

RESEARCH PAPER

Leiodidae (Coleoptera) of the Hainan Island with new faunistic records from China and with notes on the unique body modifications in the genus *Agathidium*

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Abstract. *Agathidium (Agathidium) pilulum* sp. nov., *Agathidium (Macroceble) cornigerum* sp. nov., *Agathidium (Macroceble) apiforme* sp. nov., and *Dermatohomoeus pennatus* sp. nov. from Hainan Island (China) are described and distinguished from other similar species. A key for identification of the Leiodidae subfamilies, tribes, genera and species occurring in Hainan is provided. Unique morphological modifications of the legs and the male genitalia in *Agathidium* Panzer, 1797 from Hainan are illustrated and discussed. New faunistic records of the genus *Agathidium* from the mainland China are also presented: *Agathidium (Agathidium) formosum* Angelini & De Marzo, 1984 from Jiangxi, *Agathidium (Microceble) venustum* Angelini & De Marzo, 1995 from Sichuan, *Agathidium (Agathidium) kabateki* Angelini, 2000 from Yunnan, and *Agathidium (Agathidium) puetzi* Angelini & Švec, 2000 from Gansu.

Key words. Coleoptera, Leiodidae, *Agathidium*, *Dermatohomoeus*, *Ptomaphagus*, descriptions, faunistics, key, morphology, Hainan, China

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Introduction

Hainan is the southernmost province of China consisting of Hainan Island and more than two hundred other small islands located in the South China Sea. Leiodidae fauna of Hainan province is very poorly known. Only two species of the family – *Ptomaphagus newtoni* Wang & Zhou, 2015 and *P. wuzhishanicus* Wang & Zhou, 2015 have been known to occur in Hainan Island. The genus *Ptomaphagus* Portevin, 1914 with 100 species occurring in the Palaearctic and Oriental Regions (NEWTON 2019) belongs to the subfamily Cholevinae, tribe Ptomaphagini Jeanel, 1911. Altogether sixteen species of the genus *Ptomaphagus* are known from China (WANG & ZHOU 2015). Four other leiodid species new to science belonging to the subfamily Leiodinae are described in the present paper. Three of them belong to the genus *Agathidium* Panzer, 1797, the fourth to the genus *Dermatohomoeus* Hlisenkovský, 1963.

Agathidium is by far the most numerous genus within the family Leiodidae. Taking into account the new species described in this paper, the genus currently comprises 849 species. The species inhabit the Palaearctic, Oriental, Nearctic, and Neotropical Regions; only one species is also known from the Australian Region (ANGELINI 1992, 2010).

China is extraordinary rich in the number of *Agathidium* species. Altogether 237 species are known from the country including the three new species described below (ANGELINI 2010; Švec, personal database).

Six out of seven known subgenera of the genus – *Agathidium* s. str.; *Cyphocele* C. G. Thomson, 1859; *Eurycele* Hlisenkovský, 1964; *Macroceble* Angelini, 1993; *Microceble* Angelini & De Marzo, 1986 and *Neocele* Des Gozis, 1886 have been recorded from China (ANGELINI 2010). The three species described in this paper belong to two subgenera – *Agathidium* s. str. and *Macroceble*.

The taxonomy of the tribe Agathidiini, especially of the genus *Agathidium*, is far from settled. While the authors dealing with the Old World *Agathidium* (e.g. ANGELINI 2004, HOSHINA 2009, PERREAU 2015, ŠVEC 2011) accept the present subgeneric classification, some American authors (e.g. WHEELER & MILLER 2005 and MILLER & WHEELER 2005) did not attribute American *Agathidium* species to the subgeneric rank but classified them into informal species groups that are not compatible with the valid subgenera.

The genus *Dermatohomoeus* is known from the Palaearctic, Oriental, Afrotropical, and Australian Regions; it comprises 47 species including the new species described



in the present paper. In China, the genus is represented by 7 species including the new one described below (Švec, pers. database).

Material and methods

This paper is based on the leiodid material collected recently in Hainan Island and in some other Chinese provinces. *Agathidium pilulum* sp. nov., *A. cornigerum* sp. nov., and *Dermatohomoeus pennatus* sp. nov. were obtained by sifting in the altitude 650–900 m in a mountain locality approximately in the central part of the island, while *A. apiforme* sp. nov. was collected in the altitude 1050 m in the South West of Hainan.

Abbreviations of the collections:

CNCO	Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, Canada;
NMPC	National Museum, Prague, Czech Republic;
SMTD	Senckenberg Museum of Natural History, Dresden, Germany;
ZSPC	Zdeněk Švec private collection, Prague, Czech Republic.

The examined material was compared with the type and non-type material of *Agathidium* and *Dermatohomoeus* deposited in ZSPC and in NMPC. The material mentioned in this paper is deposited in the collections of CNCO, NMPC, SMTD, and in ZSPC.

Collecting data cited in quotation marks are taken from the locality labels accompanying the examined specimens. The individual lines from the original locality labels are separated by a slash (/); the individual labels are separated by a double slash (//) in this work. Each holotype or paratype is indicated by a red label bearing the status of the specimen (holotypus or paratypus respectively), name of the species, the name of the author, year 2021, and attached to the same pin as the relevant specimen.

The male genitalia were glued by Arabic gum on the same label as the relevant type; the female genitalia (spermatheca) and aedeagus of *Dermatohomoeus* were mounted in polyvinylpyrrolidin (LOMPE 1986) on a transparent label added to the same pin as the dissected specimen.

The micrographs included in the present paper (Figs 13–18) were prepared using environmental, low vacuum SEM. The photograph of the aedeagus (Fig. 19) was taken from the permanent polyvinylpyrrolidin mount observed in the optical microscope.

The descriptions are based on the holotypes. Variability is mentioned in the paragraph “Variation and sexual dimorphism” if necessary and includes features exhibited by paratypes. The important characters of the sexual dimorphism are also included in the mentioned paragraph. Those characters that seem to be usual in the genus, e.g. presence of short recumbent setae in dorsal punctures, micro-sculpture of venter, setosity on antennae, legs and venter are not mentioned in the diagnostic descriptions.

The measurements of the total body length were taken from all the specimens examined. Specific measurements of the individual body parts were taken from the holotypes only, except for data about their variation. The measurements of body parts were measured to the first decimal place of millimetre, measurements of genitalia were approximated to two decimal places of millimetre. The ratios

of measurements of the metaventrite were approximated to integers.

