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Three new species of *Cranopygia* Burr, 1908 (Dermaptera: Pygidicranidae) from Sabah, Malaysia

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Abstract: Three new species of the genus *Cranopygia* Burr, 1908 are described from Sabah, Malaysia: *Cranopygia zhaomingzhii* **sp. nov.**, *Cranopygia marki* **sp. nov.**, and *Cranopygia lixiaofengi* **sp. nov.** Detailed illustrations of the habitus, forceps, and genitalia are provided for each species. Comparisons with closely related congeners are also included.

Keywords: Borneo; earwig; morphology; new taxa; taxonomy

马来西亚沙巴州盔螋属三新种（革翅目：大尾螋科）

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摘要：本文描述了马来西亚沙巴州的盔螋属三新种：赵氏盔螋 *Cranopygia zhaomingzhii* **sp. nov.**，马克盔螋 *Cranopygia marki* **sp. nov.**和李氏盔螋 *Cranopygia lixiaofengi* **sp. nov.**。本文提供了生境、尾铗、外生殖器的细致图片，并将新种与同属其他种进行了比较。

关键词：婆罗洲，蠼螋，形态学，新单元，分类学

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Introduction

The genus *Cranopygia* Burr, 1908, a member of the subfamily Pygidicraninae within the family Pygidicranidae, is distributed across the Indo-Austral and Oriental Regions (Steinmann 1986; Kamimura *et al.* 2016). Kamimura *et al*. (2016) extensively discussed the genus's taxonomy, listing 67 species, though the list remains incomplete, with several species marked as dubious (Steinmann 1986). Recently, Chen (2024) described a new species of *Cranopygia* from Guizhou Province, China.

Morphologically, species within *Cranopygia* can be categorized into two distinct groups: the alate and apterous groups (Anisyutkin 2014). However, it remains unclear whether these groups are monophyletic or if the loss of wings occurred independently in the apterous species. Gorochov & Anisyutkin (1994) classified *Cranopygia* into three species groups. The first group, represented by *Cranopygia vietnamensis* Gorochov & Anisyutkin, 1994 and *Cranopygia beybienkoi* Gorochov & Anisyutkin, 1994, is characterized by asymmetric male forceps and a long, simple virga. The second group, exemplified by *Cranopygia gialaiensis* Gorochov & Anisyutkin, 1994, features asymmetric male forceps with a shorter virga and a forked apex. The third group, including *Cranopygia marmoricrura* (Audinet-Serville, 1839) and *Cranopygia celebensis* (de Bormans, 1903), is characterized by symmetric male forceps and a simple virga.

This study introduces and describes three new species of *Cranopygia* collected from Mount Trus Madi, Sabah, Malaysia (Fig. 1). The newly identified species are fully illustrated and detailed, with comparisons made to related species within the genus. These comparisons highlight distinctive morphological features and contribute to a deeper understanding of the diversity and evolutionary relationships of *Cranopygia* species in Sabah.

Material and methods

The specimens examined in this study were collected using light traps (Fig. 1). Morphological observations were conducted using a SDPTOP SZM45 stereo microscope. Photographs of adults and genitalia were captured with a Canon EOS 5DSR digital camera, paired with a Canon MP-E 65 mm 5X macro lens. Images were optimized and assembled using Adobe Photoshop. Type specimens are deposited in the Insect Collection of Jiangsu University of Science and Technology (**ICJUST**), Jiangsu Province, China. Terminology follows Steinmann (1986). Abbreviations used in the figures include: **ep**, external paramere; **gl**, genital lobe; **ip**, inner process; **op**, outer process; **pm**, paramere; **v**, virga.

FIGURE 1. Light trap and habitat in Mt. Trus Madi, Sabah.

Taxonomy

Cranopygia zhaomingzhii sp. nov. 赵氏盔螋

https://zoobank.org/DCA3C437-785D-4359-9378-6AEE7C441BC2

Figs 2–5

Type material. Holotype: ♂ (ICJUST): **MALAYSIA**: Sabah, near Keningau, Mt. Trus Madi, 1180 m, 9–15.VII.2024, Ming-Zhi Zhao, Mark Chan. **Paratype:** 1♀ (ICJUST), with same data as holotype.

Etymology. The new species is dedicated to Mr. Ming-Zhi Zhao, who has collected and generously donated the specimens used in this study. Noun in the genitive case.

Description of holotype. *General appearance.* Large sized (Fig. 2), whole body densely with tiny punctations and mostly setose.

Size. Body length (from anterior of head to posterior of forceps) 46 mm. Forceps length (from visible lateral base to posterior end) 12 mm.

Head. Head slightly longer than broad (Fig. 2), margins dark, medially mostly pale, with one anteromedial and two posteromedial dark stripes. Frontal sutures obscure, coronal suture distinct. Eyes not prominent, about as long as genae. Antennae mostly dark brown, with at least 38 segments; first antennal joint long, slightly shorter than distance between antennal bases. Mouthparts pale to dark brown.

Pronotum. Pronotum near as long as broad (Fig. 2); anterior and lateral margins rounded; posterior margin weakly concaved. Median longitudinal furrow distinct. Surface mostly yellow, with two anterior and two posterior longitudinal dark stripes.

Tegmina. Tegmina well developed (Fig. 2A), about two times longer than pronotum; mostly dark brown, with yellow inner margin, a big yellow band on anterior half of dorsal surface, and a small yellow spot on posterior half of lateral surface.

Wings. Scales of hindwings slightly shorter than pronotum (Fig. 2A), longer than wide; dorsal surface yellow, lateral surface mostly dark brown; posterior margins slightly rounded.

Legs. Legs short (Fig. 2), mostly yellow, with brown spots on dorsal surfaces of all femora.

Abdomen. Abdomen dark brown (Fig. 2), gradually expanded to last tergite. Ultimate tergite broad (Fig. 3A), subquadrate, posteriorly with rounded extension, posterior margin truncate; weakly punctured; densely setose; median longitudinal sulcus present. Forceps dark brown (Fig. 3), subcontiguous, symmetrical; bases strongly expanded, with several stout inner teeth and small oblique dorsal ridges; inner margin with a small tubercle near basal one-fourth, a giant tooth near apical one-fourth, and denticles between giant tooth and apex; apex pointed, slightly upcurved. Penultimate sternite rounded laterally (Fig. 3B); posterior margin tricurved, with two posteromedial angles.

