020). As such, though the *crocusella+krausiella* group probably represents a valid distinct lineage, it is not currently possible to unambiguously delineate it morphologically, and so *A. karia* is assigned to *incertae sedis*. Given the morphological variation seen within the groups present in Clade 32, the most conservative choice would be to synonymise the subgenera *Euandrena*, *Chrysandrena*, and *Margandrena* with *Ptilandrena* and transfer all taxa within this clade to this subgenus, but this expanded *Ptilandrena* would also be difficult to delineate morphologically. Given this incomplete picture, future taxonomic reorganisation will require new sampling programs to discover and describe unknown males to allow for exploration of genital characters, and extensive taxon sampling to facilitate comprehensive molecular analysis. The only exception to these needs is *Andrena (Ptilandrena) vetula* Lepeletier, 1841 which clearly and unambiguously belongs in the subgenus *Simandrena* (Pisanty *et al.* 2020).

A final note should be made about the potential floral preferences of *A. karia* and the wider group. Most members of this putative group have a winter or very early spring activity period, and seem to mostly be associated with geophyte plants, predominantly in the families Asparagaceae, Colchiaceae, and Iridaceae, particularly *Crocus* (Table 1). Though much more study is necessary to better understand these poorly-studied species, *A. krausiella* seems to break from this pattern and collect pollen from a wider range of botanical families (Table 1, G. Pisanty *in litt.*). Because the type series of *A. karia* was collected using pan traps, no precise flight period information between December and March can be divined, and so it is not possible to say if it may have a foraging niche on *Crocus* (closer to *A. elsei* and *A. grossella*) or is more widely polylectic (closer to *A. krausiella*).

**Etymology:** The name is derived from the name Caria (Greek: Καρία, Turkish: Karya), the old Greek name for the region which now largely corresponds to Muğla Province.

**Other material examined:** (*Andrena grossella*): **GREECE:** Kefalo, 9.xi.1976, 1♂, 1♀, det. Grünwaldt, leg. W. u. L. Gross, OÖLM, illustrated Figure 76; (*Andrena hyacinthina*): **CYPRUS:** Limassol, Yermasoyia Dam, 7.iii.2017, 2♂, 1♀, TJWC; (*Andrena krausiella*): **ISRAEL:** Dahlia [Dalia], 6.ii.1948, 1♀, leg. Bytinski-Salz, OÖLM (paratype); Jerusalem, 6.iii.1948, 1♀, leg. Bytinski-Salz, OÖLM (holotype); (*Andrena menahemella*): **ISRAEL:** Netiv Halamed He, 16.ii.2010, 1♀, leg. G. Pisanty, OÖLM (paratype); (*Andrena muscaria*): **GREECE:** Delphi, 11.iv.1963, 1♀, leg. K. Warncke, OÖLM (paratype).

***Andrena (Micrandrena) atlantea spec. nov.***

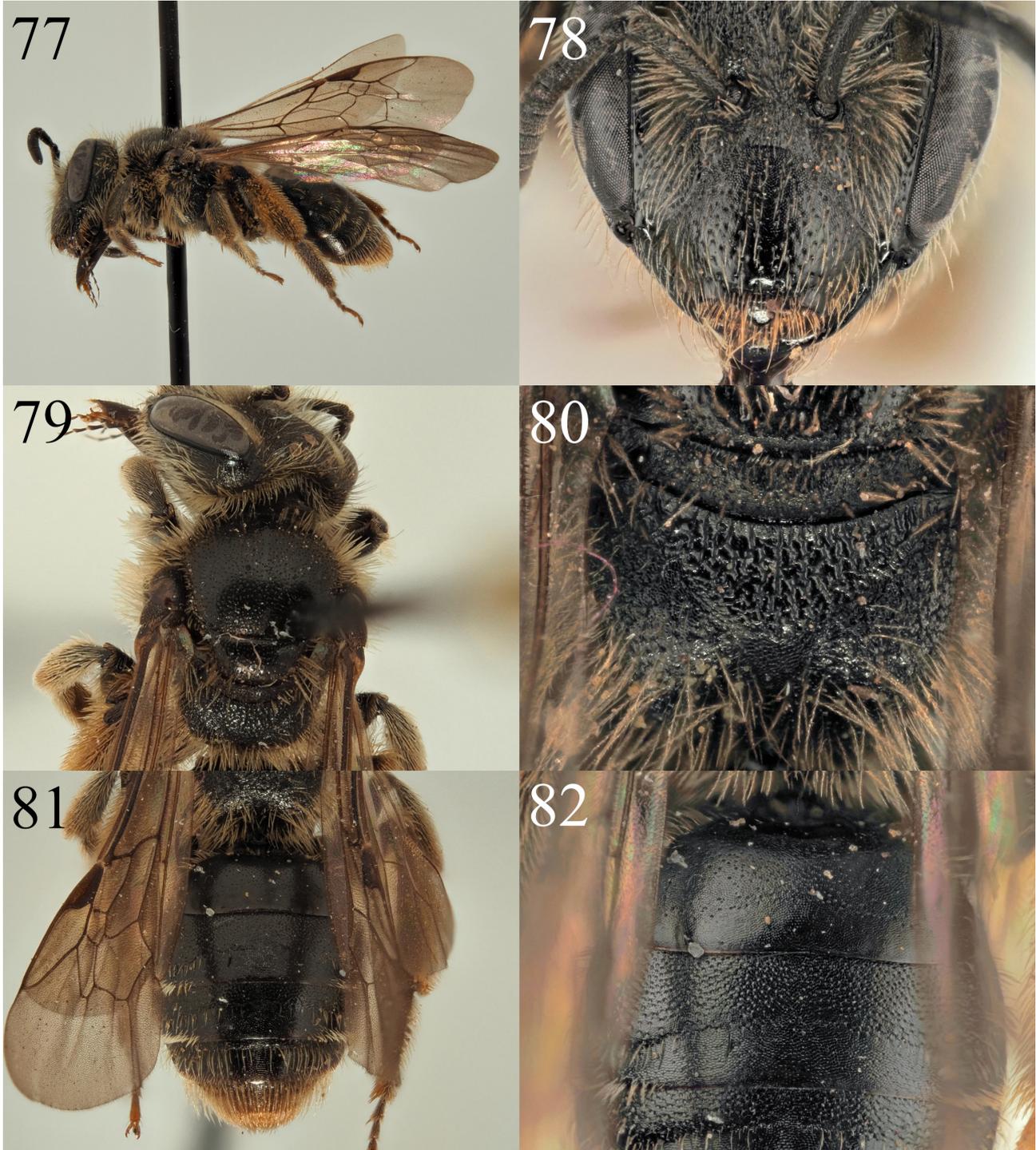
urn:lsid:zoobank.org:act:7CE72856-BAD4-4472-998F-0B2ADDB328A4

**HOLOTYPE: MOROCCO:** Oukaimeden, 50 km S Marrakech, 2700 m, 31.205212°N, -7.858660°W, 8.v.2015, 1♀, leg. Mucska (OÖLM).

**PARATYPES: MOROCCO:** Same as holotype, 6♀, (OÖLM), 1♀ (TJWC); Oukaimeden, 2800 m, 8.v.2015, 1♀, leg. K. Deneš (OÖLM); Ifrane env., 1700 m, 10.v.1997, 3♀, leg. P. Průdek (OÖLM).

**Description: Female:** Body length 7.5–8 mm (Figure 77). **Head:** Black, as long as wide. Clypeus domed, elongate, regularly punctate with large punctures separated by 1 puncture diameter; impunctate central line present, underlying surface centrally and basally shagreened, weakly shining, apically without shagreen, smooth and shiny (Figure 78). Process of labrum triangular, wider than long, shiny. Gena moderately broad, slightly exceeding width of compound eye; ocelloccipital distance narrow, less than half width of lateral ocellus. Fovea long, extending below level of antennal insertions, narrow, as wide as width of flagellum, dorsally occupying 1/3<sup>rd</sup> space between lateral ocellus and compound eye. Gena, vertex, face, and scape with whitish to light brownish hairs, longest not exceeding length of scape. Antenna dark, A5–12 slightly lightened grey below, A3 equals A4+5. **Mesosoma:** Scutum and scutellum clearly and irregularly punctate, punctures separated by 0.5–2 puncture diameters, underlying surface shagreened, weakly shining, scutellum centrally shiny (Figure 79). Pronotum rounded, without humeral angle.

Episternum and propodeum microreticulate, weakly shining, propodeal triangle strongly rugose, external margin well-defined by lateral carinae (Figure 80). Episternum, propodeum, scutum, and scutellum with brownish hairs, not exceeding half of length of scape. Legs dark, apical tarsal segments lightened brown, pubescence brownish-golden, scopa brownish-golden. Hind tarsal claws with inner tooth. Wings hyaline, venation dark brown, stigma brown, nervulus interstitial. *Metasoma*: Terga dark, apical margins very narrowly lightened brown (Figure 81), tergal discs clearly and densely punctate, on T1 separated by 1–3 puncture diameters, on T2–4 by 1 puncture diameter; underlying surface shagreened and weakly shining, tergal margins impunctate (Figure 82). T2–4 with weak lateral hair fringes present laterally, apical fringe of T5 and hairs flanking pygidial plate golden; pygidial plate pointed, dorsal surface slightly domed, impunctate.



