



A new facultatively cavernicolous planthopper species from Hainan Island, China (Hemiptera, Auchenorrhyncha, Fulgoromorpha, Cixiidae)

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Abstract

A new facultatively cavernicolous planthopper species *Borysthenes hainanensis* **sp. n.**, from Hainan Island, China, is described and illustrated. Specimens collected from lava tubes and above ground were found to be the same species but males of the former have smaller eyes. Distribution maps of the new and other species are given together with a checklist to all *Borysthenes* species and a key to Chinese ones. Type images of most *Borysthenes* species are also provided including *Borysthenes dilectus* (Walker), **comb. n.**

Key words: *Borysthenes*, taxonomy, morphology, male genitalia, subterranean, new species, new combination

Introduction

Cixiidae (Hemiptera, Fulgoromorpha) is a large planthopper family containing more than 2000 species, distributed worldwide (Bourgoin 2022). While adults usually feed on the green parts of plants, their nymphs live underground and feed on roots and/or fungi (Remane & Hoch 1988, Holzinger *et al.* 2002). This lifestyle could be interpreted as an exaptation to transforming into a permanent subterranean way of life (Remane & Hoch 1988, Hoch 2002). Correspondingly, more than 30 cixiid species have been found to be obligate cavernicoles, along with a number of facultative cavernicolous species (e.g., Hoch *et al.* 2003, Hoch *et al.* 2011, Bourgoin 2022), both usually found on plant roots penetrating from above. This cavernicolous lifestyle can often be determined by morphological traits (troglomorphies), such as reduction of compound eyes and reduced pigmentation, compared to congeners (Hoch & Howarth 1989).

Borysthenes Stål is a medium-sized genus in Cixiidae, currently containing 24 species, three of them distributed in the Ethiopian region and the rest in the Oriental region (Fig. 9). Members of the genus differ from other Cixiidae by their broad delicate forewings which overlap apically in repose and by the presence of a subantennal process (Liang 2005a). One species, *B. maculatus* (Matsumura) has also been recorded with an unusual lateral subapical labial sensillum (Liang, 2005b). Muir (1923a) placed the genus in the tribe Bothriocerini of the subfamily Cixiinae but the tribe was later elevated to the rank of subfamily (Bothriocerinae) by Metcalf (1938). Subsequently, Emeljanov (1989) established a third subfamily (Borystheninae) to accommodate the genus. However, subsequent molecular studies questioned the validity of the subfamily Borystheninae, as well as Emeljanov's three-subfamily hypothesis and also the monophyly of Cixiidae as a whole (Ceotto *et al.* 2008, Luo *et al.* 2021). The ecology and biology of *Borysthenes* is largely unknown with no cave association having been reported. Therefore, the finding of a new species from Hainan Island with some specimens collected in lava tubes as well as in epigeal habitat (with variable eye size) is surprising. This species, described in the present paper, marks the 24th *Borysthenes* species and the first cave-associated planthopper in China. Additionally, *Borysthenes dilectus* (Walker) **comb. n.** is transferred into this genus from *Cixius* Latreille, 1804.

Materials and methods

Male genitalia of examined specimens were macerated in warm 10% potassium hydroxide solution (KOH), washed in water and examined in glycerin. Specimens deposited, in Museum of Biology, Sun Yat-sen University, Guangzhou, China (SYSBM) were examined using a Zeiss Discovery V20 stereomicroscope and other specimens deposited in the Natural History Museum, London (NHM) were examined using a Wild M5 stereomicroscope. Habitus and other images of the new species were taken using a Canon EOS 7D Mark II camera equipped with LAOWA 2.5–5 × macro lens for SYSBM specimens or Canon EOS 5D with Canon MP-E 65mm 1-5x macro lens for NHM specimens. Photographs of male genitalia were taken using a Nikon SMZ25 camera. Line drawings were made using Wacom CTL-471 drawing tablet. Maps were prepared using SimpleMappr (<http://www.simplemappr.net/>) and Adobe Photoshop 2020.

Morphological terminology follows Bourgoin (1988) (male genitalia), Bourgoin (1993) (female genitalia), Bourgoin *et al.* (2015) (tegmina venation), and Löcker *et al.* (2006) (other parts).