Genitalia. Genitalia broad (Fig. 4); paramere subtriangular; genital lobes well developed, slender; virga thin, extremely long, apex simple. External parameres slender, about three times longer than wide; incision of anterior margin rounded, deep and wide; inner process pointed, with a small denticle near midpoint of its inner margin; outer process rounded.

Description of female paratype. Body shape and coloration similar to male (Fig. 5). Body length 41 mm. Forceps length 8 mm. Forceps contiguous, tapering, symmetrical; apically incurved; inner margins mostly straight and denticulate, basal teeth larger than subsequent ones.

Diagnosis. The new species belongs to the *C. marmoricrura* species group based on its symmetric male forceps and simple virga (Gorochov & Anisyutkin 1994). The male genitalia exhibit a bifid external paramere, characterized by a small but distinct denticle near the midpoint of its inner margin, a feature that is uncommon among known species of *Cranopygia*. This new species closely resembles *Cranopygia bhallaie* Kapoor, 1966 from India and *Cranopygia semenoffi* (Burr, 1912) from Transcaspica of former USSR due to the similarity of the external

parameres. However, it can be distinguished from *C. bhallaie* by several morphological differences: the male has fully developed wings, symmetrical forceps with teeth, a rounded penultimate sternite, and a rounded outer process on the external parameres. In contrast, *C. bhallaie* lacks wings, has asymmetrical forceps without obvious teeth, a rhomboidal penultimate sternite, and a pointed outer process on the external parameres (Kapoor 1966; Srivastava 1988). Furthermore, the new species can be distinguished from *C. semenoffi* by its straighter forceps and elongated virga, while *C. semenoffi* is characterized by strongly curved forceps and a short virga (Steinmann 1986).

Distribution. Malaysia (Sabah).

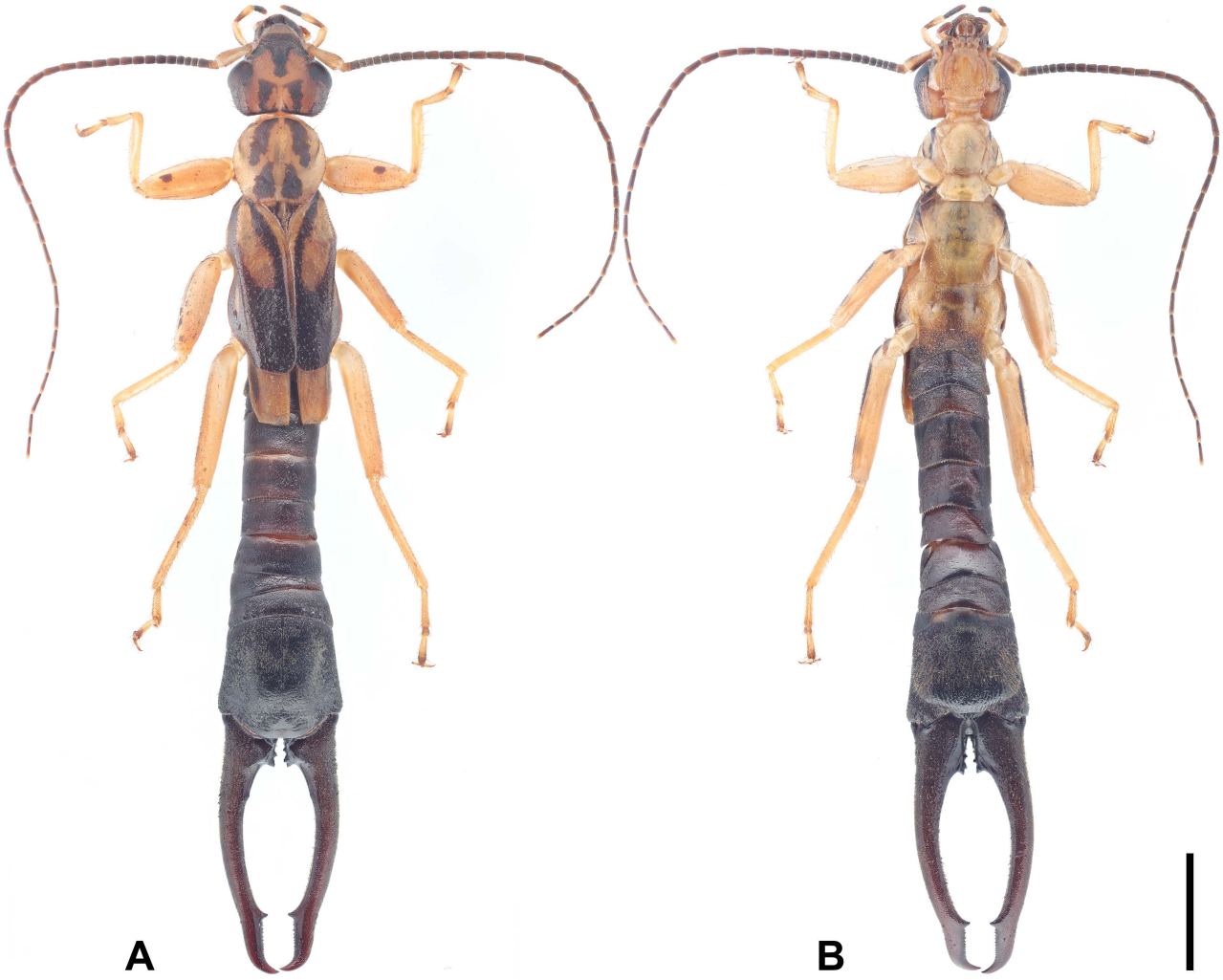

FIGURE 2. *Cranopygia zhaomingzhii* **sp. nov.**, male holotype: **A** habitus, dorsal view **B** habitus, ventral view. Scale bar = 5 mm.

