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Max Kasparek

Resin bees of the anthidiine genus *Trachusa*

Identification, taxonomy, distribution and biology of the Old World species

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Trachusa interrupta, male from Southern France,
Senckenberg Deutsches Entomologisches Institut Müncheberg (Germany)

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Max Kasparek

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Introduction

The genus *Trachusa* was erected by Georg Wolfgang Franz Panzer in 1804 for the species *Trachusa serratulae*; this name is today regarded as synonymous with *Trachusa byssina*, which had first been described by Panzer in 1798 under the name *Apis byssina*. There are many taxa which have been assigned to *Trachusa*; many of them later fell into synonymy, others turned out to belong to other genera. Today, 49 species are attributed to the genus *Trachusa*. Ten of these occur in the Western Palaearctic and four in the Eastern Palaearctic region; five are Afrotropical and six are Indomalayan. Twenty-four species are confined to the New World. There are surely many more species to be discovered; a few specimens have already been identified as hitherto undescribed species and await full description.

There are few clear morphological features which characterise the genus unambiguously. Most members of the genus *Trachusa* have arolia between their claws although not all; males of some species have black combs on the fourth and fifth sternites, while others do not; females have normally four mandibular teeth, but a few species have only three. So it is understandable that the attribution of some species to the genus *Trachusa* is still questionable. Interestingly, *Trachusa byssina,* for which Panzer originally erected the genus, is in some morphological characters not a very typical member of the genus.

The current work is a compilation and analysis of our knowledge of the Old World *Trachusa* species. The main aim is to provide detailed descriptions and illustrations that allow quick and unambiguous identification for those who are not experts in this group of bees as well as meeting the requirements of specialists. Many species can easily be identified by comparing collection material with illustrations, while it is sometimes difficult and frustrating to identify species on the basis of often lengthy text descriptions.

I succeeded in examining for this study material of almost all Old World species; in a few cases where this was not possible, photographs of the type specimens were provided by the museum collections where the material is deposited. Finally, this work comes with macro-photographs of all Old World *Trachusa* species, often of both sexes and often including the type specimens. Line drawings of characteristic body parts complement the photographs. A key for females and males is given. Maps show the distribution of each species, and the text also summarises information on biology and ecology. I understand this work not as an end result, but rather a starting point on which further study in taxonomy, biology, ecology, etc. can build. I hope this work will stimulate and initiate further studies in this bee genus.

This work would have been impossible without the great help and cooperation of many persons and institutions. In first place comes Maximilian Schwarz, Ansfelden (Austria), who loaned me his entire comprehensive collection of *Trachusa* bees. Michael S. Engel (Kansas University, Snow Entomological Collection, Biodiversity Institute & Natural History Museum, Lawrence), Stéphane Hanot and Didier van den Spiegel (Musée royal de l'Afrique centrale, Tervuren), Frank Koch and the ZooSphere-Team (Museum für Naturkunde, Berlin), David Notton (The Natural History Museum Lon-

don), and Feng Yuan (Institute of Zoology, Chinese Academy of Sciences, Beijing) provided photographs for me of material held in their collections and gave me permission to use these photographs in this publication. Lars Krogmann (Staatliches Museum für Naturkunde, Stuttgart), Despina Philippou (Ministry of Agriculture, Nicosia – Mavromoustakis collection), and Stefan Schmidt (Zoologische Staatssammlung, Munich) allowed me access to their and Michael S. Engel (Kansas University, Snow Entomological Collection, Biodiversity Institute & Natural History Museum, Lawrence), Fritz Gusenleitner (Oberösterreichisches Landesmuseum, Linz), John Midgley (Albany Museum, Grahamstown, South Africa), Andreas Taeger (Senckenberg Deutsches Entomologisches Institut Müncheberg, Germany), Patricia Peters (on behalf of the entomology curator of Senckenberg Museum, Frankfurt a.M.), Vladimir G. Radchenko (I. I. Schmalhausen Institute of Zoology, Kiev), and Zoltán Vas (Hungarian Natural History Museum, Budapest) made loans of material from the collections under their responsibility. I had very fruitful discussions with John Asher (National University of Singapore, Singapore), Connal Eardley (Agricultural Research Council, Pretoria, South Africa), Terry Griswold (United States Department of Agriculture - USDA-ARS - Bee Biology & Systematics Laboratory, Utah State University, Logan, Utah), Michael Kuhlmann (Zoological Museum Kiel, Germany), and Ze-Qing Niu and Chao-Dong Zhu (Institute of Zoology of the Chinese Academy of Sciences, Beijing). Andrew Grace helped me in editing the manuscript. I am very grateful to all of them.

Heidelberg, May 2017
Max Kasparek

Material and Methods

Terminology and Abbreviations

Terminology used here follows almost exclusively Michener (2007). Attention should be given to the following issues: abdomen: as the first abdominal segment is actually the propodeum, which is incorporated in the thorax, preference is given to the usage of metasoma; – axilla: plural: axillae; – mesepisternum (plural: mesepisterna) = mesopleuron; – metasoma: see abdomen; – pubescence: longer, erect or suberect hairs; – punctate = punctured; – puncturation = punctation; – scutellum: in Trachusa, the scutellum is always separated from the axillae, although the suture is hardly visible in a few species. The term scutellum was therefore used for the scutellum s.str., i.e. without axillae. – scutum = mesoscutum = mesonotum = dorsal plate of the middle thoracic segment; – sternite = sternum (plural: sterna). The term sternite refers here always to metasomal sternites and is abbreviated as S1, S2, S3, …; – tergite = tergum (plural terga). The term tergum refers here always to metasomal tergites and is abbreviated as T1, T2, T3, …; – thorax: including the propodeum, which is actually the first true abdominal segment.

Abbreviation: MK = Max Kasparek.

Depositories

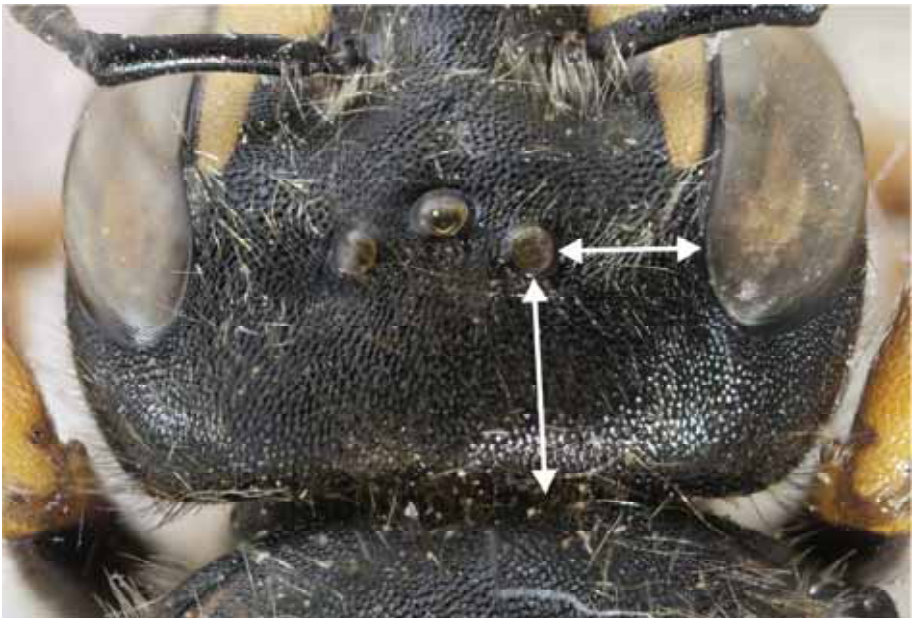
AMG	Albany Museum, Grahamstown (South Africa)
DEI	Senckenberg Deutsches Entomologisches Institut Müncheberg (Germany)
HNHM	Hungarian Natural History Museum, Budapest (Hungary)
IZCAS	Institute of Zoology, Chinese Academy of Sciences, Beijing (China)
NHMUK	The Natural History Museum, London (United Kingdom)
OLL	Oberösterreichisches Landesmuseum, Linz (Austria)
RMCA	Royal Museum for Central Africa (Musée royal de l'Afrique centrale), Trevuren (Belgium)
SEMC	Snow Entomological Museum Collection, University of Kansas, Kansas (United States of America)
SIZK	I. I. Schmalhausen Institute of Zoology, National Academy of Sciences, Kiev (Ukraine)
SMF	Senckenberg Museum, Frankfurt (Germany)
SMNS	Staatliches Museum für Naturkunde Stuttgart (Germany)
ZMB	Museum für Naturkunde Berlin (Germany)
ZSM	Zoologische Staatssammlung München (Germany)
coll. MK	collection Max Kasparek, Heidelberg (Germany)
coll. Mav.	collection Georges Mavromoustakis, Ministry of Agriculture, Nicosia (Cyprus)
coll. Schwarz	collection Maximilian Schwarz, Ansfelden (Austria)

Maps

The baseline map for the distribution maps was designed based on an open source vector world map at http://landkartenkostenlos.blogspot.de. The maps were modified and adapted to the needs of this publication. The boundaries shown on this map have a limited accuracy and are an approximation to actual country boundaries; their exact location cannot always be shown.

Photographs

The photographs of the author were taken with a Canon MP-E65/2.8 lens mounted on a Canon EOS 6D camera. Multiple photographs were taken of each specimen and then combined to create a picture of a specimen completely in focus. The camera was moved between the shots with a Cognisys StackShot Rail. A Canon Twin Lite MT24EX Macro Flash was used. Subsequently the pictures were processed with Helicon Focus (version 6.0.18) software to combine the pictures and to create one completely focused image from several partially focused images (image stacking). Usually 15-25 photographs have been taken at different focus distances to give a resulting image with a greater depth of field than any of the individual source images. The resulting images were further processed with Adobe Photoshop CS6 and Adobe Photoshop Elements 15.



Members of the genus *Trachusa* generally have a broad vertex. The lateral ocellus is hereby always nearer to the eye than to the preoccipital ridge. – *Source*: Female *Trachusa laeviventris* from Spain, coll. Schwarz. Photograph: MK.

The genus *Trachusa*: Overview

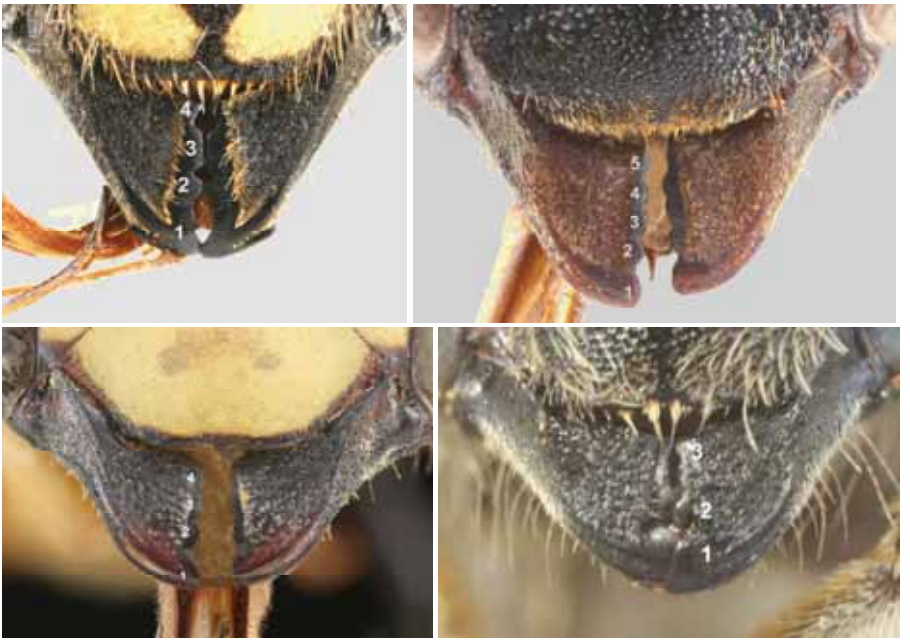
This genus *Trachusa* Panzer, 1804 consists of medium-sized to large megachiliform anthidiines: the length varies from approximately 9 mm to 16 mm. A carina on the pronotal lobe and the omaulus is often absent, sometimes present, and may then take the form of a lamella. The posterior part of the head is well-developed, thus the lateral ocellus is closer to the eye than to the posterior margin of the vertex (although equidistant in subgenus *Metatrachusa* and some New World species). The anterior margin of the median ocellus is closer to the antennal bases than to the posterior margin of the vertex (or equidistant) (Griswold & Michener 1988). The middle tibia is broad, usually nearly as broad as the hind tibia, and both anterior and posterior margins are convex; sometimes, however, in spite of these convexities, the middle tibia is distinctly narrower than the hind tibia (Michener 2007). Fore-and mid-tibial spines are produced as blunt, obtuse projections that extend along the tibial surface as carinae (Griswold & Michener 1988). Vein cu-v of the hind wing is oblique and usually nearly half as long as the second abscissa of M+Cu or longer. Arolia between the claws usually present but sometimes greatly reduced or absent. Black combs on the underside of the metasoma (on sternites S4 and S5) of the male are sometimes present but also often absent. Females have normally four mandibular teeth but sometimes three, as in *Trachusa* s. str. The number of segments in the maxillary palpus may be four or reduced to three, as in most species of subgenus *Paraanthidium* for example. Male T7 is small and curved under the abdomen so that the dorsal surface faces ventrally (Michener 2007). Several characters that are often stable within a genus thus vary in *Trachusa*. The assignation of a species to the genus needs to be done on the basis of a combination of characters.

Genetic studies still have to find out whether *Trachusa* is a monophyletic genus. Only recently, Litman et al. (2016) found, based of molecular data, that the genus *Trachusa* forms a strongly supported monophyletic clade, sister to the remainder of Anthidiini. The genera *Trachusoides* and *Apianthidium* suggest a close phylogenetic relationship with *Trachusa*; Litman et al. (2016) suggested referring to these three genera as the *Trachusa* group. Future work has to show whether the species of *Trachusoides* and *Apianthidium* can be accommodated in the genus *Trachusa*.

Identification Key for the Genera of Anthidiini of the Old World

To identify the genus *Trachusa* within the tribe Anthidiini, the following key may be used for the Eastern Hemisphere (adapted from Michener & Griswold 1994 and Michener 2007):

1 *Female:* Mandible with 5 to 18, usually sharp teeth separated by acute notches; maxillary palpus minute, two-segmented (arolia absent; base of propodeal triangle punctate or finely roughened, nearly always hairy; propodeum without basal series of pits and without fovea behind spiracle; juxtantennal carina absent). – *Male:* Arolia absent. . *Anthidium, Afranthidium,* ..... *Serapsia, Anthidioma, Pachyanthidium* (in part)*, Neanthidium,* ..... *Gnathanthidium, Indanthidium, Pseudoanthidium*



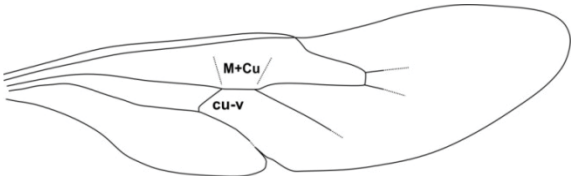
Female *Trachusa* have mandibles with usually three to four more or less subacute teeth. If the number is higher, teeth are rounded with rounded emarginations inbetween. Upper row left: *Trachusa laticeps* with four teeth; right: *T. longicornis* with five rounded teeth; Lower row left: *T. pubescens*. The upper two teeth (No. 3-4) are sometimes fused and form an undulate edentate ridge. Lower row right: *T. byssina*, the only *Trachusa* species with three teeth. – *Sources*: Upper left: Turkey, coll. MK. Upper right: Nepal, OLL. Lower left: Turkey, coll. Schwarz. Lower right: Ukraine, SIZK. Photographs: MK.

– *Female*: Mandible with two to four teeth, or if with five to ten, then the teeth are rounded and at least some of them separated by rounded emarginations; maxillary palpus commonly three- or four-segmented but sometimes two-segmented. – *Male*: Arolia present. 2

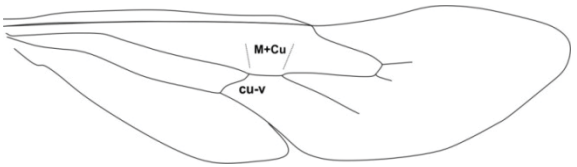
2 Hind tibia of female with scopa-like hairs, some of them at least as long as tibial width; basal vein of fore wing curved (as in *Halictus* but less strongly) and meeting vein Cu at a right angle; jugal lobe of hind wing about half as long as vannal lobe (yellow markings absent except on clypeus of male (Africa) ..... *Aspidosmia*

– Hind tibia of female with relatively short hairs or bristles; basal vein of fore wing nearly straight and meeting vein Cu at an acute angle; jugal lobe of hind wing less than half as long as vannal lobe 3

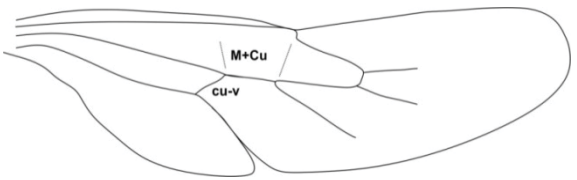
3 Omaulus lamellate, continued onto venter of thorax and there separated from middle coxa by less than width of middle trochanter ....*Anthidiellum* (in part), *Pachyanthidium* (in part)



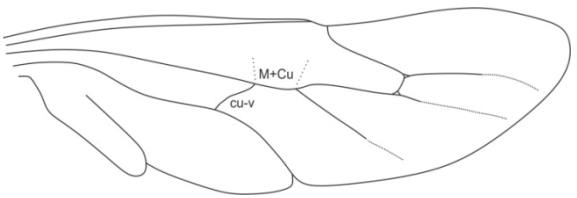
T. byssina (♀)



T. pubescens (♂)



T. interrupta (♂)



T. rufobalteata (♂)

In the genus *Trachusa*, the vein cu-v of the hind wing is oblique and usually nearly half as long as the second abscissa of M+Cu or longer. From above: *Trachusa byssina*, *T. pubescens*, *T. interrupta,* and *T. rufobalteata*. – *Sources*: *T. byssina*, Ukraine (SIZK); *T. pubescens*, Lebanon (coll. MK); *T. interrupta*, South France (DEI); *T. rufobalteata* (holotype, NHMUK 010265030). Drawings: MK.

– Omaulus lamellate or not, if lamellate then often not continued onto venter of thorax, but if so, then mesepisternum between middle coxa and omaulus (however recognised) as wide as or wider than width of middle trochanter 4

4 Lower part of preoccipital carina sloping forward and continuing directly to lower mandibular articulation; axilla frequently pointed posteriorly (anterior coxa with lamella in most species; hind trochanter of male with preapical ridge, carina, lamella or tooth on inner surface; arolia absent) ..... *Icteranthidium*

– Lower part of preoccipital carina absent, or if present and extending to lower part of head, then ending below and mesal to lower mandibular articulation; axilla not pointed posteriorly (except in some parasitic genera that lack a scopa) 5

5 Face with three longitudinal ridges or carinae, two of them juxtantennal carinae and the third – a median longitudinal one on frons and supraclypeal area – often only a shiny ridge; body without yellow markings ..... *Euaspis*

– Face without a longitudinal median ridge or carina and usually without juxtantennal carinae 6

6 Vein cu-v of hind wing usually half as long as second abscissa of M+Cu or longer, oblique; middle tibia as broad as hind tibia or nearly so; T7 of male simple or bilobed 7

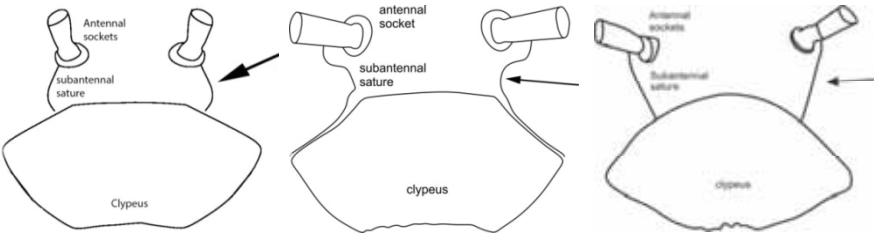
– Vein cu-v of hind wing less than half as long as second abscissa of M+Cu, oblique or transverse; middle tibia usually narrower than hind tibia ..... *Acedanthidium, Laronostelis, Eoanthidium, Cyphanthidium,* ..... *Plesianthidium, Benanthis, Rhodanthidium, Bathanthidium,* .....*Anthidiellum* (in part)*, Stelis* (in part)*, Afrostelis, Xenostelis*

7 Mid and hind tarsal claws of female simple; hind tibial spurs long, half the length of the hind basitarsus and distinctly serrate (male unknown) (India) ..... *Trachusoides*

– Mid and hind tarsal claws of female cleft or with inner median or preapical tooth; hind tarsal spurs not serrate 8

8 T7 of male curled under, dorsal surface thus facing downward; mandible of female dull, minutely roughened and bearing very short hairs, carinae absent on basal half of mandible; middle tibia with anterior margin strongly convex, at lowermost extremity usually at right angle to line across distal end of tibia ..... ***Trachusa***

– T7 of male directed posteriorly although small, short, and transverse; mandible of female slightly shining, carinae strongly shining; middle tibia with anterior margin less strongly convex, at acute angle to line across distal end of tibia (Borneo) ..... *Apianthidium*



The shape of the subantennal suture is used as a feature for subgeneric classification in *Trachusa*. Left: *Trachusa (Orthanthidium) formosana* with a subantennal suture outwardly arcuate. Centre *T. (Archianthidium) pubescens; t*he shape of the subantennal sature may take different forms in the subgenus *Archianthidium*. Right: *T. (Massanthidium) massauahensis* as an example for a subgenus with a straight subantennal sature. – Drawings: MK.

Subgeneric Classification of the Genus *Trachusa*

Pasteels (1969, 1972, 1984) classified the Old World *Trachusa* in 7 subgenera. However, *Protanthidium* Cockerell and Cockerell, 1911 is not accepted as a subgeneric name but is, according to Mavromoustakis (1937), a synonym of *Paraanthidium* Friese, 1898 (see also Sandhouse 1943). Michener & Griswold (1994) assigned the genus *Archianthidium* Mavromoustakis, 1939 as a subgenus of *Trachusa*.

The genus *Trachusa* hereby comprises 11 subgenera in the Old and New World, seven of which are Old World subgenera (Michener & Griswold 1994, Michener 2007). The Old World subgenera can be distinguished by the following key which is based on Griswold & Michener (1988) with some subsequent adaptations by Michener (2007). Further adaptations were made here in order to accommodate *Trachusa cornopes* in the subgenus *Orthanthidium*.

1 Mandible of female with three teeth (one large tooth and two smaller, flattened teeth which often are not clearly distinct as separate teeth); maxillary palpus as long a maximum width of galea, four-segmented; yellow markings on body absent except for face of male (Palaearctic) ..... *T. (Trachusa* s. str.)

– Mandible of female four- to seven-toothed (if two- or three-toothed, then mandible extremely large); maxillary palpus shorter than width of galea, three- or four-segmented 2

2 Second recurrent vein entering second submarginal cell basal to second submarginal crossvein; T7 of male with median basal projection (Palaearctic) ..... *T. (Archianthidium)*

– Second recurrent vein meeting or distal to second submarginal crossvein; T7 of male without basal projection 3

3 Subantennal suture distinctly outwardly arcuate; gonoforceps of male bifid, Y-shaped 4

– Subantennal suture nearly straight; gonoforceps of male not Y-shaped 5

The subantennal suture is outwardly arcuate in the subgenus *Paraanthidium*. Left: *Trachusa (P.) interrupta* (South France), Right: *T. (P.) longicornis* (Nepal). – Photographs: MK.

Subantennal suture in *Archianthidium* (left: *T. pubescens,* right: *T. forcipata*). The subantennal suture is curved, but not outwardly arcuate as in *Orthanthidium* and *Paraanthidium*.

4 Scutellum truncate posteriorly as seen from above, with median emargination (Indomalayan) ..... *T. (Orthanthidium)*

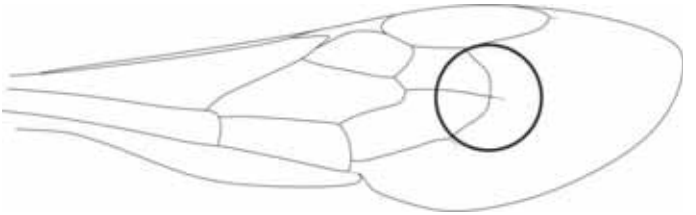
– Scutellum broadly rounded but medially emarginate; lateral margin of axilla convex but in general slanting; eyes subparallel; interocellar distance about half of ocelloccipital distance or somewhat greater (Palaearctic, Indomalayan) ..... *T. (Paraanthidium)*

5 Omaulus distinctly carinate, carina extending onto ventral surface of thorax close to middle coxa (Africa) ..... *T. (Massanthidium)*

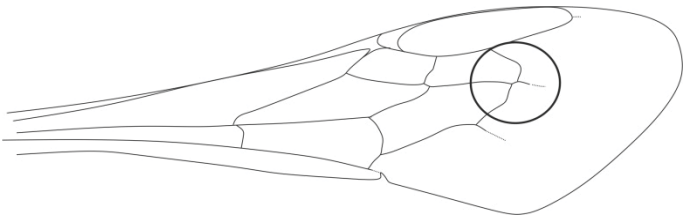
– Omaulus not carinate 6

6 Arolia present in female, absent in male; S4 and S5 of male without combs (Indomalayan) ..... *T. (Metatrachusa)*

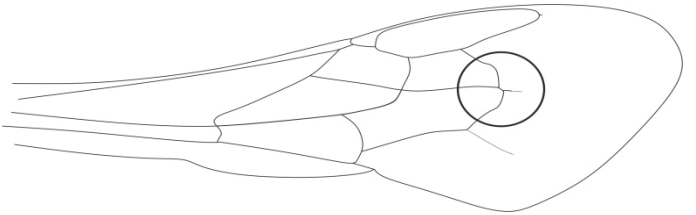
– Arolia minute if present; S4 and S5 of male with combs as in *Paraanthidium* (Africa) .....*T. (Congotrachusa)*



Subgenus *Trachusa* (s.str.): *Trachusa byssina*



Subgenus *Archianthidium*: *Trachusa pubescens*



Subgenus *Paraanthidium*: *Trachusa interrupta*

The place where the second recurrent vein enters the second submarginal cell is an important character at subgeneric level. It meets the second submarginal crossvein (or is slightly basal to it) in subgenus *Trachusa* s.str., it enters basal to second submarginal crossvein in members of the subgenus *Archianthidium*, and meets or enters distal to second submarginal crossvein in members of other subgenera such as *Paraanthidium*. – Drawings: MK.

Excluded Species (Species not belonging to *Trachusa* Panzer, 1904)

The genus *Trachusa* comprises according to Michener (2007) 43-46 species. The ITIS database (and, accordingly, also the Encyclopedia of Life) lists 57 species. There are several species that have been assigned to *Trachusa*, either by original designation or by later designation but which are presently not regarded as member of this genus. This refers particularly to species occurring in the Eastern Palaearctic (China). Table 1 gives an overview over those 49 species which are recognised here to belong to the genus *Trachusa*.

***Anthidiellum (Pycnanthidium) carinatum* (Wu, 1962)**
Paraanthidium carinatum Wu, 1962 (Acta Zool. Sinica 11, Suppl., 165-167).
Trachusa (Paraanthidium) carinatum (Wu, 1962).– Wu (2006).
Trachusa carinata (Wu, 1962).– ITIS database (Ruggiero, Ascher et al. 2009) and other sources.
Anthidiellum (Pycnanthidium) carinatum (Wu, 1962).– Niu et al. (2016).

Pasteels (1972) mentions that it is necessary to re-confirm taxonomic classification of this species, which was originally assigned to *Paraanthidium*. Niu et al. (2016) placed it in *Anthidiellum*. *Anthidiellum carinatum* is similar to *A. smithii* (Ritsema), a small-bodied species widely distributed in Southeast Asia (Niu et al. 2016).

***Anthidiellum (Pycnanthidium) coronum* (Wu, 2004)**
Trachusa (Paraanthidium) coronum [sic] Wu, 2004 (Acta Zootaxonomica Sinica 29(3): 541-548).
Trachusa corona Wu, 2004.– ITIS (2009) and other sources.
Anthidiellum (Pycnanthidium) coronum (Wu, 2004).– Niu et al. (2016).

Anthidiellum coronum and the closely related *A. latipes* belong to a distinctive group within the subgenus that in Asia also includes *A. rasorium* (Smith), *A. ramakrishnae* (Cockerell), and *A. butarsis* Griswold (Niu et al. 2016).

***Anthidiellum (Pycnanthidium) latipes* (Bingham, 1897)**
Anthidium latipes Bingham, 1897. The Fauna of British India Including Ceylon and Burma, Hymenoptera. Vol. I. Wasps and Bees. Taylor & Francis, London, xxix + 577 pp., 4 pls., p. 495.
Paraanthidium latipes Bingham, 1897.– Wu (1962).
Trachusa (Paraanthidium) latipes (Bingham, 1897).– Wu (2006).
Anthidiellum (Pycnanthidium) latipes (Bingham, 1897).– Niu et al. (2016).

Pasteels (1972) mentioned that it is necessary to re-confirm the taxonomic classification of this species, which as originally assigned to *Paraanthidium*, i.e. a subgenus of *Trachusa*. The ITIS database (2009) lists this species as a member of the genus *Anthidiellum*. Niu et al. (2016) recently combined it as "comb. nov." with *Anthidiellum*.

***Anthidiellum (Clypanthidium) popovii* (Wu, 1962)**
Paraanthidium popovii Wu, 1962 (Acta Entomolog. Sinica 11, Suppl., 163-164).
Trachusa (Paraanthidium) popovii (Wu, 1962).– Wu (2006).

Anthidiellum (Clypanthidium) popovii (Wu, 1962).– Niu et al. (2016).

Already Pasteels (1972) mentioned that it is necessary to re-assess the taxonomic classification of this species, which was originally assigned to *Paraanthidium*. Niu et al. (2016) placed it in *Anthidiellum*. This species can be distinguished from all other *Anthidiellum* known from China by the bicoloured veins of the fore wing (Niu et al. 2016).

***Anthidiellum (Anthidiellum) yunnanense* (Wu, 1962)**
Paraanthidium yunnanensis [sic] Wu, 1962 (Acta Entomolog. Sinica 11: 163-164).
Trachusa (Paraanthidium) yunnanensis (Wu, 1962).– Wu (2006).
Anthidiellum (Anthidiellum) yunnanense (Wu, 1962).– Niu et al. (2016).

Pasteels (1972) mentions that it is necessary to re-assess the assignment to *Paraanthidium*, in which it was originally described. The male of this species has no comb on S5, a feature which characterises species of the subgenus *Paraanthidium*.

***Anthidium (Proanthidium) kashgarense* (Cockerell, 1911)**
Proanthidium kashgarense Cockerell, 1911 (Proc. U.S. Nat. Hist. Mus. 40: 250).
Trachusa (Paraanthidium) kashgarense (Cockerell, 1911). – Wu (2006).
Trachusa (*Paraanthidium*) *kashgarensis* (Cockerell, 1911)
Trachusa kashgarensis (Cockerell, 1911). – ITIS database.
Anthidium kashgarense (Cockerell, 1911). – Discover Life.

The species was described from Kashgar Prefecture in southwestern Xinjiang, China in the genus *Proanthidium* Friese, but later transferred to *Trachusa*, subgenus *Paraanthidium*, by Wu (2006). As member of the genus *Trachusa* it was subsequently listed in the ITIS database, but the Discover Life database lists it under *Anthidium*. The holotype of this species is deposited in the Smithsonian National Museum of Natural History, Washington D.C., and photographs have been uploaded to the collection's web page at http://collections.nmnh.si.edu/search/ento. The pictures clearly indicate that it does not belong to *Trachusa* due to the narrow vertex, the tooth pattern and the number of teeth, the carinate scutellum and the presence of a small angle at scutellum laterally. T. Griswold, to whom these photographs were shown, confirmed that the specimen belongs to *Anthidium*, subgenus *Proanthidium* (in litt., 26.10.2016).

***Bathanthidium barkamensis* (Wu, 1986)**
Dianthidium barkamensis Wu, 1986. Sinozool. 4 (4): 214-215.
Trachusa (Paraanthidium) barkamensis (Wu, 1986). – Wu (2006).

The species has originally been described by Wu (1986) in the genus *Dianthidium*, but he later transferred the species to the genus *Trachusa*, subgenus *Paraanthidium* (Wu 2006). While Niu et al. (2012) did not cover it in a study of Chinese *Bathanthidium*, Discover Life (version 13.11.2016) lists it under *Bathanthidium* based on examination of the type material in the Institute of Zoology, Beijing (J. S. Asher, pers. comm.). A full account to justify this is in preparation (Z.-Q. Niu & T. Griswold, pers. comm.).

***Bathanthidium concavum* (Wu, 1962)**
Paraanthidium concavum Wu, 1962. Acta Zool. Sinica 11 (Suppl.): 165-167 (male).

Trachusa (Paraanthidium) concavum (Wu, 1962). – Wu (2006).
Trachusa concava (Wu, 1962). – ITIS (2009).
Bathanthidium concavum (Wu, 1962). – Disover Life (version 13.11.2016).

