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Taxonomy of the genus *Ptomaphaginus* Portevin (Coleoptera: Leiodidae: Cholevinae: Ptomaphagini) from China, with description of eleven new species

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Abstract

Ptomaphaginus Portevin, 1914 is one of the most speciose genera in the tribe Ptomaphagini (Coleoptera: Leiodidae: Cholevinae). Its members are mainly soil dwellers and are almost all distributed in the Oriental Region. This paper reports eleven new species from China: *P. guangxiensis* **sp. nov.** (type locality: Napo, Guangxi autonomous region), *P. gutianshanicus* **sp. nov.** (type locality: Gutianshan, Zhejiang province), *P. luoi* **sp. nov.** (type locality: Shennongjia, Hubei province), *P. newtoni* **sp. nov.** (type locality: Wuzhishan, Hainan province), *P. perreaui* **sp. nov.** (type locality: Jinghong, Yunnan province), *P. quadricalcarus* **sp. nov.** (type locality: Xishuangbanna, Yunnan province), *P. ruzickai* **sp. nov.** (type locality: Baoxing, Sichuan province), *P. shennongensis* **sp. nov.** (type locality: Shennongjia, Hubei province), *P. wenboi* **sp. nov.** (type locality: Fushan, Taiwan province), *P. wuzhishanicus* **sp. nov.** (type locality: Wuzhishan, Hainan province) and *P. yui* **sp. nov.** (type locality: Lijiang, Yunnan province). Five other species known to occur in China were also reviewed and mostly redescribed to update the knowledge on their identification. The Chinese fauna of the genus *Ptomaphaginus* is thus increased to sixteen species. Important characters on the last two visible ventrites and aedeagus in

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the male as well as on the ventral side of the proleg are discussed, detailed line drawings are offered for each species, and a key to species from China is presented.

Key words: Leiodidae, Cholevinae, *Ptomaphaginus*, taxonomy, China

摘要

锯尸小葬甲属 *Ptomaphaginus* Portevin, 1914 是锯尸小葬甲族（鞘翅目 : 球蕈甲科 : 小葬甲亚科）中物种数量最丰富的属之一，其成员主要营土栖且几乎均分布于东洋区。本文报告了产自中国的十一个新种：广西锯尸小葬甲 *P. guangxiensis* **sp. nov.**（模式产地：广西自治区那坡）、古田山锯尸小葬甲 *P. gutianshanicus* **sp. nov.**（模式产地：浙江省古田山）、罗氏锯尸小葬甲 *P. luoi* **sp. nov.**（模式产地：湖北省神农架）、牛顿锯尸小葬甲 *P. newtoni* **sp. nov.**（模式产地：海南省五指山）、佩罗锯尸小葬甲 *P. perreaui* **sp. nov.**（模式产地：云南省景洪）、四距锯尸小葬甲 *P. quadricalcarus* **sp. nov.**（模式产地：云南省西双版纳）、鲁卡锯尸小葬甲 *P. ruzickai* **sp. nov.**（模式产地：四川省宝兴）、神农锯尸小葬甲 *P. shennongensis* **sp. nov.**（模式产地：湖北省神农架）、文博锯尸小葬甲 *P. wenboi* **sp. nov.**（模式产地：台湾省福山）、五指山锯尸小葬甲 *P. wuzhishanicus* **sp. nov.**（模式产地：海南省五指山）以及于氏锯尸小葬甲 *P. yui* **sp. nov.**（模式产地：云南省丽江）。中国区系之锯尸小葬甲属种类由此增加到十六个。我们同样修订并基本重描述了其他五个发生于中国的已知种，使得其鉴定知识得到更新。本文还讨论了雄虫腹部末端两个可见腹板、阳茎以及前足腹面的重要特征，绘制了每个种的精细线条图，以及编制了该属中国种类的检索表。

Introduction

The Oriental genus *Ptomaphaginus*, belonging to the subtribe Ptomaphaginina, tribe Ptomaphagini, subfamily Cholevinae of the family Leiodidae (Coleoptera), was established by Portevin (1914a) based on only the species *P. longitarsis* Portevin from Sri Lanka; this was thus fixed as the generic type species by monotypy. Up to now the genus was composed of 82 known species before this study.

For the Chinese fauna, *Ptomaphagus sauteri* Portevin 1914b was described from Taiwan, and then transferred to *Ptomaphaginus* by Jeannel (1936). Schweiger (1956) described two species from Fujian: *P. similis* Schweiger and *P. gracilis* Schweiger. In the last decade of twentieth century, Perreau (1993, 1996) added two additional species: *P. franki* Perreau 1993 and *P. pingtungensis* Perreau 1996, both from Taiwan. The genus *Ptomaphaginus* thus had only five species recorded hitherto in China, and was poorly studied.

Our study was focused on the taxonomy of the genus *Ptomaphaginus* and aimed at a comprehensive revision of the Chinese fauna of this genus. Eleven new species were discovered and described. As a result, sixteen *Ptomaphaginus* species are now known from China. Important characters on the last two visible ventrites and aedeagus in the male as well as on the ventral side of the proleg were discussed and illustrated and a key to species from China was compiled.

Material and methods

Specimens were relaxed and softened in a hot saturated solution of potassium hydroxide for 4 minutes (for mounted dry specimens) or 8 minutes (for alcohol-preserved specimens), and then transferred to distilled water to rinse the residual potassium hydroxide off and stop any further bleaching. The softened specimens were moved into glycerin and dissected there to observe morphological details. After examination, the body parts were mounted on a plastic slip with Gum Arabic for future studies. Observation, drawing and measurement were performed using a Leica MZ APO stereomicroscope (magnification up to ×250) with a squared eyepiece graticule. Some microstructures were observed under an Axio Zoom.V16 motorized stereo zoom microscope (magnification up to ×270). Color photographs were taken with an AxioCam MRc 5 and the final deep focus images were created with the stacking software Helicon Focus 5.3. The program Adobe Photoshop® CS6 was used to make the line-art plates. The distribution map was downloaded from China Map Press (www.chinamap.com), and modified in Adobe Photoshop® CS6 based on examined materials and published records.

The material examined for this study is deposited in the following collections and museums:

CMPR	Collection of Michel Perreau, Paris, France
IZ-CAS	Institute of Zoology, University of Chinese Academy of Sciences, Beijing, China
NTUC	National Taiwan University, Taipei, Taiwan, China

The following abbreviations are used for measurement in millimeters (mm):

AL (antennal length): length from the antennal base to its tip.
BTW (basitarsal width): width of the widest portion of 1st protarsomere.
EBL (extended body length): summation of HL, PL, ELL and length of exposed scutellum, preventing the error introduced by exposed or retracted head.
ELL (elytral length): length from the tail end of scutellum to the elytral apex.
ELW (elytral width): width of the widest portion of two elytra closed together.
EW (eye width): width of a single compound eye in dorsal view.
HL (head length): axial length from the front apex of clypeus through the occipital carina.
HW (head width): width of the widest portion of head (usually including eyes).
PL (pronotal length): axial length of the pronotum.
PW (pronotal width): width of the widest portion of pronotum.
SE: number of striolations on elytron.
SP: number of striolations on pronotum.
TW (tibial width): width of the widest portion of protibia (excluding spines along outer margin etc.).

Taxonomy

Genus *Ptomaphaginus* Portevin, 1914

Portevin, 1914a: 194 (species included: *longitarsis*); Jeannel, 1936: 54 (characters; key to species); Szymczakowski, 1964: 66 (phylogeny; key to species; revision); Perreau, 2000: 370 (world catalog; 72 species).
Type species: *Ptomaphaginus longitarsis* Portevin, by monotypy.
Synonymy. *Euptomaphagus* Hatch, 1928: 158 (Type species: *Ptomaphagus cilipes* Portevin, by original designation); Jeannel, 1936: 54 (synonym with *Ptomaphaginus*).

The members of this genus can be distinguished from all other genera within the tribe Ptomaphagini by the combination of the following characters (according to Jeannel, 1936; Szymczakowski, 1964; Peck, 1973; Newton, 1998; Gnaspini, 1998; Perreau, 2000): (1) size small, 1.8–3.5 mm; (2) compound eyes always present; (3) pronotum with transverse striolations, interspaces generally narrower than that on elytra, widest at hind corners of base (Figs. 1A; 2A); (4) male basal three protarsomeres expanded; (5) protibiae of fossorial type, with distinct comb of short spines along outer margin as well as around apex; (6) mesepimera transverse, as wide at inner margin as at outer margin, anterior lateral margin straight, and posterior lateral corner pointing posteriorly; (7) mesosternal medial carina relatively low; (8) metasternal lateral carinae almost parallel to each other and to the axis of the body; (9) winged or wingless; (10) spiculum gastrale with anterior margin aligned with that of genital plates; (11) aedeagus subcylindrical, broad and short, stout in most species, sometimes more or less slender and flattened, apex variable in shape, genital orifice on ventral surface or cutting right margin of median lobe in shift to dorsal surface.

Some other morphological characters had also found to be of taxonomic significance: *Mouthparts*. Labrum transverse, anterior margin rounded; epipharyngeal area with torma (Figs. 1B; 2B). Left and right mandibles distinctly asymmetrical, each with a tooth on inner margin of subapex; subapical orthogonal penicillus made up of slender, fine and dense setae (Figs. 1C, D; 2C, D). Maxillary palp only penultimate palpomere wholly covered with setae, length more than twice its width, and slightly swollen towards apex; ultimate palpomere quite slender, feebly arched, a little shorter than penultimate palpomere, base slightly thickened, apex narrowly rounded (Figs. 1E; 2E). Hypopharynx and labial palps as shown in Figs. 1F; 2F, premier labial palpomere about as long as succeeding two

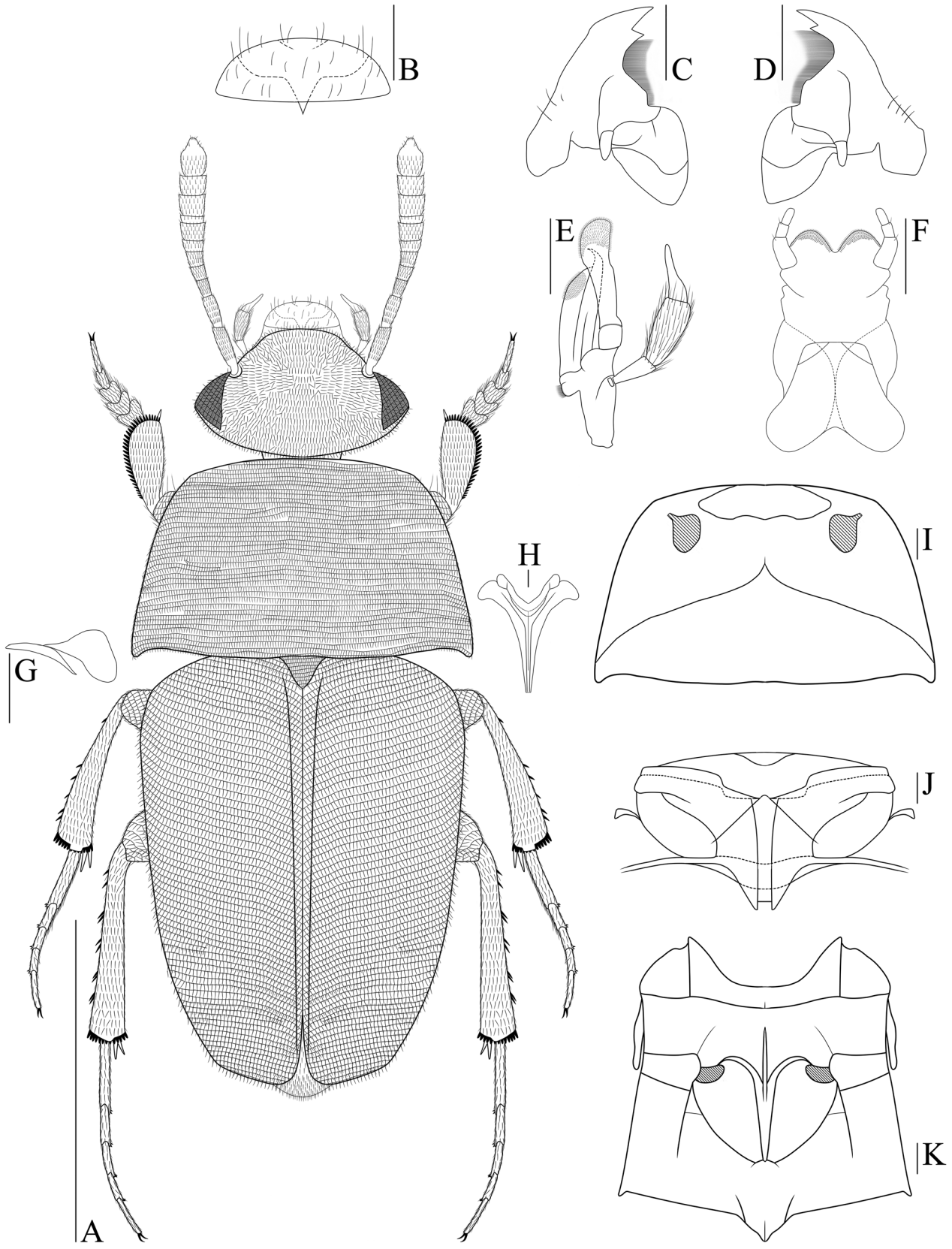

FIGURE 1. ***Ptomaphaginus gutianshanicus*** **sp. nov. ♂: A**, extended habitus (dorsal view); **B**, labrum (dorsal view); **C**, left mandible (dorsal view); **D**, right mandible (dorsal view); **E**, right maxilla (dorsal view); **F**, hypopharynx and labial palps (ventral view); **G**, cervical sclerite (dorsal view); **H**, metendosternite (dorsal view); **I**, prothorax (ventral view); **J**, metatergal apparatus (dorsal view); **K**, pterothorax (ventral view). Scales: **A** = 1 mm; **B–K** = 0.1 mm.

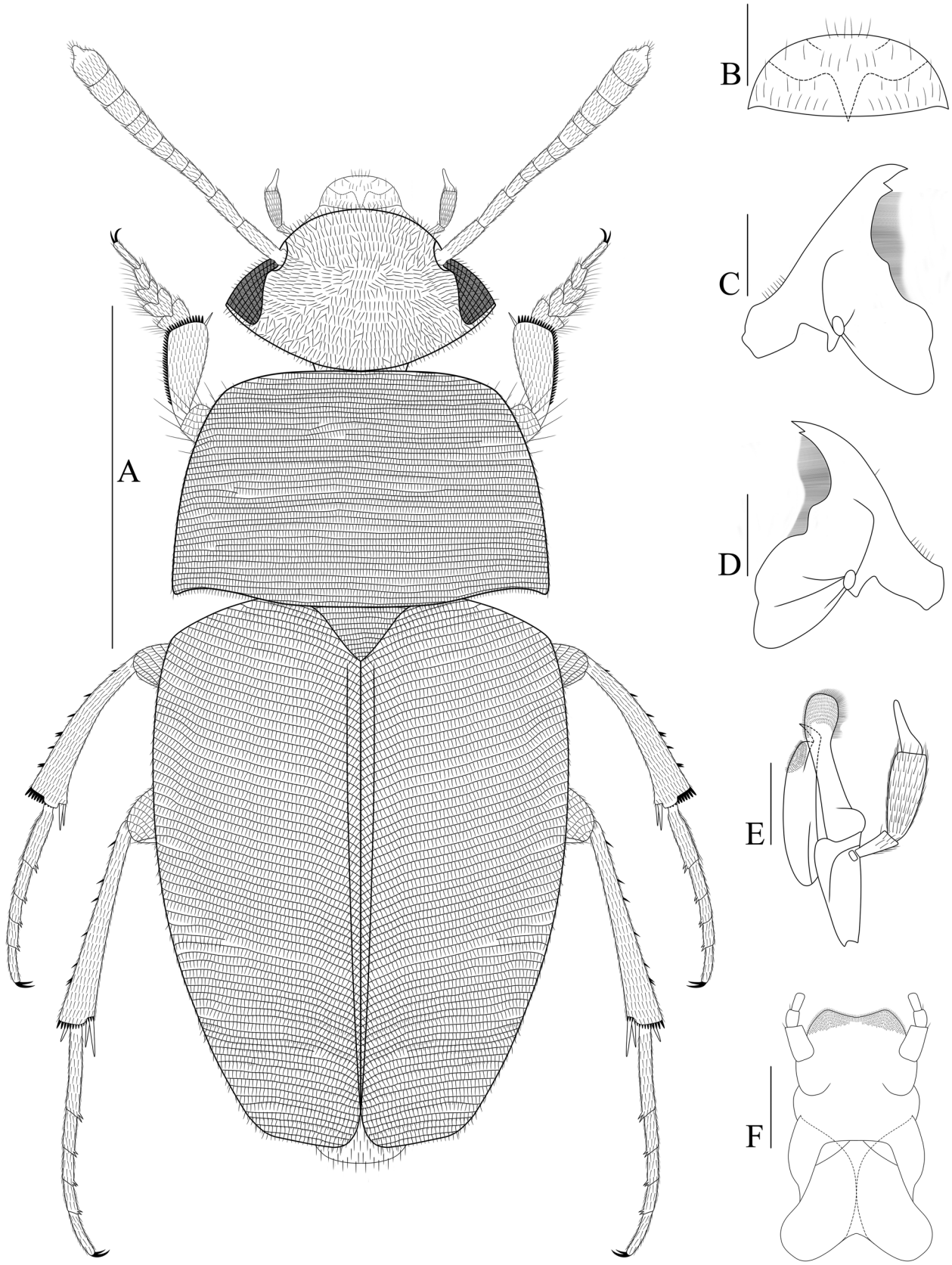

FIGURE 2. ***Ptomaphaginus quadricalcarus*** **sp. nov. ♂: A**, extended habitus (dorsal view); **B**, labrum (dorsal view); **C**, left mandible (dorsal view); **D**, right mandible (dorsal view); **E**, right maxilla (dorsal view); **F**, hypopharynx and labial palps (ventral view). Scales: **A** = 1 mm; **B–F** = 0.1 mm.

palpomeres together. *Cervical sclerites*. Cervical sclerites with end acuminate, pistol-like (Fig. 1G). *Thorax*. Prosternum with integumental foramina (where prolegs inserted) widely separated (Fig. 1I). Meso- and metasternum as shown in Fig. 1K, mesosternal apophysis strongly developed, edge somewhat thickened. Metatergal apparatus generally broad (Fig. 1J). Metendosternite with wide furcal arms (Fig. 1H).