Institution abbreviations

Bernice Pauahi Bishop Museum, Hawaii, USA (BPBM)

California Academy of Science, California, USA (CAS)

Natural History Museum, London, UK (NHM)

Museum of Biology, Sun Yat-sen University, Guangzhou, China (SYSBM)

Taxonomy

Genus *Borysthenes* Stål, 1866a

Borysthenes Stål, 1866a: 165.

Type species. *Cixius finitus* Walker, 1857: 149; by subsequent designation by Stål 1866b: 392.

Barma Distant, 1906: 266.

Type species. *Barma diversa* Distant, 1906: 266, by original designation and monotypy. Synonymised by Distant 1907: 3.

Vademela Melichar, 1914: 100.

Type species. *Vademela fusconotatus* Melichar, 1914: 101; by original designation and monotypy. Synonymised by Muir 1925: 104.

Diagnostic characters. *Borysthenes* can be distinguished from other genera by the following combination of characters: a) presence of subantennal process below compound eyes and antennae (Fig. 1D-E), b) lack of tegmina pterostigma, c) tegmen intercubital veinlet not connected with claval suture, d) hind margin of tegmina overlapping in repose (Muir 1922, Emeljanov 1989, Emeljanov 2002, Liang 2005a).

Checklist of *Borysthenes* species

B. acuminatus Fennah, 1956: 459-460 figs 5A-E. South China. (Figs. 5A-F)

B. certus Muir, 1913: 263-364. Borneo. (Figs. 7A-C)

B. cougus Huang (in Zhu), 1995: 52-53, figs 1A-D. Southeast Mainland China

B. deflexus Fennah, 1956: 460-461, figs 5I-J. South China. (Figs. 5G-J)

B. dilectus (Walker, 1857: 150, *Cixius*). Borneo. **comb. n.** (Figs. 8E-F)

B. diversa (Distant, 1906: 266-267, fig 121, *Barma*). Myanmar. (Figs. 6A-B)

B. emarginatus Fennah, 1956: 461, figs 5F-H. South China. (Figs. 5K-O)

B. fascialatus Muir, 1922: 348-349, fig 1. India

B. fatalis Emeljanov, 1989: 56-57, figs 1, 2, 5-13. Vietnam

B. finitus (Walker, 1857: 149, *Cixius*). Borneo. (Figs. 8A-D)

B. fusconotatus (Melichar, 1914: 101, Plate 3, fig 3, *Vademela*). Java

B. garambensis Van Stalle, 1984: 595, figs 5-9. Garamba National Park

B. hainanensis Lyu & Webb, **sp. n.** Hainan Island

B. incertus Muir, 1913: 264. Borneo. (Figs. 7D-F)

- B. lacteus* Tsaour & Lee, 1987: 9-10, fig 2. Taiwan Island. (Figs. 6E-F)
B. maculatus (Matsumura, 1914: 430, Barma maculata); Ishihara, 1965: 132, Plate 66, fig 11; (Kato, 1934: 468, plate 14, fig 14. Taiwan Island, *Bolysthenes* (sic) *guttatus*); Tsaour & Lee, 1987: 8-9, fig 1. Southeast Mainland China, Taiwan Island, Ryukyu Islands. (Figs. 6G-H)
B. magnus Muir, 1913: 264-265. Borneo. (Figs. 7G-I)
B. mambilenis Van Stalle, 1984: 593, figs 2-4. Nigeria
B. mlanjensis Muir, 1923b: 559; Van Stalle, 1984: 594, fig 1. Malawi. (Figs. 6I-J)
B. nicanor Fennah, 1978: 8-9, figs 29-35. Vietnam
B. ponomarenkoi Emeljanov, 1989: 57-59, figs 14-21. Vietnam
B. simulans Muir, 1913: 264. Borneo. (Figs. 7J-L)
B. strigipennis Distant, 1911: 744; Distant, 1916: 43-44. East Himalaya. (Figs. 6C-D)
B. suknanicus Distant, 1911: 744; Distant, 1916: 44, fig. 29. East Himalaya