Abbreviations of body parts and measurements:

A2–A11	antennomeres 2–11;
A3/A2	ratio of the lengths or widths of the antennomeres 3 and 2, analogously ratios of other antennomeres;
L	length;
MTLC	length of metaventrite measured at the shortest distance (between mid- and hind-coxae);
MTLM	length of metaventrite measured at midline from the top of the anterior process and the top of the posterior process of metaventrite;
MTW	width of metaventrite measured between the outermost postero-lateral points;
T1–T3	tarsomeres 1–3;
W	width.

The following terminology is used throughout the manuscript:

basal part of median lobe	= a part of the median lobe between median foramen and the basal articulation of the paramera;
femoral lines	= lines located on metaventrite, usually U- or V-shaped, their two branches lead up antero-laterally (if present);
lateral lines	= lines developed on mesoventrite connecting medially with mesoventral longitudinal carina and running obliquely antero-laterally (if present);
median lobe of aedeagus	= tegmen;
operculum (in <i>Agathidium</i>)	= ventral plates (in <i>Dermatohomoeus</i>) – a lid covering ventro-apical foramen of tegmen;
procoxal rest	= flatly elevated transverse anterior part of mesoventrite;
subocular line	= line or even carina bordering eyes on ventral side (if present);
supraocular carina	= antero-lateral raised marginal bead of head (e.g. ANGELINI 2004), i.e. carina at antero-lateral margin of head running from clypeus to just above eyes (if present) caudally;
types of eye shapes in <i>Agathidium</i>	(observed in dorsal view) follow ŠVEC (2021); they are as follows:
eyes parabola slice-shaped	= symmetric or almost symmetric eyes resembling parabola slice;
eyes drop-shaped	= eyes gradually widened caudally with broadly rounded posterior margin;
eyes flattened	= eyes well developed but flattened laterally;
eyes strip-shaped	= eyes reduced to a strip;
types of aedeagus: the terminology of the aedeagal basal part	(in the genus <i>Agathidium</i>) follows ŠVEC & ANGELINI (2019).

Instead of the official country name (the People’s Republic of China) the simplified expression China is used in the present paper.

Results

Beside the shapes of the male and female genitalia, morphological characters can also be used for the determination on species level. These characters of the Hainan species described by WANG & ZHOU (2015) were used when compiling the following identification key to the Leiodidae from Hainan.

Key to the Leiodidae of Hainan Island

- 1 Antennal insertion not visible in dorsal view. Head without any occipital carina or elevated crest (Leiodinae). Anterior tibia without or at most with several feeble spines on its lateral and/or apical margin (Pseudoliodini, Agathidiini).
- 2 Antennal insertion visible in dorsal view. Head with distinct occipital strongly elevated carina or elevated

crest (Cholevinae). Anterior tibiae with closely set row of flat wide spines laterally and also with some thorns ventrally (Ptomaphagini). Pronotum transversally strigose (*Ptomaphagus* Portevin, 1914) 5

- 2(1) Tibiae oval or a little depressed dorso-ventrally, not angular in cross-section, without any longitudinal carinas (Pseudoliadini). Mesoventrite excavate between longitudinal carina and procoxal rest (*Dermatohomoeus* Hlisenkovský, 1963). Elytra densely irregularly punctured with exception of traces of two punctured double rows near suture. Ventral plates of tegmen exceed top of parameres, terminating in long butterfly wing-shaped process (Fig. 19). Body length 2.1–2.4 mm. ***D. pennatus* sp. nov.**
- At least pro- and mesotibiae angular in cross-section bearing usually two low longitudinal carinae or ribs, each equipped with row of short stiff setae all along their length (Agathidiini). Posterior pronotal angles not developed, base continues to lateral margin in fluent arc in lateral view. Beetles are capable of partial to complete conglobation (*Agathidium* Panzer, 1797). 3
- 3(2) Metaventrite strongly shortened, without femoral lines (subg. *Macrocele*). Sutural striae not developed. Dorsum without microsculpture. Lateral outline of pronotum broadly rounded in lateral view (as in Figs 5, 11). 4
- Metaventrite not shortened; with femoral lines (subg. *Agathidium* s. str.). Dorsum without microsculpture. Supraocular carina distinctly raised anteriorly near clypeus. Lateral outline of pronotum with shortly rounded angle in lateral view (Fig. 3). Sutural striae not developed. Aedeagus of type C, apex of tegmen resembles skittle pin in dorsal view (Fig. 2). Spermatheca with pear-shaped basal part and simply bowed distal thin part (Fig. 4). Body length 1.8–2.0 mm. ***A. (A.) pilulum* sp. nov.**
- 4(3) Dorsal surface unobtrusively, very feebly sparsely and finely punctured, punctures separated by 8–10 or more times their diameter. Longitudinal mesoventral carina and lateral lines not developed. Aedeagus of type A with short basal part, tegmen terminates apically with long rounded process (Fig. 7). Spermatheca slim, cylindrical, S-shaped (Fig. 8). Body length 1.6–1.9 mm. ***A. (Macr.) cornigerum* sp. nov.**
- Dorsal surface distinctly moderately densely punctured, punctures separated by about 4–6 times their diameter. Longitudinal mesoventral carina and lateral lines developed. Aedeagus of type A with elongate basal part, tegmen truncate apically with lateral plate on each side (Figs 9, 10). Body length 2.3 mm. ***A. (Macr.) apiforme* sp. nov.**
- 5(1) Pronotal strigosity denser than that on elytra. Elytral apex with bush of strong setae. Aedeagus pyriform in dorsal view. Body length 2.6 mm. ***P. wuzhishanicus* Wang & Zhou, 2015**
- Pronotal strigosity as dense as that on elytra. Elytral apex lacks bush of setae. Aedeagus oblong ovoid. Body length 2.8 mm. ***P. newtoni* Wang & Zhou, 2015**

New species descriptions

Agathidium (Agathidium) pilulum sp. nov.

(Figs 1–4, 13)

Type locality. China, Hainan Island, Limushan Mts, 19°10.5–10.9'N, 109°44–45'E, 650–900 m.

Type material. HOLOTYPE: ♂, “CHINA: Hainan isl. [MF 19]/Limushan Mts, mountains / above first admin. centre / 19°10.5–10.9'N 109°44–45'E/ 650–900 m, 6.v.2011, Fikáček // sifting small accumulations of moist leaf litter along / and on the trail in secondary / forest partly with *Cyathea* and / bamboo” (NMPC). PARATYPES: 5 ♂♂ 2 ♀♀, same data as holotype (NMPC, ZSPC).

