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## Research article

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# Three new species of the newly recorded genus *Monochorhynchus* Muir, 1917 from China, with observations on the fine structure of the mouthparts (Hemiptera: Fulgoromorpha: Derbidae)

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**Abstract.** The planthopper genus *Monochorhynchus* Muir, 1917 is reviewed, newly recorded from China, and transferred to the subtribe Lyddina. Three new species from China, *M. dehongensis* sp. nov., *M. obscurus* sp. nov., and *M. psammochroma* sp. nov., are described and illustrated based on morphological characteristics. A checklist of the species of *Monochorhynchus*, including their geographic distribution, is provided, along with an identification key to the known species. The ultrastructure of the mouthparts of *M. dehongensis* is briefly investigated using the scanning electron microscope. The functions and taxonomic value of these structures are discussed.

**Key words.** Planthopper, Zoraidini, ultrastructure, rostrum.

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## Introduction

The planthopper genus *Monochorhynchus* Muir, 1917, belonging to the tribe Zoraidini Muir, 1913 (Derbidae Spinola, 1839: Otiocerinae Muir, 1917), is readily distinguished by the following diagnostic features: lateral marginal carinae of frons widened in the ventral half, antennae shorter than frons, apical segment of rostrum greatly enlarged into a sucker-like pad, and tegmina with both MP<sub>3+4</sub> and MP<sub>1b</sub> forked (Muir 1917; Fennah 1952). Since its establishment, the genus was considered monotypic, comprising only *M. wahri* Muir, 1917, known from Borneo. In the present study, this genus is newly recorded from China with three new species, *M. dehongensis* sp. nov., *M. obscurus* sp. nov., and *M. psammochroma*

sp. nov., being described and illustrated. A checklist of the species of *Monochorhynchus*, including distribution data, is provided, along with an identification key to the known species.

Insect mouthparts offer valuable morphological characters for phylogenetic studies. Within the Derbidae, the mouthparts of several species, *Shizuka fritillaria* (Boheman, 1838), *Diostrombus gangumis* Van Stalle, 1984, *D. politus* Uhler, 1896 and *Proutista moesta* (Westwood, 1851) have been examined morphologically (Brožek *et al.* 2006; Brožek & Bourgoin 2013a, 2013b; Meng & Qin 2018). Due to the unique morphology of the rostrum in species of *Monochorhynchus*, scanning electron microscopy (SEM) was employed to briefly investigate the mouthparts of *M. dehongensis* sp. nov., contributing additional data for future morphological and phylogenetic analyses.

## Material and methods

External morphology was examined using a Leica MZ125 stereo microscope. All measurements are given in millimeters (mm). Morphological terminology follows Bourgoin (1987) for male genitalia, Chen *et al.* (2025) for reduced female genitalia as modified from Bourgoin (1993), and Bourgoin *et al.* (2015) for wing venation, with the MP vein nomenclature adopted from Emeljanov (1995) as outlined in Bourgoin *et al.* (2015). Terminology for the maxillo-mandibular connection systems and classification of sensilla follows Brožek *et al.* (2006) and Brožek & Bourgoin (2013a, 2013b).

Genital segments were dissected and macerated in 10% NaOH solution at approximately 100°C for 1–2 minutes, then transferred to glycerin for observation and preservation. Photographs were taken using a Leica M205A microscope equipped with a Leica DFC digital camera. Image stacks were processed with Leica Application Suite (LAS) ver. 3.7.

Type specimens are deposited in the Entomological Museum of Northwest A&F University (NWFU), Yangling, Shaanxi Province, China, and in the insect collection of the College of Plant Protection, China Agricultural University (CAU), Beijing, China.

For scanning electron microscopy (SEM), fixed mouthparts were cleaned in an ultrasonic cleaner (5 cycles × 5 seconds), dehydrated through an ethanol series (75%, 80%, 85%, 90%, and 95% for 20 minutes each, followed by 100% ethanol twice for 30 minutes), then air-dried for 24 hours. The mouthparts were sputter-coated with gold using a GVC1000 sputter coater (Gevee, China). Cross-sectional analyses were conducted at the subapical segment of the rostrum. Observations and imaging were carried out under a Hitachi SU5000 scanning electron microscope at 3 kV.

## Results

### *Taxonomy*

Class Insecta Linnaeus, 1758  
Order Hemiptera Linnaeus, 1758  
Suborder Fulgoromorpha Evans, 1946  
Superfamily Fulgoroidea Latreille, 1807  
Family Derbidae Spinola, 1839  
Subfamily Otiocerinae Muir, 1917  
Tribe Zoraidini Muir, 1913  
Subtribe Lyddina Emeljanov, 1995  
  
Genus *Monochorhynchus* Muir, 1917

*Monochorhynchus* Muir, 1917: 217.

### Type species

*Monochorhynchus wahri* Muir, 1917 (by original designation).

### Description

HEAD AND THORAX. Head including eyes somewhat narrower than pronotum, conjunction of vertex and frons angular and not protruding in profile. Vertex nearly trapezoidal, width of base greater than length, about twice that of apex, anterior margin distinctly carinate and slightly convex medially, and posterior margin roundly emarginate, basal area depressed, rising to apex. Frons narrow, with lateral marginal carinae widened and slightly separated by fine median sulcus in basal half, but thin and begin to abruptly diverge distad at same level as anterior apical angles of eyes. Clypeus triangular, longer than frons, with two longitudinal lateral carinae and stouter median one. Rostrum robust and elongate, extending beyond coxae of hind legs, with apical segment short and greatly enlarged at apex, forming sucker-like pad. Eyes reniform, with ventral margins obviously concave inwards, anteroventral angle protruding to near middle of frons; ocelli present. Antenna about half length of frons, pedicel cylindrical and truncated apically, with dense sensilla, flagellum terminal. Pronotum extremely short at middle, anterior margin obtusely convex, and posterior margin deeply concave, lateral parts expand to patagium-like, with dense tubercles. Mesonotum developed and diamond-shaped, with longitudinal median carina and two lateral ones, disc raised, often with tubercles along carinae, scutellum nearly trapezoidal. Tegmina elongate, about 3.5–3.7 × as long as widest portion, narrowest basally and widest centrally, then slightly constricted distad, posterior margin arched, costal margin relatively straight with sensory pits in basal half, jugal margin slightly protruding, apical margin slightly emarginate. Costal veinlets (*hm*) connecting ScP+R (1) and ScP+RA (4) to costal margin; ScP+RA separating from RP before basal third of tegmina and slightly distad of CuA forking; RA<sub>2</sub> with two terminal branches; RP with four terminal branches, RP<sub>1</sub> sinuate; MP with nine terminal branches, MP<sub>3+4</sub> forked in single MP<sub>3</sub> and MP<sub>4</sub>, MP<sub>2</sub> single, MP<sub>1b</sub> two-branched, MP<sub>1a</sub> four-branched, six veinlets connect every two branches of MP from MP<sub>3</sub> to MP<sub>1aaa</sub> (not including between branches of MP<sub>1b</sub>); CuA forked before first *m-cu*, CuA<sub>1</sub> and CuA<sub>2</sub> fused near apex to form a common stem and extending to posterior margin, C5 present; Pcu connected with A<sub>1</sub> at basal third of clavus; clavus open, narrow, and elongate, expanded apically. Tegminal markings scattered and veins mottled. Wings slightly shorter than half of tegmina and narrowly round at apex, with anterior margin slightly convex at middle; ScP+RA separating from RP before middle, MP with two branches, CuA with two branches, CuP, Pcu, and A<sub>1</sub> relatively short and straight, stridulatory plate present with convex outer margin. Metatibiotarsal formula: 5-(7–8)-6.

MALE GENITALIA. Anal tube nearly triangular or trapezoidal in dorsal view, with lateral margins gradually converging distad, anal stylus located about middle, epiproct subrectangular, paraprocts elongate and cylindrical, extending to or beyond apex of anal tube, with few setae at apex; in lateral view, more than apical half part inclined ventrad, with slight dorsal process before turning point. Pygofer with laterodorsal angles round and not protruding, medioventral process present. Gonostylus short and broad, posterior part subquadrate, apex wider than base, dorsal margin thinly membranous, with auricular process at subapical part, dorsal apical angle acute and upcurved, apical margin medially protruding inwards; anterior part of gonostylus as long as posterior part, slender and clavate. Phallic complex broad and very complex, with various processes.

FEMALE GENITALIA. One of highly reduced types of subtribe Lyddina Emeljanov, 1995. Anal tube (AT) highly modified into anal ring terminating in two styliform processes, dorsal epiproct, and ventral paraprocts clavate and extending caudad. Pygofer (segment VIII) annular, developed, and well-sclerotized, prominently expanded ventrally, with two spiracles (Sp) adjacent to anterolateral angles, surrounded by sclerotized plates. Medioventral plate (mvP) of segment VIII present. Intermedia plates (imP) paired and located dorsally to mvP. Anteroventral lip under oviporus following imP. Intergonocoxal

plate IX (iGxP) more or less membranous. Gonocoxa IX developed. Gonoplac (Gp) laminated and C-shaped. Impaired mediodorsal sclerotized plate (mdP) connected ventrally to tergite IX.

### Remarks

In the key provided by Fennah (1952), the genus is misplaced based on the following distinctions: 1) “Antennae generally longer than frons”; however, Muir’s (1917) illustrations showed that the antennae are distinctly shorter than the frons. 2) “Media generally with five sectors” and “first medial sector with two to four branches”; Muir’s (1917) descriptions stated, “Tegmina with six median sectors, the third furcate”, and further notes, “The tegmen in this genus is similar to that in *Paraproustista* (syn. *Pamendanga* Distant, 1906)”.

This genus closely resembles *Helcita* Stål, 1856, and *Formodanga* Yang & Wu, 1994, but can be separated from them by the following features: 1) vertex with anterior margin distinctly carinate and slightly convex medially, whereas in *Formodanga*, vertex with anterior margin indistinctly carinate and distinctly incised medially; 2) head in profile not produced conically, whereas in *Helcita*, head in profile produced conically. In addition, sucker-like apical segment of rostrum, elongate paraprocts of males, and mottled tegminal veins (unknown in *M. wahri*) may be important features of this genus.

The current research provides the first descriptions of female genitalia of this genus, and the reduced features support the classification of this genus under the subtribe Lyddina. The greatly enlarged apical segment of the rostrum easily distinguishes it from other genera within the subtribe (e.g., *Proutista* Kirkaldy, 1904 and *Diostrombus* Uhler, 1896) (Fig. 1B–D).

### Checklist of the species of *Monochorhynchus* Muir, 1917

1. *Monochorhynchus dehongensis* sp. nov.  
Distribution: China (Yunnan)
2. *Monochorhynchus obscurus* sp. nov.  
Distribution: China (Guangxi)
3. *Monochorhynchus psammochroma* sp. nov.  
Distribution: China (Fujian)
4. *Monochorhynchus wahri* Muir, 1917  
Distribution: Borneo

### Key to the species of *Monorhynchus* Muir, 1917 (♂)

1. Anal tube with apex bifurcated in profile; pygofer with medioventral process truncated..... *M. psammochroma* sp. nov.  
– Anal tube with apex single in profile; pygofer with medioventral process angular or round ..... 2
2. Body generally brownish; anal tube with apex curved caudad in profile ..... *M. wahri* Muir, 1917  
– Body generally dark brown; anal tube with apex straight or inclined ventrad in profile ..... 3
3. Anal tube with apex round in dorsal view; pygofer with medioventral process round ..... *M. dehongensis* sp. nov.  
– Anal tube with apex obtusely angular in dorsal view; pygofer with medioventral process obtusely angular ..... *M. obscurus* sp. nov.