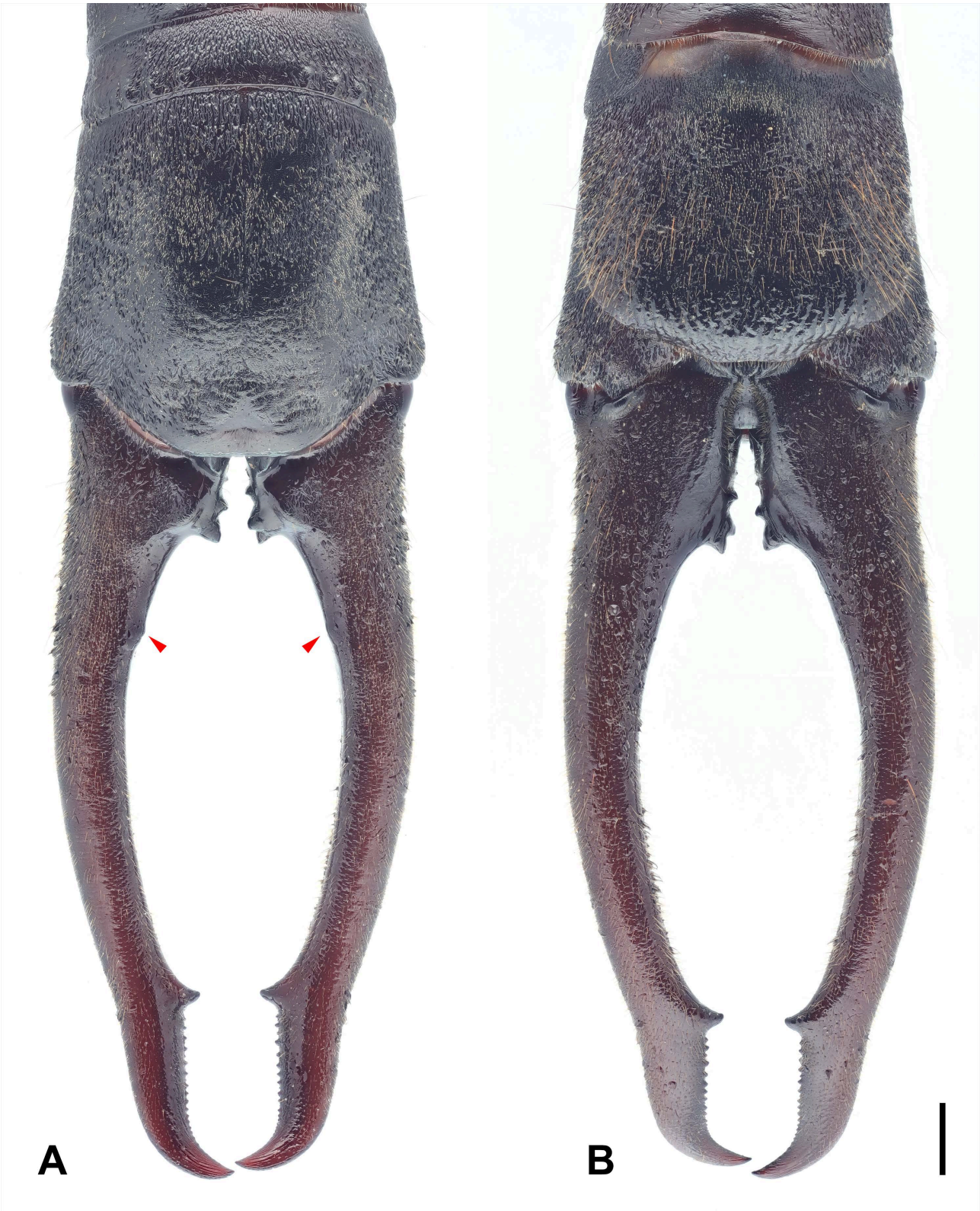

FIGURE 3. *Cranopygia zhaomingzhii* **sp. nov.**, male holotype: **A** terminalia, dorsal view **B** terminalia, ventral view. Red arrowheads indicate subbasal tubercles of forceps. Scale bar = 1 mm.

