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To cite this article: Pierre Rasmont & Thomas J. Wood (2024) An enigmatic Anthophorine bee from the south of France revealed as a new species: *Anthophora (Paramegilla) ahlamae* n. sp. (Hymenoptera: Apidae), *Annales de la Société entomologique de France (N.S.)*, 60:2, 151-165, DOI: [10.1080/00379271.2024.2325688](https://doi.org/10.1080/00379271.2024.2325688)

To link to this article: <https://doi.org/10.1080/00379271.2024.2325688>



Published online: 10 Apr 2024.



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## An enigmatic Anthophorine bee from the south of France revealed as a new species: *Anthophora (Paramegilla) ahlamae* n. sp. (Hymenoptera: Apidae)

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(Accepté le 26 février 2024 ; publié en ligne le 10 avril 2024)

**Summary.** A bee specimen identified as *Anthophora planca* Pérez, 1895, from France, was discovered in collections of Museum für Naturkunde, Berlin. This male specimen presents a morphology that does not conform to any of the *Anthophora* Latreille, 1803 species known from France, or indeed from Europe. After careful examination, it cannot be identified as *Anthophora planca* Pérez which is considered to be a *nomen dubium* (type lost), but furthermore it does not belong to any currently described species. Additional specimens of this species were collected in Morocco, Spain (Melilla) and Algeria. The new species is named *Anthophora (Paramegilla) ahlamae* Rasmont & Wood, n. sp. The new species is documented by numerous high-resolution photographs. Its diagnosis is compared with the near species *Anthophora (Paramegilla) gallica* (Dalla Torre & Friese, 1895) and *A. (Paramegilla) podagra* Lepeletier, 1841. DNA barcodes data are presented, allowing for confirmation of placement within the subgenus *Paramegilla* Friese, 1897. A detailed distribution map is provided along with ecological observations. *Anthophora ahlamae* n. sp. may be specialised on flowers of the genus *Ballota* L. (Lamiaceae).

**Résumé.** Une énigmatique abeille Anthophorine du sud de la France se révèle être une nouvelle espèce : *Anthophora (Paramegilla) ahlamae* n. sp. (Hymenoptera : Apidae). Une abeille identifiée *Anthophora planca* Pérez, 1895, provenant de France, est découverte dans les collections du Museum für Naturkunde, Berlin. Ce spécimen mâle présente une morphologie différente de toutes les autres espèces de France et du reste de l'Europe. Un examen approfondi de ce spécimen montre qu'il ne correspond pas à la description d'*Anthophora planca* Pérez, *nomen dubium* (type introuvable). L'espèce nouvelle est nommée *Anthophora (Paramegilla) ahlamae* n. sp. Outre l'unique spécimen de France, cette espèce a été découverte au Maroc, en Espagne (Melilla) et dans l'ouest de l'Algérie. L'espèce nouvelle est documentée par de nombreuses photographies de haute résolution. Sa diagnose est comparée aux espèces proches *Anthophora (Paramegilla) gallica* (Dalla Torre & Friese, 1895) et *A. (Paramegilla) podagra* Lepeletier, 1841. Les codes-barres ADN permettent de préciser ses affinités parmi le sous-genre *Paramegilla* Friese, 1897. Une cartographie détaillée est fournie ainsi que des précisions sur son écologie. *Anthophora ahlamae* n. sp. apparaît spécialisée dans la visite des fleurs de Lamiacées du genre *Ballota* L.

<https://zoobank.org/References/A0C106FF-913B-461D-B2D3-03181A0C0EE1>

**Keywords:** phylogeny; taxonomy; morphology; DNA barcodes; Morocco; France

As part of investigations into Palaearctic *Anthophora* Latreille, 1803, while revising the material of the Museum für Naturkunde, Berlin, we found a specimen of an enigmatic undated *Anthophora (Paramegilla)* species captured in south-eastern France. This male specimen presents a morphology that does not conform to any of the *Anthophora* species known from France, or indeed from Europe. After careful examination of *Anthophora* types in most European museums, we discovered that it does not belong to any currently described species. Additionally, based on the inspection of additional museum material and new collections, we found further specimens of this

species that were collected in Morocco, Spain (Melilla) and Algeria.

The aim of this paper is to describe this new species and to discuss its distribution, ecology, and its surprising presence in France and the wider European wild bee fauna more broadly.

### Materials and methods

#### Illustrations

Specimens were photographed with the device described in Rasmont et al. (2021): Camera Olympus OMD EM1 (Olympus

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corporation, Japan, Tokyo), lens Zuiko 60 mm f:2.8 macro or lens Zuiko Pro 90 mm f:3.4 (Olympus corporation, Japan, Tokyo). The higher magnifications (more than 2×) were obtained by the addition of a focal multiplier Zuiko MC20 and the highest magnifications by adding a Mitutoyo Plan Apo 10× (Mitutoyo corporation, Japan, Kanagawa) in front of the Zuiko 60 mm + focal multiplier MC20, to reach an enlargement ratio of 20×. Photos were stacked using the software Helicon Focus v.7.6.3 Pro (Ukraine, Kharkiv) Post processing was made using with Photoshop Elements 2020 v.18.0 (Adobe inc., USA, California, San Jose) and Topaz Sharpen Ai v.4.1.0 (Topaz Labs, USA, Texas, Dallas). All data were databased and mapped with Data Fauna Flora v.5.2.3 (Barbier et al. 2000–2023).

Because of the stacking process itself, scales taken during photography are actually artefacts. We here represented a recovered scale-bar only for each body profile photograph. This scale is obtained by restacking the final stacked image with one single scaled photograph focused on the left tegula. Such a recovered scale is not fully accurate as it represents only the measurement of the tegula slice (somewhere in the middle of about 100 slices with digressing focal). It could be seen nevertheless as a usable approximate scale. Such scale recovery has not been possible for other pictures.

### Morphological concepts

Subgeneric concepts follow Brooks (1988). Morphological terminology follows Iuga (1958), Brooks (1988) and Michener (2007). The more or less triangular and differentiated apical part of the gonocoxae remains unnamed in these publications. With bumblebees, it is usual to name it “volsella” (Rasmont et al. 2021). However, in Anthophorini, this part is not an individualised sclerite but just a more or less differentiated apical segment of the gonocoxa. The finger-like internal appendix at top of gonocoxa is named here “gonostylus” to follow Iuga (1958) and Brooks (1988).

### DNA barcoding

Some recently captured *Anthophora* specimens were sent for genetic barcoding: a single foreleg or mid leg was removed from pinned specimens and sent to the Canadian Center for DNA barcoding (CCDB) in Guelph, Canada, for DNA extraction and sequencing; specimens were sequenced following standardised high-throughput protocols (Ivanova et al. 2006). BeeCox1F1/BeeCox1R2 primers were used to target the COI-5 region (Bleidorn & Henze 2021). All sequences are published on the Barcode of Life Database (BOLD) website under the dataset dx.doi.org/10.5883/DS-PALANTHO. Phylogenetic trees were supplemented with additional published sequences (Schmidt et al. 2015). Sequences were aligned using MAFFT (Katoh & Standley 2013). Aligned sequences were analysed in Seaview (Gouy et al. 2010) using a maximum likelihood analysis (GTR + G with no partitioning) which was run with 1000 bootstraps. Intra- and interspecific distances were calculated using MEGA-X (Kumar et al. 2018). Only branches with bootstrap support of 75 or higher are marked as such.

