



The bee subtribe Epanthidiina, a new taxon for the Neotropical clade of Anthidiini (Hymenoptera, Apidae, Megachilinae)

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ABSTRACT

Anthidiini comprise a large, diversified, and widely distributed tribe of megachiline bees. Recently, morphological and molecular analyses recovered five major monophyletic groups within the tribe. For this reason, we review the current classification of the tribe, giving status of subtribe to these lineages. A new subtribe, Epanthidiina (type genus: *Epanthidium* Moure), is proposed for a large group restricted to the Neotropical region. Morphological and molecular phylogenetic hypotheses support the taxonomic limits of the new subtribe. We also propose a new genus, *Urbanthidium* (type species: *Anthodioctes gracilis* Urban), in order to accommodate results from a previous study in which *Anthodioctes* Holmberg came out paraphyletic. Two species are transferred to the new genus: *Urbanthidium gracile* (Urban) **comb. n.**, *Urbanthidium psauenythioides* (Holmberg) **comb. n.**

Introduction

The Anthidiini is a remarkable tribe among megachiline bees for having a great diversity of species, being widely distributed and exhibiting unique nesting behavior. The material used for construction of the nests, the mandibular dentition of females associated with this behavior and the diversity of morphological structures of sterna and genitalia of males are historically used for taxa recognition (Fabre, 1891; Pasteels, 1977; Michener, 2007). Recently, Litman et al. (2016) provide a relationship hypothesis for the tribe, based in a combined molecular-morphological dataset, in which five major suprageneric clades are recovered, named by them as the *Trachusa*, *Anthidium*, *Anthodioctes*, *Dianthidium* and *Stelis* groups. Additionally, a morphological hypothesis of phylogenetic relationships conducted by Parizotto et al. (2021) shows that a large group occurring in the Neotropical region (corresponding to the *Anthodioctes* group of Litman et al., 2016) constitute a monophyletic clade with strong support.

Based on these phylogenetic results, the purpose of this work is to recognize a subtribal classification system for the Anthidiini based

in the larger clades recovered in previous studies. All the main clades indicated by Litman et al. (2016) have already available family-group names that can be adopted form them, except for their *Anthodioctes* group. Herein, we provide the formal description of the new subtribe Epanthidiina. We also describe a new genus, *Urbanthidium* gen. nov. to accommodate *Urbanthidium gracile* (Urban, 1999) **comb. nov.** and *Urbanthidium psauenythioides* (Holmberg, 1903) **comb. nov.**, showed as paraphyletic in the morphological analysis (Parizotto et al., 2021). A work with a complete system of classification is ongoing, including a key to subtribes of the Anthidiini.

Material and methods

Most of the studied material is deposited in the Coleção Entomológica Pe. Jesus Santiago Moure, Departamento de Zoologia, Universidade Federal do Paraná, Curitiba, Brazil (DZUP). Illustrated specimens of *Anthodioctes psauenythioides* are from the American Museum of Natural History (AMNH). The terminology follows Urban (1967) and Michener (2007), except for the mandible that follows Michener and

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Fraser (1978). The abbreviations T and S are used for metasomal terga and sterna, respectively. The color images were taken with a LEICA DFC295 digital camera attached to the stereoscopic microscope LEICA M125, and finished in the software Zerene Stacker.

Results

Tribe Anthidiini Ashmead, 1899

Anthidiine bees are easily distinguished from other Megachilinae by having mostly conspicuous white, yellow or red integumental markings on various tagma and scarce pubescence. Additionally, the members of the tribe can also be recognized by the shape of the female mandible, usually wider apically, with three or more teeth (except bidentate mandible is some species); anterior portion of mesepisternum well-marked, and clearly separated from the lateral portion by a sharp angle or crest (omaulus); a small pterostigma, less than twice as long as broad; second recurrent vein placed usually distal or posterior to the second submarginal crossvein; apical margin of the malus and velum contoured by hairs and, tarsal claw of the female being cleft or with an inner tooth (except in *Trachusoides* Michener and Griswold).

The main lineages recovered in the study of Litman et al. (2016), and recognized by them as groups, are here accommodated in a subtribal classification system. The proposed classification is listed below and a more complete treatment of this classification system, with subtribal synopsis, diagnosis, and identification key will be presented in a forthcoming contribution.

1. Anthidiina Ashmead, 1899 (Type genus: *Anthidium* Fabricius, 1804) for the *Anthidium* group;
2. Dianthidiina Moure, 1947 (Type genus: *Dianthidium* Cockerell, 1900) for the *Dianthidium* group;
3. Epanthidiina subtrib. nov. (Type genus: *Epanthidium* Moure, 1947) for the *Anthodioctes* group;
4. Stelidina Schenck, 1860 (Type genus: *Stelis* Panzer, 1806) for the *Stelis* group;
5. Trachusina Robertson, 1904 (Type genus: *Trachusa* Panzer, 1804) for the *Trachusa* group.