**FIGURES 77–82.** *Andrena atlantea* **spec. nov.** 77. female profile, 78. female face, 79. female scutum, 80. female propodeal triangle, 81. female terga, 82. female terga detail.

**Male:** Unknown.

**Diagnosis:** *Andrena atlantea* can easily be placed in the *Micrandrena* because of its small size, black integument, and strongly rugose propodeal triangle. It can be immediately recognised as different from other North African *Micrandrena* because the face is as long as broad, whereas in other species it is shorter than broad, and therefore by *Micrandrena* standards can be considered to be elongate. It is most similar to *A. rugulosa* Stoeckert, 1935 that is found in Central and Eastern Europe east to Turkey and the Caucasus (Gusenleitner and Schwarz 2002) because they both share this relatively long face, combined with a clypeus that is basally shagreened and apically shiny, long narrow foveae, and punctate tergal discs. They can be separated as *A. atlantea* has a triangular process of the labrum (in *A. rugulosa* rectangular, longer than wide), shagreened and weakly shining scutum and scutellum (densely shagreened and dull scutum and scutellum), and weakly shagreened and densely punctate tergal discs (tergal discs shagreened and dull, punctures less dense, obscure).

*Andrena atlantea* is also similar to *Andrena lineolata* Warncke, 1968 which is restricted to Tenerife in the Canary Islands, as they share the same general profile and elongate face. However, *A. lineolata* has wider foveae (wider than the width of the flagellum), a more pronouncedly triangular process of the labrum, and essentially impunctate terga.

**Etymology:** The name is the feminine form of Atlas, the mythical titan condemned to hold up the heavens, and after whom the Atlas Mountains of North Africa are named. Both collecting localities are found high in the Moroccan Atlas.

***Andrena (Micrandrena) convexifrons spec. nov.***

urn:lsid:zoobank.org:act:FBDA736E-4EF8-4122-9922-E0B07CB60970

**HOLOTYPE: JORDAN:** 16 km WNW Aljun [Aljoun], 600 m, 21.v.2007, 1♀, leg. Z. Kejval (OÖLM).

**PARATYPES: JORDAN:** Same as holotype, 2♂, 38♀; 20 km SW Madaba, 31.v.2006, 6♀, leg. F. Kantner (OÖLM), 2♀ (TJWC), 2♀ (SMNHATAU); Ajlun, 30 km W Jarash, 2.vi.2006, 1♀, leg. Z. Kejval (OÖLM); Zadaba/Zadaba [Madaba?], 6.v.2012, 86♂, 3♀, leg. M. Kafka (OÖLM); Kufur, 4–5.v.2012, 3♂, leg. M. Kafka (OÖLM); North Shuna, 29–30.iv.1996, 4♂, leg. Ma. Halada (OÖLM); Aljoun, 7.v.2012, 1♂, leg. M. Kafka (OÖLM).

**Description: Female:** Body length 6.5 mm (Figure 83). *Head:* Black, 1.3 times wider than long (Figure 84). Clypeus weakly domed, irregularly punctate with sparse, large punctures, punctures slightly obscured by transverse striations, underlying surface microreticulate, weakly shining. Process of labrum rectangular, slightly wider than long, basal half transversely striate, apical half shining. Gena moderately broad, equalling width of compound eye; ocelloccipital distance equals width of lateral ocellus. Frons with two bulges immediately anterior to lateral ocelli (Figures 85, 87), bulges extend into ocellar triangle, area therefore raised above profile of vertex, whole area with longitudinal striations, particularly anterior of central ocellus. Gena, vertex, face, and scape with whitish to brownish hairs, not exceeding half of length of scape. Fovea long and narrow, extending well below level of antennal insertions, dorsally slightly narrower than width of flagellum, occupying  $\frac{1}{4}$  of space between lateral ocellus and compound eye, ventrally slightly narrowed. Antenna dark, A4 apically, A5–12 lightened orange below, A3 equals A4+5. *Mesosoma:* Scutum and scutellum strongly shagreened, shallowly punctate, punctures separated by 1–2 puncture diameters, obscured and disappearing into underlying shagreen (Figure 88). Pronotum with hint of extremely weak humeral angle, dorsolaterally slightly angulate. Episternum and propodeum shagreened, weakly shining, propodeal triangle rugose, lateral margins poorly defined. Episternum and propodeum with white hairs, propodeal corbicula well defined dorsally, scutum and scutellum with short brownish hairs. Legs dark, apical tarsal segments lightened brown, pubescence white, scopa white. Hind tarsal claws with inner tooth. Wings hyaline, venation and stigma dark brown, nervulus slightly antefurcal. *Metasoma:* Terga dark, strongly microreticulate, weakly shining, essentially impunctate (Figures 89–90). Tergal margins narrowly lightened brown apically, slightly depressed, T2–3 with weak lateral hair fringes present laterally. Apical fringe of T5 and hairs flanking pygidial plate golden; pygidial plate flattened, margins slightly raised, centrally with fine mesh-like pattern.

**Male:** Body length 6 mm (Figure 91). *Head:* As in female, but hairs on vertex longer, equalling length of scape, antenna with A5–13 lightened orange below, A3 exceeding A4 but shorter than A4+5 (Figure 92). *Mesosoma:* As in female. *Metasoma:* As in female, but terga with slightly more strongly depressed apical margins (Figure 93). Genitalia simple, gonocoxae with weakly produced apical teeth, gonostyli with straight outer margin, penis valve basally parallel sided, slightly narrowing apically (Figure 94).



**FIGURES 83–90.** *Andrena convexifrons* **spec. nov.** 83. female profile, 84. female face, 85. female frons detail, 87. female frons detail, lateral view, 88. female scutum, 89. female terga, 90. female terga detail. *Andrena paganettina* Warncke, 1965; 86. female frons detail.



FIGURES 91–94. *Andrena convexifrons* spec. nov. 91. male profile, 92. male face, 93. male terga, 94. male genitalia.

**Diagnosis:** *Andrena convexifrons* can also easily be recognised as a *Micrandrena* because of its small size, black integument, and strongly rugose propodeal triangle. In the female sex, it can be further recognised as part of the *simontornyella*-group of species that have a transversely striate clypeus, and which are most diverse in the Eastern Mediterranean. It can initially be recognised because of its small size, and is most similar to *A. paganettina* Warncke, 1965 which is the smallest West Palearctic *Micrandrena* at 5–6 mm in length, both species sharing the transversely striate clypeus, narrow foveae, and weakly shining, impunctate, strongly microreticulate terga. However, *A. convexifrons* differs in the sculpturing of the frons which conspicuously forms two bulging mounds in front of the ocellar triangle (note, this character is difficult to see in photographs without a specimen because of the compression effect of photograph stacking software), these bulges extending into the ocellar triangle and therefore raising it above the level of the vertex, this whole area longitudinally striate, most obviously immediately around the central ocellus (Figures 85, 87). In contrast, the frons of *A. paganettina* is regularly flat, not elevated, without obvious longitudinal striations (Figure 86). The two species can additionally be separated by the sculpturing of the scutum, which is strongly shagreened and only very weakly shining in *A. convexifrons* with punctures disappearing into the shagreen, but weakly shagreened and more strongly shining in *A. paganettina*, with punctures more distinct. Males are harder to diagnose because of the simple, featureless genitalia, but they also possess the same bulging frons and clearly elevated ocellar triangle (Figure 92). This character is unique in currently described *Micrandrena* species.

**Etymology:** The name is a combination of *convex* (curved, bulging) + *frons* (forehead) that describes the distinctive protrusions on the frons that allow separation from other *Micrandrena* species.