### Abbreviations

The following abbreviations are used: **CSE** Personal collection of Christian Schmid-Egger, Berlin, Germany; **ISR** Institut Scientifique de Rabat, Université Mohammed V, Rabat, Morocco (including International Center for Agricultural Research in the Dry

Areas (ICARDA) collection); **MCAT**, Museum of Central Africa, Tervueren, Belgium; **MNHN** Muséum national d’Histoire naturelle, Paris, France; **OÖLL** Oberösterreichs Landesmuseum, Linz, Austria; **RMNH** Naturalis Biodiversity Center, Leiden, the Netherlands; **TJWC** Personal collection of Thomas J. Wood, Leiden, the Netherlands; **UMH** Laboratory of Zoology collection (including P. Rasmont collection), University of Mons, Hainaut, Belgium; **ZMHB** Museum für Naturkunde, Berlin, Germany. All geographical coordinates are cited verbatim.

## Results

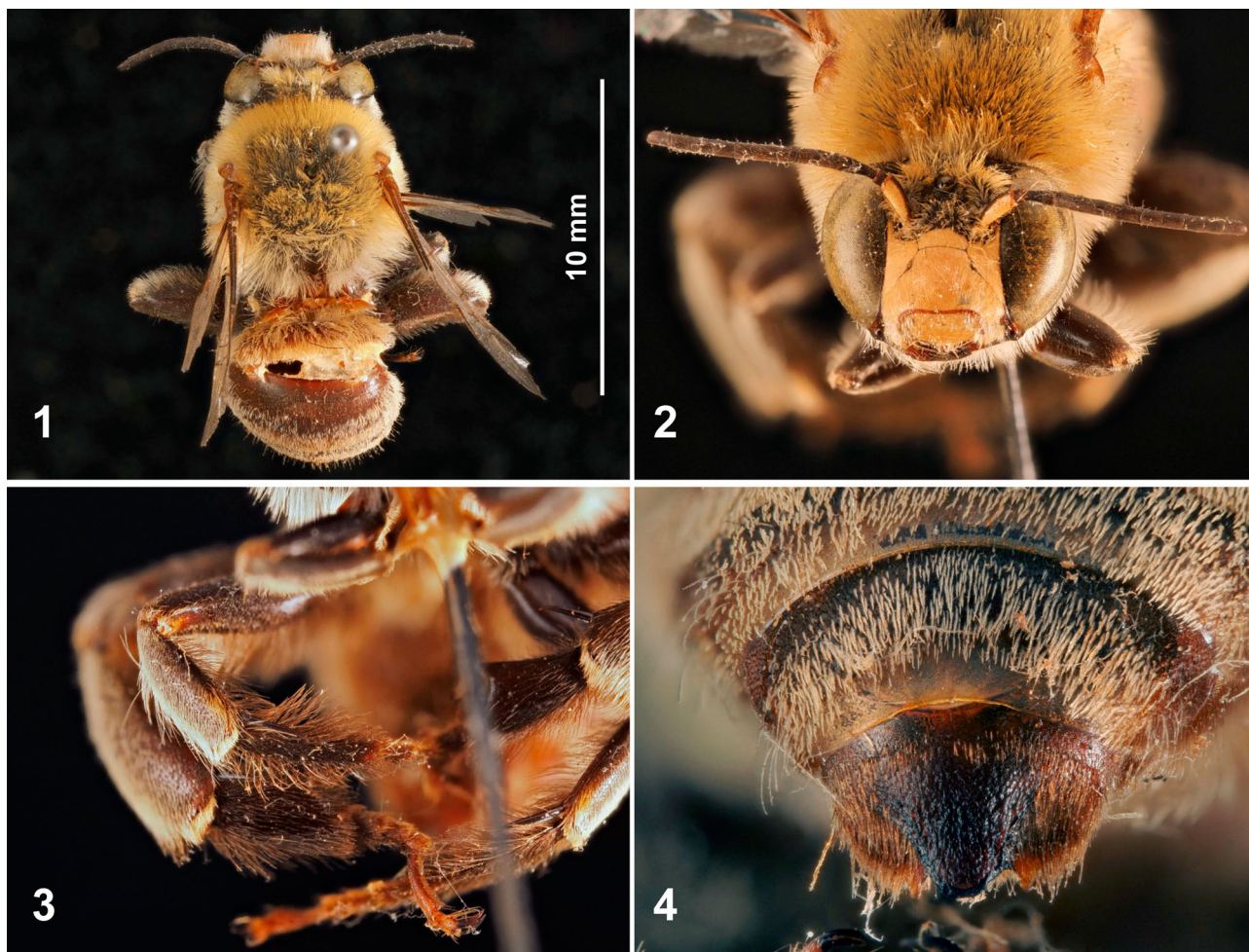
### *The French specimen from the Museum für Naturkunde, Berlin*

This specimen (Figures 1–4) displays the following labels: (1) hand-written: “Draguignan Süd-Frankreich R. Meyer” [likely Rheinhold Meyer, well known as a *Thyreus* Panzer, 1806 specialist]; (2) hand-written “*Anthophora planca* J. Pér. ♂”, printed “Alfken det.”; (3) printed “det. P. Rasmont 2017 *Anthophora (Paramegilla) planca* Pérez, 1895”

Unfortunately, the specimen is undated. Meyer (1892–1944) was active in the early part of the twentieth century, for example publishing on *Thyreus* in 1921 (Meyer 1921). Most of his collection is lost, with some small parts remaining in the Hessischen Landesmuseum Darmstadt (see Harris 2016). It seems likely that the specimen was collected between 1910 and 1930, possibly as late as 1939 before the outbreak of the Second World War.

Following the name used by Alfken, we searched for the type of *Anthophora planca* Pérez, 1895 in the MNHN, without success. However, after careful examination of the Draguignan specimen, we concluded that it does not fit at all with the description of *A. planca*. *Anthophora planca* was described only in the male sex, and Pérez (1895, p. 1) placed it in the same group of species as *A. blanda* Pérez, 1895 which was itself compared to *A. femorata* (Olivier, 1789). These species belong to the subgenus *Paramegilla* Friese, 1897, and hence we can be reasonably confident that the true *A. planca* is also a *Paramegilla* species.

Based on the description, the principal differences are that (1) *A. planca* is described as having the metasoma with wide bands of white hairs on the tergal margins, whereas the Draguignan specimen has a metasoma predominantly covered with squamous yellowish hairs; (2) *A. planca* is described as having the legs generally with black hairs, though those below the anterior tarsi are long and white, and the mid and hind tibiae have a line of white scaly hairs, whereas the Draguignan specimen has long whitish hairs on anterior tarsi and nearly all black hairs and mid and hind tibiae all covered with short yellowish hairs; and finally (3) *A. planca* is described as having the hind basitarsus strongly broadened, with its internal margin produced into a rounded or blunt angle



**Figures 1–4.** “*Anthophora planca*” (recte *A. ahlamae* n. sp.) from the location Draguignan, Southern France (ZMHB). **1**, dorsal view; **2**, face; **3**, legs; **4**, pygidial area (photos P. Rasmont).

(“*angle mousse*”), whereas the Draguignan specimen has the hind basitarsus strongly broadened with its internal margin produced into a strong tooth that is clearly pointed apically. This Draguignan specimen therefore cannot correspond to *A. planca*. Given that the type material of *A. planca* cannot be found despite our searches in the MNHN, that there is no entry for this taxon in the catalogue of Pérez which contains additional unpublished information on specimens including capture locations and dates (meaning that the *locus typicus* of *A. planca* is currently unknown since Pérez described species from across the West Mediterranean in this work, e.g. see Wood 2023), and that there is no clear *Anthophora* species that corresponds to this description, we therefore consider *A. planca* to be a nomen dubium until such time as the original type series can be located.