*Monochorhynchus wahri* Muir, 1917

*Monochorhynchus wahri* Muir, 1917: 217.

**Differential diagnosis**

*Monochorhynchus whari* can be separated from the three new species by several key characters: 1) body brownish (whereas dark brown in *M. dehongensis* sp. nov. and *M. obscurus* sp. nov.); 2) pygofer with medioventral process angular (whereas round in *M. dehongensis* and truncated in *M. psammochroma* sp. nov.); 3) in profile, anal tube with apex curved caudad and single (whereas relatively straight in all three new species, and bifurcated in *M. psammochroma*).

**Remarks**

*Monochorhynchus whari* is the type species of the genus, distributed in Borneo. Due to the difficulty in obtaining the type material, a direct comparison with the new species described here was not possible; consequently, our understanding of *M. whari* is based solely on the original description and illustrations by Muir (1917).

*Monochorhynchus dehongensis* sp. nov.

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Figs 1–3, 8–11

**Diagnosis**

This species can be easily separated from *M. wahri* by its dark brown coloration and the round medioventral process of the pygofer. In contrast, *M. wahri* has a brownish coloration and an angular medioventral process of the pygofer.

**Etymology**

The specific epithet refers to the collection site ‘Dehong’.

**Type material**

**Holotype**

CHINA • ♂; Yunnan Province, Dehong prefecture, Longchuan County, Shihuiku; 97.8355° E, 24.3430° N; 1234.5 m a.s.l.; 3 Aug. 2024; Ai Deqiang leg.; NWAUFU.

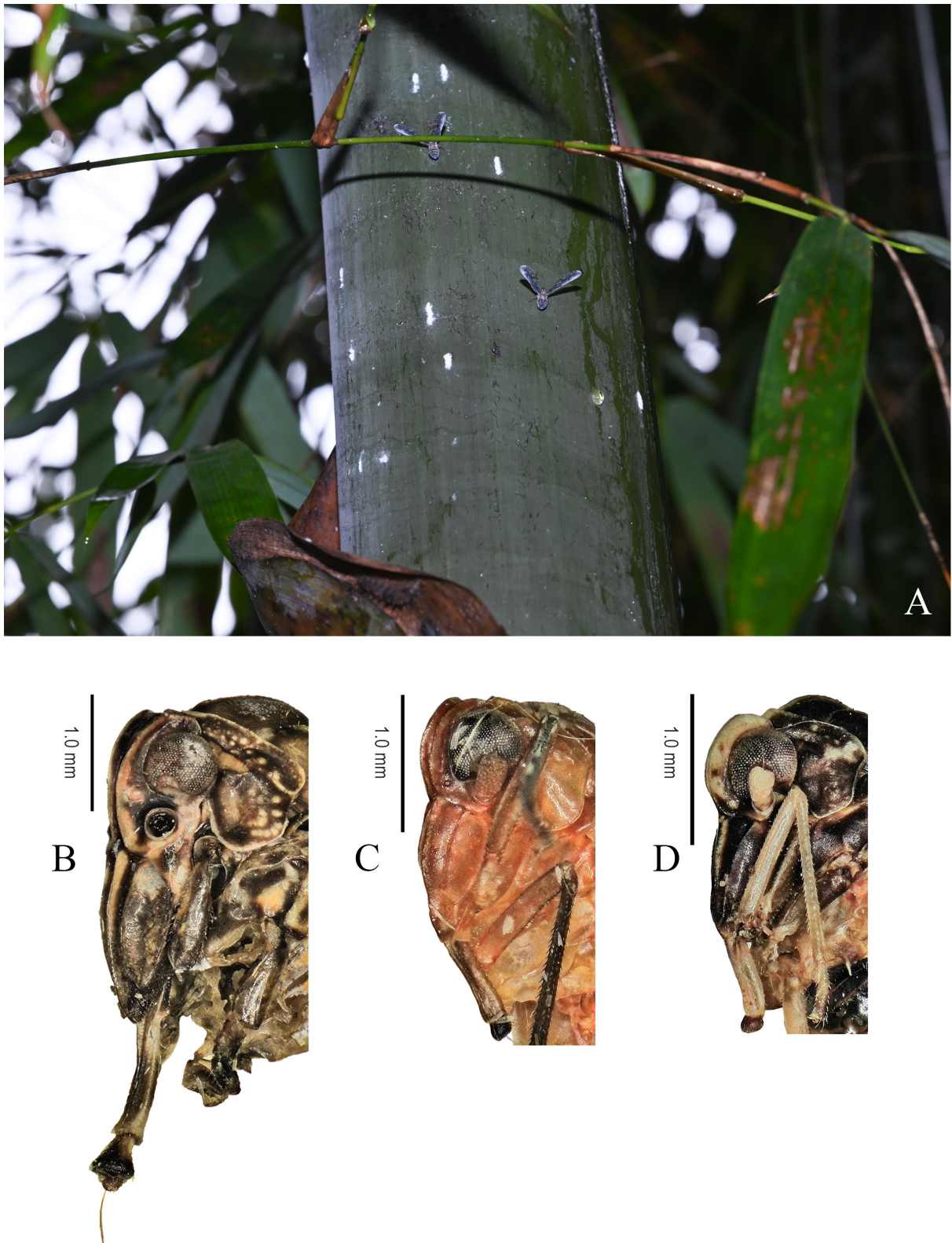
**Paratypes**

CHINA • 6 ♀♀; same data as for holotype; NWAUFU.

**Description**

MEASUREMENTS. Body length (incl. tegmen): male (N = 1) 13.0 mm, female (N = 6) 13.0–13.3 mm; length of tegmen: male (N = 1) 11.5 mm, female (N = 6) 11.5–11.8 mm.

COLORATION. Body generally dark brown (Fig. 1A). Vertex with lateral marginal carinae yellow, and disc dark brown with midline white, anterior margin brown and posterior margin white (Fig. 2A). Frons dark brown, with clear white spot at middle of base, and two white spots on each inside of lateral marginal carinae, carinae brown (Fig. 2B). Gena brownish, tinged slightly darker around eye, and much darker around antennal socket and above eye, white behind antenna and in ventrolateral angle (Fig. 2C). Clypeus brown, in frontal view, with white spot at base and longitudinal brownish stripe along median carina, three carinae brown (Fig. 2B); in lateral view, each lateral part with large white spot at base, and longitudinal brownish stripe in middle (Fig. 2C). Labrum white (Fig. 2B). Rostrum with second segment



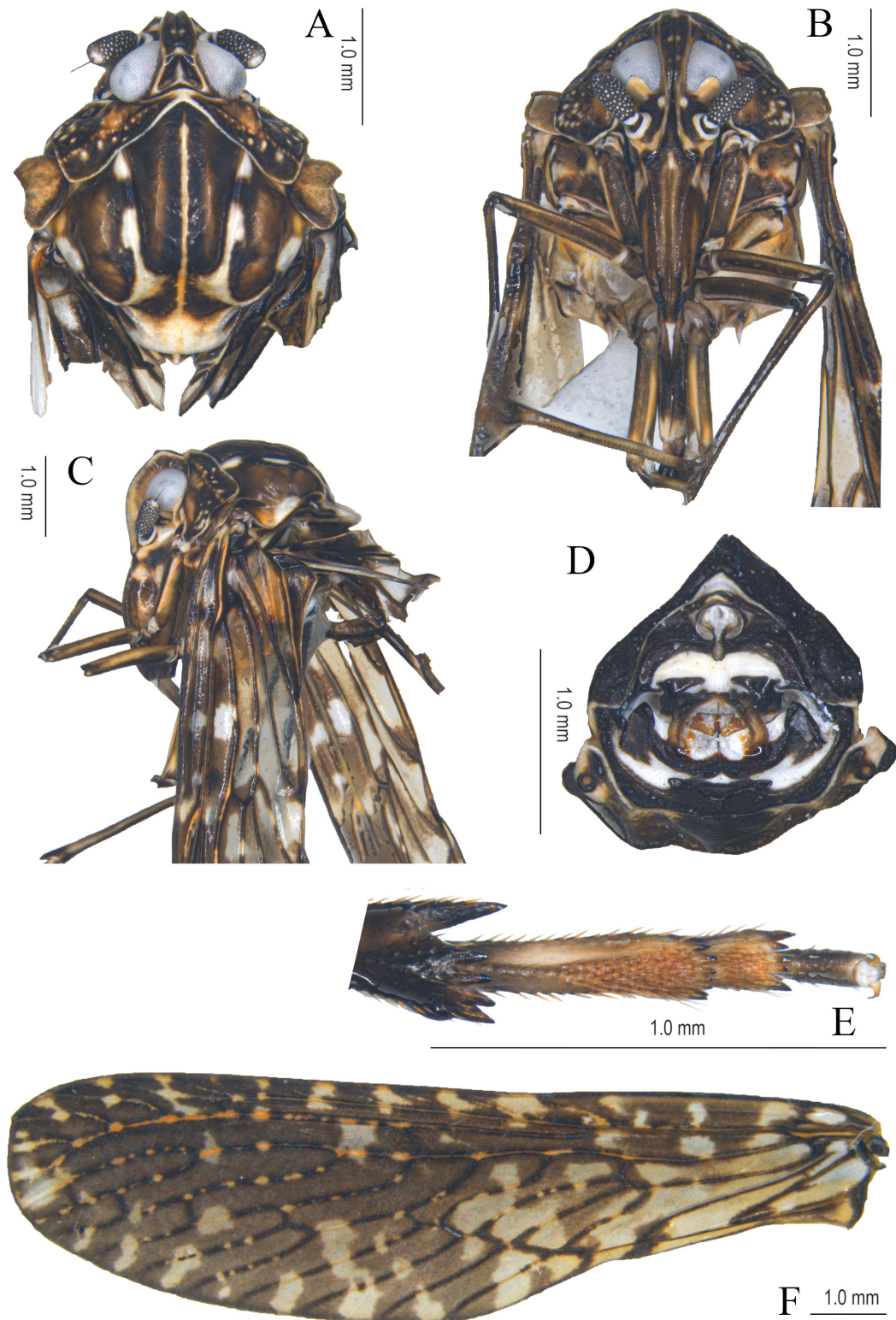
**Fig. 1.** *Monochorhynchus* Muir, 1917, adult habitus in nature, and head of three species of Derbidae Spinola, 1839, lateral views. **A.** *Monochorhynchus dehongensis* sp. nov. (photographed by Ai Deqiang in Yunnan Province, used with permission). **B.** Head of *Monochorhynchus obscurus* sp. nov. **C.** Head of *Diostrombus politus* Uhler, 1896. **D.** Head of *Proutista moesta* (Westwood, 1851).

gradually darker towards subapical part, apex white; apical segment dark brown (Fig. 2B–C). Eyes gray; ocelli white. Antennae brown with sensilla white (Fig. 2A–C). Pronotum dark brown, midline and margins white, each lateral part with two large brownish stripes behind eye, some white tubercles, and row of smaller yellow tubercles (Fig. 2A–C). Mesonotum brown, tinged darker between lateral carinae, with two longitudinal lighter lines on lateral sides of median carina, and two white spots behind yellow lateral angles; median carina white, lateral carinae white with broader white markings along them, and dark spots at anterior quarter, slightly widened at middle and expanding inwards near posterior margin; scutellum white (Fig. 2A, C). Tegula brownish, with darker stripe adjacent to posterior margin (Fig. 2A). Tegmen generally dark brown, almost every apical cell with white to yellowish spots adjacent to margins, basal half with large yellowish region with fewer dark markings, delimited by MP, MP<sub>2</sub>, subapical line, and postclaval margin, radial cell with four white spots, C2 with two white spots, subapical line with some white spots; veins mottled, mainly dark brown, with yellow spots (Fig. 2F). Wing semitransparent, with brown to dark brown markings. Legs yellowish, fore and middle legs with brown stripes on first three segments, tibiae and tarsi generally brown; hind leg lighter than first two legs, with darker markings at apex of tibia (Fig. 2B–C, E). Abdomen dark brown on dorsal side with many small yellow spots, and lighter on ventral side.