***Andrena (Orandrena) densissima spec. nov.***

urn:lsid:zoobank.org:act:BEA79392-12BB-4796-872A-8CDD9C876A4A

**HOLOTYPE: TUNISIA:** Ksar Hadada, 4–5.iv.1996, 1♀, leg. K. Deneš (OÖLM).

**Description: Female:** Body length 8 mm (Figure 95). *Head:* Black, 1.1 times wider than long. Clypeus weakly domed, shallowly and irregularly punctate, punctures separated by 0.5–3 puncture diameters; narrow longitudinal impunctate central line present, underlying surface strongly microreticulate, dull (Figure 96). Process of labrum short and wide, apically evenly rounded, dorsal surface microreticulate, dull. Gena subequal to width of compound eye; ocelloccipital distance equals

½ width of lateral ocellus. Fovea dorsally occupying ½ distance between lateral ocellus and compound eye, strongly narrowed ventrally, narrower than width of flagellum. Gena, vertex, face, and scape with long whitish to yellowish hairs, longest equalling length of scape. Antenna dark, A4 apically, A5–12 lightened orange below, A3 exceeds A4+5, shorter than A4+5+6. *Mesosoma:* Scutum and scutellum irregularly punctate, punctures separated by 0.5–3 puncture diameters, underlying surface shagreened, weakly shining (Figure 97). Pronotum rounded, without humeral angle. Episternum and lateral and dorsolateral parts of propodeum shallowly punctate with large punctures, separated by 0.5–1 puncture diameter, underlying surface shagreened, weakly shining, propodeal triangle indicated by change in sculpturing, internal area finely shagreened with weak central rugosity. Episternum and propodeum with long whitish hairs, scutum and scutellum almost hairless, laterally with short sparse light brownish hairs. Legs dark, apical tarsal segments lightened brown, pubescence white, scopa white; hind face of hind femur with 6 strongly produced semi-translucent orange pointed spines, clearly projecting perpendicularly (Figure 98). Wings hyaline, venation and stigma orange, nervulus interstitial. *Metasoma:* Tergal discs dark, apical margins occupying 2/5ths to ½ visible area, lightened orange-yellow, hyaline (Figure 99), sterna lightened dark orange-red. Terga regularly but superficially punctate, punctures separated by 1 puncture diameter; underlying surface of T1 smooth and shining, T2–4 shagreened, weakly shining. T1–4 with thick, long apical hair bands that obscure underlying surface, widely interrupted on T1–2, continuous on T3–4, apical fringe of T5 and hairs flanking pygidial plate golden; pygidial plate triangular, apex pointed, dorsal surface apically weakly domed, impunctate.

**Male:** Unknown.

**Diagnosis:** The subgenus *Orandrena* is easily recognised in the female sex by the combination of pronounced spines on the hind face of the hind femur, simple scopal hairs, and foveae that are strongly narrowed ventrally. Note, this subgenus should exclude *A. garrula* Warncke, 1965 which falls outside the true *Orandrena* (Pisanty *et al.* 2020) and which can easily be separated in the female sex by its lack of large punctures on the episternum. With the exception of *A. pela* Warncke, 1974 from Morocco that is easily separated by its strongly depressed tergal margins, female *Orandrena* fall into two groups: those with a dull clypeus (*A. monilia* Warncke, 1967), and the remaining five species (Table 2) that have clypei with clear longitudinal striations. *Andrena densissima* has a dull clypeus without striations, placing it close to *A. monilia*, but it can be easily separated (*A. monilia* character state in parentheses) by the process of the labrum which is wide, short, and shallowly rounded, not forming a clear apical point (forming a clear triangular point), by its smaller size of 8 mm (larger, 10–11 mm), by the shagreened and only weakly shining scutum (scutum with very weak shagreenation, shining. Note, this only applies to western *A. monilia* populations from Spain to Tunisia. Eastern populations in Israel and Jordan have similarly shagreened scuta; these populations may deserve species status in future revisions), and by the much wider tergal hair bands that clearly exceed the width of the tergal margins (hairbands not clearly exceeding the width of the tergal margins, Figures 99–100).

**Discussion:** As a subgenus, *Orandrena* shows a Mediterranean distribution, but individual species have strongly restricted distributions, most notably those found in Turkey which is the clear centre of diversity, most of which were described by Warncke (Table 2). The exception to this rule is *A. monilia* which is found across the Mediterranean basin, though it is variable throughout this range, and populations in the Middle East potentially deserve species status because of variation in integumental sculpturing and male clypeal colouration. *Andrena monilia* was reported from the northern part of Tunisia some years after its original description (Warncke 1980), and its presence in the country can be confirmed by more recently examined material (see below). In contrast, *A. densissima* was collected from southern Tunisia and clearly differs morphologically. Like most members of the subgenus, it may have a highly restricted range, and similar desert habitats in Algeria and Libya should be searched to see if it is more widespread in these regions.

**Etymology:** The name is the feminine superlative degree of *denso* (dense, thick, therefore very dense, very thick) because of the pronounced hair bands in the female sex that set it apart from other *Orandrena* species.



**FIGURES 95–100.** *Andrena densissima* **spec. nov.** 95. female profile, 96. female face, 97. female scutum, 98. female hind femur; 99. female terga. *Andrena monilia* Warncke, 1967 (holotype); 100. female terga.

**Other material examined:** (*Andrena monilia*): **ISRAEL:** Mishmar HaNegev, 24.iii.19xx [year unspecified], 1♀, leg. Bytinski-Salz, ZMHB; Gal'on, 23.iii.2010, 1♀, leg. G. Pisanty, SMNHSTA; **JORDAN:** 30 km N Tafila [At-Tafilah], 2.v.1996, 4♀, leg. Ma. Halada, OÖLM; Al Karak env [Kerak], 6.iv.2013, 1♂, 1♀, leg. M. Snižek, OÖLM; **TUNISIA:** Kasserine, 13.iv.1998, 2♂, leg. K. Deneš, OÖLM; Sbeitla, 12.iv.1998, 1♀, leg. K. Deneš, OÖLM; **SPAIN:** Montarco, 10.v.1933, 1♀, leg. J. M. Dusmet y Alonso, OÖLM (holotype, Figure 100); Montarco, 28.iv.1924, 1♂, leg. J. M. Dusmet y Alonso, OÖLM (paratype).

**TABLE 2.** *Andrena* (*Orandrena*) species and their global distributions. Note, following Pisanty *et al.* (2020), *Andrena garrula* Warncke, 1965 is excluded from the subgenus.

Species	Distribution	References
<i>Andrena acrana</i> Warncke, 1967	Turkey	Warncke (1975)
<i>Andrena densissima</i> <b>spec. nov.</b>	Tunisia	Current publication
<i>Andrena gallinula</i> Warncke, 1975	Armenia, Lebanon, Turkey	Gusenleitner and Schwarz (2002); Wood <i>et al.</i> (2020b)
<i>Andrena gunaca</i> Warncke, 1975	Turkey	Warncke (1975)
<i>Andrena monilia</i> Warncke, 1967	Spain, Morocco, Algeria, Tunisia, Israel, Jordan, Turkey	Gusenleitner and Schwarz (2002); Wood <i>et al.</i> (2020a)
<i>Andrena oralis</i> Morawitz, 1876	Central Europe to Turkey and the Caucasus	Gusenleitner and Schwarz (2002)
<i>Andrena pela</i> Warncke, 1974	Morocco	Gusenleitner and Schwarz (2002)
<i>Andrena platala</i> Warncke, 1975	Turkey	Warncke (1975)

***Andrena (Pallandrena) persica* **spec. nov.****

urn:lsid:zoobank.org:act:DE48897F-B2BE-4054-AA7C-F401D2179188

**HOLOTYPE: IRAN:** Fars province, Yasuj, Sarb-e Taveh, 2030 m, [30.545°N, 51.610°E], 4.v.2016, 1♀, leg. M. Kafka (OÖLM).

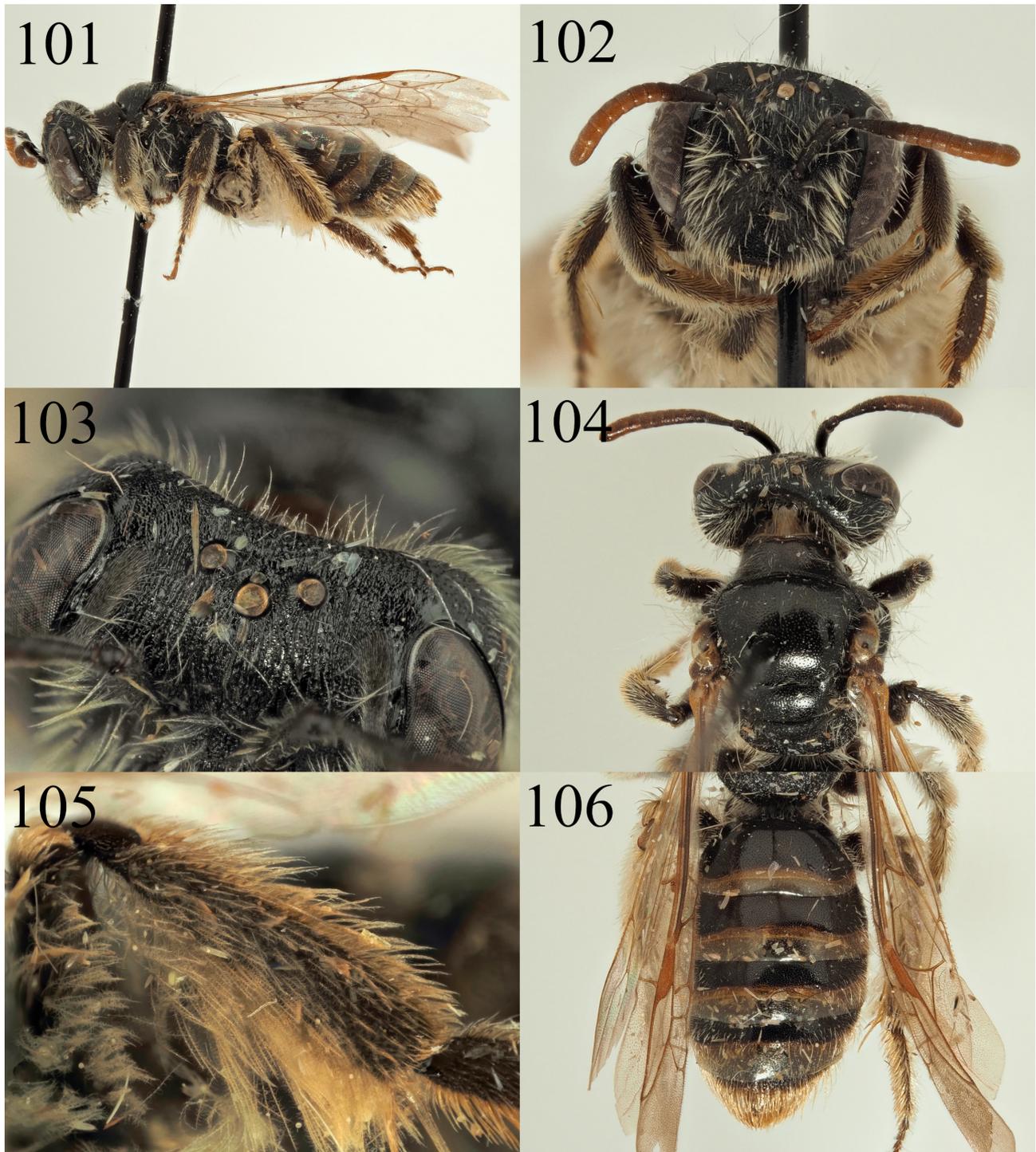
**PARATYPE: IRAN:** Same as holotype, 1♀ (OÖLM), 1♀ (TJWC).