Description. Length of body in holotype 1.9 mm, head 0.3 mm, pronotum 0.7 mm, elytra 0.9 mm, antenna 0.6 mm, aedeagus 0.74 mm. Maximum width of head 0.8 mm, pronotum 1.2 mm, elytra 1.2 mm.

Body short oval. Pronotum chestnut, elytra dark chestnut with feebly expressed reddish narrow strip along suture, head lighter than pronotum. Legs and antennae yellow-red with A9 and A10 a little darker. Ventral surface yellow-brown. Dorsum punctured, without microsculpture. Sutural striae absent; femoral lines developed, supraocular carina raised anteriorly.

Head. Maximum width of head far before posterior margin of eyes. Eyes parabola slice-shaped. Supraocular carina low posteriorly, raised anteriorly. Subocular line not developed. Clypeus straight, feebly emarginate, clypeal line lacking (Fig. 13). Antennomere 3 distinctly longer than A2 (A3/A2 = 1.5). Ratio of lengths of A2–A11 (A2 = 1.0): 1.0-1.5-0.8-0.6-0.5-0.5-0.6-1.3-1.1-2.0. Ratio of widths of A2–A11 (A2 = 1.0): 1.0-0.5-0.7-0.8-1.0-1.2-1.3-1.7-1.8-1.8. Ratio of W/L of A2–A11: 0.8-0.3-0.7-1.0-1.5-1.8-1.6-1.0-1.2-0.7. Surface of head smooth with very fine very sparse punctures separated by more than 10 times their own diameters.

Pronotum. Lateral outline with shortly rounded angle in lateral view (as in Fig. 3). Puncturation sparse and fine, similar to that on head with punctures separated by about 10 or even more times their own diameter.

Elytra widest at lateral angles, then evenly roundly narrowed posteriorly. Elytral margin straight behind lateral angles in lateral view (Fig. 3). Lateral elytral channel as narrow behind lateral angles as in basal part. Puncturation similar to that on head but punctures a little stronger, separated by about 6–10 or more times their own diameter. Sutural striae not developed.

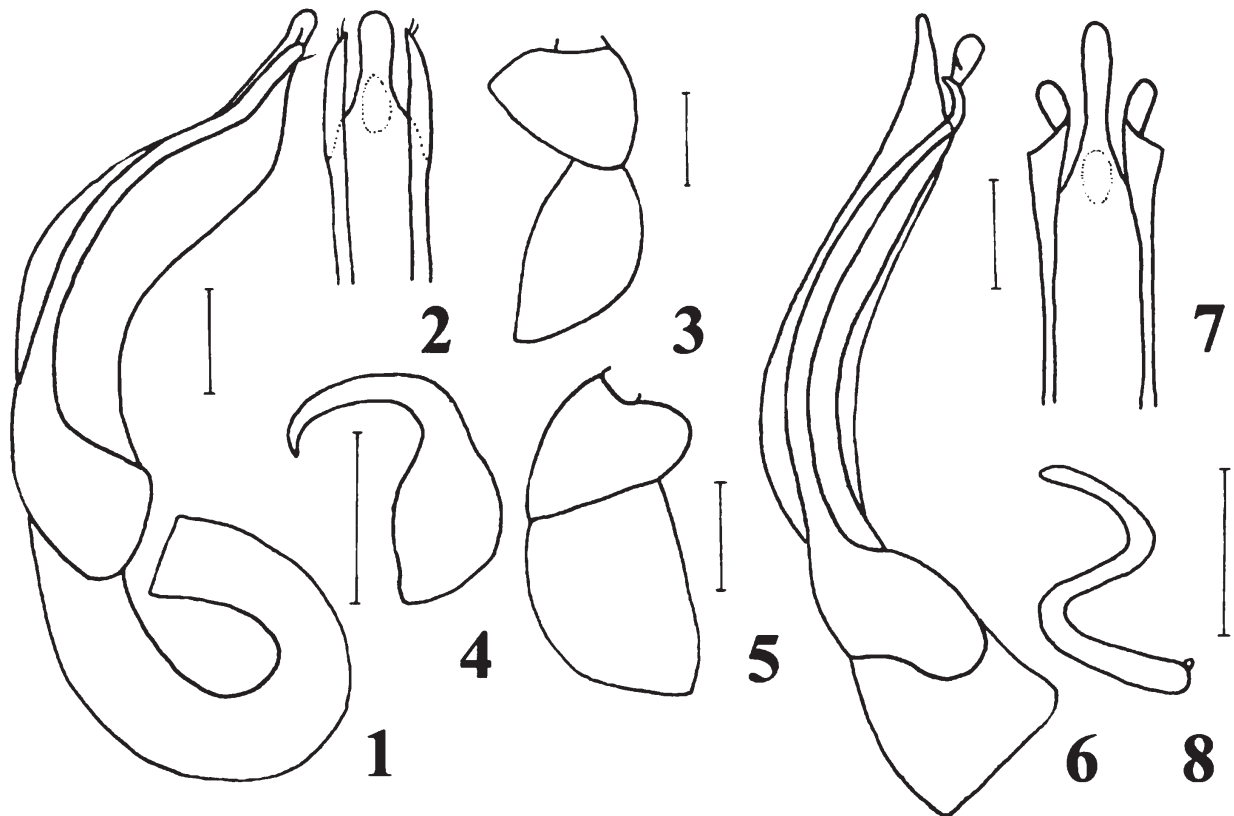
Legs. Tarsi slim, all tibiae slim, metafemora simple, without specific characters. Tarsal formula: 5-5-4 in male.

Mesoventrite. Posterior part subconcave. Anterior part raised with longitudinal carina. Lateral lines not developed.

Metaventrite moderately developed. Femoral lines developed, shortened for half of their possible length. Fovea located in middle of posterior margin of metaventrite equipped with bush of erect setae.

Membranous wings developed.

Genitalia. Basal part of median lobe narrow ring-shaped of type C. Shape of median lobe apex resembles skittle pin in dorsal view. Apical part of median lobe first contracted, emarginated laterally, then feebly widened. Operculum egg-shaped. Parameres narrowed apically; each with two



Figs 1–8. 1, 2, 6, 7 – aedeagus laterally and tip of aedeagus dorsally. 3, 5 – lateral view of body. 4, 8 – spermatheca. 1–4 – *Agathidium (Agathidium) pilulum* sp. nov.; 5–8 – *Agathidium (Macroceble) cornigerum* sp. nov. Scale bars in Figs 1, 2, 4, 6, 7, 8 = 0.1 mm; 3, 5 = 0.5 mm.

short and fine setae (aedeagus as in Figs 1, 2).