A provisional key to species of *Ptomaphaginus* Portevin from China

(except *P. similis* Schweiger and *P. gracilis* Schweiger, see their notes)

1 Ventrite VII with two distinct teeth at posterior margin 2
- Ventrite VII simple, without any teeth at posterior margin 4
2 Teeth of ventrite VII long and hook-like (Fig. 11F); ventrite VIII without fossa (Fig. 11G); apical expansion of aedeagus distinctly and narrowly stuck out at apex (Fig. 11I); median lobe sharply acuminated to a subacute apex in lateral view (Fig. 11K) . . . . . *P. luoi* **sp. nov.**
- Teeth of ventrite VII strong, never hook-like; ventrite VIII with a fossa; apical expansion of aedeagus almost absent or roundly stuck out at apex; median lobe slightly or generally thinned towards apex in lateral view 3
3 Many small spines located around middle emargination formed by two large teeth of ventrite VII (Fig. 6E); fossa of ventrite VIII subround, without any ornaments bordered (Fig. 6F); aedeagus in dorsal view distinctly incurved around middle, and parameres strongly and sinuately curved, totally invisible before middle (Fig. 6H) . . . . . *P. franki* Perreau
- Several blunt spines located on moderately strong teeth of ventrite VII (Fig. 15G); fossa of ventrite VIII subtriangular, several blunt spines bordered its lateral sides (Fig. 15H); aedeagus in dorsal view oblong, parameres normal and distinctly widened at apical part (Fig. 15J) . . . . . *P. ruzickai* **sp. nov.**
4 Elytral apex with a tuft of strong hairs different to pubescence background (Fig. 18E); spiculum gastrale bottle-like, truncated at posterior end (Fig. 18G); aedeagus piriform in dorsal view (Fig. 18H) . . . . . *P. wuzhishanicus* **sp. nov.**
- Elytral apex clothed with uniform pubescence, without any tuft of strong hairs different; spiculum gastrale not bottle-like; aedeagus more or less oval, or oblong, or subquadrate, but never piriform in dorsal view 5
5 Aedeagus subquadrate in dorsal view, right apical expansion strongly and narrowly stuck out and dorsally rolled (Fig. 17J). . . . . *P. wenboi* **sp. nov.**
- Aedeagus more or less oval, or oblong 6
6 Spiculum gastrale more or less flared at posterior end 7
- Spiculum gastrale not flared at posterior end 10
7 Aedeagus suboval in dorsal view, median lobe gradually but distinctly narrowing towards the slightly asymmetrical apex (Fig. 19H); median lobe distinctly bent ventrad and strongly thinned to apex from about apical 1/3 in lateral view (Fig. 19J); spiculum gastrale slender, distinctly constricted at middle (Fig. 19G) . . . . . *P. yui* **sp. nov.**
- Aedeagus oblong in dorsal view, median lobe slightly narrowed towards apex; median lobe gently bent ventrad, apex a little thinned in lateral view 8
8 Spiculum gastrale slender (Fig. 8G); ventral operculum of aedeagus invertedly piriform, only divided a little at apex, each lobe widely subrounded apically (Fig. 8I) . . . . . *P. pingtungensis* Perreau
- Spiculum gastrale wide; ventral operculum of aedeagus broad, only divided in apical part, each lobe feebly emarginate apically 9
9 EBL quite long, exceeding 3.00 mm; several subacute spines bordered lateral sides of subtriangular fossa on ventrite VIII (Fig. 9H); parameres not reaching apical margin of median lobe and moderately widened towards apex in dorsal view (Fig. 9J). . . . . *P. guangxiensis* **sp. nov.**
- EBL only slightly exceeds 2.50 mm; no spines bordered lateral sides of subtriangular fossa on ventrite VIII (Fig. 16H); parameres reaching apical margin of median lobe and distinctly widened at apical part in dorsal view (Fig. 16J). . . . . *P. shennongensis* **sp. nov.**
10 Median lobe with apex truncated. 11
- Median lobe with apex not truncated 12
11 Spiculum gastrale widest at posterior 1/5, then strongly narrowing posteriorly to a narrowly rounded end (Fig. 3H); right apical expansion moderately stuck out of apical margin of median lobe (Fig. 3I); ventral operculum with two lobes symmetrical, bluntly rounded apically (Fig. 3J) . . . . . *P. sauteri* (Portevin)
- Spiculum gastrale elongate, narrowly rounded at posterior end (Fig. 10F); right apical expansion acuminated to a narrowly subround apex (Fig. 10F); ventral operculum with two lobes asymmetrical, subrounded apically on different levels (Fig. 10H) . . . . . *P. gutianshanicus* **sp. nov.**
12 EBL quite short, approximately equal to 2.00 mm; ventral operculum distinctly and widely emarginate, each short lobe obliquely truncated apically (Fig. 13H). . . . . *P. perreaui* **sp. nov.**
- EBL exceeds 2.50 mm; ventral operculum not distinctly and widely emarginate 13
13 Metatibia not only born two spurs at inner side of distal end, but also two large spur-like spines at ventral side (Fig. 14D); median lobe generally narrowed towards apex, apical margin distinctly emarginate at middle (Fig. 14G); right apical expansion rounded at apex (Fig. 14G); median lobe obviously bent ventrad, apical part strongly thinned and flattened in lateral view (Fig. 14J) . . . . . *P. quadricalcarus* **sp. nov.**
- Metatibia typically born two spurs at inner side of distal end; median lobe distinctly narrowed towards an asymmetrical apex

(Fig. 12H); right apical expansion subtruncated at apex (Fig. 12H); median lobe sharply bent ventrad at about apical 1/4, generally thinned towards apex in lateral view (Fig. 12J) . . . . . *P. newtoni* **sp. nov.**

Ptomaphaginus sauteri (Portevin, 1914)

(Figs. 3A–L)

Portevin, 1914b: 5 (*Ptomaphagus*; Type locality: CHINA, Taiwan: Akau); Hatch, 1928: 165 (*Ptomaphagus*; catalog); Jeannel, 1936: 58 (*Ptomaphaginus*; combination change; key to species; characteristic figures); Szymczakowski, 1959: 135 (*Ptomaphaginus*; new distributional locations); Szymczakowski, 1964: 83 (*Ptomaphaginus*; female description; taxonomical remarks); Hayashi, 1990: 29 (*Ptomaphaginus*; notes; characteristic figures); Perreau, 1996: 288 (*Ptomaphaginus*; new distributional locations; notes); Perreau, 2000: 375 (*Ptomaphaginus*; catalog).

Material examined. CHINA, Taiwan: 1♂, Taichung Hsien, Wufeng, 60 m, 24.IV–2.V.1992, A. Smetana leg. // *Ptomaphaginus sauteri* M. Perreau det. 2000 (CMPR); 1♂, 1♀, Fushan, mouse carcass bait, VI.2007, Wen-Bo Huang leg. (IZ-CAS); 2♂♂, 1♀, same data as previous except: VIII.2007 (IZ-CAS); 6♂♂, 1♀, same data as previous except: IX.2007 (IZ-CAS); **CHINA, Guangdong:** 3♂♂, 5♀♀, Dinghushan [=Mt. Dinghu], 240–250 m, monsoon evergreen forests, window trap, 21.VIII.2004, Jie Wu & Yong-Jie Chen legg. (IZ-CAS).

Redescription. *Male*. EBL: 2.66 mm. Length of different body parts: HL : AL : PL : ELL = 0.45 : 0.86 : 0.64 : 1.44 mm; width: HW : EW : PW : ELW = 0.75 : 0.08 : 1.15 : 1.18 mm. Proportion of antennomeres from base to tip in μm (length × width): 132 × 43, 111 × 44, 75 × 45, 48 × 50, 50 × 58, 42 × 66, 72 × 81, 24 × 79, 77 × 92, 71 × 93, 124 × 93.

Habitus elongated oval, relatively convex and lustreless. Moderately pigmented: mostly chestnut brown; only mouthparts, basal three antennomeres and apical half of ultimate antennomere, and apical part of tarsi yellowish. Dorsum continually clothed with fine, recumbent and sallow pubescence. Insertions of pubescence on dorsal surfaces of pronotum, scutellum, elytra and femora align along transverse striolations.

Head moderately short and convex, surface finely punctured, without visible transverse striolations, HW/HL = 1.64; anterior margin round. Compound eyes normally developed, EW/HW = 0.11. Antennae slender and relatively long (Fig. 3A), AL/HW = 1.15; 5th slightly longer than 4th; 6th wider than long; 9th and 10th slightly wider than long; 11th pear-like.

Pronotum rather transverse and convex (Fig. 3E), widest at hind corners, PW/PL = 1.80. Sides almost rectilinearly narrowing from posterior to anterior; hind corners drawn out and relatively acute. Posterior margin with distinct postero-lateral emargination. Surface transversely striolated, SP: 40–43, interspaces narrower than that on elytra.

Elytra of medium length and weakly convex, widest directly after base, ELL/EW = 1.22. Sides feebly curved, gradually narrowing from base to apices; apices feebly emarginate (Fig. 3F). Surface transversely striolated, SE: 69–71. Metathoracic wings fully developed.

Prolegs robust, with basal three protarsomeres moderately expanded (Fig. 3B): TW/BTW = 1.44. Spinal arrangement on ventral side of protibia as shown in Fig. 3D. Profemora wider than protibiae, and carried strong and long hairs on ventral side. Mesotibiae arcuate.

Ventrite VII simple. Ventrite VIII with a large fossa subround and moderately shallow, emarginate posteriorly (Fig. 3G). Segment IX: spiculum gastrale widest at posterior 1/5, then strongly narrowing posteriorly to a narrowly rounded end (Fig. 3H).

Aedeagus oblong in dorsal view (Fig. 3I): median lobe gradually narrowed from base to a truncate apex; right apical expansion weakly sclerotized, stuck out of apical margin of median lobe; parameres relatively wide, gently widened towards apex, firmly attached to median lobe. Ventral operculum poorly sclerotized, limit inconspicuous, divided in apical half, each lobe bluntly rounded apically (Fig. 3J). In lateral view, median lobe strongly bent ventrad at about apical 1/3, gradually thinning to a subround apex, and four ventrally-oriented setae inserted below apex as well as two just before middle (Fig. 3K). Internal stylus quite slender.

Female. Similar to male in general appearance, except for the following characters: protarsi normal (Fig. 3C), profemora without strong and long hairs on ventral surface and ventrite VIII regularly rounded posteriorly. Spermatheca 'C' shape (Fig. 3L).

Distribution. China (Guangdong, Taiwan).

Remarks. This species is recorded from mainland China for the first time. And it is worth noting that the

specimens from Guangdong have a shallower fossa on ventrite VIII and aedeagus more slender than that from Taiwan. These suggest a geographical variation from Taiwan.

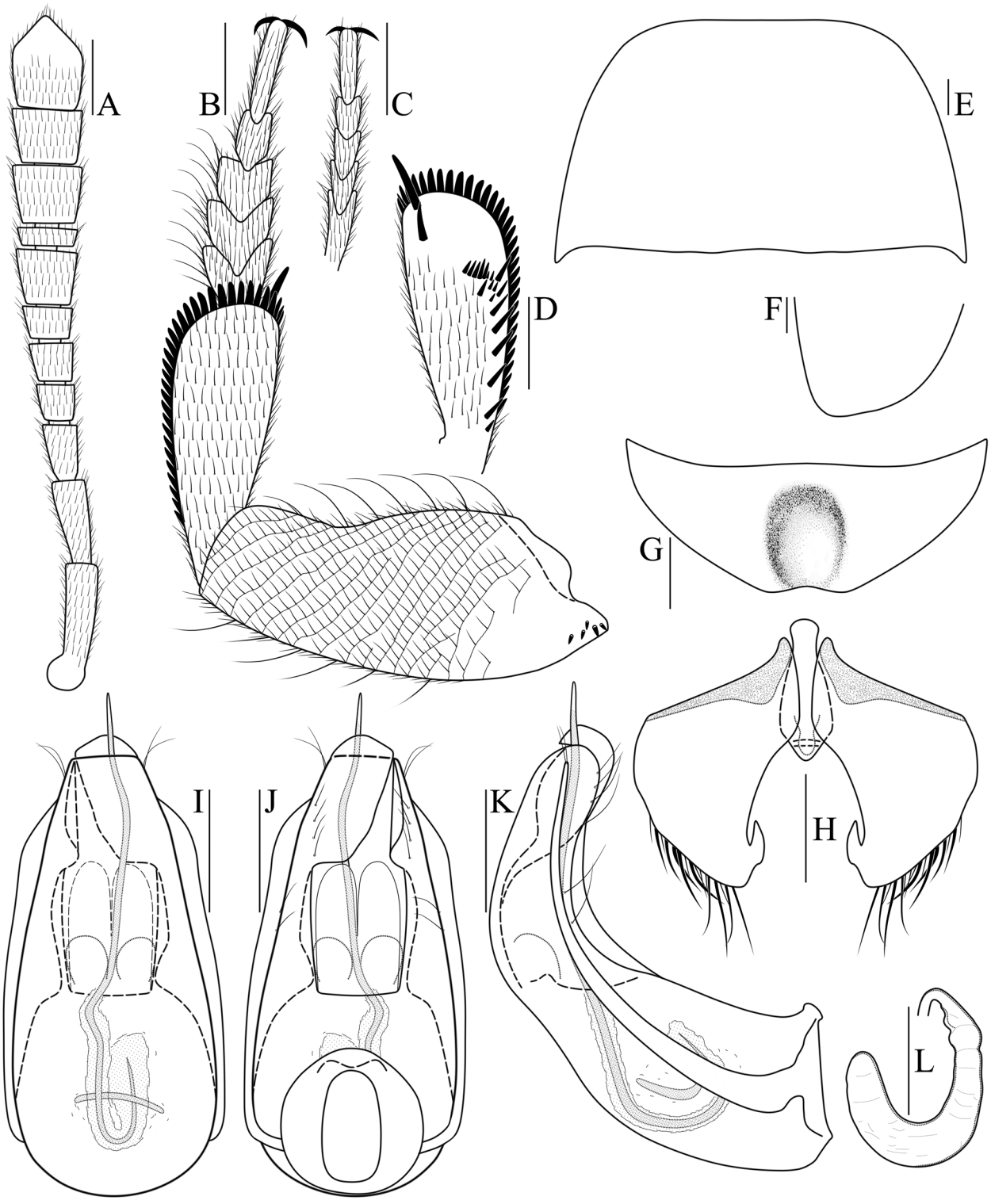

FIGURE 3. ***Ptomaphaginus sauteri*** **(Portevin 1914): A**, antenna ♂ (dorsal view); **B**, proleg ♂ (dorsal view); **C**, protarsus ♀ (dorsal view); **D**, protibia ♂ (ventral view); **E**, pronotum ♂ (dorsal view); **F**, elytral apex ♂ (dorsoapical view); **G**, ventrite VIII ♂ (ventral view); **H**, abdominal segment IX ♂ (ventral view); **I**, aedeagus (dorsal view); **J**, aedeagus (ventral view); **K**, aedeagus (lateral view); **L**, spermatheca. Scales: 0.1 mm.

Ptomaphaginus similis Schweiger, 1956
(Fig. 4)

Schweiger, 1956: 535 (*Ptomaphaginus*; Type locality: CHINA, Fukien: Kuatun); Szymczakowski, 1964: 147 (*Ptomaphaginus*; note); Perreau, 2000: 376 (*Ptomaphaginus*; catalog).

Material examined. None.

Distribution. China (Fujian).

Remarks. Szymczakowski (1964) was the first person to discuss the problem concerning the holotypes of *P. similis* Schweiger and *P. gracilis* Schweiger: they were considered to be lost. Michel Perreau (Université Paris 7, Paris, France; personal communication) told us the holotypes were in his collection at present, yet the two specimens were found not complete at all: both do not have their aedeagi; for *P. similis* Schweiger, we have the chance that the genital segment is still present, what is important because some characters are useful on the spiculum gastrale (widely subelliptic) (Fig. 4); for *P. gracilis* Schweiger, only parts of the genital segment remain, but not the spiculum gastrale. According to Schweiger's (1956) original descriptions and considering the conditions of the holotypes, it was difficult to distinguish the two species.

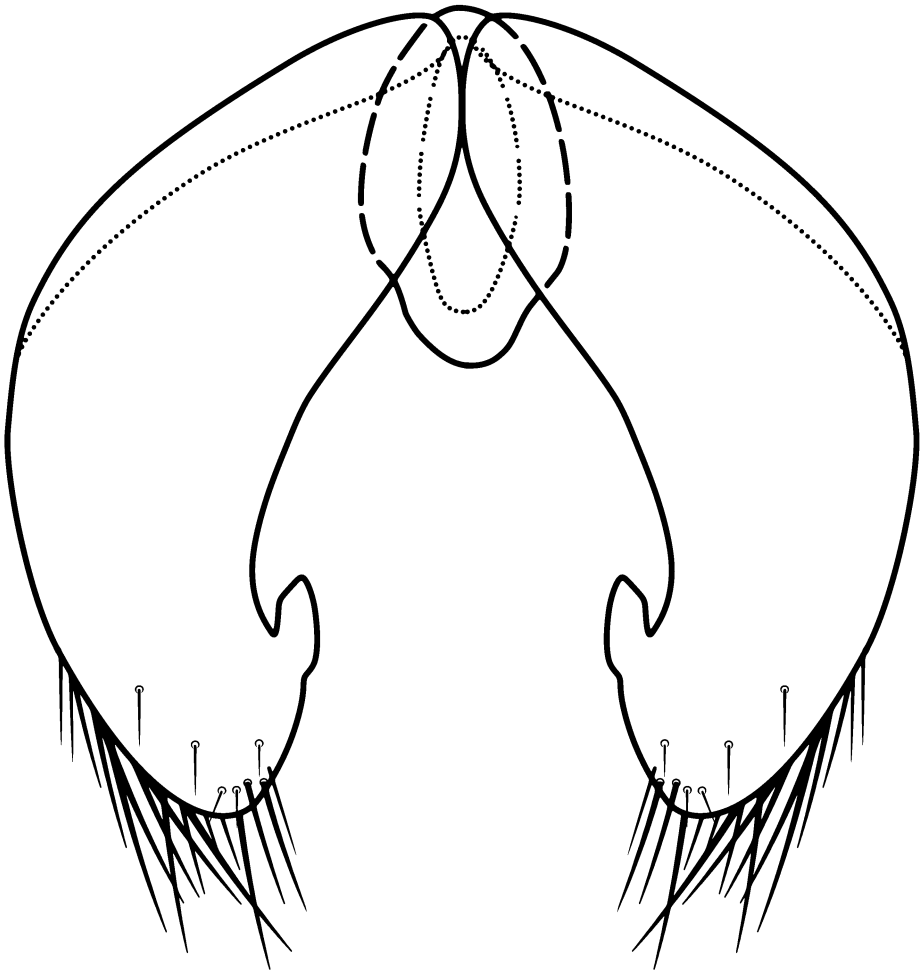

FIGURE 4. ***Ptomaphaginus similis* Schweiger, 1956:** abdominal segment IX ♂ (ventral view; holotype; based on Michel Perreau's photo).

Ptomaphaginus gracilis Schweiger, 1956

Schweiger, 1956: 535 (*Ptomaphaginus*; Type locality: CHINA, Fukien: Kuatun); Szymczakowski, 1964: 147 (*Ptomaphaginus*; note); Perreau, 2000: 372 (*Ptomaphaginus*; catalog).

Material examined. None.

Distribution. China (Fujian).

Ptomaphaginus franki Perreau, 1993

(Figs. 5; 6A–K)

Perreau, 1993: 343 (*Ptomaphaginus*; Type locality: CHINA, Taiwan: Fenchihu, 1409 m); Perreau, 1996: 290 (*Ptomaphaginus*; new distributional locations); Perreau, 2000: 371 (*Ptomaphaginus*; catalog); Hoshina & Sugaya, 2003: 127 (*Ptomaphaginus*; aedeagus figures).

Material examined. Paratype: CHINA, Taiwan: 1♂, Fenchihu, 1400 m, 10.V.1977, Klapperich leg. // PARATYPE, *Ptomaphaginus franki* M. Perreau det. 1992 // Coll. M. Perreau (CMPR).

Redescription. *Male*. EBL: 2.53 mm. Length of different body parts: HL : AL : PL : ELL = 0.41 : 0.78 : 0.66 : 1.37 mm; width: HW : EW : PW : ELW = 0.70 : 0.08 : 1.09 : 1.11 mm. Proportion of antennomeres from base to tip in μm (length × width): 124 × 41, 107 × 47, 63 × 42, 40 × 45, 44 × 48, 30 × 54, 57 × 71, 25 × 70, 63 × 79, 61 × 78, 109 × 79.

Habitus elongated oval, relatively convex and lustreless. Moderately pigmented: mostly chestnut brown: only mouthparts, basal five antennomeres and apical half of ultimate antennomere, elytral apex, and apical part of tarsi more or less yellowish. Dorsum continually clothed with fine, recumbent and sallow pubescence. Insertions of pubescence on dorsal surfaces of head, pronotum, scutellum, elytra and femora align along transverse striolations (Fig. 5).

