

Trachusa vietnamensis, a new species from Vietnam (Hymenoptera Apoidea Megachilidae)

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Abstract

A new species of *Trachusa* Panzer 1804 is described from Vietnam: *Trachusa vietnamensis* sp. nov. that is assigned to subgenus *Paraanthidium* Friese 1898 and is the first *Trachusa* species found in Vietnam. The species is described from a single female specimen, so the male remains undescribed. A morphological description and a series of pictures are given to distinguish this species from other species of the same subgenus; the Kasperek's identification key is also updated. The barcode sequence obtained from the amplification of COI region was deposited in the BOLD System (SPNCR001-21).

Key words: wild bees, taxonomy, anthophila, species description, DNA barcode.

Introduction

The genus *Trachusa* Panzer 1804, composed of robust and medium-sized species, belongs to the family Megachilidae (tribe Anthidiini), and contains 42 species in the Old World (Kasperek, 2018a; 2018b, 2019, 2020; Niu *et al.*, 2019) including the new species described in this paper; in a molecular analysis, Litman *et al.* (2016) found that the genus *Trachusa* forms a strongly supported monophyletic clade, sister to the rest of Anthidiini. Few morphological characters allow to clearly separate the genus *Trachusa* from the other genera of the Anthidiini tribe and this could lead to the exclusion of some species previously assigned to the genus (Kasperek, 2017). As for Indomalayan Realm, Kasperek (2017) and Niu *et al.* (2019) listed 14 species assigned to 3 subgenera: *Metatrachusa* Pasteels 1969; *Orthanthidium* Mavromoustakis 1953; *Paraanthidium* Friese 1898. In this paper, we describe morphologically a new *Trachusa* species coming from Vietnam. In addition, we barcoded its Cytochrome Oxidase I (COI) region, and deposited the sequence in Barcode of Life Data System (BOLD System) and GenBank.

Materials and methods

Morphological analysis

Images were taken using a Leica M205 stereomicroscope with Leica DFC295 digital camera, while measurements were taken with a WILD M5A equipped with an ocular micrometre. Measurements are expressed in mm. Morphological terminology follows Michener, 2007; T1, T2...T5 is used as an abbreviation in the text for tergite 1, tergite 2, etc.

Molecular analysis and DNA Barcode

To preserve the specimen intact as possible, DNA was extracted using the buffer reported by Gilbert *et al.* (2007) changing the incubation time. The whole specimen was placed in a 2 ml microtube, fully immersed in

1.5 ml of digestion buffer, and incubated for 3 hours at 55 °C with continue and moderate agitation.

After the incubation, the specimen was removed from the extraction buffer, placed in 100% EtOH for 1 hour to stop the digestion process, hairdryer dried and then replaced in its collection box.

DNA was purified from the digestion buffer, using a commercial kit (GeneJET Genomic DNA Purification Kit, ThermoFisher, Waltham, MA, USA), following the manufacturer's instruction.

Primers, amplifying a 710 bp fragment of COI region, were HCO2198 (CAGGAAACAGCTATGACTAA-ACTTCAGGGTGACCAAAAATCA) and LCO1490 (TGAAAACGACGGCCAGTGGTCAACAAATCAT-TAAAGATATTGG), following the thermal PCR protocol previously reported (Folmer *et al.*, 1994). The nucleic acid was amplified using EconoTaq PLUS 2X Master Mix (Lucigen, Middleton, WI, USA) in a total reaction volume of 25 µl, following the manufacturer's instruction. The PCR protocol was performed on 2720Therma Cycler (Applied Biosystems, Foster City, CA, USA).

The obtained amplicon was visualized on 1.5% agarose gel, sequenced (BMR Genomics, Padua, Italy), and analysed using BioEdit (Hall, 1999) and BLAST (Altschul *et al.*, 1990). Finally, the obtained sequence was deposited in GenBank and Barcode of Life Data Systems (BOLD Systems) (Ratnasingham and Hebert, 2013).

Results

Trachusa vietnamensis Flaminio et Quaranta sp. nov. description

The new species is assigned to the subgenus *Paraanthidium* Friese 1898 based on the following characters (Michener, 2007; Kasperek, 2017): mandible with 5 teeth; intercellar distance about half of ocelloccipital distance; subantennal suture slightly arcuate outward; second recurrent vein distal to second submarginal crossvein; scutellum protruding; omaulus carinate; arolia present.