Variation and sexual dimorphism. Length of body is 1.8–2.0 mm in the type series. The ratio of A3/A2 varies between 1.3–1.6. Tarsal formula 5-4-4 in female. Spermatheca with pear-shaped basal part and simply bowed distal thin part (Fig. 4). Length of spermatheca 0.13 mm.

Differential diagnosis. *Agathidium (Agathidium) pilulum* sp. nov. as well as the species it is compared with bellow habitually belong to the *A. madurense* species group sensu ANGELINI (1993) due to raised anterior part of the supraocular carina. The new species stands closest to *A. (Agathidium) occultum* Angelini & De Marzo, 1998 from China, Yunnan (ANGELINI & DE MARZO 1998b) as both species are similar in the shape of body that is broadly oval, in the shape of straight, feebly emarginated clypeus, in the eyes that are parabola slice-shaped and in the raised anterolateral bead of head. Colour of the antenna is yellow-red with A9 and A10 a little darker in both species. Both compared species possess A3 distinctly longer than A2 and also slim tibiae. Sutural stria is missing in both species. *Agathidium pilulum* sp. nov. differs from *A. occultum* in the specific shape of its median lobe that is simply cylindrical with broadly rounded tip in *A. occultum*. *Agathidium pilulum* sp. nov. can be also compared to *A. (A.) alesi* Angelini & De Marzo, 1998 from Taiwan (ANGELINI & DE MARZO 1998a), that also belongs to the *A. madurense* species group, having similar skittle pin-shaped apical part of the median lobe. The new species differs from *A. alesi* in distinctly smaller body (1.8–2.0 mm), while the length of

body is 3.0–4.1 mm in *A. alesi*. Antenna is bicolored in *A. pilulum* sp. nov., antenna in *A. alesi* is unicolorous, light. Posterior femora are straight on their hind margin, while the same are toothed in *A. alesi*. Moreover, the apex of the tegmen is distinctly bent upwards and paramera is shorter in *A. alesi* compared with *A. pilulum* sp. nov. Spermatheca is similar in its shape in all the compared species; basal part of spermatheca is pear-shaped in *A. pilulum* sp. nov. while the same is subcylindrical in *A. occultum* and *A. alesi*. **Etymology.** The name of the new species draws the attention to the globular shape of the apex of the median lobe. Therefore the name is derived from the Latin word *pilula* (= globule in English). Noun in apposition.

***Agathidium (Macroceble) cornigerum* sp. nov.**

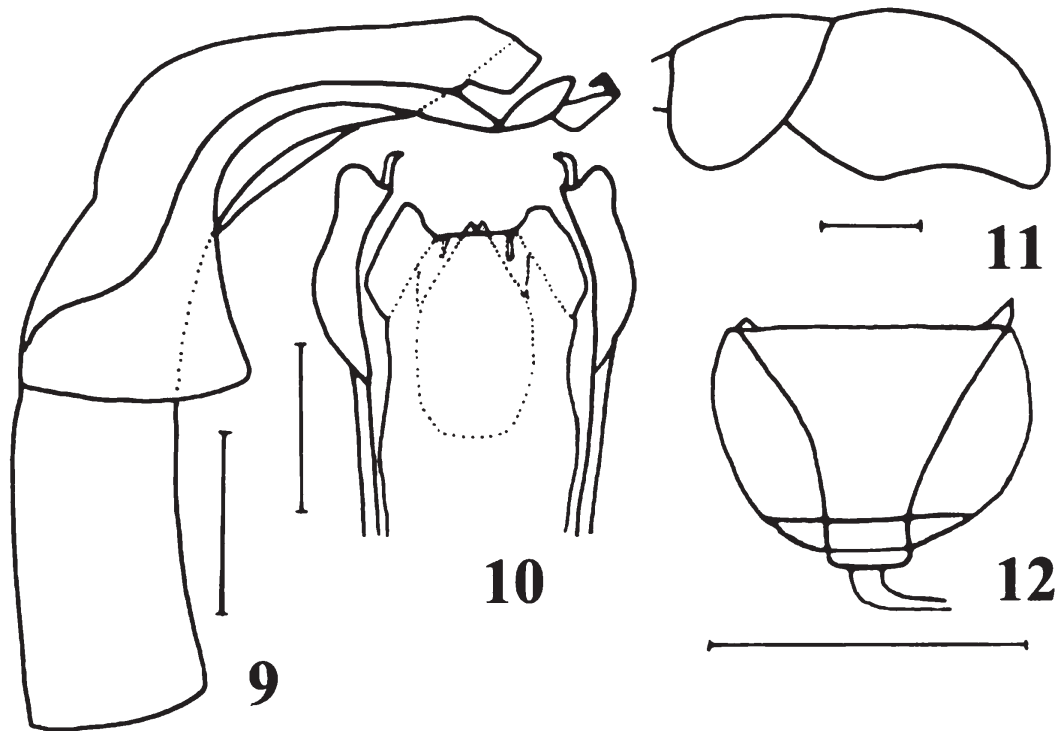
(Figs 5–8, 14, 16)

Type locality. China, Hainan Island, Limushan Mts, 19°10.5–10.9'N, 109°44–45'E, 650–900 m.

Type material. HOLOTYPE: ♂, “China: Hainan isl. [MF 19] / Limushan Mts., mountains / above first admin. centre / 19°10.5–10.9'N 109°44–45'E / 650–900 m, 6.v.2011, Fikáček // sifting small accumulations of moist leaf litter along / and on the trail in secondary / forest partly with *Cyathea* and / bamboo” (NMPC). PARATYPES: 2 ♂♂ 5 ♀♀, same data as holotype (NMPC, ZSPC).

Description. Length of holotype 1.6 mm, head 0.2 mm (0.5 mm including mandibular horn), pronotum 0.7 mm, elytra 0.7 mm, antenna 0.7 mm, aedeagus 0.78 mm. Maximum width of head 0.9 mm, pronotum 1.1 mm, elytra 1.1 mm.

Body very shortly oval. Dorsum, antennomere 1 and legs light chestnut coloured, tarsi lighter; A2–A8



Figs 9–12. 9, 10 – aedeagus laterally and tip of aedeagus dorsally. 11 – lateral view of body. 12 – spermatheca. 9–11 – *Agathidium (Macroceble) apiforme* sp. nov.; 12 – *Dermatohomoeus pennatus* sp. nov. Scale bars in Figs 9, 10 = 0.2 mm; 11 = 0.5 mm; 12 = 0.1 mm.

yellowish, A9–A10 brown, A11 yellow-red. Ventral surface yellow-red. Dorsum punctured, without microsculpture. Sutural striae absent; femoral lines absent, metaventricle shortened, supraocular carina low all along its length.