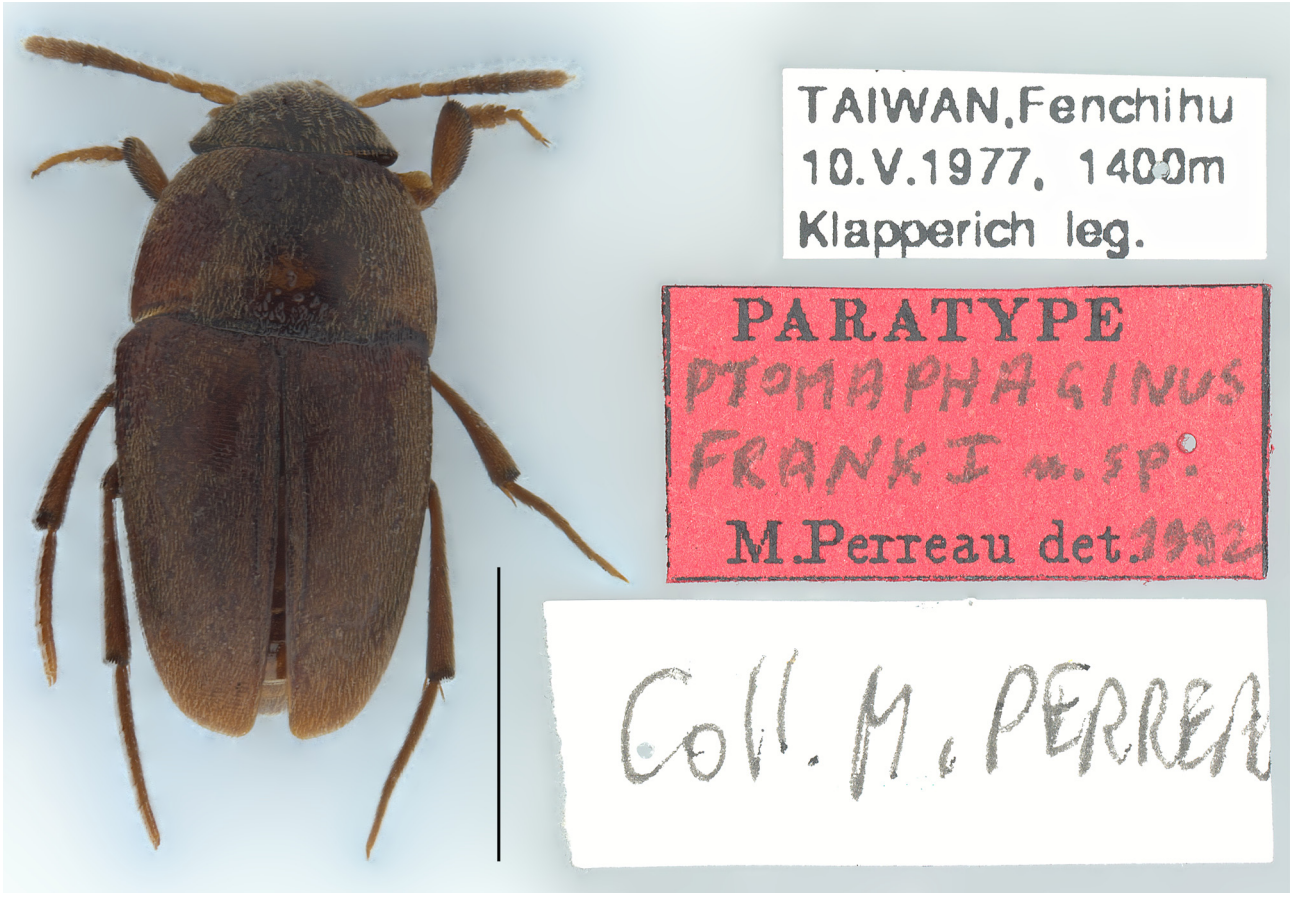

FIGURE 5. *Ptomaphaginus franki* Perreau, 1993 ♂: habitus (dorsal view; paratype). Scales: 1 mm.

Head short and convex, transversely and superficially striolated, interspaces narrower than that on pronotum, HW/HL = 1.72; anterior margin round. Compound eyes normally developed, EW/HW = 0.11. Antennae slender but not very long (Fig. 6A), AL/HW = 1.11; 5th slightly longer than 4th; 6th wider than long; 9th and 10th a little wider than long; 11th pear-like.

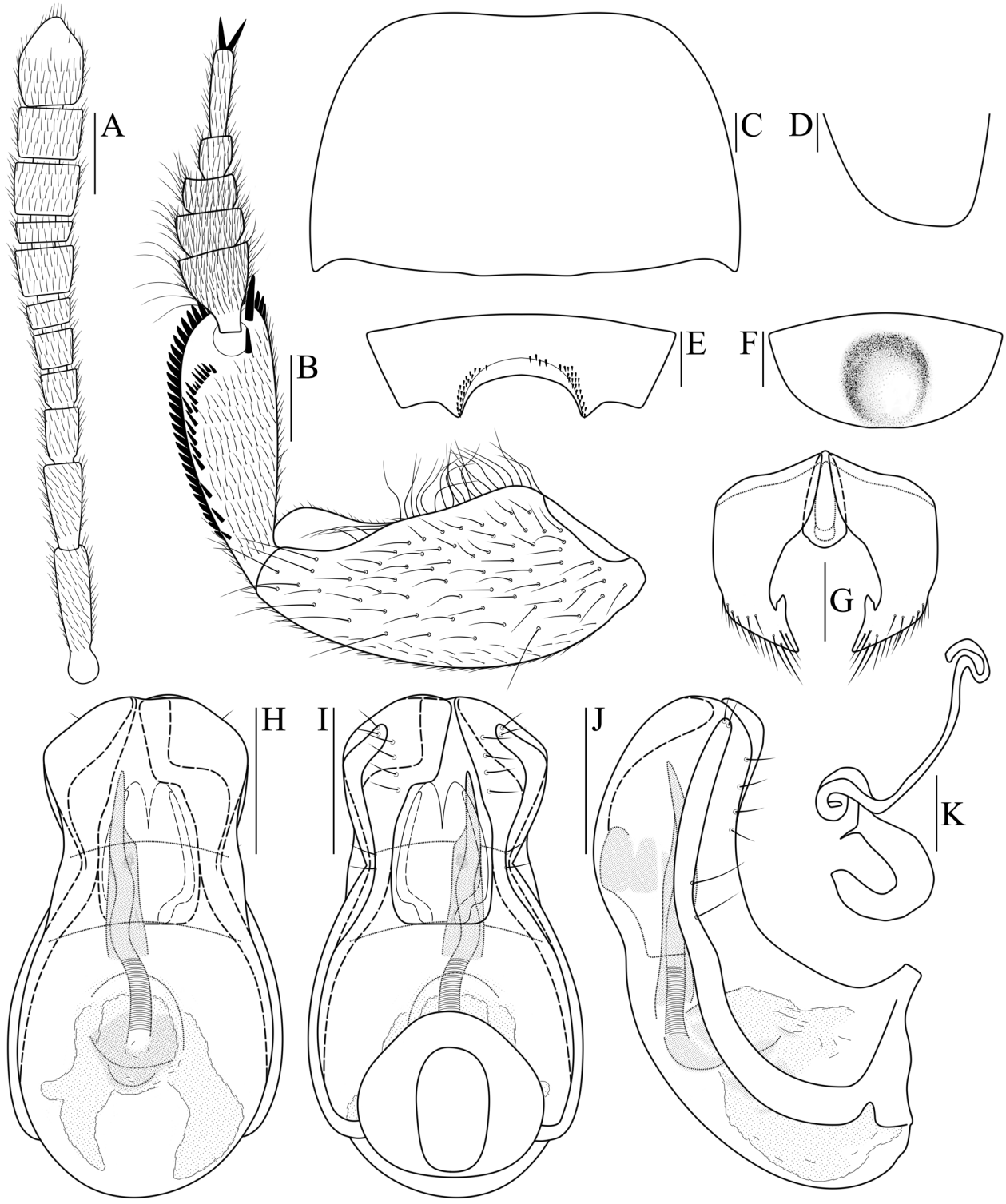

FIGURE 6. ***Ptomaphaginus franki*** **Perreau, 1993: A**, antenna ♂ (dorsal view); **B**, proleg ♂ (ventral view); **C**, pronotum ♂ (dorsal view); **D**, elytral apex ♂ (dorsoapical view); **E**, ventrite VII ♂ (ventral view); **F**, ventrite VIII ♂ (ventral view); **G**, abdominal segment IX ♂ (ventral view); **H**, aedeagus (dorsal view); **I**, aedeagus (ventral view); **J**, aedeagus (lateral view); **K**, spermatheca (after Perreau, 1993). Scales: 0.1 mm.

Pronotum transverse and convex (Fig. 6C), widest directly before corners, PW/PL = 1.66. Sides slightly curved, narrowing from posterior to anterior; hind corners drawn out and blunt. Posterior margin with distinct postero-lateral emargination. Surface transversely striolated, SP: 46–49, interspaces narrower than that on elytra.

Elytra of medium length and weakly convex, widest directly after base, ELL/EW = 1.24. Sides feebly curved, gradually narrowing from base to apices; apices obliquely truncated (Fig. 6D). Surface transversely striolated, SE: 89–92. Metathoracic wings fully developed.

Prolegs robust, with basal three protarsomeres moderately expanded (Fig. 6B): TW/BTW = 1.35. Spinal arrangement on ventral side of protibia as shown in Fig. 6B. Profemora wider than protibiae, and carried strong and long hairs on ventral side. Mesotibiae arcuate.

Ventrite VII with two large teeth at posterior margin, and many small spines located around middle emargination (Fig. 6E). Ventrite VIII with a large fossa subround and moderately shallow, almost not emarginate posteriorly (Fig. 6F). Segment IX: spiculum gastrale wide, widely rounded at posterior end (Fig. 6G).

Aedeagus stout and distinctly incurved around middle in dorsal view (Fig. 6H): median lobe widest before base; parameres narrow, firmly attached to median lobe, strongly and sinuately curved, totally invisible before middle. Ventral operculum distinctly divided in apical part, each lobe narrowly rounded apically (Fig. 6I). In lateral view, median lobe very thick and strongly bent ventrad at about apical half, apex almost not thinned, and four ventrally-oriented setae inserted below apex as well as two just before middle (Fig. 6J). Internal stylus wide, multiannulate at about basal 1/3.

Female. Unexamined. Spermatheca 'C' shape (Fig. 6K; after Perreau, 1993).

Distribution: China (Taiwan).

Remarks. For *Ptomaphaginus* species from China, only this one has aedeagus distinctly incurved around middle when viewed dorsally, and parameres strongly and sinuately curved, totally invisible before middle.

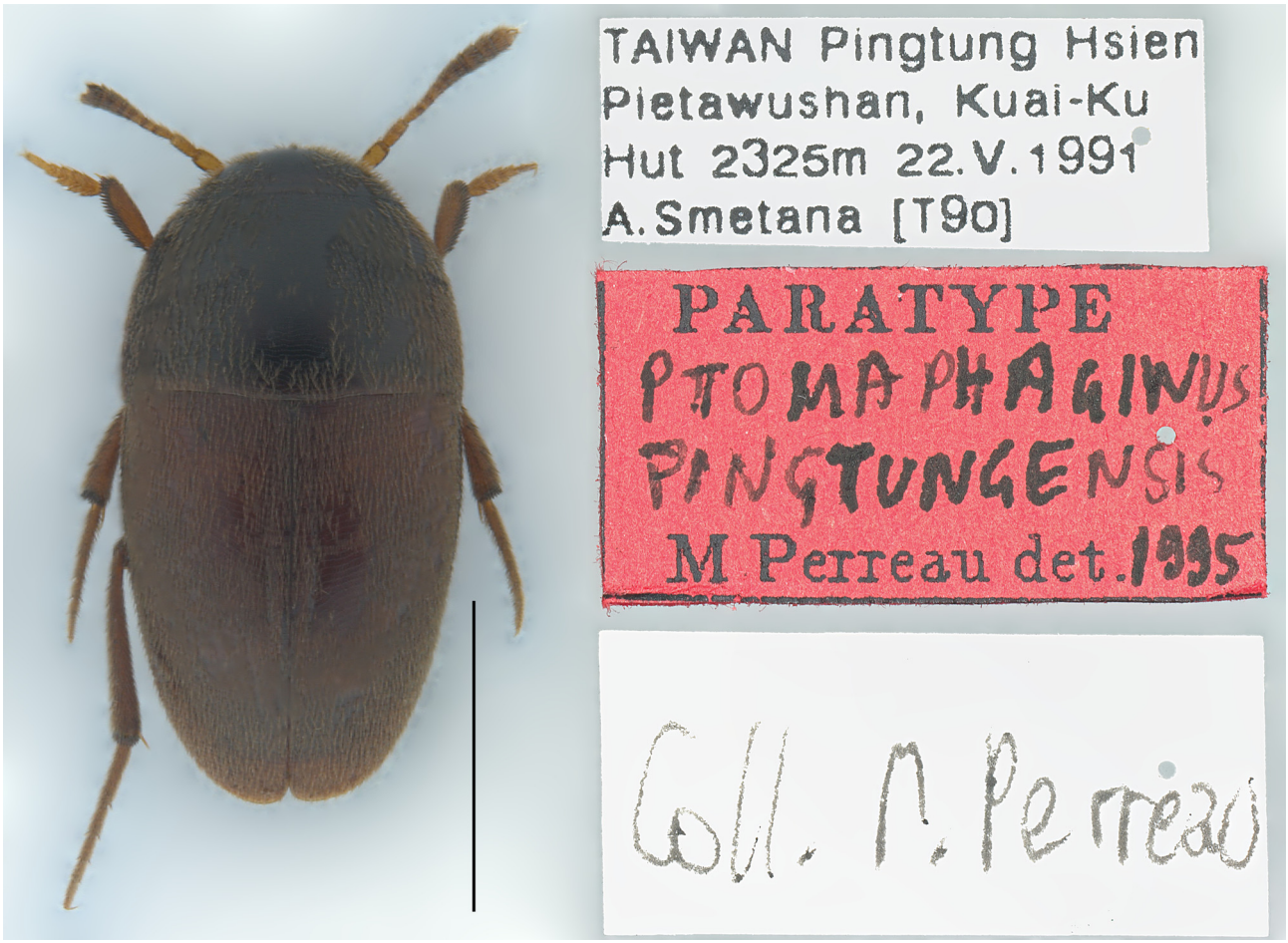

FIGURE 7. ***Ptomaphaginus pingtungensis*** **Perreau, 1996 ♂:** habitus (dorsal view; paratype). Scales: 1 mm.

***Ptomaphaginus pingtungensis* Perreau, 1996**
(Figs. 7; 8A–K)

Perreau, 1996: 287 (*Ptomaphaginus*; Type locality: CHINA, Taiwan: Pingtung Hsien, Pietawushan, 2000 m); Perreau, 2000: 374 (*Ptomaphaginus*; catalog).

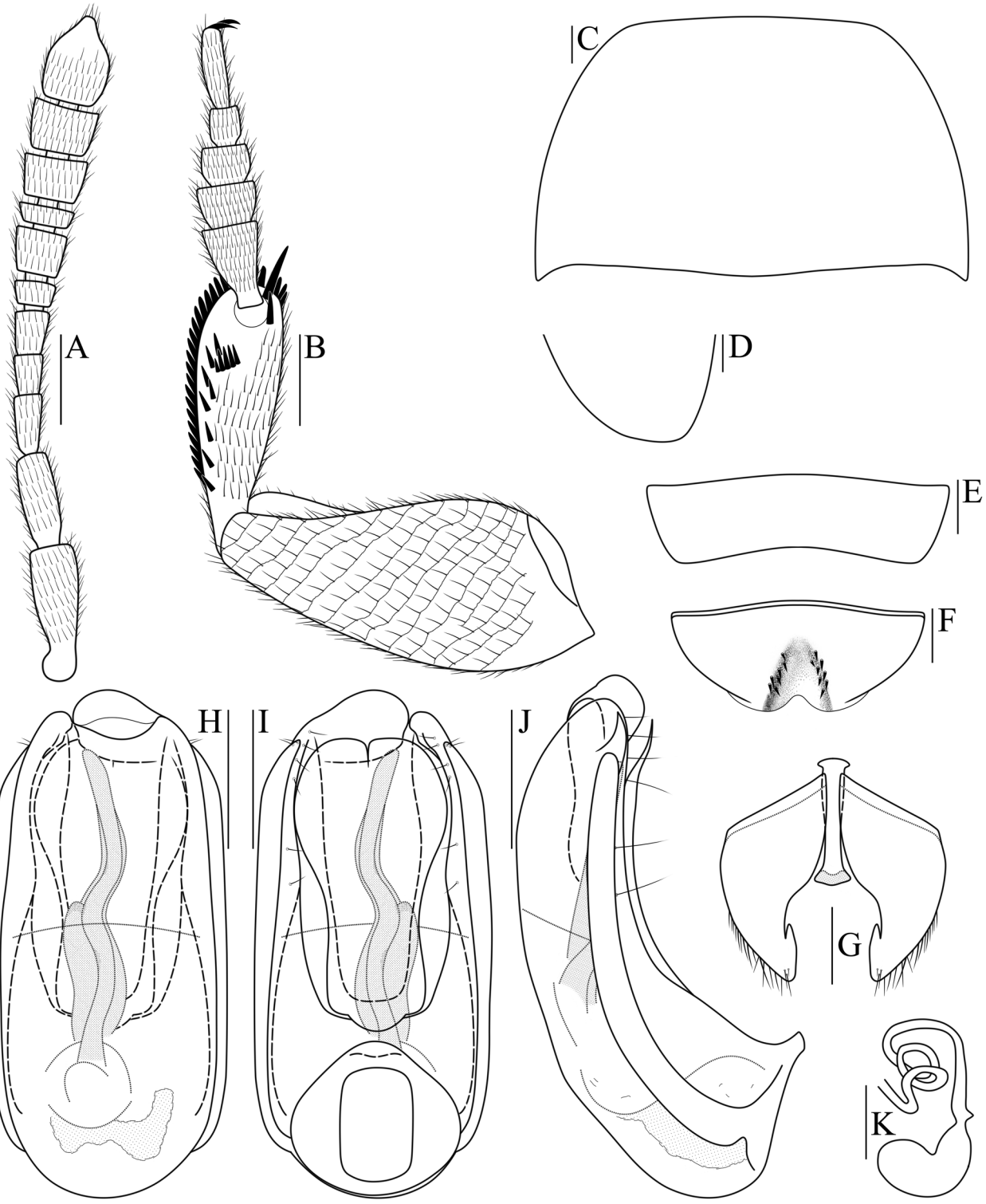

FIGURE 8. ***Ptomaphaginus pingtungensis* Perreau, 1996: A**, antenna ♂ (dorsal view); **B**, proleg ♂ (ventral view); **C**, pronotum ♂ (dorsal view); **D**, elytral apex ♂ (dorsoapical view); **E**, ventrite VII ♂ (ventral view); **F**, ventrite VIII ♂ (ventral view); **G**, abdominal segment IX ♂ (ventral view); **H**, aedeagus (dorsal view); **I**, aedeagus (ventral view); **J**, aedeagus (lateral view); **K**, spermatheca (after Perreau, 1996). Scales: 0.1 mm.

Material examined. Paratype: CHINA, Taiwan: 1♂, Pingtung Hsien, Pietawushan, Kuai-Ku Hut, 2325 m, 22.V.1991, A. Smetana [T90] // PARATYPE, *Ptomaphaginus pingtungensis* M. Perreau det. 1995 // Coll. M. Perreau (CMPR).

Redescription. *Male*. EBL: 2.56 mm. Length of different body parts: HL : AL : PL : ELL = 0.43 : 0.71 : 0.69 : 1.33 mm; width: HW : EW : PW : ELW = 0.72 : 0.09 : 1.15 : 1.17 mm. Proportion of antennomeres from base to tip in μm (length × width): 117 × 51, 104 × 40, 66 × 31, 44 × 32, 49 × 38, 27 × 45, 48 × 56, 20 × 61, 46 × 69, 50 × 72, 98 × 69.

Habitus elongated oval, relatively convex and lustreless. Moderately pigmented: mostly chestnut brown; only mouthparts, basal five antennomeres and apical half of ultimate antennomere, elytral apex, and tarsi yellowish. Dorsum continually clothed with fine, recumbent and sallow pubescence. Insertions of pubescence on dorsal surfaces of head, pronotum, scutellum, elytra and femora align along transverse striolations (Fig. 7).

Head moderately short and convex, transversely and superficially striolated, interspaces narrower than that on pronotum, HW/HL = 1.65; anterior margin round. Compound eyes slightly reduced, EW/HW = 0.09. Antennae slender (Fig. 8A), AL/HW = 0.99; 5th longer than 4th; 6th, 9th and 10th wider than long; 11th pear-like.

Pronotum transverse and convex (Fig. 8C), widest just before hind corners, PW/PL = 1.67. Sides curved, narrowing from posterior to anterior; hind corners drawn out and slightly acute. Posterior margin with distinct postero-lateral emargination. Surface transversely striolated, SP: 44–46, interspaces narrower than that on elytra.

Elytra short and weakly convex, widest at about basal 1/3, ELL/EW = 1.13. Sides curved, gradually narrowing from base to apices; apices somewhat obliquely truncated (Fig. 8D). Surface transversely striolated, SE: 67–70. Metathoracic wings fully developed.

Prolegs robust, with basal three protarsomeres not much expanded (Fig. 8B): TW/BTW = 1.52. Spinal arrangement on ventral side of protibia as shown in Fig. 8B. Profemora wider than protibiae, and hairs on ventral side similar to that of protibiae. Mesotibiae arcuate.

Ventrite VII simple (Fig. 8E). Ventrite VIII with a subtriangular fossa moderately deep, several subacute spines bordered lateral sides of fossa, and distinctly emarginate posteriorly (Fig. 8F). Segment IX: spiculum gastrale slender, flared at posterior end (Fig. 8G).

Aedeagus oblong in dorsal view (Fig. 8H): median lobe widest around middle and slightly narrowed to both ends; opening of genital orifice trended to cut right margin of median lobe; right apical expansion regularly and subroundly stuck out at apex; parameres slightly widened towards apex, firmly attached to median lobe. Ventral operculum invertedly piriform, only divided a little at apex, each lobe widely subrounded at apical margin (Fig. 8I). In lateral view, median lobe gently bent ventrad, apex a little thinned, and four ventrally-oriented setae inserted below apex as well as two just before middle (Fig. 8J). Internal stylus wide.