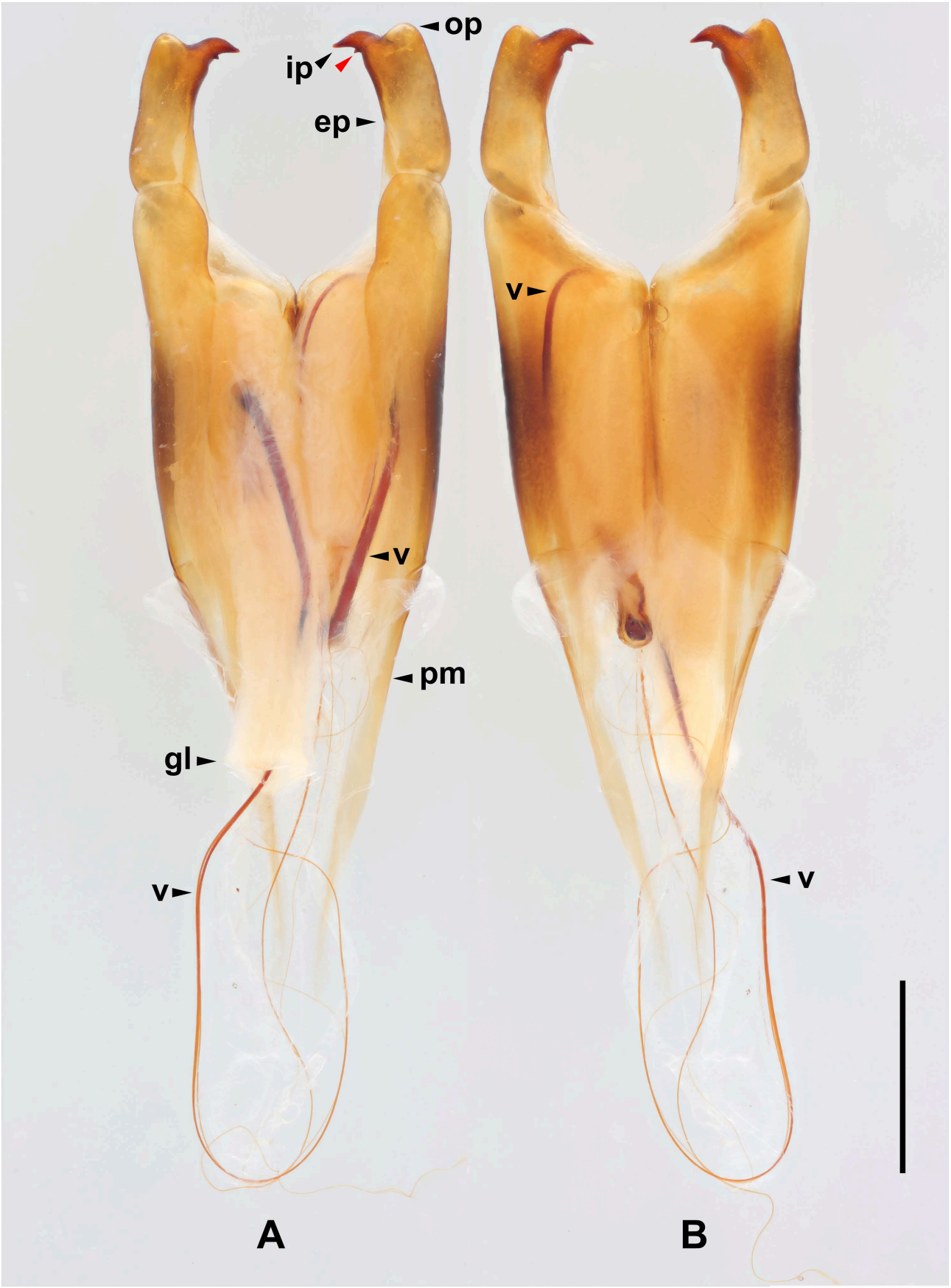

FIGURE 4. *Cranopygia zhaomingzhii* **sp. nov.**, male holotype: **A** genitalia, dorsal view **B** genitalia, ventral view. Abbreviations: **ep**, external paramere; **gl**, genital lobe; **ip**, inner process; **op**, outer process; **pm**, paramere; **v**, virga. Scale bar = 1 mm.

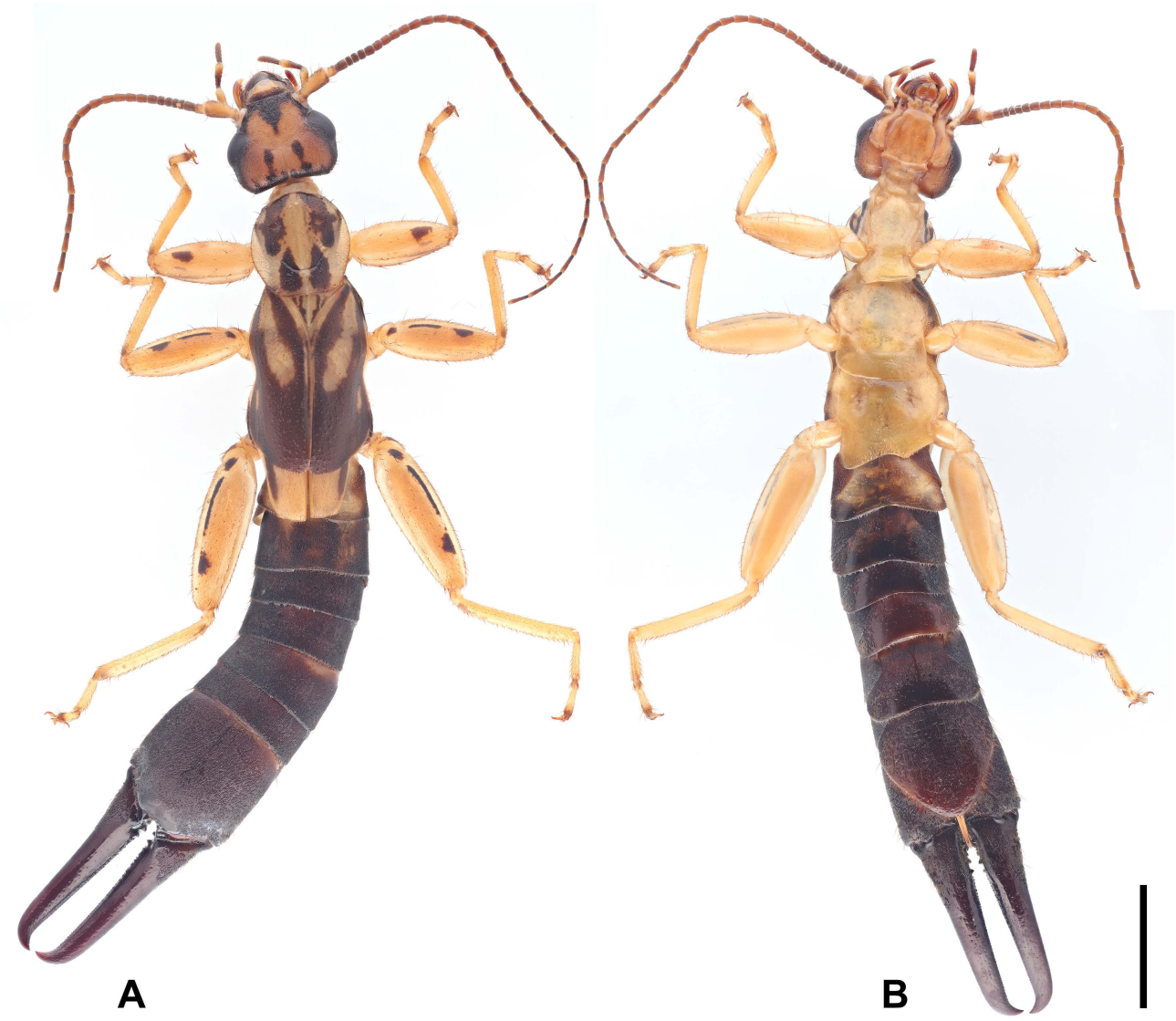

FIGURE 5. *Cranopygia zhaomingzhii* **sp. nov.**, female paratype: **A** habitus, dorsal view **B** habitus, ventral view. Scale bar = 5 mm.

Cranopygia marki sp. nov. 马克盔螋

https://zoobank.org/B78474E0-94C5-422C-AF1C-5FDCF8848BA4

Figs 6–9

Type material. Holotype: ♂ (ICJUST): **MALAYSIA:** Sabah, near Keningau, Mt. Trus Madi, 1180 m, 9–15.VII.2024, Ming-Zhi Zhao, Mark Chan. **Paratype:** 1♂ (ICJUST), with same data as holotype.