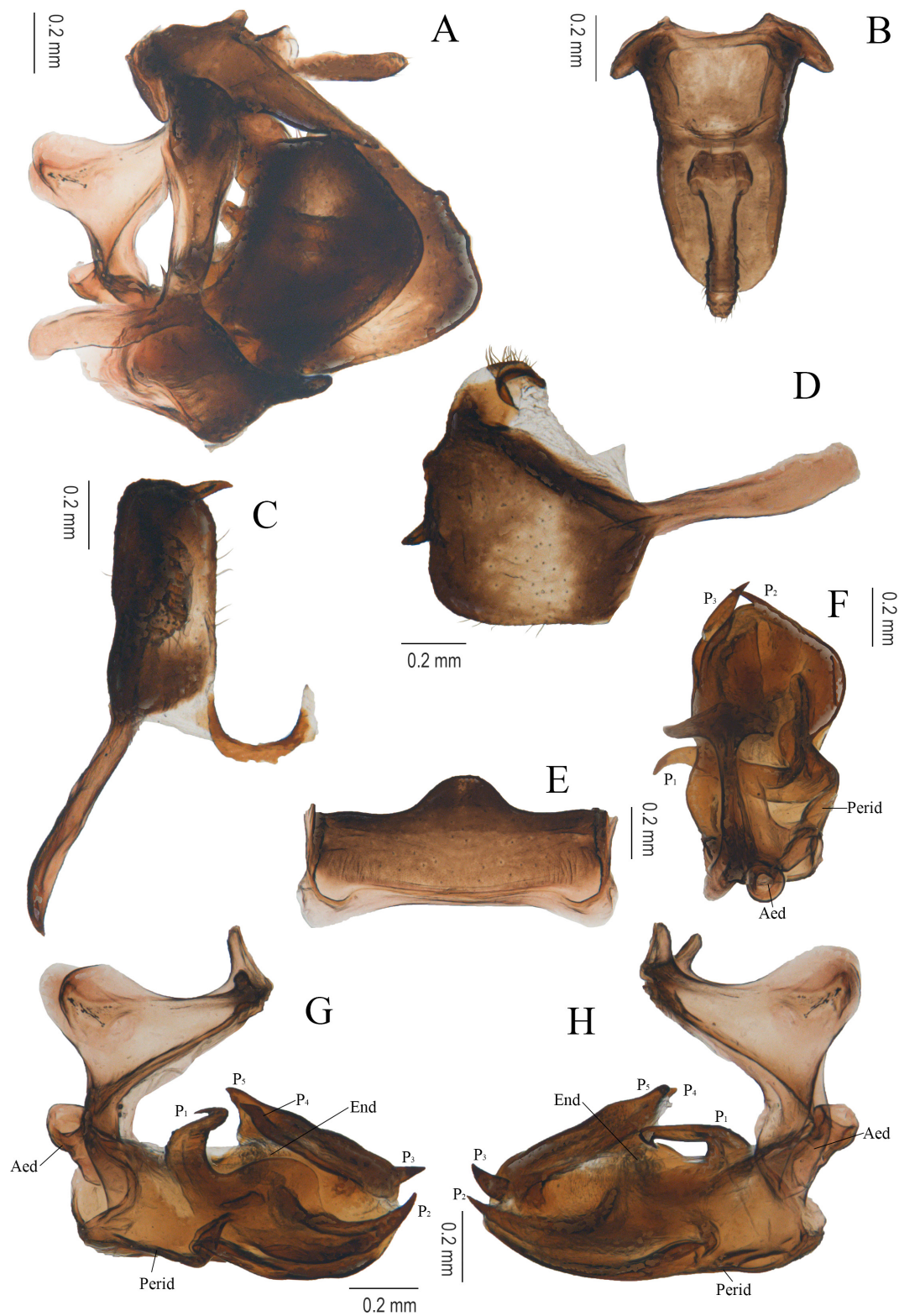
**HEAD AND THORAX.** Vertex with width of base  $1.9 \times$  as long as length of midline (Fig. 2A). Antenna with pedicel about  $2.6 \times$  as long as widest portion, slightly constricted apically (Fig. 2A–C). Pronotum with small tubercles arranged in lines parallel with posterior margin (Fig. 2A). Mesonotum with few small tubercles along posterior portion of median carina (Fig. 2A). Tegmina about  $3.7 \times$  as long as widest portion (Fig. 2F). Metatibiotarsal formula: 5-(7–8)-6 (Fig. 2E).

**MALE GENITALIA.** Anal tube tongue-shaped in dorsal view, with midline length about  $1.6 \times$  as long as basal width (excluding basal angles), apex round, basal half with trapezoidal ventral opening, lateral margins slightly incised medially, becoming elevated and infolded posteriorly (Fig. 3B); in lateral view, basal third relatively straight, with two basal angles protruding ventrad and dorsal process protruding dorsocaudad before turning point, apical two thirds triangular and inclined ventrad, with dorsal margin straight, paraprocts extending beyond apex of anal tube (Fig. 3A). Pygofer rectangular in ventral view, with medioventral process slight and round (Fig. 3E). Gonostyli subrectangular in dorsal view, with apical process extending inwards, lamina sclerotized and C-shaped (Fig. 3C); in lateral view, with auricular process protruding outwards, blunt and hirsutiusculus at apex (Fig. 3D); in caudal view, apical margin irregular, deeply concave in ventral quarter, with apical process narrow-acicular at ventral third, and small angular process at dorsal third (Fig. 8C). Phallic complex robust and broad, in dorsal view, perianthium gourd-shaped, with left margin double-arched, right margin arched in basal portion and relatively straight in apical portion, five characteristic processes: 1) elongate and sinuous process (P<sub>1</sub>) originating from mid-left margin, extending beyond right margin, with main portion curved caudad, apex acute and recurving cephalad; 2) broad and curved process (P<sub>2</sub>) originating from mid-left margin, following apical portion of left margin, with apex acute and directed right-caudad, slightly exceeding apex; 3) short and spinous process (P<sub>3</sub>) originating from subapical right margin, extending caudad, with apex acute; 4) elongate and triangular process (P<sub>4</sub>) originating from apical dorsum, extending cephalad to basal third, with apex straight and acute; 5) broad and flat process (P<sub>5</sub>) adjacent to P<sub>4</sub> on its right dorsal side, also originating from apical dorsum, and extending cephalad to basal third, with apex constricted and curved rightwards (Fig. 3F). In lateral view, P<sub>1</sub> arched dorsad basally, sinuous and gradually tapered distad, P<sub>2</sub> horn-shaped and upcurved, P<sub>3</sub> short and extending to level of P<sub>2</sub> apex, P<sub>4</sub> and P<sub>5</sub> extending dorsocephalad; endosoma small; aedeagus cylindrical and sclerotized at base (Fig. 3G–H).

**FEMALE GENITALIA.** Pygofer without dorsolateral tergal processes and ventrosternal processes. Medioventral plate with dorsolateral angles obtusely angular, dorsal margin slightly convex at each lateral quarter. Intermedia plates hammer-shaped, not directly connected to other sclerotized structures, broad



**Fig. 2.** *Monochorhynchus dehongensis* sp. nov., adult external morphology. A–C, E–F. Holotype, ♂ (NWAFU). D. Paratype, ♀ (NWAFU). A. Head and thorax, dorsal view. B. Head and thorax, frontal view. C. Head and thorax, lateral view. D. Female genitalia, caudal view. E. Metatibiotarsal formula. F. Tegmen.



**Fig. 3.** *Monochorhynchus dehongensis* sp. nov., holotype, ♂ (NWAFU), genitalia. **A.** Lateral view. **B.** Anal tube, dorsal view. **C.** Gonostylus, dorsal view. **D.** Gonostylus, lateral view. **E.** Pygofer, ventral view. **F.** Phallic complex, dorsal view. **G.** Phallic complex, left view. **H.** Phallic complex, right view. Abbreviations: P<sub>1-5</sub> = process 1–5; Aed = aedeagus; Perid = periandrium; End = endosoma.

at bases, narrow at apices that meet medially, displaying faint dividing line at middle. Intergonocoxal plate IX with ventral margin slightly incised at middle, sclerotized parts double-C-shaped and widened subapically, and with short rod along median incision. Gonocoxa IX with dorsolateral angle angularly convex. Gonoplac in caudal view, broadest near base and apex, obtusely angular at base, slightly incurved at apex. Mediodorsal sclerotized plate semi-circular and slightly concave at middle (Figs 2D, 8F).

### Host plant association

An unidentified bamboo species (Poaceae Barnhart: Bambuseae Kunth ex Dumort.), likely belonging to the genus *Bambusa* Schreb., *Thyrsostachys* Gamble, or *Dendrocalamus* Nees.

### DNA Barcode

The *COI* sequence was uploaded to the Nucleotide database of GenBank with the accession number (PX568410).

### Remarks

Unfortunately, owing to delicate hind wings, we were unable to fully document them.

In this species, between gonoplacs and medioventral plate, there is a pair of intermedia plates (imP), strongly sclerotized (Figs 2D, 8F). Morphologically, these plates resemble the gonocoxae VIII of *Proutista moesta* and *P. pseudomoesta* in shape and position (Chen *et al.* 2025); however, their anteroventral margins are not directly connected to the posterodorsal margin of sternite VIII, and they coexist with the medioventral plate (mvP). Presumably, these unique intermediate plates are characteristic of the entire genus. This structure also likely represents an intermediate state of reduction of gonapophyses VIII, constituting a transitional stage between the well-developed condition (as in subtribe Zoraidina Muir, 1913) and the complete absence observed in genera (e.g., in *Proutista* and *Shizuka*).

### *Monochorhynchus obscurus* sp. nov.

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Figs 4–5, 8

### Diagnosis

This species is easily separated from *M. wahri* by coloration, and from *M. dehongensis* sp. nov. by its dark brown coloration and straight anal apex in profile. In contrast, *M. wahri* with a brownish coloration and anal apex curved caudad in profile.

### Etymology

The specific epithet is derived from Latin ‘*obscurus*’ (‘dark’, ‘shadowy’), referring to the predominantly dark coloration of the integument.