Female. Unexamined. Spermatheca swollen at end (Fig. 8K; after Perreau, 1996).

Distribution. China (Taiwan).

Remarks. The aedeagi of *P. pingtungensis* Perreau, *P. guangxiensis* **sp. nov.**, *P. ruzickai* **sp. nov.**, and *P. shennongensis* **sp. nov.** are closely allied and easily confused. We compared them in detail with some selected but important morphological characters to show their differences and to make it easy for species identification (Table 1).

***Ptomaphaginus guangxiensis* sp. nov.**

Figs. 9A–M)

Type material. Holotype: CHINA, Guangxi: ♂, Napo, Nonghua, 960 m, 14.IV.1998, Hai-Sheng Zhou leg. (IZ-CAS). **Paratypes:** 4♂♂, 2♀♀, same data as holotype (IZ-CAS); 1♂, same data as holotype except: 1130 m, 13–14.IV.1998, Min Wu leg. (IZ-CAS).

Description. *Male*. EBL: 3.21 mm. Length of different body parts: HL : AL : PL : ELL = 0.48 : 0.81 : 0.79 : 1.81 mm; width: HW : EW : PW : ELW = 0.87 : 0.12 : 1.35 : 1.39 mm. Proportion of antennomeres from base to tip in μm (length × width): 137 × 37, 114 × 48, 75 × 43, 48 × 42, 54 × 48, 33 × 54, 63 × 71, 29 × 72, 62 × 80, 63 × 83, 102 × 90.

Habitus elongated oval, relatively convex and lustreless. Moderately pigmented: mostly chestnut brown; mouthparts, basal five antennomeres and apical half of ultimate antennomere, base of pronotum, elytral apex, and

tarsi yellowish. Dorsum continually clothed with fine, recumbent and sallow pubescence. Insertions of pubescence on dorsal surfaces of head, pronotum, scutellum, elytra and femora align along transverse striolations.

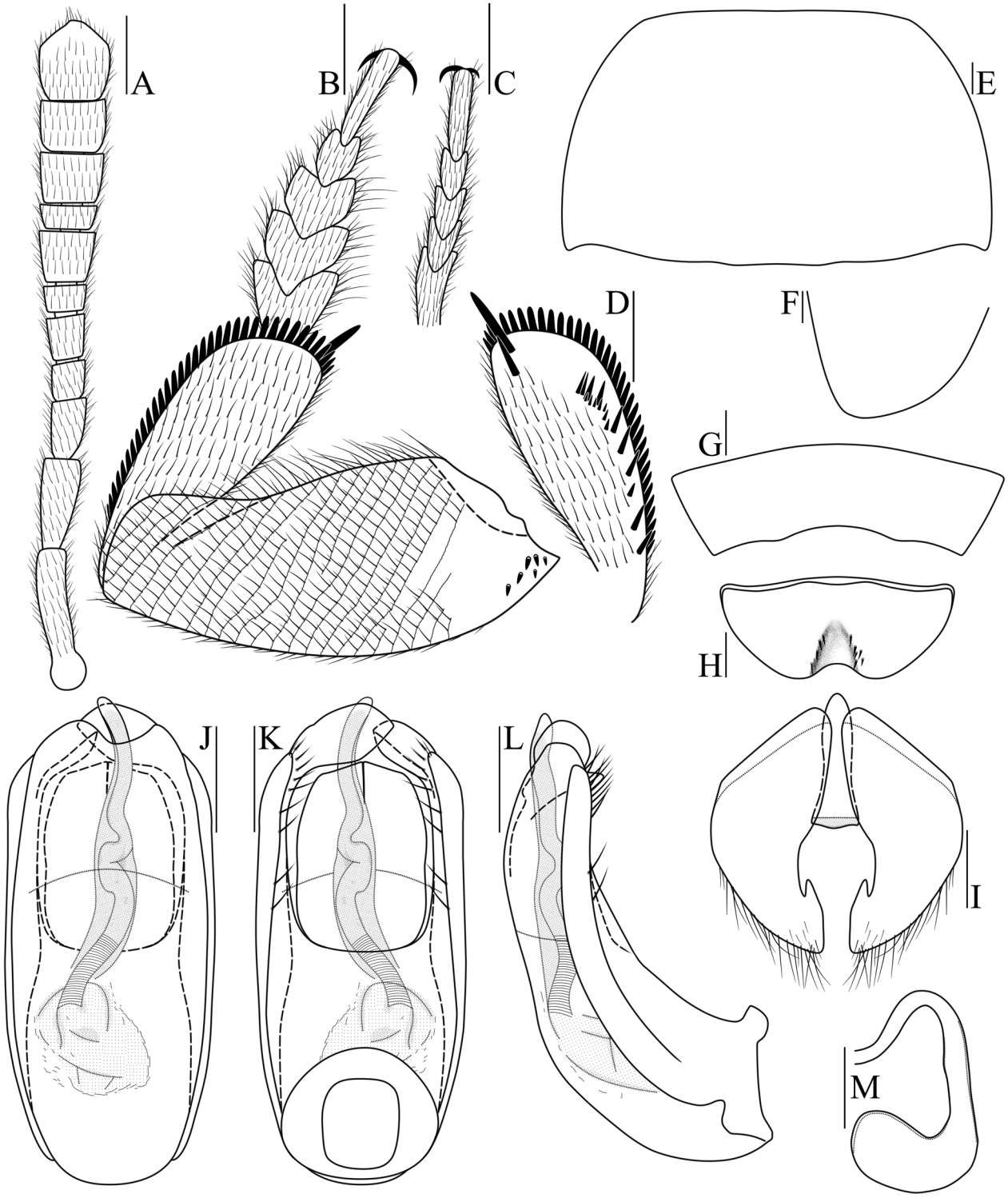

FIGURE 9. ***Ptomaphaginus guangxiensis*** **sp. nov.: A**, antenna ♂ (dorsal view); **B**, proleg ♂ (dorsal view); **C**, protarsus ♀ (dorsal view); **D**, protibia ♂ (ventral view); **E**, pronotum ♂ (dorsal view); **F**, elytral apex ♂ (dorsoapical view); **G**, ventrite VII ♂ (ventral view); **H**, ventrite VIII ♂ (ventral view); **I**, abdominal segment IX ♂ (ventral view); **J**, aedeagus (dorsal view); **K**, aedeagus (ventral view); **L**, aedeagus (lateral view); **M**, spermatheca. Scales: 0.1 mm.

Head very short and convex, transversely striolated, interspaces narrower than that on pronotum, HW/HL = 1.81; anterior margin round. Compound eyes well developed, EW/HW = 0.13. Antennae slender and relatively

short (Figs. 9A), AL/HW = 0.93; 5th longer than 4th; 6th wider than long; 9th similar to 10th, wider than long; 11th pear-like.

Pronotum moderately transverse and convex (Fig. 9E), widest just before hind corners, PW/PL = 1.70. Sides regularly curved, narrowing from posterior to anterior; hind corners drawn out and blunt. Posterior margin with distinct postero-lateral emargination. Surface transversely striolated, SP: 49–51, interspaces narrower than that on elytra.

Elytra slender and regularly convex, widest at base, ELL/EW = 1.31. Sides feebly curved, gradually narrowing from base to apices; apices nearly rounded (Fig. 9F). Surface transversely striolated, SE: 80–83. Metathoracic wings fully developed.

Prolegs robust, with basal three protarsomeres strongly expanded (Fig. 9B): TW/BTW = 1.31. Spinal arrangement on ventral side of protibia as shown in Fig. 9D. Profemora wider than protibiae, and hairs on ventral side a little longer than that of protibiae, but much longer on inner margin. Mesotibiae moderately arcuate.

Ventrite VII slightly bisinuated at posterior margin (Fig. 9G). Ventrite VIII with a subtriangular fossa moderately deep, several subacute spines bordered lateral sides of fossa, and distinctly emarginate posteriorly (Fig. 9H). Segment IX: spiculum gastrale wide, flared at posterior end (Fig. 9I).

TABLE 1. Selected important morphological differences in related *Ptomaphaginus* species.

	P. pingtungensis	*P. guangxiensis*	*P. ruzickai*	*P. shennongensis*
EBL (mm)	2.56	3.32	2.54	2.53
HW/HL	1.65	1.81	1.66	1.73
ELL/EW	1.13	1.31	1.23	1.28
TW/BTW	1.52	1.31	1.27	1.3
SP	49–51	44–46	37–39	37–40
SE	80–83	67–70	69–72	67–69
ventrite VII	simple (Fig. 8E)	slightly bisinuated at posterior margin (Fig. 9G)	with two moderately strong teeth at posterior margin and several blunt spines located on teeth (Fig. 15G)	slightly bisinuated at posterior margin (Fig. 16G)
ventrite VIII	several subacute spines bordered lateral sides of subtriangular fossa (Fig. 8F)	several subacute spines bordered lateral sides of subtriangular fossa (Fig. 9H)	several blunt spines bordered lateral sides of subtriangular fossa (Fig. 15H).	no spines bordered lateral sides of subtriangular fossa (Fig. 16H).
spiculum gastrale	slender (Fig. 8G)	wide (Fig. 9I)	wide (Fig. 15I).	wide (Fig. 16I).
right apical expansion	regularly and subroundly stuck out at apex (Fig. 8H)	regularly curved at apex (Fig. 9J)	strongly and roundly stuck out at apex (Fig. 15J)	moderately and roundly stuck out at apex (Fig. 16J)
parameres	not reaching apical margin of median lobe and slightly widened towards apex (Fig. 8H)	not reaching apical margin of median lobe and moderately widened towards apex (Fig. 9J)	not reaching apical margin of median lobe and distinctly widened at apical part (Fig. 15J)	reaching apical margin of median lobe and distinctly widened at apical part (Fig. 16J)
ventral operculum	invertedly piriform, only divided a little at apex, each lobe widely subrounded at apical margin (Fig. 8I)	broad, only divided in apical part, each lobe feebly emarginate at apical margin (Fig. 9K)	broad, only divided in apical part, each lobe feebly emarginate at apical margin (Fig. 15K)	broad, only divided in apical part, each lobe slightly emarginate at apical margin (Fig. 16K)

Aedeagus oblong in dorsal view (Fig. 9J): median lobe widest around middle and gently narrowed to both ends; opening of genital orifice trended to cut right margin of median lobe; right apical expansion regularly curved at apex; parameres moderately widened towards apex, firmly attached to median lobe. Ventral operculum broad, only divided in apical part, each lobe feebly emarginate at apical margin (Fig. 9K). In lateral view, median lobe gently bent ventrad, apex a little thinned, and several ventrally-oriented setae inserted below apex as well as two at middle (Fig. 9L). Internal stylus wide, multiannulate at about basal 1/3.

Female. Similar to male in general appearance, except for the following characters: protarsi normal (Fig. 9C), profemora without long hairs on ventral side and ventrite VIII regularly rounded posteriorly. Spermatheca swollen at end (Fig. 9M).

Distribution. China (Guangxi).

Etymology. The specific epithet is from the Chinese name (Pinyin) of the type locality "Guangxi", an autonomous region in southern China.

Remarks. Table 1 shows some important difference of four closed-allied species: *P. pingtungensis* Perreau, *P. guangxiensis* **sp. nov.**, *P. ruzickai* **sp. nov.**, and *P. shennongensis* **sp. nov.**

***Ptomaphaginus gutianshanicus* sp. nov.**
(Figs. 1A–K; 10A–J)

Type material. Holotype: CHINA, Zhejiang: ♂, Gutianshan [=Mt. Gutian], 296–402 m, broadleaved mixed forest, pitfall trap, 30.IV–3.V.2010, Chong-Ling Liu leg. (IZ-CAS). **Paratypes:** 20♂♂, 48♀♀, same data as holotype (IZ-CAS); 2♀♀, same data as holotype except: 446–715 m, 11–14.VI.2009 (IZ-CAS); 1♀, same data as holotype except: 296 m, 20–23.VI.2009 (IZ-CAS); 2♀♀, same data as holotype except: 500–750 m, 22–25.VI.2009 (IZ-CAS); 1♀, same data as holotype except: 429 m, 2–5.VIII.2009 (IZ-CAS); 1♀, same data as holotype except: 446–715 m, 9–12.IX.2009 (IZ-CAS); 1♀, same data as holotype except: 560 m, 16–19.IX.2009 (IZ-CAS); 1♂, 1♀, same data as holotype except: 446–715 m, 23–27.IX.2009 (IZ-CAS); 1♀, same data as previous except: 19–22.X.2009 (IZ-CAS); 79♂♂, 114♀♀, same data as holotype except: 446–715 m, 1–4.V.2010 (IZ-CAS); 17♂♂, 37♀♀, same data as holotype except: 390–605 m, 2–5.V.2010 (IZ-CAS); 2♂♂, 2♀♀, same data as holotype except: 543–823 m, 10–13.V. 2010 (IZ-CAS); 6♂♂, 16♀♀, same data as holotype except: 308–605 m, 23–27.V.2010 (IZ-CAS); 7♂♂, 9♀♀, same data as holotype except: 446–823 m, 25–29.V.2010 (IZ-CAS).

Description. *Male*. EBL: 2.37 mm. Length of different body parts: HL : AL : PL : ELL = 0.40 : 0.73 : 0.65 : 1.23 mm; width: HW : EW : PW : ELW = 0.67 : 0.08: 1.12: 1.00 mm. Proportion of antennomeres from base to tip in μm (length × width): 127 × 39, 100 × 38, 53 × 32, 43 × 39, 46 × 44, 34 × 59, 51 × 69, 22 × 67, 62 × 75, 59 × 77, 115 × 76.

Habitus elongated oval, relatively convex and rather lustreless. Moderately pigmented: mostly chestnut brown, occiput somewhat darker; only mouthparts, antennae, elytral apex and tarsi yellowish. Dorsum continually clothed with fine, recumbent and sallow pubescence. Insertions of pubescence on dorsal surfaces of pronotum, scutellum, elytra and femora align along transverse striolations (Fig. 1A).

Head moderately short and gently convex, surface finely punctured, without visible transverse striolations, HW/HL = 1.67; anterior margin round. Compound eyes well developed, EW/HW = 0.12. Antennae slender but not very long (Fig. 10A), AL/HW = 1.10; 5th slightly longer than 4th; 6th wider than long; 9th and 10th slightly wider than long; 11th pear-like.

Pronotum moderately transverse and convex (Fig. 10D), widest at base, PW/PL = 1.72. Sides almost rectilinearly narrowing from posterior to anterior; hind corners drawn out and bluntly rouned. Posterior margin with distinct postero-lateral emargination. Surface transversely striolated, SP: 41–45, interspaces narrower than that on elytra.

Elytra of medium length and weakly convex, widest directly after base, ELL/EW = 1.23. Sides feebly curved, gradually narrowing from base to apices; apices obliquely truncated (Fig. 1A). Surface transversely striolated, SE: 65–68. Metathoracic wings fully developed.

Prolegs robust, with basal three protarsomeres strongly expanded (Fig. 10B): TW/BTW = 1.30. Spinal arrangement on ventral side of protibia as shown in Fig. 10B. Profemora wider than protibiae, and carried long hairs on ventral side. Mesotibiae feebly arcuate.

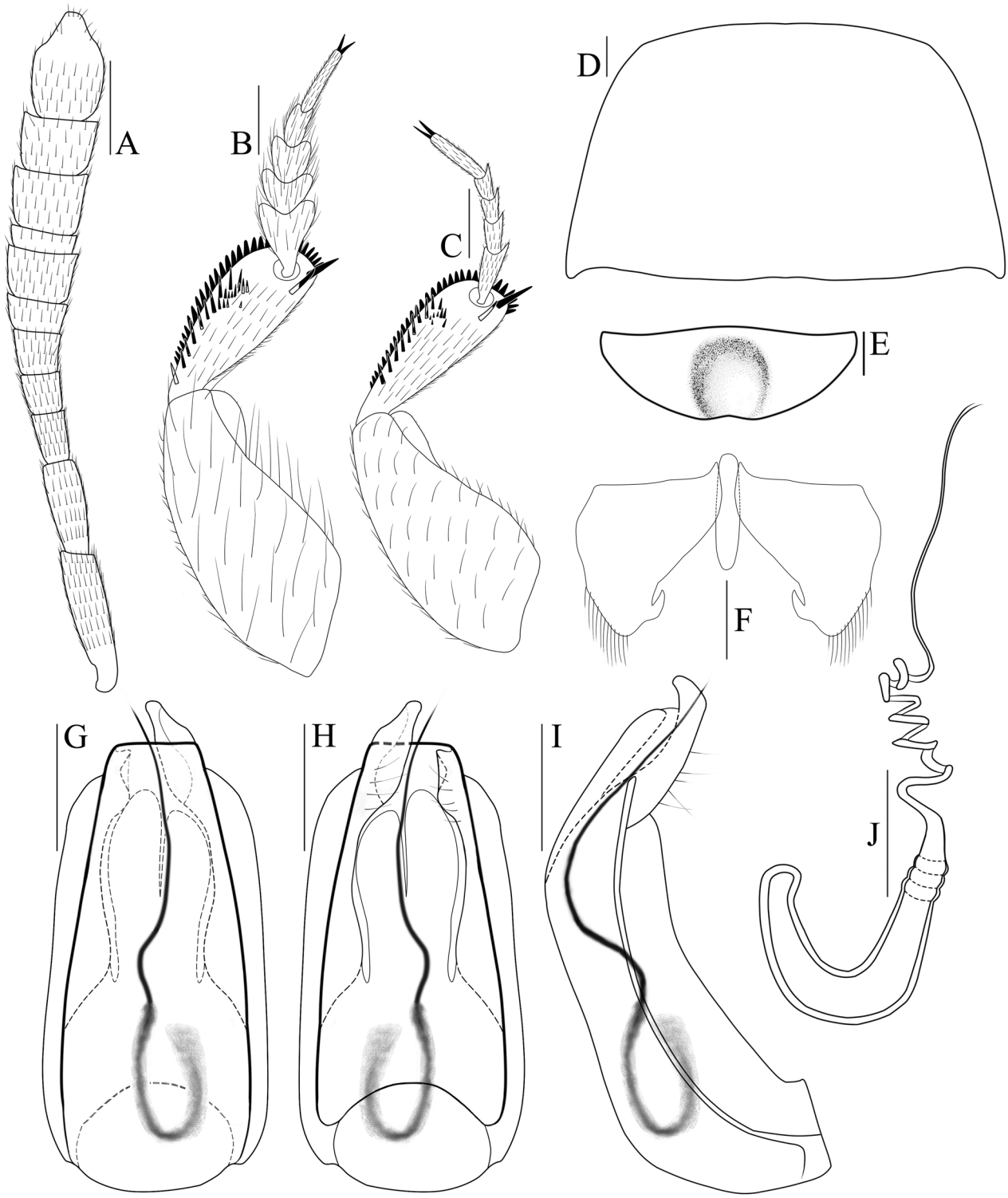

FIGURE 10. ***Ptomaphaginus gutianshanicus*** **sp. nov.: A**, antenna ♂ (dorsal view); **B**, proleg ♂ (ventral view); **C**, proleg ♀ (ventral view); **D**, pronotum ♂ (dorsal view); **E**, ventrite VIII ♂ (ventral view); **F**, abdominal segment IX ♂ (ventral view); **G**, aedeagus (dorsal view); **H**, aedeagus (ventral view); **I**, aedeagus (lateral view); **J**, spermatheca. Scales: 0.1 mm.

Ventrite VII simple. Ventrite VIII with a large fossa subround and shallow, slightly emarginate posteriorly (Fig. 10E). Segment IX: spiculum gastrale elongate, narrowly rounded at posterior end (Fig. 10F).

Aedeagus oblong in dorsal view (Fig. 10G): median lobe moderately narrowed from base to apex, apical margin truncated; right apical expansion weakly sclerotized, stuck out of apical margin, acuminating to a narrowly subround apex (shape somewhat variable); parameres relatively wide, firmly attached to median lobe. Ventral

operculum poorly sclerotized, limit inconspicuous, divided in apical half, two lobes asymmetrical, subrounded apically on different levels (Fig. 10H). In lateral view, median lobe of about apical 1/3 obviously bent ventrad, apex thinned, and several ventrally-oriented fine setae inserted at subapex (Fig. 10I). Internal stylus quite slender.

Female. Similar to male in general appearance, except for the following characters: protarsi normal, profemora without long hairs on ventral side (Fig. 10C) and ventrite VIII regularly rounded posteriorly. Spermatheca 'C' shape (Fig. 10J).

Distribution. China (Zhejiang).