Key to species of *Borysthenes* from China

1. Tegmina with 3 dark broad transverse bands (Figs 5A-B); aedeagus with a dorsal process curved ca. 180 degrees, directed caudally (Fig. 5D) (Hubei) *B. acuminatus*
 – Tegmina and aedeagus not as above 2
2. Tegmina with a distal Y-shaped dark marking with two terminals connected with coastal margin and one terminal reaching *icua* (Fig. 2F), and a dark strip near apical margin; anal segment with 2 apical lobes slightly deflexed, not folded inward or elongate 3
 – Tegmina pattern not as such; apical lobes of anal segment folded inward or elongate 4
3. Tegmina without a V-shaped dark mark subapically; gonostyli with an expanded lobe at ventral margin of keel, apex not bifurcate (Figs. 5K-L) (Southern mainland China) *B. emarginatus*
 – Tegmina with a V-shaped dark mark subapically (Fig. 2F); gonostyli without expanded lobe at ventral margin of keel, with bifurcate apex (Figs. 3H-I) (Hainan Island) *B. hainanensis* sp. n.
4. Tegmina with numerous scattered dark spots; anal segment with apical lobes folded inward; left caudal margin of male pygofer without obvious depression under base of anal segment, no sharp lateral process 5
 – Tegmina with few dark spots; anal segment with elongate apical lobe, deflexed; left caudal margin of male pygofer with depression under base of anal segment, with or without sharp lateral process 6
5. Aedeagus with right lateral process curved downward (Zhejiang) *B. congus*
 – Aedeagus with right lateral process straight, pointing ventro-cephalad (Fig. 5I) (Guangdong) *B. deflexus*
6. Tegmina milky white, with small dark spots (Fig. 6E); male pygofer strongly asymmetrical in ventral view, with right caudal margin angulately elongate (Taiwan Island) *B. lacteus*
 – Tegmina with large dark spots (Fig. 6G); male pygofer nearly symmetrical in ventral view with right caudal margin not angulately elongate (Ryu Kyu Islands, Taiwan Island, Southeastern mainland China) *B. maculatus*

Borysthenes hainanensis Lyu & Webb sp. n.

Holotype ♂, Hainan Is., Porten, vii.1904, Brit. Mus. 1924-292 (NHM register entry: “Pres. By Lord Rothschild”). NHMUK 013588924.

Paratypes. 1♀, same data as holotype; 1♂, 3♀♀, 2 sex unknown (abdomen missing), same data as holotype except 1-2.vii.1904 (1 probably associated with a genitalia dissection on card under coverslip, mount in the style of Fennah); 2♂♂ (1 dissected by second author, NHMUK 013588925), same data as holotype except 3.vii.04, 1911-288 (NHM register entry: “Taipaishan presented by Hon. Walter Rothschild”); 1♂ Hainan Is., Taipinshi, 17.vi.1905, Brit. Mus. 1924-292; 1♀, 2♂♂ (dissected by first author), Haikou, Shishan, Rongtang Village, Qishierdong lava tubes, 19°33'36"N, 110°7'12"E, ca. 100 m elev.; leg. Tianlang Lyu; 2021-VII-20 (SYSBM); 2♂, same data as the previous paratype except 23.vii.2022; 2♂♂, Haikou, Shishan, Rongtang Village, outside Qishierdong lava tubes 19°33'36"N, 110°7'12"E, ca. 100 m elev.; leg. Tianlang Lyu; 23.vii.2022 (SYSBM).

Diagnosis: The new species is distinguished by the following combination of characters: a) tegminal markings comprising an oval spot in coastal cell and a V-shaped dark mark subapically (Fig. 2F); b) tegmina with RP not fused with M basally (Fig. 2F); c) anal segment with 2 apical lobes slightly deflexed, not folded inward or elongate (Fig. 3A); d) aedeagus with two ventral processes (Fig. 2K), endosoma with two cup-like sclerous processes.

Description. *Measurements:* body length (incl. tegmina): ♂♂ 5.7–5.9 (n=2), ♀ 6.4 mm (n=1).