**Description: Female:** Body length 8–8.5 mm (Figure 101). **Head:** Black, 1.2 times wider than long (Figure 102). Clypeus evenly arched, underlying surface shagreened, weakly shining, weakly, shallowly, and irregularly punctate, punctures disappearing into underlying shagreenation and obscured by irregular transverse microcarinae that become more pronounced apically. Process of labrum trapezoidal with shallow median ‘v’ shaped emargination. Gena moderately broad, equalling width of compound eye; ocelloccipital distance equals width of lateral ocellus. Gena, vertex, face, and scape with long whitish hairs, not exceeding length of scape. Fovea narrow, occupying 1/3<sup>rd</sup> of area between compound eye and lateral ocellus, separated from inner margin of compound eye by less than half own width. Antenna dark, A5–12 lightened orange below, A3 equals A4+5+6. Frons strongly striate with raised longitudinal carinae, extending to lateral ocelli but not reaching edge of vertex (Figure 103). **Mesosoma:** Scutum shagreened and weakly shining in apical third and extreme margins, remaining areas smooth and shining, clearly and regularly punctate, punctures separated by 1.5–2 puncture diameters; scutellum sculpted like central part of scutum (Figure 104). Pronotum rounded, without humeral angle. Episternum and propodeum rugose, rugae fine and even, underlying surface microreticulate and weakly shining, propodeal triangle marked with clear fine carinae, internal surface undifferentiated from surrounding propodeum. Scutum and scutellum with short and very sparse whitish hairs, episternum and propodeum with longer whitish hairs, not exceeding length of scape. Legs dark, apical tarsal segments lightened brown, pubescence yellowish-brown, hind legs with pronounced, thick, and plumose floccus and femoral and tibial scopa, ventral hairs of tibial scopa greatly exceeding dorsal hairs in length, scopal hairs yellowish-brown (Figure 105). Wings hyaline, venation and stigma orange, nervulus antefurcal. **Metasoma:** Terga dark, with wide hyaline margins occupying 2/5ths of dorsal area, slightly depressed, most strongly laterally (Figure 106). Tergal discs densely and clearly punctate, punctures separated by 1 puncture diameter, extending onto basal part of apical margins; underlying surface of tergal discs smooth and shiny. Apical fringe of T5 and hairs flanking pygidial plate golden; pygidial plate flat with slightly upturned margins, centrally with fine, honeycomb-like network pattern.

**Male:** Unknown.

**Diagnosis:** Members of the subgenus *Pallandrena* can be swiftly recognised by their unique combination of characters, in the female sex by the clear ‘v’ shaped emargination of the process of the labrum, the absence of a carina on the rear face of the hind femur, the absence of the vanal lobe in the hind wing, the densely plumose and branched scopal hairs on the ventral side of the hind tibia, clearly exceeding the length of the dorsal hairs, and the weak propodeal corbicula. *Andrena persica* can be partially recognised by its small size, at 8–8.5 mm in length becoming the smallest known *Pallandrena*, with other species more typically reaching 9–11 mm in the female sex. Its

lack of red tergal markings place it closest to *A. pallidicincta* Brullé, 1832, *A. braunsiana* Friese, 1887, and *Andrena korbella* Grünwaldt, 2005 from which it can easily be separated by the sculpturing of the scutal integument which is clearly shiny, not strongly shagreened and dull.



**FIGURES 101–106.** *Andrena persica* **spec. nov.** 101. female profile, 102. female face, 103. female frons detail, 104. female scutum, 105. female tibial scopa, 106. female terga.

**Discussion:** The subgenus *Pallandrena* is small, containing 8–9 species, with the status of *A. oblita* Warncke, 1967 currently unclear and known only from female type material from southern Italy (see Wood *et al.* 2020a), but it is likely to be distinct in the opinion of the author as it does not match well with Central European *A. braunsiana* material. The greatest species richness is found to the east, with known diversity centred on Turkey and Iran and with only one species extending to North Africa in the west (Table 3). Five *Pallandrena* species have now been

described since 2005 from mountainous and difficult to access regions in Turkey, Iran, and Turkmenistan, so the biogeographical affinities of the subgenus have only recently become clearer. The collection of *A. persica* at over 2000 m in the southern Zagros mountain chain therefore fits well with this overall pattern. All species are likely to be specialists of Geraniaceae based on available pollen load data, behavioural observations, and their distinctive loose and plumose scopa (Wood *et al.* 2020a; b).

**TABLE 3.** *Andrena* (*Pallandrena*) species and their global distributions. Note, the status of *Andrena oblita* is currently unclear and is known only from the type series from southern Italy.

Species	Distribution	References
<i>Andrena braunsiana</i> Friese, 1887	Central Europe to the Caucasus, Greece, Russia, and Turkey	Gusenleitner and Schwarz (2002)
<i>Andrena byrsicola</i> Schmiedeknecht, 1900	Algeria, Morocco, Tunisia	Gusenleitner and Schwarz (2002); Wood <i>et al.</i> (2020a)
<i>Andrena christineae</i> Dubitzky, 2006	Iran, Lebanon, Turkey	Dubitzky (2006); Wood <i>et al.</i> (2020b)
<i>Andrena korbella</i> Grünwaldt, 2005	Turkey	Grünwaldt <i>et al.</i> (2005)
<i>Andrena pallidicincta</i> Brullé, 1832	Southern Balkans, Turkey, Israel, Lebanon	Gusenleitner and Schwarz (2002); Wood <i>et al.</i> (2020b)
<i>Andrena oblita</i> Warncke, 1967	Italy	Warncke (1967)
<i>Andrena persica</i> <b>spec. nov.</b>	Iran	Current publication
<i>Andrena scheuchli</i> Dubitzky, 2006	Turkmenistan	Dubitzky (2006)
<i>Andrena zagrosa</i> <b>spec. nov.</b>	Iran	Current publication

**Etymology:** The name *persica* is derived from the Latin word for Persia or Persians (*Persa*) which itself ultimately comes from the province Fars (or Pars), the historical homeland of the Persian people and from which this material was collected.