Etymology. The specific epithet is from the Chinese name (Pinyin) of the type locality "Gutianshan" in Zhejiang province, China.

Remarks. This new species well resembles *P. similis* Schweiger from Fujian, China in general appearance and their type localities also with geographical proximity, but the new species has spiculum gastrale elongate, median lobe with apical margin truncated, and apex thinned in lateral view; while spiculum gastrale of the latter very widely subelliptic (Fig. 4), median lobe with apical margin round, and apex significantly thickened in lateral view. And this new species is also similar to *P. sauteri* (Portevin), but it can be distinguished from the latter by the shape of spiculum gastrale, apical expansion of aedeagus, wider parameres and the shape of ventral operculum. In addition, it is less common to collect a large number of *Ptomaphaginus* specimens at one location, and we learn from the collector that there were so many logs during his collection time at Gutianshan, this kind of ecological condition might have stimulated the rising of population density.

***Ptomaphaginus luoi* sp. nov.**
(Figs. 11A–K)

Type material. Holotype: CHINA, Hubei: ♂, Shennongjia, Jiuchonggangou, 870 m, sifting, 19.VII.1998, Tian-Hong Luo leg. (IZ-CAS).

Description. *Male*. EBL: 2.37 mm. Length of different body parts: HL : AL : PL : ELL = 0.39 : 0.61 : 0.59 : 1.32 mm; width: HW : EW : PW : ELW = 0.63 : 0.09 : 0.97 : 1.03 mm. Proportion of antennomeres from base to tip in μm (length × width): 109 × 32, 83 × 39, 47 × 34, 34 × 34, 36 × 41, 24 × 45, 49 × 60, 17 × 61, 46 × 70, 46 × 70, 80 × 74.

Habitus elongated oval, relatively convex and lustreless. Moderately pigmented: mostly chestnut brown; mouthparts, basal six antennomeres and apical half of ultimate antennomere, base of pronotum, elytral apex, and tarsi more or less yellowish. Dorsum continually clothed with fine, recumbent and sallow pubescence. Insertions of pubescence on dorsal surfaces of head, pronotum, scutellum, elytra and femora align along transverse striolations.

Head moderately short and convex, transversely and superficially striolated, interspaces narrower than that on pronotum, HW/HL = 1.64; anterior margin round. Compound eyes slightly reduced, EW/HW = 0.09. Antennae slender (Fig. 11A), AL/HW = 0.96; 5th slightly longer than 4th; 6th wider than long; 9th similar to 10th, wider than long; 11th pear-like.

Pronotum transverse and convex (Fig. 11D), widest at hind corners, PW/PL = 1.65. Sides regularly curved, narrowing from posterior to anterior; hind corners drawn out and bluntly rounded. Posterior margin with distinct postero-lateral emargination. Surface transversely striolated, SP: 38–40, interspaces narrower than that on elytra.

Elytra slender and regularly convex, widest at about basal 1/3, ELL/EW = 1.28. Sides feebly curved, gradually narrowing from base to apices; apices nearly rounded (Fig. 11E). Surface transversely striolated, SE: 68–70. Metathoracic wings fully developed.

Prolegs robust, with basal three protarsomeres moderately expanded (Fig. 11B): TW/BTW = 1.37. Spinal arrangement on ventral side of protibia as shown in Fig. 11C. Profemora wider than protibiae, hairs on ventral side moderately longer and stronger than that of protibiae, but much longer on inner margin. Mesotibiae moderately arcuate.

Ventrite VII with two large hook-like teeth at posterior margin (Fig. 11F). Ventrite VIII widely and moderately emarginate posteriorly (Fig. 11G). Segment IX: spiculum gastrale very wide, sharply acuminated towards anterior end (Fig. 11H).

Aedeagus broadly oval in dorsal view (Fig. 11I): median lobe widest before base and gently narrowed towards middle, then slightly widened again before middle, finally gradually narrowed towards apex; apical expansion

distinctly and narrowly stuck out at apex; parameres firmly attached to median lobe, somewhat widened at apical part and more or less hided before middle. Ventral operculum poorly sclerotized, limit inconspicuous, divided in apical half, two lobes asymmetrical, rounded apically at different levels (Fig. 11J). In lateral view, median lobe slightly bent ventrad, sharply acuminated to a subacute apex, and three ventrally-oriented setae inserted below apex as well as two just before middle (Fig. 11K). Internal stylus moderately wide, multiannulate at about basal 1/2.

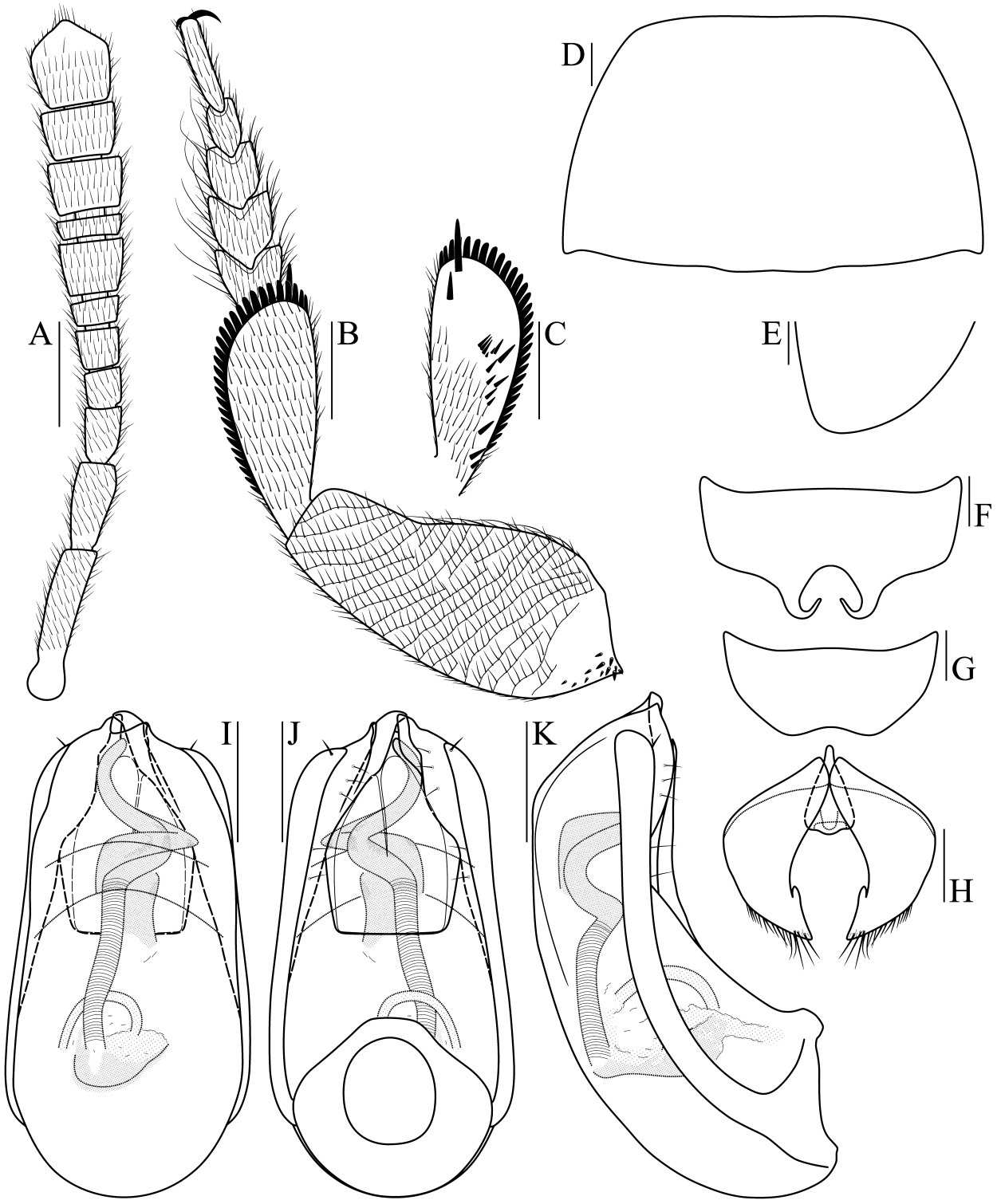

FIGURE 11. ***Ptomaphaginus luoi*** **sp. nov.** ♂**: A**, antenna (dorsal view); **B**, proleg (dorsal view); **C**, protibia (ventral view); **D**, pronotum (dorsal view); **E**, elytral apex (dorsoapical view); **F**, ventrite VII (ventral view); **G**, ventrite VIII (ventral view); **H**, abdominal segment IX (ventral view); **I**, aedeagus (dorsal view); **J**, aedeagus (ventral view); **K**, aedeagus (lateral view). Scales: 0.1 mm.

Female. Unknown.

Distribution. China (Hubei).

Etymology. The specific epithet is dedicated to Dr. Tian-Hong Luo (IZ-CAS, Beijing, China), the collector of this new species and a researcher on forensic coleopterology in our research team.

Remarks. This new species is sympatric with *P. shennongensis* **sp. nov.**, but it seems that the former is much more rare than the latter from specimen quantity. And more, this new species is one of those of the genus *Ptomaphaginus* that can be identified just from external morphology without aedeagal characters, for its two particularly large and hook-like teeth at the posterior margin of ventrite VII.

***Ptomaphaginus newtoni* sp. nov.**
(Figs. 12A–K)

Type material. Holotype: CHINA, Hainan: ♂, Wuzhishan [=Mt. Wuzhi], 620 m, rainforest, sifted from grotten woods, 9.XII.2007, Zhuo Yang leg. (IZ-CAS).

Description. *Male*. EBL: 2.89 mm. Length of different body parts: HL : AL : PL : ELL = 0.46 : 0.82 : 0.73 : 1.52 mm; width: HW : EW : PW : ELW = 0.77 : 0.08 : 1.18 : 1.20 mm. Proportion of antennomeres from base to tip in μm (length × width): 120 × 38, 108 × 48, 65 × 45, 49 × 48, 52 × 56, 36 × 62, 68 × 78, 24 × 77, 75 × 86, 71 × 88, 128 × 92.

Habitus elongated oval, relatively convex and lustreless. Mildly pigmented: mostly light brown; apical half of ultimate antennomere, base of pronotum somewhat lighter. Dorsum continually clothed with fine, recumbent and sallow pubescence. Insertions of pubescence on dorsal surfaces of pronotum, scutellum, elytra and femora align along transverse striolations.

Head moderately short and gently convex, finely punctured, without visible transverse striolations, HW/HL = 1.65; anterior margin round. Compound eyes normally developed, EW/HW = 0.10. Antennae slender and moderately long (Fig. 12A), AL/HW = 1.07; 5th slightly longer than 4th; 6th wider than long; 7th a little longer than wide; 9th and 10th a little wider than long; 11th pear-like.

Pronotum not rather transverse and convex (Fig. 12D), widest at about basal 1/5, PW/PL = 1.61. Sides slightly curved, narrowing from widest to anterior and gently narrowing to posterior; hind corners drawn out and blunt. Posterior margin with distinct postero-lateral emargination. Surface transversely striolated, SP: 47–49, interspaces as wide as that on elytra.

Elytra slender and convex, widest near base, ELL/EW = 1.27. Sides feebly curved, gradually narrowing from base to apices; apices somewhat obliquely truncated (Fig. 12E). Surface transversely striolated, SE: 79–83. Metathoracic wings fully developed.

Prolegs robust, with basal three protarsomeres strongly expanded (Fig. 12B): TW/BTW = 1.30. Spinal arrangement on ventral side of protibia as shown in Fig. 12C. Profemora wider than protibiae, carried long hairs on ventral side. Mesotibiae moderately arcuate.

Ventrite VII simple. Ventrite VIII moderately emarginate on posterior margin (Fig. 12B). Segment IX: spiculum gastrale constricted to a papillary posterior end.

Aedeagus elongated suboval in dorsal view (Fig. 12H): median lobe distinctly narrowed towards an asymmetrical apex; right apical expansion weakly sclerotized, subtruncated at apex, stuck out of apical margin of median lobe; parameres relatively narrow, firmly attached to median lobe, each with two setae rather long at apex. Ventral operculum poorly sclerotized, limit inconspicuous, divided in apical half, each lobe straight at apical margin (Fig. 12I). In lateral view, median lobe sharply bent ventrad at about apical 1/4, generally thinned towards apex, and several ventrally-oriented long setae inserted below apex (Fig. 12J). Internal stylus quite slender.

Female. Unknown.

Distribution. China (Hainan).

Etymology. The specific epithet is dedicated to Dr. Alfred F. Newton (FMNH, Chicago, USA), a well-known coleopterologist on Staphyliniformia, for his always generous help to our study.

Remarks. This new species is one of the two species (another one is *P. wuzhishanicus* **sp. nov.**) of Cholevinae recorded for the first time from Hainan Island. It well resembles *P. assimilis* Szymczakowski, 1972 from Vietnam in general appearance, but the new species has median lobe of aedeagus asymmetrical at apex, right apical

expansion subtruncated at apex, terminal setae of parameres rather long, median lobe sharply bent ventrad at about apical 1/4 in lateral view, and ventral operculum straight at apical margin; whereas the latter has median lobe of aedeagus symmetrical and truncated at apex, right apical expansion rounded at apex, terminal setae of parameres moderately long, median lobe sharply bent ventrad at apical 1/3 in lateral view, and ventral operculum widely round at apical margin.

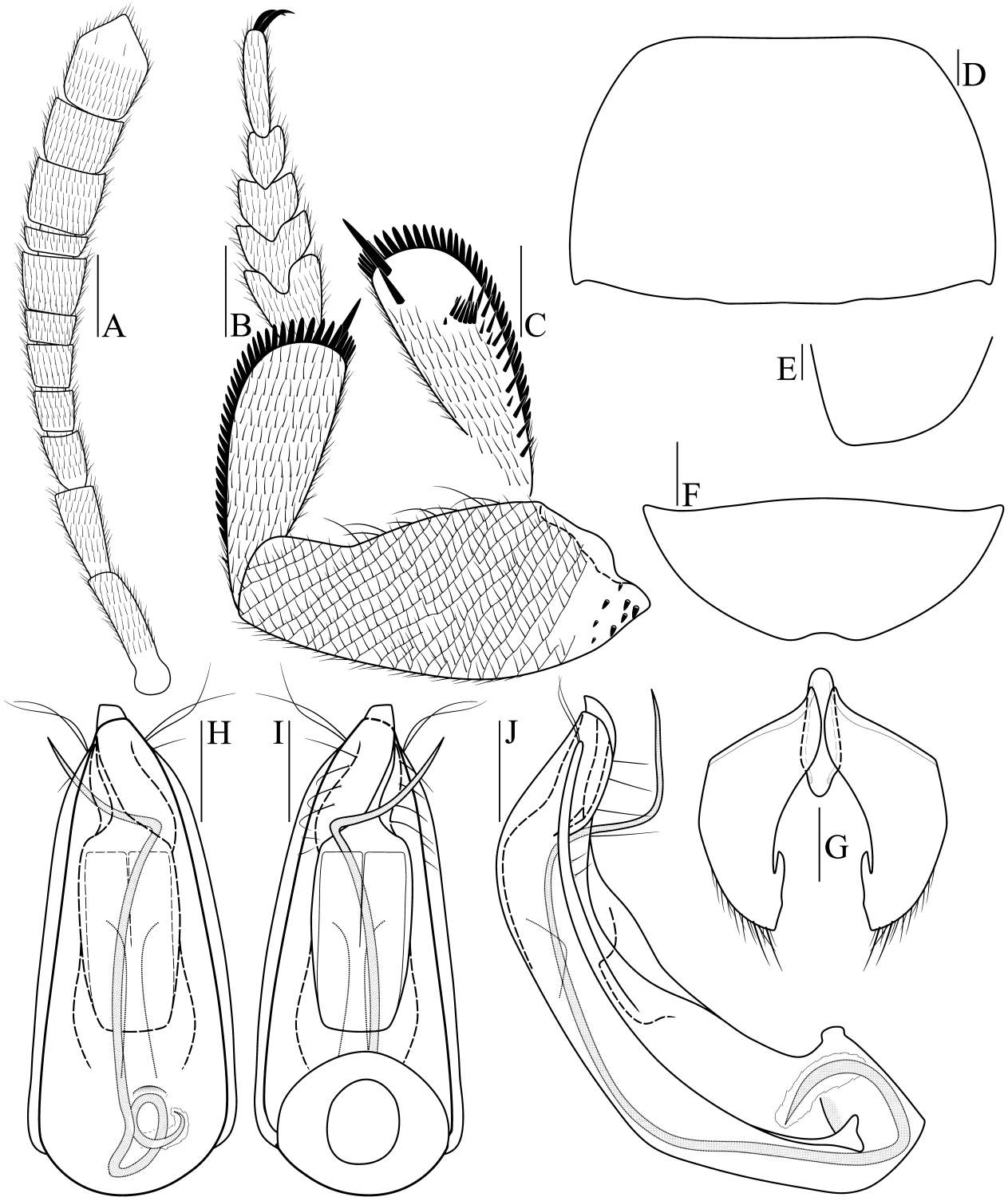

FIGURE 12. ***Ptomaphaginus newtoni*** **sp. nov. ♂: A**, antenna (dorsal view); **B**, proleg (dorsal view); **C**, protibia (ventral view); **D**, pronotum (dorsal view); **E**, elytral apex (dorsoapical view); **F**, ventrite VIII (ventral view); **G**, abdominal segment IX (ventral view); **H**, aedeagus (dorsal view); **I**, aedeagus (ventral view); **J**, aedeagus (lateral view). Scales: 0.1 mm.

***Ptomaphaginus perreaui* sp. nov.**
(Figs. 13A–I)

Type material. Holotype: CHINA, Yunnan: ♂, Jinghong forest park, 800 m, rainforest valley, pitfall trap, 26.II.2004, Jie Wu leg. (IZ-CAS).

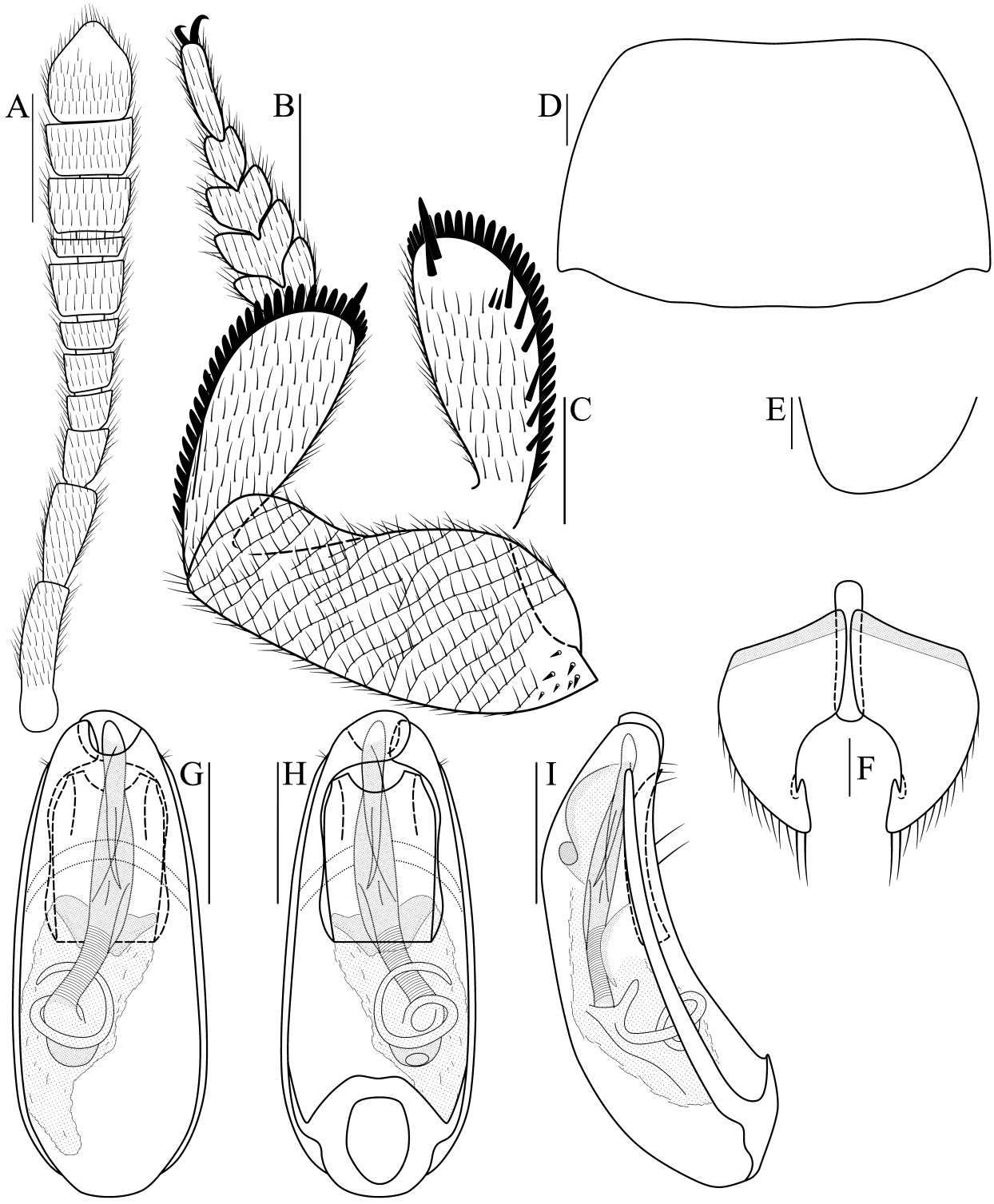

FIGURE 13. ***Ptomaphaginus perreaui* sp. nov.** ♂**: A**, antenna (dorsal view); **B**, proleg (dorsal view); **C**, protibia (ventral view); **D**, pronotum (dorsal view); **E**, elytral apex (dorsoapical view); **F**, abdominal segment IX (ventral view); **G**, aedeagus (dorsal view); **H**, aedeagus (ventral view); **I**, aedeagus (lateral view). Scales: 0.1 mm.