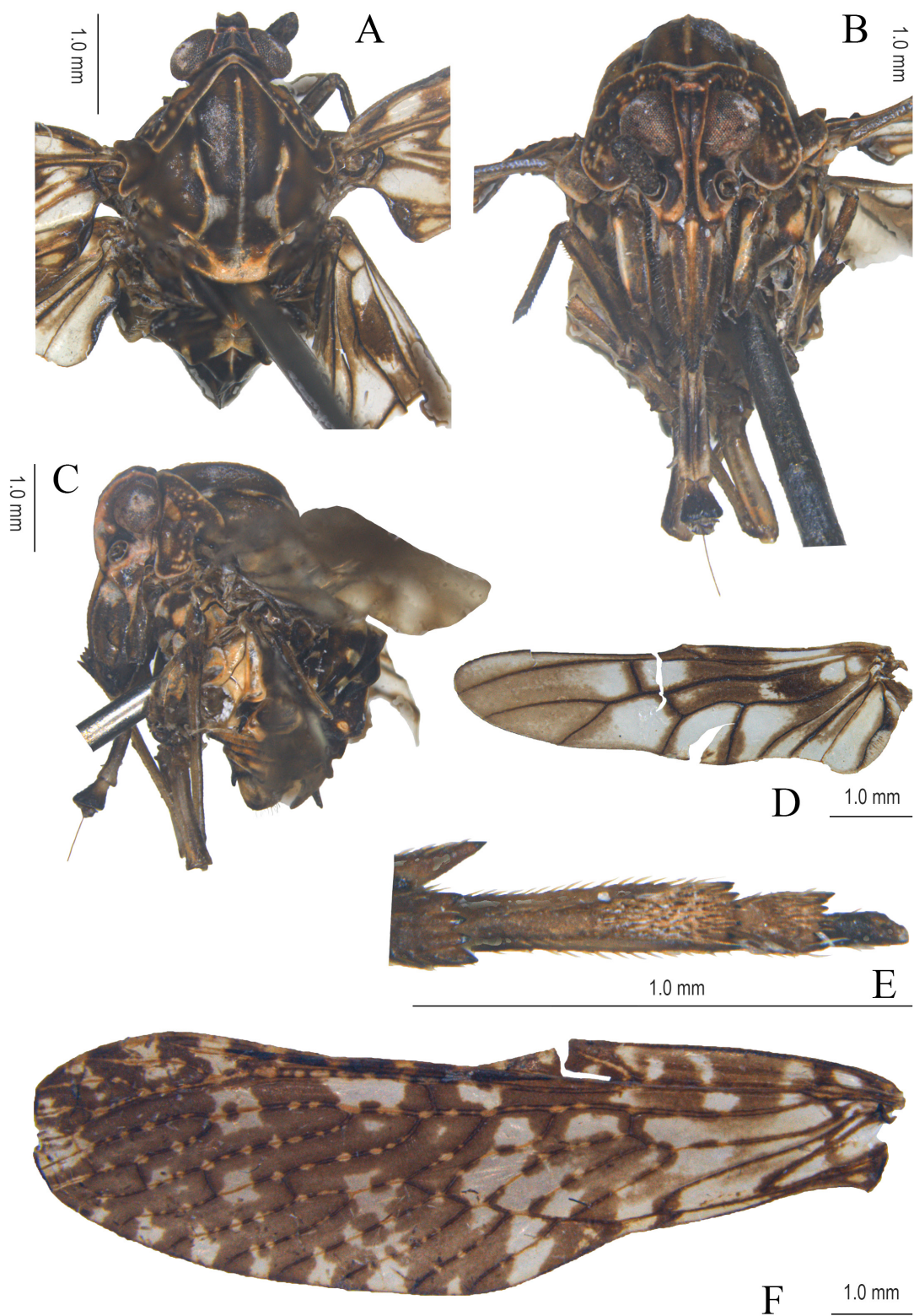
### Type material

#### Holotype

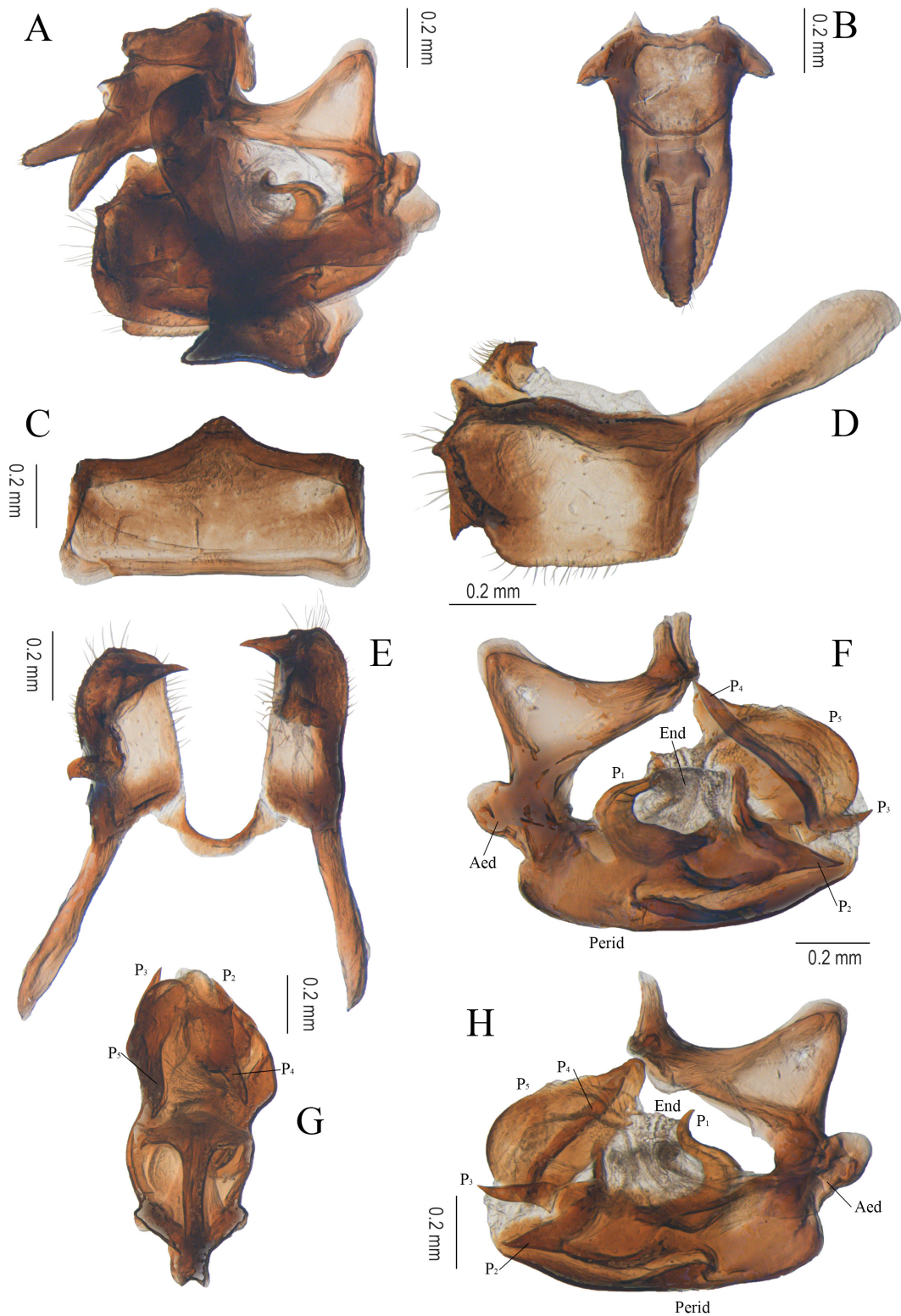
CHINA • ♂; Guangxi Zhuang Autonomous Region, Guilin City, Longsheng County, Huaping, Anjiangping; 2 Aug. 2006; Guo Hongwei leg.; NWAUFU.

#### Paratypes

CHINA • 2 ♂♂; same data as for holotype; NWAUFU.



**Fig. 4.** *Monochorhynchus obscurus* sp. nov., adult, external morphology. **A–E.** Holotype, ♂ (NWAFU). **F.** Paratype, ♂ (NWAFU). **A.** Habitus, dorsal view. **B.** Habitus, frontal view. **C.** Habitus, lateral view. **D.** Wing. **E.** Metatibiotarsal formula. **F.** Tegmen.



**Fig. 5.** *Monochorhynchus obscurus* sp. nov., holotype, ♂ (NWAFU), genitalia. **A.** Lateral view. **B.** Anal tube, dorsal view. **C.** Pygofer, ventral view. **D.** Gonostylus, lateral view. **E.** Gonostyli, dorsal view. **F.** Phallic complex, left view. **G.** Phallic complex, dorsal view. **H.** Phallic complex, right view. Abbreviations: see Fig. 3.

## Description

MEASUREMENTS. Body length (incl. tegmen): male (N = 3) 12.2–12.4 mm; length of tegmen: male (N = 3) 10.7–10.9 mm.

COLORATION. Body generally dark brown (Fig. 4A–C). Vertex with lateral marginal carinae light orange, and disc dark brown with midline lighter, anterior margin light orange and posterior margin white (Fig. 4A). Frons dark brown, with clear white spot at middle of base, and column of small unclear spots on each inside of lateral marginal carinae, carinae light orange (Fig. 4B). Genae light orange, tinged dark brown around eye and antennal socket, white behind antenna and in ventrolateral angle (Fig. 4C). Clypeus dark brown, in frontal view, with short light orange stripe along basal quarter of median carina, three carinae brown (Fig. 4B); in lateral view, each lateral part with large white spot at base (Fig. 4C). Labrum white (Fig. 4B). Rostrum with second segment white at base and apex, gradually darker towards middle; apical segment dark brown (Fig. 4B–C). Eyes dark gray; ocelli light orange. Antennae dark brown with sensilla white (Fig. 4A–C). Pronotum dark brown, midline and margins yellow, each lateral part with two large lighter stripes behind eye, some yellow tubercles, and row of smaller yellow tubercles (Fig. 4A–C). Mesonotum brown, tinged darker between lateral carinae, with two longitudinal slightly lighter lines on lateral sides of median carina, and two white spots behind lateral angles; median carina yellow in anterior half and white in posterior half, lateral carinae generally yellow with dark spots at its anterior quarter, white spots at posterior third expanding inwards; scutellum yellow to light orange (Fig. 4A, C). Tegula dark brown (Fig. 4A–B). Tegmen generally dark brown, almost every apical cell with white spots adjacent to margins, basal half with large white region with fewer dark markings, delimited by MP, MP<sub>2</sub>, subapical line, and postclaval margin, radial cell with four white spots, C2 with two white spots expanded posteriorly into circular shapes, subapical line with some white spots; veins mottled, mainly dark brown, with light orange spots (Fig. 4F). Wing semitransparent, tinged brownish in apical quarter, and brown along veins, with subquadrate dark brown near middle, from anterior margin to CuA<sub>1</sub>, another one near base, from MP to A<sub>1</sub>, and small oval brown spot at apex of CuA<sub>2</sub>; veins dark brown (Fig. 4D). Legs yellowish, fore and middle legs with brown stripes on first three segments, tibiae and tarsi generally brown; hind leg lighter than first two legs, with slightly darker markings at apex of tibia (Fig. 4B–C, E). Abdomen dark brown on dorsal side with many small yellow spots, and lighter on ventral side (Fig. 4A, C).

HEAD AND THORAX. Vertex with width of base  $2.6 \times$  as long as length of midline (Fig. 4A). Antenna with pedicel about  $2.3 \times$  as long as widest portion, slightly constricted apically (Fig. 4A–C). Pronotum with small tubercles almost arranged in lines parallel with posterior margin (Fig. 4A, C). Mesonotum with few small tubercles along three carinae (Fig. 4A). Tegmina about  $3.6 \times$  as long as widest portion (Fig. 4F). Metatibiotarsal formula: 5-8-6 (Fig. 4E).