The species has been described by Wu (1962) as member of the genus *Paraanthidium*, which was later accepted as a subgenus of *Trachusa*. Pasteels (1972) mentioned that it is necessary to re-assess the taxonomic classification of this species. While Niu et al. (2012) did not cover it in a study of Chinese *Bathanthidium*, Discover Life (version 13.11.2016) lists it under *Bathanthidium* based on examination of the type material in the Institute of Zoology in Beijing (J. S. Asher, pers. comm.). A full account to justify this is in preparation (Z.-Q. Niu & T. Griswold, pers. comm.).

***Bathanthidium rubopunctatum* (Wu, 1992)**
Anthidium rubopunctatum Wu, 1992. Insects of the Hengduan Mt. Region, 2: 1397-1398.
Trachusa (Paraanthidium) rubopunctatum (Wu, 1992). – Wu (2006).
Trachusa rubopunctata (Wu, 1992). – ITIS (2009).
Bathanthidium rubopunctatum (Wu, 1992). – Discover Life (version 13.11.2016).

Originally described by Wu (1992) as a species belonging to the genus *Anthidium*, but later transferred it to *Trachusa* (Wu 2006). While Niu et al. (2012) did not cover it in a study of Chinese *Bathanthidium*, Discover Life (version 13.11.2016) lists it under *Bathanthidium* based on examination of the type material in the Institute of Zoology in Beijing (J. S. Asher, pers. comm.). A full account to justify this is in preparation (Z.-Q. Niu & T. Griswold, pers. comm.).

***Pseudoanthidium (Pseudoanthidium) ludingense* (Wu, 1993)**
Anthidiellum ludingensis Wu, 1993 (Ins. Hedguan Mt. Region 2: 2992, 1400-1401).
Trachusa (Paraanthidium) ludingensis Wu, 1992. – Wu (2006).

The species has originally been described in the genus *Anthidiellum*, but the author himself later placed it in the genus *Trachusa* (Wu 2006). Niu et al. (2016) transferred it recently to *Pseudoanthidium* Friese based on a study of the holotype, which conforms with this subgenus as delineated in Michener (2007).

Table 1. List of the members of the genus *Trachusa* Panzer, 1804. The list is divided between Old World species (covered in this publication) and New World species (not covered). Species of the Western Palaearctic region are underlined. Soh et al. (2016) mention a recently detected, yet undescribed species of *Paraanthidium* from Laos. Another still undescribed species of the subgenus *Massanthidium* is found in Namibia (description in preparation).

Old World Species (>25 species)	**New World Species** (24 species)
Subgenus *Archianthidium* Mavromoustakis, 1939 – West Palaearctic • *Trachusa baluchistanica* (Mavromoustakis, 1939) • *Trachusa fasciatellum* (Friese, 1917) • *Trachusa forcipata* (Morawitz, 1875) • *Trachusa laeviventris* (Dours, 1873) • *Trachusa laticeps* (Morawitz, 1873) • *Trachusa pubescens* (Morawitz, 1873) **Subgenus *Congotrachusa* Pasteels, 1969 –** Afrotropical • *Trachusa schoutedeni* (Vachal, 1910) **Subgenus *Massanthidium* Pasteels, 1969** Afrotropical • *Trachusa eburneomaculata* Pasteels, 1984 • *Trachusa flavorufula* Pasteels, 1969 • *Trachusa massauahensis* Pasteels, 1984 • *Trachusa* sp. [Namibia] **Subgenus *Metatrachusa* Pasteels, 1969 –** Indomalayan • *Trachusa pendleburyi* (Cockerell, 1927) • *Trachusa orientalis* Pasteels, 1972 **Subgenus *Orthanthidium* Mavromoustakis, 1953 –** East Palaearctic / Indo-Malayan • *Trachusa cornopes* Wu, 2004 • *Trachusa formosana* (Friese, 1917) **Subgenus *Paraanthidium* Friese, 1898 –** East and West Palaearctic, Afrotropical, Indomalayan • *Trachusa aquiphila* (Strand, 1912) • *Trachusa dumerlei* (Warncke, 1980) • *Trachusa interrupta* (Fabricius, 1781) • *Trachusa heinzi* Dubitzky, 2007 • *Trachusa longicornis* (Friese, 1902) • *Trachusa maai* (Mavromoustakis, 1953) • *Trachusa muiri* Mavromoustakis, 1937 • *Trachusa ovata* (Cameron, 1902) • *Trachusa rufobalteata* (Cameron, 1902) • *Trachusa xylocopiformis* (Mavromoustakis, 1954) **Subgenus *Trachusa* s. str. Panzer, 1804 –** West Palaearctic • *Trachusa byssina* (Panzer, 1798)	**Subgenus *Heteranthidium* Cockerell, 1904 –** Nearctic • *Trachusa atoyacae* (Schwarz, 1933) • *Trachusa autumnalis* (Snelling, 1966) • *Trachusa bequaerti* (Schwarz, 1926) • *Trachusa catinula* Brooks & Griswold, 1988 • *Trachusa cordaticeps* (Michener, 1949) • *Trachusa crassipes* (Cresson, 1878) • *Trachusa dorsalis* (Lepeletier, 1841) • *Trachusa fontemvitae* (Schwarz, 1926) • *Trachusa larreae* (Cockerell, 1897) • *Trachusa occidentalis* (Cresson, 1868) • *Trachusa pectinata* Brooks & Griswold, 1988 • *Trachusa timberlakei* (Schwarz, 1928) • *Trachusa zebrata* (Cresson, 1872) **Subgenus *Legnanthidium* Griswold & Michener, 1988 –** Nearctic • *Trachusa ridingsii* (Cresson, 1878) **Subgenus *Trachusomimus* Popov, 1964 –** Nearctic • *Trachusa gummifera* Thorp, 1963 • *Trachusa perdita* Cockerell, 1904 **Subgenus *Ulanthidium* Michener, 1948 –** Nearctic • *Trachusa alamosana* Thorp & Brooks, 1994 • *Trachusa fulvopilosa* Thorp & Brooks, 1994 • *Trachusa interdisciplinaris* (Peters, 1972) • *Trachusa manni* Crawford, 1917 • *Trachusa mitchelli* (Michener, 1948) • *Trachusa nigrifascies* Thorp & Brooks, 1994 • *Trachusa notophila* Thorp & Brooks, 1994 • *Trachusa pueblana* Thorp & Brooks, 1994

Closely Related Genera

Within the tribe Anthidiini, the genera most closely related to *Trachusa* are *Apianthidium* Pasteels, 1969 and *Trachusoides* Michener & Griswold, 1994.

Apianthidium occurs in Kalimantan (Borneo). The only species is *A. apiforme* Meade-Waldo, 1914. It shares with *Trachusa* the megachiliform body and size (length 12–13 mm), the oblique and long cu-v (fully half the length of the second abscissa of M+Cu) of the hind wing and the small T7 of the male. In the absence of arolia and the absence of all the usual anthidiine carinae it agrees with some subgenera of *Trachusa*. It differs in the strongly hooked apices of the hind tibial spurs, the relatively slender hind basitarsus of the female (over three times as long as broad) and the yellow or reddish-yellow body with the posterior half of each tergum black (Michener 2007). Pictures of the type specimen taken by Zestin Soh are found at www.flickr.com/photos/80045868@N06/albums/72157666732217864.

The genus *Trachusoides* contains two species, *T. simplex* Michener and Griswold, 1994 and *T. elsieae* Griswold, 2015. *T. simplex* is known only from a few females found in the Western Ghats of India, and *T. elsieae* from a single female found in Laos. Females of this genus are unique among Anthidiini in the simple rather than cleft or toothed mid and hind tarsal claws. They share with *Apianthidium* and *Trachusa* the large megachiliform body and the tendency for reduced maculations. Unusual is the almost complete lack of carinae on the head and thorax (carinae limited to pronotal lobe). Almost all Anthidiini are heavily adorned with such carinae. Furthermore, the hind tibial spurs are longer, half the length of the hind basitarsus, and distinctly serrate.

Sexual Dimorphism

Similar to most other bees, the sexes in *Trachusa* are quite different from one another, and in the key the sexes are treated separately. Males have 13 antennal segments, females have 12. Males have seven exposed metasomal tergites; females have six. Females have stings, and males have sclerotized genitalia, but both are usually retracted.

As regards habitus, two types of *Trachusa* can be distinguished: those with only minor differences in colouration, morphological proportions and size between males and females, and those with striking differences between the sexes. Differences between males and females in the latter group are usually manifested in the colour pattern of the face: the face including the clypeus, the lower paraocular area and sometimes also the supraclypeal area may either be dark or may show a bright yellow colouration. The exact extent of the yellow colouration varies by species, in addition to any individual variation within a species.

An overview of the Eastern Hemisphere species gives the following result:

Subgenus *Archianthidium*: All six species with yellow paraocular areas in both sexes.

Subgenus *Congotrachusa*: In *T. schoutedeni*, the only known species, the female has dark, the male yellow paraocular areas;

Subgenus *Massanthidium*: Females of all three species with dark faces. The males are not known.

Subgenus *Metatrachusa*: In *T. pendleburyi*, the female has a dark face, the male is unknown. In *T. orientalis*, both sexes have yellow paraocular areas.

Subgenus *Orthanthidium*: The female of *T. formosana* has a dark face, the male is unknown. In *T. cornopes*, both sexes have yellow paraocular areas.

Subgenus *Paraanthidium*: The females of *T. aquiphila, T. longicornis, T. maai, T. muiri, T. ovata*, and *T. rufobalteata* have black faces, those of *T. dumerlei, T. interrupta*, and *T. heinzi* yellow paraocular areas. The female of *T. xylocopiformis* is not known. The males of all species of the subgenus have yellow paraocular areas.

Subgenus *Trachusa*: The female of the only species, *T. byssina*, has a dark, the male yellow paraocular areas.

Altogether, the male has in all species (at least for those for which descriptions of the males are available), yellow paraocular areas. The female has a dark face in all species of *Congotrachusa*, *Massanthidium* and *Trachusa* s.str. In *Metatrachusa*, the female of one species has a dark, the female of the other species a yellow face; the same is true in *Orthanthidium* (female of one species with dark and another with yellow face). The subgenus *Paraanthidium* is mixed: The females of six species possess dark faces, those of three species with yellow faces (in one species, male not known).

Based on the assumption that the subgeneric division of the genus *Trachusa* reflect the evolutionary development, the yellow face in females must have developed several times independently. The understanding of the role of the yellow face in behaviour would be essential for an explanation. Michener (2007) supposed that the yellow face markings in male hymenopterans are involved in male-male interactions, when males face one another in disputes of various sorts. However, this does not explain the fact why females of some species have similar yellow markings, whereas they are absent in other species.

Biology

Little is known of the biology of bees in the genus *Trachusa*. Actually, *Trachusa byssina* is the only Old World-species whose life cycle has been studied. So far as is known, species of *Trachusa* nest in the ground; unlike most anthidiines they make their own burrows. Cells are made from resin and fragments of green leaf by bees of the subgenera *Trachusa* s. str. (Hachfeld 1926, Westrich 1989).

Conservation Status and Threats

Trachusa bees seem to be affected by the global pollinator crisis, although few “hard facts” about population decline and reasons for it are known. The status of all *Trachusa* species is either entirely unknown or very insufficiently known. The European Red List of Bees (Niets et al. 2014) has assigned the following conservation statuses (according to IUCN Red List categories) to the European species of *Trachusa*:

- *Trachusa byssina*: Least Concern (LC) in Europe;
- *Trachusa dumerlei*: Least Concern (LC) in Europe;

- *Trachusa interrupta*: Endangered (EN: B2ab(v)) in Europe;
- *Trachusa laeviventris*: Data Deficient (DD) in Europe;
- *Trachusa laticeps*: Near Threatened (NT) in Europe;
- *Trachusa pubescens*: Data Deficient (DD) in Europe.

According to this classification, *T. interrupta* has been given Red List status in Europe. Westrich (1989) reported a population decline of *T. byssina* in south-western Germany (Baden-Württemberg) in altitudes below 400 m, while the populations in higher altitudes were stable.

Members of the genus *Trachusa* collect pollen on the underside of the abdomen where they have a metasomal scopa. Here a female of *Trachusa byssina* with a fully loaded scopa. – Photograph: MK (female from Turkey in SMF).

Taxonomic Features

Scutellum and Axillae

The shape of scutellum and axillae can be used as feature for taxonomic classification. Most species have broadly rounded, convex scutellum/axillae and the suture between scutellum and axilla is often hardly visible. In some species such as *T. orientalis* and *T. byssina* the combined scutellum / axillae look almost half-moon shaped.

Some species have an emargination in the middle of the scutellum, which is shallow in *T. schoutedeni*, *T. flavorufula*, *T. eburneomaculata*, and *T. massauahensis*, but is a rather V-shaped notch in *T. formosana*, *T. ovata*, *T. rufobalteata*, and *T. aquiphila*. *Trachusa dumerlei* takes in this respect an intermediate position.

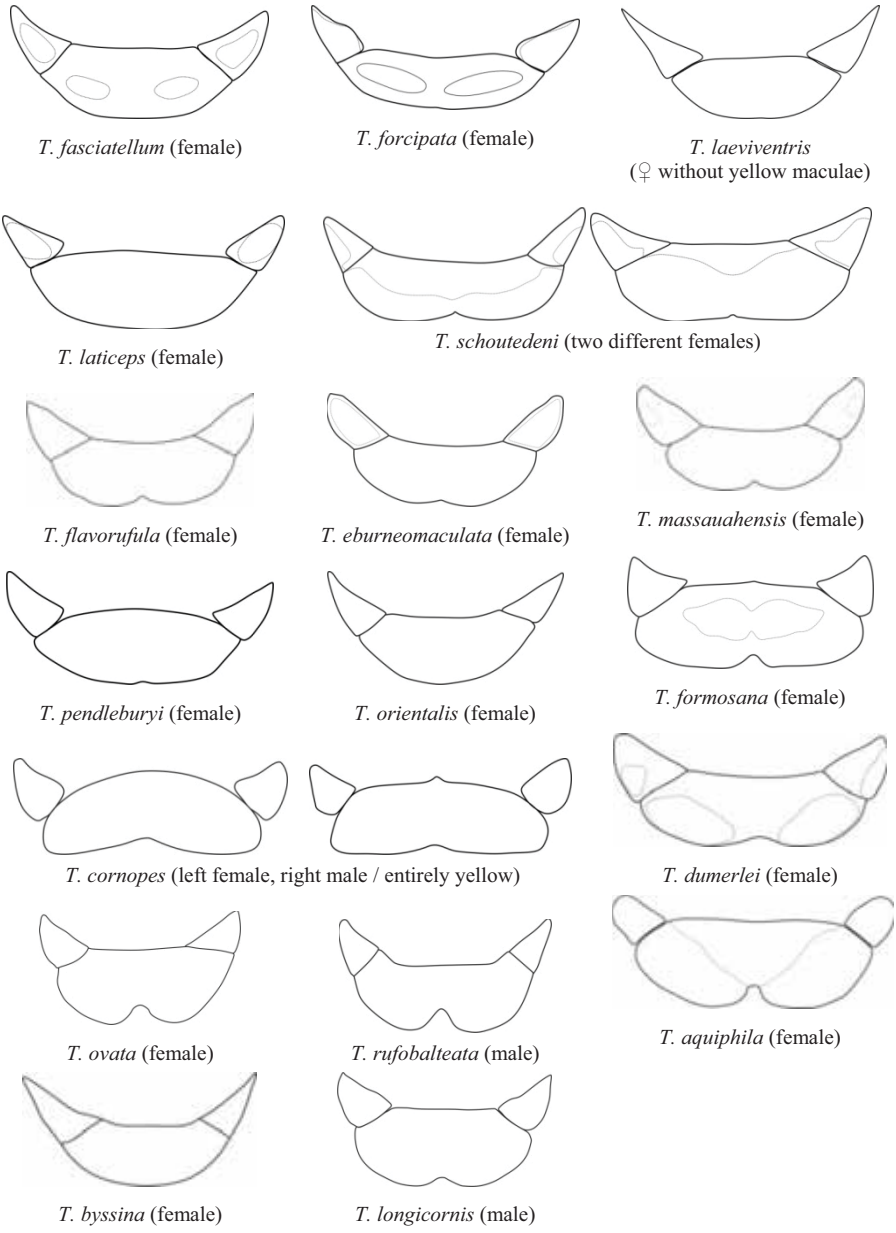
The shape of the scutellum from a dorsal view is truncated in *T. formosana*, *T. schoutedeni*, and *T. cornopes*. *Trachusa cornopes* is the only species in which the scutellum is broadly concavely rounded on the proximal side (more conspicuous in female).

Many species show a bright yellow colour pattern on scutellum/axillae. Some species including *Trachusa cornopes, T. formosana, T. aquiphila*, and *T. schoutedeni* have striking yellow colourations which surely have an important signal function in their biology. This has yet to be studied. In species such as *T. fasciatellum*, *T. laeviventris*, *T. laticeps*, *T. dumerlei*, or *T. massauahensis*, the yellow colouration is less conspicuous and in some species partly hidden by pubescence. *Trachusa forcipata* takes an intermediate position. Some species including *T. flavorufula*, *T. pendleburyi*, *T. orientalis*, *T. ovata*, and *T. rufobalteata* have an entirely black scutellum and axillae. This is also the case in *T. byssina*, where scutellum and axillae are covered by dense pubescence.

Maxillary Palpus

The number of segments in the maxillary palpus may be four or reduced to three (Michener 2007). It is sometimes difficult to determine the number; segments sometimes seem to be only partly separated, so that one must make arbitrary decisions. As the maxillary palpi are not always visible in dried specimens, they could not be examined in all species. Segments are numbered here from basal segment to apical segment (Sg-1, Sg-2, etc.).

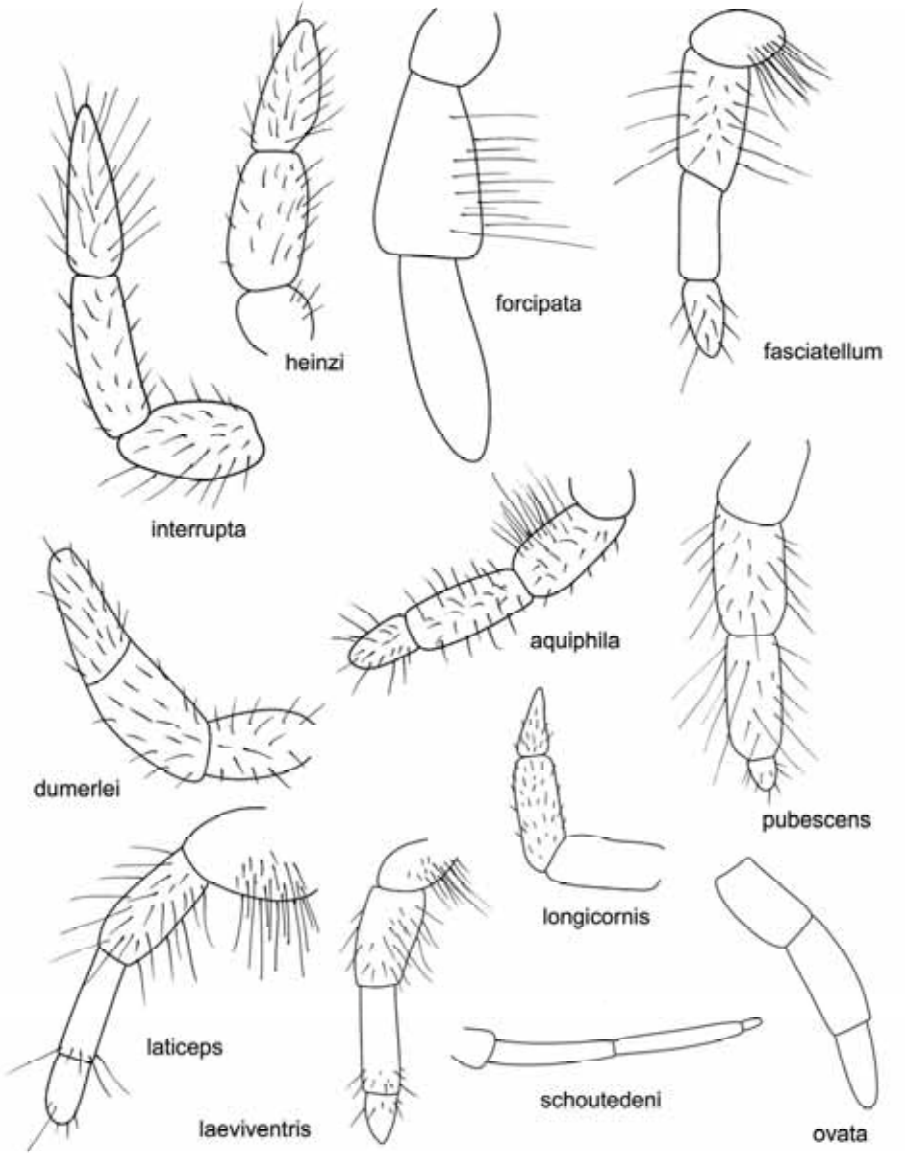
The subgenera *Archianthidium, Congotrachusa* and *Trachusa* s.str. have principally four-segmented maxillary palpi with one exception*: T. (Archianthidium) forcipata* was found to have only three. The subgenera *Massanthidium*, *Metatrachusa*, and *Paraanthidium* have principally three-segmented maxillary palpi, with one exception: *T. (Paraanthidium) aquiphila* has four segments.



Scutellum and axillae in the genus *Trachusa*. Dotted lines show the border between dark (mostly black) and yellow areas.

Table 2. Maxillary palpus (number of segments and description) in members of the genus *Trachusa*.

Subgenus	Species	No.	Description
T. (Archianthidium)	*fasciatellum*	4	Basal segment oviform with erect hair; Sg-2 to Sg-4 longish, decreasing in length and diameter towards the apex. Black to dark brown, brightened at apical segment.
	forcipata	3	Basal segment oviform, Sg-2 and Sg-3 equal in length, Sg-2 thicker than Sg-3; Sg-3 flattened; dark brown to black, Sg-1 brightened. Note: The unusual 3-segmented pattern could be studied in one male and is present in both maxillary palpi. The shape of the apical segment clearly indicates that it is the final one and that there was no additional missing segment.
	laeviventris	4	Basal segment rounded, Sg-2 and Sg-3 equally long, Sg-4 shorter. Sg-2 to Sg-4 dark brown, Sg-3 and Sg-4 flat. Sg-1 brightened.
	laticeps	4	Sg-1 one swollen with a tuft of hair on one side, light-coloured; Sg-2 dark brown, Sg-3 and Sg-3 light brown; Sg-2 as long as Sg-3, Sg-4 shorter.
	pubescens	4	Basal segment rounded, Sg-3 slightly shorter than Sg-2, Sg-4 short, almost globular; Sg-2 to Sg-4 dark brown, Sg-2 and Sg-3 flattened. Sg-1 brightened. Relatively dense pubescence on all segments. Altogether, very similar to *laeviventris*, but apical segment mostly shorter.
T. (Congotrachusa)	*schoutedeni*	4	Basal segment rounded, two longish segments and one reduced apical segment (Pasteels 1984).
T. (Massanthidium)	*flavorufula*	3	Number according to Pasteels (1984).
	eburneomaculata	3	Number according to Pasteels (1984).
	massauahensis	3	Number according to Pasteels (1984).
T. (Metatrachusa)	*pendleburyi*	3	Number according to Pasteels (1972).
T. (Paraanthidium)	*aquiphila*	4	Basal segment globular, not clearly separated from the ground where it is attached; Sg-2 longer than Sg-3, Sg-4 being the shortest; dark brown, basal and apical segments brightened; Sg-3 flattened.
	dumerlei	3	Basal segment globular to slightly elongated, Sg-2 and Sg-3 elongated, both the same length; Sg-1 light brown, Sg-2 to Sg-3 dark brown.
	interrupta	3	One spherical basal segment and two elongated segments. Black.
	heinzi	3	Basal segment globular, Sg-2 and Sg-3 elongated, of equal length; all segments dark brown.
	longicornis	3	Basal segment and two longish segments; dark brown with very short erect pubescence.
	ovata	3	Three more or less equally long elongated segments (Pasteels 1972).
T. (Trachusa)	*byssina*	4	Five segments according to Pasteels (1969) and Warncke (1980), but Griswold & Michener (1988) and Müller (1996) noted that the actual number is four.



Maxillary palpi in the genus *Trachusa*. – *Sources*: Original drawings by MK, *T. schoutedeni* and *T. ovata* redrawn after Pasteels (1969, 1972).

Key to the Species of *Trachusa* of the Old World

The following is the first comprehensive key for the Old World species of *Trachusa*. Elements for this key have been taken and adapted from the works of Warncke (1980), Wu (2006), Michener (2007) and others.

Females

The female of *Trachusa (Paraanthidium) xylocopiformis* is unknown and is therefore not covered by the key.

1 Body entirely black 2

– Body with yellow colouration on metasoma (if yellow colouration on tergites inconspicious, then also clypeus yellow) 3

2 Mandible with three teeth (one large tooth and two smaller, flattened teeth which are often not clearly separated from each other); subantennal suture straight; axillae fused with scutellum, scutellum without median emargination; body with dense pubescence (Palaearctic) ..... *T. (Trachusa) byssina*

– Mandible with five equidistant teeth (one large and four smaller teeth decreasing in size from distal to proximal); subantennal sature arcuate outward; axillae clearly separated from scutellum, scutellum notched in the middle; tergites with only scattered hair (Indomalayan) ..... *T. (Paraanthidium) ovata*

3 Second recurrent vein entering second submarginal cell basal to second submarginal crossvein (*Archianthidium*) (Palaearctic) 4

– Second recurrent vein meeting or distal to second submarginal crossvein 9

4 Mandibles yellow with black teeth 5

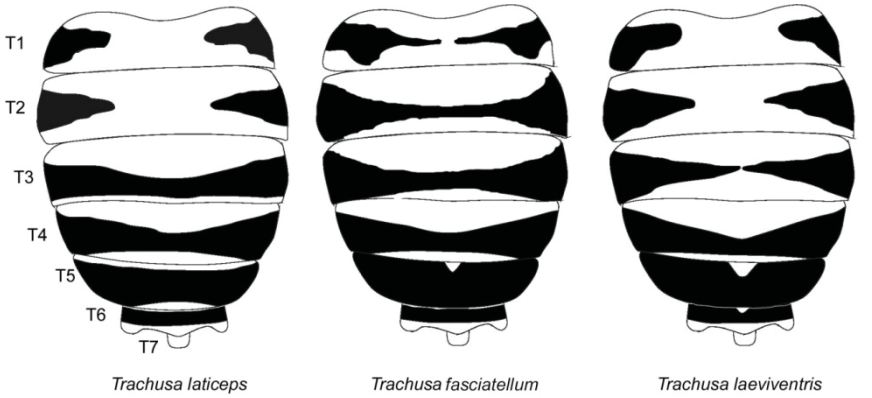
– Mandibles including teeth black 6

5 Clypeus conspicuously emarginate; yellow maculation extending from paraocular area to preoccipital ridge; yellow bands on tergites interrupted in the middle (lateral yellow stripes on T1 and T2 widely separated from each other, lateral stripes on T3 and T4 almost reaching the middle) ..... *T.* (*Archianthidium*) *forcipata*

– Clypeus shallowly emarginate at apical end; yellow maculation in paraocular area reach top of eyes; lateral yellow stripes on T1-T2 nearly reaching the middle, T3 and T4 with continuous yellow bands ..... *T. (Archianthidium) baluchistanica*

6 Clypeus yellow with a large, median V-shaped black maculation becoming narrower from the base to the apex (black macula rarely reduced to a few black spots); genal area with yellow maculation 7

– Clypeus entirely yellow with the exception of the black distal margin 8



Comparison of the colour pattern of metasoma in *Trachusa laticeps*, *T. fasciatellum* and *T. laeviventris*. Yellow parts are shown in black.

7 Lateral yellow stripes on each side of abdominal tergites T1 and T2 widely separated from each other in the middle; mandible with condylar ridge broadly rounded subapically ..... *T.* (*Archianthidium*) *laticeps*

– Abdominal tergite T2 with an uninterrupted yellow band, broadly attenuated in the middle, lateral band on each side of T1 usually nearly reaching the middle or forming a continuous transverse band; condylar ridge of mandible bulging subapically, the apical tooth thereby becoming elevated over the body of mandible ..... *T. (Archianthidium) fasciatellum*

8 Genal area with large yellow marking ..... *T.* (*Archianthidium) pubescens*

– Genal area black without yellow marking ..... *T.* (*Archianthidium*) *laeviventris*

9 Subantennal suture straight or almost straight (Afrotropical: *Congotrachusa* and *Massanthidium;* Indomalayan*: Metatrachusa*) 10

– Subantennal sature arcuate outward (East and West Palaearctic, Afrotropical, Indomalayan) (*Orthanthidium*, *Paraanthidium*) 15

10 Omaulus not carinate 11

— Omaulus distinctly carinate, carina extending onto ventral surface of thorax close to middle coxa (Afrotropical: *Massanthidium*) 13

11 Mesonotum (scutum, scutellum, axilla) and T1 black; scutellum and axillae nearly half-moon-shaped, apical edge rounded (*Metatrachusa*) 12

– Scutum with one lateral yellow band on each side; scutellum: proximal and distal margins almost parallel and with widely rounded angles laterally; apical margin angular, slightly emarginate medially, yellow with the exception of proximal parts; T1 with transverse yellow band (*Congotrachusa*) ..... *T. (Congotrachusa) schoutedeni*

12 Distal half of clypeus yellow, proximal half dark, with an undulated border line resulting in a crown-like yellow pattern; tergites dark with the exception of a lateral yellow maculation in T5 ..... *T. (Metatrachusa) orientalis*

– Clypeus dark; T2-T6 with yellow transverse band (interrupted in T2, thin in T2 and T3, wider in T4-T6) ..... *T. (Metatrachusa) pendleburyi*

13 Clypeus with V-shaped emargination at apex; tergites yellow-orange with reddish maculation; metasoma parallel-sided (with T1 as wide as T2) ..... *T. (Massanthidium) flavorufula*

– Apical margin of clypeus crenulated to dentate in the middle; tergites black or red-brown with lateral yellow maculation 14

14 Integument reddish to reddish-brown; sharp contrast between reddish mandibles and its black teeth and between the reddish clypeus and the small black teeth at its apical margin; scutum with short, erect hair; vertex with a lateral ivory coloured to yellow spot on each side and a smaller in the middle ..... *T. (Massanthidium) massauahensis*

– Integument black; no colour contrast between mandibles and teeth nor between clypeus and the small teeth on its apical margin; pubescence of scutum include a patch of relatively long white hair in the middle of anterior margin; vertex with a lateral yellow spot on each side . *T. (Massanthidium) eburneomaculata*

15 Scutellum truncate posteriorly as seen from above, with median emargination; large species (13-20 mm) (subgenus *Orthanthidium:* Indomalayan) 16

– Scutellum broadly rounded, emarginate in the middle; lateral margin of axilla convex but in general slanting; eyes subparallel; interocellar distance about half of ocelloccipital distance or somewhat greater (subgenus *Paraanthidium*: Palaearctic, Indomalayan) 17

16 Large (18-20 mm), robust, dark species with typical megachiliform body shape; lateral side of axillae parallel; scutellum obviously produced, apical margin truncate, not sharp, with median emargination *T. (Orthanthidium) formosana*

– Medium-sized species (13-15 mm); slender species with a heriadiform body shape; inner margin of scutellum convex; T1-T5 with narrow yellow subapical bands; T6 black ..... *T. (Orthanthidium) cornopes*

17 Colour of body black and bright yellow (“wasp like”) (Palaearctic species) (*interrupta* group of subgenus *Paraanthidium*) 18

– Light parts of the body ochreous or rufous (Indomalayan and Afrotropical) 20

18 Dorsolateral parts of pronotum without tooth-like projection; hind margin of vertex rounded to sharp-edged 19

– Dorsolateral parts of pronotum with tooth-like projection; hind margin of vertex distinctly lamellate; mandibles black ..... *T. (Paraanthidium) heinzi*

19 Mandibles completely black, mesepisternum black ..... *T. (Paraanthidium) interrupta*

– Mandibles yellowish to brownish, teeth black; mesepisternum with large yellow macula ..... *T. (Paraanthidium) dumerlei*

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 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*

23 Tergite T1 black, T2 with lateral rufous colouration, T3 with rufous band; clypeus narrowly carinated in the middle; mandible with 4 teeth ..... *T. (Paraanthidium) rufobalteata*

– Tergite T1-T3 black, (T4-) T5 with yellow band, T6 yellow; scutellum deeply emarginate; pronotal lobe black with sharp lamella on anterior side; clypeus emarginate, apical margin slightly crenulated but no distinctive tooth-like structures; mandible with one blunt rounded and four flattened teeth; sharp lamella in upper omaulus ..... *T. (Paraanthidium) longicornis*

Males

Males of the following species have not been described and are therefore absent in the key: *Trachusa flavorufula*, *T. eburneomaculata*, *T. massauahensis*, *T. pendleburyi*, and *T. formosana*.