Coloration. Head (Figs. 1D-F, J-L) generally light yellow; carinas on frons orange; sub-antennal process, lateral carina of postclypeus and apex of rostrum fuscous brown; compound eyes red (cave ♂) to black with edge partially

reddish (other); ocelli yellow. Pronotum white, fore margin with a triangular flange-like projection adjacent to lower corner of eye, brown. Mesonotum light brown. Fore and middle legs dark brown; hind legs yellowish brown. Tegmina subtranslucent; with an oval spot in the middle of coastal cell, a Y-shaped pattern in middle of tegmina sometimes interrupted by RP, a strip in apical half of tegmina sometimes interrupted by MP, areas around *m-cu* and distal end of claval suture, fuscous brown. Hindwing hyaline, with spot covering *r-m* and a submarginal strip brownish suffused. The patterns on tegmina and hindwing is generally more strongly suffused in female than in male. Abdomen yellowish brown, caudal segments dark brown. Torso, legs and basal area of tegmina covered with a thin layer of white waxy secretion.

Structure. Head: vertex broad, ca. 5 times wider than long; anterior and posterior margin arched concave. Frons ca. 1.4 times longer than maximum width; lateral carina developed; median carina developed, connected with frontoclypeal suture, almost but not connected with transvers carina between vertex and frons. Compound eyes more developed in females of cave population (Figs. 1J-L) and in both sexes of the epigeal population (see Figs. 2C-E for male), reaching antennae and ocelli from lateral view, compared with males of cave population (Figs. 1D-F), where compound eyes are partially reduced, not reaching antennae. Ocelli present. Subantennal process with setae, linear arranged. Clypeus with lateral carina distinct, median carina not connected with frontoclypeal suture. Rostrum slender, extending beyond hind coxae.

Thorax: Pronotum ca. 1.7 times wider than posterior margin of vertex, arcuate, fore margin with a triangular flange-like projection adjacent lower corner of eye. Mesonotum rhombic, tricarinate. Tegulae developed. Tegmina (Fig. 2F) well developed, surpassing hindwings; coastal margin slightly wrinkled, in subbasal and anterior terminal margin bearing tubercles; pterostigma absent; basal part of RP forms a common stalk with Sc+RA, instead of fusing with MP. 10-11 apical cells (due to the intraspecific instability of RP furcation), 7 subapical cells; RA unbranched; RP with 3 or 4 terminals; MP with 5 terminals; CuA with 3 terminals; *icu* light colored, indistinct, not associated with claval suture. Hindwing (Fig. 2G) developed, surpassing tip of anal segment; anterior margin wrinkled; RP bifurcate, M bifurcate or trifurcate, CuA bifurcate. Legs with rows of setae on femora, tibiae and tarsi; hind tibiae with 6 apical spines, first hind tarsi 7 apical spines; second hind tarsi with 5 apical spines.

Male genitalia: pygofer (Figs. 3A, 3C) generally symmetrical, dorsal caudal margin concave, U-shaped ventrally; in lateral view, lateral lobes with smooth margin, without spinose process, arched and extended caudally, middle 1/3 with setae pointing caudally; medio ventral process widest at base, campaniform, slightly turned downward. Anal tube (Fig. 3G) slightly asymmetrical, with left latero-apical lobe not so strongly deflexed compared with right one. Aedeagus (Figs. 2H-K) in middle position of pygofer, asymmetrical and complex, in total with 6 processes, all visible from ventral view; dorsal side with a short spinose process (Fig. 2J: d) emerging from base of endosoma, directed left cephalic, basal half denticulate, apical half curved downward; left side bears two processes near apex: upper one (Fig. 2H: l1) emerges from base of endosoma, with basal part denticulate, basal 1/2 connected by membrane with the short spinose process noted above (Fig. 2H: d), apex directed rightward, almost approaching base of periandrium; lower one (Fig. 2H: l2) emerges from apex of periandrium, shorter, strongly curved inward, apex directed right ventrally; ventral side of periandrium bears two processes apically (Fig. 2K: vl, vr) both slightly curved, overlapping at ca. 2/3 from apex of aedeagus in ventral view, apex approaching basal 1/3 of periandrium; right side of periandrium bears one apical process (Fig. 2K: r), curved downward, apex directed ventrocephally. Gonostyli (Figs. 3H-I) symmetrical in ventral view, sparsely setose; from maximum outer view, apical half curved dorsally for ca. 90 degrees, expanded, with bifurcate apex; true apex inside, thinner; secondary apex outside, blunt.

Female genitalia: caudal margin of seventh sternite concave; anal segment small and short, rectangular; ovipositor complete, long, surpassing caudal margin of anal segment.