MALE GENITALIA. Anal tube triangular in dorsal view, with midline length about  $1.9 \times$  as long as basal width (excluding basal angles), apex obtusely angular, basal half with subquadrate ventral opening, lateral margin very slightly incised medially, becoming elevated and infolded posteriorly (Fig. 5B); in lateral view, basal third relatively straight, with two basal angles protruding ventrad and dorsal process protruding caudad before turning point, apical two thirds triangular and inclined ventrad, with dorsal margin relatively straight, paraprocts extending beyond apex of anal tube (Fig. 5A). Pygofer rectangular in ventral view, with medioventral process slight and obtusely angular (Fig. 5C). Gonostylus subrectangular in dorsal view, with apical process extending inwards, lamina sclerotized and C-shaped (Fig. 5E); in lateral view, with auricular process protruding outwards, acute and hirsutiusculus at apex (Fig. 5D); in caudal view, apical margin irregular, moderately concave in ventral quarter, with apical process broad-triangular at middle, and small angular process at dorsal third (Fig. 8D). Phallic complex robust and broad, in dorsal view, periandrium gourd-shaped, with left and right margins both double-arched, five characteristic processes: 1) elongate and sinuous process (P<sub>1</sub>) originating from mid-left

margin, extending before right margin, with main portion curved caudad, apex acute and recurving cephalad; 2) broad and curved process ( $P_2$ ) originating from mid-left margin, following apical portion of left margin, with apex acute and directed right-caudad, not reaching apex; 3) short and spinous process ( $P_3$ ) originating from subapical right margin, extending caudad, with apex acute; 4) elongate and triangular process ( $P_4$ ) originating from left apical dorsum, extending cephalad to middle, with apex gradually tapered; 5) broad and flat process ( $P_5$ ) separated from  $P_4$ , originating from right apical dorsum, and extending cephalad to middle, with apex constricted and slightly curved rightwards (Fig. 5G). In lateral view,  $P_1$  not arched dorsad basally, gradually tapered distad,  $P_2$  curved dorsad basally, recurving caudad distally,  $P_3$  extending beyond level of  $P_2$  apex,  $P_4$  very slender and  $P_5$  broad-foliar, both extending dorsocephalad; endosoma large; aedeagus cylindrical and sclerotized at base (Fig. 5F, H).

*Monochorhynchus psammochroma* sp. nov.

[urn:lsid:zoobank.org:act:58B2F14F-7746-42C2-B966-536528F8A81F](https://zoobank.org/act:58B2F14F-7746-42C2-B966-536528F8A81F)

Figs 6–8

**Diagnosis**

This species closely resembles *M. wahri* in general coloration, but can be separated from it by its truncated medioventral process of the pygofer and bifurcated anal apex in profile. In contrast, *M. wahri* with angular medioventral process of the pygofer and anal apex single in profile.

**Etymology**

The specific epithet derives from the Greek ‘psamos’ (‘sand’) and ‘chroma’ (‘color’), referring to the distinctive sandy-yellow coloration of the tegmina and body; the name is in apposition.

**Type material**

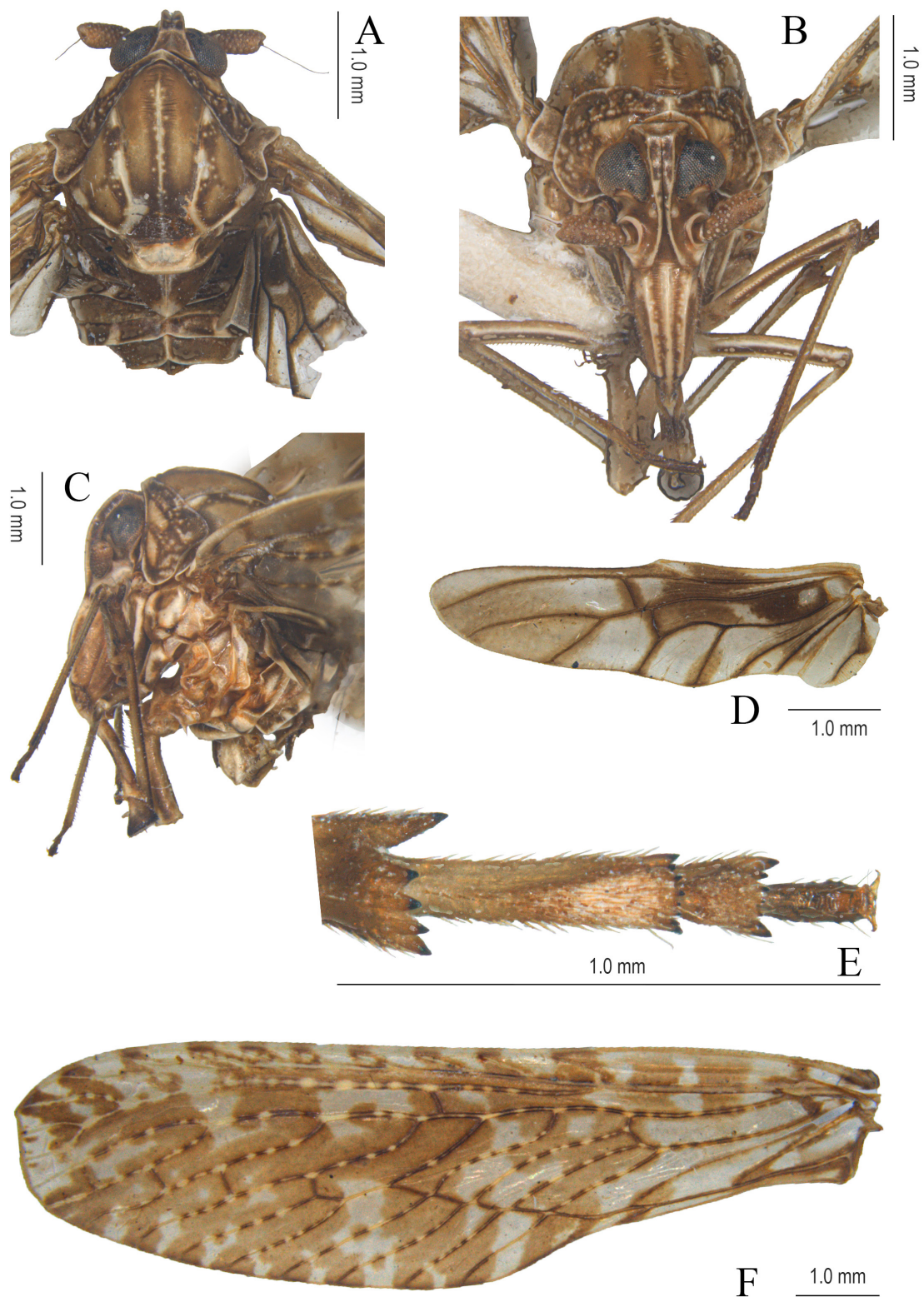
**Holotype**

CHINA • ♂; Fujian Province, Quanzhou City, Dehua County, Shuikou Town; 6 Nov. 1974; Li Fasheng leg.; CAU.

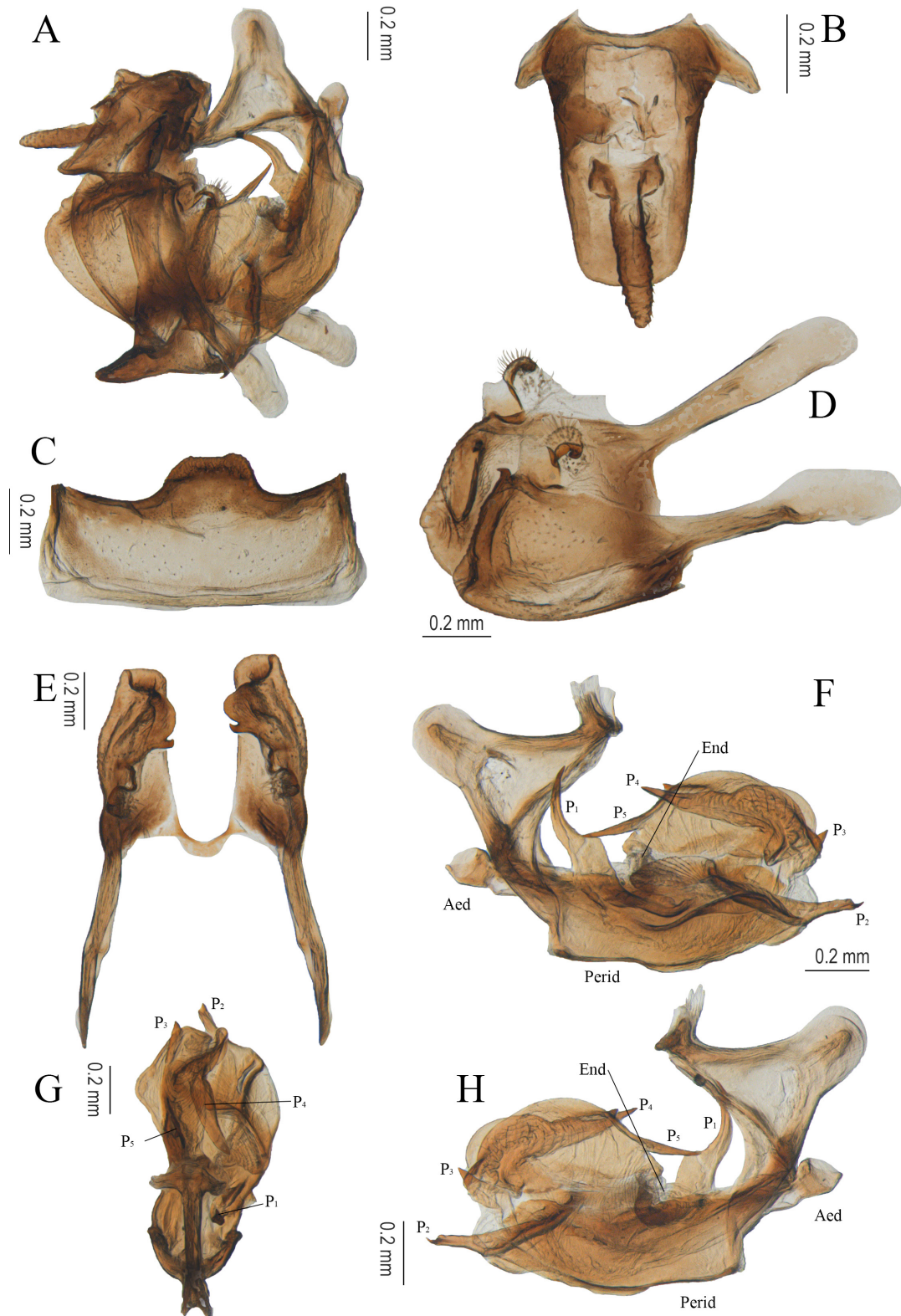
**Description**

MEASUREMENTS. Body length (incl. tegmen): male (N = 1) 11.9 mm; length of tegmen: male (N = 1) 10.4 mm.