1 Mesosoma and metasoma black without yellow markings (at most some inconspicuous yellowish lateral maculation on T5); yellow are at most clypeus and paraocular area 2

– Metasoma *with* yellow markings 5

2 Head, meso- and metasoma with dense pubescence; second recurrent vein meeting second submarginal crossvein (or slightly basal or distal to it); S3 with deep median notch, S4-S5 emarginated in the middle (Palaearctic) ..... *T.* (*Trachusa*) *byssina*

– Sparse pubescence on head, mesonotum and metanotum; second recurrent vein distal to second *submarginal* crossvein 3

3 Arolia absent, omaulus not carinate; black combs on S4-S5 absent; antennal socket dark brown (Indomalayan) ..... *T. (Metatrachusa) orientalis*

– Arolia *present*; subantennal suture outwardly arcuate; black combs on S4-S5 present 4

4 Small to medium-sized species (11 mm); legs relatively short, hind tibia thickened; antennal socket dark brown with dull yellow stripe beneath (Indomalayan) ..... *T. (Paraanthidium) ovata*

– Large *species* (16 mm); legs elongated, hind tibia parallel-sided; light pubescence on T1, other tergites practically hairless; antennal socket dark brown (Indomalayan) ..... *T. (Paraanthidium) xylocopiformis*

5 Second recurrent vein entering second submarginal cell basal to second submarginal crossvein; T7 of male with median basal projection; black combs on S4 and/or S5 absent (subgenus *Archianthidium*) 6

– Second *recurrent* vein meeting or distal to second submarginal crossvein; T7 of male without basal projection; black combs on apical margins of S4 and/or S5 present (subgenera *Congotrachusa, Orthanthidium* and *Paraanthidium*) 11

6 T7 tridentate, tripod-shaped ..... *T. (Archianthidium) pubescens*

T7 with one tooth 7

7 T7 prolonged into a long spine, becoming narrower towards apex; underside of spine concave; mandible large, bidentate with a strong apical and a smaller subapical tooth; condylar ridge bulged subapically .... *T. (Archianthidium) baluchistanica*

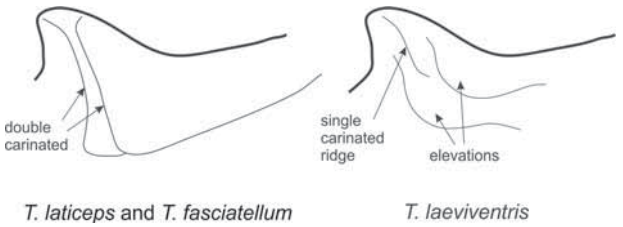
– Prolongation of T7 flat and parallel-sided in dorsal view 8

8 Highly elevated keel on the ventral side of the prolongation of T7, reaching the apex of the prolongation; the keel is divided into two lateral halves with a groove in between 9

– No or *only* inconspicuous keel under the prolongation of T7 10

9 Lateral yellow stripes on each side of abdominal tergites T1 and T2 widely separated from each other in the centre; mandible with condylar ridge broadly rounded subapically; yellow maculation on scutum, scutellum and axillae absent ..... *T.* (*Archianthidium*) *laticeps*

– Abdominal tergite T2 with an entire yellow band, broadly attenuated in the middle, lateral band *on* each side of T1 usually nearly reaching the middle or forming a continuous transverse band; condylar ridge of mandible bulging subapically, the apical tooth thereby becoming elevated over the body of mandible; scutum with a lateral yellow stripe on each side or at least some remnant of yellow maculation near the tegulae ..... *T. (Archianthidium) fasciatellum*



Shape of the last tergite (T7) of *T. laticeps*, *T. fasciatellum* and *T. laeviventris* in lateroventral view.

10 Low carina on the ventral side of the prolongation of T7, not reaching the apex of the prolongation; mesosoma black, rarely some small yellow maculation anterolaterally; T4 and T5 with uninterrupted yellow bands; vertex with yellow transverse stripe on each side ..... *T. (Archianthidium) laeviventris*

– Underside of the prolongation of T7 grooved; T4 and T5 with a yellow lateral band on each side not reaching the middle; scutum with conspicuous yellow bands along anterior and/or lateral margin; vertex with large yellow triangular maculation on each side ..... *T.* (*Archianthidium*) *forcipata*

11 Subantennal sature straight or almost straight; slender, rod-shaped projection arising from the underside of the head; clypeus projecting; strongly protuberant eyes and clypeus ..... *T. (Congotrachusa) schoutedeni*

– Subantennal sature arcuate outward; projection on underside of head absent; clypeus flat or moderately convex (subgenera *Orthanthidium* and *Paraanthidium*) 12

12 T1-T5 with yellow markings (continuous transverse bands, lateral bands or entirely yellow) 13

– T1 without *light* markings (*longicornis*-group) 15

13 T1-T5 black, each with a narrow submarginal yellow band; all bands linear, even in width; most of scutellum and axillae yellow; proximal margin of scutellum concave, distal margin truncate with wide emargination ..... *T. (Orthanthidium) cornopes*

– Shape of the light bands not the same on all tergites 14

14 Light parts of the integument ochreous; outer side of tibiae bright yellow with large longish black maculation ..... *T. (Paraanthidium) aquiphila*

– Light parts *of* the integument bright yellow; black and yellow wasp-like colour pattern; outer side of tibiae bright yellow (*interrupta*-group) 18

15 T2 with continuous yellow transverse band; T6 with longitudinal mid-line reaching apical margin; S4 with wide V-shaped emargination, both arms of the V convex; medium-sized species ..... *T. (Paraanthidium) muiri*

– T2 with a *lateral* yellow stripe on each side 16

16 Scutum with short lateral yellow stripe at each side; scutellum and axillae black; small yellow mark on each side of occiput; apical margin of S4 with deep median emargination and in the middle of the emargination, a small V-shaped notch; large species ..... *T. (Paraanthidium) maai*

– Scutum black 17

17 Supraclypeal area yellow; T4 yellow with the exception of the brown margin (some irregular brown maculation may occur within the yellow area); clypeus widely rounded, apex truncated ..... *T. (Paraanthidium) longicornis*

– *Supraclypeal* area dark; T4 with a narrow transverse band; clypeus emarginate at apex ..... *T. (Paraanthidium) rufobalteata*

18 Lateral black comb on S4 reaches apex; gonoforceps deeply forked apically 19

– Lateral comb on S4 only on inner half of the semicircular lobe if S4; gonoforceps only *slightly* forked apically ..... *T. (Paraanthidium) dumerlei*

19 Hind margin of vertex distinctly lamellate; pronotum with dorsolateral tooth-like projection; subapical patches of dark bristles absent on S4 .... *T. (Paraanthidium) heinzi*

– Hind *margin* of vertex rounded to weakly carinate; pronotum without dorsolateral tooth-like projection; S4 with distinct patches of subapical bristles ..... *T. (Paraanthidium) interrupta*

Species Accounts

Subgenus *Archianthidium* Mavromoustakis, 1939

The subgenus *Archianthidium* is clearly differentiated from the other subgenera in the genus *Trachusa* and is characterised by the second recurrent vein of the fore wing which enters the second submarginal cell basal to the second sub-marginal crossvein, and by the basal projection of the last tergite (T7) of the male. Prior to Michener & Griswold (1994), *Archianthidium* has been treated as separate genus of the Anthidiini tribe (see also Michener (2007).

Trachusa (Archianthidium) baluchistanica (Mavromoustakis, 1939)

Archianthidium baluchistanicum Mavromoustakis, 1939 (Ann. Mag. Nat. Hist., 11. Ser., 3: 88–97). Female and male. Pakistan.

Trachusa (Archianthidium) baluchistanica (Mavromoustakis, 1939).– Michener & Griswold (1994).

Similar to *Trachusa forcipata*, from which males differ in the different colour pattern and the shape of the seventh tergite (T7). Females are differentiated from *T. forcipata* by the colour pattern of head, thorax, and abdominal tergites.

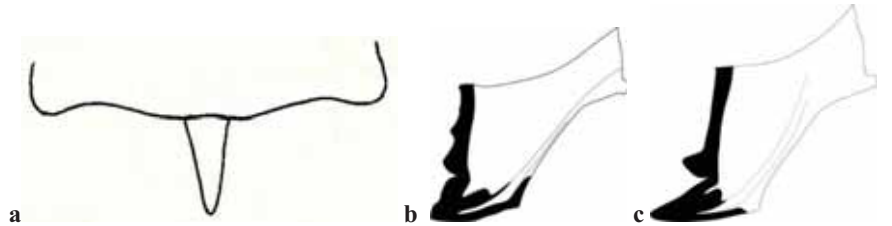
*Female***.** 14 mm. *Head*: Clypeus yellow, finely punctured, lower margin slightly emarginate in the middle and black-brown; crenulated in the emargination; mandible yellow, apex black and with an apical large blunt tooth, two blunt smaller subapical teeth, followed by an edentate ridge; condylar ridge strongly bulged subapically; paraocular area yellow, yellow marking reaching almost top of eye; gena also yellow except very narrowly the base on outer side; the occipital broad and short yellow stripe not reaching the gena, but extending somewhat onto vertex and triangularly notched in the middle beneath; antenna black; scape reddish-brown in front; supraclypeal area, front, vertex, and occiput with yellowish-brown hair; gena with shining white hair; clypeus with short and sparse yellowish-brown hair; sides of face up to insertion of antennae with shining white hair; remainder with dull yellowish-brown hair. – *Mesosoma*: Black; scutum very densely punctured and moderately shining, with somewhat dense dull yellowish-brown hair; scutellum narrow, nearly yellow, with denser and longer dull yellowish-brown hair; axilla with large yellow mark; scutum with an L-shaped yellow stripe, slightly interrupted and attenuated at side above; tubercle black; side of thorax with shining white hair. – Femora yellow, with black narrow stripe beneath; tibiae yellow, and nearly black-brown beneath and on outer side; tarsi yellow; hind basitarsi flat and broad, base broader than apex; with dense and short yellowish-brown hair on inner side; tibiae above and tarsi on outer side with sparse and short light yellowish-brown hair; spurs yellowish. – *Metasoma:* Black; tergites sparsely and very finely punctured, apical margins broadly densely and very finely punctured; apical margin of T3 slightly and convexly produced in the middle; T1 and T2 with broad and long lateral yellow bands nearly reaching the middle; T3 and T4 each with a transverse yellow median band slightly notched above, apical margin of T4 broadly emarginate in the middle; T5 yellow, apical margin black and

Table. Some characteristic features for distinguishing females of *Trachusa baluchistancia* from *T. forcipata*.

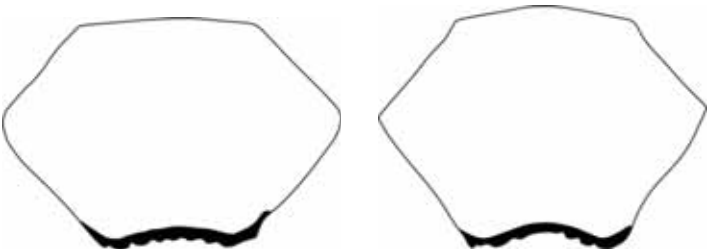
	***T. baluchistanica* (female)**	***T. forcipata* (female)**
Clypeus	Apical margin shallowly emarginate.	Apical margin conspicuously emarginate.
Mandible	Rounded apical tooth, two smaller subapical teeth and an edentate ridge.	Rounded apical tooth and an edentate ridge.
Face: colour pattern	Yellow lateral maculations nearly reaching top of eyes.	Yellow lateral maculations extend over paraocular area and vertex and nearly reach preoccipital ridge.
Antenna: scape	Reddish-brown in front.	Reddish-brown at base, otherwise uniformly dark brown to black; slightly curved and flattened.
T1-T2	With broad and long lateral yellow bands nearly reaching the middle.	With broad und long lateral yellow bands, well separated in the middle.
T3-T4	With transverse yellow median band slightly notched above. Apical margin of T4 broadly emarginate in the middle.	With yellow band narrowly broken.
T5	Yellow, apical margin black and broadly emarginate in the middle.	As T3/T4.

broadly emarginate in the middle; T6 short and entire, with large lateral marks nearly reaching the middle.

*Male***.** 15 mm. Similar to the female. *Head*: Mandibles large as in *T. forcipata*; with an apical tooth and a smaller subapical one and a long edentate ridge; scape with yellow stripe in front; lower margin of clypeus crenulated. – *Mesosoma:* Black; scutum with dense and somewhat short dull yellowish-brown hair above; scutellum with similar but longer hair; thorax with white hair at sides; scutum with very narrow yellow stripe at sides along the base of tegulae. – *Legs:* Anterior femora black, apex broadly above and a stripe beneath yellow; middle femora black, with a yellow stripe beneath and a stripe above nearly reaching the base; hind femora yellow above, black with short basal stripe beneath; anterior tibiae yellow above, light reddish-brown on inner side, black-brown beneath and on outer side except the reddish-brown apex; middle tibia yellow above and black beneath and on outer side except narrowly the apex; hind tibia yellow above and black-brown beneath; tarsus yellow, apex of claws black; anterior basitarsus conspicuously shorter than tibia; middle basitarsus very long, as long as tibia and very narrow. – *Metasoma:* T1-T2 each with a lateral band; T3 with broadly interrupted yellow band; T4 and T5 with broad transverse yellow stripe slightly notched in the middle above; T6 yellow, broadly interrupted in the middle, apical margin black (brown at sides), with



Trachusa baluchistana. **a.** T6 and T7 of male in dorsal view. **b.** Female mandible. **c.** Male mandible *Sources*: a. redrawn by MK from Mavromoustakis (1939). b. female holotype and c. male, both in coll. Mavromoustakis (from: Kasparek 2017).



Comparison of the clypeus of the female of *Trachusa baluchistana* (left) and *T. forcipata* (right). – *Sources*: *T. baluchistanica*: Holotype, coll. Mav., *T. forcipata*, coll. Schwarz. – Drawings: MK.

Trachusa baluchistanica, female habitus and head. *Source*: Holotype in coll. Mavromoustakis, photographs: MK.

Trachusa baluchistanica, male (habitus). – *Source*: Specimen from coll. Mavromoustakis, photographs: MK.

Trachusa baluchistanica, male. Left: Genitalia, right: Tergite T7 from below. Note that the underside of the median spine-shaped process of T7 is concave. – *Source*: The same individual from coll. Mavromoustakis, photographs: MK.

Trachusa baluchistanica, Clypeus and mandible of male. – *Source*: Specimen from Tajikistan in coll. Mavromoustakis, photograph: MK.

rounded sides as in *T. forcipata*; T7 short and produced in the middle into a long spine, brown at the base and black at the apex. Ventral side of spine concave.

Biology: Found on the wing in May (Mavromoustakis 1939).

Distribution: Pakistan (Mavromoustakis 1939). Found at an altitude of 2100 m (7,000 ft.) in the Chitan Mountain (Koh-i-Chiltān) near Quetta, close to the border with Afghanistan.

Distribution of *Trachusa baluchistanica*. The species is known only from one locality in Pakistan in the border area with Afghanistan.

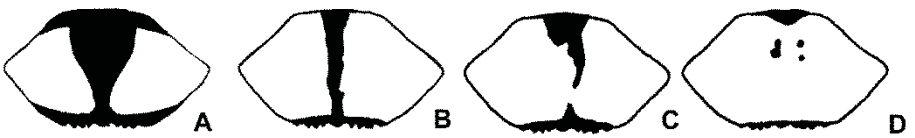
Trachusa (Archianthidium) fasciatellum (Friese, 1917)

Anthidium fasciatellum Friese, Dt. Entomol. Zeitschr., 1917, p. 53 (Turkey) (female).
Archianthidium laticeps ssp. *anatolicum* Mavromoustakis, Ann. Mag. Nat. Hist., 3 (11), 1939: 91 (male) (Turkey, non Syria).
Anthidium laticeps Morawitz, 1873 (partim) – Warncke (1980).
Trachusa laticeps (Morawitz, 1873) (partim). – Michener & Griswold (1994).
Trachusa (Archianthidium) fasciatellum (Friese, 1917). – Kasparek (2017).

The species is similar to *T. laticeps* but can easily be distinguished in both sexes particularly by the continuous yellow band on T2 (lateral stripes not reaching the middle in *T. laticeps*) and the subapically bulged condylar ridge of the mandible.

The taxon was described based on a single female from Turkey (Friese 1917) and Warncke (1980), without stating any reasons, put it into synonymy with *Anthidium laticeps* Morawitz, 1873, today recognised as *Trachusa laticeps* (Morawitz, 1873). Consequently, *Anthidium*/*Trachusa fasciatellum* has not been included in the World Bee Checklist of the Integrated Taxonomic Information System (ITIS 2012), the Encyclopedia of Life (EOL) based on that (Asher and Pickering 2016), the Checklist of the Western Palaearctic Bees (Kuhlmann et al. 2016), and other works. Based on examination of Friese's type material and examination of a series of specimens collected in Turkey, the status of this taxon as a good species was re-established by Kasparek (2017).

Female. 13–14 mm. Head, scutum and metasoma with short, erect whitish-ochreous pubescence, underside of head and thorax with long white hair. *Head*: Mandible black with one large tooth and three smaller, blunt teeth which are sometimes not clearly separated from each other; condylar ridge strongly bulged subapically; clypeus yellow with black medial maculation; the form of the black pattern is mostly notch-shaped, but sometimes reduced and may be confined to some irregular spots. Clypeus almost twice as wide as long (on average 1.9x for N=6); apical margin black with small tubercles, slightly emarginate in the middle; yellow maculation in the paraocular area nearly reaching the top of eye; yellow band in the genal area not reaching mandible; sometimes two small yellow spots on vertex; preoccipital area rounded; antenna relatively short with a relatively long scape; black. – *Mesosoma*: Scutum black with small yellow lateral stripe close to tegula; sometimes very small, narrow yellow bands also at upper side; two yellow spots on scutellum and one on each axilla; scutellum rounded; large yellow maculation on mesepisternum; tegula black with broad, semicircular yellow outer margin. –

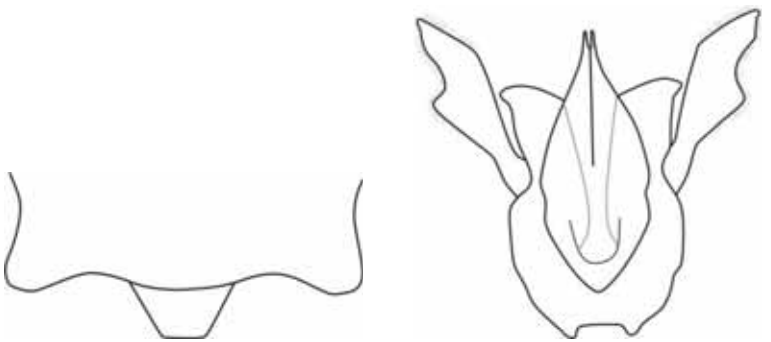


Trachusa fasciatellum, female. Extension of the black colouration on the clypeus. A is the most common pattern, B-D are patterns less frequently found. – Drawing: MK after material in coll. MK, coll. Schwarz and SMF.

Trachusa fasciatellum. Habitus of female (left) and male (right). Note the different colour pattern of head, scutum and first tergites. – *Sources*: SW Turkey 2013 and 2014, coll. Kasparek. Photographs: MK.

Metasoma: T1 with lateral, irregularly formed yellow stripe which often reach the middle and then form a continuous transverse band attenuated in the middle; T2 with yellow stripe attenuated in the middle; T3-T5 with continuous yellow bands; T6 black with yellow apical end (when retracted, only yellow colouration visible). Sterna black with lateral yellow spots on S2-S5 (one spot at each side on each sternum); scopa yellowish. Outer side of basitarsus of hind legs light yellow, mediotarsi distinctly darker.

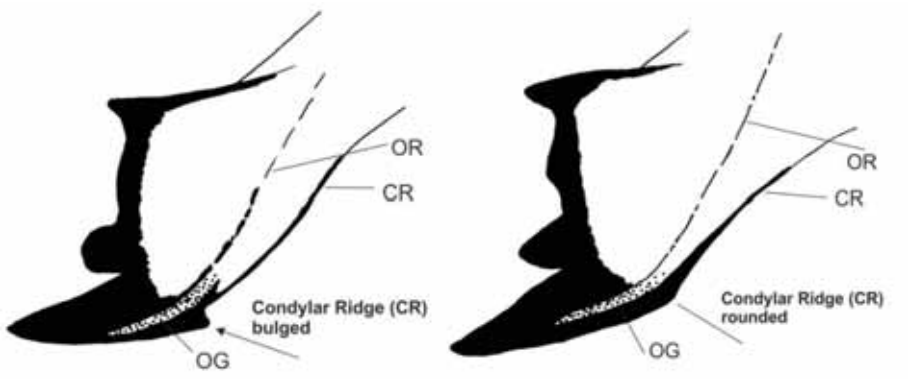
Male. 13–16 mm (on average slightly larger than female). *Head*: Clypeus yellow, sometimes with some small black maculae in the middle of the upper margin; slightly convex and lower margin shallowly emarginate, transparent and crenulate. Mandibles yellow with black teeth; one large acute tooth forming the apex is followed by three small, broad, obtuse teeth (often forming a single ledge). Condylar ridge bulged subapically. Paraocular area yellow, yellow macula almost reaches the upper end of the eye. Two yellow spots on vertex; genal area with broad yellow stripe reaching the mandible; underside of head with long whitish hair. – *Mesosoma*: L-shaped stripe extending along upper and lateral side; scutellum and axilla with large yellow maculae; scutellum pulvinate; small yellow spot at mesepisternum not always present (present in 7 out of 12 indi-



Trachusa fasciatellum, male. Left tergites T6 and T7, right genitalia. – From: Mavromoustakis (1939), redrawn by MK.

Trachusa fasciatellum, head. Left: female. Right: male. Note the different colouration of clypeus and the different yellow pattern of paraocular areas. Mandibles differ both in shape and colouration. – Source: Turkey, coll. MK. Photographs: MK.

viduals); scutum with short yellowish-white hair, underside of thorax with longer white pubescence. – *Metasoma*: T1 with lateral yellow bands attenuated in the middle; the two bands often meet, leaving only narrow space in between; sometimes the two bands merge and form a single band extending over the entire tergum; the yellow band extends on the lateral ends of T1 (i.e. those parts bent inward and seen from ventral). T2-T5 with yellow bands attenuated in the middle; T6 entirely yellow; T6 with two lateral and one median, rounded projections; the median projection is often not clearly distinguishable from a projection of T7. T7 with rounded median tooth and a highly elevated keel under this projection; the keel reaches the apical end of the prolongation and is divided into two lateral halves with a groove in between. One yellow spot on each side of sterna S2-S5.

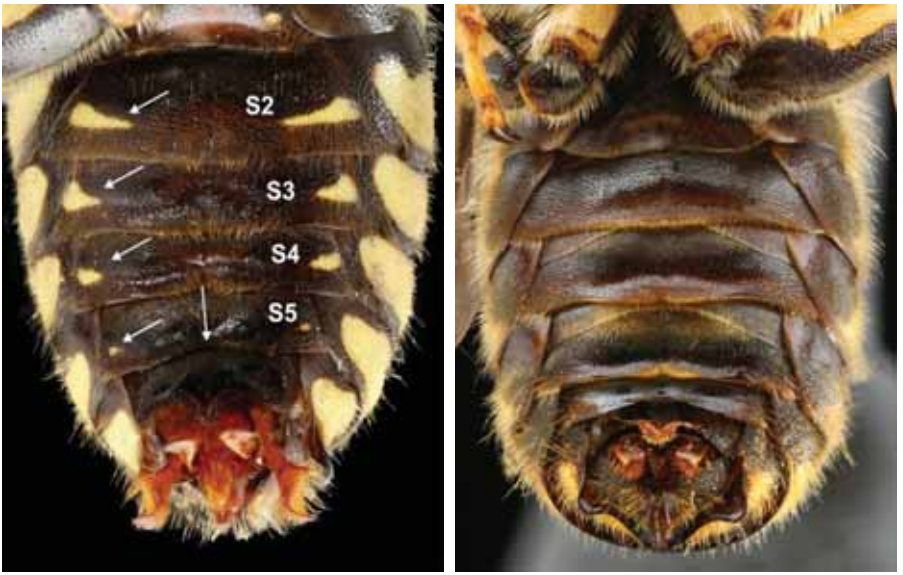


Comparison of the mandibles of the male of *Trachusa fasciatellum* (left) and *T. laticeps* (right). Note the bulged condylar ridge in *T. fasciatellum*. OR = Outer Ridge; CR = Condylar Ridge; OG = Outer Groove. – *Source*: Kasparek (2017).

Trachusa fasciatellum, male. Mandible (left) and T6 and T7 (right). – *Sources*: Turkey, leg. coll. MK. Left photograph from Kasparek (2017), right photograph: MK.

Trachusa fasciatellum, male, evaginated genitalia from two perspectives. – *Source*: Turkey (coll. MK). Photographs: MK.

Biology: In Western and southern Turkey the flight period extends from May to June (Güler et al. 2014; Kasparek, unpubl.), but the species was recorded from north-eastern and eastern Turkey as late as August (Özbek & van der Zanden 1993, Kasparek 2017). Flower visits recorded for *Oreganon* sp., *Phlomis rigida, Vitex agnus-castus, Centaurea solstitialis*, and *Cephalaria alpina* (Güler et al. 2014, Özbek & van der Zanden 1993, Kasparek unpubl.).



Comparison of the underside of metasoma of *Trachusa fasciatellum* (left) and *T. laticeps* (right). Note in *T. fasciatellum* the lateral yellow spots on the sternites and the emarginate S5. – *Sources*: Turkey, coll. MK (*T. fasciatellum*) and Greece, coll. Schwarz (*T. laticeps*). Photographs: MK.

Distribution: Endemic to Turkey and probably the Greek islands close to the Anatolian land mass (Kasparek 2017). The distribution in Turkey extends from the Dardanelles Strait (Çanakkale) in the west over Manisa, Muğla, Antalya and Içel (Mersin) provinces to Hakkâri province in the east and Artvin in the northeast (Kasparek 2017). It can be expected that specimens from Mersin (Güler et al. 2014), Antalya and Erzurum (Özbek & van der Zanden 1993), published as *T. laticeps*, may also be attributed to this species. Found from sea level up to approximately 2300 m (Özbek & van der Zanden 1993).

Distribution of *Trachusa fasciatellum* (orange-red) and *T. laticeps* (red-brown).

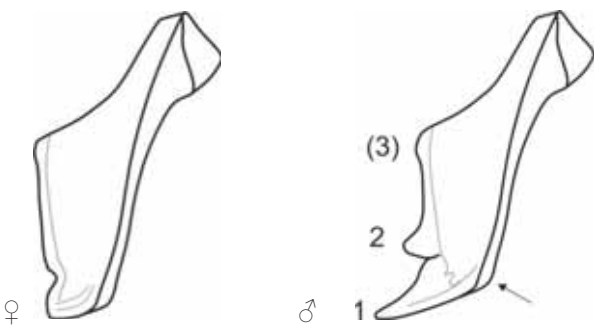
Trachusa (Archianthidium) forcipata (Morawitz, 1875)

Anthidium forcipatum Morawitz, 1875. In Fedtschenko: Turkestan *Apidae* 1: 121 (Uzbekistan, nec Tajikistan as claimed by Warncke 1980). Male.
Anthidium edentatum Friese, 1931 (Konowia 10: 36) [synonymized by Warncke 1980]. Female.
Archianthidium forcipatum Morawitz, 1875.
Trachusa (Archianthidium) forcipata (Morawitz, 1875).– Michener & Griswold (1994).

Robust species, habitus similar to *T. pubescens* and closely related to *T. baluchistanica*. Both *T. forcipata* and *T. baluchistanica* have a characteristic angular shape of mandibles (subapically bulged condylar ridge), a feature which is shared otherwise in the genus only with *T. fasciatellum*. The male of *T. forcipata* can is easily be distinguished from *T. laticeps* by the shape of the last tergite (ventral side elevated in *T. laticeps,* flat in *T. forcipata*). In *T. baluchistanica*, the last tergite has a different structure, with a median spine-shaped process.

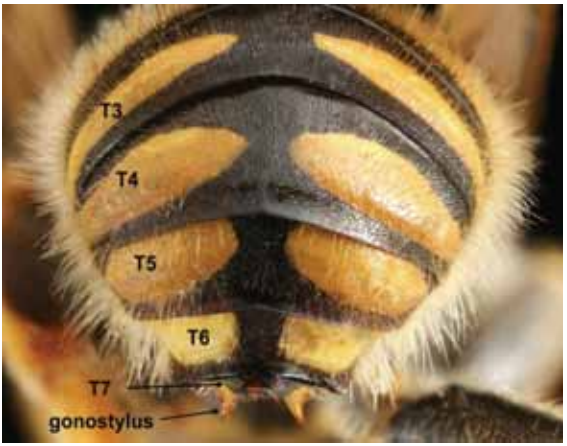
Morawitz (1875) described the male only. The examination of a small series of two males and a female collected together in Tajikistan (coll. Schwarz) and the type material of *Anthidium edentatum* Friese, 1931 in the Berlin museum confirmed that *A. edentatum* Friese, 1931 is the female of *T. forcipata* as already suspected by Friese (1931) himself and suggested by Warncke (1980).

Female (14-16 mm): Black with abundant yellow markings and ochreous pubescence; puncturation fine and densely wrinkled; dull. *Head*: Head as wide and almost as large as scutum. Clypeus, mandibles and genal area yellow. Wide yellow maculation extending from lower paraocular area to the preoccipital ridge; small yellow spot also in supraclypeal area; clypeus convex and apical end of clypeus distinctly emarginate; distal margin of clypeus dark brown; clypeus sometimes with small dark brown maculae; antenna dark brown to black; ventral side of head with long, white pubescence. Mandible with an apical tooth, but no distinct inner teeth. – *Mesosoma:* Scutum with broad, L-shaped yellow lateral stripe, attenuated in the anterolateral corner. Scutellum pulvinate with



Trachusa forcipata: mandible of female (left) and male (right). The female has originally been described under the name *Anthidium edentata*, "the toothless". The male is bidentate. A third tooth is sometimes (as in this drawing) weakly developed. – Drawing: MK.

Trachusa forcipata. Male. Clypeus and mandible. – Source: Rushan, Pamir Mountains, Tajikistan, coll. Schwarz. Photograph: MK.



Trachusa forcipata, male, terminal tergites. Note that the yellow bands on T4 and T5 do not reach the middle (in the closely related *T. baluchistanica*, a broad transverse yellow stripe slightly notched in the middle is present on T4 and T5). – *Source*: Pamir Mountains, Tajikistan, coll. Schwarz. Photograph: MK.

large yellow spot on either side, but this feature may vary (sometimes only a small, inconspicuous yellow maculation is present); axilla yellow or black with a yellow mark; side of thorax with two large yellow spots (one each on mesepisternum and metepisternum). – *Legs:* Yellow, underside of femur and tibia more or less dark brown striated; spur yellow. Wings yellowish infuscation, veins and tegulae ochreous. – *Metasoma*: Tergites finely and sparsely punctured; T1-T6 with broad, yellow bands on both sides, well separated in the middle especially in T1-T2; scopa yellowish to whitish.

Trachusa forcipata, habitus. Left female, right male. Note the two yellow maculae on the side of thorax of the female (absent in the male) and the yellow maculae on scutellum and axillae (absent in the male). – *Sources*: Pamir Mountains, Tajikistan, coll. Schwarz. Photographs: MK.

Male. 14-16 mm. Similar to female. Black, dorsally with dense yellow, ventrally with grey pubescence; tergites with regular, sparse puncturation; tergites with large yellow bands on both sides; mandibles almost rectangular; apical end of clypeus emarginate, crenulate; yellowish areas are: almost the entire paraocular area, two large triangular spots on vertex, anterior and lateral stripes on scutum, tibiae and tarsi. Middle metatarsi slightly curved; apex of apical end of last tergite emarginate. The yellow maculations on paraocular area and vertex may also come in contact with each other. In contrast to the female, yellow maculation on sides of thorax absent.

Biology: Found on the wing in Turkey in June and July (Özbek & van der Zanden 1993), in Tajikistan in July (Mavromoustakis 1939) and in Uzbekistan in August (Friese 1931).

Trachusa forcipata. Above: Female, below two different males. Note that in the female the continuous yellow colour pattern extends from the lower paraocular area to the preoccipital ridge. In the upper male, the yellow paraocular area is separated from the large triangular-shaped macula, in the lower male, the two yellow maculations are in contact. – *Source*: Tajikistan, coll. Mavromoustakis and coll. Schwarz. Photographs: MK.

Trachusa forcipata: Apical tergites of male. Note the shape of tergite T7 with almost parallel sides and a shallow emargination at apex. Right: ventral view. Note the groove which leads to the apex. – *Sources*: Males from Tajikistan in coll. Mavromoustakis and coll. Schwarz. Photographs: MK.

Distribution: Described from Uzbekistan (Zarafshon = Sarafschan) and subsequently found in Tajikistan (Mavromoustakis 1939) and Turkey (Özbek & van der Zanden 1993). In Tajikistan at 3040 m (Mavromoustakis 1939), in Uzbekistan at 2200 m (Friese 1931).

Distribution of *Trachusa forcipata*.

Trachusa (Archianthidium) laeviventris (Dours, 1873)

Anthidium laeviventre Dours, 1873. Rev. et Mag. Zool. (3)1: 303-304 (Spain). Male.
Anthidium atlanticum Benoist, 1934 (Bull. Soc. ent. France 39 p. 160). Female and male.
Archianthidium atlanticum ssp. *ibericolum* Mavromoustakis, 1939 (Spain) [synonymized with nominate *laeviventris* by Warncke 1980].
Trachusa (Archianthidium) atlantica Benoist, 1934.
Anthidium laeviventris ssp. *atlanticum* Benoist, 1934.– Warncke (1980).
Trachusa laeviventris ssp. *atlanticum* Benoist, 1934.
Trachusa (Archianthidium) laeviventris (Dours, 1873).– Michener & Griswold (1994).
Trachusa (Archianthidium) laeviventris atlantica (Benoist, 1934).