Head very broad, maximum width of head just before posterior margin of eyes. Eyes, feebly flattened, somewhat drop-shaped (Fig. 16). Supraocular carina low with raised anterior edge of right carina forming triangular process. Subocular line not developed. Clypeus feebly roundly emarginate, clypeal line lacking. Antennomere 3 distinctly longer than A2 ($A3/A2 = 1.7$). Ratio of lengths of A2–A11 ($A2 = 1.0$): 1.0–1.7–0.9–0.9–0.7–0.9–0.9–1.4–1.1–2.6. Ratio of widths of A2–A11 ($A2 = 1.0$): 1.0–0.8–0.8–0.8–0.8–1.2–1.4–2.0–2.2–2.4. Ratio of W/L of A2–A11: 0.7–0.3–0.7–0.7–0.8–1.0–1.2–1.0–1.4–0.7. Surface of head smooth with very fine and very sparse punctures, separated by more than 10 times their own diameters. Left mandible bears long upwards oriented caudally bent horn (Figs 14, 16).

Pronotum. Lateral outline broadly rounded in lateral view (Fig. 5). Punctuation sparse and fine, rather similar to that on head with punctures separated by about 8–10 or even more times their own diameter.

Elytra widest at lateral angles, then distinctly narrowed posteriorly. Elytral margins straight behind lateral angles in lateral view (Fig. 5). Lateral elytral channel narrow. Punctuation similar to that on head.

Legs. Tarsi slim, all tibiae slim, metafemora without specific characters. Tarsal formula: 5–5–4 in male.

Mesoventrite. Posterior part subconcave. Anterior part raised without longitudinal carina. Lateral lines not developed.

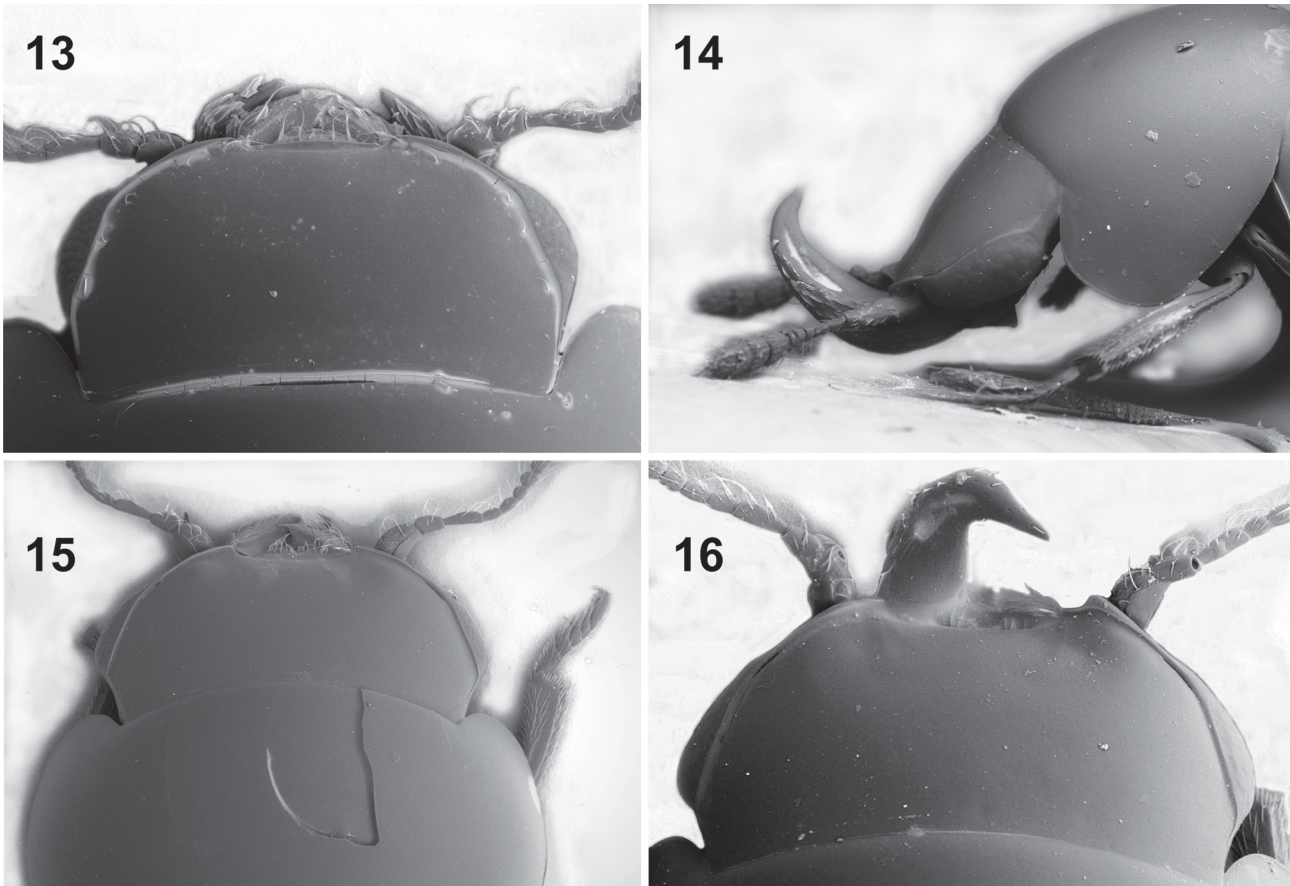
Metaventricle. Distinctly shortened – $MTW/MTLM = 3$; $MTW/MTLC = 6$. Femoral lines missing.

Membranous wings absent.

Genitalia. Basal part of median lobe simple (type A). Apical part of median lobe narrow, elongate in long process rounded at its top in dorsal view. Operculum small, oval. Parameres flattened, triangularly widened at apex with flat oval apendices (Figs 6, 7).

Variation and sexual dimorphism. Length of body 1.6–1.9 mm in the type series. The ratio $A3/A2$ varies between 1.2–1.7. One of the male paratypes possesses simple left mandible without any horn, the other male paratype is with large mandibular horn as in the holotype. Tarsal formula 4–4–4 in female. Spermatheca slim, cylindrical, S-shaped (Fig. 8). Length of spermatheca 0.15 mm.