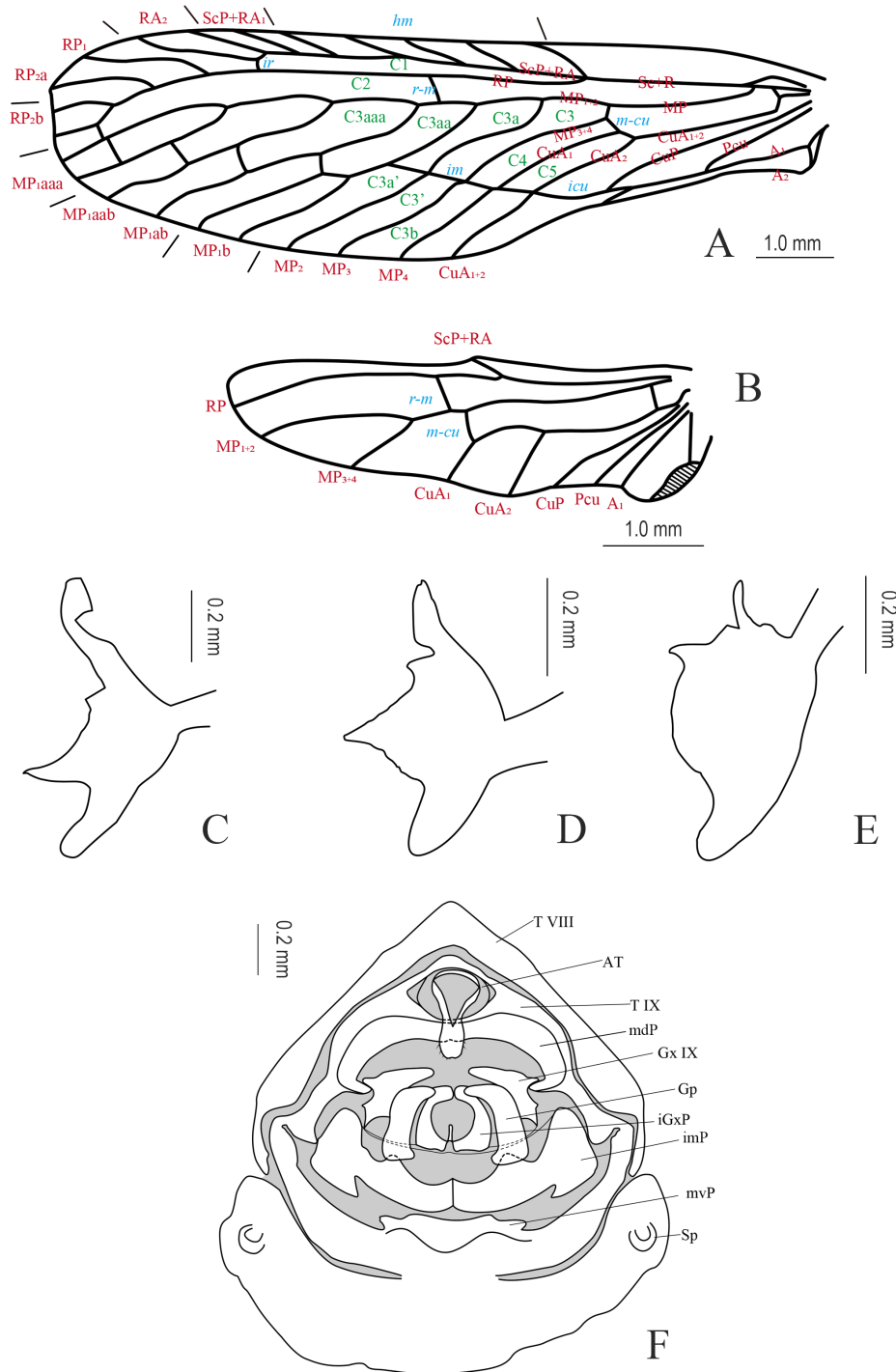
COLORATION. Body generally brownish (Fig. 6A–C). Vertex with lateral marginal carinae white, and disc brown with midline lighter, anterior and posterior margins white (Fig. 6A). Frons brown, with clear white spot at middle of base, and five white spots inside of each lateral marginal carina, of small, medium, small, large, and medium size, respectively, carinae white (Fig. 6B). Genae brown, tinged white around antennal socket and behind it, and in ventrolateral angle (Fig. 6C). Clypeus brown, in frontal view, with longitudinal white stripes along carinae, three carinae white (Fig. 6B); in lateral view, each lateral part with large white spot at base (Fig. 6C). Labrum white (Fig. 6B). Rostrum with second segment white at base and apex, gradually darker towards middle; apical segment with base brownish, darker distad (Fig. 6C). Eyes dark gray; ocelli white. Antennae brown with sensilla white (Fig. 6A–C). Pronotum brown, midline and margins yellow, each lateral part with two large brownish stripes behind eye, some white tubercles, and row of smaller white tubercles (Fig. 6A–C). Mesonotum brownish, with longitudinal brown stripes along carinae, round brown marking anterior to scutellum, and two white spots behind lateral angles; three carinae generally white, lateral ones with dark spots at anterior quarter, white spots at posterior third slightly expanding inwards; scutellum white to yellowish (Fig. 6A, C). Tegula brownish, with brown stripe adjacent to posterior margin (Fig. 6A–B). Tegmen generally brownish, almost every apical cell with white spots adjacent to margins, basal half with large white region with fewer dark



**Fig. 6.** *Monochorhynchus psammochroma* sp. nov., adult, holotype, ♂ (CAU), external morphology. A. Habitus, dorsal view. B. Habitus, frontal view. C. Habitus, lateral view. D. Wing. E. Metatibiotarsal formula. F. Tegmen.



**Fig. 7.** *Monochorhynchus psammochroma* sp. nov., holotype, ♂ (CAU), genitalia. **A.** Lateral view. **B.** Anal tube, dorsal view. **C.** Pygofer, ventral view. **D.** Gonostyli, lateral view. **E.** Gonostyli, dorsal view. **F.** Phallic complex, left view. **G.** Phallic complex, dorsal view. **H.** Phallic complex, right view. Abbreviations: see Fig. 3.



**Fig. 8.** Tegmen, wing, and genitalia. **A–B, E.** *M. psammochroma* sp. nov., holotype, ♂ (CAU). **A.** Tegminal venation. **B.** Wing venation. **C.** *M. dehongensis* sp. nov., holotype, ♂ (NWAFU), sclerotized outline of gonostylus, caudal view. **D.** *M. obscurus* sp. nov., holotype, ♂ (NWAFU), sclerotized outline of gonostylus, caudal view. **E.** Sclerotized outline of gonostylus, caudal view. **F.** *M. dehongensis* sp. nov., paratype, ♀ (NWAFU), genitalia, caudal view. Abbreviations: AT = anal tube; Gx IX = gonocoxa IX; Gp = gonoplac; iGxP = intergonocoxal plate IX; imP = intermedia plates; mdP = mediodorsal plate; mvP = medioventral plate; Sp = spiracle; T IX, VIII: tergite IX, VIII.

markings, delimited by MP, CuA<sub>2</sub>, first *m-cu*, and postclaval margin, radial cell with four white spots, C2 with two white spots expanded posteriorly to L-shaped, subapical line with some white spots; veins mottled, mainly brown, with yellow spots (Fig. 6F). Wing semitransparent, tinged brownish in apical quarter, and brown along veins, with subquadrate brown near middle, from anterior margin to CuA<sub>1</sub>, another slightly darker one near base, from MP to A<sub>1</sub>, and small oval spot at apex of CuA<sub>2</sub> with color lighter than first two; veins brown (Fig. 6D). Legs yellowish, with brown stripes excluding tarsi generally brown; hind leg with fewer markings than fore and middle legs, tinged darker markings at apex of tibia (Fig. 6B–C, E). Abdomen brown on dorsal side with many small yellow spots, and lighter on ventral side (Fig. 6A, C).

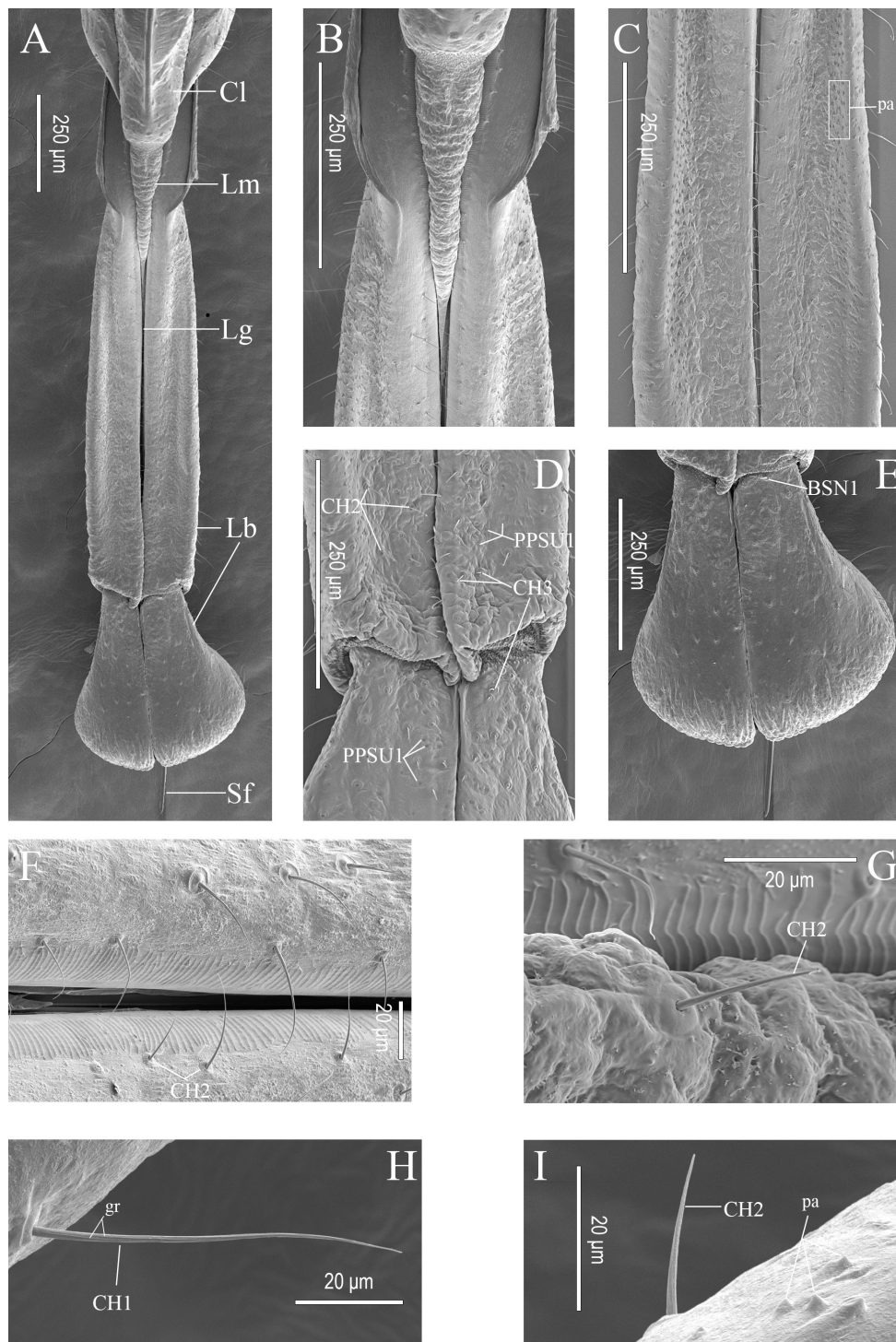
**HEAD AND THORAX.** Vertex with width of base  $2.3 \times$  as long as length of midline (Fig. 6A). Antenna with pedicel about  $2.6 \times$  as long as widest portion, anterior apical angles slightly protruding (Fig. 6A–C). Pronotum with small tubercles arranged in lines parallel with posterior margin (Fig. 6B–C). Mesonotum with many small tubercles along three carinae (Fig. 6A). Tegmina about  $3.5 \times$  as long as widest portion (Fig. 6F). Metatibiotarsal formula: 5-8-6 (Fig. 6E).