***Andrena* (*Pallandrena*) *zagrosa* **spec. nov.****

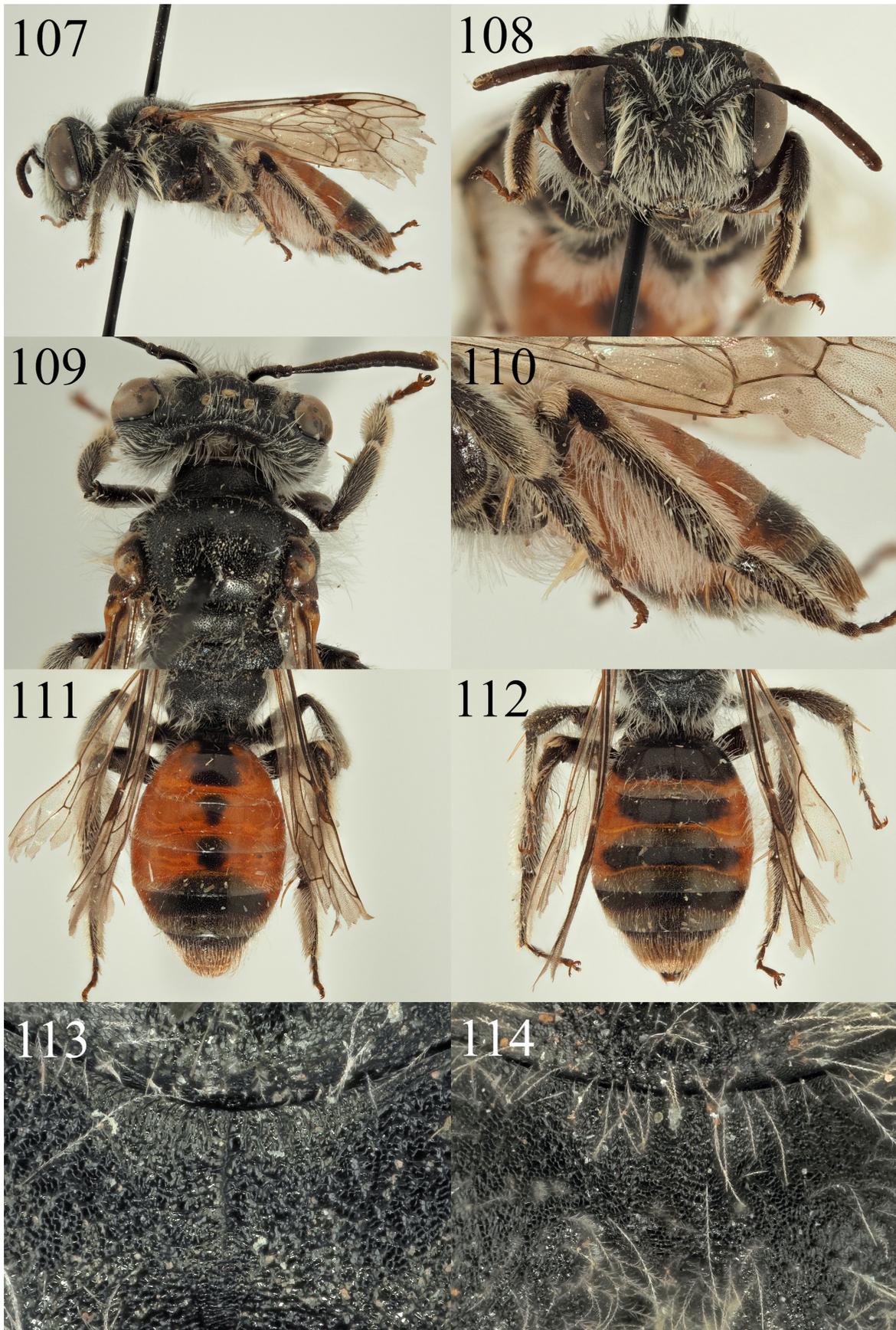
urn:lsid:zoobank.org:act:898EB986-642E-4233-930D-9AB828B76E42

**HOLOTYPE: IRAN:** Fars province, Yasuj, Sarb-e Taveh [30.545°N, 51.610°E], 2030 m, 4.v.2016, 1♂, leg. M. Kafka (OÖLM).

**PARATYPES: IRAN:** Same as holotype, 1♀ (OÖLM), 1♀ (TJWC); Ilam province, Abda Man, Dinar Gaouh, 1830 m, 12.v.2016, 1♀, leg. M. Kafka (OÖLM).

**Description: Female:** Body length 11 mm (Figure 107). *Head:* Black, 1.3 times wider than long (Figure 108). Clypeus evenly arched, underlying surface strongly shagreened, dull, shallowly and irregularly punctate, punctures disappearing unto underlying shagreenation and obscured by irregular transverse microcarinae. Process of labrum trapezoidal with shallow median ‘v’ shaped emargination. Gena moderately broad, equalling width of compound eye; ocelloccipital distance 1.8 times width of lateral ocellus. Fovea moderately wide, occupying just under half of area between compound eye and lateral ocellus, not separated from inner margin of compound eye. Gena, vertex, face, and scape with long whitish hairs, not exceeding length of scape. Antenna dark, A6–12 slightly lightened grey-brown below, A3 equals A4+5+6. Frons strongly striate with raised longitudinal carinae, extending beyond lateral ocelli and occupying area immediately behind ocellar triangle but not quite reaching edge of vertex. *Mesosoma:* Scutum shagreened in anterior third, dull, remaining areas less strongly shagreened, therefore weakly shining, densely and evenly punctate, punctures separated by 0.5 puncture diameters (Figure 109). Scutellum evenly shagreened, dull, densely and shallowly punctate, punctures separated by 0.5 puncture diameters. Pronotum rounded, without humeral angle. Episternum and propodeum finely rugose, underlying surface finely microreticulate and weakly shining, propodeal triangle poorly marked by change in surface sculpture, internal surface weakly rugose with strong central longitudinal carina. Scutum and scutellum with short and very sparse whitish hairs, episternum and propodeum with longer whitish hairs, not exceeding length of scape. Legs dark, apical tarsal segments lightened brown, pubescence whitish, hind legs with fine and plumose floccus and femoral and tibial scopa, ventral hairs of

tibial scopa greatly exceeding dorsal hairs in length, scopal hairs silver-white (Figure 110). Wings hyaline, venation and stigma dark brown, nervulus interstitial. *Metasoma*: Terga dark with variable red markings, red form with



FIGURES 107–114. *Andrena zagrosa* spec. nov. 107. female profile, 108. female face, 109. female scutum, 110. female tibial

scopa, 111. female terga (Fars province), 112. female terga (Ilam province), 113. female propodeal triangle. *Andrena christineae* Dubitzky, 2006; 114. female propodeal triangle.

T1–3 with all but central part of disc red marked (Figure 111), dark form with red markings restricted to lateral parts of T1–3 (Figure 112). Tergal margins broad, occupying  $\frac{1}{4}$  to  $\frac{1}{2}$  tergal disc, yellow-hyaline, very slightly depressed laterally. Tergal discs finely and evenly punctate, punctures separated by 1–1.5 puncture diameters, extending onto majority of apical margins; underlying surface of tergal discs smooth and shiny. Apical fringe of T5 and hairs flanking pygidial plate golden to brown; pygidial plate flat with slightly upturned margins, centrally with fine, honey-comb-like network pattern.

**Male:** Body length 10 mm (Figure 115). *Head:* Black, 1.3 times wider than long (Figure 116). Clypeus evenly arched, shagreened, dull, densely and shallowly punctate, punctures separated by 0.5 puncture diameter, puncture margins coalescing to form slightly raised transverse carinae. Process of labrum trapezoidal, shallowly medially emarginate. Gena broad, slightly exceeding width of compound eye, vertex broad; ocelloccipital distance 2.5 times width of lateral ocellus (Figure 117). Gena, vertex, face, and scape with long whitish hairs, not exceeding length of scape. Antenna dark, A6–13 slightly lightened grey-brown below, A3 exceeds A4+5, shorter than A4+5+6. Frons striations as in female. *Mesosoma:* As in female. *Metasoma:* Terga dark, with apical hyaline margin occupying  $\frac{2}{5}$ <sup>th</sup> of dorsal area (Figure 118). Terga evenly punctate, punctures separated by 2 puncture diameters, underlying surface smooth and shiny. S8 strap-shaped, deeply emarginate apically forming a ‘v’, densely covered with short pale hairs on ventral surface. Genital capsule long (Figure 119), gonocoxae without teeth, gonostyli apically produced into scoops, internal face concave. Penis valve grossly broadened, bladder-like, equalling width of gonostyli, apically produced into sharp point (Figure 120).

**Diagnosis:** As for *A. persica*, female *A. zagrosa* can be swiftly recognised by the emarginate process of the labrum, the non-carinate hind femur, and the distinctive scopal hairs. Male material is harder to diagnose without examination of the genitalia which are large, with an elongate capsule and comparatively long, toothless gonocoxae. Two *Pallandrena* species with red-marked terga have been described: *A. christineae* Dubitzky, 2006 and *A. scheuchli* Dubitzky, 2006. *Andrena zagrosa* female material can be easily separated from *A. scheuchli* because the former species has a vertex and scutum are dull, not shiny; the male of *A. scheuchli* is unknown. Differences from *A. christineae* (alternative character state in parentheses) in the female sex are more subtle and ideally require comparative material, but can be separated using the following characters: T2–4 without basal lateral depression, dorsolateral convexity evenly flattened (T2–4 with basal depression that extends laterally across the terga, dorsolateral convexity swollen), propodeal triangle with clear central longitudinal carina (Figure 113) that is more pronounced than the surrounding rugae (propodeal triangle finely wrinkled, without a clearly distinct and longitudinal carina, Figure 114), scutum comparatively weakly shagreened, weakly shining (scutum comparatively more strongly shagreened, dull). Male material is much more easily separated, as the genitalia are conspicuously different, with the penis valve of *A. zagrosa* conspicuously and grossly widened, almost exceeding the width of the gonostyli (Figure 116), whereas in *A. christineae* the penis valve is only slightly broadened, therefore comparatively parallel-sided (see illustrations in Wood *et al.* 2020b).