Trachusa laeviventris. Above: female, below: male. – *Sources*: Female from prov. Soria, Spain, male from Granada, Spain (both from coll. Schwarz). – Photographs: MK.

12-16 mm. Similar to *Trachusa laticeps* and *T. fasciatellum*. All three species are characterised by a very broad vertex, rounded onto occiput. Males have a similar structure to the last tergite (T7). Female *laeviventris* can be distinguished from *laticeps* and *fasciatellum* by the colour pattern of the clypeus (entirely yellow in *laeviventris*) and the genal area (dark in *laeviventris*, except for very rare cases with yellow maculation in *laticeps* and *fasciatellum*), males by the shape of the apical tergites T6 and T7.

Female. 12-13 mm. *Head*: Clypeus broader than long, lemon yellow with black apical margin; sometimes some small black maculation at the base; apical margin crenulated and slightly emarginate in the middle; yellow maculation in paraocular area not reaching top of eye; small yellow spot sometimes present between antennal sockets and clypeus; sometimes also two small yellow spots on vertex; antenna dark brown to black. – *Mesosoma*: Dark brown to black; short, narrow yellow transverse stripes at upper end of

Trachusa laeviventris. Left: female, right: male. – Sources: Female from prov. Soria, Spain, male from Granada, Spain (both from coll. Schwarz). – Photographs: MK.

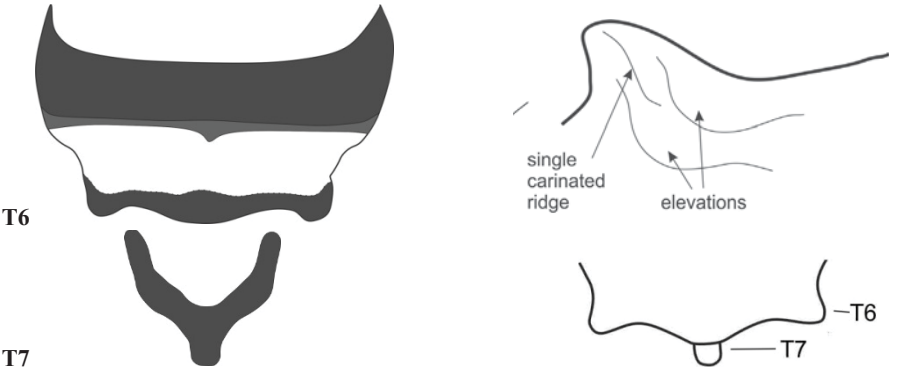
mesonotum, but not always present; short, erect pubescence on scutum and longer, white pubescence on underside; scutellum and axillae pulvinate, rounded; a yellow spot on each side of scutellum sometimes present. – *Metasoma*: Tergites T1-T3 with a lateral, wedge-shaped yellow stripe on each side, attenuated towards the middle; these stripes are well separated from each other in T1 and T2, but reach the middle in T3. Continuous bands attenuated in the middle on T4 and T5; T6 entirely yellow. Sternites dark brown, scopa yellow.

Male. 12-13 mm. *Head*: Clypeus broader than long, shallowly and somewhat sparsely punctured and shining; ochreous; paraocular area with yellow maculation exceeding antennal insertion but not reaching top of eye; basal ochreous narrow stripe on supraclypeal area sometimes present; a bright yellow mark above each eye; this mark sometimes large, taking the form of band extending from one side of vertex to the other; antenna black, scape yellow beneath; mandibles yellow, teeth blackish brown. – *Mesosoma*: Entirely black or with L-shaped yellow maculation along lateral and anterior side of scutum or with broad yellow band along the sides (see ssp. *atlantica*); tegula brown, finely punctured; axilla dark or with yellow spot; scutellum dark or with two yellow spots (one on each side). – *Metasoma*: Colour pattern of T1-T3 as in female, T4 and T5 with yellow band notched in the middle; T6 entirely yellow, T7 entirely black. T6 with lateral, rounded lobes; T7 produced in the middle similar to *T. laticeps*, *T. fasciatellum* and *T. forcipata*. The process of *T. laeviventris* is parallel-sided and has a truncated to rounded apex (parallel-sided and emarginate apex in *T. forcipata*, becoming narrower towards apex in *T. laticeps* and *T. fasciatellum*).

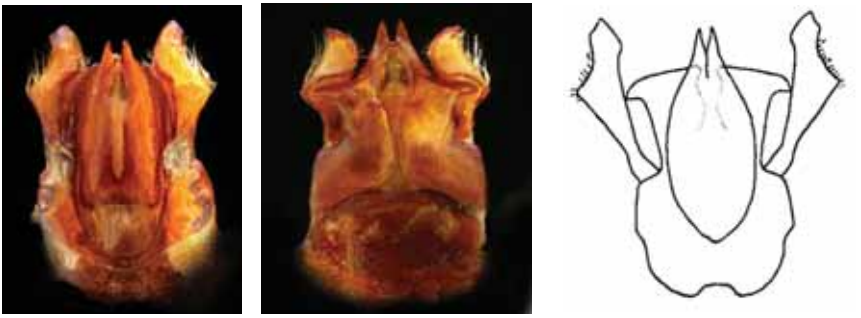
Trachusa laeviventris, head in frontal view (left female, right male). – Both specimens from Spain (from coll. Schwarz and OLL). – Photographs: MK.

Trachusa laeviventris. Head of male in lateral and frontal view. Note the long, white pubescence on the underside of head and thorax and around the base of antenna, and the relatively short, erect ochreous pubescence on upper sides. – Source: Specimen from Provence, France ex OLL. Photographs: MK.

Subspecies. Benoist (1934) described *Archianthidium atlanticum* from Morocco, and Mavromoustakis (1939) a subspecies thereof, *Archianthidium atlanticum ibericolum* from Spain, which differs from the typical subspecies in the entirely black thorax. Warncke (1980) regarded *ibericolum* as synonymous with nominate *laeviventris*, and *atlanticum* as subspecies of *laeviventris.* Some authors such as Ortiz y Sánchez (1990) still regard *ibericolum* as valid subspecies.



Trachusa laeviventris. Apical tergites. Left: T6 and T7 disassembled from dorsal. – Right above: T7 from ventral. Note that the underside is relatively flat with only a slightly elevated carinated ridge and two lateral humps. The closely related *T. laticeps* and *T. fasciatellum* have a strongly elevated median double-carina. – Right below: T6 and T7 from dorsal in natural position. – *Sources*: Drawings by MK, the drawing right below redrawn after Mavromoustakis (1939).



Trachusa laeviventris. Male genitalia. Left and middle: dorsal and ventral view of the genitalia of a specimen from south France. The right drawing shows *Archianthidium atlanticum ibericolum* Mavromoustakis, 1939, which was synonymised with nominate *Trachusa laeviventris.* – *Sources:* Photographs by MK after material in OLL. Drawing from Mavromoustakis (1939), redrawn by MK.

Examination of 11 specimens from France and Spain (OLL, coll. Schwarz) showed that the colour pattern of the scutum does not unambiguously allow identification: the series included both individuals with entirely black mesonotum (6 ex.), individuals with remnants of a yellow stripe on each side of the anterior side of scutum (4 ex.) and also an individual with a conspicuous yellow anterolateral band (the latter individual was collected together with another individual with black mesonotum). Almost half of these individuals are thus fully in conformity neither with nominate *laeviventris* (entirely black

Trachusa laeviventris. Apical tergites. Left: from dorsal, right from ventral (specimen from Provence, France ex OLL). – Photographs: MK.

mesonotum) nor with *atlantica* (lateral longitudinal line on each side of scutum, yellow on axillae and scutellum). It is therefore necessary to understand individual variation before taxonomic conclusions can be drawn.

Biology: Found on the wing in France and Spain from June to August (Mavromoustakis 1939, material in coll. Schwarz and OLL), in Morocco in June (Benoist 1934). Müller (1996) found in pollen grain counts of female scopal contents that Leguminosae are with 80.0 percent the preferred flowers, followed by Labiatae with 13.5 percent.

Distribution: So far only known from the western part of the Mediterranean basin (Southern France, Iberian Peninsula and Northern Africa), where it overlaps with its closely related *T. laticeps*. Country records are: France, Spain, Portugal (Ornosa et al. 2008), and Morocco (Benoist 1934). Probably also Algeria (Warncke 1982). The two subspecies *atlanticum* and *ibericolum* are listed for the Iberian Peninsula (Ortiz y Sánchez 1990), but not the nominate subspecies. In France apparently confined to the Mediterranean region, in the east to the border with Italy.

Distribution of *Trachusa laeviventris*.

Trachusa (Archianthidium) laticeps (Morawitz, 1873)

Anthidium laticeps Morawitz, 1873. Horae Soc. entomol. Ross. 10, 1873-1874: 121 (Greece) (male).
Archianthidium laticeps (Morawitz, 1873).– Van der Zanden (1984).
Anthidium laticeps Morawitz, 1873 (partim).– Warncke (1980).
Trachusa (Archianthidium) laticeps (Morawitz, 1873).– Michener & Griswold (1994).

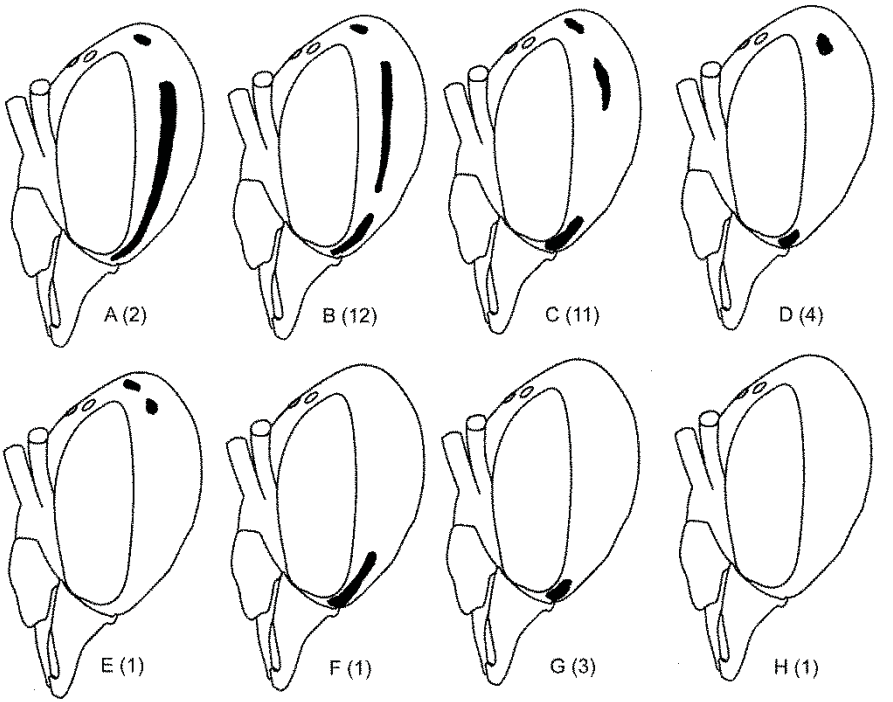
As with *T. laeviventris* and *T. fasciatellum* both sexes have a broad vertex, rounded onto occiput. Females are distinguished from *T. laeviventris* by a combination of a dark median maculation on the clypeus and a yellow maculation in the genal areas. Males are best distinguished from their congeners by the shape of T6 and T7. The pattern of yellow colouration on T2 and the subapically rounded, not bulged condylar ridge of the mandible is a good feature for distinguishing *T. laticeps* from *T. fasciatellum* in both sexes.

Female. *Head*: The extent and shape of the black maculation in the middle of the clypeus is apparently less variable than in *T. fasciatellum*: Among 18 females examined, all show the typical V-shaped pattern. The broad black apical margin of the clypeus is truncated and crenulated. Short golden hair on the inner side of the clypeus protrude to the apical margin. Mandibles broad, black, with four obtuse, flattened teeth decreasing in size from distal to proximal. Characteristic broad yellow spot in the genal area narrowing towards the mandibles. The size of this spot shows some minor individual variation in size and shape but is altogether much less variable than in males. – *Mesosoma*: Large yellow maculation on mesepisternum; small yellow maculation on axilla but not always present; very rarely also yellow spot on scutellum and even more rarely yellow, narrow, longish macula close to tegula. Tegula with halfmoon-shaped yellow colouration on outer side

Trachusa laticeps, colour pattern of tergites (Left: female, Right: male). Note that the band on T2 is interrupted, an important feature for distinguishing the species from *T. fasciatellum*. – *Sources*: Female from Greece (coll. Schwarz), and male from Croatia (SMF). Photographs: MK.

Trachusa laticeps, habitus from lateral. Above: female. Below: male. – *Sources*: Male and female from Greece (coll. Schwarz and OLL). Photographs: MK.

and black or dark brown on inner side. Scutellum and axillae pulvinate and broadly rounded. – *Metasoma*: Principally a similar colour pattern as in male with one yellow lateral band on each side of T1 and T2, not reaching the middle. Transverse yellow bands on T3 to T5, sometimes interrupted in T3 in the middle. T6 (often hidden under T5) black with two lateral yellow maculations. – *Pubescence*: Relatively long,



Trachusa laticeps. Head colouration pattern of the male (back spots stand for yellow areas). The number behind the letters give the number of cases (total number of specimens examined: N=40). Note that there is only one specimen without yellow colouration at head (H). – Drawings by MK after material in DEI, OLL, SMF and coll. Schwarz.

white pubescence on underside of head and thorax; shorter, often erect whitish-yellowish pubescence on dorsal surfaces.

Male. 15-16 mm. *Head*: Clypeus, broad, entirely yellow, rarely with some brownish marks at base. Apical margin slightly emarginate with thin, brownish, translucent fringe; mandible yellow with a large apical tooth and three smaller proximal teeth; these are not always discernible as separate teeth but may appear as a more or less continuous ridge; yellow lateral face marks extending over paraocular area, reaching upper third of the eye; a quite variable yellow stripe on vertex, varying in length and form and often separated into more than one maculation. Antenna reddish-brown to black; scape yellow beneath. – *Mesosoma*: Integument entirely black with dense pubescence, ochreous to brownish on upper side and white or whitish on underside. Coxa and femora with an irregular dark brown/black and yellow longitudinal colour pattern, tibiae yellow often with irregular, light brown darkenings; only inner side of hind tibiae dark brown; tarsi yellow. – *Metasoma*: Black with a lateral yellow band on T1 and T2 on each side; T3 to T5 each with a yellow transverse band attenuated in the centre; T6 trilobed with one median and two

Trachusa laticeps, face. Left: female. Right: male. – Source: Both from Croatia in OLL (left) and SMF (right). Note that paraocular areas are yellow in both sexes. Photographs: MK.

Trachusa laticeps. Left: Female apical tergites. Note the two yellow spots on T6. Right: Male apical tergites with evaginated gonoforceps. – Material: Greece, coll. Schwarz. Photographs: MK.

lateral rounded lobes; pregradular area (mostly hidden under T5) and lobes black, disc yellow; often small, black wedge-shaped colouration in the middle of the disc. Lateral yellow markings of T1 not extending onto the ventral side, i.e. ventral parts of T1 brown; sterna brown, rarely with some lateral yellowish lightenings (one lateral spot on each side of some sterna).

Biology: Found in Spain between late April and May (Ortiz 1990), in Greece from May to July (Standfuss et al. 2003), in Algeria in June (Saunders 1908). Visiting *Centaurea solstitialis, Cephalaria alpina, Vitex agnus-castus* (Özbek & van der Zanden 1993), *Oregano* sp. (Kasparek, unpubl.), *Phlomis rigida* Labill. (Lamiaceae) (Güler et al. 2014), *Digitalis paliurus* (van der Zanden 1984) and *Acanthus* (Greece, OLL). Müller (1996) found in pollen grain counts of female scopal contents that Leguminosae (mainly Genis-

teae) are with 45.9 percent the preferred flowers, followed by Labiatae with 44.8 percent (more or less equally shared between Lamioideae and Nepetoideae).

Standfuss et al. (2003) state that this species is the host of the cleptoparasite *Stelis gigantea*.

Distribution: Circummediterranean with the exception of the eastern Mediterranean, where the species is replaced by *Trachusa fasciatellum* (Kasparek 2017). Records are available from Algeria, Spain, France (SMF), Croatia (SMF), Bosnia and Herzegovina, Montenegro, Albania (Maidl 1922), Former Yugoslav Republic of Macedonia, Greece, and Bulgaria. Recorded in Spain (Granada) in up to 1500 m a.s.l. (Ortiz 1990).


Distribution of *Trachusa laticeps*.

Trachusa (Archianthidium) pubescens (Morawitz, 1873)

Anthidium pubescens Morawitz, 1873. Horae Soc. entomol. Ross. 9, 1872: 59-60 (male) (Caucasia).
Anthidium pubescens var. *maximum* Friese, 1931 (female and male, Turkey). Konowia 10: 34-39.
Anthidium (*Archianthidium*) *pubescens verhoeffi* (Mavromoustakis, 1955) (female and male, Israel and Lebanon). Ann. Mag. Nat. History 12. Ser., 7: 919-914.
Anthidium maximum Friese, 1931.
Trachusa (Archianthidium) pubescens (Morawitz, 1873).– Michener & Griswold (1994).

A relatively large, robust species with abundant pubescence. Males can easily be identified by the tripod-shaped last tergite (T7), females – once identified as member of the subgenus *Archianthidium* (second recurrent vein entering second submarginal cell basal to second submarginal crossvein) – by the black mandibles and a broad yellow clypeus in combination with a yellow spot on the gena.

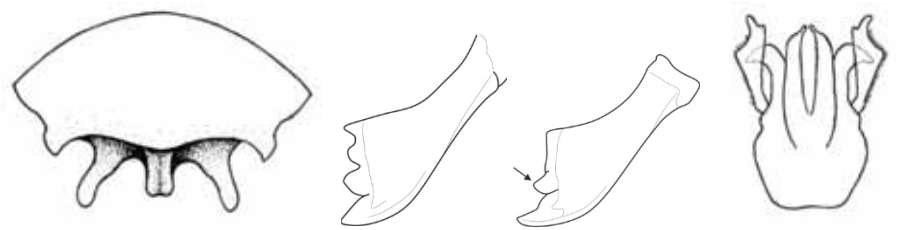
Friese (1931) already pointed out that there is much variation in this species but that all forms are in line with the same basic type, particularly with the shape of the last tergite in the male. He concluded that the small deviations found are probably due to "climatic variations", and described the "variety" "var. *maximum*" from southern Turkey.

Trachusa pubescens. Female from eastern Turkey in lateral view. Note the two small yellow spots on the metepisternum (rarely present). – *Source*: OLL, photograph: MK.

Mavromoustakis (1954) principally confirmed this, but emphasized differences in the shape of the sixth tergites in males. He therefore described *T. pubescens verhoeffi* as a new subspecies. As these morphological features overlap and do not always correlate with each other, the taxonomic situation is complex and needs to be further elaborated.

Female: 12-17 mm. *Head*: Clypeus yellow, slightly convex, apically truncate, with a black apical margin. Mandibles black, with four obtuse teeth. Maxillary palpus four-segmented. Paraocular area yellow with yellow colouration reaching almost top of eye, small triangular yellow spot in supraclypeal area, rarely taking a crown-like shape; the gena with a large yellow maculation not reaching mandible; yellow strip on vertex rarely present. Frons and vertex with normally dense brownish pubescence. – *Mesosoma*: Scutum with an L-shaped yellow anterolateral band; tegula yellowish-brown with sharp lamella; pronotal lobe rounded, yellow; sides of thorax: mesopleuron with large yellow maculation, sometimes a second spot on metapleuron. Underside of thorax with long white or light grey pubescence, upper side with usually dense, erect brownish pubescence; scutellum and axillae rounded, scutellum emarginate medially; both scutellum and axillae black with one yellow spot each; scutellum rarely also with two spots (one on each side) or entirely black. – *Metasoma*: T1-T2 with lateral yellow bands not reaching the middle; T3-T4 with continuous yellow bands, attenuated in the middle (sometimes also interrupted); T5 yellow with a V-shaped black maculation in the middle (not always present). T6 yellow or black, sometimes with some maculations (e.g. one small yellow spot on each side on black ground colour). Ventral scopa whitish to light yellow.

Trachusa pubescens. Female (left) and male (right) in dorsal view. – *Sources*: Female from Greece, male from Turkey, both from coll. Schwarz. Photographs: MK.



Trachusa pubescens. From left to right: Tergites T6-T7 of male, mandible of female and male, male genitalia. The second tooth in the male (arrow) may also be absent. – *Sources*: Tergites: Banaszak & Romasenko (2001); Mandibles: drawings MK; genitalia: Mavromoustakis (1939).

Trachusa pubescens. Shape of tergite T6 of the male in the three subspecies recognised.

Male: 12-18 mm. Habitus and general colouration pattern as female. *Head*: Clypeus convex with a truncated or emarginate apical margin; yellow, apical margin finely crenulated to serrate, light brown; mandibles yellow, wide apically, four-dentate with a large, acute apical tooth; the form of the inner three teeth highly variable; often only the outer tooth available, whereas the other two not clearly separated, forming a continuous ridge; sometimes all three teeth together form a ridge without discernible teeth. In addition to

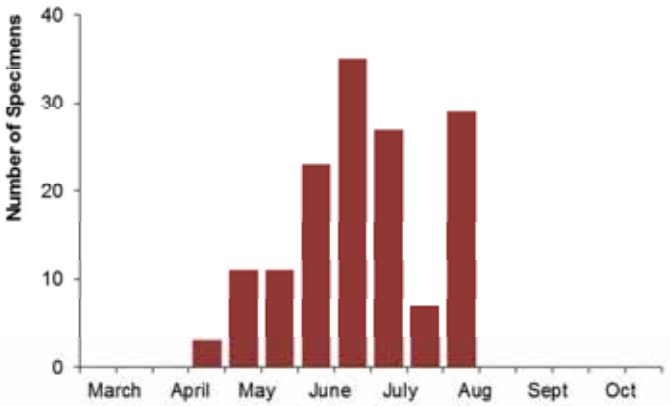
Trachusa pubescens. Head of the male in frontal view. Note the variation in the form of the head (wide versus longish), the shape of the yellow maculation of the supraclypeal area and vertex. – *Sources*: Material from Hakkâri in Turkey (left and middle; OLL) and SW Turkey (coll. MK). Photographs: MK.

Trachusa pubescens. Head of the female in frontal view. Note the wide, black mandibles with four obtuse teeth and the black apical margin of the clypeus. – *Source*: Material from eastern Turkey in coll. Schwarz. Photograph: MK.

the clypeus yellow areas are: paraocular area, band on vertex, supraclypeal spot and gena. The individual variation in the extent of yellow colouration is high. – *Mesosoma*: L-shaped yellow band on scutum anterolaterally which however may be reduced or in rare cases entirely absent; dense brownish pubescence. Scutellum and axillae rounded; scutellum with one yellow spot on each side and axilla with yellow spot. However, yellow pattern is highly variable and yellow markings may be absent. – *Metasoma*: Typical specimens have on T1-T2 a lateral yellow band not reaching the middle, on T3 a yellow band interrupted in the middle, and on T4-T5 one continuous yellow band each attenuated in the middle. T6 yellow or black with a lateral lobe on each side and a median projection. The lateral lobes rounded or acute (see subspecies). The metasomal pattern is subject to variation and all bands on T3-T5 may be interrupted in the middle. T7 tripod-shaped with a flat median projection (apex truncate) and two lateral acute projections. Sternites with dense, fine pubescence; S3-S4 with small median brush-like pubescence. Lateral yellow spots on the sternites sometimes present.

Trachusa pubescens. Left: Apical tergites of male, Right: Mandible and clypeus of male. – *Sources*: Males from Hakkâri (coll. Schwarz) and Ankara (SMF), Turkey. Photographs: MK.

Biology: The flight season of adults extends from late April to early August with a peak in June and early July. The earliest records in late April come from Jordan and the Mediterranean lowland of Hatay province in Turkey. In early August, the species is still found commonly on the wing in the highlands of eastern Anatolia, while the flight season has ended by then in the other parts of the range.



Seasonal distribution of adult *Trachusa pubescens*. – *Source*: 146 records from throughout the distribution range, based on various museum collections. Note that the peak early August is attributed exclusively to a larger series from the highlands of Eastern Anatolia.

Friese (1921) suppose that the species is the host of the cleptoparasite *Stelis gigantea* (cf. Kasparek 2013).

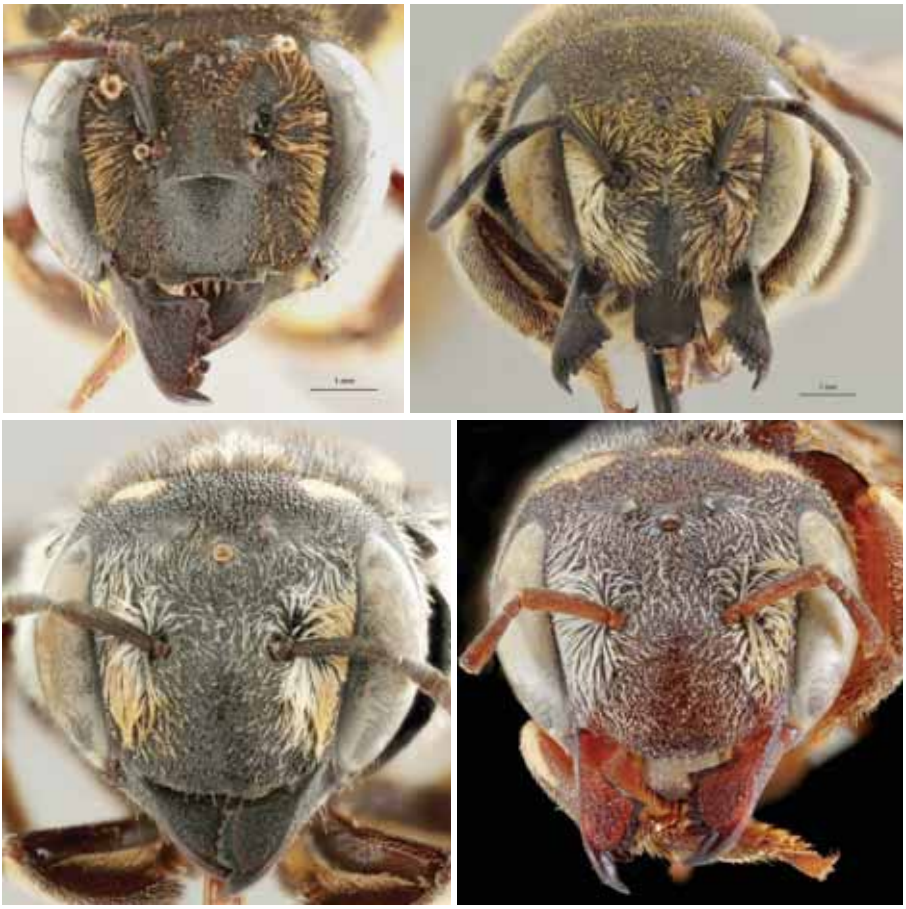
Flower relationships: According to Müller (1996), the species restricts pollen foraging to the Labiatae. He found in pollen grain counts that 99.3 percent of all pollen belongs to Labiatae with 99.2 percent to Lamioideae. Banaszak & Romasenko (1998) give Asteraceae and Fabaceae. Found in Hungary on *Genista* and *Stachys germanica* (Friese 1897), in Lebanon on Goldleaf Jerusalem Sage *Phlomis chrysophylla* (Lamiacae), where several males held territories (Kasparek, unpubl.), and in the Palestinian Territories on *Phlomis viscosa* (record in SEMC). In Turkey found on *Onobrychis viciifolia* (Özbek & van der Zanden 1993), *Phlomis grandiflora*, and *P. nissolii* (Lamiaceae) (Güler et al. 2014). In Armenia, the species generally visits the flowers of the Lamiaceae (Red Book Armenia 2015). Visiting *Scabiosa ohrodeuca* (Caprifoliaceae) in Moldova (Stratan & Andreev 2015) and *Digitalis paliurus* (Digitalideae) in Macedonia (van der Zanden 1984).

Distribution: The distribution extends from the Balkans through Turkey, Iran, the Levant and the Caucasus to Central Asia. The northernmost areas are situated in Hungary. An occurrence mentioned for Algeria (Mocsáry 1884) and a unpublished records in northern Italy and southern France (specimen in the Pittioni bee collection, see http://pittioni.myspecies. info) needs confirmation. South Africa is wrongly cited by Güler (2011).

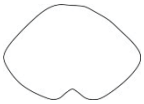
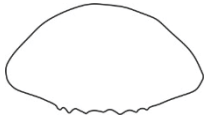
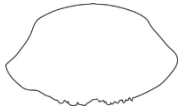
The population in the Levant has been assigned to subspecies *verhoeffi*, the population in southern Turkey to subspecies *maxima* and the remaining populations to the nominate subspecies. In Turkey this bee is found up to 1800 m (Özbek & van der Zanden 1993), in Armenia at 1800–2200 m (Red Book Armenia 2015), and in Iran up to 2800 m (Warncke 1982; records from the Alborz Mountains at 2450 m in SEMC).

Distribution of *Trachusa pubescens*.

Heads in the subgenera *Congotrachusa* and *Massanthidium*



Heads in the subgenera *Congotrachusa* and *Massanthidium*: *Trachusa* (*Congotrachusa*) *schoutedeni* (above, left), *T. (Massanthidium) flavorufula* (above right), *T. (M.) eburneomaculata* (below left) and *T. (M.) massauahensis* (below right). – Photographs: Musée royal de l'Afrique centrale and MK.

shallow emargination	V-shaped emargination	No distinct emargination, apical margin crenulated	
			
T. schoutedeni	*T. flavorufula*	*T. eburneomaculata*	*T. massauahensis*
Congotrachusa	***Massanthidium***		

Comparison of the form of the clypeus of the females of the four African species belonging to the subgenera *Congotrachusa* and *Massanthidium*.

Subgenus *Congotrachusa* Pasteels, 1969

Trachusa (Congotrachusa) schoutedeni (Vachal, 1910)

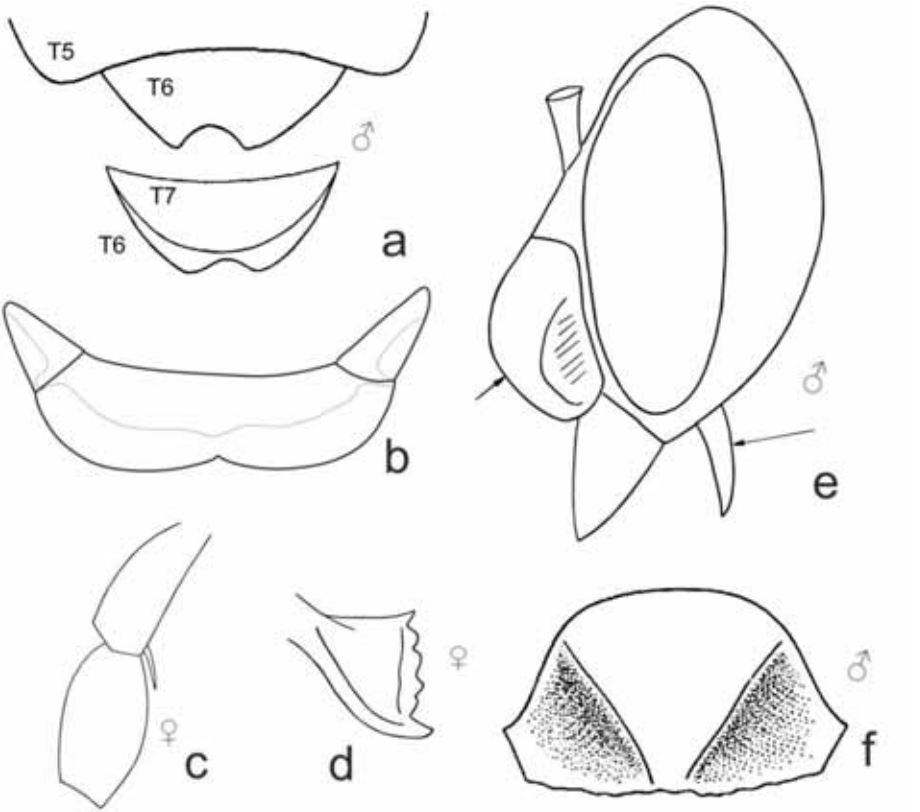
Anthidium schoutedeni Vachal, 1910. Ann. Soc. Ent. Bel. 54: 315 (female).
Trachusa (Congotrachusa) schoutedeni Vachal, 1910: Pasteels 1969; Acad. Roy. Belgique, Mém. Classe Sci. Collection in-4° - 2e ser., 19(1): 117-119 (re-description of female and description of male).

The only member of the subgenus *Congotrachusa*. The erection of an own subgenus for this species is justified by a several morphological features unique to this species. Among these there is a long and slender rod-shaped projection arising from the underside of the head (i.e. from the anterior part of the hypostomal carina) of the male, which is unique in the entire genus. The strongly protuberant eyes and clypeus of the male are also features not found in other species of the genus.