Description. *Male*. EBL: 2.05 mm. Length of different body parts: HL : AL : PL : ELL = 0.35 : 0.52 : 0.50 : 1.13 mm; width: HW : EW : PW : ELW = 0.59 : 0.08: 0.83: 0.91 mm. Proportion of antennomeres from base to tip in μm (length × width): 82 × 28, 78 × 35, 41 × 32, 28 × 35, 28 × 39, 22 × 46, 40 × 58, 13 × 56, 41 × 64, 40 × 67, 78 × 65.

Habitus elongated oval, relatively convex and lustreless. Moderately pigmented: mostly chestnut brown; occiput blakish brown; mouthparts, basal six antennomeres and apical half of ultimate antennomere, base of pronotum, about apical 1/3 of elytra, and tarsi yellowish. Dorsum continually clothed with fine, recumbent and sallow pubescence. Insertions of pubescence on dorsal surfaces of pronotum, scutellum, elytra and femora align along transverse striolations.

Head moderately short and convex, finely punctured, without visible transverse striolations, HW/HL = 1.67; anterior margin round. Compound eyes well developed, EW/HW = 0.13. Antennae short and condensed (Fig. 13A), AL/HW = 0.89; 4th antennomere as long as 5th; 6th transverse; 9th and 10th wider than long; 11th pear-like.

Pronotum transverse and convex (Fig. 13D), widest at base, PW/PL = 1.65. Sides almost rectilinearly narrowing from posterior to anterior; hind corners drawn out and bluntly rounded. Posterior margin with distinct postero-lateral emargination. Surface transversely striolated, SP: 31–34, interspaces as wide as that on elytra.

Elytra of medium length and convex, widest directly after base, ELL/EW = 1.23. Sides feebly curved, gradually narrowing from base to apices; apices nearly rounded (Fig. 13E). Surface transversely striolated, SE: 61–64. Metathoracic wings fully developed.

Prolegs robust, with basal three protarsomeres moderately expanded (Fig. 13B): TW/BTW = 1.37. Spinal arrangement on ventral side of protibia as shown in Fig. 13C. Profemora wider than protibiae, and hairs on ventral side similar to that of protibiae. Mesotibiae moderately arcuate.

Ventrite VII simple. Ventrite VIII regularly rounded posteriorly. Segment IX: spiculum gastrale elongate and moderately wide, sides nearly parallel, posterior end subrounded (Fig. 13F).

Aedeagus oval in dorsal view (Fig. 13G): median lobe gently narrowed towards apex; opening of genital orifice trended to cut right margin of median lobe; right apical expansion golfclub-like at apical part; parameres narrow, firmly attached to median lobe. Ventral operculum distinctly and widely emarginate, each short lobe obliquely truncated apically (Fig. 13H). In lateral view, median lobe slightly bent ventrad at about apical 1/3, apex a little thinned, and three ventrally-oriented setae inserted below apex as well as two just before middle (Fig. 13I). Internal stylus wide, multiannulate at about basal 1/3.

Female. Unknown.

Distribution. China (Yunnan).

Etymology. The specific epithet is dedicated to Dr. Michel Perreau (Université Paris 7, Paris, France), a famous taxonomist on Leiodidae, for his excellent work on Chinese fauna and generous help to our study.

Remarks. Obviously, this new species has the smallest body size of all species included here, EBL only approximately equal to 2.00 mm and its aedeagus is similar to *P. bengalicola* Perreau, 1991 from India, *P. bucculentus* Szymczakowski, 1974 from Nepal, *P. cherrapunjeensis* Perreau, 1991 from India, *P. minimus* Perreau, 1988 from Nepal and *P. palpaloides* Perreau, 1988 from Nepal, but it can be distinguished from those mentioned by the combination of its minute size, spiculum gastrale elongate and lateral sides parallel, ventral operculum distinctly and widely emarginate, and aedeagal shape when viewed laterally.

***Ptomaphaginus quadricalcarus* sp. nov.**
(Figs. 2A–F; 14A–I)

Type material. Holotype: CHINA, Yunnan: ♂, Xishuangbanna, Yao Region, 21°43.850′N 101°30.953′E, 1150 m, window trap, 4.X.2010, Liang Lü, Xi Zhang & Yu-Lingzi Zhou legg. (IZ-CAS).

Description. *Male*. EBL: 2.68 mm. Length of different body parts: HL : AL : PL : ELL = 0.47 : 0.88 : 0.69 : 1.42 mm; width: HW : EW : PW : ELW = 0.79 : 0.10 : 1.10 : 1.21 mm. Proportion of antennomeres from base to tip in μm (length × width): 146 × 42, 118 × 46, 68 × 40, 51 × 44, 58 × 47, 51 × 56, 67 × 71, 34 × 72, 82 × 84, 76 × 88, 129 × 89.

Habitus elongated oval, relatively convex and rather lustreless. Moderately pigmented: mostly chestnut brown; only mouthparts, antennae, protarsi, elytral apex, and distal half of meso- and metatarsi yellowish. Dorsum

continually clothed with fine, recumbent and sallow pubescence. Insertions of pubescence on dorsal surfaces of pronotum, scutellum, elytra and femora align along transverse striolations (Fig. 2A).

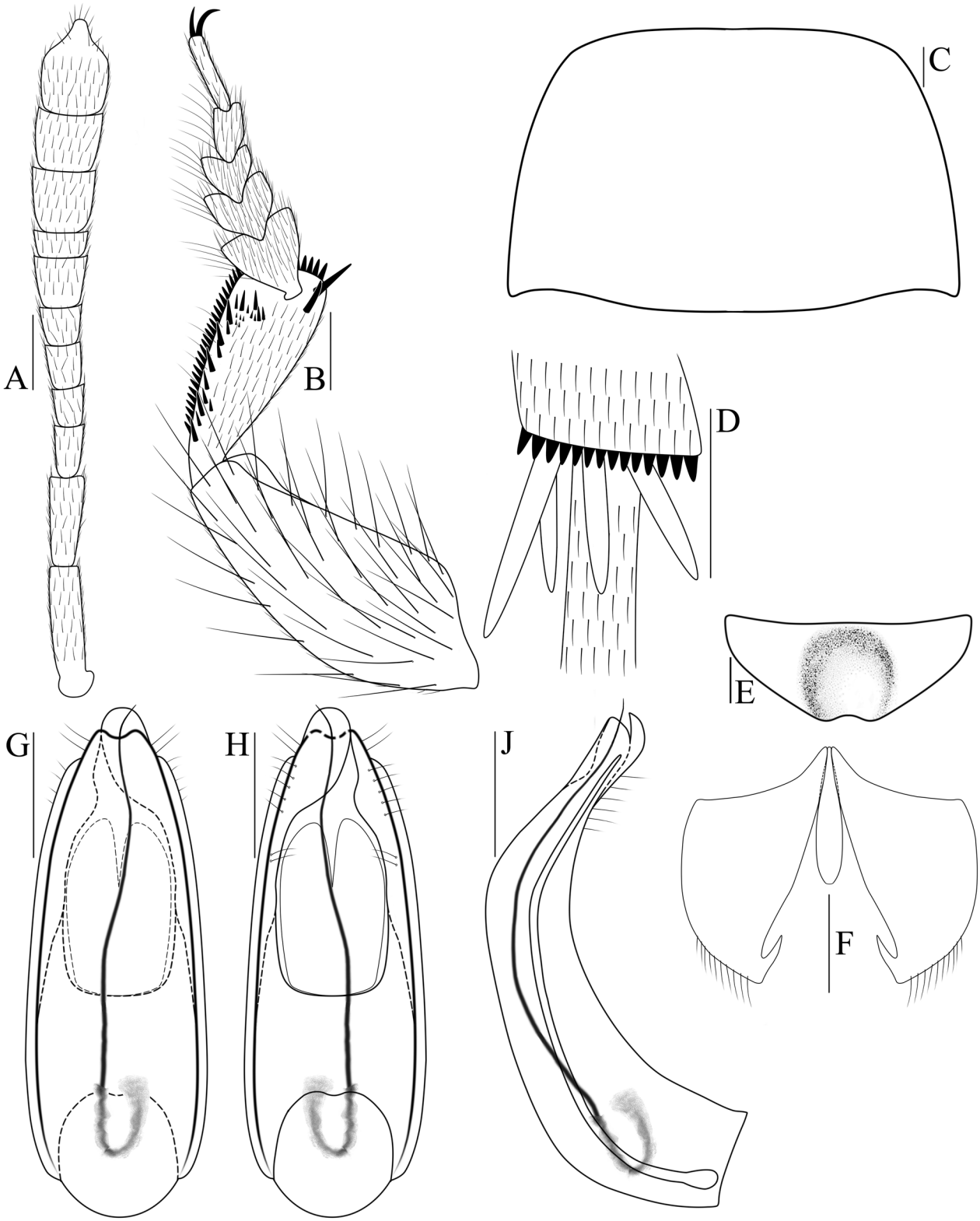

FIGURE 14. ***Ptomaphaginus quadricalcarus*** **sp. nov. ♂: A**, antenna (dorsal view); **B**, proleg (ventral view); **C**, pronotum (dorsal view); **D**, metatibial apex (ventral view); **E**, ventrite VIII (ventral view); **F**, abdominal segment IX (ventral view); **G**, aedeagus (dorsal view); **H**, aedeagus (ventral view); **J**, aedeagus (lateral view). Scales: 0.1 mm.

Head moderately short and gently convex, finely punctured, without visible transverse striolations, HW/HL = 1.66; anterior margin round. Compound eyes well developed, EW/HW = 0.13. Antennae slender but not very long (Fig. 14A), AL/HW = 1.12; 5th longer than 4th; 6th and 9th almost quadrate respectively; 10th slightly wider than long; 11th pear-like.

Pronotum not rather transverse and convex (Fig. 14C), widest at base, PW/PL = 1.59. Sides almost rectilinearly narrowing from posterior to anterior; hind corners drawn out and bluntly rouned. Posterior margin with distinct postero-lateral emargination. Surface transversely striolated, SP: 41–44, interspaces narrower than that on elytra.

Elytra relatively short and convex, widest at about basal 1/3, ELL/EW = 1.18. Sides curved, gradually narrowing from base to apices; apices obliquely truncated (Fig. 2A). Surface transversely striolated, SE: 64–66. Metathoracic wings fully developed.

Prolegs robust, with basal three protarsomeres very strongly expanded (Fig. 14B): TW/BTW = 1.15. Spinal arrangement on ventral side of protibia as shown in Fig. 14B. Profemora wider than protibiae, carried long and strong hairs on ventral side. Mesotibiae moderately arcuate. Metatibia not only born two spurs at inner side of distal end, but also two large spur-like spines at ventral side (Fig. 14D).

Ventrite VII simple, feebly bisinuated at posterior margin. Ventrite VIII with a large fossa subround and shallow, moderaterly emarginate posteriorly (Fig. 14E). Segment IX: spiculum gastrale subfusiform, narrowly rounded at posterior end (Fig. 14F).

Aedeagus rather elongated oval in dorsal view (Fig. 14G): median lobe generally narrowed towards apex, apical margin distinctly emarginate at middle; right apical expansion weakly sclerotized, rounded at apex, stuck out of apical margin of median lobe; parameres narrow, firmly attached to median lobe. Ventral operculum distinctly divided in apical part, each lobe narrowly subrounded apically (Fig. 14H). In lateral view, median lobe obviously bent ventrad, apical part strongly thinned and flattened, and several ventrally-oriented setae inserted below apex as well as two just before middle (Fig. 14J). Internal stylus quite slender.

Female. Unknown.

Distribution. China (Yunnan).

Etymology. The specific epithet is from the Latin words *quadr* (four) and *calcar* (spine) to refer to two inner spurs and two additional spur-like ventral spines on distal end of metatibia in this new species.

Remarks. The rather elongated oval aedeagus of this new species is similar to two Japanese species: *P. shibatai* Hayashi, 1969 and *P. okinawaensis* Hoshina & Sugaya, 2003, but it is easily to be distinguished from the latter two (even all other congeners) by the following characters: two inner spurs and additional two spur-like ventral spines on distal end of metatibia, median lobe distinctly emarginate at middle of apical margin and a special shape when aedeagus was viewed laterally.

***Ptomaphaginus ruzickai* sp. nov.**
(Figs. 15A–M)

Type material. Holotype: CHINA, Sichuan: ♂, Baoxing, Fengtongzhai, 1680–2080 m, broad-leaved mixed forest, pitfall trap, 30.VI–3.VII.2001, Xiao-Dong Yu & Hong-Zhang Zhou legg. (IZ-CAS). **Paratypes:** 2♂♂, 3♀♀, same data as holotype except: 1680–2080 m (IZ-CAS); 1♀, Baoxing, Guobayangou, 2290 m, bamboo forest + broad-leaved forest, pitfall trap, 1–4.VII.2001, Xiao-Dong Yu & Hong-Zhang Zhou legg. (IZ-CAS); 1♂, same data as previous except: 2507 m, broad-leaved forest, 4–7.VIII.2003, Xiao-Dong Yu legg. (IZ-CAS); 1♂, Baoxing, Longdong, Ganyanggou, 1965 m, broad-leaved mixed forest, pitfall trap, 9–12.VIII.2003, Xiao-Dong Yu leg. (IZ-CAS).

Description. *Male*. EBL: 2.54 mm. Length of different body parts: HL : AL : PL : ELL = 0.42 : 0.67 : 0.62 : 1.37 mm; width: HW : EW : PW : ELW = 0.70 : 0.09 : 1.06 : 1.12 mm. Proportion of antennomeres from base to tip in μm (length × width): 118 × 33, 101 × 41, 54 × 36, 41 × 37, 38 × 44, 23 × 50, 48 × 66, 22 × 66, 44 × 76, 48 × 78, 92 × 74.

Habitus elongated oval, relatively convex and lustreless. Moderately pigmented: mostly chestnut brown; mouthparts, basal five antennomeres and apical half of ultimate antennomere, base of pronotum, elytral apex, and tarsi yellowish. Dorsum continually clothed with fine, recumbent and sallow pubescence. Insertions of pubescence on dorsal surfaces of head, pronotum, scutellum, elytra and femora align along transverse striolations.

Head moderately short and convex, transversely and superficially striolated, interspaces narrower than that on pronotum, HW/HL = 1.66; anterior margin round. Compound eyes well developed, EW/HW = 0.13. Antennae slender (Fig. 15A), AL/HW = 0.96; 5th slightly shorter than 4th; 6th about twice wider than long; 9th similar to 10th, wider than long; 11th pear-like.

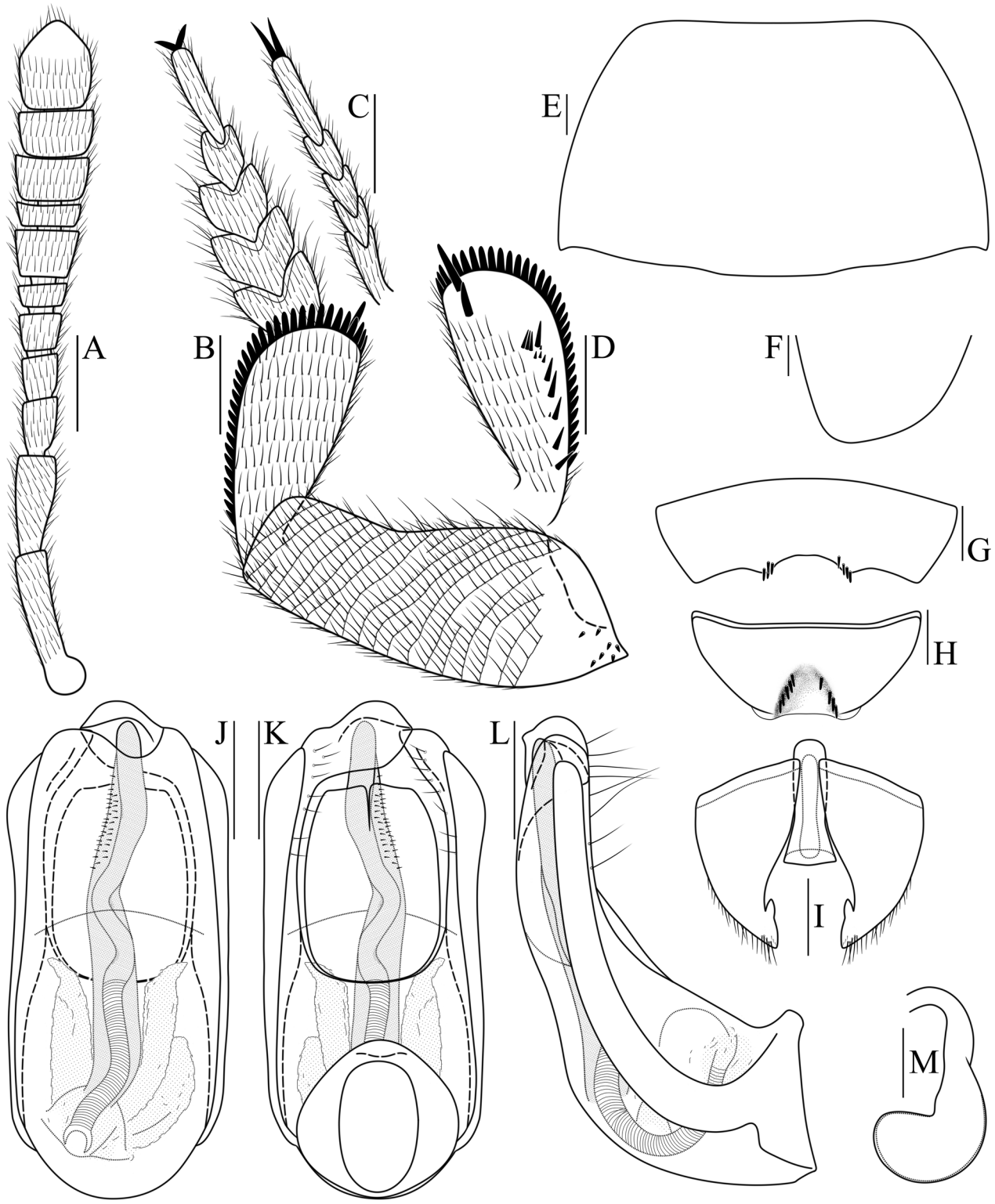

FIGURE 15. ***Ptomaphaginus ruzickai*** **sp. nov.: A**, antenna ♂ (dorsal view); **B**, proleg ♂ (dorsal view); **C**, protarsus ♀ (dorsal view); **D**, protibia ♂ (ventral view); **E**, pronotum ♂ (dorsal view); **F**, elytral apex ♂ (dorsoapical view); **G**, ventrite VII ♂ (ventral view); **H**, ventrite VIII ♂ (ventral view); **I**, abdominal segment IX ♂ (ventral view); **J**, aedeagus (dorsal view); **K**, aedeagus (ventral view); **L**, aedeagus (lateral view); **M**, spermatheca. Scales: 0.1 mm.

Pronotum moderately transverse and convex (Fig. 15E), widest at hind corners, PW/PL = 1.70. Sides regularly curved, narrowing from posterior to anterior; hind corners drawn out and blunt. Posterior margin with distinct postero-lateral emargination. Surface transversely striolated, SP: 37–39, interspaces narrower than that on elytra.

Elytra of medium length and regularly convex, widest at base, ELL/EW = 1.23. Sides feebly curved, gradually narrowing from base to apices; apices somewhat obliquely truncated (Fig. 15F). Surface transversely striolated, SE: 69–72. Metathoracic wings fully developed.