Epanthidiina subtrib. nov.

urn:lsid:zoobank.org:act:D4CF9618-547D-408C-838F-CA3D9CB4E93A
Type genus: *Epanthidium* Moure, 1947

Diagnosis and Comments. It corresponds to the clade referred as “*Anthodioctes* group” by Litman et al. (2016). The phylogenetic relationships among the genera included here in Epanthidiina were recently investigated by Parizotto et al. (2021). The results demonstrated that this subtribe constitute a monophyletic group that can be recognized by the following features: internal margin of the antennal socket projected; a carina on the inner surface of the scape; and a reduction on the ventral region of the gonocoxite of the male.

Additionally, the taxa usually have a juxtantennal carina (except in *Tylanthidium* Urban, *Hypanthidium* Cockerell, *Allanthidium* Moure, *Anthidianum* Michener, *Chrisanthidium* Urban and *Notanthidium* Isensee) and the absence of dorsal region of gonobase (also absent in members of other subtribes, as *Loyolanthidium* Urban and some *Anthidium* Fabricius). A complete list of the genera included in the subtribe Epanthidiina is presented in Table 1.

Table 1

Genera of Anthidiini included in the Epanthidiina subtrib. nov. Clades according to the phylogenetic results of Parizotto et al. (2021).

Clade A	<i>Allanthidium</i> Moure, 1947 <i>Ananthidium</i> Urban, 1992 <i>Anthidianum</i> Michener, 1948 <i>Chrisanthidium</i> Urban, 1997 <i>Notanthidium</i> Isensee, 1927
Clade B	<i>Aztecanthidium</i> Michener & Ordway, 1964 <i>Carloticola</i> Moure & Urban, 1991 <i>Duckeanthidium</i> Moure & Hurd, 1960 <i>Epanthidium</i> Moure, 1947 <i>Grafanthidium</i> Urban, 1995 <i>Ketianthidium</i> Urban, 2000
Clade C	<i>Anthodioctes</i> Holmberg, 1903 <i>Bothranthidium</i> Moure, 1947 <i>Urbanthidium</i> gen. nov. <i>Nananthidium</i> Moure, 1947
Clade D	<i>Saranthidium</i> Moure & Hurd, 1960 <i>Hypanthidium</i> Cockerell, 1904 <i>Tylanthidium</i> Urban, 1995
Clade E	<i>Austrostelis</i> Michener & Griswold, 1994 <i>Hoplostelis</i> Dominique, 1898 <i>Melostelis</i> Urban, 2011 <i>Rhynostelis</i> Moure & Urban, 1995
Clade F	<i>Anthidulum</i> Michener, 1948 <i>Ctenanthidium</i> Urban, 1993 <i>Dichanthidium</i> Moure, 1947 <i>Dicranthidium</i> Moure & Urban, 1975 <i>Hypanthidioides</i> Moure, 1947 <i>Larocanthidium</i> Urban, 1997 <i>Michanthidium</i> Urban, 1995 <i>Mielkeanthidium</i> Urban, 1996 <i>Moureanthidium</i> Urban, 1995

Description. Sculpture of integument coarse, diameter of punctures more than twice the diameter of the setae arising from them; mandible with three or four teeth; maxillary palpi with two or three articles; juxtantennal carina usually present; paraocular carina present; internal margin of the antennal socket projected; inner surface of scape concave, with a longitudinal carina; first flagellomere of female short, equal to or shorter than length of second flagellomere; small postocellar area (distance between the posterior ocelli and the preoccipital margin is smaller than the distance between the posterior ocelli and compound eyes); pronotal lobe with carina or lamella; basal area of the propodeum usually with foveae (exceptions are *Aztecanthidium* Michener & Ordway and *Notanthidium*); fovea of the propodeal spiracle usually delimited by a carina (except in *Aztecanthidium*); S8 of male elongated, triangle-shaped; male genitalia with gonobase incomplete dorsally and gonocoxite narrow ventrally.

Urbanthidium gen. nov.

urn:lsid:zoobank.org:act:BE0A9B8D-175B-47AE-A7D2-A7BF8D8AA3A8
Type species: *Anthodioctes gracilis* Urban, 1999

Diagnosis and comments. *Urbanthidium* gen. nov. can be recognized for the mandible with a concave basal area on the external surface, followed apically by a hump in females; a distinctly broad gena, lacking a crest along the outer orbit, and with shallower punctures than remainder of head; basal area of metapostnotum with foveae more weakly differentiated medially; and elongated metasoma. The new genus is most closely related to *Anthodioctes* Holmberg, *Bothranthidium* Moure and *Nananthidium* Moure sharing with them a coarse punctation and presence of carina along the inner orbits, in the preoccipital area and

pronotal lobe. These genera also have a transverse carina along the transition between the anterior and the posterior surfaces of the T1. *Urbanthidium* gen. nov. resembles *Bothranthidium* and *Nananthidium* in its more elongated metasoma. The metasoma of *Anthodiocetes* is

distinct, especially in males whose sterna and apical segments are shorter than in *Urbanthidium* gen. nov. The gena of the new genus is distinctly broad, being about as wide as the width of the compound eye, in lateral view, in females, and slightly narrower than compound eye