Female. 13.5 mm. *Head*: Head wider than long (about 1.3 times as wide as long), black, vertex flattened; eyes slightly converging below; in the middle part, the clypeus is convex and has a shallow emargination at apical edge; emargination crenulated with 4-5 small brushes of hair; mandibles with one large and five obtuse teeth; the obtuse teeth are, however, hardly recognisable as separated teeth when abrased; there is some long, ochreous pubescence in the paraocular area, around ocelli, on vertex and on the genal

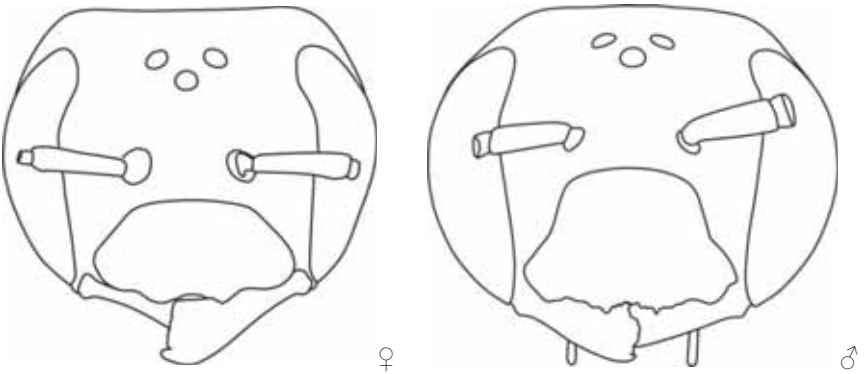
Trachusa schoutedeni. Female (left) and male (right) in dorsal view. Note the different extent of yellow colouration on scutellum and axillae, and the yellow stripe on T1 which is interrupted in the male. – Photographs: Musée royal de l'Afrique centrale, Tervuren.

Trachusa schoutedeni. Female (above) and male (below) in lateral view. – Photographs: Musée royal de l'Afrique centrale, Tervuren.



Trachusa schoutedeni. **a.** The last tergites of male (above dorsal, below ventral view); **b.** Scutellum female; **c.** Hind tibia and basitarsus female. **d.** Mandible of female. **e.** Head of male in lateral view. **f.** Scutellum in frontal view. – *Sources*: a, c-f. Pasteels (1969, 1984), b. Drawing MK.

area; otherwise very short, scattered erect hair. – *Mesonotum*: Scutum black with an ochreous pubescence in the paraocular area, around ocelli, on vertex and on the genal area; otherwise very short, scattered erect hair. – *Mesonotum*: Scutum black with a narrow yellow longitudinal band on each side; ochreous pubescence anterolaterally and laterally; otherwise only short, scattered erect pubescence; scutellum overhanging metanotum, narrowly rounded posteriorly as seen from the side; shallow emargination medially; yellow, proximal side black; axilla triangular and like scutellum yellow with black proximal side; sides of thorax with long ochreous pubescence. Tibia with yellow longitudinal stripe on outer side; hind basitarsus wider than tibia. – *Metasoma*: Yellow band on T1, attenuated in the middle; one small dark brown spot within the yellow band on each side; marginal zone of T2 dark; T2 with an inconspicuous, narrow, yellow lateral stripe; other tergites without yellow maculation.



Trachusa schoutedeni. Female (left) and male (right). Note the different shape of head (flattened vertex particularly in the female) and clypeus (much wider than long in female and almost as wide as long in the male). – *Sources*: Drawings by MK after material in Musée royal de l'Afrique centrale, Tervuren.

Trachusa schoutedeni. Male. Left: Face, right: hind tibia. – *Photographs*: Musée royal de l'Afrique centrale, Tervuren.

Male. 13.5 mm. *Head*. Males are characterised by their extremely protuberant clypeus with depressed, smooth areas on both sides and by possession of a long rod-shaped projection extending downward from the inner edge of the lower surface of the genae. This projection is a unique peculiarity in the Anthidiini. Upper side of head (vertex) not as much flattened as in female. Clypeus black proximally and yellow distally with an M-shaped border line between the two colour fields; mandibles largely yellow; apical edge of clypeus with one large median emargination and a few smaller emarginations laterally; median parts of the clypeus with coarse punctures and small, longish depressions; yellow parts of the clypeus largely impunctate. Paraocular area with impunctate yellow maculation. Reddish-brown pubescence on frons, vertex and genae. – *Mesosoma*: Colouration and pubescence as in female although the black portions of scutellum and axilla are greater than in the female. Tibia with yellow and dark brown colour pattern, basitarsus largely yellow. – *Metasoma*: Yellow band on T1 similar to female, but interrupted in the middle; dark spots within the yellow band larger than in female; T2-T5 each with thin subapical yellow band, interrupted on T2 and T3; T6 yellow.

Biology: Unknown.

Distribution: Records are available from the Republic of Congo (Brazzaville) and the Democratic Republic of Congo (Bukavu) (Pasteels 1984, see also Litman et al. 2016). Mitchener (2007) refers to a record from "Portugese Congo (Cabinda?)", an exclave and province of Angola situated between the Republic of Congo and the Democratic Republic of Congo. Discover Life and Eardley et al. (2010) give just "Angola".

Distribution of *Trachusa schoutedeni*.

Subgenus *Massanthidium* Pasteels, 1969

Undescribed species of *Massanthidium* from Namibia are mentioned by Michener (2007: 535) and Eardley et al. (2010). It is not clear whether these two references refer to the same material. A species of *Trachusa* (*Massanthidium*) from Namibia is being described by the author (Kasparek, in prep.)

Trachusa (Massanthidium) eburneomaculata Pasteels, 1984

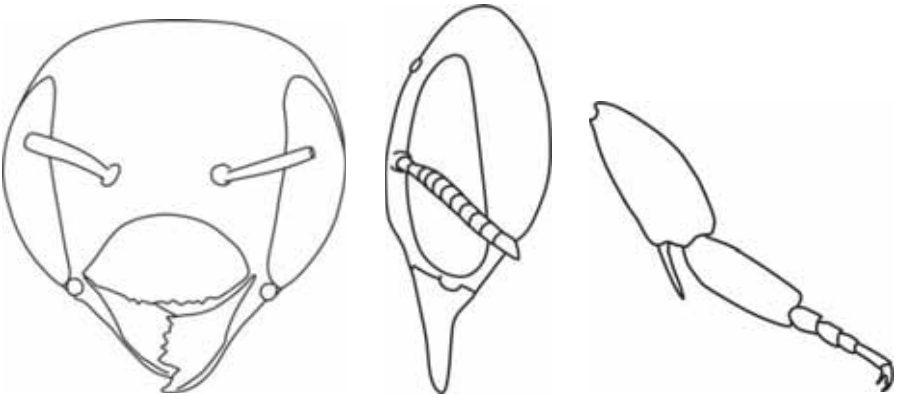
Trachusa eburneomaculata Pasteels, 1984. Acad. Roy. Belgique, Mém. Classe Sci. Collection in-4° - 2e ser., 19(1): 118-120 (female).

Female. 12.5 mm. Black, including mandibles, legs and tegulae. Yellow to ivory-coloured maculae found: two on the vertex, one kidney-shaped maculation on each side of the scutum, one on each axilla, one each on the base of the tibia, and one on each side of tergites T1-T5. – *Head*: Mandibles with one big and five smaller blunt teeth. The smaller teeth are not clearly separated from each other. Clypeus with crenulated apical margin; inner edges of eyes converging; shape of face shows considerable variation from broad to elongated; vertex rounded onto occiput, length about 1.5 times the length of the interocellar distance. Puncturation very fine around and between ocelli, while puncturation is coarser on vertex with wider spaces between punctures. Paraocular and genal areas densely covered with long white hair; the central part of the clypeus has small erect black hair which is difficult to see; on vertex brownish black erect hair. – *Mesosoma*:

Trachusa eburneomaculata. Dorsal and lateral views of female holotype. – Photographs: RMCA.

Puncturation of scutum flat and uneven; scutellum with larger punctures, punctate-reticulate. On scutum brownish black erect hair; very dense white pubescence on the upper half of the sides of the thorax; characteristic triangular patch of white hair in the

Trachusa eburneomaculata. Variation in the shape of the face. Note that the female on the left has a much broader face than the one in the right. Both females are from the type series in Kenya. – *Sources*: Photographs by SEMC, Kansas, and RMCA, Trevuren.



Trachusa eburneomaculata. Female. Head in front and lateral view and hind leg. Note the clypeus with centrally crenulated at apical margin, and the mandibles with six blunt teeth. Clypeus not convex. – Drawings by MK.

central anterior margin of scutum. – *Metasoma*: Tergites with small punctures and wide, shining interstices, but usually less than two times the diameter of the punctures; tergites with lateral white hairs; T6 covered with short, soft, silky-white pubescence; scopa red in the middle, black on the outer sides.

Male. Unknown.

Biology. Found in Kenya on the wing in June (Pasteels 1984).

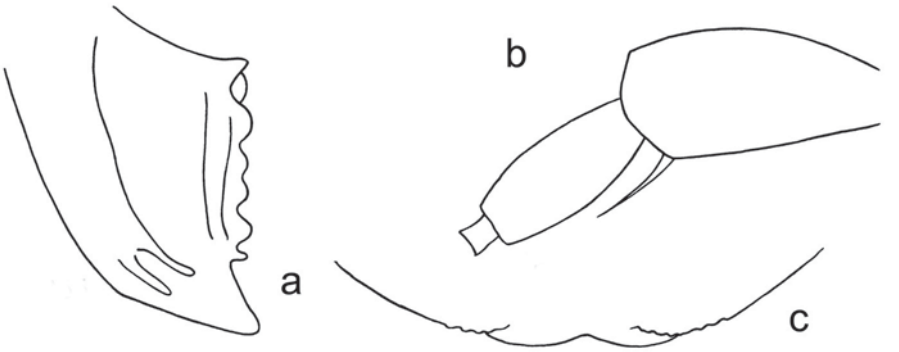
Distribution. Only known from Kenya (Pasteels 1984).


Distribution of *Trachusa eburneomaculata*.

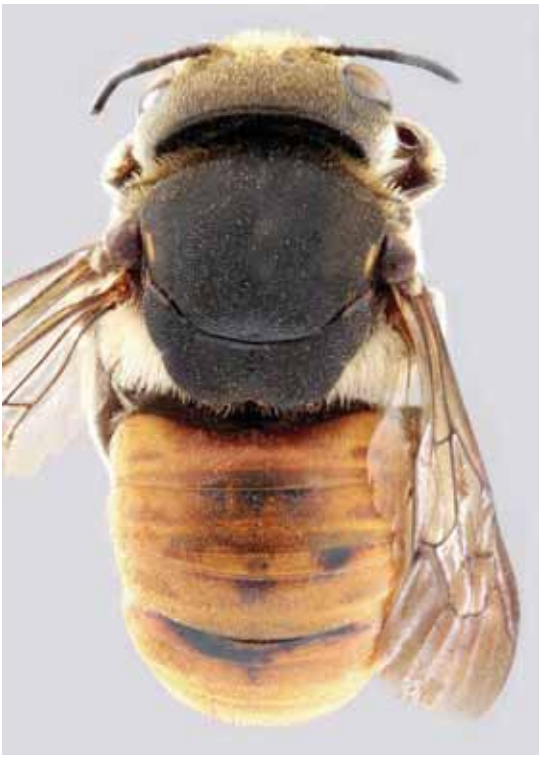
Trachusa (Massanthidium) flavorufula Pasteels, 1969

Trachusa (*Massanthidium*) *flavorufula* Pasteels, 1969. Mém. Soc. R. Ent. Belg. 31: 111-113 (female).

The species can easily be recognised by the largely ochreous tergites. *Trachusa flavorufula* does not have the typical megachiliform body form of most *Trachusa*: with a wide, almost parallel-sided metasoma (T1 as wide as T2), and wider than the mesosoma, the species differs from most other members of the Anthidiini. The species is known only from a single female collected in Kenya.



Trachusa flavorufula. Female. **a.** Mandible; **b.** Hind tibia and basitarsus. **c.** Apical margin of tergite T6. – *Source*: combined from Pasteels (1969, 1984).



Trachusa flavorufula. Female holotype from Kenya. – *Photographs*: RMCA, Tervuren.

Female. 14 mm. Head and thorax black including mandibles and legs; one small golden yellow macula on each side of the scutum, on tegula and on the base of tibia. Tergites yellow-orange with reddish maculations. – Maxillary palpus with three segments; mandibles with one large and six small, blunt teeth; clypeus with a V-shaped emargination and having a median longitudinal impunctate area in the upper half; eyes weakly convergent; vertex very long, almost twice as long the interocellar distance and rounded onto occiput; mesepisternum carinated (not lamellate) with the carina extending ventrally; scutellum overhanging metanotum, widely emarginate in the middle. – *Metasoma*: Tergite T6 broadly rounded with a shallow notch in the middle; tibia short and clavate; hind basitarsus 2.5 times longer than its maximum width; arolia present, but weakly developed.

Male. Unknown.

Biology: Found in Kenya at 1060 m a.s.l. on the wing in June (Pasteels 1969).

Distribution: Kenya (Pasteels 1969, 1984).

Distribution of *Trachusa flavorufula.*

Trachusa (Massanthidium) massauahensis Pasteels, 1984

Trachusa massauahensis Pasteels, 1984. Acad. Roy. Belgique, Mém. Classe Sci. Collection in-4° - 2e ser., 19(1): 118-120 (female).

A small species closely related to *T. eburneomaculata*. As in that species, only the female is known. The holotype of *T. massauahensis* comes from Massawa on the Eritrean Red Sea coast. Date and collector are not known.

Female. 11 mm. It shares with *T. eburneomaculata* the same structure, in particular the structure of the mandibles (one large and five smaller teeth). Apical margin of the clypeus dentate with approximately five black teeth. There are no significant differences in the pubescence between *T. massauahensis* and *T. eburneomaculata* except that the scopa is reddish-brown in *T. massauahensis*. Paraocular area, area between antennal sockets and eyes with relatively long white hair; hair on other parts of the head and thorax short, mostly erect, resulting in a prickly appearance. The white hair forms a sharp contrast to the colour of the integument which is brown with a slight reddish tinge; clypeus,

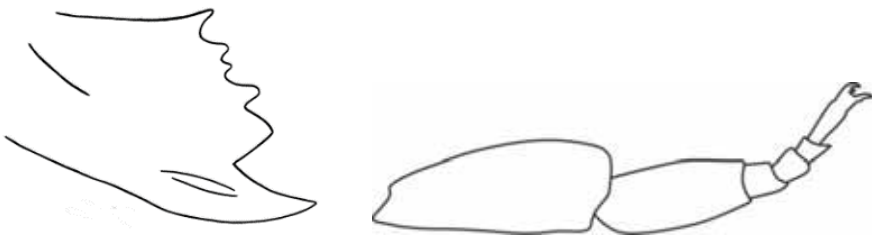
Trachusa massauahensis, lateral and dorsal view of female. Note the yellow colouration on head (three maculae), scutum (lateral band close to tegula on each side), axillae (less conspicuous spots) and tergites T1-T5. – Photograph of holotype in HNHM by MK.

Trachusa massauahensis (female holotype). Above: Scutellum: Rounded with an emargination at apex, an inconspicuous light yellow spot on each axilla. Below: Hind tibia and basitarsus. Note the black bristle-like hair. – Photographs: MK.

mandibles, mesepisterna, tegulae and scutellum including axillae are almost red, while the ground colour of the other parts of the integument is dark brown with a slight reddish tinge. Yellow areas are: three spots (one median and two lateral) on the vertex, a lateral band on each side of the scutum, an almost imperceptible spot on axillae, maculations on the most lateral parts of tergites T1-T5, and spots on the outer side at the base of each tibia. The scopa consists of dark brown bristle-like hairs with lighter ochreous hairs in the middle. Legs with short, black bristles. Black bristles also at the apex of labrum. Wings strongly infuscated, almost black. – Subantennal suture straight, but difficult to see as it is only a very thin black line, mostly hidden under the long white hair in the

Trachusa massauahensis, female holotype. Apical end of metasoma from dorsal (left) and ventral scopa (right). Note the lateral yellow pattern on T4 and T5. T6 without yellow marking. The scopa consists of dark brown bristle-like hair laterally mainly and lighter hair medially. – Photograph of holotype in HNHM by MK.

Trachusa massauahensis, female. Left: Mandibles. Right: Lateroventral view. Note the distinctly carinate omaulus (carina extends onto ventral surface of thorax close to middle coxa). – Photograph of holotype in HNHM by MK.



Trachusa massauahensis (holotype). Female. Mandible (left) and hind leg (right). – *Source*: Redrawn by MK after Pasteels (1984).

paraocular area. The omaulus is distinctly carinate; the carina extending onto the ventral surface of thorax close to the mid coxa. The clypeus appears slightly wider in *T. massauahensis* than in *T. eburneomaculata* (width/length 1.86 in *T. eburneomaculata*, 1.73 in the holotype of *T. massauahensis*).

Male: Unknown.

Biology: Unknown.

Distribution: Massawa on the Red Sea coast of Eritrea (Pasteels 1984).

Distribution of *Trachusa massauahensis*.

Subgenus *Metatrachusa* Pasteels, 1969

Trachusa (Metatrachusa) orientalis Pasteels, 1972

Trachusa (Metatrachusa) orientalis Pasteels, 1972. Bull. Ann. Soc. R. Belg. Ent., 108: 73-75 (female and male).

A dark brown, almost black *Trachusa* with only sparse maculations. The species is known from a male and three females found in Malaysia, and it is together with *T. pendleburyi* the only *Trachusa (Metatrachusa)* occurring in southeast Asia.

Female. 11.5 mm. Ground colour of integument blackish-brown as in male. – *Head*: Clypeus slightly convex, apical margin crenulated; distal part of clypeus yellow, proximal part blackish-brown; border between the two colourations undulated giving the clypeus a crown-like yellow pattern; puncturation coarse; mandibles blackish-brown with a reddish tone; five teeth diminishing in size towards mandibular base; yellow spot in the lower paraocular area (sometimes also absent); distance between lateral and median ocellus less than ocellar diameter. – *Mesosoma*: Blackish-brown without light maculation; scutellum and axillae half-moon-shaped, outer edge rounded. – *Metasoma*: Ground colour as in mesosoma; lateral yellow maculation in T5, sometimes also on T6 and T7

Trachusa orientalis. Head. Left: female paratype, right male holotype. – *Sources*: NHMUK 010266355 (female) and NHMUK 010266353 (male). Photographs: The Natural History Museum (London).

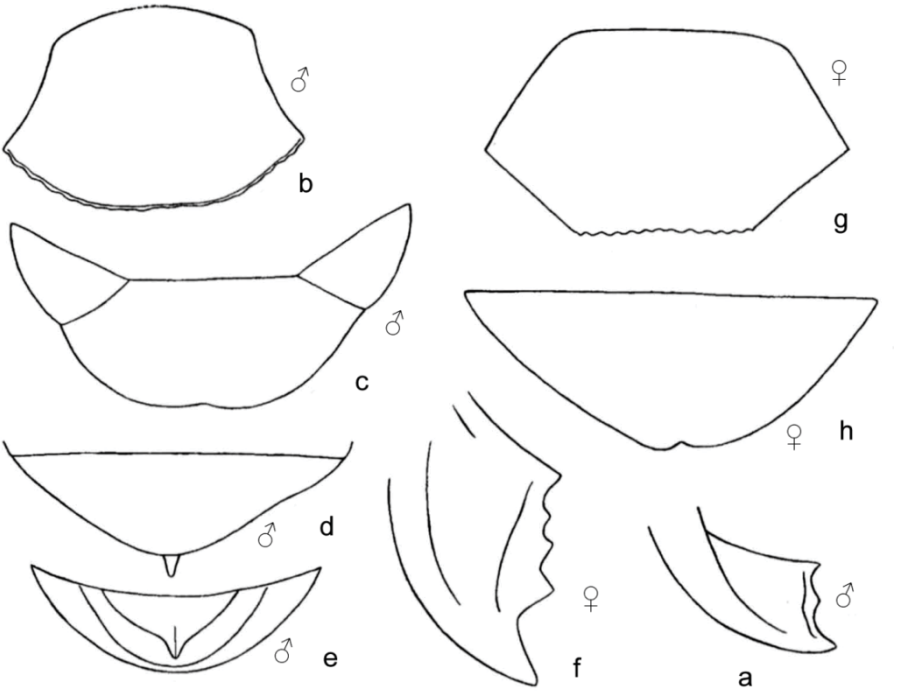
Trachusa orientalis. Habitus from dorsal. Left: Female paratype, Right: male holotype. – *Sources*: Natural History Museum (London): NHMUK 010266355 (female) and NHMUK 010266353 (male).

Trachusa orientalis. Above: female paratype. Below: male holotype. – *Source*: Natural History Museum (London): NHMUK010266355 (female) and NHMUK010266353 (male).

Trachusa orientalis. Ventral side of male metasoma. Note the median fringe of yellow hair on the apical margin of S2-S4 (S5). The apical margin is straight in S1-S5 and curved in S6. – *Source*: Natural History Museum (London): NHMUK 010266353.

(number and extent of these yellow spots variable); last tergite rounded at apical end; scopa light yellow.

Male. 9.0 mm. Ground colour of integument brownish-black as in female with yellow only in the face and on T5. – *Head*: Base of the mandible, clypeus, and lower part of paraocular area (up to antennal sockets) yellow; mandible tridentate with one big and two smaller, broad teeth; clypeus slightly convex with crenulated apical margin; shining with small punctures separated by a little more than their diameter; subantennal suture slightly arcuate outward; inner margins of eyes parallel-sided; genal area in lateral view narrower than eyes; puncturation on head strong and deep with small interspaces; vertex broad, 2.6 times as long as an ocellar diameter; antennae dark brown to reddish-brown. – *Mesonotum*: Omaulus angular, not carinate; pronotal lobe small with a hardly visible carina; scutellum rounded, slightly emarginate at apex, and slightly overhanging metanotum; puncturation on mesonotum coarse with deep punctures and small interstices; reticulate on scutum; short, erect, brownish hair on scutum and long white hair on underside of thorax; arolia absent. – *Metasoma*: Entirely dark brown to black with only a lateral inconspicuous yellowish maculation on T5; T6 almost completely covers T7, from which only a small projection is visible in dorsal view; sterna S2 to S4 with a dense fringe of



Trachusa orientalis. **a.** Mandible male; **b**. Clypeus male; **c.** Scutellum male; **d.** Last tergite male (dorsal view); **e.** Last tergite male (ventral view); **f.** Mandible female; **g.** Clypeus female; **h.** Last tergite T6 female. – *Source*: Re-arranged from Pasteels (1972).

yellowish hair at apical margin medially; without black combs; puncturation on tergites finer than on head and thorax, but dense and the interstices are somewhat smaller than the diameter of the punctures.

Biology: Collected on the wing in March and April (Pasteels 1972).

Distribution: Malaysia. Found at 1000 m (Pasteels 1972).

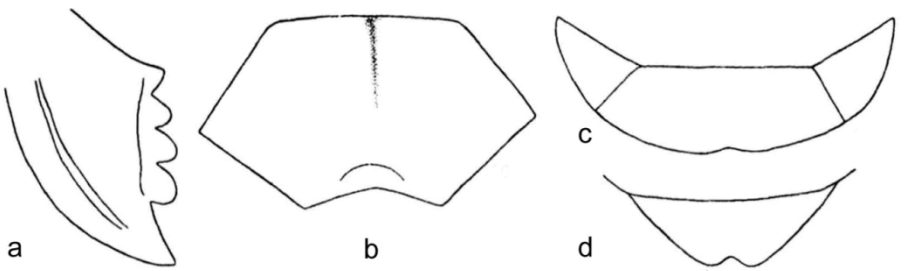

Distribution of *Trachusa orientalis*.

Trachusa (Metatrachusa) pendleburyi (Cockerell, 1927)

Protanthidium pendleburyi Cockerell, 1927. Ann. Mag. Nat. Hist., Ser. 9, 20: 532 (female).
Paraanthidium pendleburyi (Cockerell, 1927). – Mavromoustakis (1953).
Trachusa (*Metatrachusa*) *pendleburyi* (Cockerell, 1928). – Pasteels (1972).

Only the female of this species is known. The species was described by Cockerell (1927) on the basis of a single female; the type specimen re-examined by Mavromoustakis (1953) and the species re-described by Pasteels (1972). With yellow colouration of metasomal tergites starting from T2, it resembles members of the *longicornis*-group of the subgenus *Paraanthidium*, which, however, have an outward arcuate (not straight) subantennal suture and other characters of the subgenus.

Female. 11.5 mm. Black with yellow markings only on metasoma; one golden-yellow subapical band on each of T2-T6, the first ones very narrow, but gradually increasing in breadth from proximal to distal (band on T2 interrupted in the middle, the others continuous); a large transverse golden-yellow spot on T6. – *Head*: Clypeus broader than long; emarginate at its apical end; slightly depressed in the middle; mandibles chagrined with five obtuse teeth; vertex not carinated, length 1.5 times the interocellar distance; head finely punctate with punctures clearly separated from each other and with flat interstices except for a small impunctate space in the middle of the supraclypeal area; white hair on underside of head, genal area, paraocular area and on clypeus; upper side of head with black erect hair. Maxillary palpi with three segments; subantennal suture straight; antennae black, antennal segments 1.5 times longer than wide. – *Mesosoma*: Erect, dense, black pubescence on scutum; legs with black hair, tarsi with red hair on inner side. Mesepisternum not carinated; pronotal lobes slightly carinated, not lamellate; scutellum emarginate and slightly projecting, overhanging metanotum, rounded at sides and slightly emarginate in the middle; no demarcation between scutellum and axillae; disc of scutellum with punctures more separated; on scutum, the spaces between the punctures are acute and form a fine and dense reticulation. Spurs black; pulvilli well developed. Hind basitarsi in the middle as wide as tibia and three times longer than wide; hind tibiae lamellate; arolia present. – *Metasoma*: Scopa yellow to orange; tergites with scattered, very short, black, bristle-like hair; last tergite subtriangular, but with a marked median emargination which is framed by two rounded lobes; puncturation on the tergites is scattered with flat interstices.



Trachusa pendleburyi. Female. **a.** Mandible; **b.** Clypeus; **c.** Scutellum; **d.** Last tergite T6. – *Source*: Pasteels (1972).

Trachusa pendleburyi. Female holotype. Face, habitus in dorsal and lateral view. NHMUK 010266352. – Photographs: The Natural History Museum, London.

Male. Unknown.

Biology: Collected in Malaysia in June (Cockerell 1927).

Distribution: Malaysia, at 1575 m (Cockerell 1927). GBIF Database (http://demo.gbif.

org/occurrence/1319869551) gives Indonesia as type locality, however, the location is actually situated in Malaysia.

Distribution of *Trachusa pendleburyi*.

Subgenus *Orthanthidium* Mavromoustakis, 1953

The subgenus *Orthanthidium* was comprising so far only one species, *T. formosana*. A second species, *T. cornopes,* has been assigned here to this subgenus provisionally. Further studies are needed to show whether it is justified to accommodate these two quite different species in the same subgenus.

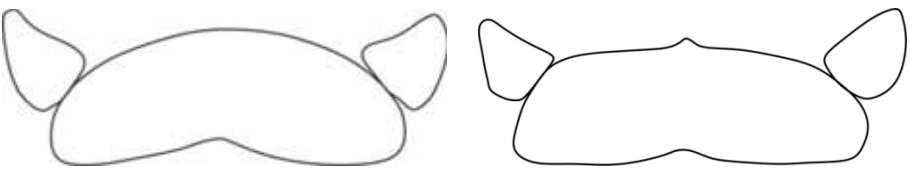
Trachusa (Orthanthidium) cornopes Wu, 2004

Trachusa (Paraanthidium) cornopes Wu, 2004. Acta Zootaxonomica Sinica 29(3): 541-548.
Trachusa (Orthanthidium) cornopes (Wu, 2004). – Discover Life (version 13.11.2016).

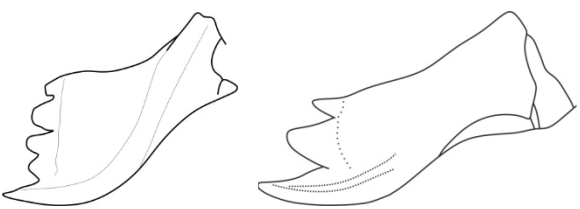
A large species, whose subgeneric assignment is not unambiguous. It shares e.g. a few characters with *Trachusa formosana* and J. Asher (in: Discover Life) put it therefore into the subgenus *Orthanthidium*. *Trachusa cornopes* has in particular a scutellum and axillae very distinct from the members of the subgenus *Paraanthidium* (to which it had originally been assigned) and more closely resembles in this aspect *T. formosana*. The subantennal suture is in *T. cornopes* only slightly outwardly arcuate, almost straight, and comes in this character close to *Massanthidium, Metatrachusa* and *Congotrachusa*. The interocellar distance in relation to the ocelloccipital distance puts the species closer to *Paraanthidium* than to *Orthanthidium*. As the characteristic features of the subgenus *Orthanthidium* are not well-defined (the subgenus contained only *T. formosana* whose male is unknown), the attribution of *T. cornopes* to it should be regarded as preliminary.

Female. 13-15 mm. Head including clypeus and mandibles black with the exception of an inconspicuous buff transverse band on the vertex; mandible with five teeth joined by rounded concavities (six teeth according to Wu 2004, but see photograph of paratype); clypeus broader than long (2.5 : 1.5) with short golden hair; slightly depressed medially and with median emargination of apical margin; punctures in depression smaller and denser than on remainder of clypeus; golden pubescence on the upper face and vertex, white pubescence on genal area and on underside of head. – *Mesosoma*: Scutum with

Trachusa cornopes, face. Left: female, right: male. – *Sources*: Male holotype, female paratype, both in Institute of Zoology (IZCAS), Beijing. Photographs: Feng Yuan.



Trachusa cornopes, scutellum and axillae (left female paratype, right male holotype). – Drawings: MK.

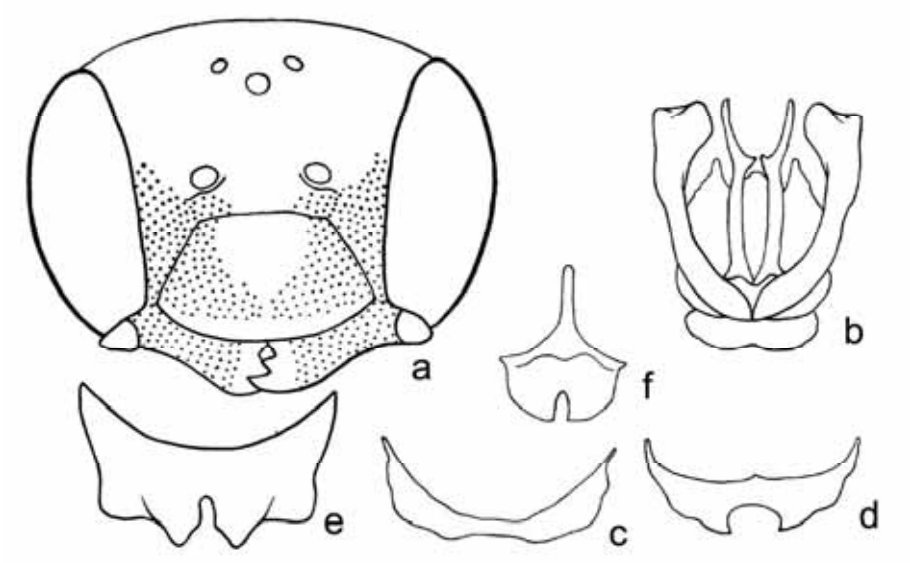


Trachusa cornopes, mandible (left female paratype, right male holotype). – Drawings: MK.

Trachusa cornopes, habitus in lateral view. Above: female, below: male. – *Sources*: Female paratype, male holotype, both in Institute of Zoology (CAS), Beijing. Photographs: Feng Yuan.

lateral yellow band on each side; pronotal lobe, scutellum and axillae yellow with darker area in the middle; proximal margin of scutellum convex, distal margin truncate; scutellum with a longitudinal, deep groove and emargination at apical end; the emargination and the darker colour in the middle results in a double-leaf appearance; axillae triangular;

Trachusa cornopes, face. Left: female, right: male. Note in particular the difference in the yellow colouration pattern and the shape of mandibles and teeth. – *Sources*: Male holotype, female paratype, both in Institute of Zoology (IZCAS), Beijing. Photographs: Feng Yuan.



Trachusa cornopes, male. **a.** Head; **b.** Genitalia; **c.** Tergite T7; **d.** Sternite S6; **e.** Sternite S7; **f.** Sternite S8. – *Source*: Wu (2004).

scutellum slightly overhanging metasoma; legs red-brown, basal part of femora black-brown, especially darker on hind femora and tarsi; outer surface of fore femora with apical projection; pubescence on legs grey and yellow. – *Metasoma*: Black; T1-T5 with narrow yellow subapical bands; T6 black; tergites with dense, small puncturation; basal part of scopa yellowish, apical part black.

Trachusa cornopes. China, Beijing, Mutianyu at the Great Wall, 5 August 2009. Note the shape and yellow colouration of mesonotum (especially the scutellum) which has a strong signal effect. – *Photograph*: J. S. Ascher. From: Discover Life.