**Discussion:** As for *A. persica*, *A. zagrosa* fits the typical *Pallandrena* pattern of being found at high altitude in the Middle Eastern region. Given the vast and underexplored mountain chains of Central Asia, there may yet be many more undetected species of *Pallandrena* present in these regions.

**Etymology:** This name is derived from the Zagros mountains that include the *locus typicus*.

**Other material examined** (*Andrena christineae*): **LEBANON:** N Lebanon, Arz Bcharre Forest of the Cedars of God Reforestation Area, 1933 m, 18.iv.2018, 1♀, leg. M. Boustani, TJWC, *Geranium libanoticum*; Arz Bcharre, Forest of the Cedars of God, Forest Limit, 1897 m, 20.v.2019, 1♂, leg. M. Boustani, OÖLM.

### ***Andrena (Suandrena) inaquosa spec. nov.***

urn:lsid:zoobank.org:act:FA154C3C-05CE-46CA-B358-F35F0F6614C0

**HOLOTYPE: SYRIA:** 30 km W Palmyra, 580 m, 23.iv.1992, 1♂, leg. K. Warncke (OÖLM).

**PARATYPES: SYRIA:** Same as holotype, 1♂ (TJWC); 110 km E of Palmyra, 350 m, 21.iv.1992, 1♂, leg. K. Warncke (OÖLM).

**Description: Female:** Unknown.

**Male:** Body length 12 mm (Figure 121). *Head:* Black, 1.2 times wider than long (Figure 122). Clypeus evenly

arched, evenly and densely punctate, punctures separated by <0.5 puncture diameters over majority of disc with exception of apex, here becoming sparser, separated by 1 puncture diameter, leaving small, narrow, central, longitudinal impunctate area; underlying clypeal surface smooth and shiny, lacking shagreenation. Process of labrum with deep central 'v' shaped emargination. Gena moderately broad, equalling width of compound eye; ocelloccipital distance 1.5 times width of lateral ocellus. Gena, vertex, face, and scape with long white hairs, longest equalling width of scape. Antenna dark, A3 apically and A4–13 lightened orange below, A3 exceeds A4, shorter than A4+5 (Figure 123). *Mesosoma*: Scutum microreticulate, dull, weakly and shallowly punctate, separated by 0.5–1 puncture diameters laterally, becoming sparser centrally (Figure 124). Scutellum less strongly microreticulate, weakly shining centrally, more strongly and densely punctate, punctures separated by 1 puncture diameter. Pronotum rounded, without humeral angle. Episternum and propodeum microreticulate to weakly rugose, very weakly shining, propodeal triangle outlined with lateral carinae, internal surface moderately rugose. Episternum, propodeum, scutum, and scutellum long white hairs, longest clearly exceeding length of scape. Legs dark, apical tarsal segments lightened orange, pubescence white. Wings hyaline, venation dark orange to dark brown, stigma light orange, nervulus antefurcal. *Metasoma*: Terga dark with very faint metallic green sheen, T2–4 with apical margins slightly depressed, T1–5 with apical bands of dense white hairs obscuring underlying surface (Figure 125). Tergal surface tessellate, weakly shining, clearly, evenly, and densely punctate, punctures separated by 1 puncture diameter. S8 laterally compressed, forming a ventrally projecting keel, keel with ventrolaterally projecting hair tufts (Figure 126); apically S8 dorsolaterally compressed, ventral face with short weak hair tuft, laterally with stronger tufts (Figure 127). Genitalia broad, gonocoxae with pronounced apical teeth, diverging apically, gonostyli strongly curved, outer apical margin with numerous plumose hairs (Figure 128). Penis valve strongly broadened, occupying majority of area between gonostyli, centrally flattened, laterally with pair of disc-shaped bulges that stand clear from underlying surface.

**Diagnosis:** *Andrena inaquosa* can quickly be placed in the subgenus *Suandrena* because of its defined and rugose propodeal triangle, black male clypeus, large body size (>10 mm), three submarginal cells, and complex genitalia with inflated penis valve and gonostyli with clear kink in their outer margin. It is most similar to *A. planiventris* Dours, 1872 (Morocco to Egypt) because both species have an unwidened A3, a strongly widened (but not circular) penis valve, and antenna that are lightened orange below. They differ in the structure of the genitalia, as the gonocoxal teeth of *A. inaquosa* are set more closely together and their apical points diverge more strongly (Figures 128–129). More clearly, *A. inaquosa* has two rounded bulges laterally on the central part of the penis valve (Figure 128), whereas this area is entirely flat in *A. planiventris* (Figure 129). Requiring comparative material, they can be further separated (*A. planiventris* character state in parentheses) as *A. inaquosa* has a labral process that is more sharply and strongly emarginate (emargination weaker, less sharp), the ventral keel of S8 is more strongly produced ventrally (S8 in profile flatter), and the scutum is more clearly punctate, punctures shallow but visible against microreticulation (punctures difficult to see, only visible in the centre of the disc, almost completely disappearing into underlying shagreenation).

**Discussion:** Modifying the key of Dylewska (1983), the male of *A. inaquosa* runs to couplet seven where it can be separated from *A. planiventris* using the genital characters outlined in the diagnosis. Specimens of *A. inaquosa* were collected in sympatry with male and female specimens of *A. cyanomicans mirna* Warncke, 1969, the subspecies *mirna* being known from Israel, Iran, Jordan, Lebanon, and now newly reported from Syria (Gusenleitner and Schwarz 2002; Khodaparast and Monfared 2012; Wood *et al.* 2020b). Male material can easily be separated because of the clearly different genitalia, lacking an inflated penis valve (Figure 130). Despite a large number of female *Suandrena* specimens collected by Warncke from both the *locus typicus* of *A. inaquosa* and surrounding sites, no aberrant female material that could constitute the female of *A. inaquosa* could obviously be detected.

**Etymology:** The name is derived from the Latin *inaquosa* meaning dry, arid, without water because of the *locus typicus* found deep in the Syrian desert.

**Other material examined:** (*Andrena cyanomicans mirna*): **SYRIA:** 30 km W Palmyra, 580 m, 23.iv.1992, 2♂, 30♀, leg. K. Warncke, OÖLM; 110 km E of Palmyra, 350 m, 21.iv.1992, 1♂, 6♀, leg. K. Warncke, OÖLM; 80 km E of Palmyra, 450 m, 22.iv.1992, 1♂, 28♀, leg. K. Warncke, OÖLM.

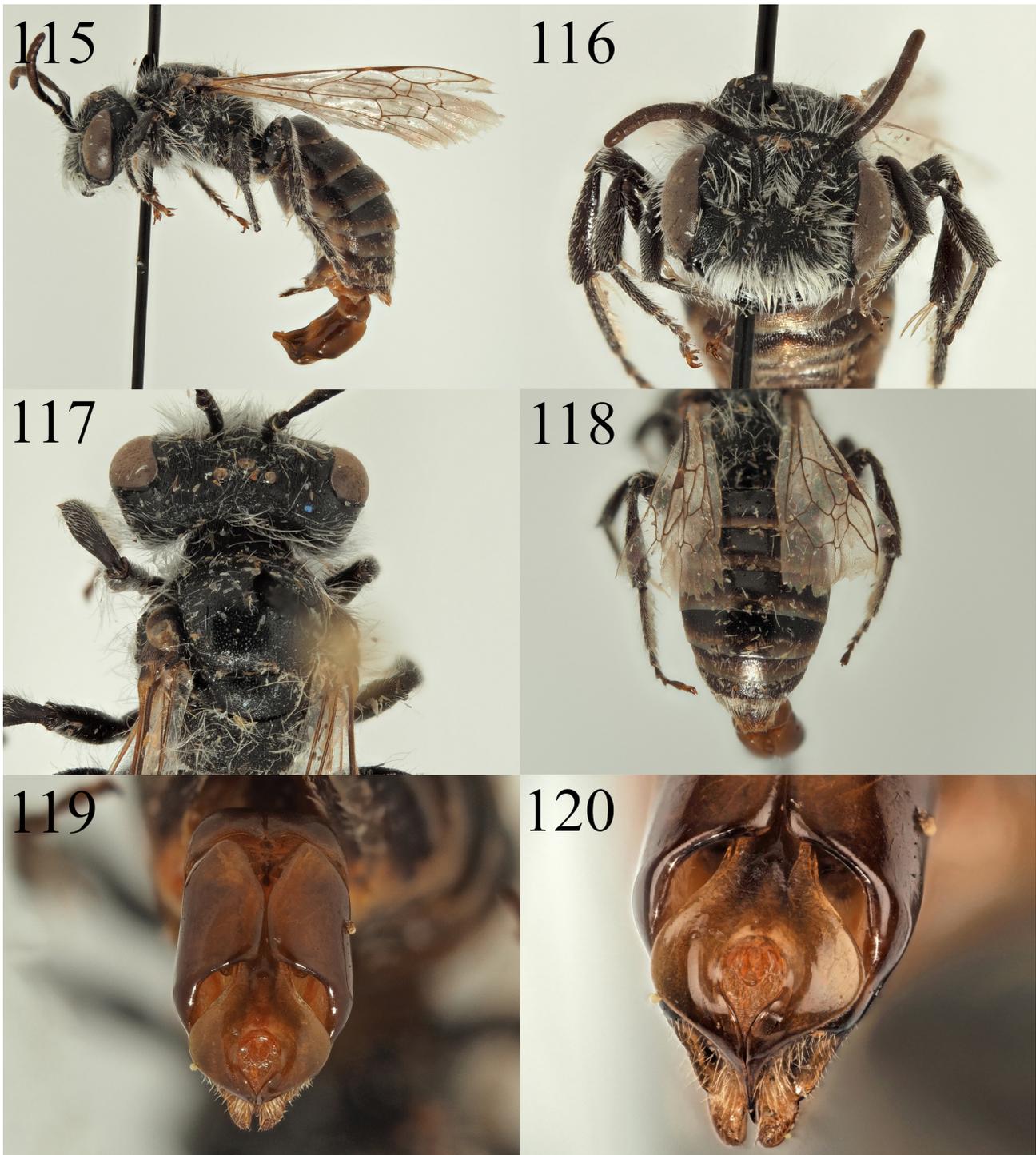
***Andrena (Truncandrena) syriensis spec. nov.***