Prolegs robust, with basal three protarsomeres quite expanded (Fig. 15B): TW/BTW = 1.27. Spinal arrangement on ventral side of protibia as shown in Fig. 15D. Profemora wider than protibiae, carried long hairs on ventral side. Mesotibiae moderately arcuate.

Ventrite VII with two moderately strong teeth at posterior margin and several blunt spines located on teeth (Fig. 15G). Ventrite VIII with a subtriangular fossa moderately deep, several blunt spines bordered lateral sides of fossa, and widely emarginate posteriorly (Fig. 15H). Segment IX: spiculum gastrale wide, flared at posterior end (Fig. 15I).

Aedeagus oblong in dorsal view (Fig. 15J): median lobe widest below middle and gently narrowed to both ends; opening of genital orifice trended to cut right margin of median lobe; right apical expansion strongly and roundly stuck out at apex; parameres distinctly widened at apical part, firmly attached to median lobe. Ventral operculum broad, only divided in apical part, each lobe feebly emarginate at apical margin (Fig. 15K). In lateral view, median lobe slightly bent ventrad, apex a little thinned, and several ventrally-oriented setae inserted below apex as well as two just before middle (Fig. 15L). Internal stylus wide, multiannulate at about basal 1/3 and many spinules on left part of preapical area.

Female. Similar to male in general appearance, except for the following characters: protarsi normal (Fig. 15C), profemora without long hairs on ventral side and ventrites VII & VIII simple. Spermatheca very swollen at end (Fig. 15M).

Distribution. China (Sichuan).

Etymology. The specific epithet is dedicated to Dr. Jan Růžička (Czech University of Life Sciences, Prague, Czech Republic), a famous specialist on Agyrtidae, Silphidae and Leiodidae, for his kind help to our study.

Remarks. Table 1 shows some important difference of four closed-allied species: *P. pingtungensis* Perreau, *P. guangxiensis* **sp. nov.**, *P. ruzickai* **sp. nov.**, and *P. shennongensis* **sp. nov.**

***Ptomaphaginus shennongensis* sp. nov.**
(Figs. 16A–M)

Type material. Holotype: CHINA, Hubei: ♂, Shennongjia, Longmenhezhan, 1725 m, *Cyclobalanopsis* forest, pitfall trap, 28–30.VII.2002, Jie Wu leg. (IZ-CAS). **Paratypes:** 7♀♀, same data as holotype (IZ-CAS); 1♀, same data as holotype except: sifting, 28.VII.2002 (IZ-CAS); 1♂, 2♀, Shennongjia, Jiuchonggangou, 1240 m, pitfall trap, 18–21.VII.1998, Hong-Zhang Zhou leg. (IZ-CAS); 1♂, same data as previous except: sifting, Jun-Jian He leg. (IZ-CAS); 1♀, Shennongjia, Jiuchongwanjiagou, 900 m, sifting, 19.VII.1998, Hai-Sheng Zhou leg. (IZ-CAS); 1♂, Shennongjia, Guanmenshan, 1460 m, pitfall trap, 30.VII–11.VIII.1998, Hai-Sheng Zhou leg. (IZ-CAS).

Description. *Male*. EBL: 2.53 mm. Length of different body parts: HL : AL : PL : ELL = 0.39 : 0.66 : 0.62 : 1.42 mm; width: HW : EW : PW : ELW = 0.68 : 0.07 : 1.07 : 1.11 mm. Proportion of antennomeres from base to tip in μm (length × width): 115 × 34, 93 × 40, 60 × 38, 39 × 39, 38 × 46, 23 × 53, 46 × 66, 19 × 70, 47 × 79, 48 × 80, 96 × 80.

Habitus elongated oval, relatively convex and lustreless. Moderately pigmented: mostly chestnut brown; mouthparts, basal five antennomeres and apical half of ultimate antennomere, base of pronotum, and protarsi yellowish. Dorsum continually clothed with fine, recumbent and sallow pubescence. Insertions of pubescence on dorsal surfaces of head, pronotum, scutellum, elytra and femora align along transverse striolations.

Head short and convex, transversely and superficially striolated, interspaces narrower than that on pronotum, HW/HL = 1.73; anterior margin round. Compound eyes normally developed, EW/HW = 0.11. Antennae slender (Fig. 16A), AL/HW = 0.96; 5th as long as 4th; 6th wider than long; 9th similar to 10th, wider than long; 11th pear-like.

Pronotum moderately transverse and convex (Fig. 16E), widest just before hind corners, PW/PL = 1.72. Sides regularly curved, narrowing from posterior to anterior; hind corners drawn out and blunt. Posterior margin with

distinct postero-lateral emargination. Surface transversely striolated, SP: 37–40, interspaces narrower than that on elytra.

Elytra slender and regularly convex, widest at about basal 1/3, ELL/EW = 1.28. Sides slightly curved, gradually narrowing from base to apices; apices somewhat obliquely truncated (Fig. 16F). Surface transversely striolated, SE: 67–69. Metathoracic wings fully developed.

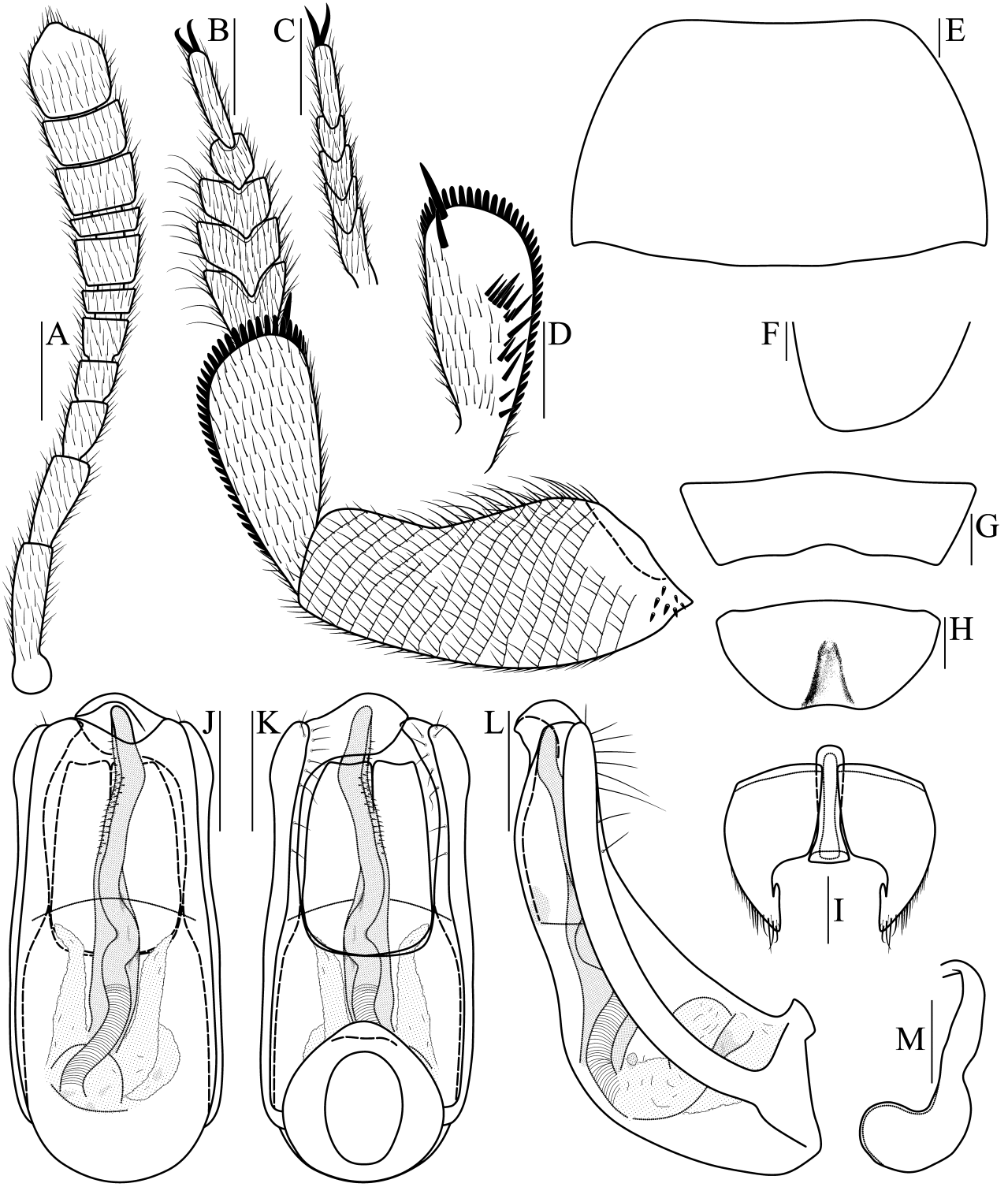

FIGURE 16. ***Ptomaphaginus shennongensis*** **sp. nov.: A**, antenna ♂ (dorsal view); **B**, proleg ♂ (dorsal view); **C**, protarsus ♀ (dorsal view); **D**, protibia ♂ (ventral view); **E**, pronotum ♂ (dorsal view); **F**, elytral apex ♂ (dorsoapical view); **G**, ventrite VII ♂ (ventral view); **H**, ventrite VIII ♂ (ventral view); **I**, abdominal segment IX ♂ (ventral view); **J**, aedeagus (dorsal view); **K**, aedeagus (ventral view); **L**, aedeagus (lateral view); **M**, spermatheca. Scales: 0.1 mm.

Prolegs robust, with basal three protarsomeres strongly expanded (Fig. 16B): TW/BTW = 1.30. Spinal arrangement on ventral side of protibia as shown in Fig. 16D. Profemora wider than protibiae, carried long hairs on ventral side. Mesotibiae moderately arcuate.

Ventrite VII slightly bisinuated at posterior margin (Fig. 16G). Ventrite VIII with a subtriangular fossa more or less narrow and shallow, widely emarginate posteriorly (Fig. 16H). Segment IX: spiculum gastrale wide, flared at posterior end (Fig. 16I).

Aedeagus oblong in dorsal view (Fig. 16J): median lobe widest below middle and slightly narrowed to both ends; opening of genital orifice trended to cut right margin of median lobe; right apical expansion moderately and roundly stuck out at apex; parameres long, reaching apical margin of median lobe and distinctly widened at apical part, firmly attached to median lobe. Ventral operculum broad, only divided in apical part, each lobe slightly emarginate at apical margin (Fig. 16K). In lateral view, median lobe gently bent ventrad, apex a little thinned, and several ventrally-oriented setae inserted below apex as well as two just before middle (Fig. 16L). Internal stylus wide, multiannulate at about basal 1/3 and many spinules on left part of preapical area.

Female. Similar to male in general appearance, except for the following characters: protarsi normal (Fig. 16C), ventral side of profemora without long hairs and ventrites VII & VIII simple. Spermatheca very swollen at end (Fig. 16M).

Distribution. China (Hubei).

Etymology. The specific epithet is from the Chinese name (Pinyin) of the type locality "Shennongjia" in Hubei province, China.

Remarks. Table 1 shows some important difference of four closed-allied species: *P. pingtungensis* Perreau, *P. guangxiensis* **sp. nov.**, *P. ruzickai* **sp. nov.**, and *P. shennongensis* **sp. nov.**

***Ptomaphaginus wenboi* sp. nov.**
(Figs. 17A–M)

Type material. Holotype: CHINA, Taiwan: ♂, Fushan, mouse carcass bait, IX.2007, Wen-Bo Huang leg. (NTUC). **Paratypes:** 3♂♂, 1♀, same data as holotype except: VI.2007 (2♂♂ in NTUC, and 1♂, 1♀ in IZ-CAS); 2♀♀, same data as holotype except: VIII.2007 (NTUC).

Description. *Male*. EBL: 2.89 mm. Length of different body parts: HL : AL : PL : ELL = 0.50 : 0.89 : 0.70 : 1.57 mm; width: HW : EW : PW : ELW = 0.80 : 0.11 : 1.26 : 1.30 mm. Proportion of antennomeres from base to tip in μm (length × width): 154 × 42, 115 × 47, 72 × 47, 50 × 49, 57 × 54, 40 × 62, 65 × 78, 26 × 78, 69 × 86, 66 × 86, 119 × 90.

Habitus elongated oval, relatively convex and lustreless. Moderately pigmented: mostly chestnut brown; only mouthparts, apical half of ultimate antennomere, and tarsi somewhat yellowish. Dorsum continually clothed with fine, recumbent and sallow pubescence. Insertions of pubescence on dorsal surfaces of pronotum, scutellum, elytra and femora align along transverse striolations.

Head relatively longer and gently convex, finely punctured, without visible transverse striolations, HW/HL = 1.59; anterior margin round. Compound eyes rather developed, EW/HW = 0.14. Antennae slender but not very long (Fig. 17A), AL/HW = 1.11; 5th longer than 4th; 6th wider than long; 7th longer than wide; 9th and 10th wider than long; 11th pear-like.

Pronotum rather transverse and convex (Fig. 17E), widest just before hind corners, PW/PL = 1.82. Sides slightly curved, narrowing from posterior to anterior; hind corners drawn out and relatively acute. Posterior margin with distinct postero-lateral emargination. Surface transversely striolated, SP: 46–48, interspaces narrower than that on elytra.

Elytra of medium length and convex, widest after base, ELL/EW = 1.20. Sides feebly curved, gradually narrowing from base to apices; apices somewhat obliquely truncated (Fig. 17F). Surface transversely striolated, SE: 78–80. Metathoracic wings fully developed.

Prolegs robust, with basal three protarsomeres not much expanded (Fig. 17B): TW/BTW = 1.55. Spinal arrangement on ventral side of protibia as shown in Fig. 17D. Profemora wider than protibiae, carried long hairs on ventral side. Mesotibiae moderately arcuate.

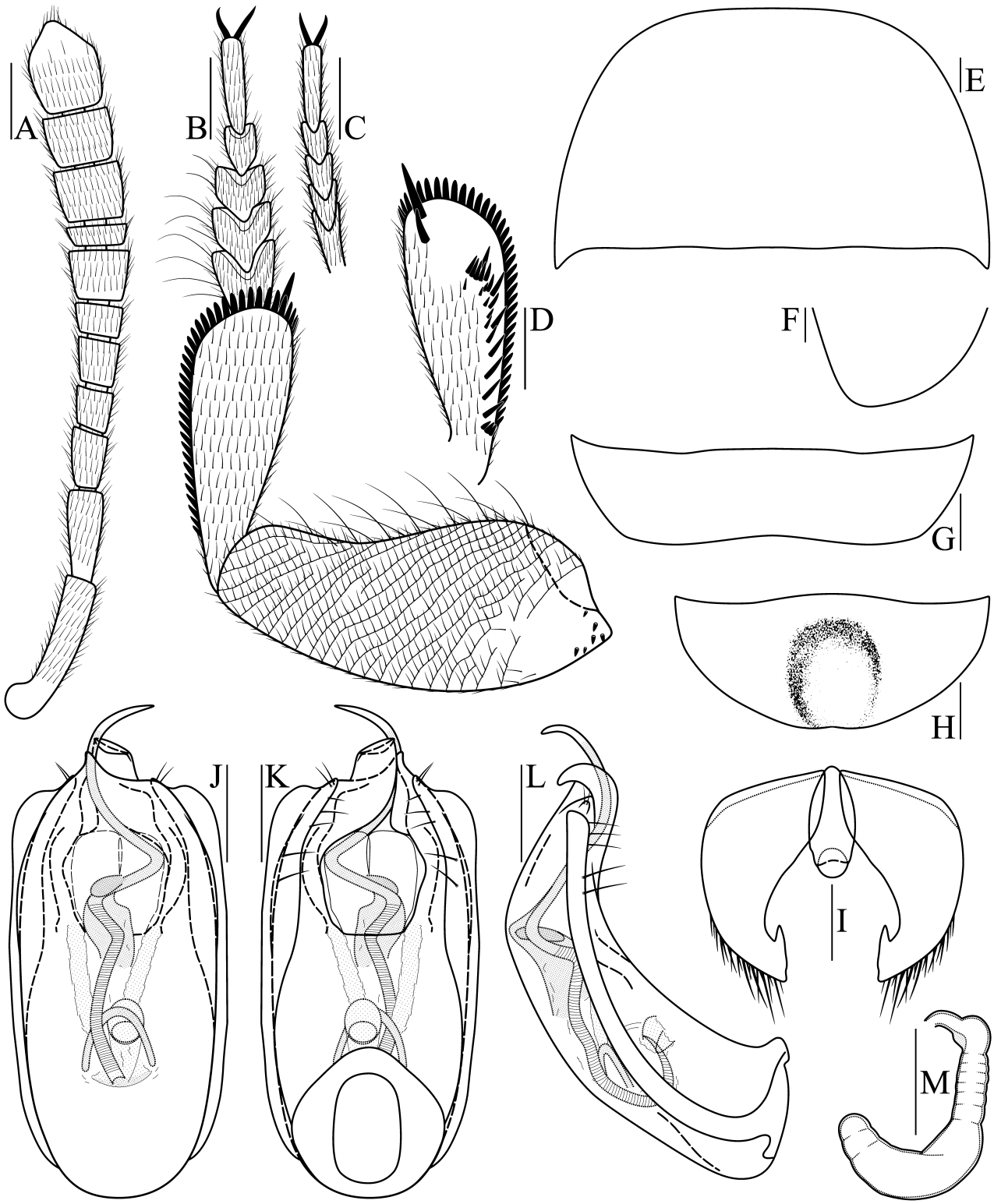

FIGURE 17. ***Ptomaphaginus wenboi*** **sp. nov.: A**, antenna ♂ (dorsal view); **B**, proleg ♂ (dorsal view); **C**, protarsus ♀ (dorsal view); **D**, protibia ♂ (ventral view); **E**, pronotum ♂ (dorsal view); **F**, elytral apex ♂ (dorsoapical view); **G**, ventrite VII ♂ (ventral view); **H**, ventrite VIII ♂ (ventral view); **I**, abdominal segment IX ♂ (ventral view); **J**, aedeagus (dorsal view); **K**, aedeagus (ventral view); **L**, aedeagus (lateral view); **M**, spermatheca. Scales: 0.1 mm.

Ventrite VII simple, widely and slightly emarginate on posterior margin (Fig. 17G). Ventrite VIII with a large fossa subround and moderately shallow, feebly emarginate posteriorly (Fig. 17E). Segment IX: spiculum gastrale widely subelliptic, rounded at posterior end (Fig. 17I).

Aedeagus subquadrate in dorsal view (Fig. 17J): sides of median lobe curved; right apical expansion strongly and narrowly stuck out of apical margin of median lobe and dorsally rolled; parameres firmly attached to median lobe, distinctly widened at apex in dorsal view, each with two setae at apex. Ventral operculum poorly sclerotized, limit inconspicuous, divided in apical half, each lobe substraight apically (Fig. 17K). In lateral view, median lobe distinclty bent ventrad at about apical 1/3, apex a little thinned, and three ventrally-oriented setae inserted below apex as well as two just before middle (Fig. 17L). Internal stylus slender, multiannulate at about basal 1/2.

Female. Similar to male in general appearance, except for the following characters: protarsi normal (Fig. 17C), profemora without long hairs on ventral surface and ventrite VIII regularly rounded posteriorly. Spermatheca anchor-like (Fig. 17M).

Distribution. China (Taiwan).

Etymology. The specific epithet is dedicated to Dr. Wen-bo Huang (National Taiwan University, Taipei, China), the collector of this new species and a researcher of insect ecology in National Taiwan University.

Remarks. This new species is sympatric with *P. sauteri* (Portevin) and both of them with a subround fossa on ventrite VIII, so they are easily confused, but can be distinguished by their conspicuously different aedeagi. Aedeagus of this new species is similar to *P. coronatus* Szymczakowski, 1974 from Philippines, *P. fornicatus* Szymczakowski, 1972 from Vietnam, *P. honestus* Szymczakowski, 1964 from Myanmar, *P. kurbatovi* Schilthuizen & Perreau, 2008 from Indonesia, *P. latipes* (Pic, 1929) from Philippines, *P. obtusus* Szymczakowski, 1959 from Indonesia, *P. sabahensis* Schilthuizen & Perreau, 2008 from Malaysia and *P. takaosanus* Nakane, 1982 from Japan; these all with subquadrate aedeagus and non-incurved sides of median lobe when viewed dorsally. But, this new species differs obviously from them by aedeagus with right apical expansion narrowly stuck out and dorsally rolled, together with aedeagal shape when viewed laterally.

***Ptomaphaginus wuzhishanicus* sp. nov.**
(Figs. 18A–J)

Type material. Holotype: CHINA, Hainan: ♂, Wuzhishan [=Mt. Wuzhi], 790 m, undergrowth, window trap, 10.VII.2004, Jie Wu & Yong-Jie Chen legg. (IZ-CAS).