Male. 15 mm. Head black with yellow markings. Yellow areas are: mandible (except teeth), clypeus (black marking at base in the middle), quadratic mark in the lateral part of supraclypeal area, and lower paraocular area (up to antennal socket). Mandible tridentate; clypeus more than two times wider than long; punctures on vertex and genae larger than on clypeus; apical part of first antennal flagellum yellow or yellow-brown, others a dark brownish-grey colour. – *Mesonotum*: Scutum laterally with long triangular yellow stripe on each side; dense and small punctures; axillae yellow, rounded, with conspicuous dense and small punctures; most of scutellum yellow, middle of basal part black, with median groove, margin straight, in the middle weakly emarginate, overhanging metanotum; tegulae yellowish-brown. Legs thickened; subapical part of fore and mid tibia with horn-like projection. – *Metasoma:* Black; subapical yellow band on T1-T5; T6 black without yellow maculation, basal part with a median triangular convexity, margin rounded, with median emargination; margin of T7 with median shallow emargination; S2-S5 with marginal emargination, covered in S2-S3 with yellow pubescence.

Distribution: China (Hubei, Shaanxi, Beijing) (Wu 2004, Asher 2009).

Biology: Found on the wing in June, July and August (Wu 2004, 2006).

Distribution of *Trachusa cornopes* (known from three provinces of China).

Trachusa (Orthanthidium) formosana (Friese, 1917)

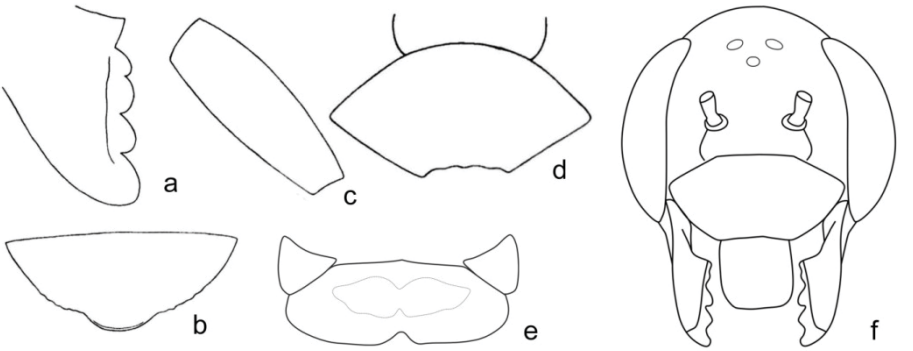
Anthidium formosanum Friese, 1917. Dt. Entomolog. Zeitschr. 1917: 49-60 (female).
Paraanthidium (Orthanthidium) formosanum (Friese, 1917). – Mavromoustakis (1953).
Trachusa (Orthanthidium) formosana (Friese, 1917). – Pasteels (1972).
Trachusa (Orthanthidium) formosanum (Friese, 1917). – Wu (2006).

At up to 20 mm in length, this is the largest species of the genus *Trachusa*. A distinctly arcuate outward subantennal suture and the shape of scutellum and axillae (lateral sides of axillae parallel, scutellum obviously produced, with truncate apical margin and median emargination) characterise it as a member of the subgenus *Orthanthidium*. Only the female of this species is known from a few specimens from Taiwan and the Chinese mainland.

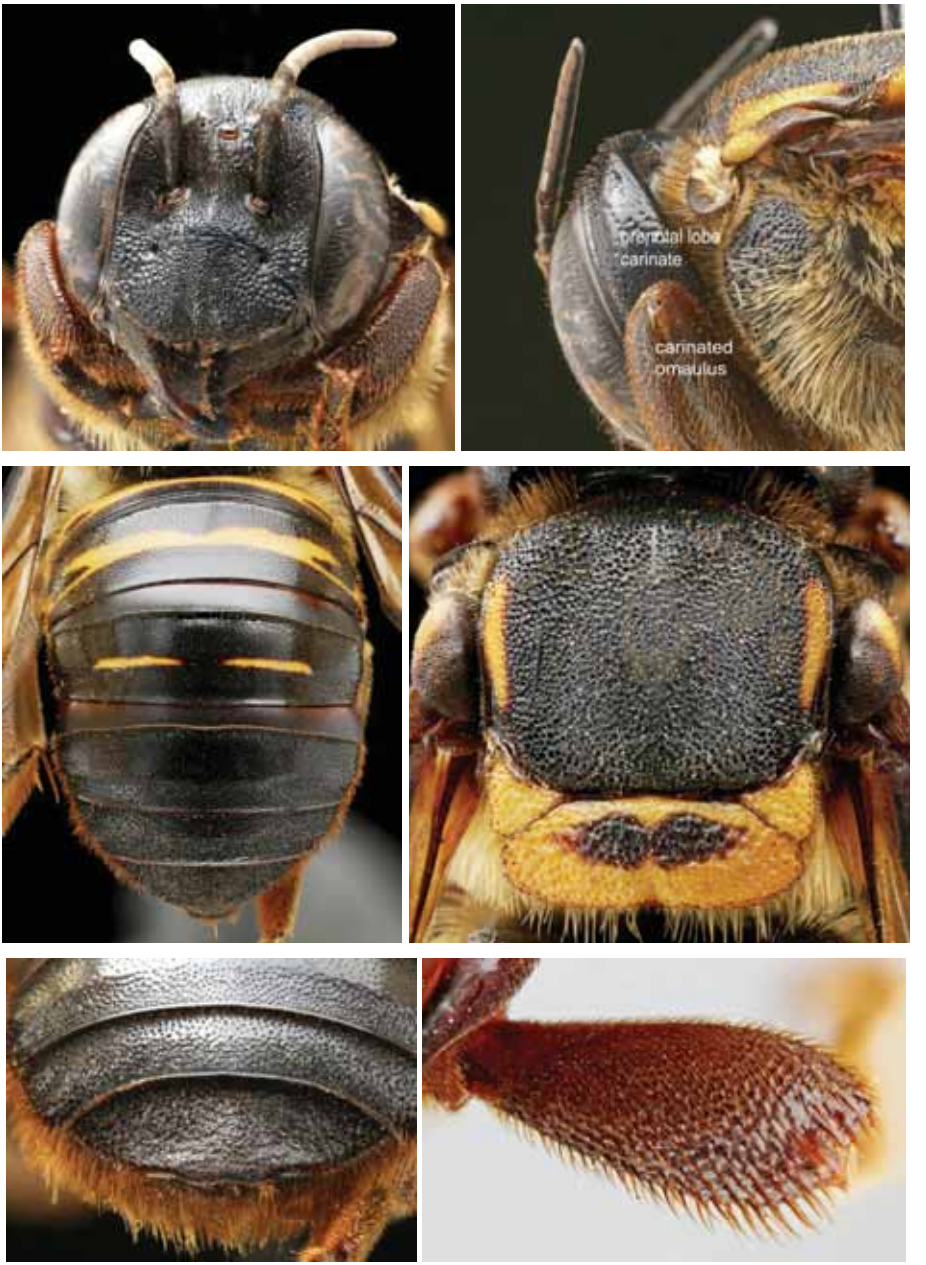
Female. 18-20 mm. Black, sparse yellowish, mostly erect hair on the head, meso- and metasoma. Longer pubescence confined to the ventral and lateral surfaces of the thorax. – *Head*: Clypeus convex with strongly emarginate apex; fine and somewhat irregular puncturation along the middle line, but coarser on sides; mandibles with five obtuse teeth; puncturation on frons irregular and wrinkled, vertex shining with large interspaces between the punctures; antenna dark brown with underside somewhat darker than upper side; scape and the first three to four segments dark brown as underside of flagellum; almost black, bristle-like hair between antennal sockets and in paraocular area; inner edges of eyes slightly diverging downward; subantennal suture curved outward; vertex long, the distance between the hind ocelli and the preoccipital ridge about twice the interocellar distance. – *Mesosoma*: Scutum black with sparse short erect golden hairs; broad yellow band along lateral side; scutellum large, overhanging metanotum, apex slightly emarginate, yellow with a dark central spot on disc (or two smaller spots);

Trachusa formosana. Female from Taiwan in DEI. – Photograph: MK.

Trachusa formosana. Female from Taiwan in DEI. – Photograph: MK.



Trachusa formosana. Female. **a.** Mandible; **b.** Tergite T6; **c.** Fore basitarsus; **d.** Clypeus; **e.** Scutellum with triangular-shaped axillae; **f.** Head. – *Source*: a-d. Pasteels (1972), e-f. Drawings of the holotype in ZMB by MK.



Trachusa formosana. Female from Taiwan in DEI. – Photographs: MK.

axillae triangular and completely yellow; pronotal lobe with sharp carina; omaulus carinated, carina not continued onto venter of thorax. Metatarsi almost as wide as tibiae. – *Metasoma*: Tergites black, shining; T1-T2 with one continuous yellow band each on disc; some brown maculae within the yellow bands laterally; one narrow yellow stripe each on both sides of the middle line of T3; T4 may have a yellow band, and also T5 can have some yellow maculation; T6 without yellow maculation; puncturation on T1-T4 scattered, on marginal area of T4 and on T5-T6 denser, deeper and slightly wrinkled; puncturation of sternites densely wrinkled, dull; scopa with relatively long, brownish-yellow hair which becomes reddish toward S5.

Male. Unknown.

Biology. Found in Taiwan in June (specimen in SEMC) and August (Friese 1917) and in July and August in China (Mavromoustakis 1953; coll. Mav.).

Distribution. Taiwan (Friese 1917) and at 1500 m in Fujian Province in People's Republic of China (Mavromoustakis 1953). This region is, depending on the source, assigned to the East Palaearctic or the Indo-Malayan region.

Distribution of *Trachusa formosana*. Known from Taiwan and the Fujian province on the opposite mainland.

Subgenus *Paraanthidium* Friese, 1898

Within the subgenus, the West Palaearctic species *T. dumerlei, T. heinzi* and *T. interrupta* are closely related and are called here "*interrupta* group". In contrast to their cosubgeners, they have a yellow-black, wasp-like general appearances. The clypeus and paraocular area is yellow in the female, while they are black in the other species. The Indomalayan species *T. longicornis*, *T. maai*, *T. muiri* and *T. rufobalteata* constitute another group of closely related species, called here "*longicornis* group". A dull yellow or ochreous (rather than bright yellow) colouration is common to them. The thorax has no or only little yellow colouration, the first tergite is black and the extent of yellow colouration increases toward the apical tergites. The African *T. aquiphila* is abundantly marked with dull yellow and does not have a close ally. The two (almost) black species within the subgenus *Paraanthidium, T. ovata* and *T. xylocopiformis*, are structurally very different and appear not to be closely related to each other.

Altogether 10 species have been assigned to the subgenus *Paraanthidium*. Soh et al. (2016) mention a further recently detected, yet undescribed species of the subgenus *Paraanthidium* from Houaphanah province in Laos.

Trachusa (Paraanthidium) aquiphila (Strand, 1912)

Anthidium aquiphilum Strand, 1912. Mitt. Zoolog. Museum Berlin 6: 306 (female).
Anthidium aquifilum Mavromoustakis 1945 [mis-spelling]. Ann. Mag. Nat. Hist. (11) 12: 185 (male).
Trachusa (Philotrachusa) aquiphilum (Strand, 1912).– Pasteels, 1969. Mém. Soc. R. Ent. Belg.) 31:22.
Trachusa (Paraanthidium) aquifilum Strand, 1912 [mis-spelling]. Pasteels in: Acad. Roy. Belgique, Mém. Classe Sci. Collection in-4° - 2e ser., 19(1): 1984: 117-119 (re-description).
Trachusa (Massanthidium) aquiphilum (Strand, 1912): Michener 2000: 518.
Trachusa (Paraanthidium) aquiphilum (Strand, 1912): Michener 2007: 536.

This is one of the few representatives of the genus *Trachusa* in Sub-Saharan Africa, and to date the only species in southern Africa (description of another species from southern Africa is in preparation by MK). Strand (1912) described the female of *T. aquiphila*, Mavromoustakis (1945) the male, and Pasteels (1984) provided a re-description including line drawings of some characteristic features.

Female. 13.5 mm. Black with abundant yellow-orange to yellow-brown markings. – *Head*: Clypeus convex with a longitudinal, somewhat ill-defined central carina; apical margin crenulated in the middle and smooth, shining margins at sides; the crenulation consists of one median projection and three tooth-like projections on each side. Mandible four-toothed with a large apical tooth, a smaller blunt subapical tooth and two small rounded teeth. Number of maxillary palpi four (three segments in other species of the subgenus *Paraanthidium*). Vertex concave in dorsal view, with yellow transverse band on the edge of the vertex; preoccipital ridge angular; length of vertex 1.5 times the interocellar distance. *Mesosoma*: Pronotal lobe oval, yellow, with a sharp lamella; tegula yellow; scutum with a broad L-shaped band in the angle between the front and the side and reaching the posterior side of the scutum; dense erect ochreous pubescence; scutellum swollen on both sides, constricted in the middle, forming a deep median emargination; yellow with a large black triangle; axillae yellow. Lateral side of mesepisternum black with long ochreous hair; omaulus angular. Legs brown with a yellow spot at the base of the tibia; arolia present although small. Wings relatively strongly infuscate. – *Metasoma*: Tergites T1-T5 with wide yellow-brown bands, each (at least T3-T5) with a pair of red-brown maculae on the sides;T6 black with a large yellow-brown spot; yellow-brown band on T2 to T6 attenuated in the middle (widely wedge-shaped on T2, becoming narrower towards the apex). T6 slightly bilobed; apical margin of T1-T5 brown. Pubescence on tergites dense and ochreous, becoming denser and stronger (almost bristle-like) towards T6. S2-S5 each with a subapical yellow band (may be hidden under scopa). Scopa shining dark red to reddish-brown.

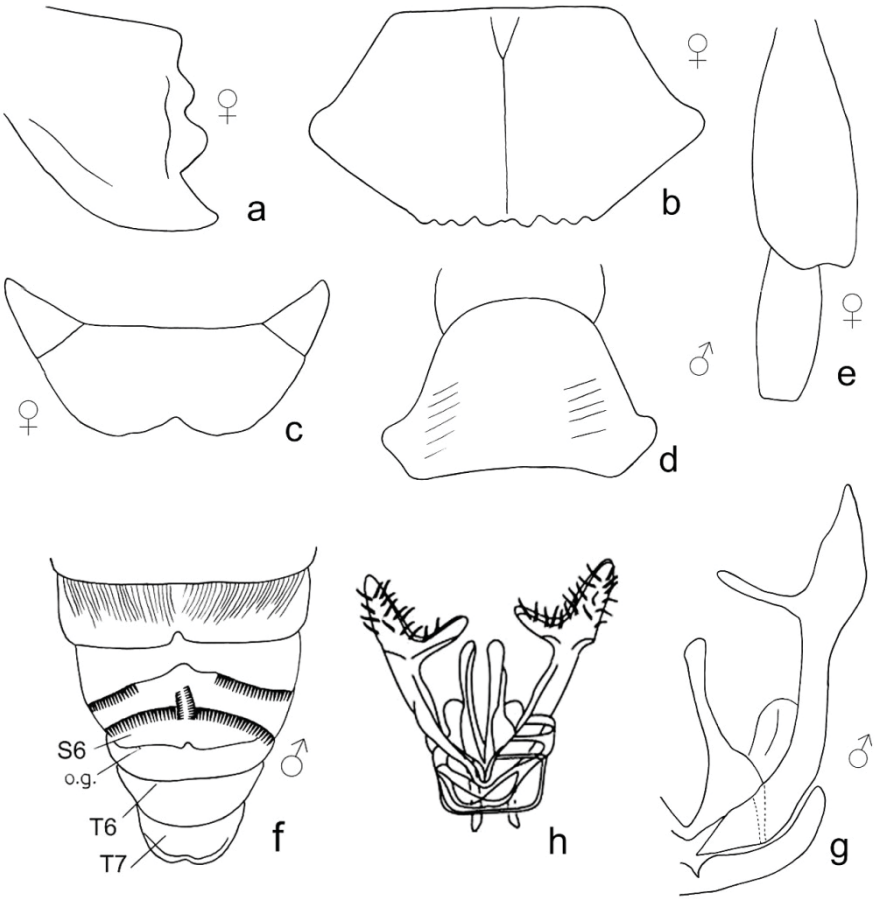
Trachusa aquiphila. Habitus of female (left) and male (right). – Sources: Female holotype in ZMB, male in AMG. Photographs: MK.

Male: Length 13 mm. Black; clypeus convex, not carinated as in female; densely punctured, dull, lower margin obtusely crenulated; mandibles tridentate, dull yellow with black-brown tips; light markings in paraocular area reaching level of insertion of antennae, lower part and sides of supraclypeal area and a broad entire occipital stripe dull yellow; scape black, somewhat short, dull yellow in front; flagellum dark brown and brown in front; second antennal joint short, conspicuously shorter than third; antennal joints 3 to 5 of equal length; vertex and occiput with short and somewhat dense fulvous hair, genae with white hair; a somewhat broad longitudinal furrow between clypeus supraclypeal area and inner orbits. – *Mesosoma*: Thorax black; scutum strongly punctured and dull; scutellum slightly projected, rounded at sides and emarginated in middle; pronotum with a dull yellow mark on each side; scutum with a broad L-shaped dull yellow stripe on each side above; apical margin of scutellum broadly dull yellow and interrupted by black in middle; axillae mostly dull yellow; tubercles dull, small, rounded, disc plain, not erected in front; tegulae dull yellow in front, disk yellowish red behind. Thorax with somewhat dense and short bright fulvous hair above and with dense light fulvous hair at sides. – *Wings*: Fore wings slightly fuscated, upper half of marginal cell and apical margin fuscated; nervures and stigma brown. – *Metasoma*: Abdomen dull yellow, base of T1 and that of T2 and T3 very narrowly black, widening centrally; apical margins of T1 to T5 brownish-yellow; T1 with a pair of short brown lines on centre of disc; T2 to T5 with a basal lateral small brown mark and a pair of a short transverse brown

Trachusa aquiphila. Habitus of female (left) and male (right). – Sources: Female holotype in ZMB, male in AMG. Photographs: MK.

Trachusa aquiphila. Female. Habitus dorsal and lateral (top), head (in frontal view) and scutum/scutellum (middle) and head in dorsal and lateral view. – *Photographs*: MK, holotype in ZMB.

Trachusa aquiphila. Male. Left: sternites. Note the long S2 with a long dull white fringe of hair at apical margin and black combs on each side of S4-S5. Right: Head. – *Source*: Material from Namibia, AMG. Photographs: MK.



Trachusa aquiphila. **a.** Female mandible; **b.** Female clypeus; **c.** Female scutellum; **d.** Male clypeus; **e.** Female hind tibia and basitarsus; **f.** Male sternites; **g-h.** Male genitalia. – *Sources*: a-g: Pasteels (1984), h. Combey (2008).

lines centrally; apical margin of T6 narrowly dull yellow, roundly emarginate in middle, lamellate at margin; T7 hidden below T6, semi-crescentic, black. Sternite S2 very large, with fringe of long dull white hair on apical margin; S3 with deep notch in the middle (usually difficult to see as S3 is completely covered by S3); S4 widely V-shaped with a comb of black bristles on each side; length of bristles increases from inside to outside; S5 V-shaped with an undulated comb of black bristles on each side. Abdomen with short somewhat dense bright yellow-brown hair above.

Trachusa aquiphila. Female. Fore (above left), middle (above right) and hind leg (below). – *Photographs*: MK, holotype in ZMB.

Biology: Recorded on the wing in Namibia during February and March (Combey 2008, Strand 1912, material in AMG). It was found visiting the yellow flowers of *Crotalaria* (Papilionaceae) in Namibia (material in AMG).

Distribution: Namibia (Strand 1912, Mavromoustakis 1945, Combey 2008, material in AMG).

Distribution of *Trachusa aquiphila*.

Trachusa (Paraanthidium) dumerlei (Warncke, 1980)

Anthidium (*Paraanthidium*) *dumerlei* Warncke, 1980. Entomofauna 1(10): 119-209 (female and male).

The species is closely related to *Trachusa interrupta* and *T. heinzi*, but can be clearly distinguished in both sexes by characters of structure of the sternites.

Female: 12-14 mm. *Head*: Clypeus yellow with the exception of the broad, dark brown or black apical margin; apical margin emarginate. Mandibles yellow at the base, becoming brown toward the outer side (black in *interrupta* and *heinzi*). Yellow areas are supraclypeal area and paraocular area (yellow maculation almost reaching upper end of eye), and a wide stripe on genal area extending from mandibular base to upper end of eye (yellow maculae in paraocular and genal areas rarely merge above the eye, as was observed in one case among 21 specimens examined). In *T. dumerlei*, the yellow genal maculation extends to the base of mandibles as in *T. heinzi*, whereas this is mostly not the case in *T. interrupta*. Antennal socket and upper side of antenna black, underside of antenna dark brown. – *Mesosoma*: Characteristic large yellow spot on mesepisternum (absent in *T. heinzi* and *T. interrupta*); the scutum has an L-shaped yellow stripe anterolaterally; scutellum emarginate with a large yellow spot on each side; axilla with yellow maculation; hind margin of vertex acute and possessing a polished transverse line on the underside. – *Metasoma*: Each tergites with a large lateral band interrupted in the middle (in *T. heinzi* and *T. interrupta*, yellow colouration of at least T3-T5 in the form of

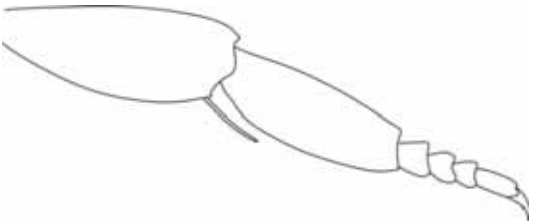
Trachusa dumerlei. Dorsal view of female (left) and male (right). Note the different colouration pattern on vertex and abdominal tergites (uninterrupted bands on T3-T6 in the male). – *Sources*: Paratypes in OLL. Photographs: MK.

Trachusa dumerlei. Lateral view of female (above) and male (below). Note the large yellow maculation on mesepisternum in female, which distinguishes the species from females from *A. interrupta* and *A. heinzi* (black in those species). – *Source*: Paratypes from Turkey in OLL. Photographs: MK.

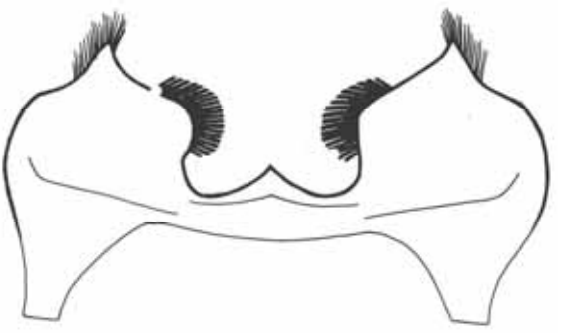
uninterrupted transverse bands); T6 black; both sides of T1 where downward curved towards the ventral area possesses sparse puncturation on outer and polished inner surfaces; scopa greyish-white.

Trachusa dumerlei. Head of female (left) and male (right). Note the yellow-brownish mandibles which distinguish females from *A. interrupta* and *A. heinzi* (black in those species). – *Source*: All material from Turkey (coll. MK). Photographs: MK.

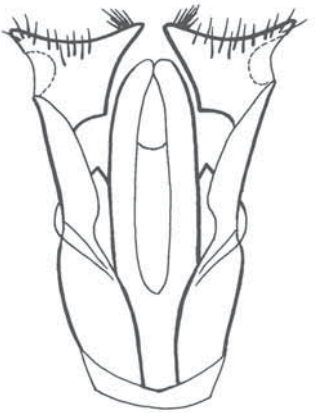
Trachusa dumerlei. Left: View of vertex from the rear. Note the sharp angle where the vertex curves down onto the posterior surface of the head. Right: Tergum T7 is small and partly covered by T6. T7 has an emarginate apical margin and a longitudinal keel. – *Source*: Paratypes from Turkey in OLL. Photograph: MK.



Trachusa dumerlei. Female, hind leg. (tibia and tarsus).



Trachusa dumerlei. Left: Sternite S6 of male. – *Source*: Warncke (1980).



Trachusa dumerlei. Male genitalia. Note that the gonoforceps are only shallowly forced. – *Sources*: Left: Photograph of a male from Turkey (coll. MK, photograph: MK), right drawing from Warncke (1980).

Male. 10-13 mm. *Head*: Mandible yellow, much more slender than in the female, tridentate with one large apical and two small inner teeth; teeth black; clypeus slightly convex, the apical semi-transparent margin crenulated with short golden hair; puncturation of clypeus coarse, with a slightly less densely punctured middle line; supraclypeal area yellow; yellow paraocular maculation reaching above antennal sockets but ending before upper margin of eye; yellow transverse stripe on vertex, sometimes interrupted in the middle; malar area yellow; antenna greyish-brown, darker on the upper side; front side of flagellum yellow; white pubescence between antennal sockets and on underside of head, sparse short ochreous erect pubescence on vertex. – *Mesosoma*: Lateral yellow stripe on sides of anterior half of scutum, two yellow spots on scutellum, axillae black; upper side

of tegula yellow, posterior side black; anterior-facing surface of mesepisternum polished with only scattered punctures, lateral-facing surface coarsely punctured; omaulus angular. – *Metasoma*: Lateral yellow bands on T1-T2, complete bands on T3-T5 with a median V-shaped indentation especially on T3 and T4; T6 yellow (a minute median maculation sometimes present); T7 small and often hidden under T6, emarginate in the middle, yellow with dark brown margins and a weak, brown median longitudinal keel. The apical margins of the tergites (especially T3-T5) are slightly translucent and slightly curled upward. Apical margin of S2-S3 with long hair; S3 with median V-shaped emargination; S4 with median black comb consisting of approximately 50 teeth; S5 strongly curved with a large acuminate lobe on each side; short median comb (approximately 10 teeth – comb can only be seen when the abdominal segments are stretched) and two lateral semicircular combs (with approximately 23 teeth each); S7 with a slight median longitudinal groove. Gonoforceps only slightly forked apically.

The only male available from the eastern end of the distribution range (Hakkâri in eastern Turkey, OLL) is distinctly lighter: the yellow maculation in the malar area extends over the genal area and merges with the yellow stripe on vertex; T7 without median dark colouration, antennae light brown. Without further material, it remains unclear whether these features are of taxonomic importance.

Biology: Seasonal occurrence in Turkey June and July, in eastern Turkey also in August (Özbek & van der Zanden 1993, material in OLL, coll. MK, coll. Schwarz). Recorded from Greece in August (OLL).

Trachusa dumerlei is a strict specialist of knapweeds and thistles (Asteraceae = Compositae) (Praz 2008). This is confirmed by Müller (1996), who found in pollen grain counts of female scopal contents that the pollen consists exclusively (100 percent) of Compositae (Cardueae). In Turkey recorded visiting *Centaurea solstitialis* subsp. *solstitialis, C. solstitialis* subsp. *carneola, Onopordum carduchorum*, *O. anatolicum* and *Cephalaria alpina* (Özbek & van der Zanden 1993, Güler et al. 2014).

Distribution: Found in Bulgaria (coll. Schwarz), Greece and western, southern, inner and eastern Turkey.

Distribution of *Trachusa dumerlei*.

Trachusa (Paraanthidium) heinzi Dubitzky, 2007

Trachusa (Paraanthidium) heinzi Dubitzky, 2007

Trachusa heinzi is very closely allied to *T. interrupta.* Due to overlapping characters, identification often remains challenging. *T. heinzi* can, following Dubitzky (2007), clearly be distinguished by the following characters (character states of *T. interrupta* given in parentheses): Average body length of female 10.6 mm (11.7 mm); vertex of both sexes upcurved, lamellate (rounded to slightly carinate); dorsolateral angle of pronotum with tooth-like projection in both sexes (dorsolateral angle flat to weakly convexly rounded, without projection); basal declivous part of T1 with coarse and rather dense punctation in female (indistinct, flat, more dispersed); male S4 lacking patches of subapical bristles (distinct patches of subapical bristles; pronotal lobes almost entirely yellow in female, partly yellowish in male (pronotal lobes completely black in both sexes); extensive yellow colouration on dorsal parts of male thorax, especially scutum with broad lateroapical yellow maculation (dorsal part of thorax mainly black, scutum nearly always black, sometimes with thin, lateral maculations); mesepisternum of female often with yellow maculations (always entirely black); all female tergites with extended yellow colouration, especially T1 and T2 nearly always with complete yellow banding, only sometimes weakly interrupted (yellow colouration of all tergites of female less extended, on T1 and T2 always broadly interrupted).

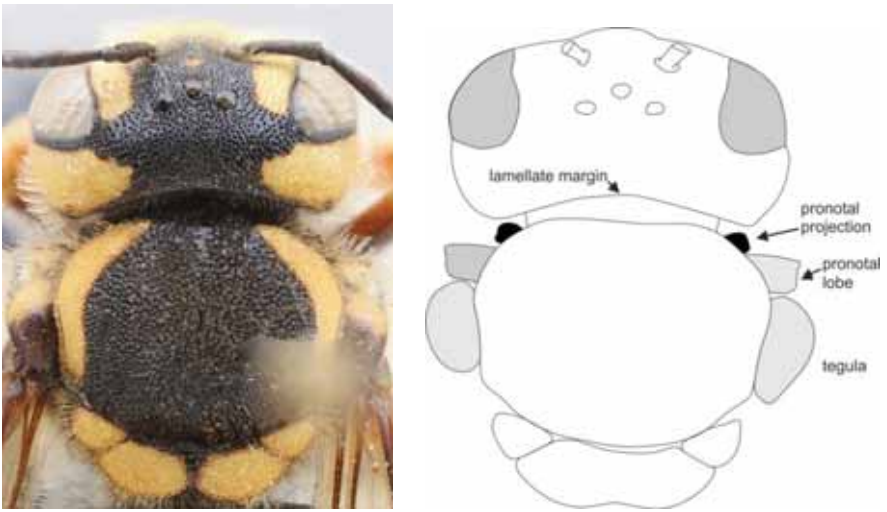
Biology: The range of *Trachusa heinzi* overlaps with *T. interrupta* and both species were also collected together in the Oramar area of Hakkâri province (coll. M. Schwarz).

Trachusa heinzi. Habitus dorsal. Left female, right male. – *Sources*: Paratypes in OLL (♀) and coll. Schwarz (♂). Photographs: MK.

Trachusa heinzi. Habitus lateral. Left: female (paratype), right: male. – Source: Paratypes in OLL. Photographs: MK.

Trachusa heinzi. Male. Underside of metasoma and genitalia. – *Source*: Paratype from Turkey in coll. Schwarz. Photograph: MK.

Trachusa heinzi. Male head. – Source: Paratype in OLL. Photograph: MK.



Trachusa heinzi. Head and mesoscutum of male. Note the lamellate margin of the margin of the vertex and the tooth-like projection at dorsolateral angle of pronotum. – *Sources*: Paratype from Turkey in OLL. Photograph and drawing: MK.

Distribution: Endemic to Turkey. The distribution is confined to south-eastern and eastern parts of the country and includes the provinces of Kahraman Maraş, Şanlı Urfa, Mardin and Hakkâri (Dubitzky 2007, material in coll. Schwarz and OLL).

Distribution of *Trachusa heinzi*.

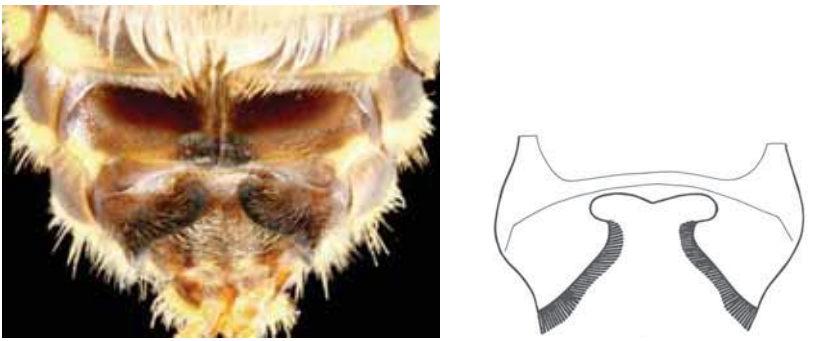
Trachusa (Paraanthidium) interrupta (Fabricius, 1781)

Apis interrupta J. G. Fabricius, 1781 (Spec. Insect., Vol. 1: 482).
Anthidium (Paranthidium) interrupta (Fabricius, 1781).– Friese (1911).
Anthidium (Paraanthidium) interruptum (Fabricius, 1781).
Paraanthidium interruptum (Fabricius, 1781).
Anthidium interruptum J. C. Fabricius.– Syst. Piez., 1804, p. 336.
Anthophora interrupta, Illiger in: Magazin für Insektenkunde, v.o 1806, p. 118
Apis rufipes Fabricius, 1787 (nec. Fabricius, 1781) Mant. Insect. 1: 303 (Spain).
Apis varia Olivier, 1789.
Apis erythropus Gmelin 1790.
Apis fulvipes Fabricius, 1793 (Entom. Syst. 2: 333).
Anthidium flavilabre Latreille, 1809.– Ann. Mus. Hist. Nat. 13, p. 45, 222 (S France).
Anthidium dufourii Lepeletier, 1841.– Hist. nat. Insect. Hymen. 2, p. 380 (S France).
Anthidium luteipes Lepeletier, 1841.– Hist. nat. Insect. Hymen. 2: 368 (N France).
Anthidium integrum Eversmann, 1852.– Bull. Soc. Ent. Ross. Moscou 25, p. 83 (SE Russia) (not *Anthidium intregrum* Friese, 1905).
Anthidium curvipes Schmid, 1872. Mittheil. Schweiz. entom. Ges. 3, 471-472, Tafel 10 (Switzerland).
Anthidium melanostomum Costa, 1884.– Rendiconti Accad. Sci. fis. mat. Napoli 23: 170 (Sardinia).
Anthidium foliivolutor Ferton, 1921.– Annales de la Société Entomologique de France 89, 1920: 344.