urn:lsid:zoobank.org:act:E653EFDF-CD62-4021-A7AD-FCE0D9AEE618

**HOLOTYPE:** SYRIA: Homs, 250 m, As-Shuknah, 22 km E, 24.iii.1988, 1♂, leg. L. Blank (OÖLM).

PARATYPE: SYRIA: Homs, E 20 km, 400 m, 1.iv.1988, 1♂, leg. S.M. Blank (OÖLM).

Description: Female: Unknown.



FIGURES 115–120. *Andrena zagrosa* spec. nov. 115. male profile, 116. male face, 117. male scutum, 118. male terga, 119. male genitalia, 120. male genitalia detail.

**Male:** Body length 10–10.5 mm (Figure 131). *Head:* Black, 1.2 times wider than long. Clypeus coloured yellow with exception of two lateral black marks, yellow colouration extending onto lower paraocular areas (Figure 132). Clypeus regularly punctate, punctures laterally separated by 0.5–1 puncture diameter, becoming sparser centrally, here separated by 1–2 puncture diameters; underlying surface shagreened, weakly shining. Process of labrum trapezoidal, fore margin rounded emarginate. Gena equalling width of compound eye; ocelloccipital distance equalling width of lateral ocellus. Gena, vertex, face, and scape with long white hairs, not exceeding length of

scape. Antenna dark, A4 apically, A5–13 lightened orange below, A3 exceeds A4, shorter than A4+5 (Figure 133). *Mesosoma*: Scutum and scutellum consistently punctate, punctures separated by 0.5–1 puncture diameter, underlying surface shagreened, weakly shining, shagreenation becoming weaker centrally, here shining more strongly. Pronotum rounded, without humeral angle. Episternum and propodeum microreticulate, weakly shining, becoming weakly rugose on propodeum, propodeal triangle indicated by change in surface sculpture, surface finely microreticulate. Episternum, propodeum, scutum, and scutellum covered with long whitish hairs, clearly exceeding length of scape. Legs dark, apical tarsal segment and hind basitarsi lightened orange, pubescence whitish. Wings hyaline, venation and stigma orange, nervulus strongly antefurcal. *Metasoma*: Terga dark, apical margins narrowly lightened yellow, partly hyaline (Figure 134). Tergal discs finely and regularly punctate, punctures separated by 2 puncture diameters; terga covered with loose, long whitish hairs, forming denser hairbands on apical margins of T2–4, obscuring underlying surface. Genital capsule compact, gonocoxae with short, weakly pointed teeth, these diverging widely; gonostyli with apical blades flattened, triangular, outer face weakly concave, with long plumose hairs. Penis valve broad, laterally with pair of lamellate, finger-like projections (Figures 135–136).



**FIGURES 121–124.** *Andrena inaquosa* **spec. nov.** 121. male profile, 122. male face, 123. male antenna detail, 124. male scutum.

**Diagnosis:** Placement of *A. syriensis* within a subgenus is not immediately clear. The combination of very short malar space, granulose propodeal triangle with clear dorsal area (not declivous), rounded (uncarinate) pronotum, large body size (>8 mm), and yellow clypeus with colouration extending onto the lower paraocular area would suggest placement in the *Nobandrena*. However, *A. syriensis* lacks depressed tergal margins and the typical elongate genital capsule of *Nobandrena*, making *Truncandrena* a better fit where, though less common, yellow facial markings can extend onto the lower paraocular area, and the overall more ‘beak-like’ shape of the clypeus is a better fit, though it should be noted that the antefurcal nervulus is unusual for the *Truncandrena* (usually interstitial to postfurcal).

Within the *Truncandrena*, based on genital construction *A. syriensis* can be placed closest to *A. rotundilabris*

Morawitz, 1878 (Israel, Lebanon, Turkey) and *A. ulula* Warncke, 1969 (Israel, Turkey) because of the broad penis valve that occupies most of the space between the gonostyli, and the broad apically triangular gonostyli. As well as different facial markings (both with yellow markings restricted to the clypeus), structurally *A. syriensis* differs in the position of the antefurcal nervulus (both with a postfurcal nervulus), the centrally weak shagreenation of the scutum (both with dull scuta, shagreenation uninform, not centrally shining), and most noticeably in the form of the gonocoxal teeth which are short, pointed, and broadly splayed laterally (pointed but only diverging weakly in *A. rotundilabris*, apically rounded in *A. ulula*) and of the penis valve, which has laterally projecting, lamellate, finger-like projections (absent in both other species).



**FIGURES 125–130.** *Andrena inaquosa* **spec. nov.** 125. male terga, 126. male sternite 8 profile, 127. male sternite 8 ventral view, 128. male genitalia, arrow indicating bulges on surface of penis valve. *Andrena planiventris* Dours, 1872; 129. male genitalia. *Andrena cyanomicans mirna* Warncke, 1969; 130. male genitalia.



**FIGURES 131–136.** *Andrena syriensis* **spec. nov.** 131. male profile, 132. male clypeus detail, 133. male antenna detail, 134. male terga, 135. male genitalia detail, 136. male genitalia detail, dorsal view, arrow indicating lateral ‘finger-like’ projections of the penis valve.

**Discussion:** The subgenus *Truncandrena* has its greatest diversity in the Eastern Mediterranean, and so the presence of another undescribed species here is not surprising. The formation of the genital capsule with reduced and laterally splayed gonocoxal teeth and the lateral extensions to the penis valve has not previously been described within the *Truncandrena*, and the antefurcal position of the nervulus is aberrant within the subgenus. However, the Middle East is home to some remarkable *Andrena* diversity that does not fit well with existing subgeneric concepts and traits, even when they can be placed in subgenera at all (e.g. Pisanty *et al.* 2016; 2018; 2020; Wood 2020; Wood

*et al.* 2020b). The diversity of new taxa and their morphological peculiarities described both here and elsewhere recently (Wood 2020) from arid desertic regions of Syria suggests that molecular study of this fauna could shed further light of our understanding of the evolution of this genus, given its likely East Mediterranean origin (Pisanty *et al.* 2020).

**Etymology:** This species is named after the country of Syria.

## Concluding remarks

These findings illustrate that the deserts and mountains of North Africa, the Middle East, and Turkey remain full of undiscovered and undescribed *Andrena* diversity. Indeed, three of the new species from Tunisia (*A. densissima*, *A. inflata*, and *A. plumbea*) were collected at the same site on the same day. The recent revelation that *Andrena* actually arose in the Old World, likely somewhere in or between the Middle East and Central Asia (Pisanty *et al.* 2020), has fundamentally changed our understanding of the evolution of the genus. Against this context, and in light of the large numbers of species that continue to be described, proposals that the genus could actually contain around 2,000 species (Dubitzky *et al.* 2010) may yet prove to be an underestimate. Indeed, since the last update to the global checklist of Gusenleitner and Schwarz (Gusenleitner *et al.* 2005), over 110 new *Andrena* species have been described, almost entirely from the Old World, along with many other taxonomic changes that have raised subspecies to full species status. It is highly likely that as more attention turns to these hard to access, arid parts of the world, and taxonomic revisions are conducted with the use of up to date molecular tools, the size of the genus will continue to grow and grow.