Figure 1 Species of *Urbanthidium* gen. nov. A-C, *Urbanthidium gracile*. A. Female, habitus in lateral view. B. Female head, in frontal view. C. Male head (holotype), in frontal view. D-F, *Urbanthidium psauenyithioides*. D. Female, habitus in lateral view. E. Female head, in frontal view. F. Male head, in frontal view. A and D, and B, C, E and F, respectively at same scale.

in males. Additionally, the gena has a shallower punctation compared to that on the remainder of the head and it lacks a crest along the outer orbit. In *Anthodiocetes*, *Bothranthidium* and *Nananthidium* the scutoscuteellar sulcus is broad and deep, with the disc of the axilla and scutellum convex, while in *Urbanthidium* gen. nov. the sulcus is narrow and the disc of the axilla and scutellum mostly flat. The new genus also differs from these three genera by its less differentiated fovea on the basal area of the metapostnotum. In these three other genera the basal area has well-delimited foveae, marked posteriorly by a sharp edge with the remaining portion of the metapostnotum.

Description. Integumental surface predominantly densely punctate, punctures mostly coalescent. Head and mesosoma densely punctate, with punctures distinctly shallower and larger in the gena. Terga with shallower and smaller punctures than mesosoma. Supraclypeal area with juxtantennal carina; clypeus short, with apical tubercles; mandible large with strong and protuberant acetabular carina and with a concave basal area; apical margin with four teeth; apical tooth longer than following, the second tooth near the first, the third and fourth smaller, and equidistant. Occipital carina long, from the vertex to the hypostomal carina. Gena as large as the width of compound eyes in female and little narrower in the male. Pronotal lobe with short carina; narrow scutoscuteellar suture; disc of axilla and scutellum relatively flat; scutellum with carina on the apical margin and projected over the metanotum. Omaulus carinated, extending onto ventral area of mesosoma; ventral region of mesepisternum, coxa, trochanter and base of femur with curved hairs; basal area of metapostnotum with weak foveae, slightly more pronounced laterally; propodeal spiracle with fovea delimited posteriorly by a carina; arolia present in both sexes. Transverse carina present on T1; scopae with simple hairs; S2-S6 of male long, 2.5x wider than long and with dense pilosity. Genitalia of male with short inconspicuous hairs.

Included species. The new genus is proposed for two species previously described in *Anthodiocetes*: *Urbanthidium gracile* (Urban, 1999) comb. nov. (Figs 1A-C), *Urbanthidium psauenythioides* (Holmberg, 1903) comb. nov. (Figs 1D-F). Females and males of these two species are illustrated in Figure 1.

Distribution. The new genus is restricted to southern South America, occurring in Argentina, Paraguay, and southern Brazil.

Etymology. The genus is named in honor of Prof. Danuncia Urban, in recognition of her contributions for the systematics of bees, in particular of the fauna of Anthidiini from the Neotropical region.

Concluding Remarks

The suprageneric classification of Megachilinae, including the recognition and description of new taxa, has been reviewed in recent studies, supported by phylogenetic hypotheses (Praz et al., 2008; Litman et al., 2011; Gonzalez et al., 2012, 2019). Some of these works investigated the relationships at tribal level and demonstrated the paraphyly of some lineages, such as the fideliine bees (Litman et al., 2011), the Osmiini (Praz et al., 2008) and the Anthidiini (Gonzalez et al., 2019).

Among the representatives of Anthidiini, the phylogenetic studies (Litman et al., 2016; Parizotto et al., 2021) recovered the monophyly of five main groups. These groups are here recognized as subtribes: Anthidiina, Dianthidiina, Epanthidiina subtrib. nov., Stelidina, and Trachusina. We believe that a classification giving status of subtribes to the major groups within Anthidiini will facilitate changing from a system which recognizes large genera, many of them with multiple subgenera, to one in which the subgenera are raised to genus level. Under this new system, the sense of unity brought by the previously large genera is maintained by reference to the subtribe to which they belong. This classificatory approach is already in use for the Epanthidiina (see

Urban & Moure 2007) and has been corroborated by the phylogenetic analyses published in Parizotto et al. (2021).

Epanthidiina correspond to a large group of taxa restricted to the Neotropical region, composed by 31 genera (Table 1), whose monophyly has been previously demonstrated by molecular and morphological data (Litman et al. 2011; Parizotto et al., 2021). The diversity and taxonomy of Epanthidiina is relatively well known, with many taxa described and revised. However, the fauna from some areas, as well as biological and evolutionary aspects of their representatives, still need to be further investigated in future studies.

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Conflicts of interest

The authors declare no conflicts of interest.

Author contribution statement

DRP Formal analysis (Equal), Investigation (Equal), Methodology (Equal), Resources (Lead), Writing – original draft (Lead), Writing – review & editing (Equal). GARM Conceptualization (Lead), Formal analysis (Equal), Investigation (Supporting), Methodology (Equal), Resources (Equal), Writing – original draft (Supporting), Writing – review & editing (Equal).

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