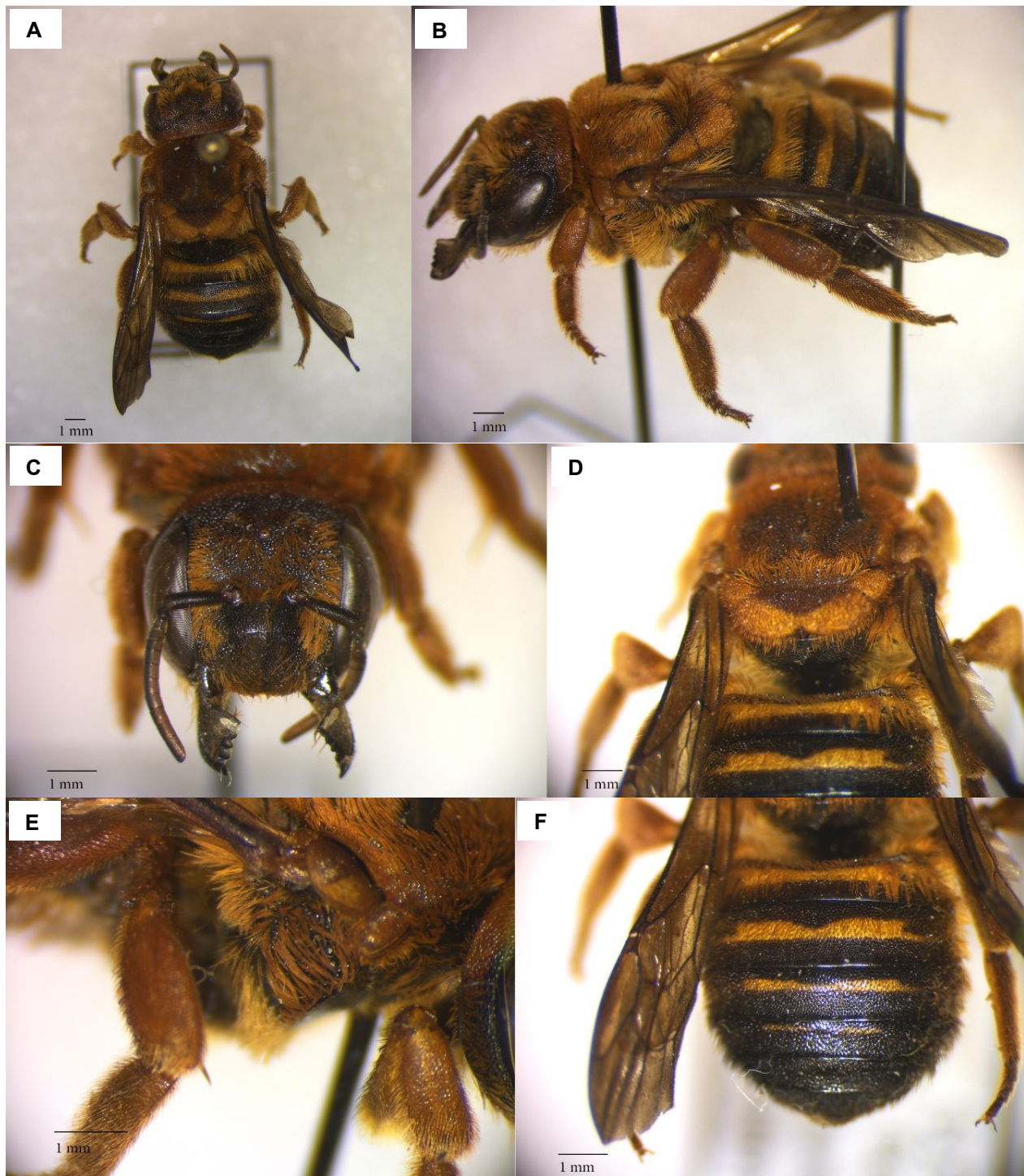


Figure 1. *Trachusa (Paraanthidium) vietnamensis* sp. nov., female. **A)** body in dorsal view; **B)** body in lateral view; **C)** head in frontal view; **D)** dorsal view, with details of propodeum and scutellum; **E)** omaulus in lateral view; **F)** metasoma in dorsal view. Scale bar: 1 mm.

The subgenus *Paraanthidium*, therefore, now includes fifteen species with this newly described, 12 of which with Oriental distribution.

Female (figure 1A-B) - above 15 mm.

Differential diagnosis (female) - *T. vietnamensis* can be separated from *Trachusa muiri* (Mavromoustakis 1937) for the presence of reddish preoccipital stripe (absent in *T. muiri*), the clypeus emarginate in the middle (undulate margin in *T. muiri*) and without impunctate carina. Scutum

is covered with decumbent reddish hairs and with a yellowish band on each side (absent in *T. muiri*); scutellum yellowish and with a red spot in the proximal part (almost black in *T. muiri*). Tergites 1-4 with yellow stripes decreasing in size and sternites black in *T. vietnamensis* (only red marks on T1 and S2-S5 with yellow apical transverse stripe in *T. muiri*). The other Asian species in the subgenus *Paraanthidium* are easily separable due to the colour of the scutellum, yellowish only in *T. vietnamensis*. *Trachusa*

aquiphila (Strand 1912) share a similar coloration of head and scutum but it's a species with Afrotropical distribution.