In addition, during recent field work in Morocco, we discovered numerous male specimens that closely resemble the Draguignan specimen, with associated females. This taxon clearly belongs to the subgenus *Paramegilla* as delineated by Brooks (1988), and does not

match any known members of this subgenus. It is therefore described as new here as *A. ahlamae* n. sp. This new species shows a morphology close to *Anthophora podagra* Lepeletier, 1841. Given its historical presence in France, it could have co-occurred with *Anthophora gallica* Dalla Torre & Friese, 1895, with some risk of confusion.

***Anthophora (Paramegilla) ahlamae* n. sp.**

**Material**

**Holotype.** ♂, Morocco, Safi, 32.2587°N 9.2387°W, 14.V.2023, leg. A. Sentil, reference code ASSA1430, deposited in MCAT.

**Paratypes.** Morocco, same collecting information as holotype. Deposited in MCAT: N°04 1♀ ASSA1423; N°05 1♀ ASSA1426. Deposited in ISR: N°11 1♀ ASSA1458; N°12 1♂ ASSA1431 TJW\_1577; N°06 1♀ ASSA1428. Deposited in PR coll. (UMH): N°02

1♀ ASSA1432; N°03 1♀ ASSA1425. Deposited in TJWC: N°01 1♂ ASSA1440 TJW\_1558; N°13 1♀ ASSA1433 TJW\_1575; N°14 1♀ ASSA1427 TJW\_1576. Deposited in RMNH: N°07 1♀ ASSA1429; N°08 1♀ ASSA1434. Deposited in OÖLL: N°09 1♀ ASSA1443. Deposited in MNHN: N°10 1♀ ASSA1457. Ahlam Sentil indicated that all specimens were collected on the same foraging plant, *Ballota hirsuta* Bentham (Lamiaceae; Figure 42).

#### **Additional examined material (non-type)**

**Algeria.** 2♂, 1♀, Oran [35.69°N, 0.64°W], [undated], labelled “Oran”, “*Anthophora valga* Kl” (ZMHB).

**France.** 1♀, Var, Draguignan [43.5356°N, 6.4691°E], [undated], leg. R. Meyer (ZMHB).

**Morocco.** 1♂, 1♀, Aït Baha 10 km SEE [30.0250°N –9.06416°W] ca. 1000 m, 14.IV.2015, leg. C. Schmid-Egger (CSE); 1♀, Aghbalou Aqorar, Azzaba [33.8622°N –4.7105°W] 671 m, 20.VII.2018, leg. L. Hamroud & P. Lhomme, reference code “ICARDA10489”, *Cucurbita pepo* (ISR); 1♀, Laoussar [33.6234°N –4.9001°W] 1474 m, 23.VII.2018, leg. L. Hamroud & P. Lhomme, reference code “ICARDA10471”, Lamiaceae (ISR); 3♀, Sidi Ahmed Ben youssef, Mojou [33.8078°N –4.7623°W] 826 m, 19.VI.2019, leg. L. Hamroud & P. Lhomme, reference codes “ICARDA21680 – ICARDA21682 – ICARDA21683”, *Marrubium vulgare* (ISR); 1♀, Sidi Boukil [32.2208°N –4.7581°W] 1486 m, 26.VII.2018, leg. O. Ihsane, reference code “ICARDA06068”, *Lycopersicon esculentum* (ISR); 1♂, 1♀, 15 km SSE Tafraout [Merchich 29°38'02"N –08°56'40"W] 1490 m, 29.V.1998, leg. P. Rasmont, reference code “PR98\*087”, *Ballota hirsuta* subsp. *anteatlantica* (UMH); 1♂, El Jabha [Merchich 35°11'16"N –04°39'27"W] 260 m, 23.V.1996, leg. P. Rasmont, *Ballota hirsute* (UMH); 1♂, Nif Debdou [Merchich 34°02'00"N –3°08'33"W] 800 m, 20.V.1994, leg. Y. Barbier, *Ballota hirsute* (UMH); 2♂, 1♀, Pont Hassan II [Merchich 34°54'31"N –2°38'33"W] 70 m, 21.V.1994, leg. P. Rasmont, *Ballota hirsute* (UMH); 1♂, Tafoughalt [Merchich 34°51'48"N –2°26'10"W] 300 m, 23.V.1994, leg. P. Rasmont, *Ballota hirsute* (UMH); 1♂, 12♀, Tighboula [Merchich 32°35'46"N –6°02'16"W] 730 m, 8.VI.1996, leg. P. Rasmont, *Ballota hirsute* (UMH).