Etymology. The new species is dedicated to Mark Chan (Macao SAR, China), who has collected and generously donated the specimens used in this study. Noun in the genitive case.

Description of holotype. *General appearance.* Large sized (Fig. 6), whole body densely with tiny punctations and mostly setose.

Size. Body length 31 mm. Forceps length 7 mm.

Head. Head near as long as broad (Fig. 6), margins dark brown, medially mostly pale, with one anteromedial and two posteromedial dark stripes. Frontal sutures and coronal suture distinct. Eyes not prominent, about as long as genae. Antennae mostly brown, with at least 36 segments; first antennal joint long, slightly shorter than distance between antennal bases. Mouthparts pale to brown.

Pronotum. Pronotum slightly longer than wide (Fig. 6A); anterior and lateral margins rounded; posterior margin weakly concaved. Median longitudinal furrow distinct. Surface with yellow background, with two irregular, brown, longitudinal stripes.

Tegmina. Tegmina well developed (Fig. 6A), about two times longer than pronotum; mostly dark brown, with a small yellow spot on anterolateral surface, a smaller yellow spot on midpoint of dorsal surface, and a small yellow spot on posterior half of lateral surface.

Wings. Scales of hindwings much shorter than pronotum (Fig. 6A), longer than wide; surface entirely yellow; posterior margins slightly rounded.

Legs. Legs short (Fig. 6), mostly yellow, with large areas of brown marks on dorsal surfaces of all femora.

Abdomen. Abdomen dark brown (Fig. 6), gradually expanded to last tergite. Ultimate tergite broad (Fig. 7A), subquadrate, posteriorly with rounded extension, posterior margin truncate; weakly punctured; densely setose; median longitudinal sulcus present. Forceps dark brown (Fig. 6), subcontiguous, symmetrical; bases strongly expanded, with several stout inner teeth and small oblique dorsal ridges; inner margin with a stout dorsal tooth near basal one-third, another giant tooth near apical one-fifth, and denticles between subapical tooth and apex; apex pointed, slightly upcurved. Penultimate sternite rounded both laterally and posteriorly (Fig. 7B); posterior margin slightly emarginate.

Genitalia. Genitalia broad (Fig. 8); paramere subtriangular; genital lobes well developed, slender; virga thin, extremely long, apex simple. External parameres stout, about two times longer than wide; incision of anterior margin subtriangular, deep and wide; inner process pointed, with a small tubercle near midpoint of its inner margin; outer process near conical, apex obtuse.

Description of Male paratype. Body length 30 mm. Forceps length 7 mm. Body shape and coloration similar to holotype. Subapical inner tooth of forceps located near apical two-fifth (Fig. 9), basal to counterpart in holotype. Genitalia identical to holotype.

Diagnosis. The new species belongs to the *C. marmoricrura* species-group based on its symmetric male forceps and simple virga (Gorochov & Anisyutkin 1994). The bifid external paramere of the male genitalia displays a small but distinct tubercle near the midpoint of its inner margin, a feature not commonly found in other species of *Cranopygia*. *Cranopygia marki* sp. nov. is most similar to *Cranopygia formosa* Hincks, 1955 and *C. marmoricrura* due to the resemblance in their external parameres. However, the new species differs from *C. formosa* by several key characters: the male has symmetrical and toothed forceps, a greatly expanded ultimate tergite, shorter external parameres (about twice as long as wide), and a larger outer process. In contrast, *C. formosa* has asymmetrical and unarmed forceps, a slightly expanded ultimate tergite, longer external parameres (about four times longer than wide), and a larger inner process (Hincks 1955; Steinmann 1986). The new species can be further distinguished from *C. marmoricrura* by the male's almost straight apical half of the forceps, the presence of a stout dorsal tooth on the inner margin near the basal third of the forceps, significantly longer genital lobes and virga, and a distinctly different color pattern on the head and thorax. In *C. marmoricrura*, the male's apical half of the forceps is strongly curved, the inner margin lacks a dorsal tooth near the basal third, and the genital lobes and virga are much shorter (Hincks 1959; Steinmann 1986).

Distribution. Malaysia (Sabah).