Differential diagnosis. *Agathidium (Macroceble) cornigerum* sp. nov. possesses greatly shortened metaventricle; femoral lines on metaventricle missing. Therefore, the new species is attributed to the subgenus *Macroceble* Angelini, 1993. It is habitually similar to *A. (Macroceble) pokornyi* Švec, 2017, a mountain species from Yunnan, China (ŠVEC 2017). Both species are similar in the shape of body, shape of head broadest at posterior part of eyes, feebly roundly emarginate clypeus, in dark antennal club with a little lighter colour of antennomere 11, both species are similar also in the length of A3 that is distinctly longer than A2. *Agathidium cornigerum* sp. nov. differs from *A. pokornyi* in lighter colouring of the dorsum, in the drop-shaped eyes that are parabola slice-shaped in *A. pokornyi* and mainly in the median lobe constricted before rounded tip while the tegmen is linden leaf-shaped in *A. pokornyi*. Also, the para-



Figs 13–16. 13, 15, 16 – head dorsally; 14 – head laterally. 13 – *Agathidium (Agathidium) pilulum* sp. nov.; 14, 16 – *Agathidium (Macroceble) cornigerum* sp. nov.; 15 – *Agathidium (Macroceble) apiforme* sp. nov.

meres are quite different as paramera is lacking appendix in *A. pokornyi*. The shape of the parameres bearing appendices is very distinctive and very specific, distinguishing the new species from the known *Agathidium* species except for *A. apiforme* sp. nov. that also possesses apical parameral appendices, but beside the shape of genitalia both species differ also in the morphological characters mentioned in the key above. Spermatheca is S-shaped in *A. cornigerum* sp. nov. while the same has semi-circular basal part with curved cylindrical distal part in *A. pokornyi*.

Etymology. The name of the new species draws the attention to the well-developed horn on the left mandible of the holotype. The name is derivate from Latin words *cornum* (= horn) and *gere* (= bear in English). Adjective.

***Agathidium (Macroceble) apiforme* sp. nov.**

(Figs 9–11, 15, 17, 18)

Type locality. China, Hainan Island, Bawangling National Forest Park, 19°05.20'N, 109°11.80'E, 1050 m.

Type material. HOLOTYPE: ♂, “China: Hainan isl. [MF 23] / Bawangling Nat. Forest Park / 12.3 km SEE of Baotie / 19°5.20'N 109°11.80' E / 1050 m, 8.v.2011, Fikáček // rotting banana trunks at the / banks of a stream amid the / primary mountain forest” (NMPC).

Description. Length of body 2.3 mm, head 0.4 mm, pronotum 0.8 mm, elytra 1.1 mm, antenna 0.8 mm, aedeagus 0.9 mm. Maximum width of head 1.1 mm, pronotum 1.4 mm, elytra 1.4 mm.

Body shortly oval. Dorsum dark chestnut coloured, legs

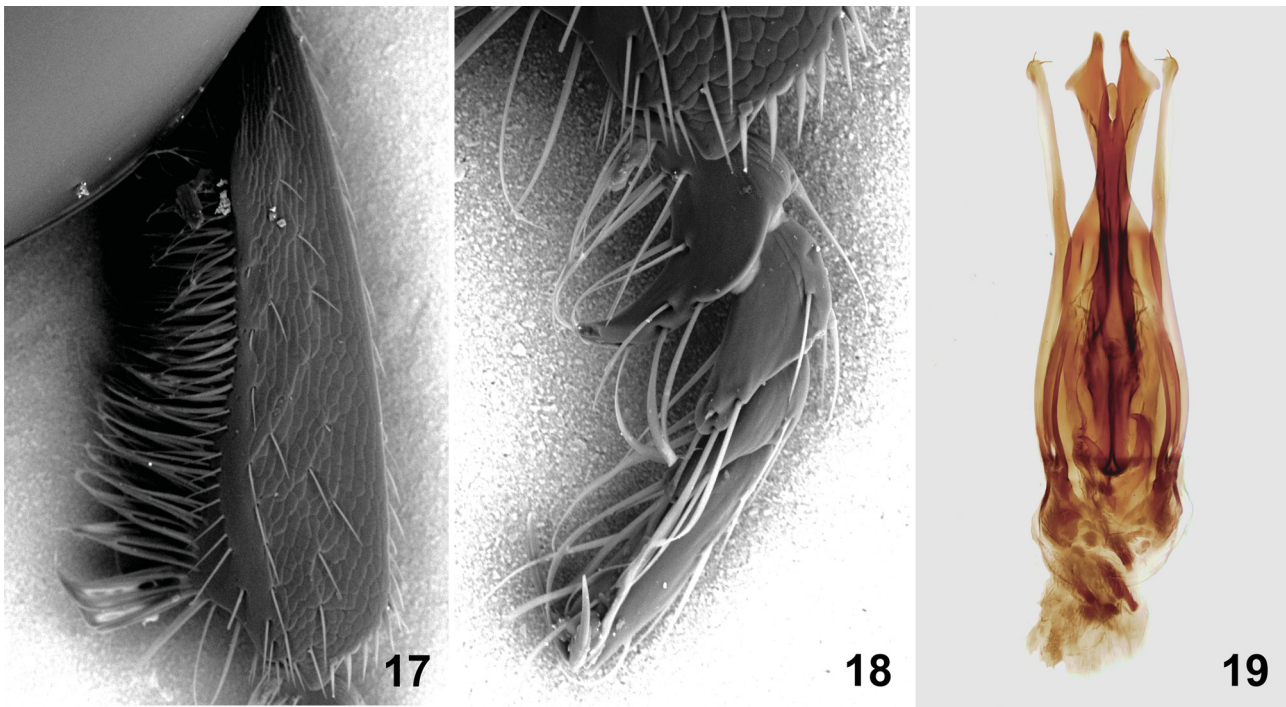
and antennomere 1 chestnut, A2–A8 yellow-red, A9–A10 brown, A11 slightly lighter than A9–A10. Ventral surface brown. Dorsum punctured, without microsculpture. Sutural striae absent; femoral lines absent, metaventrite shortened.

Head very broad, shape as in Fig. 15. Maximum width of head just before posterior margin of eyes. Eyes somewhat flattened, drop-shaped. Supraocular carina low all along its length. Subocular line not developed. Clypeus feebly roundly emarginate, clypeal line lacking. Antennomere 3 longer than A2 ($A_3/A_2 = 1.3$). Ratio of lengths of A2–A11 ($A_2 = 1.0$): 1.0-1.3-0.7-0.7-0.5-0.6-0.5-1.1-1.0-1.8. Ratio of widths of A2–A11 ($A_2 = 1.0$): 1.0-0.7-0.6-0.6-0.7-0.9-0.9-1.4-1.6-1.7. Ratio of W/L of A2–A11: 0.6-0.4-0.5-0.5-0.8-0.9-1.0-0.8-1.0-0.6. Surface of head smooth with distinct punctures separated by 4–5 times their own diameters. Left mandible a little stronger and longer than right one.