A relatively small black species with bright yellow colouration. Males can easily be distinguished from most of their congeners by the presence of black combs on the venter of the mesosoma and the shape of the apical tergites. Females are distinguished from the

Trachusa interrupta. Habitus of female (dorsal) and head of male. – *Sources*: Material from Macedonia in OLL and from France in DEI. Photographs: MK.

Trachusa interrupta. Variation in the colouration pattern of female metasomal tergites. Note the difference in particular in the pattern of T7. Both specimens were collected together at the same location in Greece. – *Source*: Material fr om OLL. Photograph: MK.

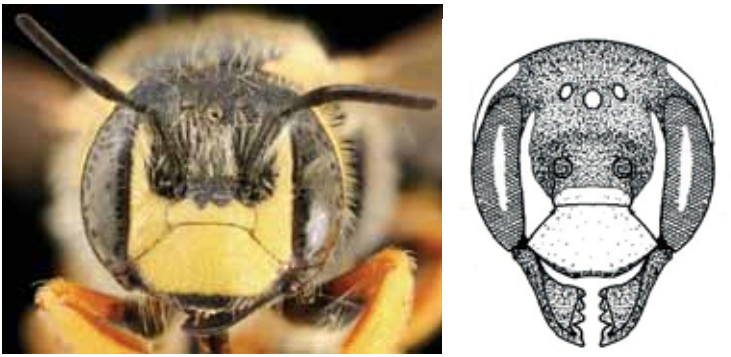


Trachusa interrupta. 6th sternum (S6) of male. – *Source*: Photograph MK, drawing: Warncke (1980).

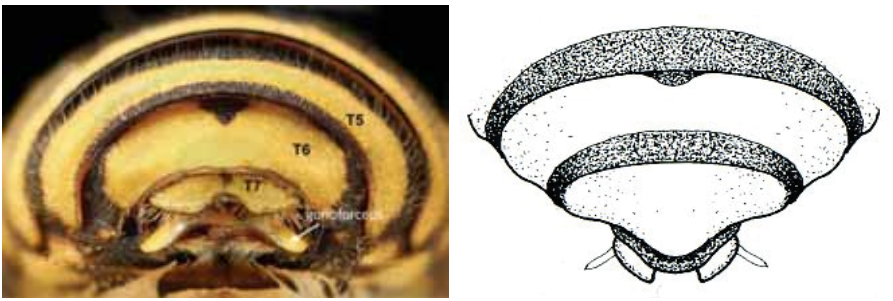
closely related *T. dumerlei* by the absence of yellow maculation on the mesepisternum and the usually entirely black mandibles. However, it needs some experience to distinguish the species from its sister species, *T. heinzi*, which is very similar in both sexes.

Trachusa interrupta shows within the distribution range considerable variation in the colour pattern as well as in structure (e.g. length of antennae), and it still remains unresolved whether this reflects different taxonomic entities. Some of the synonyms listed above may still be revealed as good species.

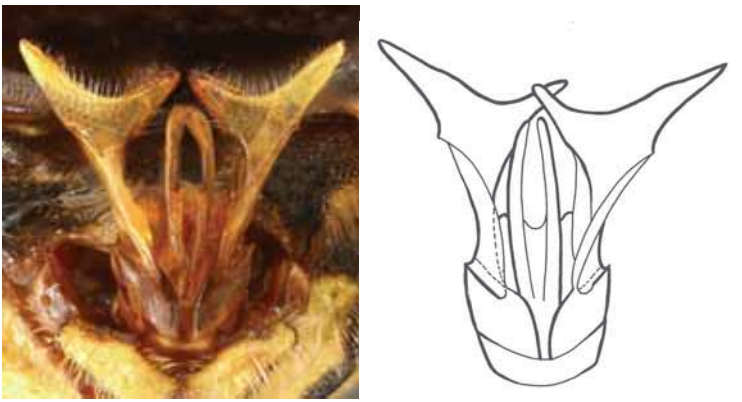
Female (10-14 mm). Clypeus yellow, with a relatively wide, black apical margin; mandible with one large apical and three smaller, obtuse teeth; yellow paraocular area reaches top of eye; supraclypeal area yellow; a yellow elongated spot on the upper gena, sometimes extending almost to mandible; antennae dark. – *Mesosoma*: Scutum with a



Trachusa interrupta. Face of female in frontal view. Left: specimen from eastern Turkey, right: drawing of a specimen from Switzerland. – *Sources*: Photograph by MK, drawing from Amiet et al. (2004).



Trachusa interrupta. – *Sources*: Photograph by MK, drawing from Amiet et al. (2004).



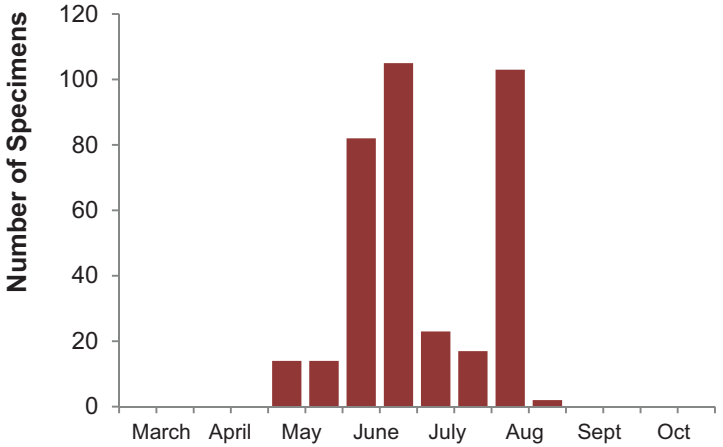
Trachusa interrupta, male genitalia. – *Sources*: Left: SW Turkey (photograph: MK). Right: drawing by Warncke (1980).

yellow long L-shaped stripe laterally and anterolaterally; outer margin of scutellum lamellate; scutellum overhanging metanotum, emarginate in the middle; one yellow rounded spot on each side; axilla also with rounded yellow spot. Pronotal lobe with sharp lamella; tegula bi-coloured black (or brown) and yellow. – *Metasoma*: Black with yellow bands attenuated in the middle; the proximal bands (at least T1, mostly T1-T2) interrupted and the lateral bands then take the shape of acute triangles. T6 with two maculae which may cover the entire integument of the tergite, although there are specimens which have an entirely black T6, and also intermediate forms. Tarsi and tibiae golden yellow or orange-yellow, tibiae often with some longish black maculation on inner side. Wings dark brown, strongly fuscated. Ventral scope white.

Male (11-15 mm). Clypeus entirely yellow without crenulated to finely serrate apical margin; mandibles narrow, yellow, with three black, subacute teeth; antennae longer than in female; scape yellow beneath; yellow spot in the upper gena, smaller than in the female. – *Mesosoma*: Scutum entirely dark brown without yellow maculation (the most common instance) or with a narrow yellow band laterally, usually not extending to the anterior side. Scutellum and axillae dark or with yellow spots (as found in most females); these spots are often confined to scutum. Legs and wings as in female. – *Metasoma*: First one or two (rarely three) tergites with one yellow lateral band each, the others with one uninterrupted band each; T6 yellow with median lamellate projection, T7 lamellate with a deep rounded emargination apically (two-lobed shape); the yellow, longer arm of the Y-shaped gonoforceps can be seen in dorsal view. Black median combs of black bristles on S4 and S5: on S4, one median apical comb and two small subapical patches of black bristles (these subapical bristles are absent in *T. heinzi*. They can only be seen in the stretched abdomen). On S5 one slightly curved comb, ending in an acute apex on each side. S2-S3 brown with large yellow maculation; S4 brown with the exception of yellow lateral tips. S2 with long whitish hair which covers the combs when the abdomen is curled inward, in the bee's resting position. S3 with a deep V-shaped median emargination.

Biology: Seasonal occurrence of adults extends from early May to late August. While the species is usually found in August only in high altitudes (e.g. inner and eastern Turkey), it is sometimes still on the wing at this time at sea level (Croatia).

Flower relationships: According to Praz (2008), *Trachusa interrupta* exclusively collects pollen on Dipsacaceae, whereas the closely related sister species *T. dumerlei* is a strict specialist of knapweeds and thistles (Asteraceae). Literature records do not always confirm this statement, and records are found for Asteraceae (*Picris*, *Xeranthemum*), Linaceae (*Linum*), Dipsacaceae (*Scabiosa*), and Campanulaceae (*Jasione*) (Schmiedeknecht 1907, Banaszak & Romasenko 1998, Aguib et al. 2010, Saunders 1908). Özbek & van der Zanden (1993) list from Turkey *Centaurea solstitialis, Cirsium* spp., *Onopordum* sp., *M. officinalis, Cephalaria alpina*, and *Vitex agnus-castus.* Güler et al. (2014) list *Carduus olympicus* subsp. *hypoleucu*s (Asteraceae), *Pterocephalus plumosus*, *Scabiosa atropurpurea* subsp. *maritima*, and *S. reuteriana* (Dipsacaceae). In Algeria also found on *Echium* (Boraginaceae) (Saunders 1908). Maharramov et al. (2014) collected the species in Nakhchivan (Azerbaijan) at *Astragalus resupinatus*. Müller (1996) found in pollen grain counts of female scopal contents that Dipsacaceae are with 98.8 percent by far the most preferred flowers (mainly Scabiosoideae, followed by Dipsacoideae).



Seasonal distribution of adult *Trachusa interrupta* based on records in museum collections (N=360). Note that the records come from different parts of the entire distribution area and are not equally represented. The seasonal pattern is therefore influenced by both geographic differences and different collecting activities. The peak in early August is for example biased because of high collecting activity in eastern Turkey.

Stelis annulata was found to be a cleptoparasite of *T. interrupta* (Friese 1895, Mavromoustakis 1960, see Kasparek 2014).

Nests are located in the soil, their structure is similar to that of *Trachusa byssina*. Cells constructed from leaf ribbon and lined with a thin layer of resin inside.

Distribution: Mediterranean and Central Europe up to 48°N. The distribution extends in Turkey from sea level to 2600-3000 m in the east. In Switzerland the highest location recorded is at 1200 m (Amiet et al. 2004). The species is the only *Trachusa* regarded as "threatened" at the European and EU 27 level by Nieto et al. (2014).

Distribution of *Trachusa interrupta*. A record in Central Asia (Tajikistan) is beyond the area shown on the map.

Trachusa (Paraanthidium) longicornis (Friese, 1902)

Megachile steloides Bingham, 1896. J. Bombay Nat. Hist. Soc. 10: 198, Plate I: Fig. 5 (female).
Anthidium steloides (Bingham, 1898) [Friese 1901, Zeitschr. Hym. Dipt. 1: 224].
Protanthidium steloides (Bingham, 1896)
Paraanthidium steloides (Bingham, 1896).– Mavromoustakis (1948).
Trachusa (Protanthidium) steloides (Bingham, 1896).
Anthidium longicorne Friese, 1902 (Zeitschr. Hym. Dipt. 2: 109) [replacement name].
Paraanthidium longicorne Friese, 1902.– Wu (1962).
Trachusa longicorne (Friese, 1902) [Wu 2005].
Trachusa (Paraanthidium) longicorne (Friese, 1902).– Wu (2006).

Pasteels (1972) argues that the name *steloides* should be available as the taxon does not belong to *Anthidium*, but to *Trachusa*. So, according to Pasteels, the introduction of a replacement name by Friese (1902) was not justified. This view is not followed here.

The species forms together with *T. maai*, *T. muiri* and *T. rufobalteata* a group of closely related species, the "*longicornis* group".

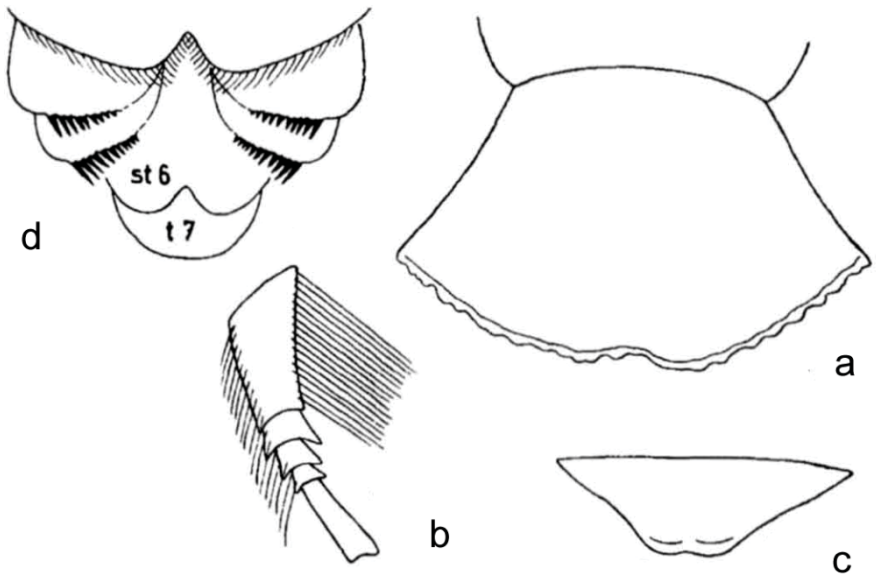
Female. Head, thorax and metasoma entirely black, with the last two abdominal segments ochre yellow. – *Head* as broad as the thorax, shining. Clypeus with a wide,

Trachusa longicornis. Habitus of female (left) and male (right). – *Source*: Material from Nepal in OLL. Photographs: MK.

Trachusa longicornis. Habitus of female (left) and male (right). – *Source*: Material from Nepal in OLL. Photographs: MK.

shallow apical emargination; laterally bisinuate; puncturation on anterior half of clypeus usually less than a puncture diameter, but much denser and finer in apical half; mandibles reddish black with five black, obtuse teeth, very broad at the tips. Puncturation of head: interstitial distance mostly more than two puncture diameters wide, but denser and finer puncturation between antennal sockets. Antenna dark (almost black) on upper side, ochre on underside; segments 3-5 ochre on upper and underside. – *Mesosoma:* Scutum,

Trachusa longicornis. Habitus of female (left) and male (right). – *Source*: Material from Nepal in OLL. Photographs: MK.



Trachusa longicornis. Male. **a.** Clypeus; **b.** Fore tarsus; **c.** Tergite T6 dorsal; **d.** Sternites S4-S6 und last tergite T7 from ventral. – *Source*: Pasteels (1972).

scutellum and axillae very densely and coarsely punctate, distance between punctures less than a puncture diameter; scutellum projecting backwards and overhanging metanotum, its posterior margin rounded and impressed in the middle; axillae separated from

Trachusa longicornis. Male. Note the notched apical margin of S3 and the black combs on S4 and S5. – *Source*: Holotype in SMF. Photograph: MK.

Trachusa longicornis, male from Nepal. Note the large, lamellate pronotal lobes, the dense and deep puncturation, and the shape of scutellum and axillae. – *Source*: Left male from Nepal in OLL, right male from India in SMF. Photographs: MK.

Trachusa longicornis. Apical tergites and scopa of female (left) and mid tibia of male (right) . – *Source*: Material from Nepal in OLL. Photographs: MK.

scutellum by a clearly visible axillary suture. Pronotal lobe relatively large with a big and sharp lamella directed upwards. A Sharp lamella also in the upper half of the omaulus. Legs brown, the outer margins of femora, tibiae and tarsi rich ferruginous-brown. – *Metasoma*: Black and shining, T1-T2 with base sparsely punctured, remainder of disk punctured, apical margin broadly impunctate, polished and shining; T5-T6 yellow. Scopa bright ferruginous.

Male. With a characteristic colour pattern: lower face (clypeus, supraclypeal area, lower part of paraocular area, lower part of gena; mandible with the exception of teeth) yellow, clypeus with a narrow, brown, translucent apical margin, teeth black or reddish-brown; thorax black or dark brown, T1 completely brown, T2 brown with a yellow spot laterally, T3 brown with yellow transverse band (narrow in the centre and broad at the lateral ends; sometimes interrupted in the middle), T4-T7 yellow (some dark markings may occur especially on T4). T6 forming a slight bulge at both lateral ends (Friese describes them as tubercles), but not always clearly visible; apical end of T6 in the middle bilobed and lamellate; T7 very small, often hidden under T6, and convex. – *Head*: Clypeus with sparse puncturation; interstices especially laterally and medially often 2-3 times wider than the diameter of a puncture. – *Mesosoma*: Lamella in upper omaulus, but less prominent than in the female. – *Metasoma*: Sternite S3 notched in the middle, V-shaped emargination with a fringe of dense hair; S4 with transverse black combs on each side (each comb with 16-19 teeth); S5 with diagonal combs (15-18 teeth each), which form a large 'V' but do not meet in the middle. – Altogether, puncturation on head, thorax and abdomen much denser than in female.

Biology: Found in the Khasia Hills (India) in April (SMF), in Sikkim (India) in May (Bingham 1896) and in Yunnan (China) April and May (Wu 1962). Bingham (1896) noted that the species was visiting flowers and wet sand along the banks of a river.

Distribution: Known from India, where it occurs in the north-eastern parts of the country (Sikkim, Meghalaya, West Bengal, etc.) and where it seems to be not uncommon (Bingham 1896, SMF, ZMB, Discover Life), Nepal, and from Yunnan Province of China (Wu 1962). Berlin Museum has, for example, a series of over 170 specimens.

Distribution of *Trachusa longicornis*. The species is found in China, Nepal and India. The actual distribution area seems to be confined to a relatively narrow belt extending from the Himalayan mountains of Nepal in the west to Yunnan province, China, in the east.

Trachusa (Paraanthidium) maai (Mavromoustakis, 1953)

Paraanthidium maai Mavromoustakis, 1953. Ann. Mag. Nat. History 12. Ser., 6: 834 (female).

Paraanthidium maai Mavromoustakis, 1954. Ann. Mag. Nat. History 12. Ser., 7: 250-251 (male).

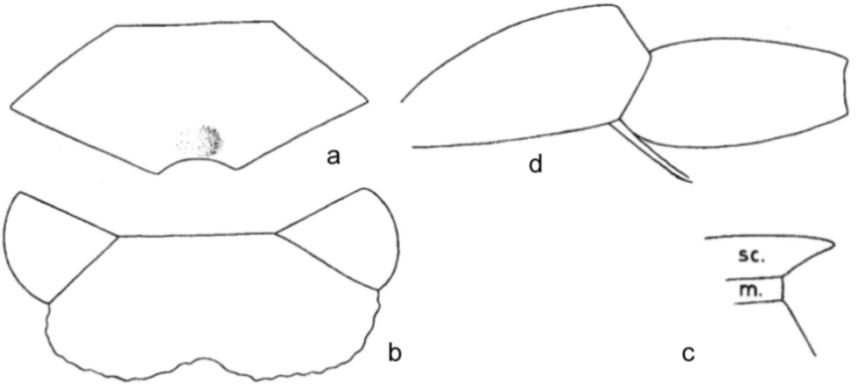
Trachusa (Proanthidium) maai (Mavromoustakis, 1953).– Pasteels (1972) [assigned to *Proanthidium*, but listed under *Protanthidium*].

Male similar to *Trachusa muiri* which is, however, much smaller, and differs strongly in having vertex and occiput moderately shining and very strongly punctured. *Trachusa longicornis* is larger and differs in the colour and puncturation of the integument, and has a much wider T6. Mavromoustakis (1953, 1954) provided detailed descriptions of both sexes; Pasteels (1972) examined another female, re-described it and came to the conclusion that the species belongs to the subgenus *Proanthidium* rather than to *Paraanthidium*.

Female. 16 mm. Black. *Head*: Clypeus broader than long, sides and basal area polished and shining, apical margin very slightly emarginate in middle; clypeus with a shining longitudinal slightly elevated middle line starting from basal middle and not reaching the apical margin; slightly emarginate; supraclypeal area polished and shining, with a polished longitudinal line from base to apex; vertex and occiput polished and shining, with very sparse, fine and shallow punctures; mandibles broad, with five obtusely pointed teeth; scape long; second segment of flagellum longer than broad, longer than first or third; 3rd segment broader than long and as long as 4th; antennae black; lower half of genae with somewhat longer and denser yellowish-white hair. – *Mesosoma*: Scutum strongly punctured, distance between punctures often one puncture diameter. Pronotal lobe large, lamellate; upper half of mesepisternum lamellate; scutellum polished and shining, the apical margin regularly crenulate, deeply and roundly emarginate in the

Trachusa maai, habitus of female (left) and male (right). – *Sources*: Holotype (female) and allotype (male) in coll. Mav., photographs: MK.

Trachusa maai, head of female (left) and male (right). – *Sources*: Holotype (female) and allotype (male) in coll. Mav., photographs: MK.



Trachusa maai. Male. **a.** Clypeus; **b.** Scutellum with axillae (dorsal view); **c.** Scutellum (sc.) with metanotum (m.) in lateral view; **d.** Hind tibia and basitarsus. – *Source*: Pasteels (1972).

middle and rounded at sides; axillae rounded at sides, between axillae and scutellum emarginate; scutum with a dull yellow band at each side. Femora dark brown-black, anterior pair light brown towards apex on inner side; anterior and mid tibiae dark brown above and light reddish-brown beneath; hind tibiae brown; middle tibiae thick and broad; tarsi reddish-brown, with golden hair above; hind basitarsi long and broad, base somewhat broader than apex; pulvilli developed. – *Metasoma*: Shining; T1 with base narrowly strongly and sparsely punctured, disc towards apical margin with similar but shallow and dense punctures, apical margin broadly polished impunctate and shining; T2 with strong and sparse punctures at each side; remainder of disc with shallow and somewhat sparse punctures, apical margin broadly polished and impunctate; a dull yellow mark in middle of disc at each side; T3 with basal and transverse dull yellow band, strongly and somewhat sparsely punctured; T4 and T5 with basal transverse dull yellow band (broader at

Trachusa maai. Above: female middle leg and abdominal tergites. Below: Male fore leg and sternites. – *Source*: Female holotype in coll. Mav., photograph: MK.

sides) and strongly punctured; T6 dull yellow except the brownish sides, disc covered with light golden depressed hair; ventral scopa dense, golden white, the hair on last sternite reddish-brown.

Male. Similar to the female. *Head*: Black, yellow areas are: clypeus, paraocular area though not reaching antennal insertion, supraclypeal area, a mark at each side of occiput, mandibles, except the dark reddish-brown apex; scape short, yellow in front; flagellum long, second segment of antennae longer than first and much shorter than third; third segment very long, much longer than broad, of same length as 4th to 7th. Pubescence on head somewhat dense on occiput and golden-white, that on front whitish-yellow; pubes-

cence on genae denser and whitish. –*Mesosoma*: Scutum and scutellum with somewhat dense yellowish-brown hair. Scutum with a short dull yellow stripe at each side close to tegula; fore tibia yellow on inner side above and light reddish-brown on inner side beneath middle and hind tibia yellow and light reddish-brown at the apex; tarsi with the basitarsi yellowish-brown; median basitarsi longer than the fore and hind ones; pulvilli well developed. Long fringe of hair at fore metatarsus; – *Metasoma*: Tergite T2 with lateral dull yellow mark; T3 and T4 each with a very broad discal transverse dull yellow stripe; T5 almost dull yellow, apical margin deep brown; T6 dull yellow, apical margin brown; T7 very short and brown, hidden below T6 and densely covered with dull silky hair; apical margin of S4 with deep median emargination, and in the middle of the emargination, a small V-shaped notch. S5 margined with two black combs at each side.

Distribution: Fujian (= Fukien) and Jiāngxī Provinces in south-east China at 300 to 1000 m (Mavromoustakis 1953, 1954, Pasteels 1972, Wu 2006).

Biology: Found on the wing in June (Mavromoustakis 1953, 1954).

Distribution of *Trachusa maai*. Within China, the species has so far has been recorded in two western provinces (Fujian and Jiāngxī: dots).

Trachusa (Paraanthidium) muiri Mavromoustakis, 1937

Paraanthidium muiri Mavromoustakis, 1937. Ann. Mag. Nat. History 10. Ser., 19: 155-157 (female). Following Mavromoustakis (1954), the publication date is 1937 not 1936.
Paraanthidium muiri Mavromoustakis, 1954. Ann. Mag. Nat. History 12. Ser., 7: 249-250 (male).
Trachusa (Paraanthidium) muiri (Mavromoustakis, 1937). – Wu (2006).

A small but robust species. *Trachusa muiri* is closely related to *T. maai,* and superficially resembles small individuals of that species.

Female. 12 mm. *Head*: Black and rounded; clypeus broader than long, slightly convex; apical margin undulate; finely and densely punctured, moderately shining, lower sides strongly and densely punctured; clypeus with a very slight longitudinal carina, upper part

Trachusa muiri. Habitus. Above left: female, Right: male. Below: male. – *Source*: Female holotype and male allotype in coll. Mav., photographs: MK.

Table. Selected distinguishing characters between *Trachusa maai* and *T. muiri*.

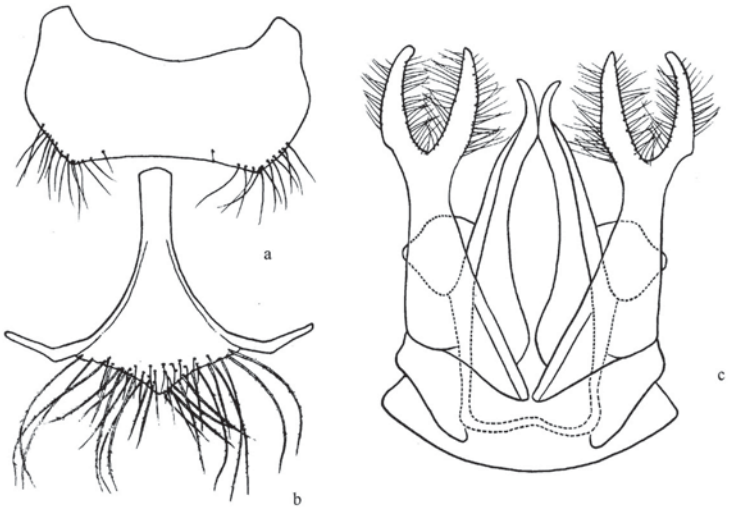
	Trauchusa maai	***Trachusa muiri***
Size	Large species.	Medium-sized species.
Male		
Teeth	3 subacute teeth.	3 rounded, blunt teeth.
Occiput	With 2 yellow spots.	Dark.
Scutum	Yellow lateral stripe near tegula on each side.	Dark.
Tergites	T1 black, T2 with a lateral yellow band on each side, T3-T5 each with a yellow transverse band.	T1 black, T2-T5 each with a yellow transverse band.
Sternites	S4 with rounded concave emargination and a small V-shaped median notch.	S4 with wide V-shaped emargination, both arms of the V convex.
Female		
Pronotal lobe	Conspicuously large, shining, with some fine, short hair.	Less conspicuous, longer pubescence, dull.
Middle tibia	Thick and broad.	Still broad but not as in *T. maai*.
Omaulus	Upper half carinate.	Angular, carina absent.
Scutum	Deep and coarse puncturation, distance between punctures usually equal to their diameter.	Puncturation somewhat finer, distance between punctures often less than their diameter.
Tergites	Apical margins polished (impunctate, shining).	Puncturation normally reaches the apical margins.

very narrowly impunctate and shining, lower margin slightly emarginate in middle; supraclypeal area slightly convex, densely punctured and moderately shining; sides of face (between clypeus, supraclypeal area, and eyes) very strongly and densely punctured and shining; mandibles large and black with five short rounded black-brown teeth; scape black, flagellum brown; third antennal segment slightly longer than 2nd and 4th, but shorter than 3rd and 4th together; vertex and occiput moderately shining and very strongly punctured; sides of face, upper half of clypeus, and genae with somewhat dense and very short yellowish-white hair. – *Mesosoma*: Black; scutum strongly and densely punctured, moderately shining; scutellum overhanging metanotum, apical margin subcrenulate, rounded at sides and broadly emarginate in middle; tegulae with a faint deep yellow spot

Trachusa muiri. Above: Head and apical tergites of male. Below: Legs. Left female, right male. – *Source*: Female holotype and male allotype in coll. Mav., photographs: MK.

in front; sides of scutum (near tegulae) with a faint and short deep yellow stripe; scutellum with subapical deep yellow stripe broadly interrupted in middle (however, in one out of four specimens examined, yellow stripe absent). Pulvilli present; spurs yellowish-brown. – *Metasoma*: Broad, black, and moderately shining; T1 with base somewhat strongly punctured, remainder of tergite densely punctured; sides of T1 with a deep yellow mark (this mark absent in one out of four specimens examined); T2 and T3 somewhat densely punctured, T2 and T3 each with a transverse and deep yellow band, broad at sides; base of T4 black, apical margin reddish-brown, remainder deep yellow; T5-T6 deep yellow, apical margin of T5 narrowly reddish-brown. Sternites black, S2-S5 with yellow apical transversal stripe. Scopa white. Maxillary palpi with three segments.

Male. Length 11 mm. Similar to the female. – *Head*: Creamy yellow areas are: clypeus, mandibles except the dark reddish-brown apex, lower paraocular area entirely up to antennal sockets, lower half of supraclypeal area, scape in front. Clypeus slightly emarginate at apical margin, coarsely punctured, with scattered punctures in the longitudinal middle line. Three blunt teeth. Antennae long; scape rather short; second segment of flagellum a little longer than first, but much shorter than third or fourth. – *Mesosoma*: Scutum and scutellum entirely black; pubescence similar to the female. Fore legs with relatively long pubescence on posterior surface of femur, tibia and metatarsus; on middle legs, long, slightly undulated hair only on femur; hind leg with only short hair. Scutellum



Trachusa muiri, male. **a-b.** The "hidden sternites" S7 and S8 of the male. **c.** Male genitalia. – *Source*: Wu (2006).

large, deeply emarginate in the middle, widely overhanging metanotum. – *Metasoma*: T1 with pale yellowish-white hair, somewhat denser at sides; T2 with a transverse, pale yellow discal stripe widely notched at each side of the centre; T3 and T4 with similar discal transverse, deep yellow stripes ; T5 with subapical broad and transverse, deep yellow stripe in the middle; T6 broader than long, apical margin blunt and emarginate in the middle; T7 short, hidden below T6, broader than long, with a longitudinal carina starting nearly from the middle of disc and reaching the apical margin (carina very slightly produced over the apical margin), sternites deep brown, apical margin of S1 pale, those of S2 and S3 tinged with brown; S3 sinuate in the middle of the apical margin and bearing a longitudinal median furrow; sternites with dull yellowish white hair.

Wu (2006) depicted male genitalia with large, forked gonoforceps with two equally strong arms, while the male described by Mavromoustakis (1954) (the allotype examined in the Mavromoustakis collection) has two differently strong arms of gonoforceps, this fitting better the characters of the subgenus *Paraanthidium*.

Biology: Found on the wing in April (Wu 1962), May (Wu 2006) and June (Mavromoustakis 1954).

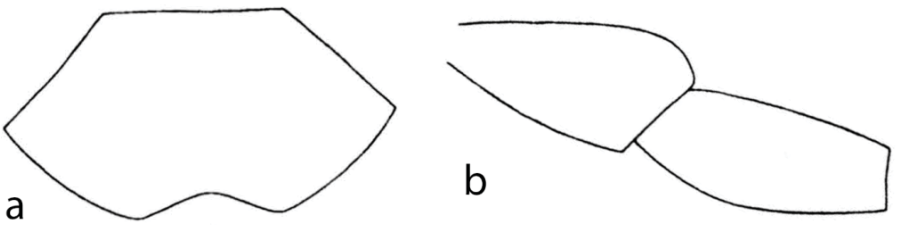
Distribution: *Trachusa muiri* occurs in southern China where the Palaearctic and the Indomalayan ecoregions meet: found near Hongkong in Fujian (= Fukien) province and in Yunan (Mavromoustakis 1937, 1954, Wu 1962) and Guangdong province (Asher in: Discover Life).

Distribution of *Trachusa muiri*. Within China, the species has been recorded in three provinces (dots).

Trachusa (Paraanthidium) ovata (Cameron, 1902)

Protoanthidium ovatum Cameron, 1902. J. Straits Branch Roy. Asiat. Soc. 37: 126-127 (female).
Dianthidium ovatum (Cameron, 1902).– Cockerell (1922).
Protoanthidium ovatum (Cameron, 1902).– Mavromoustakis (1936) (male).
Protanthidium ovatum (Cameron, 1902).– Mavromoustakis (1936).
Trachusa (Protanthidium) ovata (Cameron, 1902).– Pasteels (1972).
Paraanthidium ovatum (Cameron, 1902).– The Systematic List of Mavromoustakis' collection (1989).
Trachusa (Paraanthidium) ovata (Cameron, 1902).– Michener & Griswold (1994).

Female. 14 mm. Black; hair on thorax and metasoma black; there is a tuft of fulvous hair on the front; face and clypeus are covered with short rufous pubescence. – *Head*: Clypeus broader than long, slightly convex with the lower margin emarginate in the middle and finely, uniformly and deeply punctured; in the middle a longitudinal, almost impunctate line, puncturation in lateral parts coarser; in the supraclypeal area punctures are larger and more scattered. Frons and vertex uniformly and strongly punctured; the face less strongly punctured. Mandible brownish or dull yellow with five black teeth: besides the apical tooth, there are four short, round ones joined by shallow concavities. Upper side of antennae brown to black, underside rufous; maxillary palpi with three



Trachusa ovata. Female. **a.** Clypeus; **b.** hind tibia and basitarsus. – *From*: Pasteels (1972).