**Spain.** 3♂, 1♀, env. Melilla [35.3167°N 2.9500°W] 1–6.VI.1955, leg. N.F. d'Andrade (RMNH).

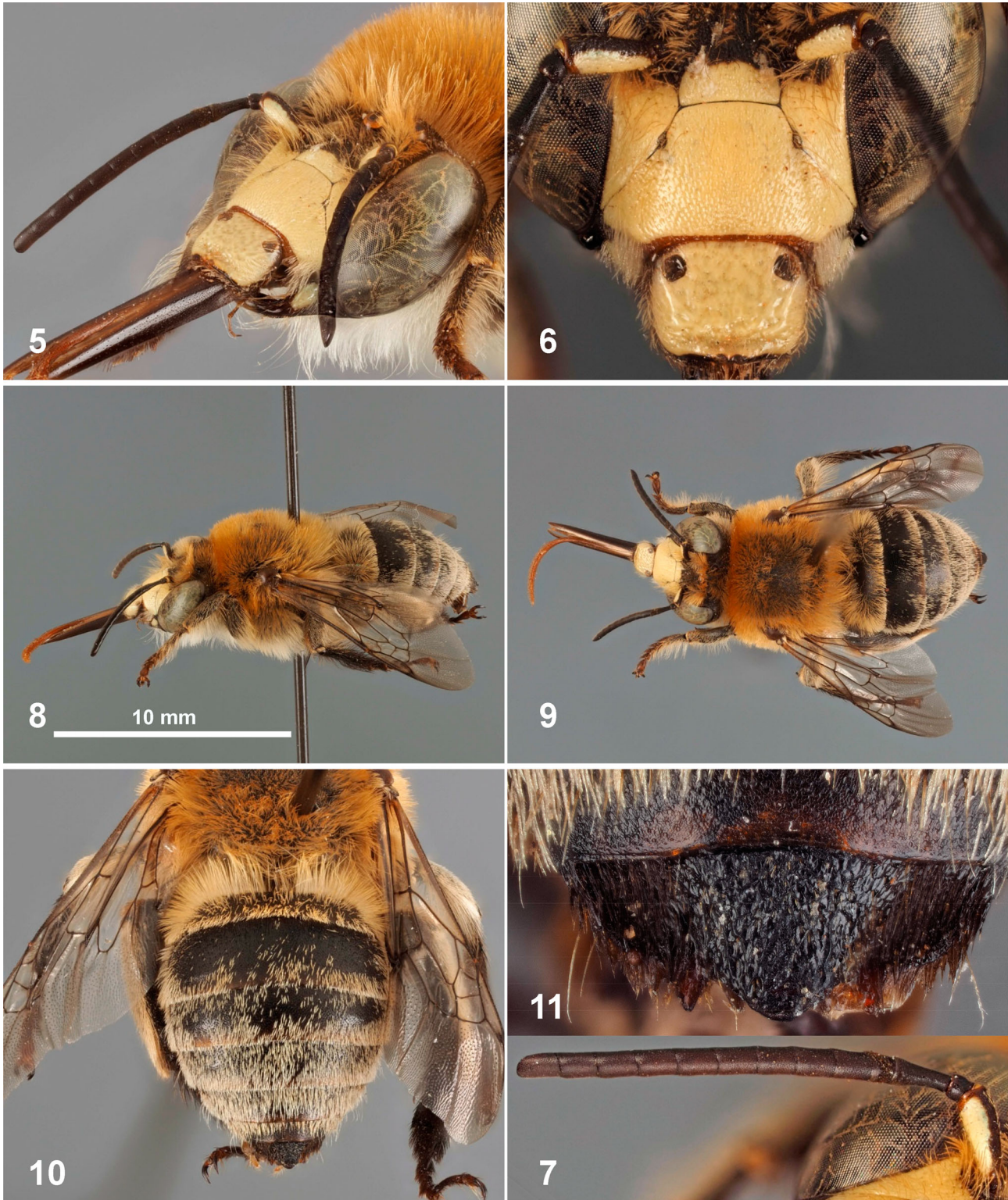
#### **Description**

**Male.** Length: 16 mm. Interlar width = 4 mm. Head: face with pale yellow markings at base of mandible, labrum

(except for two small black spots basolaterally), clypeus (with exception of two very small black points along junction with lower paraocular areas), paraocular areas, ventral part of supraclypeal area, and ventral face of scape (Figure 5). Labrum rectangular, slightly broader than long, anterior margin with weakly raised carina, medially weakly emarginate; underlying surface polished and shining, with irregular large and shallow punctures, punctures separated by 0.5 puncture diameters (Figure 6). Clypeus is wider than long, weakly domed, densely covered with slightly elongate punctures converging towards small median triangle along anterior margin where punctures are vertical (Figure 6). Face below antennal insertions with sparse short pale pubescence, becoming longer and light brown on frons and vertex; gena with abundant long white hairs, longest ventrally, exceeding length of scape. Mandibles curved, slightly crossing apically, with subapical inner tooth. Antennae: A3 apical width = 1; length of articles (measured in the middle): A3 = 4.0; A4 = 1.0; A5 = 2.6; A6 = 3.0; the A5 has a trapezoidal profile (Figure 7).

Mesosoma: Scutum, scutellum, mesepisternum, and propodeum covered with uniform dense network of punctures, punctures separated by <0.5 puncture diameters, almost confluent, puncture rims raised, thus forming appearance of fine network of raised reticulation, surface dull to weakly shining. Mesepisternum with pale weakly plumose hairs, becoming slightly shorter on scutum and scutellum, hairs here light brown (Figures 8, 9). All legs with cuticle black. Forelegs entirely covered with light brown to grey hairs, except for the apical tarsal segments (Figure 8). Mid legs (Figure 13) with tibiae covered with short light brown hairs dorsally, laterally with weak fringe of yellowish hairs 1.5 times wider than width of tibiae, mid basitarsi with anterior and posterior fringes of long intermixed black and light brown hairs, hairs 2 times width of basitarsus, tarsal segments with black hairs. Hind legs (Figure 14) with weakly swollen femora and tibiae, femora with long light-brown to greyish erect hairs, hind tibiae entirely covered with short, decumbent, and strongly plumose yellowish-brown hairs, collectively almost scaly; hind basitarsi covered with long semi-erect black hairs intermixed with occasional grey hairs, remaining tarsal segments with black hairs. Viewed laterally, outer face of hind basitarsus with very strong tooth medially on ventral margin, tooth pointing towards apex of basitarsus, thus presenting long straight ventral margin. Viewed posteriorly, inner face of basitarsus presents pronounced longitudinal carina along ventral margin, this carina forming base of tooth which can be considered three-dimensional carina (Figure 15). Wings hyaline, venation dark brown, nervulus interstitial (Figure 20).

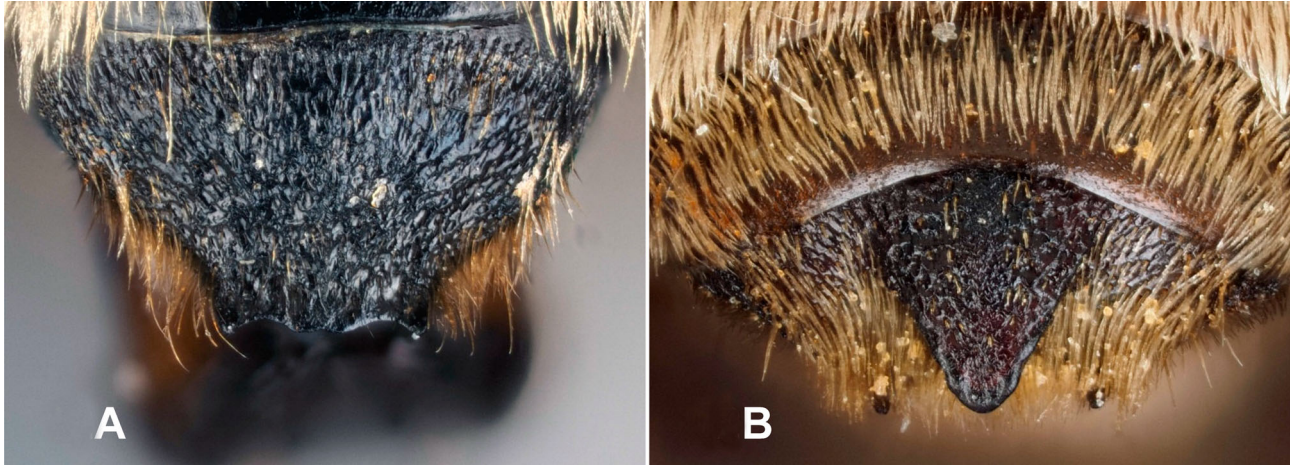
Metasoma: Tergal discs dark, apical margins moderately lightened hyaline-yellow-brown. Terga densely



**Figures 5–11.** *Anthophora ahlamae* n. sp., holotype male. 5, head; 6, face; 7, antenna; 8, left profile; 9, dorsal view; 10, metasoma; 11, pygidial area (photos P. Rasmont).

punctate with shallow punctures, punctures separated by 0.5–1 puncture diameter, underlying surface shagreened, weakly shining. T1 with light brown hairs equalling

length of mesosomal hairs, with thin hairband along apical margin composed of short hairs the same colour (Figure 10). Surface of T2–3 with few short thin black



**Figure 12.** *Anthophora* spp., male pygidial area. **A**, *A. gallica*; **B**, *A. podagra* (photos P. Rasmont).



**Figures 13–15.** *Anthophora ahlamae* n. sp., holotype male. **13**, right mid leg; **14**, right hind leg; **15**, right hind basitarsus, internal view (photos P. Rasmont).

hairs basally, predominantly covered with adpressed short light brown hairs, these moderately dispersed and not obscuring underlying surface; surface of T4–6 entirely

covered with adpressed short light brown hairs, in fresh specimens obscuring underlying surface, scarce inter-mixed erect black hairs, laterally with scattered erect



**Figures 16–19.** *Anthophora ahlamae* n. sp., male, Melilla 2.VI.1955 (RMNH). **16**, genitalia dorsal view; **17**, left extremity of gonocoxite and gonostylus; **18**, sternum 7; **19**, sternum 8 (photos P. Rasmont).