Pronotum. Lateral outline broadly rounded in lateral view (Fig. 11). Punctuation sparser and finer than that on head with punctures separated by about 4–6 times their own diameter.

Elytra widest at lateral angles, then distinctly narrowed posteriorly. Elytral margin concave behind lateral angles in lateral view (Fig. 11). Lateral elytral channel wider behind lateral angles than in basal part. Punctuation similar to that on head.

Legs. Pro- and mesotarsi slim, protibia a little widened,



Figs 17–19. 17 – metatibia; 18 – metatarsus; 19 – aedeagus dorsally. 17, 18 – *Agathidium (Macroceble) apiforme* sp. nov.; 19 – *Dermatohomoeus pennatus* sp. nov.

wider than mesotibia, narrower than metatibia. Metafemora distinctly bent in apical third, making their posterior margin concave. Metatibia of unique shape, widened, with dorsal longitudinal groove-shaped depression equipped by transversally oriented recumbent setae (Fig. 17). This apparatus resembles pollen baskets of bees. Metatarsi unusually modified, first metatarsomere possesses an eagle beak-shaped process oriented medio-caudally (Fig. 18). Tarsal formula: 5-5-4 in male; female unknown.

Mesoventrite. Posterior part subconcave. Anterior part raised with longitudinal carina. Lateral lines developed, shortened.

Metaventricle. Distinctly shortened, $MTW/MTLM = 3$; $MTW/MTLC = 10$. Femoral lines missing.

Membranous wings absent.

Genitalia. Basal part of median lobe simple but unusually elongate (type A) (Fig. 9). Apical part is very specific, bearing flattened lateral process on each side in dorsal view (Fig. 10). Parameres terminate in flattened widened curved plates bearing appendices (Fig. 9).

Differential diagnosis. *Agathidium (Macroceble) apiforme* sp. nov. is attributed to the subgenus *Macroceble* Angelini, 1993 due to strongly shortened metaventricle and missing femoral lines. It can be compared to *A. (Macr.) oui* Švec, 2011 (China: Sichuan) and *A. (s. str.) procerum* Angelini & DeMarzo, 1998 (China: Sichuan, Yunnan, and Gansu) (ANGELINI & DEMARZO 1998b, ŠVEC 2011). All the mentioned species are similar in the shortly oval body, head broadest just before posterior margin of somewhat flattened, drop-shaped eyes; supraocular carina is low all along its length while the subocular line is not developed, clypeus is feebly roundly emarginate, clypeal line lacking, and A3 is longer than A2 in both compared species. All the three species also lack dorsal microsculpture and sutural striae and possess

much shortened metaventricle. *Agathidium apiforme* sp. nov. (length of body 2.3 mm) differs from *A. oui* (1.5–1.8 mm) and *A. procerum* (1.8–2.0 mm) in larger body, darker colour of dorsum and in A3 distinctly longer than A2 ($A3:A2 = 1.3$) while A3 is approximately as long as A2 or a little longer (length ratio of $A3/A2 = 1.0$ – 1.1) in *A. oui* and *A. procerum*. The new species differs from *A. procerum* in the absence of the femoral lines. *Agathidium apiforme* sp. nov. differs from all currently known species of *Agathidium* in the unique shape of hind tibiae in male and in the flattened lateral processes of the apex of tegmen. Also, the shape of the parameres bearing appendices is very distinctive and very specific, distinguishing the new species from all known *Agathidium* species except for *A. cornigerum* sp. nov. that also possesses apical parameral appendices, but beside the shape of genitalia both species differ also in the morphological characters mentioned in the key above.

Etymology. The name of the new species draws the attention to the specific shape of the posterior tibiae resembling pollen baskets in bees (Latin *apis* means bee in English). Adjective.

Dermatohomoeus pennatus sp. nov.

(Figs 12, 19)

Type locality. China, Hainan Island, Limushan Mts, $19^{\circ}10.5$ – $10.9^{\circ}N$, $109^{\circ}44$ – $45^{\circ}E$, 650–900 m.

Type material. HOLOTYPE: ♂, “CHINA: Hainan Isl. [MF 19] / Limushan Mts., mountains above first admin. centre / $19^{\circ}10.5$ – $10.9^{\circ}N$, $109^{\circ}44$ – $45^{\circ}E$ / 650–900 m; 6.v.2011, Fikáček // sifting – small accumulations of moist leaf litter along / and on trail in secondary / forest partly with *Cyathea* and / bamboo” (NMPC). PARATYPES: 3 ♂♂ 3 ♀♀, the same locality data as holotype (NMPC, ZSPC).

Description. Length 2.4 mm in holotype, head 0.2 mm, pronotum 0.7 mm, elytra 1.5 mm, antenna 0.8 mm, aedeagus 1.00 mm. Maximum width of head 0.6 mm at eyes,

pronotum 1.4 mm at base, elytra 1.4 mm in basal third.

Dorsum reddish-brown, A1–A6 and A8 yellow-red, A7, A9–A11 a little darker, femora and tibiae chestnut coloured, tarsi yellow-red. Underside chestnut, metaventrite and coxal margins darker. Entire dorsum punctured. Basal part of head dorsally and elytra with fine strigosites.

Head without microsculpture except for transversally strigose narrow strip on base of vertex. Eyes subglobose, well developed. Dorsal surface of head with distinct puncturation, punctures separated by 2–3 times their own diameter. Antennomeres A2–A6 and A8–A11 longer than wide. W/L of A7 = 1.6. A11 broader than A10.

Pronotum broadest at hind angles. Base straight centrally; oblique-angled laterally to very blunt abruptly rounded hind angles. Very feeble emargination before hind angles in dorsal view. Hind angles rectangular with tip abruptly rounded in lateral view. Sides evenly curved from base to anterior angles in both dorsal and lateral view. Pronotal puncturation distinct, dense, separated by 3–4 times their own diameter on disc, becoming sparser anteriorly, denser posteriorly.

Elytra broadest approximately in basal third of their length; then roundly curved to apex. Elytral surface punctured. Punctures separated predominantly by 1–2 times their own diameter. Medially, near suture, punctures tend to create two irregular double rows of punctures. Remaining surface of elytra irregularly punctured. Interval punctures very similar, irregular, a little sparser than row punctures. Elytral punctures connected by transverse or oblique strigosity. Sutural stria extending approximately to basal third of elytra.