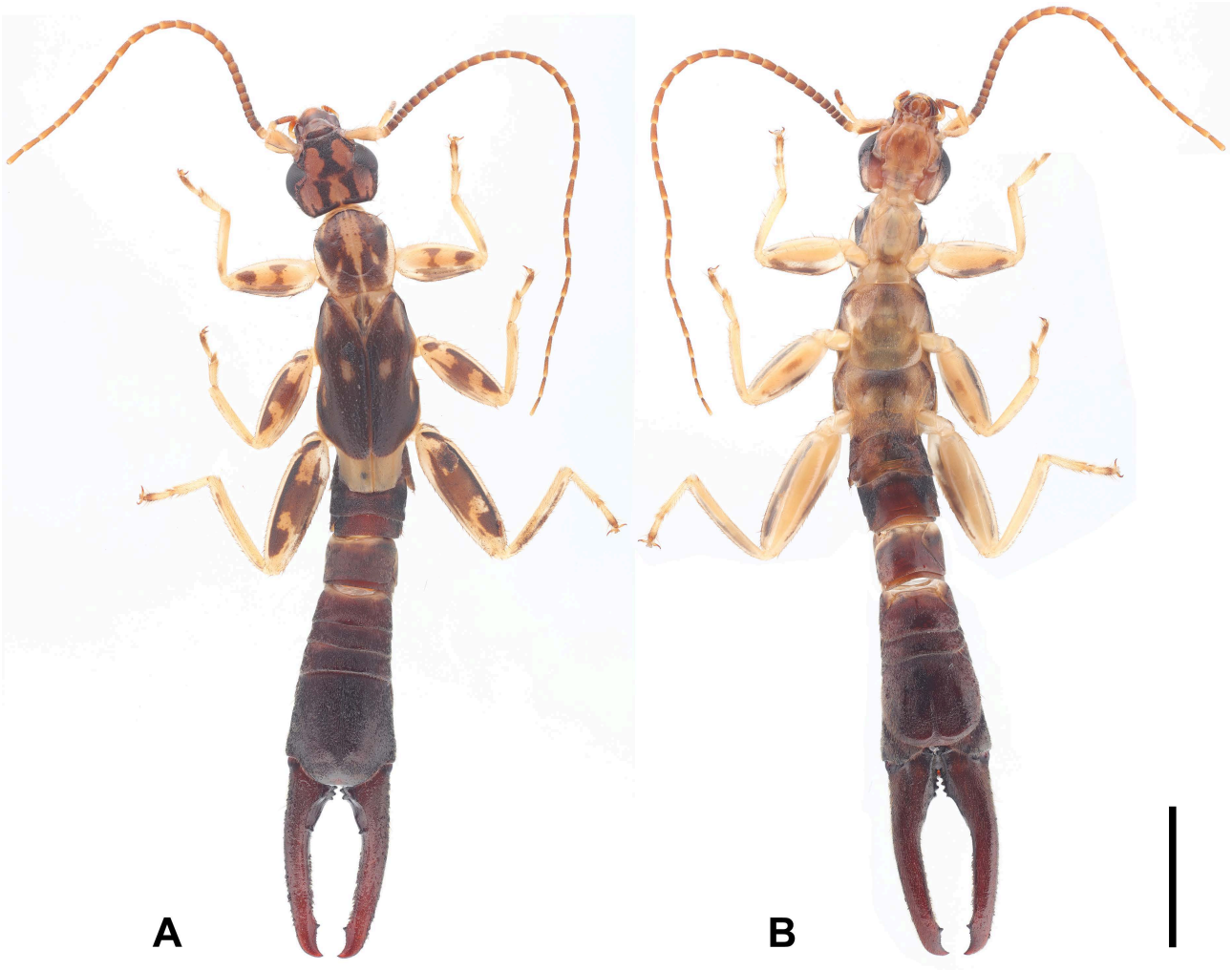

FIGURE 6. *Cranopygia marki* **sp. nov.**, male holotype: **A** habitus, dorsal view **B** habitus, ventral view. Scale bar = 5 mm.

FIGURE 7. *Cranopygia marki* **sp. nov.**, male holotype: **A** terminalia, dorsal view **B** terminalia, ventral view. Scale bar = 1 mm.

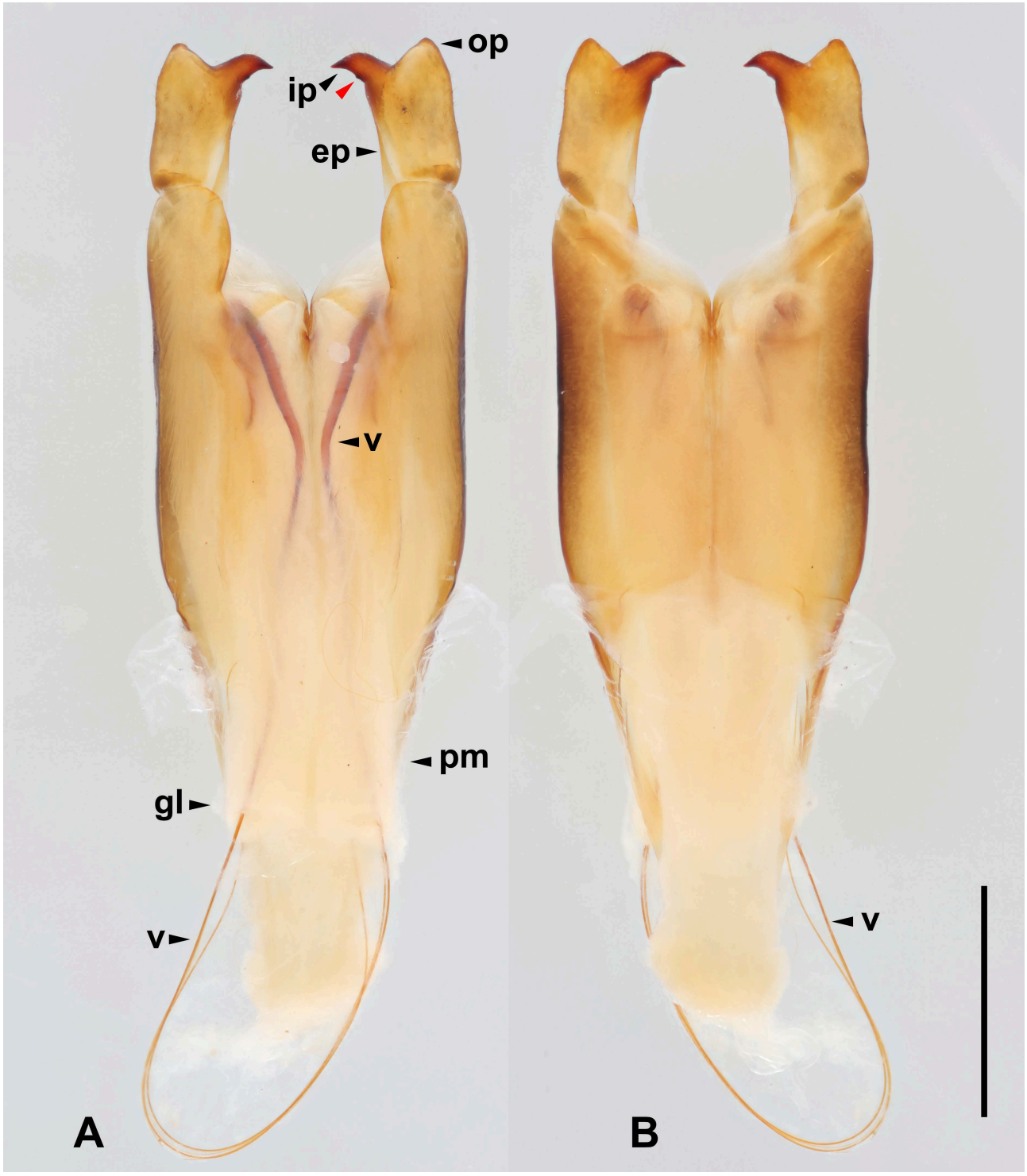

FIGURE 8. *Cranopygia marki* **sp. nov.**, male holotype: **A** genitalia, dorsal view **B** genitalia, ventral view. Red arrowhead indicates the tubercle on inner process of external paramere. Abbreviations: **ep**, external paramere; **gl**, genital lobe; **ip**, inner process; **op**, outer process; **pm**, paramere; **v**, virga. Scale bar = 1 mm.