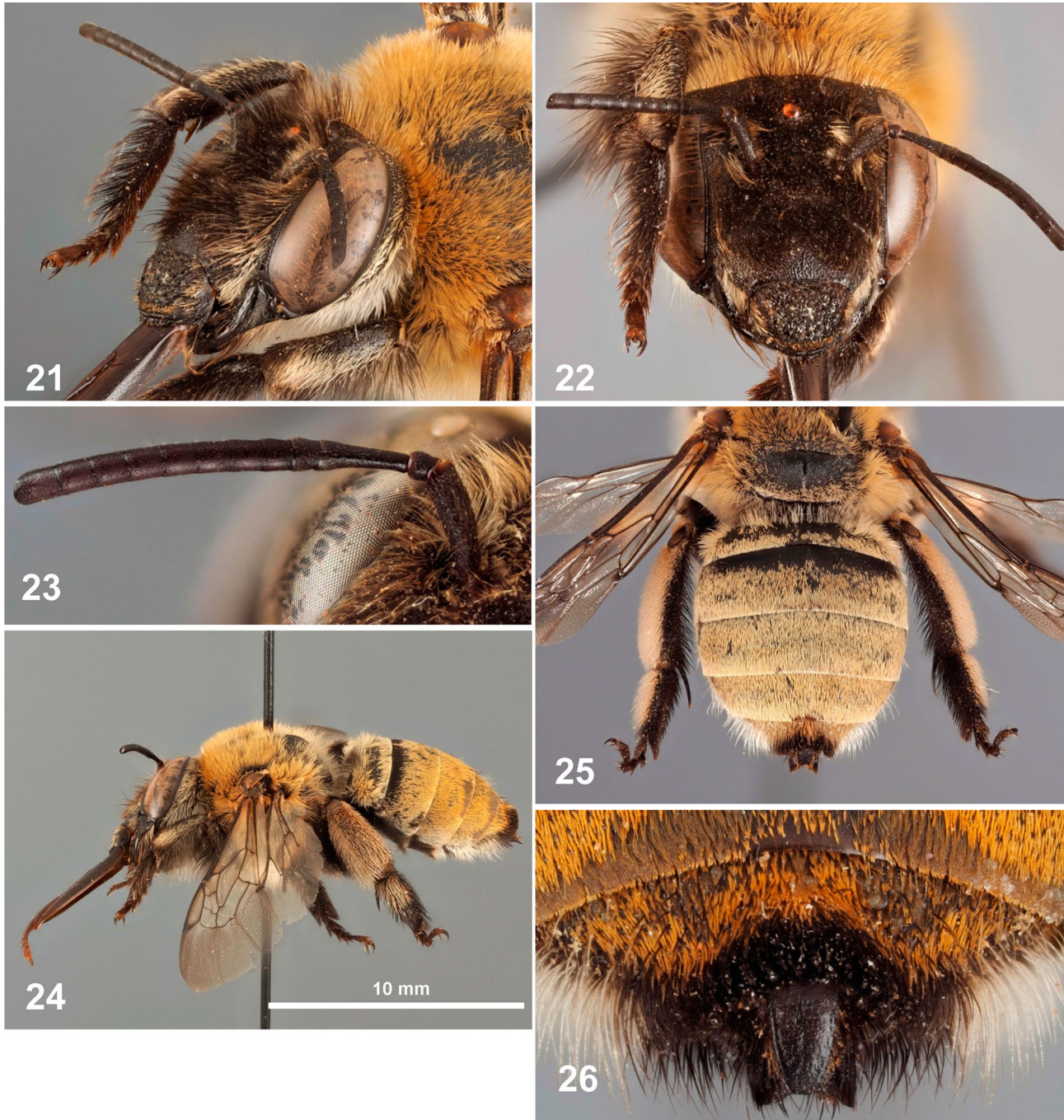
**Figure 20.** *Anthophora ahlamae* n. sp., holotype male, left wings (photo P. Rasmont).

light brown hairs. T7 covered with dark brown hairs laterally, medially with rounded and poorly defined pygidial plate, laterally with two small weakly pointed teeth

(Figure 11). Abdominal sterna apically with long yellowish-brown hairs, shorter terminal sterna; discs of S1–3 with long dark brown hairs, most strongly produced on S3. Genitalia (Figures 16, 17) compact, quadrate in dorsal view. Gonocoxae apically produced into triangular segment densely covered with slightly plumose light brown hairs. Gonostylus finger-like, hyaline, 2.5 times longer than wide, apex rounded, with fringe of long golden hairs. Sterna 7 and 8, see Figures 18, 19.

**Female.** Length: 16–17 mm; interalar width = 4 mm. Head: Cuticle black with exception of apex of mandibles lightened olive-yellow. Labrum rounded trapezoidal, surface covered with coarse network of irregular shining ridges, covered with short greyish hairs. Clypeus wider than long, more or less flattened either side of a weak longitudinal mid-line, with strong and dense punctuation, punctures almost confluent, densely covered with black to dark brown short erect hairs (Figure 21); hairs extending into frons, vertex with





**Figures 21–26.** *Anthophora ahlmae* n. sp., female. **21**, head of paratype 3; **22**, face of paratype 3; **23**, right antenna of paratype 2; **24**, left profile of paratype 3 (with 10 mm scale bar); **25**, metasoma of paratype 2; **26**, pygidial area of paratype 3 (photos P. Rasmont).

light brown to yellowish-brown hairs; gena with abundant long whitish hairs, exceeding length of scape. Antennae black; distal width of A3=1.2; length of articles (measured in the middle): A3=3.2; A4=1.0; A5=1.1; A6=1.2; A4–6 slightly swollen. (Figure 23).

Mesosoma: Structurally as in male; mesepisternum covered with erect and short pale pubescence, becoming

slightly shorter on scutum and scutellum, hairs here light brown (Figure 24). Legs dark, forelegs covered with mixture of erect black and yellowish-brown hairs. Mid legs (Figure 27) covered with erect yellowish-brown hairs on femorae and tibiae, almost adpressed on tibiae; tarsi with mixture of predominantly black and yellowish-brown short erect hairs. Hind legs (Figure 28) with short erect black



**Figures 27–29.** *Anthophora ahlamae* n. sp., female. **27**, left mid leg of paratype 2; **28**, right hind leg of paratype 2; **29**, female paratype 3 left wings (photos P. Rasmont).

hairs on trochanters, femora, and posterior face of tibiae. Tibial scopae composed of silvery whitish simple hairs, extending to cover external face of hind basitarsi. Posterior faces of hind basitarsi covered with long but flattened black hairs, in dorsal view opposing faces of hind basitarsi thus strongly contrasting. Wings hyaline, venation dark brown, nervulus slightly ante-furcal or nearly interstitial (Figure 29).

Metasoma: T1 basally with similar hairs to mesosoma, apically with very short adpressed yellow-brown hairs, medially with sparse short erect black hairs (Figure 25). T2–5 entirely covered with short adpressed yellow-brown hairs that obscure underlying surface with exception of base of T2 and apex of T5, apex of T5 covered with long dense pile of dark brown to black hairs forming dense brush, brush overlying pygidial plate. T6 adjacent to pygidial plate with two pencil-like tufts of parallel black hairs (Figure 26); pygidial plate apically rounded, surface covered with fine transversal striations, lateral margin

weakly raised. S2–5 with thin brushes of long erect yellowish hairs on hind margins.