## Acknowledgements

My thanks go to Esther Ockermüller and Martin Schwarz for access to the Warncke collection and hospitality in Linz, to Gideon Pisanty (SMNHTAU) for helpful discussion on Middle Eastern *Andrena*, and to Pierre Rasmont (UMONS) for substantial assistance with photography. I also specifically thank Christian Schmid-Egger and Gideon Pisanty for critical comments that substantially improved the manuscript. The author is supported by an F.R.S.-FNRS fellowship (Chargé de recherches).

## References

- Brito, J.C., Martínez-Freiría, F., Sierra, P., Sillero, P. & Tarroso, P. (2011) Crocodiles in the Sahara Desert: an update of distribution, habitats and population status for conservation planning in Mauritania. *PLoS ONE*, 6, e14734.  
<https://doi.org/10.1371/journal.pone.0014734>
- Dubitzky, A. (2006) New palearctic species of the bee genus *Andrena* (Insecta: Hymenoptera: Andrenidae). *Zootaxa*, 1284 (1), 1–27.  
<https://doi.org/10.11646/zootaxa.1284.1.1>
- Dubitzky, A., Plant, J. & Schönitzer, K. (2010) Phylogeny of the bee genus *Andrena* Fabricius based on morphology (Hymenoptera: Andrenidae). *Mitteilungen der Münchner Entomologische Gesellschaft*, 100, 137–202.
- Dylewska, M. (1983) *Andrena suerinensis* Friese und verwandte Arten (*suerinensis*-Untergruppe) (Hymenoptera, Apoidea, Andrenidae). *Entomologische Abhandlungen, Staatliches Museum für Tierkunde in Dresden*, 47, 15–34.
- Grünwaldt, W. (1976) *Andrena grossella* n. sp., eine Insekten-Art mit 9gliedrigen Maxillar- und Labialpalpen (Hymenoptera, Apoidea). *Nachrichtenblatt der Bayerischen Entomologen*, 25, 65–70.
- Grünwaldt, W., Osytshnjuk, A.Z. & Scheuchl, E. (2005) Neue *Andrena*-Arten aus der Paläarktische (Hymenoptera: Apidae: Andreninae). *Entomofauna*, 26, 349–368.
- Gusenleitner, F. (1998) Neue westpaläarktische *Andrena*-Arten (Hymenoptera: Apidae: Andreninae). *Entomofauna*, 19, 109–144.
- Gusenleitner, F. & Schwarz, M. (2002) Weltweite Checkliste der Bienengattung *Andrena* mit Bemerkungen und Ergänzungen zu paläarktischen Arten (Hymenoptera, Apidae, Andreninae, *Andrena*). *Entomofauna*, Supplement 10, 1–1280.
- Gusenleitner, F., Schwarz, M., Ascher, J. & Scheuchl, E. (2005) Korrekturen und Nachträge zu Gusenleitner & Schwarz (2002): “Weltweite Checkliste der Bienengattung *Andrena* mit Bemerkungen und Ergänzungen zu paläarktischen Arten (Hymenoptera, Apidae, Andreninae, *Andrena*)”. *Entomofauna*, 26, 437–472.
- Khodaparast, R. & Monfared, A. (2012) A survey of bees (Hymenoptera: Apoidea) from Fars Province, Iran. *Zootaxa*, 3445 (1),

37–58.

<https://doi.org/10.11646/zootaxa.3445.1.2>

- Larkin, L.L., Neff, N.L. & Simpson, B.B. (2008) The evolution of a pollen diet: Host choice and diet breadth of *Andrena* bees (Hymenoptera: Andrenidae). *Apidologie*, 39, 133–145.  
<https://doi.org/10.1051/apido:2007064>
- Mavromoustakis, G.A. (1952) On the bees (Hymenoptera: Apoidea) of Cyprus. Part III. *Annals and Magazine of Natural History*, Series 12, 5 (57), 814–843.  
<https://doi.org/10.1080/00222935208654357>
- Mavromoustakis, G.A. (1958) New bees of the genera *Andrena* and *Nomada* from the island Cyprus (Hymenoptera: Apoidea) Part II. *Beiträge zur Entomologie*, 8, 212–219.
- Pisanty, G., Scheuchl, E. & Dorchin, N. (2016) Eight new species of *Andrena* Fabricius (Hymenoptera: Apoidea: Andrenidae) from Israel – a Mediterranean hotspot for wild bees. *Zootaxa*, 4189 (3), 485–515.  
<https://doi.org/10.11646/zootaxa.4189.3.3>
- Pisanty, G., Scheuchl, E. & Dorchin, N. (2018) Taxonomic review of the subgenus *Andrena* (*Poecilandrena*) (Hymenoptera: Andrenidae) in Israel and the Levant. *Zootaxa*, 4374 (2), 151–188.  
<https://doi.org/10.11646/zootaxa.4374.2.1>
- Pisanty, G., Richter, R., Martin, T., Dettman, J. & Cardinal, S. (2020) Molecular phylogeny and historical biogeography of andrenine bees (Hymenoptera: Andrenidae). *bioRxiv*. [published online]  
<https://doi.org/10.1101/2020.06.09.103556>
- Potts, S.G., Vulliamy, B., Roberts, S.P.M., O’Toole, C., Dafni, A., Ne’eman, G. & Willmer, P. (2005) Role of nesting resources in organising diverse bee communities in a Mediterranean landscape. *Ecological Entomology*, 30, 78–85.  
<https://doi.org/10.1111/j.0307-6946.2005.00662.x>
- Praz, C., Müller, A. & Genoud, D. (2019) Hidden diversity in European bees: *Andrena amieti* sp. n., a new Alpine bee species related to *Andrena bicolor* (Fabricius, 1775) (Hymenoptera, Apoidea, Andrenidae). *Alpine Entomology*, 3, 11–38.  
<https://doi.org/10.3897/alpento.3.29675>
- Scheuchl, E. & Gusenleitner, F. (2009) *Andrena* (*Margandrena*) *elsei* nov.sp., eine neue türkische Sandbienenart (Hymenoptera, Apidae, Andreninae). *Linzer biologische Beiträge*, 41, 947–962.
- Scheuchl, E. (2010) Beitrag zur Kenntnis westpaläarktischer Bienen der Gattung *Andrena* (Hymenoptera: Apidae: Andreninae). *Linzer biologische Beiträge*, 42, 1445–1455.
- Schwenninger, H.R. (2015) Revision of the Western Palaearctic species of the *Andrena taraxaci*-group with description of four new species (Hymenoptera: Andrenidae). *Stuttgarter Beiträge zur Naturkunde A, Neue Serie*, 8, 251–270.
- Warncke, K. (1965) Beitrag zur Kenntnis der Bienengattung *Andrena* Fabricius in Griechenland. *Beiträge zur Entomologie*, 15, 27–76.
- Warncke K. (1967) Beitrag zur Klärung paläarktischer *Andrena*-Arten. *Eos*, 43, 171–318.
- Warncke, K. (1968) Die Untergattungen der westpaläarktischen Bienengattung *Andrena* F. *Memórias e Estudos do Museu Zoológico da Universidade de Coimbra*, 307, 1–110.
- Warncke, K. (1975) Die Sandbienen der Türkei (Hymenoptera, Apoidea, *Andrena*), Teil B. *Mitteilungen der Münchner Entomologischen Gesellschaft*, 65, 29–102.
- Warncke, K. (1980) Zur Verbreitung der Bienengattung *Andrena* F. in Tunesien. *Mitteilungen der Münchner Entomologischen Gesellschaft*, 70, 86–87.
- Warncke, K. (1992) Die westmediterranen Arten der Bienen *Osmia* subg. *Hoplitis* Klug, 1807. *Linzer Biologische Beiträge*, 24, 103–121.
- Westrich, P. (1989) Die Wildbienen Baden-Württembergs. Eugen Ulmer, Stuttgart, 972 pp.
- Wood, T.J. (2020). Description of a remarkable new *Andrena* species (Hymenoptera: Andrenidae) from Syria. *Zoology in the Middle East*, 66, 262–268.  
<https://doi.org/10.1080/09397140.2020.1782580>
- Wood, T.J. & Roberts, S.P.M. (2018) Constrained patterns of pollen use in Nearctic *Andrena* (Hymenoptera: Andrenidae) compared with their Palaearctic counterparts. *Biological Journal of the Linnean Society*, 124, 732–746.  
<https://doi.org/10.1093/biolinnean/bly080>
- Wood, T.J., Michez, D., Cejas, D., Lhomme, P. & Rasmont, P. (2020a) An update and revision of the *Andrena* fauna of Morocco (Hymenoptera, Apoidea, Andrenidae) with the description of eleven new North African species. *Zookeys*, 974, 31–92.  
<https://doi.org/10.3897/zookeys.974.54794>
- Wood, T.J., Boustani, M. & Rasmont, P. (2020b) A revision of the *Andrena* (Hymenoptera: Andrenidae) of Lebanon with the description of six new species. *Annales de la Société entomologique de France*, 56, 279–312.  
<https://doi.org/10.1080/00379271.2020.1794960>