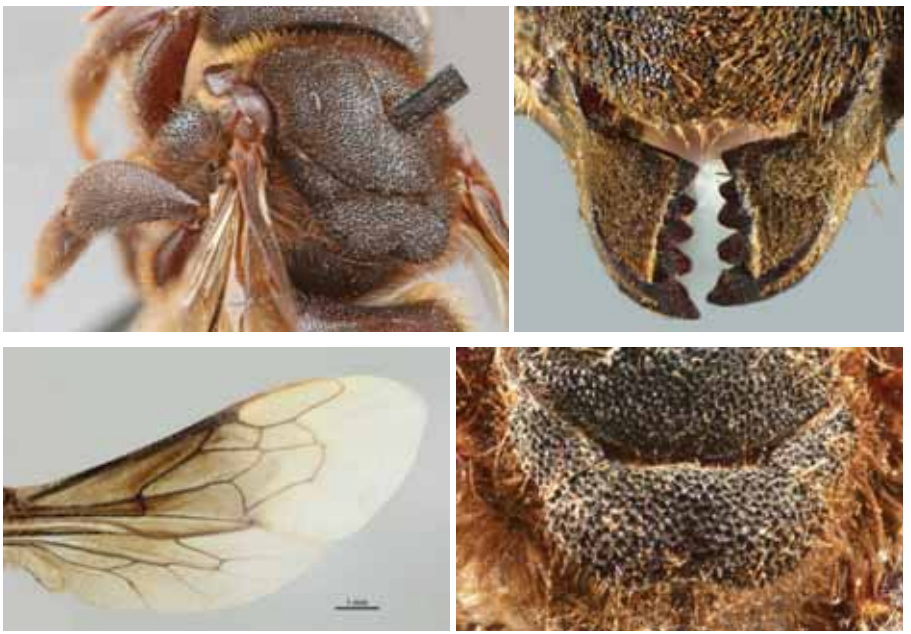
Trachusa ovata, female, habitus dorsal (two different specimens). – *Source*: Material in SEMC (above) and in coll. Mav. (below), Photographs: MK.

Trachusa ovata, female, habitus lateral. – *Source*: Specimen from Malaysia (Kalimantan, Borneo) in SEMC, Photographs: MK.

segments, the two apical ones not more than three times as long as wide. Inner orbital margins parallel; in lateral view, the genal area has about the same width as the eye; vertex rounded onto occiput and very long, the distance from the ocelli to the preoccipital ridge about double the interocellar distance; punctures on vertex small to medium with acute edges; the underside of the thorax has sooty and woolly hair. – *Mesosoma*: Scutum and scutellum closely and uniformly punctured; scutum with reticular punctation and densely covered with reddish brown erect pubescence; scutellum notched in the middle and overhanging metasoma. Upper one third of the omaulus with carina. Legs black, and thickly covered with black hair; irregularly punctured; tibia short and strong. Wings: Basal half strongly fuscated, outer half milky white. – *Metasoma*: Disc of tergites black, densely covered with small and shallow punctures (interstices are longer than the diameter of the punctures), outer side dark brown and with denser puncturation followed by a narrow impunctate margin. Sparse and short erect hair especially on the sides; T6 triangular in dorsal view with a rounded apex. Scopa rufous to fulvous.

Male. 11 mm. Black; clypeus dull yellow; broader than long; lower margin slightly emarginate in the middle; mandible dull yellow; apex black; lower paraocular area and lower margin of supraclypeal area dull yellow; antennae very long; scape short and black, with dull yellow stripe beneath; second antennal segment black, other segments

Trachusa ovata, face of female. – *Source*: Specimen from Borneo in SEMC. Photograph: MK.



Trachusa ovata, female. Above: Thorax and mandible, below fore and hind wing and scutellum. Note the relatively strongly fuscated inner parts of the wing. – *Sources*: Specimens from Borneo (SEMC, coll. Mav.). Photographs: MK. Wing from holotype NHMUK 10265029 (Photograph: D. Notton).

reddish-brown beneath and brown above; second and third segments conspicuously shorter than fourth; T6 covering T7, apical margin rounded and slightly emarginate in the middle; pulvilli present; second recurrent nervure out of second transverse cubital nervure.

Biology: Found on the wing in May and June (Mavromoustakis 1936, material in SEMC).

Distribution: Malaysia (Sarawak) at 1000 and 1080 m (Cameron 1902). A specimen from the Malaysian Peninsula (Johor) in SEMC may belong to an undescribed species (MK).

Distribution of *Trachusa ovata*.

Trachusa (Paraanthidium) rufobalteata (Cameron, 1902)

Protoanthidium rufobalteatum, Cameron, 1902. J. Straits Branch Roy. Asiat. Soc. 37: 125-126 (female holotype and male).
Dianthidium rufobalteatum, Cameron, 1902.– Cockerell (1922).
Protanthidium rufobalteatum (Cameron, 1902).– Mavromoustakis (1936).
Trachusa (Proanthidium) rufobalteata (Cameron, 1902).– Pasteels (1972) [listed under *Protanthidium*, but assigned to *Proanthidium*. Misspelling?].
Trachusa (Paraanthidium) rufobalteata (Cameron, 1902).– Michener & Griswold (1994).
Trachusa rufobalteata (Cameron, 1902).– ITIS (2009).
Trachusa (Paraanthidium) rufobalteata (Cameron, 1902).– Discover Life (version 13.11.2016).

Similar to the other Asian species *T. longicornis*, *T. maai* and *T. muiri*, from which the species may be difficult to distinguish when only one sex is available. While the variation in *T. longicornis* is relatively well-known, *T. maai* and *T. muiri* are known only from a few specimens and the variation in taxonomic characters remains to be determined.

Female. 12 mm. Black with yellow colouration on abdomen. – *Head*: Clypeus distinctly, narrowly carinated in the middle; the apex of the clypeus truncated, with rounded sides; the apical tooth of the mandible is bluntly rounded and projects; behind it are three short, bluntly rounded teeth. Head closely rugosely punctured, clypeus more finely than the vertex; in front and above closely covered with short, erect, black hair. Antennae black, short, smooth and shining. – *Mesosoma*: Scutum densely covered with erect, moderately long black hair; thorax closely and somewhat strongly and uniformly punctured; scutellum distinctly projecting over metanotum; its apical margin slightly emarginate; legs black; the apical three segments of the tarsi rufous; pulvilli present. – *Metasoma*: Black; there is a narrow rufous stripe on each side of T2, an almost entire band on the apex

Trachusa rufobalteata, male habitus. – *Source*: Paratype in Natural History Museum (London), NHMUK 10265030, photograph: D. Notton.

Trachusa rufobalteata. Male. Tergite T6. – *Source*: Redrawn after Pasteels (1972).

of T3, and a broader one, narrowed at the sides, on T4. The whole of T5 and T6 are rufous. The ventral scopa is bright ferruginous.

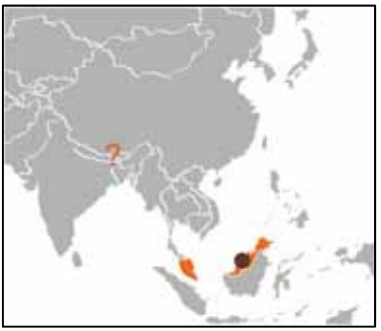
Male. Similar to female, but antennae much longer; clypeus and lower parts of paraocular area bright yellow; yellow maculation in paraocular area not reaching antennal sockets; distal margin of clypeus hyaline and crenulated, widely emarginate in the middle; mandible yellow with one large and two smaller brown teeth; upper half of face and underside of head with white pubescence; some brown pubescence on vertex. – Scutum, scutellum and axillae black; scutellum deeply emarginate in the middle. Middle tibia at its widest point much wider than hind tibia. – T1 black, T2 with a narrow yellow

Trachusa rufobalteata, male paratype. – *Source*: Natural History Museum (London), NHMUK 10265030, photograph: D. Notton.

transverse band on each side; T3 and T4 with yellow bands; T5-T7 entirely yellow; T6 slightly emarginate in the middle; T7 almost completely hidden under T6. Apical margin of S2-S3 with dense fringe of white hair.

Biology. Collected on the wing in June (Mavromoustakis 1936).

Distribution. Malaysia (Kalimantan) at 1090 m (Cameron 1902). Pasteels (1972) also gives Sikkim in India (to be confirmed).



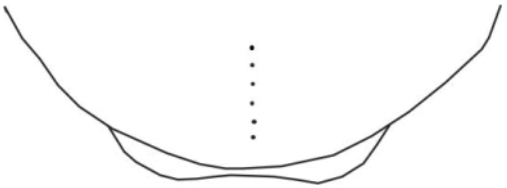
Distribution of *Trachusa rufobalteata*. A doubtful record in Sikkim (India) is shown with a question mark.

Trachusa (Paraanthidium) xylocopiformis (Mavromoustakis, 1954)

Paraanthidium xylocopiforme Mavromoustakis, 1954. Ann. Mag. Nat. History, 12. Ser., 7: 249-252 (male).

One of the largest species of the genus. Completely black with yellow markings only in the lower face and on clypeus (male). Can be distinguished from *Trachusa ovata*, which has a similar colour pattern by the colouration of the wings (wings from base to stigma

Trachusa xylocopiformis, male. Habitus dorsal, ventral and lateral. Head and apical tergites. – *Sources*: Holotype in coll. Mav., photographs: MK.



Trachusa xylocopiformis. Male. Tergites T6-T7. – Redrawn from: Mavromoustakis (1965).

smoky fuscous, distally a milky hyaline in *T. ovata*, and fuscated throughout in *T. xylocopiformis*) and the legs (slender, long legs in *T. xylocopiformis*, thicker and broader legs in *T. ovata*). From other large species such as *Trachusa formosana* distinguished by the body colouration and the form of the scutellum. *T. xylocopiform* is known only from a single male specimen.

Female. Unknown.

Male. Length 16.0 mm. *Head*: Black; mandibles tridentate, yellow, apex dark polished reddish-brown; clypeus broader than long, ochreous yellow, shining, slightly convex with shallow median emargination, punctured, lower sides more strongly punctured, longitudinal middle line less punctured; lower margin of supraclypeal area and lower paraocular area (not reaching antennal sockets) broadly ochreous yellow; clypeus and lower paraocular area with very sparse brown hair at sides; cheeks with somewhat long, dull white hair; remainder of the head with brown hair, hairs on front denser and longer; antennae somewhat long and black-brown; flagellar segments except the first are longer than broad, second segment somewhat longer than third. – *Mesosoma*: Scutum densely rugosely punctured, moderately shining, with short erect rather dense, pale hair; tegulae light reddish-brown, densely punctured; scutellum projecting and overhanging metasoma, shining, densely rugosely punctured, apical margin slightly emarginate in the middle and rounded at sides, with sparse pale hair particularly on sides of axillae; propodeum dull with coriaceous microsculpture, with sparse punctures in the middle above and denser punctures on lateral surfaces; wings infuscated, marginal cell strongly infuscated. Thorax with somewhat short, dull silky hair at sides and below. – Legs long and slender (a feature useful to distinguish the species from *T. ovata*). Femora black-brown, median ones light reddish-brown on inner side (except the base), hind ones light reddish-brown at the apex on inner side; femora with short and sparse whitish hair; anterior tibiae light reddish-brown, deep reddish brown on outer side above; middle tibiae deep reddish-brown, light reddish-brown on outer side and beneath; hind tibiae deep reddish-brown; tarsi reddish-brown, median and hind basitarsi deep reddish-brown; middle tibiae longer than the anterior or hind ones; middle basitarsi longer than the anterior or median ones; tibiae with sparse and very short dull white hair; hind spurs pale reddish-yellow; pulvilli somewhat developed. – *Metasoma*: Shining; T1 strongly punctured, densely at sides, subapical area very narrowly, finely and densely punctured; T2 strongly punctured, somewhat sparsely in the middle and densely punctured at sides, subapical area and apical margin (except the sides) finely punctured; T6 broad, the apical margin rounded and reddish-brown (broadly in the middle), with a weak longitudinal carina not reaching the base or the apex of tergite; T7 short and broad, transverse, dull reddish-brown, the

apical margin entire and very slightly concave in the middle, disc with a weak longitudinal carina in the middle; T1 with pale hair denser at sides; sternites reddish-brown; S4 with median V-shaped emargination, S5 with deep median emargination. Stipes broadly and deeply emarginate at the middle above and with pale silky hair; penis valve enclosing the spatha; gonoforceps very slightly surpassing level of the penis valve.

Biology: Found on the wing in August (Mavromoustakis 1954).

Distribution: China (Fujian = Fukien province). Found at 1800 m altitude (Mavromoustakis 1954).

Distribution of *Trachusa xylocopiformis*. Within China, the species is only known to occur in Fujin province.

Subgenus *Trachusa* Panzer, 1804

Trachusa byssina (Panzer, 1798)

Anthidium byssinum Panzer, 1798. Faun. Insect. German, 56: 21.
Trachusa serratulae Panzer, 1804 (1805?) (Faun. Insect. German 86: 15).
Trachusa byssina (Panzer, 1798).
Apis byssina Panzer, 1798.
Diphysis pyrenaica Lepeletier, 1841 (Hist. Nat. Inst. Hum. 2: 308).
Megachile resinana Schilling, 1849 (Arb. schles. Ges. vaterl. Kultur 1848: 101).
Megachile rotundiventris Perris, 1852 (Ann. Soc. Linn. Lyon 1: 195)
Megachileoides serratulae (Panzer, 1804)
Megachiloides serratulae (Panzer, 1804), incorrect subsequent spelling
Osmia bluethgeni Maidl, 1922 (Ann. Nat. Mus. Wien 35: 95)
Trachusa byssina var. *seitzi* Cockerell, 1925 [see e.g. Tkalců 1974].
Megachile kychtacensis Cockerell, 1928 (Ann. Mag. Nat. Hist. 10) [cf. van der Van der Zanden 1995, Rasmont et al. 1995].
Trachusa bussina Panzer, 1898.– mis-spelled, see Proshchalykin (2013).

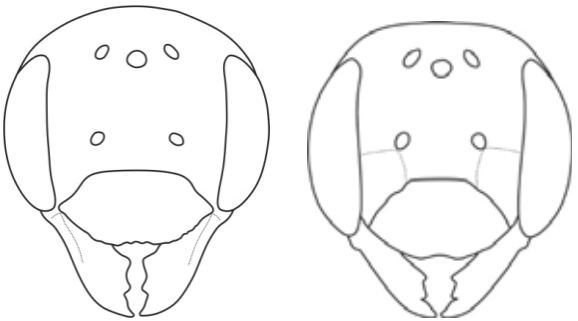
The species is still frequently assigned to *Anthidium*; it is sometimes also wrongly named *Trachusa byssinum* (e.g. in Fauna Europaea).

Trachusa byssina. Left female, right male (both from Ukraine, SIZK). – Photographs: MK.

Although *Trachusa byssina* is the nominate species of the genus, it is not a very typical member and differs from all other congeners in a number of features. Therefore it has been assigned to a subgenus (*Trachusa* s. str.) whose only representative it is. *T. byssina* is not easily recognisable as a member of the Anthidiini tribe. At first sight, it resembles *Megachile* or *Osmia ,* e.g. *Osmia aurulenta*, and was in the past put into these genera. It is not rare, has probably the widest distribution of all the species in the genus, and occurs in different climatic zones.

Female: 9-12 mm. Light markings entirely absent, also face completely black. Dense pubescence, grey to ochreous on head, sides of thorax and abdomen, but reddish-brown

Trachusa byssina, head in frontal view. Left female, right male. Note the different shape of mandibles and the yellow colouration of mandibles, clypeus and lower paraocular areas. – Photographs: Female from Germany (SMF), male fromUkraine (SIZK). – Photographs: MK.



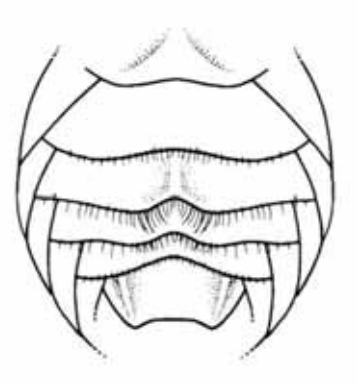
Trachusa byssina, left: female, right: male.– *Source*: Scheuchl (2006).

on scutum. – *Head*: Width of clypeus 1.6 times its length; clypeus with coarse puncturation and a shining longitudinal impunctate (or almost impunctate) midline; apical margin of clypeus finely crenulated and slightly emarginate. Mandibles black, teeth dark horn-coloured brown, tridentate; one apical large tooth and two broad, plain and blunt smaller teeth. Puncturation of vertex and gena finer than on face and clypeus. – *Mesosoma*: Dark with reddish brown pubescence. Scutellum rounded with very small emargination in the middle. – *Metasoma*: Tergites dark brown, apical end lighter reddish-brown. Tibia 2 and 3 with short, dense almost white pubescence. Ventral scopa light yellow or white.

Male: 9-12 mm. Similar to female, but face laterally (paraocular area up to antennal sockets), clypeus and mandibles yellow or yellowish. Apical margin of clypeus crenulated and translucent; mandibles narrower than in female, with three dark teeth,

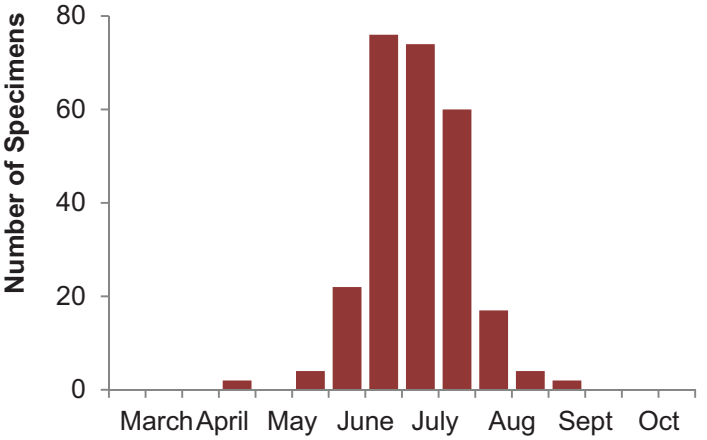
Trachusa byssina, female. Head in dorsal view (Germany, SMF). – Photograph: MK.

Trachusa byssina, male. Left apical tergites, right hind leg (Germany, SMF). – Photograph: MK.



Trachusa byssina. Ventral side of male metasoma. – Photograph: specimen from Ukraine in SIZK (MK); drawing: From Scheuchl (2006).

which are more acute than in female. Puncturation of head as in female. – *Mesosoma*: As in female, pronotal lobe without lamella. – *Metasoma*: Tergites dark brown to black, brightened towards the apical margin; puncturation in marginal zones denser than on disc; marginal zone with denser pubescence; tergum T6 with a sharp, lamellate margin;



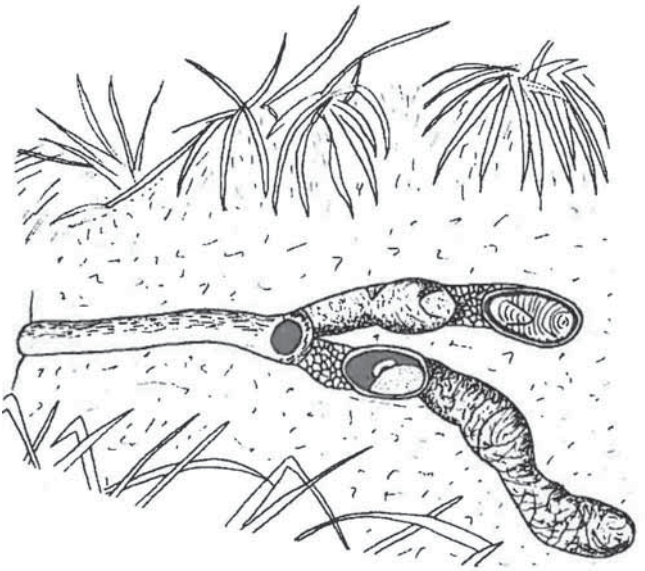
Seasonal occurrence of adult *Trachusa byssina* in Germany. – After data in www.wildbienen-kataster.de.

in lateral view of triangular shape. T7 small and often hidden under T6, with a slight emargination at apical end; sternite S2 with an elevation with a longitudinal furrow; S3 with deep median notch, S4-S5 emarginated in the middle; S6 almost rectangular with strong sides and an apical emargination.

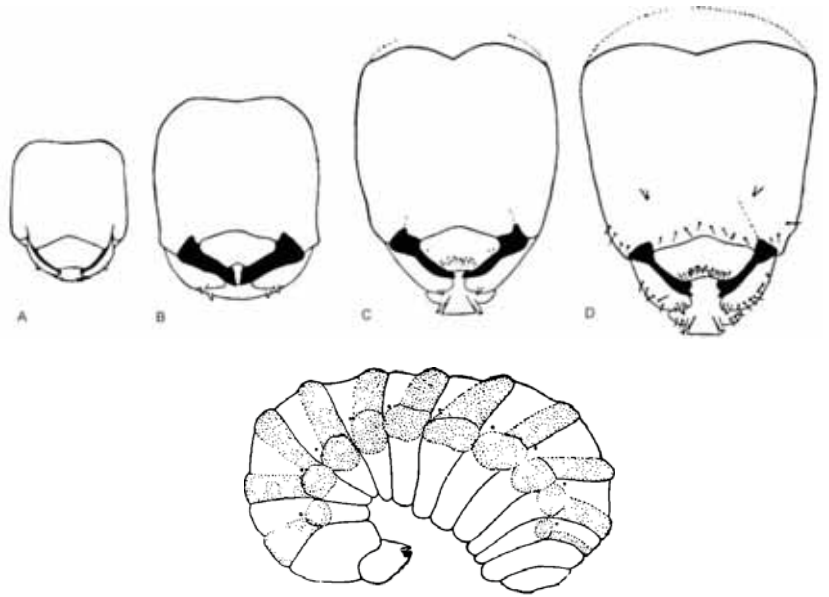
Wolf (1992) described a hermaphrodite individual with a mosaic of male and female characters. – Pasteels (1969) and Warncke (1980) mention the occurrence of five-segmented maxillary palpi in *T. byssina*. However, the actual number is four (Griswold & Michener 1988, Müller 1996, own observation).

Biology: Compared to other *Trachusa* species, the biology of *T. byssina* is relatively well studied. Seasonal occurrence in Central and south-eastern and eastern Europe from May to September with a peak in June and July (Amiet et al. 2004, Banaszak & Romasenko 2001, Stöckl 2000, Adolph 1934, Ban-Calefariu 2008, 2009, Jorgensen 1921, material in various collections). In Ukraine June to July (SIZK), in Turkey July and August (Özbek & van der Zanden 1993). Males appear a few days prior to females (Westrich 1989).

Habitat dry, often sandy locations such as sand pits, sand dunes, sandy dirt roads, heathlands and dry grasslands. Nests located in sand or sandy soil and constructed by the females, often in larger colonies, often close to pine trees (esp. *Pinus sylvestris*), whose resin is used for nest construction. Up to a few hundred nests can be found on a few square metres (Bellmann 1981, 2005). Nests usually 10-15 cm long, linear-branched, situated dose to one another in soil at depths of 12–15 cm, forming small aggregations of 10 to 50 nests. They usually consist of one main and two lateral passages. Cells located in lateral passages, constructed from long leaf ribbons and resin (e.g. of *Pinus sylvestris*, Stöckl 1998), lining the cell inside. The cell linings are constructed from pine resin, and do not appear to contain any exocrine secretions (Cane 1981). One nest usually consists of 1 to 4 cells (Banaszak & Romasenko 2001), which are constructed of leaf particles



Trachusa byssina. Nest in soil. – *Source*: Banaszak & Romasenko (2001).



Trachusa byssina. Head of instar larvae I to IV (above) and instar larva IV of *Trachusa byssina.* – *Source*: Hachfeld (1926).

(mostly rolls of longish stripes of leaves, up to 20 mm long and 2-3 mm wide) and resin. Bellmann (2005) observed that adults sometimes steal construction material from neighbouring nests. After hatching from the egg, the larva undergoes four larval instars before moulting into the pupal stage. A detailed description of larval development and reproduction biology is given by Friese (1923), Hachfeld (1926) and others. The species overwinters as prepupa, and the development to pupa occurs in spring.

An oligolectic species, specialised to some degree on Fabaceae (*Medicago*, *Trifolium*, *Lotus*), preferring *Lotus corniculatus* (Schmiedeknecht 1907, Banaszak & Romaseno 2001, Amiet et al. 2004, Westrich 1989). Also found on *Echium vulgare* (Balles 1927, Dylewska & Bąk 2005), *Stachys recta* (Westrich 1983), *Stachys* sp. (Dylewska & Bąk 2005), *Arctium lappa* (Asteraceae) (Adolph 1934), *Onobrychis viciifolia*, *Ononis repens*, *Lathyrus heterophyllus, L. sylvestris, L. tuberosus, Medicago sativa,* and *Coronilla varia* (Westrich 1989). Erfving (1968) lists for Finland *Anthriscus silvestris, Calluna vulgaris, Crepis paludosa, Erigeron* cf. *speciosus*, *Hieracium pilosella*, *Lathyrus pratensis*, *Thymus serpyllum*, *Trifolium*, *Veronica spicata*, and *Vicia cracca*. Jorgensen (1921) lists for Denmark *Lotus corniculatus*, *Ononis spinosa*, *Lathyrus silvestris* and *Thymus serpyllum*. Warncke (1981) lists for Austria *Genista*, *Lathyrus*, *Lotus*, *Medicago*, *Ononis*, and *Vicia*. Müller (1996) found in pollen grain counts of female scopal contents that Leguminosae are with 96.3 percent by far the most preferred flowers (mainly Loteae).

Coelioxys quadridentata (Westrich 1983, 1989; Banaszak & Romaseko 2001), *Aglaoapis tridentata* (Scheuchl & Willner 2016) and probably also *Coelioxys conica* (Amiet et al. 2004) are cleptoparasites of *Trachusa byssina*.

Distribution: Widely distributed. Europe from the Mediterranean region up to 64° North, in the east to East Siberia, the Russian Far East and Mongolia. Absent from Great Britain (Falk 2015). Occurs in Switzerland up to 2300 m (Beaumont 1958) and is abundant in medium altitudes. In Turkey found up to 1600 m (Özbek & van der Zanden 1993) and in Albania at 1400-1500 m (Tkalců 1974).

Distribution of *Trachusa byssina*. The distribution extends in the east to Mongolia (not shown on the map). Note that the species is absent from Great Britain.

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Annex: Material

The following sources were used for the preparation of the species descriptions.

Subgenus *Archianthidium* Mavromoustakis, 1939

Trachusa baluchistanica (Mavromoustakis, 1939): Original description by Mavromoustakis (1939). Female type and male allotype in coll. Mav.

Trachusa fasciatellum (Friese, 1917): Original description by Friese (1917), holotype in ZMB and material in coll. MK (12), coll. Mav. (2 specimens, including *A. laticeps anatolicum*), coll. Schwarz (5) and OLL (1).

Trachusa forcipata (Morawitz, 1875): Original description by Morawitz (1875). Holotype of *Anthidium edentatum* loaned from Museum für Naturkunde (ZMB). 3D photoghraph also available under http://eos.naturkundemuseum-berlin.de/search). Three spec. (1♀, 2♂) coll. Schwarz, 1 spec. coll. Mav.

Trachusa laeviventris (Dours, 1873): Descriptions by Dours (1873), Benoist (1934), and Mavromoustakis (1939); examination of 10 spec. loaned from OLL and coll. Schwarz.

Trachusa laticeps (Morawitz, 1873): Based on literature and examination of 57 specimens loaned from DEI (3), OLL (35), SMF (4), coll. Mav. (1) and coll. Schwarz (15).

Trachusa pubescens (Morawitz, 1873): Based on literature and examination of 175 specimens loaned from DEI (2), OLL (49), SEMC (4), SIZK (6), SMF (11), coll. MK (12), coll. Mav. (19) and coll. Schwarz (72).

Subgenus *Congotrachusa* Pasteels, 1969

Trachusa schoutedeni (Vachal, 1910): Original description by Vachal (1910), re-description by Pasteels (1969), and photographs of the type and paratype (both sexes) kindly prepared for the purpose of this study by RMCA.

Subgenus *Massanthidium* Pasteels, 1969

Trachusa flavorufula Pasteels, 1969: Original description of Pasteels (1969) and photographs of the holotype kindly taken for the purpose of this study by RMCA.

Trachusa (Massanthidium) eburneomaculata Pasteels, 1984: Original description by Pasteels (1984) and various photographs of a female paratype and another female deposited in the RMCA, and of a paratype deposited in the SEMC.

Trachusa massauahensis Pasteels, 1984: Original description by Pasteels (1984) and examination of the holotype (loan from HNHM).

Subgenus *Metatrachusa* Pasteels, 1969

Trachusa orientalis Pasteels, 1972: Original description (Pasteels 1972) and photographs taken for the purpose of this study by NHMUK (D. Notton).

Trachusa pendleburyi (Cockerell, 1927): Descriptions by Cockerell (1927), Mavromoustakis (1953) and Pasteels (1972). Photographs taken for the purpose of this study by NHMUK (D. Notton).

Subgenus *Orthanthidium* Mavromoustakis, 1953

Trachusa cornopes Wu, 2004: Description by Wu (2004), photographs of male holotype and female paratype in IZCAS kindly taken for the purpose of this study by Feng Yuan.

Trachusa formosana (Friese, 1917): Original description (Friese, 1917), and Mavromoustakis (1953), Pasteels (1972), and Wu (2006). 3D photographs of holotype in Museum für Naturkunde Berlin (ZMB) www.zoosphere.net/sequence/ 71/Anthidium/formosanum. Female loaned from DIE (Hueisuen, Experimental Forest [600 m] 24°07'N 121°03E, Taiwan (ROC), 27.6.2000 [leg. Andreas Dubitzky]).

Subgenus *Paraanthidium* Friese, 1898

Trachusa aquiphila (Strand, 1912): Original description of the female by Strand (1912) and the male by Mavromoustakis (1945), redescription of the species by Pasteels (1984). Genitalia in Combey (2008). Holotype (female) loaned from ZMB. 3D photographs available at www.zoosphere.net/sequence/77/Anthidium/aquiphilium. Male allotype examined in coll. Mav. Male loaned from AMG.

Trachusa dumerlei (Warncke, 1980): Description by Warncke (1980); 39 specimens examined in OLL (13) (loan material) and coll. MK (26).

Trachusa interrupta (Fabricius, 1781): Various literature and altogether 347 specimens loaned from DEI (12), OLL (208), SIZK (73), SMF (8), and coll. Schwarz (46), and 45 specimens in coll. MK. One specimen of *Anthidium foliivolutor* examined in coll. Mav.

Trachusa heinzi Dubitzky, 2007: Description by Dubitzky (2007) and 24 specimens, including the type material, loaned from OLL and col. Schwarz.

Trachusa longicornis (Friese, 1902): Original description, examination of material in SMF (two males) and OLL (two females, one male).

Trachusa maai (Mavromoustakis, 1953): Description of female by Mavromoustakis (1953) and male by Mavromoustakis (1954). Re-description by Pasteels (1972). Female holotype and male allotype examined in coll. Mav.

Trachusa muiri Mavromoustakis, 1937: Description of female by Mavromoustakis (1937) and male by Mavromouistakis (1954). Female holotype and male allotype examined in coll. Mav.

Trachusa ovata (Cameron, 1902): Original description of female by Cameron (1902), description of male by Mavromoustakis (1936). Redescription of female by Pasteels (1972). Photographs of female in NHMUK kindly taken for the purpose of this study by D. Notton. Another female examined in coll. Mav. Two females loaned from SEMC.

Trachusa rufobalteata (Cameron, 1902): Species account based on the description of Cameron (1902). Photographs of a male paratype deposited in the NHMUK. Cameron (1902) described both sexes with the female being the type specimen. A redescription has been provided by Pasteels (1972); he says that his description refers to the male, but actually includes female characters (scopa). He also says that the holotype is from Sikkim, India, while it had been described by Cameron (1902) from Malaysia. Some aspects of this redescription therefore needs confirmation, and it has been ignored here.

Trachusa xylocopiformis (Mavromoustakis, 1954): Original description by Mavromoustakis (1954). Male holotype examined in coll. Mav.

Subgenus *Trachusa* s. str. Panzer, 1804

Trachusa byssina (Panzer, 1798): Various descriptions and examination of >100 specimens in various collections.

Bees belonging to the genus *Trachusa* are relatively large, robust species. Females are important pollinators which have a specialised pollen-carrying structure on the underside of the abdomen. *Trachusa* bees are solitary although usually construct their nests in aggregations. For those species whose breeding biology is known, nest cells are made from resin and pieces of green leaves. *Trachusa* has a world-wide distribution. This publication is the first comprehensive overview and guide to the 25 species found in Europe, Africa and Asia. It provides descriptions of all species and gives separate identification keys to females and males. All species are illustrated, with altogether 205 colour micro photographs and over 50 line drawings showing morphological details. The species accounts are further supported by distribution maps and graphs depicting seasonal occurrences. This publication hereby summarises our knowledge and attempts to stimulate further research in the taxonomy, biology and ecology of this still little-known group of insects.