Head (figure 1C) - head slightly wider than long (table 1); clypeus black, coarsely punctate covered with dense brownish hairs, distal margin slightly emarginate in the middle. Mandible black, bearing five teeth: the apical one larger and blunt, the second one slightly smaller than the apical one, the others smaller and almost equal in size. Malar area short, compound eyes almost touching mandibles. Paraocular area black, genae also black except for the upper side which is reddish brownish; preoccipital stripe as well reddish brownish, straight and regular in size. Antennae dorsally black, ventrally brownish. Subantennal sutures slightly arcuate outward. Face hairs brownish, more reddish on vertex, less dense than on clypeus.

Mesosoma (figure 1D-E) - scutum cuticle black with yellowish L-shaped anterolateral bands close to tegulae, coarsely punctate and shiny, covered with reddish hairs; cuticle of the axillae yellowish, scutellum also yellowish but with a reddish spot in the shape of a triangle in the proximal part; rounded, it is clearly emarginated in the middle and projecting over the propodeum; tegulae yellowish in proximal part, reddish on distal part; omaulus carinate; coxae, trochanter and basal half of femora black; the remaining parts of all legs mostly reddish; basal parts of the tibiae of all the legs have a small yellow spot on the outer face; middle and hind tibia almost equal in width size (table 1); arolia present.

Metasoma (figure 1F) - T1 in the proximal half black, with a yellow stripe black emarginated at both ends; coarsely punctate, covered with long yellow-brownish hairs, longer than those of the mesosoma; T2 mostly black, with a yellow stripe placed almost in the middle of the tergite, less wide than one third of the entire width of the tergite, but shorter than that of T1, clearly emarginated in the middle, black emarginated at both ends. The tergite coarsely punctate in the proximal half but with smaller punctures in the distal half; hairs brownish-yellow, denser at the tergite sides; T3 black with a yellow stripe, less wide and shorter than that of T2; punctuation in the proximal part clearly finer than that of T1, each

point distant from another about half the diameter of a point; hairs reddish and thinned out; T4 black with a short and narrow yellow stripe interrupted in the middle, hairs black; T5 black with sparse black hairs, T6 black and covered with very dense black hairs; scopa mostly white, black in the last sternite.

Type material - holotype, ♀, Vietnam, Quang Nam Province, Tay Giang district, Zilieng Mountain, Axan, 1300 m a.s.l., X/2019, local collector legit. The holotype is deposited in the Entomological Collection at Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, Centro di ricerca Agricoltura e Ambiente, via di Corticella 133, 40128 Bologna, Italy.

Distribution - Vietnam (Quang Nam).

Derivatio nominis - the specific name is attributed based on the country of discovery of the species (Vietnam).

Remarks - there are several species described only on male specimens from the Indomalayan kingdom, but we assume that they are not the males of *T. vietnamensis*; however, a genetic analysis is necessary to investigate the relationships between species with males or females undescribed and, in further, to help in the clarification of the subgeneric placement and classifications since the molecular data of *Trachusa* is lack compared to its subgeneric diversity.

Table 1. Morphological measures, expressed in mm.

Morphological character	Measures (mm)
Head length	4.5
Head width	4.83
Interocellar distance (IOD)	0.66
Lateral to middle ocellus distance (LMD)	0.33
Middle ocellus diameter (MOD)	0.17
Ocellocular (OCD)	1.08
Compound eye width (at widest point)	1.42
Intertegular distance (ITD)	4.17
Middle tibia width (at widest point)	1
Hind tibia width (at widest point)	1.25

Identification key

The identification key proposed by Kasperek (2017) can be updated, for females, as follow:

- 20 - Scutum with yellow or ochreous colouration 21
- - Scutum black (Indomalayan) 23
- 21 - Scutellum dark; T1 without light markings, T2 with dull yellow mark on each side; T3-T5 with dull yellow band, T6 dull yellow *T. (Paraanthidium) maai*
- - Scutellum with light marking; T1 with lateral yellow marking or transverse yellow band 22
- 22 - Scutum with short yellow stripe near tegula; scutellum with yellow stripe on each side interrupted in the middle; T1 with yellow marks at sides; T2 with yellow lateral stripe, broad at sides; T3-T4 with yellow bands; T5-T6 yellow (Indomalayan) *T. (Paraanthidium) muiri*
- - Scutum with L-shaped anterolateral band; scutellum with widespread yellow colouration 22a
- 22a - Scutum with L-shaped yellowish anterolateral band; T1-T3 with one yellow band each decreasing in size; stripe of T4 interrupted in the middle; scutellum yellowish with a red spot in a shape of a triangle; clypeus slightly emarginated in the middle (Indomalayan) *T. (Paraanthidium) vietnamensis*
- - Scutum with L-shaped anterolateral ochreous band; T1-T5 with one broad yellow band each; large, yellow scutellum with black median triangle; posterior edge deeply emarginate; pronotal lobe yellow with sharp lamella; clypeus convex, apical margin crenulated to dentate (Afrotropical) *T. (Paraanthidium) aquiphila*

Molecular analysis and DNA Barcode

The sequence analysis of COI region amplicons revealed no match with all other *Trachusa* spp. deposited sequences in GenBank.

The sequence was deposited in GenBank and BOLD System (SPNCR001-21).

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Received April 2, 2021. Accepted September 27, 2021.