Legs. Protarsomere 1 distinctly dilated and elongate in male. Ratio of lengths of T1 : T2–T5 (without claws) of protarsus = 0.4.

Genitalia. Aedeagus possesses distinctive ventral plates extending level of top of median lobe; ventral plates terminating at apex in long bent process resembling wings of butterfly (Fig. 19).

Variation and sexual dimorphism. Length of body 2.1–2.4 mm in the type series. Protarsi slender in female. Length of spermatheca 0.08 mm, width 0.10 mm. Spermatheca in Fig. 12.

Differential diagnosis. The species of the genus *Dermatohomoeus* are generally very similar in their appearance, especially those that are of similar colour of dorsum and the size of body. The best way to differentiate the individual species is to compare their genitalia, especially the shape of the aedeagus, its ventral plates and the internal sac while the spermatheca is of very similar or even identical shape in the individual species (ŠVEC & BAŇAŘ 2021). Nevertheless the new species can be compared with those Chinese, Nepalese and Indian species that are larger than 2.0 mm, irregularly densely punctured on elytra, and have ventral plates reaching at least the level of the top of parameres (*D. longicollis* Daffner, 1988, *D. obscuratus* Daffner, 1988, *D. punctatus* Daffner, 1988, *D. schuelkei* Švec, 2011, and *D. strigellus* Daffner, 1988). *Dermatohomoeus pennatus* sp. nov. differs from all the mentioned species in the pronotal base strongly obliquely angled toward posterior pronotal angles and mainly in the shape of ventral plates terminating at apex in long bent process resembling the

wings of a butterfly.

Etymology. The name of the new species is derived from the Latin word *penna* (wing in English) as the shape of the ventral plates resembles wings. Adjective.

Faunistics

Agathidium (Agathidium) formosum

Angelini & De Marzo, 1984

Material examined. 1 ♂, “China, Jiangxi Prov., 26.iv.2011 / Jिंगgang Shan Mts. / Xiangzhou vill. env. / rice fields; forested stream valley / 26°35.5'N, 114°16.0'E, 374 m / M. Fikáček & J. Hájek lgt.” (NMPC).

Distribution. Taiwan (ANGELINI & DE MARZO 1984), China (Jiangxi) (new record), Thailand (ANGELINI & DE MARZO 1992).

Agathidium (Microceble) venustum

Angelini & De Marzo, 1995

Material examined. 2 ♂♂ 1 ♀, “China: W-Sichuan / Ya'an Pref., Shimian Co. / Daxue Shan, road betw. / Anshunchang-Wamba / 20 km WSW Shimian 1500 m / 9.vii.1999, leg. A. Pütz” (SMTD, ZSPC).

Distribution. Taiwan (ANGELINI & DE MARZO 1995), China: Guangxi, Shaanxi and Hong Kong (ANGELINI 2010), Sichuan (new record).

Agathidium (Agathidium) kabateki Angelini, 2000

Material examined. 1 ♂, “P.R.CHINA, Yunnan, E / slope Cangshan at Dali, / N25°40'13.2”, E 100°07'54.8”, 2728 m 13.v.2010, / sift. 09-11, V. Grebennikov” (CNCO).

Distribution. China: Sichuan (ANGELINI 2000), Yunnan (new record).

Agathidium (Agathidium) puetzi Angelini & Švec, 2000

Material examined. 1 ♂, “China [8] S-Gansu / mountains SE Longuan / sifted, 33°11'20"N / 105°14'24"E, 2030 m / 31.vii.2012 V. Assing” (ZSPC).

Distribution. China: Gansu (new record), Shaanxi (ANGELINI & ŠVEC 2000).

Discussion

Two of the four species new to science described in the present paper possess some unique or even bizarre characters distinguishing those species significantly from all others presently known taxa.

The most obtrusive character is the strongly modified posterior tibia in *Agathidium apiforme* sp. nov. belonging to the subgenus *Macroceble* Angelini 1993. Generally *Macroceble* comprises the most modified species within the genus *Agathidium*. The main morphological modifications typical for the subgenus are strongly shortened metaventrite and broad flat head (ANGELINI 1993). Therefore, the beetles have capability of almost complete conglobation. Beetles of the subgenus *Macroceble* are able to cover their meso- and metaventrite and also abdominal ventrites by casting their head and prothorax down, ventrally (Švec, personal observation). Wide, simply flattened posterior tibia without long arranged setae can be observed in many *Macroceble* species but none of them has tibiae modified as *A. apiforme* (ANGELINI 2004; Švec, pers. database). Posterior tibiae in male of *Agathidium apiforme* sp. nov. possess longitudinal

carina bordering adjacent strip-shaped depression located on the dorsal surface that is equipped with long and very dense recumbent setae. This area resembles pollen baskets on bee metatibiae with incurving hairs accommodated to the pollen collecting. Also, metatarsomeres of the holotype of *A. apiforme* sp. nov. are unusually modified. The first metatarsomere possesses a medio-distal eagle beak-shaped process. Beside this, all the metatarsomeres are equipped with unusually long and strong setae. None of the *Agathidium* species described up to now is in possession of such a distinctive modification of the hind legs.

The function of the modification of the posterior tibiae in *Agathidium apiforme* sp. nov. is unknown. Due to lack of evidence concerning the significance of those morphological modifications, only hypothesis based on the knowledge of the biology of *Agathidium* can be given. The species of the genus *Agathidium* are known to be associated with slime moulds and mushrooms. But there is also a known exception. One Chinese species, *Agathidium (Neoceble) dundai* Angelini & Švec, 1994, was repeatedly found in blossoming umbelliferous plants (pers. communication: Ondřej Konvička – Č. Budějovice and Jan Schneider – Praha, both Czech Republic). Taking into account the biology of *Agathidium* it can be supposed that the leg modification in *A. apiforme* can be a specific type of exoskeletal mycangia enabling to gather and transfer fungal spores or even pollen.

As the female of *A. apiforme* sp. nov. is not known, another probable hypothesis is to be considered. Perhaps the leg modification can be specific to males only as an expression of the sexual dimorphism.

Two of the three *Agathidium* species discovered in Hainan Island also show striking and unique shapes of the male genitalia. Parameres in *A. cornigerum* sp. nov. and *A. apiforme* sp. nov. bear unique apical appendices.

Also, the elongate basal part of aedeagus in *A. apiforme* sp. nov. is quite unusual in the genus. Similar basal part of aedeagus is known in only one other *Macroceble* species, *A. (Macr.) penultimum* Angelini & Cooter, 2003, from the Chinese province Hubei (ANGELINI & COOTER 2003).

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