Description. *Male*. EBL: 2.62 mm. Length of different body parts: HL : AL : PL : ELL = 0.43 : 0.68 : 0.65 : 1.40 mm; width: HW : EW : PW : ELW = 0.70 : 0.10 : 1.03 : 1.19 mm. Proportion of antennomeres from base to tip in μm (length × width): 124 × 35, 103 × 44, 63 × 42, 34 × 43, 31 × 49, 21 × 54, 39 × 67, 16 × 65, 51 × 79, 53 × 77, 99 × 80.

Habitus elongated oval, relatively convex and lustreless. Moderately pigmented: mostly chestnut brown; mouthparts, basal five antennomeres and apical half of ultimate antennomere, base of pronotum, and tarsi yellowish. Dorsum continually clothed with fine, recumbent and sallow pubescence. Insertions of pubescence on dorsal surfaces of pronotum, scutellum, elytra and femora align along transverse striolations.

Head moderately short and gently convex, finely punctured, without visible transverse striolations, HW/HL = 1.65; anterior margin round. Compound eyes rather developed, EW/HW = 0.15. Antennae slender (Fig. 18A), AL/HW = 0.96; 5th shorter than 4th; 6th transverse; 9th and 10th wider than long; 11th pear-like.

Pronotum not rather transverse and convex (Fig. 18D), widest at base, PW/PL = 1.57. Sides almost rectilinearly narrowing from posterior to anterior; hind corners drawn out and blunt. Posterior margin with distinct postero-lateral emargination. Surface transversely striolated, SP: 41–43, interspaces narrower than that on elytra.

Elytra relatively short and convex, widest near base, ELL/EW = 1.18. Sides feebly curved, gradually narrowing from base to apices; apices obliquely truncated and with a tuft of strong hairs (ca. six) different to pubescence background (Fig. 18E). Surface transversely striolated, SE: 71–72. Metathoracic wings fully developed.

Prolegs robust, with basal three protarsomeres only slightly expanded (Fig. 18B): TW/BTW = 1.70. Spinal arrangement on ventral side of protibia as shown in Fig. 18C. Profemora wider than protibiae, and hairs on ventral side of profemora similar to that of protibiae. Mesotibiae moderately arcuate.

Ventrite VII simple. Ventrite VIII also simple, gently emarginate posteriorly (Fig. 18F). Segment IX: uncinate tooth of genital plate much small and spiculum gastrale bottle-like, truncated at posterior end (Fig. 18G).

Aedeagus piriform in dorsal view (Fig. 18H): median lobe widest at about basal 1/3, sides of preapical part

parallel; opening of genital orifice trended to cut right margin of median lobe; parameres relatively narrow, firmly attached to median lobe. Ventral operculum prominently and deeply bisected into long, narrow lobes, each rounded apically (Fig. 18I). Aedeagus like a tobacco pipe in lateral view, median lobe very arched, forming a right angle (Fig. 18J). Internal stylus very slender.

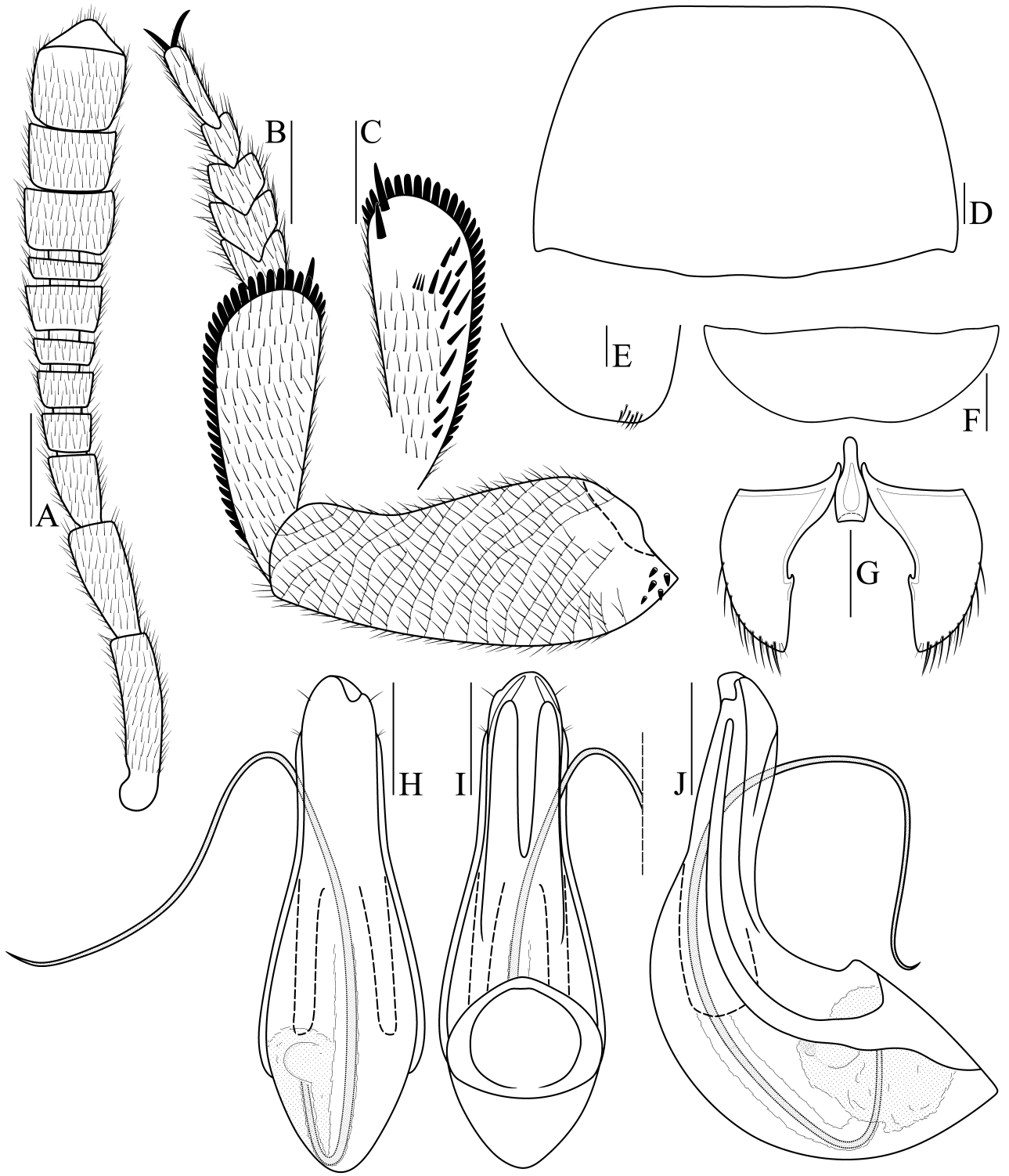

FIGURE 18. ***Ptomaphaginus wuzhishanicus*** **sp. nov.** ♂**: A**, antenna (dorsal view); **B**, proleg (dorsal view); **C**, protibia (ventral view); **D**, pronotum (dorsal view); **E**, elytral apex (dorsoapical view); **F**, ventrite VIII (ventral view); **G**, abdominal segment IX (ventral view); **H**, aedeagus (dorsal view); **I**, aedeagus (ventral view); **J**, aedeagus (lateral view). Scales: 0.1 mm.

Female. Unknown.

Distribution. China (Hainan).

Etymology. The specific epithet is from the Chinese name (Pinyin) of the type locality "Wuzhishan" in Hainan province, China.

Remarks. This new species is sympatric with *P. newtoni* **sp. nov.**, but it is easily to be distinguished from all other congener species from China by elytral apices with a tuft of strong hairs different from the pubescence background and its piriform aedeagus. Interestingly, this new species should belong to a group from Indian fauna with common character of piriform aedeagus, incluing *P. apiculatus* Szymczakowski, 1975, *P. pilipennis* Perreau, 1991, *P. pilipennoides* Perreau, 1991, *P. piraster* Szymczakowski, 1975, and *P. riedeli* Perreau, 1995. However, it differs from *P. apiculatus* Szymczakowski, *P. pilipennoides* Perreau, *P. piraster* Szymczakowski and *P. riedeli* Perreau by its very arched median lobe, forming a right angle when viewed laterally; and in the new species, the aedeagus is relatively wider at basal half, and basal protarsomere obviously narrower than protibial apex, ELL/EW = 1.18, while in *P. pilipennis* Perreau the aedeagus is relatively narrower at basal half, and basal protersomere as wide as protibial apex, ELL/EW = 1.3. This new species is also similar to *P. scaphaner* Szymczakowski, 1972 from Vietnam, Malaysia and Indonesia, but they have differences in aedeagal apex shape: the latter with right apical expansion of aedeagus triangular and somewhat dorsally upturned; while the new species without apical expansion of aedeagus stuck out.

***Ptomaphaginus yui* sp. nov.**
(Figs. 19A–K)

Type material. Holotype: CHINA, Yunnan: ♂, Lijiang, Yulong Snow Mountain Nature Reserve, 2980 m, pine forest, pitfall trap, 1–3.VIII.2000, Xiao-Dong Yu & Hong-Zhang Zhou legg. (IZ-CAS). **Paratypes:** 1♀, same data as holotype (IZ-CAS); 1♂, Zhongdian County, south of Gezaxiang, 3080 m, pine forest, pitfall trap, 23–25.VII.2000, Xiao-Dong Yu & Hong-Zhang Zhou legg. (IZ-CAS).

Description. *Male*. EBL: 2.75 mm. Length of different body parts: HL : AL : PL : ELL = 0.42 : 0.74 : 0.62 : 1.58 mm; width: HW : EW : PW : ELW = 0.74 : 0.08 : 1.06 : 1.13 mm. Proportion of antennomeres from base to tip in μm (length × width): 122 × 35, 101 × 45, 63 × 42, 40 × 41, 42 × 49, 31 × 56, 52 × 69, 24 × 73, 50 × 82, 53 × 87, 103 × 101.

Habitus elongated oval, relatively convex and lustreless. Well pigmented: mostly dark brown, head blackish; mouthparts, basal six antennomeres and apical half of ultimate antennomere, base of pronotum, elytral apex, and tarsi somewhat yellowish. Dorsum continually clothed with fine, recumbent and sallow pubescence. Insertions of pubescence on dorsal surfaces of head, pronotum, scutellum, elytra and femora align along transverse striolations.

Head short and convex, transversely striolated, interspaces narrower than that on pronotum, HW/HL = 1.75; anterior margin round. Compound eyes normally developed, EW/HW = 0.11. Antennae slender but not very long (Fig. 19A), AL/HW = 1.00; 5th slightly longer than 4th; 6th distinctly wider than long; 7th a little wider than long; 9th and 10th wider than long; 11th wide, peach-like.

Pronotum moderately transverse and convex (Fig. 19E), widest just before hind corners, PW/PL = 1.72. Sides slightly curved, narrowing from posterior to anterior; hind corners drawn out and bluntly rounded. Posterior margin with distinct postero-lateral emargination. Surface transversely striolated, SP: 39–41, interspaces as wide as that on elytra.

Elytra relatively long and convex, widest at basal 1/5, ELL/EW = 1.40. Sides feebly curved, gradually narrowing from base to apices; apices nearly rounded (Fig. 19F). Surface transversely striolated, SE: 80–84. Metathoracic wings fully developed.

Prolegs robust, with basal three protarsomeres moderately expanded (Fig. 19B): TW/BTW = 1.41. Spinal arrangement on ventral side of protibia as shown in Fig. 19D. Profemora wider than protibiae. Pubescence on ventral side of profemora similar to that of protibiae. Mesotibiae moderately arcuate.

Ventrite VII simple. Ventrite VIII regularly rounded posteriorly. Segment IX: spiculum gastrale slender, distinctly constricted at middle and flared at posterior end (Fig. 19G).

Aedeagus suboval in dorsal view (Fig. 19H): median lobe gradually but distinctly narrowing towards the slightly asymmetrical apex; right apical expansion only stuck out of apical margin of median lobe a little bit;

parameres relatively narrow, firmly attached to median lobe, each with two small setae at apex. Ventral operculum poorly sclerotized, limit inconspicuous, only divided in apical part, each lobe bluntly rounded apically (Fig. 19I). In lateral view, median lobe distinctly bent ventrad and strongly thinned to apex from about apical 1/3, several ventrally-oriented long setae inserted below apex (Fig. 19J). Internal stylus moderately wide, multiannulate at basal part; two lateral sacs at basal region of aedeagus.

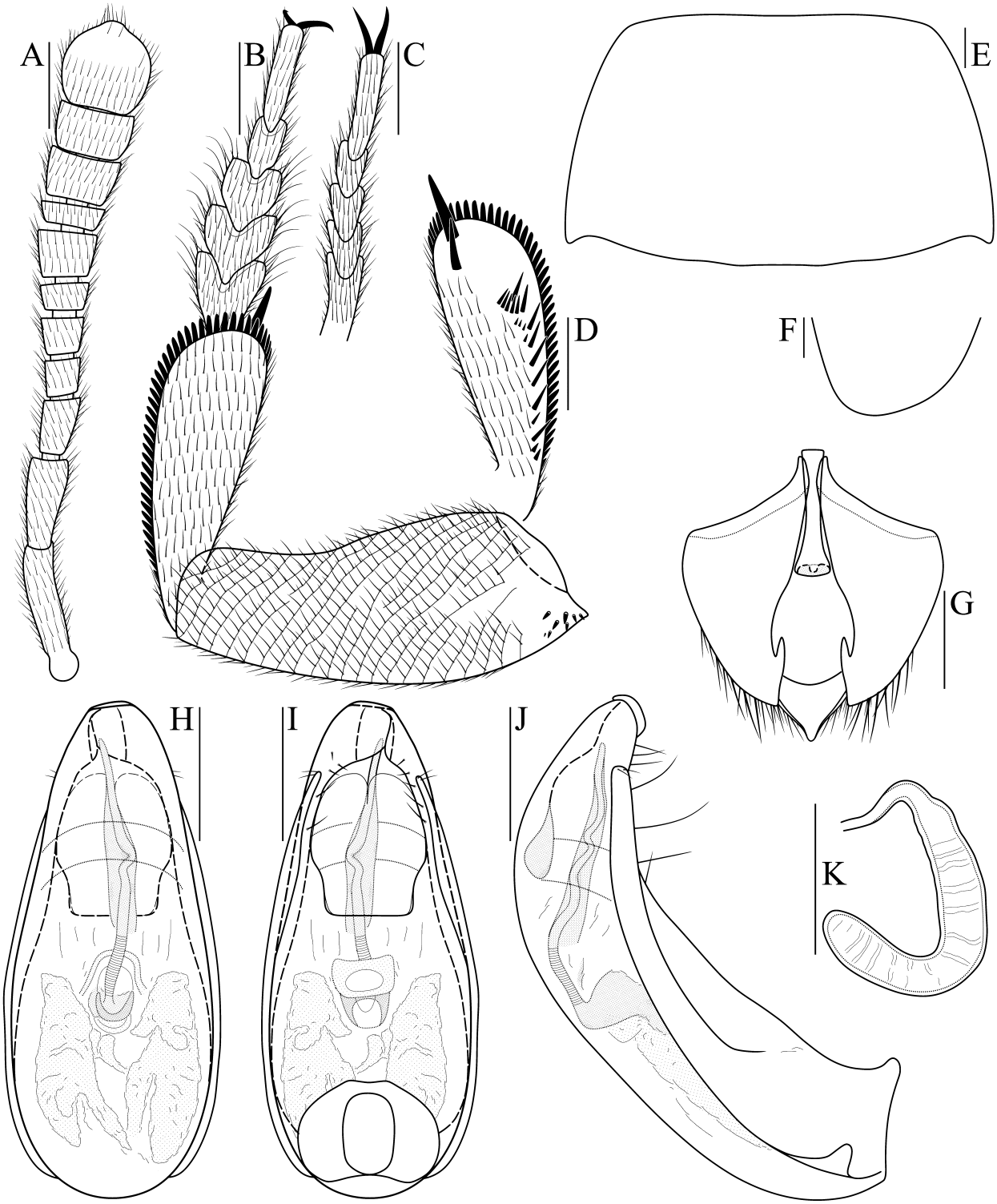

FIGURE 19. ***Ptomaphaginus yui*** **sp. nov.: A**, antenna ♂ (dorsal view); **B**, proleg ♂ (dorsal view); **C**, protarsus ♀ (dorsal view); **D**, protibia ♂ (ventral view); **E**, pronotum ♂ (dorsal view); **F**, elytral apex ♂ (dorsoapical view); **G**, abdominal segment IX ♂ (ventral view); **H**, aedeagus (dorsal view); **I**, .aedeagus (ventral view); **J**, aedeagus (lateral view); **K**, spermatheca. Scales: 0.1 mm.

Female. Similar to male in general appearance except simple protarsi (Fig. 19C). Spermatheca 'C' shape (Fig. 19K).

Distribution. China (Yunnan).

Etymology. The specific epithet is dedicated to Dr. Xiao-Dong Yu (IZ-CAS, Beijing, China), the first collector of this new species and a researcher on insect ecology in our research team.

Remarks. *P. yui* **sp. nov.** with aedeagus suboval, gradually but distinctly narrowing towards apex in dorsal view, which is similar to species of *P. anas* Schilthuizen & Perreau, 2008 from Malaysia, *P. assimilis* Szymczakowski, 1972 from Vietnam, *P. scaber* Szymczakowski, 1964 from Myanmar and P. *shibatai* Hayashi, 1969 from Japan. However, in *P. anas* Schilthuizen & Perreau, its aedeagus quite more narrowed at apex and almost semicircular when viewed laterally; in *P. assimilis* Szymczakowski, its right apical expansion rounded at apex and internal stylus rather slender; in *P. scaber* Szymczakowski, its aedeagus slightly bent ventrad when viewed laterally, and for external morphology, its pronotum rather narrow, PW/PL merely 1.49; and in P. *shibatai* Hayashi, its aedeagus only a little bent ventrad when viewed laterally.

FIGURE 20. Distribution map of *Ptomaphaginus* species from China.

Discussion

The data so far suggest that the distribution patterns of *Ptomaphaginus* species are usually small-scale, and all known species from China are distributed in the south of Qinling Mountains–Huaihe River Line (all recorded locations are to the south of 32°N in China) (Fig. 20).

Besides crucial primary and secondary sexual characters, members of *Ptomaphaginus* are very uniform in general body shape, however, some strange characters may be present on the last two visible ventrites in the male of some species, providing significant specific characters. Perreau (1993) found there are two strong teeth at the posterior margin of ventrite VII in *P. franki* Perreau and *P. trautneri* Perreau, 1993 (from Tailand), and we observed *P. luoi* **sp. nov.** and *P. ruzickai* **sp. nov.** to have similar characters as well. But these teeth are not simple at all: in *P. franki*, many small spines are located around the middle emargination formed by two large teeth (Fig. 6E); in *P. luoi* **sp. nov.**, the two large teeth are impressively hook-like (Fig. 11F); while in *P. ruzickai* **sp. nov.**, several blunt spines are located on the two moderately strong teeth (Fig. 15G). For ventrite VIII, whether with a fossa or not, and the shape of fossa, are important and useful in identification. Perreau (1996) also noted that in *P. takaosanus* Nakane, its fossa on ventrite VIII is bordered with small tubercles. In our study, similar kinds of ornaments were also found in *P. pingtungensis* Perreau (Fig. 8F), *P. guangxiensis* **sp. nov.** (Fig. 9H) and *P. ruzickai* **sp. nov.** (Fig. 15H), although these spines bordering the sides of the fossa in *P. ruzickai* **sp. nov.** are distinctly stronger and blunter than those of the first two. During our study, we observed that characters on the ventral side of the proleg may provide good complementary characters to distinguish species, i.e. spinal arrangement on the ventral side of the protibia combined with whether the profemora have long and strong hairs on the ventral side. For many *Ptomaphaginus* species, the aedeagus usually has a weakly sclerotized apical expansion extending from its apical margin; on account of small aedeagal size as well as observation equipment or negligence, many previous aedeagus figures had not shown this character, e.g. *P. sauteri* (Portevin) in Jeannel (1936), so these descriptions and aedeagus figures missed the apical expansion, probably leading to misidentifications. And the ventral operculum is also usually poorly sclerotized and its limits inconspicuous; previous works had often neglected this important character. Therefore, much work is needed to update the characteristic figures of aedeagus to show these characters accurately.

Although in this paper we added eleven new species of *Ptomaphaginus* for the Chinese fauna, there are still unknown species present since we examined several unknown female specimens from Hunan, Guangxi, and Yunnan. Despite these having some characters different from known congeners, we do not recommend using only female specimens to describe new species.

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