FIGURE 9. *Cranopygia marki* **sp. nov.**, male paratype: **A** terminalia, dorsal view **B** terminalia, ventral view. Scale bar = 1 mm.

***Cranopygia lixiaofengi* sp. nov. 李氏盔螋**

https://zoobank.org/A5D72C56-17D0-4BCC-B285-6054DED0577B

Figs 10–12

Type material. Holotype: ♂ (ICJUST): **MALAYSIA:** Sabah, near Keningau, Mt. Trus Madi, 1180 m, 9–15.VII.2024, Ming-Zhi Zhao, Mark Chan. Noun in the genitive case.

Etymology. The new species is dedicated to Mr. Xiao-Feng Li, who has provided much help in the author's studies on Dermaptera. Noun in the genitive case.

Description of the holotype. *General appearance.* Median sized (Fig. 10), whole body densely with tiny punctations and mostly setose.

Size. Body length 24 mm. Forceps length 4 mm.

Head. Head slightly longer than broad (Fig. 10), margins brown, medially mostly pale, with trilobed dark marks on both anterior and posterior margins. Frontal sutures and coronal suture distinct. Eyes not prominent, about as long as genae. Antennae mostly pale brown, with at least 24 segments; first antennal joint long, slightly shorter than distance between antennal bases. Mouthparts pale to pale brown.

Pronotum. Pronotum longer than wide (Fig. 10A); anterior and lateral margins rounded; posterior margin truncate. Median longitudinal furrow indistinct. Surface with yellow background, with two irregular, brown, longitudinal stripes.

Tegmina. Tegmina well developed (Fig. 10A), about two times longer than pronotum; mostly dark brown, with yellow inner margin, a slender yellow stripe on anterior two-third of dorsal surface, and a small yellow spot on posterior half of lateral surface.

Wings. Scales of hindwings much shorter than pronotum (Fig. 10A), longer than wide; lateral surface brown, dorsal surface mostly yellow; posterior margins slightly truncate.

Legs. Legs short (Fig. 10), mostly yellow, with large areas of brown marks on dorsal surfaces of all femora and tibiae.

Abdomen. Abdomen dark brown (Fig. 10), gradually expanded to last tergite. Ultimate tergite broad (Fig. 11A), subquadrate, posteriorly with rounded extension, posterior margin truncate; weakly punctured; densely setose; median longitudinal sulcus present. Forceps dark brown (Fig. 11), subcontiguous, symmetrical; bases with oblique dorsal ridges; inner margin with row of stout teeth mainly on basal half, apical half nearly unarmed; apex pointed, slightly upcurved. Penultimate sternite rounded both laterally and posteriorly (Fig. 11B).

Genitalia. Genitalia broad (Fig. 12); paramere subtriangular, with two elliptical lateral sclerites; genital lobes well developed, short; virga thick and very short, apex forked. External parameres slender, about three times longer than wide; incision of anterior margin rounded, deep and wide; inner process pointed; outer process near conical, apex obtuse.

Diagnosis. The new species does not belong to any of the three species groups defined by Gorochov & Anisyutkin (1994), and as such, it represents a new species group characterized by symmetric male forceps and apically forked virga. The male forceps are strictly symmetrical, slender, and feature straight inner margins with basal serration, a combination not observed in any other known *Cranopygia* species. In addition to the unique forceps, *Cranopygia lixiaofengi* sp. nov. can be readily distinguished from other congeners by a combination of features: fully developed wings, a rounded penultimate sternite, a deeply bifid external parameres approximately three times longer than wide, with a pointed and unmodified inner process and an outer process of similar size but with an obtuse apex, and very short genital lobes and virga.

Distribution. Malaysia (Sabah).