**MALE GENITALIA.** Anal tube trapezoidal in dorsal view, with midline length about  $1.4 \times$  as long as base width (excluding basal angles), apex relatively truncated, basal half with quadrate ventral opening, lateral margins relatively straight, elevated and infolded after middle (Fig. 7B); in lateral view, basal third relatively straight, with two basal angles protruding ventrad and dorsal process protruding dorsocaudad before turning point, apical two thirds inclined ventrad and bifurcated apically, ventral lobe smaller than dorsal lobe, paraprocts extending beyond apex of anal tube (Fig. 7A). Pygofer rectangular in ventral view, with medioventral process subtrapezoidal and relatively truncated, apex shorter than base (Fig. 7C). Gonostyli subrectangular in dorsal view, with apical process round and extending inwards, lamina sclerotized and C-shaped (Fig. 7E); in lateral view, with auricular process protruding outwards, blunt and hirsutiusculus at apex (Fig. 7D); in caudal view, apical margin irregular, shallowly concave in ventral quarter, with semicircular apical process at middle, and small hook near dorsal angle (Fig. 8E). Phallic complex robust and broad, in dorsal view, perianthrium reniform, with left margin arched outwards in postmedian portion, right margin shallowly concave from base to subapical portion, apex constricted, five characteristic processes: 1) elongate and sinuous process (P<sub>1</sub>) originating from mid-left margin, extending before longitudinal midline; 2) broad and curved process (P<sub>2</sub>) originating from mid-left margin, following apical portion of left margin, with apex obliquely truncated and directed right-caudad, exceeding apex; 3) very short and spinous process (P<sub>3</sub>) originating from subapical right margin, extending caudad, with apex acute; 4) elongate and triangular process (P<sub>4</sub>) originating from apical dorsum, extending cephalad to middle, with apex straight and acute; 5) broad and flat process (P<sub>5</sub>) adjacent to P<sub>4</sub> on its right dorsal side, also originating from apical dorsum, and extending cephalad to basal third, with apex constricted and slightly curved rightwards, in addition with a small thorn near apex (Fig. 7G). In lateral view, P<sub>1</sub> broad at base, abruptly constricted cephalad into hook, tapered distad and curving dorsad, P<sub>2</sub> chicken-claw-shaped and extending caudad, P<sub>3</sub> short and extending before level of P<sub>2</sub> apex, P<sub>4</sub> broad at base and gradually tapered at apex, extending dorsocephalad, P<sub>5</sub> broad-foliar in main portion, with small thorn at subapical portion, apex spinous and extending cephalad to middle of P<sub>1</sub>; endosoma small; aedeagus cylindrical and sclerotized at base (Fig. 7F, H).

### ***Fine morphology*** (Figs 9–11)

#### **General structure of the mouthparts**

The mouthparts of *M. dehongensis* sp. nov. conform to the typical piercing-sucking type observed in the Derbidae, originating posterior to the cephalic capsule and comprising three main components: 1) a cone-shaped labrum (Lm), 2) a three-segmented tubular labium (Lb), and 3) a stylet fascicle (Sf).



**Fig. 9.** *Monochorhynchus dehongensis* sp. nov., paratype, ♀ (NWAUFU). SEM of the mouthparts of the adult, anterior view. **A.** Entire morphology of the mouthparts. **B.** Labrum. **C.** Surface of second labial segment. **D.** Connection of second and third labial segment. **E.** Third labial segment. **F.** Both sides of groove of second labial segment. **G.** CH2 of labrum. **H.** CH1 of second labial segment. **I.** CH2 and papillae of second labial segment. Abbreviations: BSN1 = sensilla basiconica subtype I; CH1–3: sensilla chaetica subtypes I–III; Cl = clypeus; gr = grooved surface of sensillum chaeticum; Lb = labium; Lg = labial groove; Lm = labrum; pa = papillae; PPSU1 = peg-in-pit sensillum, uniporous (sensillum coeloconicum) subtype I; Sf = stylet fascicle.

The labrum (Fig. 9A–B, G) arises from the apex of the anteclypeus and extends along the median longitudinal groove of the second labial segment. It measures approximately 410  $\mu\text{m}$  in length and 85  $\mu\text{m}$  in basal width, overlapping about one-fifth to one-quarter of the groove. The labral surface is predominantly wrinkled, except for the smooth distal apex.

The labium (rostrum) features a narrow longitudinal groove (Lg) along its anterior surface (Fig. 9A). The first segment measures 400  $\mu\text{m}$  in length, with basal and apical widths of 200  $\mu\text{m}$  and 270  $\mu\text{m}$ , respectively. It is tubular, slightly expanded distally in posterior view (Fig. 10D), and obscured by the clypeus (Cl) in anterior view (Fig. 9A–B). The lateral surface exhibits slight oblique striations (Fig. 10A). A short membranous articulation connects the first and second segments. The second segment is the longest, measuring 1255  $\mu\text{m}$  in length and expanding distally to a maximum width of 295  $\mu\text{m}$ . The lateral surfaces bear horizontal striae and are densely covered with numerous small papillae (pa) (Fig. 9B–C, F). The posterior surface presents an indistinct midline groove in its distal third and an extended apical margin that overlaps the base of the third segment (Fig. 10B, E). The anterior surface displays a slightly convex medial apical margin (Fig. 9D–E).

The third segment, the shortest, is strongly expanded distally (350  $\mu\text{m}$  in length; 420  $\mu\text{m}$  in width) and has longitudinal striae on its apical surface (Figs 9E, 10B, E). The underside bears a crater-like protrusion surrounding the stylet fascicle, with a distinct honeycomb-like surface texture (Fig. 11A–B).

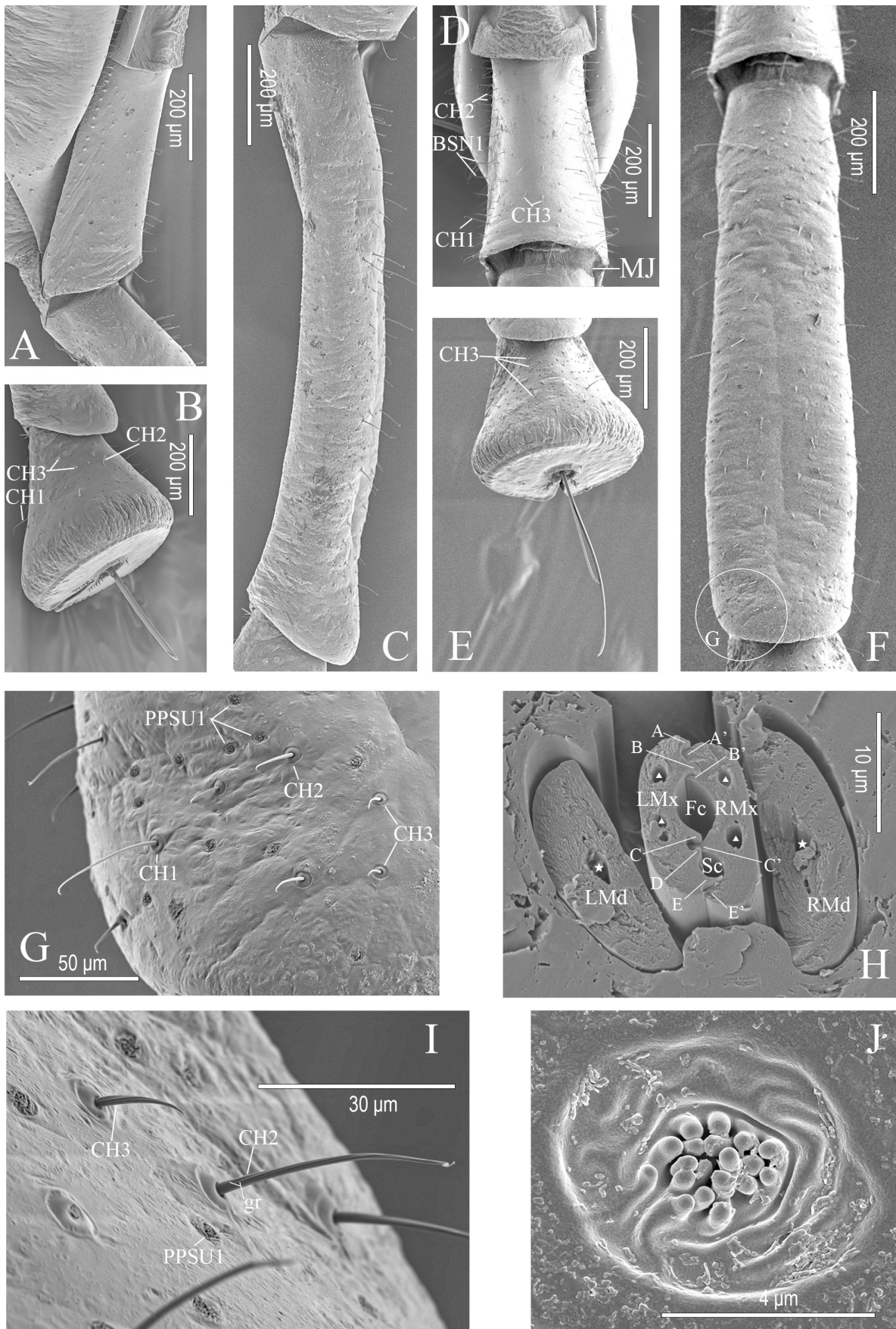
The stylet fascicle is needle-like, approximately 26  $\mu\text{m}$  in diameter, and dorsoventrally compressed in cross-section (Fig. 10H). The mandibular stylets are laterally compressed, semicircular, and symmetric, with lengths approximately 2.9–3.0  $\times$  their maximum width, and remain separated dorsally and ventrally. The maxillary stylets form an oval-shaped bundle, enclosing a large dorsal food canal and a smaller ventral salivary canal. The maxillary connection apparatus comprises a three-locking system:

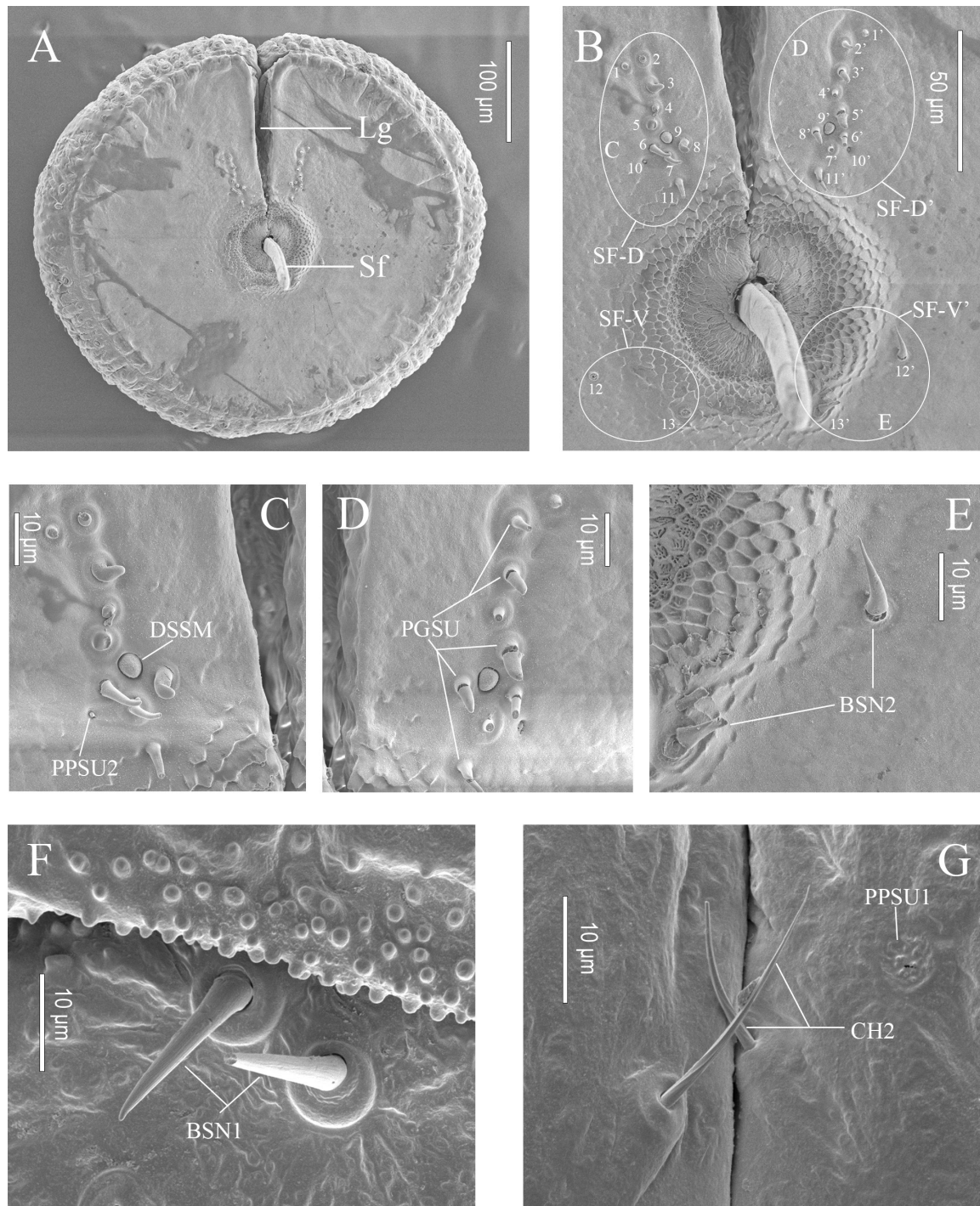
- (1) The dorsal lock includes four processes: on the left maxilla, the upper angular (A) and lower auricular (B); on the right, the upper quadrate (A') and lower angular (B'); A interlocks with B', and A' with B.
- (2) The median lock involves three processes: angular processes (C, D) on the left maxilla interlocking with an auricular process (C') on the right.
- (3) The ventral lock consists of an angular process (E) on the left and a blunt process (E') on the right.

### Sensilla

Five main types of sensilla were observed: sensillum chaetica (CH1, CH2, CH3), peg-in-pit uniporous sensillum (PPSU1, PPSU2), sensillum basiconica (BSN1, BSN2), multiporous dome-shaped sensillum (DSSM), and uniporous peg sensillum (PGSU).

**Fig. 10** (see next page). *Monochorhynchus dehongensis* sp. nov., paratype, ♀ (NWAUFU), SEM of the mouthparts of the adult. **A.** First labial segment, lateral view. **B.** Third labial segment, lateral view. **C.** Second labial segment, lateral view. **D.** First labial segment, posterior view. **E.** Third labial segment, posterior view. **F.** Second labial segment, posterior view. **G.** Left posterior surface of second labial segment, posterior view. **H.** Cross-section of stylet fascicle: A–E = processes of left maxillary stylet; A'–C', E' = processes of right maxillary stylet; two dendritic canals in each maxillary stylet (white triangle) and one dendritic canal in each mandibular stylet (white star). **I.** Right posterior surface of second labial segment, posterior view. **J.** PPSU1. Abbreviations: BSN1 = sensilla basiconica subtype I; CH1–3 = sensilla chaetica subtypes I–III; Fc = food canal; gr = grooved surface of sensillum chaeticum; LMd = left mandibular stylet; LMx = left maxillary stylet; MJ = membranous joint between first and second labial segments; PPSU1 = peg-in-pit sensillum, uniporous (sensillum coeloconicum) subtype I; RMd = right mandibular stylet; RMx = right maxillary stylet; Sc = salivary canal.





**Fig. 11.** *Monochorhynchus dehongensis* sp. nov., paratype, ♀ (NWFU), SEM of the third labial segment of the adult. **A.** Labial tip, front view. **B.** Distribution of various sensilla of labial tip, front view: Nos. 1–8, 11(1'–8', 11') = PGSU; No. 9 (9') = DSSM; No. 10 (10') = PPSU2; No. 12, 13 (12', 13') = BSN2; **C.** Left dorsal sensory field, front view. **D.** Right dorsal sensory field, front view. **E.** Right ventral sensory field, front view. **F.** BSN1 at base, anterior view. **G.** CH2 and PPSU1 of both sides of labial groove, anterior view. Abbreviations: BSN1, BSN2 = sensilla basiconica subtype I/II; CH2 = sensilla chaetica subtype II; DSSM = dome-shaped sensillum; Lg = labial groove; PGSU = peg sensillum; PPSU1, PPSU2 = peg-in-pit sensillum, uniporous (sensillum coeloconicum) subtype I / II; Sf = stylet fascicle; SF-D (SF-D') = left (right) dorsal sensory field; SF-V (SF-V') = left (right) ventral sensory field.

On the labrum, one or two CH2 occur(s) along the anterior midline (Fig. 9G). The first labial segment bears sparse CH3 on the posterior surface, CH1 and CH2 in lateral rows, and BSN1 along the lateral margins (Fig. 10A, D). The second segment shows several rows of CH2 and CH3, and numerous PPSU1 (clustered finger-like structures in epidermal fossae) along its anterior surface (Figs 9B–D, F, 10J), with lateral CH1 and CH2 (Figs 9H–I, 10C), and posteriorly with CH2, CH3, and PPSU1 (Fig. 10F–G, I). The third segment has dense CH2, CH3, and PPSU1 around the labial groove (Figs 9D, 11G), two BSN1 at the base on the anterior surface (Figs 9E, 11F), sparse CH1 laterally (Fig. 10B), and dense CH2 and CH3 posteriorly (Fig. 10B, E).

The sensilla distribution at the labial tip is comparable to other derbids. The sensory structures are organized into four sensory fields: the left and right dorsal (SF-D, SF-D') and ventral fields (SF-V, SF-V') (Fig. 11A–B), symmetrical about the labial groove. In the dorsal right field, sensilla 1'–11' form a slightly curved arc: 1'–8' and 11' are PGSU; 9' is DSSM; 10' is PPSU2 (a smooth, finger-like structure in an epidermal fossa); 5'–8' encircle 9', while 10' lies externally to 6' and 7' (Fig. 11B–D). In the ventral field, 12' and 13' are BSN2, positioned along the margin of the crater-like protrusion (Fig. 11E).

### Comparative morphology

The mouthparts of *M. dehongensis* sp. nov. are generally similar to those of *Shizuka fritillaris* (Boheman, 1838), *Proutista moesta*, *Diostrombus politus*, and *D. gangumis* in structure and sensillar composition (Brožek *et al.* 2006; Brožek & Bourgoïn 2013a, 2013b; Meng & Qin 2018), but differ in several respects:

- (1) considerably larger overall size and surface area;
- (2) higher density of PPSU1;
- (3) presence of a crater-like protrusion with a honeycomb-like surface at the labial tip;
- (4) distinct arrangement of sensilla on the labial tip;
- (5) slight variation in the configuration of the maxillary connection apparatus.

### Discussion

The tribe Zoraidini represents a relatively large and morphologically diverse group, exhibiting pronounced variation particularly in rostral structure, tegminal venation, and female genitalia.

Within the Zoraidini, the genus *Monochorhynchus* belongs to the “deposing-type” group, characterized by highly reduced gonapophyses VIII and IX in the female genitalia (Figs 2D, 8F), a condition also observed in *Proutista* and *Shizuka* (Chen *et al.* 2025). Based on this morphological evidence, *Monochorhynchus* is herein proposed to be placed within the subtribe Lyddina.

A remarkable morphological adaptation observed in this genus is the markedly expanded apical segment of the rostrum – a trait rarely encountered in other members of Lyddina (e.g., *Proutista* and *Diostrombus*), which typically exhibit only slight rostral expansion (Muir 1917; Fennah 1952; Meng & Qin 2018). Although adults of *M. dehongensis* sp. nov. were primarily observed and collected on live bamboo stalks (Fig. 1A), suggesting a close association with this host plant, unfortunately, no nymphs were encountered during our collections, and therefore, the diet of the nymphal stage remains unconfirmed. Derbid nymphs are widely believed to be fungal feeders in decaying organic matter (e.g., Howard *et al.* 2001). Consequently, our observation of adults on live bamboo does not exclude the possibility that the nymphs rely on fungi associated with the decaying bamboo litter.

Compared to *Proutista* and *Diostrombus*, the rostrum of *M. dehongensis* sp. nov. is significantly longer and more robust (Fig. 9A–E). The dense aggregation of sensilla coeloconica (PPSU1) on the second and third labial segments may enhance olfactory and thermo-hygrosensory capabilities, potentially allowing

the insect to detect host volatiles or assess microclimatic conditions. However, this sensilla subtype is rarely reported in other derbid genera. The general types, distributions, and densities of sensilla on the rostrum do not differ substantially from those in related genera (Brožek & Bourgoin 2013a; Meng & Qin 2018). These observations suggest that the strongly expanded rostral apex is more likely an adaptation for enhanced mechanical performance rather than sensory specialization.

Most bamboo-feeding derbids preferentially feed on bamboo leaves and young shoots (e.g., some species of *Pamendanga*, *Proutista*, and *Shizuka*; Chen *et al.* 2024), as the hardened texture of mature culms typically inhibits stylet penetration. The more robust rostrum of *M. dehongensis* sp. nov. may confer an adaptive advantage for accessing these tougher tissues. In cross-section, the unique configuration of the stylet fascicle may reduce friction loss and optimize mechanical transmission during feeding (Fig. 10H). A crater-like protrusion with a honeycomb-like surface on the underside of the labial tip likely assists in stabilizing the stylet fascicle during feeding.

Additionally, the apical sensilla on the labial tip (Fig. 11A–E) may possess significant taxonomic value. Recent studies indicate that the distribution of apical sensilla varies markedly among derbid genera such as *Shizuka*, *Proutista*, *Diostrombus*, and *Monochorhynchus* (Brožek & Bourgoin 2013a; Meng & Qin 2018). However, whether these patterns exhibit species-level specificity within a genus remains to be elucidated through examination of additional material.

## Acknowledgments

We are sincerely grateful to Dr Ai Deqiang for providing specimens and photos of *M. dehongensis* sp. nov., and to Dr Ruihong Chen (Horticulture Science Research Center, Northwest A&F University) for providing professional technical assistance with the Field Emission Scanning Electron Microscope (Hitachi, SU5000). This study is supported by the Science & Technology Fundamental Resources Investigation Program (Grant No. 2022FY202100) and the National Animal Collection Resource Center, China.

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