#### **Diagnosis**

*Paramegilla* is the most species-rich subgenus in *Anthophora*, including about 85 species, mainly from the Palearctic region with around 20 species from Eastern Africa and only two from the Nearctic. Males are easily recognised by their hind legs which are strongly modified with more or less inflated femora and tibiae, the hind basitarsus generally with a bump, strong tooth, or conspicuous carina along its anterior margin, and by the T7 with a poorly delineated pygidial plate and frequently with two lateral teeth. Females generally have a weakly swollen clypeus and more or less rounded labrum of small size more or less surrounded by the lateral lobes of the clypeus. Both sexes show a short and even coat that is somewhat velvet-like on the thorax and adpressed on the



**Figures 30–33.** *Anthophora* spp., males. **30–31**, Hind legs: **30**, *A. gallica* [France, Hérault, Montagnac, 19.V.2022, leg. B. Louboutin]; **31**, *A. podagra* [France, Vaucluse, Gordes, 24.VII.1993, leg. G. Le Goff]. **32, 33**, Left extremity of gonocoxite and gonostylus: **32**, *A. gallica* [France, Hérault, Montagnac, 19.V.2022, leg. B. Louboutin]; **33**, *A. podagra* [France, Bouches-du-Rhône, Eygalières, 9.VII.1989, leg. R. Fonfria] (photos P. Rasmont).

metasoma. While males are easily assigned to *Paramegilla*, females are quite difficult to separate from other short-haired species of other subgenera, such as *Mystacanthophora* Brooks, 1988. *Paramegilla* are generally medium sized species, from 12 to 16 mm in length (maximum 9.5–24 mm after Brooks 1988). *Paramegilla* generally fly in the summer while most other *Anthophora* subgenera only fly in spring or even in winter. The only other predominantly summer-flying subgenus is *Heliophila* Klug, 1807, that includes generally much smaller species (most species being 7–12 mm in length).

*Anthophora ahlmae* is easily distinguishable from other *Paramegilla* in the female sex by its flattened clypeus covered with dark brown to black erect hairs, in the male sex by its hind basitarsus which is covered with black semi-erect hairs, the basitarsus presenting a sub-medial acute tooth along its anterior margin, this tooth elongate and produced into a strong oblique carina on the posterior

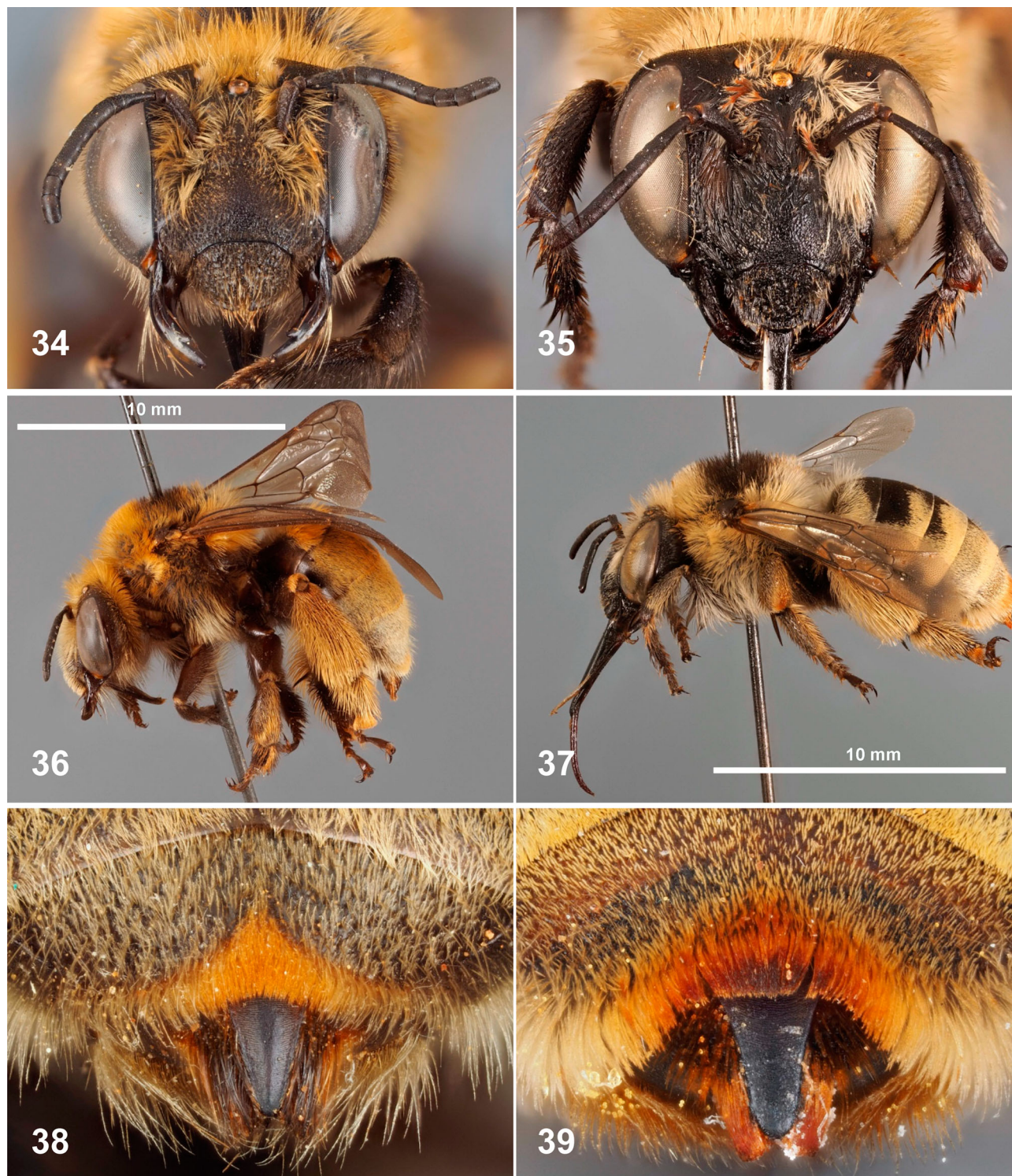
face of the basitarsus, and in both sexes by the colour scheme with the scutum covered with yellowish-brown short erect hairs without any intermixed black hairs and the metasoma covered with very short adpressed hairs. This character combination is unique. The most similar species is *A. podagra*, but some confusion could be possible too with *A. gallica*; for comparative diagnosis, see Table 1.

#### Etymology

The species is dedicated to Dr Ahlam Sentil (Safi, Morocco), an active Moroccan specialist of wild bees, who collected the specimens of the type series.