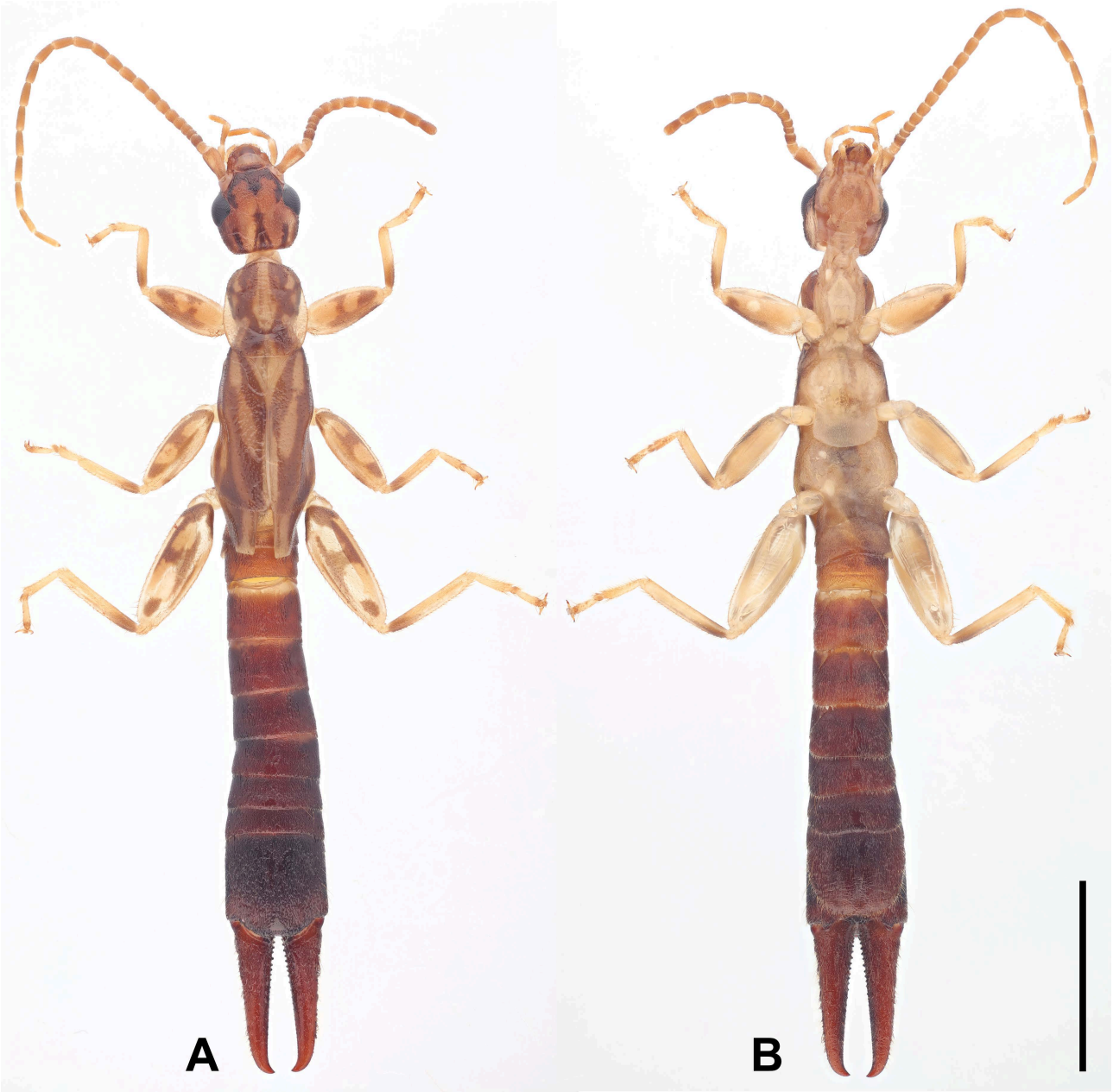

FIGURE 10. *Cranopygia lixiaofengi* **sp. nov.**, male holotype: **A** habitus, dorsal view **B** habitus, ventral view. Scale bar = 5 mm.

FIGURE 11. *Cranopygia lixiaofengi* **sp. nov.**, male holotype: **A** terminalia, dorsal view **B** terminalia, ventral view. Scale bar = 1 mm.

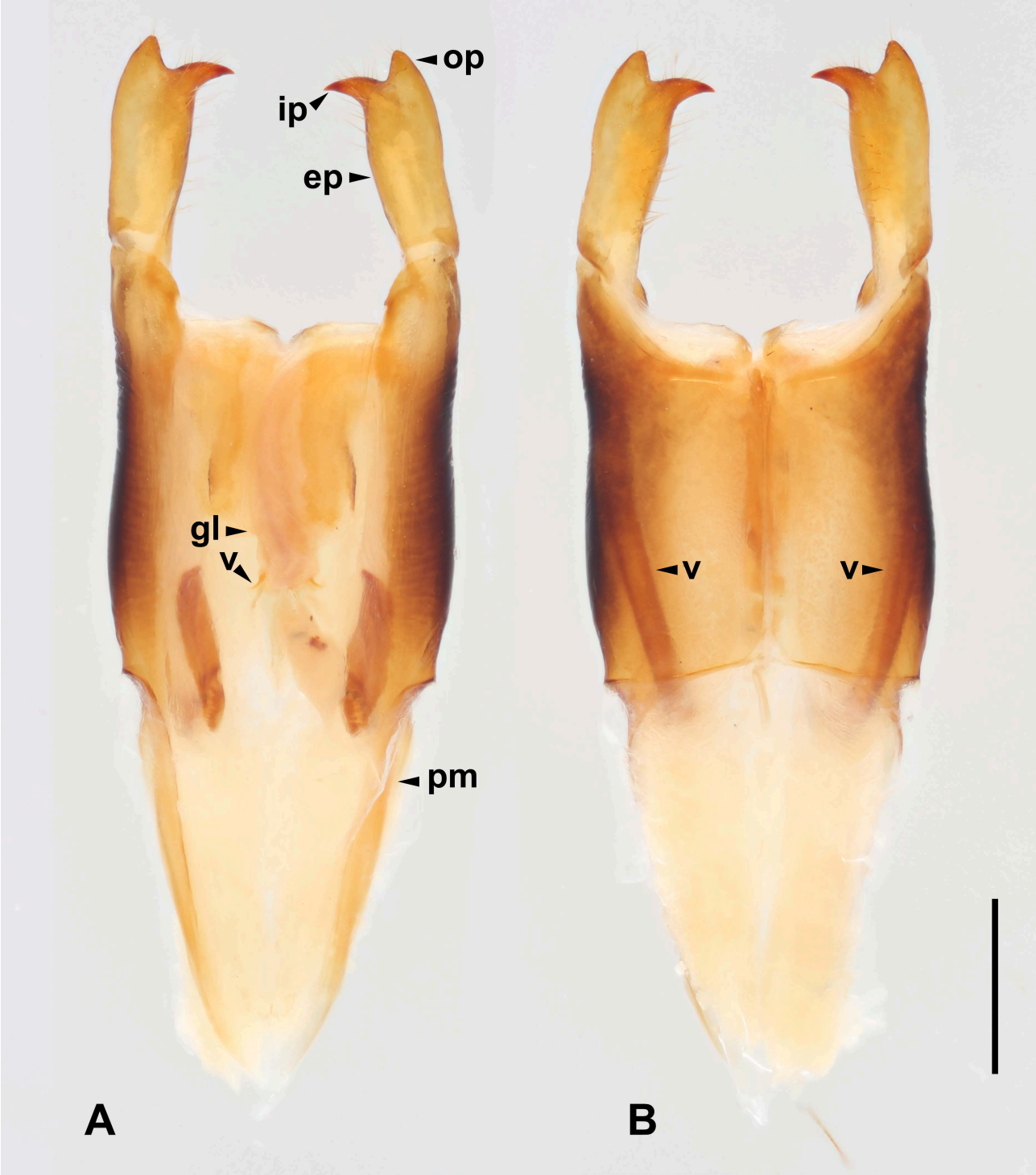

FIGURE 12. *Cranopygia lixiaofengi* **sp. nov.**, male holotype: **A** genitalia, dorsal view **B** genitalia, ventral view. Abbreviations: ep, external paramere; gl, genital lobe; ip, inner process; op, outer process; pm, paramere; v, virga. Scale bar = 0.5 mm.

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Additional information

Author contributions: The author solely contributed to this work.

Conflict of interest: The author has declared that no competing interests exist.

Data availability: All of the data that support the findings of this study are available in the main text.

Ethical statement: No ethical statement was reported.

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