#### Genetics

A single barcode was generated for the new species, along with additional barcodes for other members of



**Figures 34–39.** *Anthophora* spp., females. **34, 35,** Faces: **34,** *A. gallica* [France, Bouches-du-Rhône, La Crau, 10.VI.1999, leg. A. Foucart]; **35,** *A. podagra* [France, Bouches-du-Rhône, Eygalières, 9.VII.1997, leg. R. Fonfria]. **36, 37,** Left profiles: **36,** *A. gallica* [*idem* Figure 34]; **37,** *A. podagra* [*idem* Figure 35]. **38, 39,** Pygidial areas: **38,** *A. gallica* [*idem* Figure 34]; **39,** *A. podagra* [*idem* Figure 35] (photos P. Rasmont).

the subgenus *Paramegilla* (Figure 40). Genetically, *A. ahlamae* placed closest to *A. balneorum* Lepeltier, 1841 *sensu lato* sequences from France, Spain, and

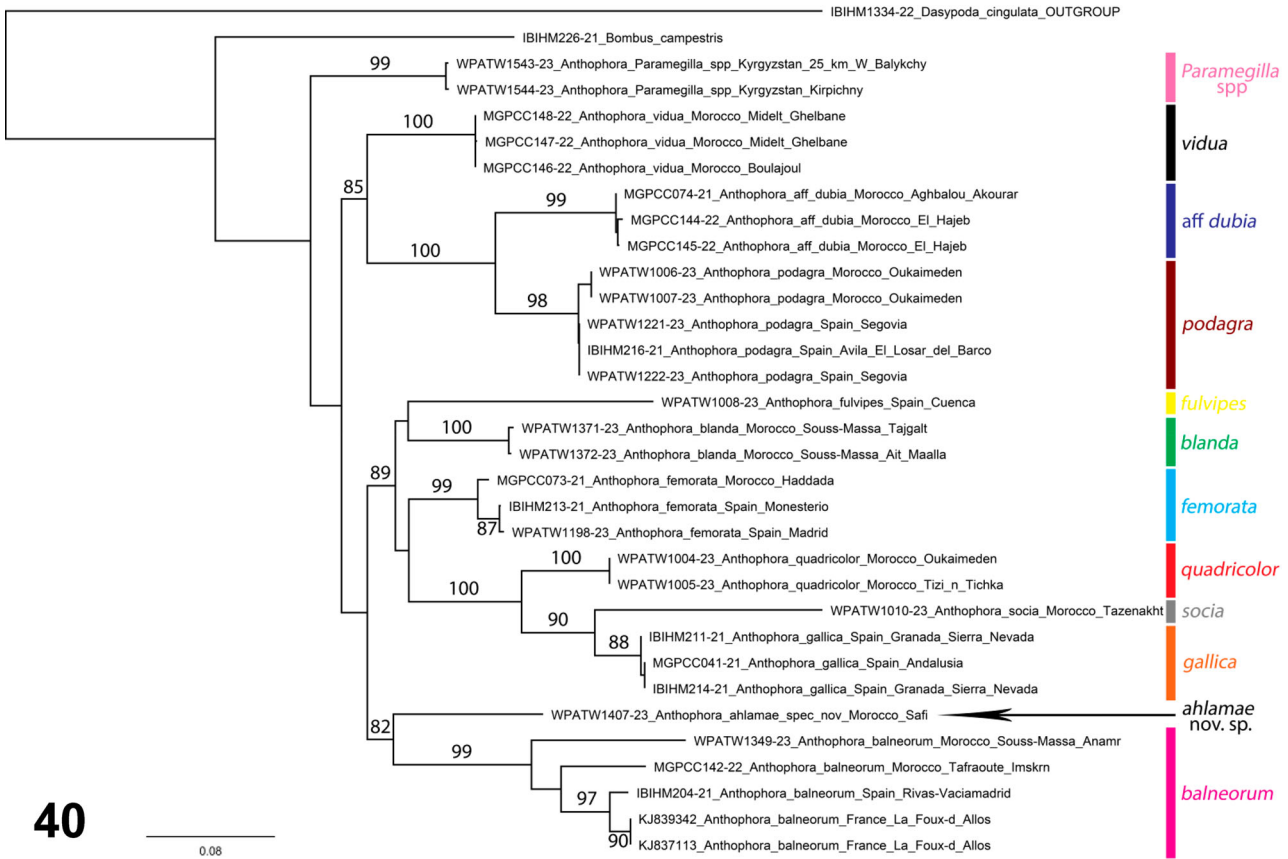
Morocco, though was separated by an average of 16.59% (range 15.80–18.66%). *Anthophora balneorum* itself showed high average intraspecific variation of

**Table 1.** Main distinctive features allowing the identification of *Anthophora ahlamae* n. sp., *A. gallica* Dalla Torre & Friese and *A. podagra* Lepeletier.

Sex	Feature	<i>A. ahlamae</i>	<i>A. gallica</i>	<i>A. podagra</i>
♂	Facial markings	Pale yellow	Pure white	Whitish
	Antennae	A3 width = 1; A3 = 4; A4 = 1; A5 = 2.6; A6 = 6.3 thin antennae with long A3 and A6 (Figure 7)	A3 width = 2.2; A3 = 3.1; A4 = 1; A5 = 2.7; A6 = 3.1 thicker antennae with short A3 and A6	A3 width = 1; A3 = 2.2; A4 = 1; A5 = 1.1; A6 = 1.7 thicker antennae with very short A3 and A6
	Metasoma	T2–6 with relatively short adpressed yellowish-brown hairs (Figures 8–10)	T2–3 with long erect brown hairs, T4–5 with intermixed brown hairs	T2–6 with long and somewhat bent yellowish-brown hairs
	Tergum 7	Large, weakly rounded and poorly defined pygidial plate and two small lateral teeth (Figure 11)	No pygidial plate but two small teeth in the middle then two stronger lateral teeth (Figure 12A)	Large, triangular well-defined pygidial plate and two small lateral teeth (Figure 12B)
	Hind basitarsus	With a strong tooth at the middle of the anterior edge and a strong carina on the posterior face, outer face covered with long semi-erect black hairs (Figures 14, 15)	Without any tooth but with a longitudinal carina, outer face covered with mixed black and greyish hairs (Figure 30)	With a strong tooth in the middle of the anterior edge, outer face covered with short partially adpressed yellowish hairs (Figure 31)
	Gonocoxae	With a subterminal narrowing (Figure 17)	Without a subterminal narrowing (Figure 32)	With a subterminal narrowing (Figure 33)
	Apical part of gonocoxite	Shaped like a thin irregular isosceles triangle (Figure 17)	Shaped like a tooth (Figure 32)	Shaped like an equilateral triangle (Figure 33)
	Gonostyli	Shaped like a thumb, 2.5 times longer than wide, with a rounded apex (Figure 17)	Shaped like a finger, 4 times longer than wide, with a rounded apex (Figure 32)	Shaped like a long finger, 5 times longer than wide, with a more acute apex (Figure 33)
	Head	Clypeus transverse, more or less flattened, covered with dense short erect black or brownish hairs, vertex with black or dark brown hairs (Figure 22)	Clypeus as long as wide, slightly protruding, covered with sparse thin brownish hairs, vertex covered with brownish hairs (Figure 34)	Clypeus as long as wide, slightly protruding, covered with sparse thin brownish hairs, vertex covered with brownish hairs (Figure 35)
♀	Antennae	A3 width = 1.2; A3 = 3.2; A4 = 1; A5 = 1.1; A6 = 1.2	A3 width = 1.4; A3 = 3.2; A4 = 1; A5 = 1.2; A6 = 1.5	A3 width = 1.3; A3 = 3.1; A4 = 1; A5 = 1.1; A6 = 1.3
	Mesosoma	Covered with very short erect yellowish-brown hairs (Figure 24)	Covered with short erect brown hairs, broadly intermixed with black medially (Figure 36)	Covered with short erect yellowish-brown hairs, broadly intermixed with black medially (Figure 37).
	Metasoma	T2–4 mainly covered with short adpressed squamous yellowish brown hairs, intermixed with small erect black hairs in the middle of T2 and T3. T5 with a large triangular brush of black hairs in the middle (Figure 25).	T2–3 covered with adpressed plumose brownish hairs, T4–5 covered with adpressed whitish plumose hairs, T5 with a small triangular brush of reddish hairs in the middle (Figure 36)	T2–4 mainly covered with short adpressed squamous yellowish brown hairs, intermixed with small erect black hairs in the middle of T2 and T3. T5 with a large triangular brush of reddish hairs in the middle (Figure 37)
	Tergum 6	Pygidial plate with a rounded extremity, flattened, its surface covered with fine transversal sculptures and a thin rim all around (Figure 26).	Pygidial plate triangular, weakly keeled, with a quite acute extremity, its surface covered with fine transversal sculptures and a thin rim laterally (Figure 38)	Pygidial plate triangular, flattened, with somewhat concave sides, its surface covered with fine transversal sculptures and a thin rim laterally (Figure 39)
	Wings	Nervulus slightly ante-furcal (Figure 29)	Nervulus inter-furcal (Figure 36)	Nervulus post-furcal (Figure 37)

8.35% (range 0.00–12.90%), though no taxonomic action is taken at the present time. Though morphologically more similar, *A. ahlamae* was strongly separated from *A. podagra* by an average genetic distance of

13.89% (range 13.64–14.14%) and from *A. gallica* by an average genetic distance of 16.75% (range 16.64–16.97%). None of the *Paramegilla* species for which sequences are available were separated by less than



40

Figure 40. Phylogenetic tree (maximum likelihood) of *Anthophora* subgenus *Paramegilla* Friese, 1897, based on the mitochondrial COI gene. Numbers above branches represent bootstrap support (values of <75 are omitted).

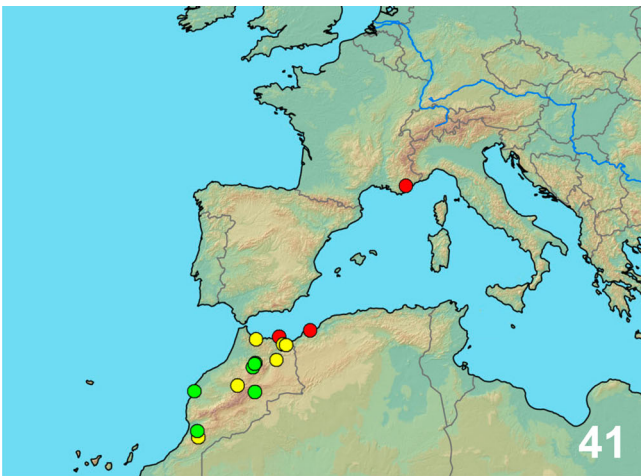


Figure 41–42. *Anthophora ahlamae* n. sp. 41, Geographical distribution. Red dots = before 1970; yellow dots = from 1970 to 1999; green dots = from 2000 to 2023. 42, Female foraging on *Ballota hirsuta* Benthams, Morocco, Safi (photo Ahlam Sentil).

12%. As such, *A. ahlamae* appears to be well defined genetically in the context of the high inter-specific genetic distances found between *Paramegilla* species.

**Distribution**

The species is known mainly from several locations in Morocco, as well as the Spanish exclave of Melilla (Figure 41). Some ancient specimens have been collected

**Table 2.** Foraging plants of *Anthophora ahlamae* n. sp. All observations from Morocco.

Foraging plant	♂	♀
<i>Ballota hirsuta</i> Bentham	9	29
<i>Marrubium vulgare</i> L.	–	3
<i>Lycopersicon esculentum</i> Miller	–	1
<i>Curcubita pepo</i> L.	–	1
Undetermined Lamiaceae	–	1

in Oran (Algeria) not far from the Moroccan border. Only one specimen is known from outside of this area and it is the ancient specimen from Draguignan in southern France. The species has never been seen in this region after this original collection, and given the extensive entomological surveys in this region in recent decades it is likely that it has disappeared. A comprehensive revision of old material from mainland Spain is required to determine if *A. ahlamae* was ever present in the Iberian Peninsula. The species seems to fly across a large altitudinal range, from 70 to 1490 m.

#### Habitat and foraging plants

In Morocco, the species has been collected in semi-arid areas, mostly covered with scattered matorral, and in adjacent cultivated areas with traditional crops. The observed foraging plants are presented in Table 2. It clearly appears that *Ballota hirsuta* is the favourite plant of this species (Figure 42). Pollen analysis is required to determine if *A. ahlamae* is broadly oligolectic on this family, or whether it uses additional host plants as pollen sources.

#### Phenology

The earliest collected specimens (male and female) were observed on 14.IV, with the final records (a female) coming on 26.VII. The peak is in April for both sexes.

#### Discussion

It is very noticeable that most specimens of *A. ahlamae* n. sp. from both sexes have been collected foraging on *Ballota hirsuta*. It may be the case that the species is specialised on this plant, or at least the family Lamiaceae. Several other *Anthophora* from the subgenus *Paramegilla* are foraging specialists: *A. balnearum*, *A. femorata*, and *A. nigrovittata* Dours, 1869 on *Echium* spp. (Boraginaceae; Dours 1869; Amiet et al. 2007; Baldock et al. 2018; Rasmont & Wood, unpublished data); and *A. ireos* (Pallas, 1773) on *Phlomis tuberosa* (Lamiaceae; Osytsnjuk 1978a, b). We suspect that *A. ferruginea* Lepeletier,

1841 may also be specialised on Lamiaceae (Rasmont, unpublished data) and *A. podagra* on Asteraceae subfamily Carduoideae (Wood, unpublished data). Clearly, much fundamental work is needed to clarify the dietary breadths of *Paramegilla* specifically and *Anthophora* more generally.

In southern France, another species of the genus *Ballota* is abundant: *Ballota nigra* L., and the landscape also includes some semi-arid areas with low matorral. That makes the historical occurrence of this species plausible in southern France. However, no specimens have been observed during the past 100 years. It is suspected that the species has vanished from the country. Nevertheless, the regional rediscovery of some bee-species, like *Bombus wurflenii mastrucatus* Gerstäcker, 1869 in Belgium after more than one century (see Debaille & Rasmont 1997), makes such a case of long absence of *A. ahlamae* sampling possible in south France. *Anthophora ahlamae* could be simply a rare element of the French fauna, just waiting to be retrieved. It is noticeable that in the surroundings of Draguignan, the most suitable areas with semi-arid matorral habitats are now included in the very large military camp of Canjuers, in which it is now very difficult or even impossible to perform sampling. It is also noticeable that the species has also not been seen in the Oran region (Algeria) for more than a century, despite recent samplings. Additional study of historical and contemporary collections is required before additional conclusions can be drawn.

#### Acknowledgements

We acknowledge Dr Ahlam Sentil who collected the type series. We acknowledge the following people who helped with collecting in Morocco: Yvan Barbier, Laila Hamroud, Oumayma Ihsane, Patrick Lhomme, Michaël Terzo, all collaborators of the University of Mons (Belgium), and Gérard Le Goff (France). A special acknowledgement for the late Jacques Lambinon (Université de Liège, Belgium) who identified all plant specimens from Morocco. We also acknowledge the FNRS for supporting T.J. Wood (F.R.S.-FNRS Chargé de Recherches), and the expeditions in Morocco in the frame of the P. Rasmont CALYPSO project (1994–1998). We acknowledge the following people who helped in access to institutions: M. Arahou (IS, Rabat), B. Brugge & K. van Achterberg (RMNH), S. Christmann and P. Lhomme (ICARDA, Rabat), S. Krause & V. Richter (ZMHB), A. Touret-Alby (MNHN).

#### Disclosure statement

No potential conflict of interest was reported by the authors.

#### Funding

This work was supported by Fonds De La Recherche Scientifique – FNRS [grant number CALYPSO project].

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