Remarks. By the tegminal pattern and shape of the male pygofer and anal segment, *Borysthenes hainanensis* sp. n. is somewhat similar to *B. emarginatus* from Guangdong, S. China, but the latter species can be distinguished by a) a reddish-brown suffusion near base of tegmina covering clavus (clavus light-colored in *B. hainanensis*), b) tegmina without subapical “V-shaped” marking, c) aedeagus without ventral process (two ventral processes in *B. hainanensis*), d) gonostyli not branched, with an eminence on inner margin and ventral margin with an expanded lobe at the keel (in *B. hainanensis*, gonostyli bifurcate subapically, with ventral margin smoothly curved dorsally).

The new species is also similar to *B. fasialatus* from India in having a cup-shaped endosoma, but the latter species can be distinguished by: a) an emargination on caudal margin of male pygofer near base of anal tube (absent *B. hainanensis*); b) with two light bands on tegmina (absent in *B. hainanensis*); c) anal segment with left apical lobe thinner and longer (in *B. hainanensis* the right apical lobe is thinner and longer).

The overall length of the specimens given above is taken from cave specimens as the holotype and other paratypes have the wings extended or damaged. However, there is no difference in tegmina length between populations, *i.e.*, males, 4.9–5.1 mm, females 5.6 mm.

Distribution and ecology: *Borysthenes hainanensis* is known from both cave and epigean habitats. The cave population is so far only recorded in Qishierdong lava tube in Haikou, Hainan Island. Overall length of the lava tube system is more than 780 m (Dong 2021), but with a few gaps and “skylights” connected with outside (Fig. 4A), causing a considerable portion of the lava tube to become a twilight zone. Four surveys have been made: February 2021 (1 nymph); July 2021 (3 adults); January 2022 (3 nymphs); July 2022 (2 adults), which the nymphs (Fig. 4C) were never found together with adults, so it remains a question whether they belong to the same species. All specimens of cave population were collected in the deeper zone (Fig. 4B) of the lava tube (the deepest for the author to reach, but there are small voids leading to deeper zone), more than 40 meters from the nearest gap, in permanent darkness and high humidity. Many unidentified roots penetrate into the cave and dangle from the roof, on which *B. hainanensis* is found. Currently, no *B. hainanensis* is found in the twilight zone. Epigean population(s) were collected from Baoting (= “Porten”) in central-south of Hainan Island, Dwa Bin (= “Tai Pin”) in northern Limushan Mountain, central north of Hainan Island, and understory of woods near Qishierdong lava tube, Rongtang Village, Haikou. Epigean individuals are very alert and fly when disturbed, while cave individuals (males only, female behaviors unrecorded) prefer hiding into crevices of rocks when disturbed.

A cixiid nymph likely belonging to *B. hainanensis* was recorded in Xianrendong lava tube adjacent to Qishierdong lava tube, Feb. 2022. This is a longer lava tube system (1216 meters, Dong 2021) and the nymph was collected at ca. 100 meters from entrance. The possibility that it is the nymph of *B. hainanensis* is only speculation before further research is made.

Etymology. The species epithet “*hainanensis*” refers to the type locality of the new species.

Discussion

Regarding the new taxon, the male genitalia are almost identical between epigean and cavernicolous males, indicating no evidence for reproductive isolation. The smaller eyes in the cavernicolous population males might indicate incipient speciation, where characters with adaptive value start to occur but have not been pronounced in both sexes. However, there are examples of species where morphologically distinct populations do not separate into the process of speciation, such as the new world cavefish *Astyanax mexicanus*. Therefore, no certain conclusion can be made before the ecological status of the cave population is determined and the degree of gene flow between populations is measured ultimately. Considering these factors and the Biological Species Concept (Mayr 1969), cave and epigean populations of the new taxon described here are hypothesized to be representatives of the same species, with eye reduction of males in lava tube considered as intraspecific variation. A similar sexual dimorphism was reported for the subtroglophile cixiid *Trigonocranus emmeae* Fieber by Hoch *et al.* (2013).

Based on the cavernicolous classification level by Sket (2008), *B. hainanensis* **sp. n.** is tentatively considered to be at least subtroglophile. For the cave individuals in particular, hypothesized from the fact that all males have smaller eyes, a cave population might be able to maintain, thus they are probably eutroglophile (while it remains to be tested whether reproduction takes place in or outside the cave).

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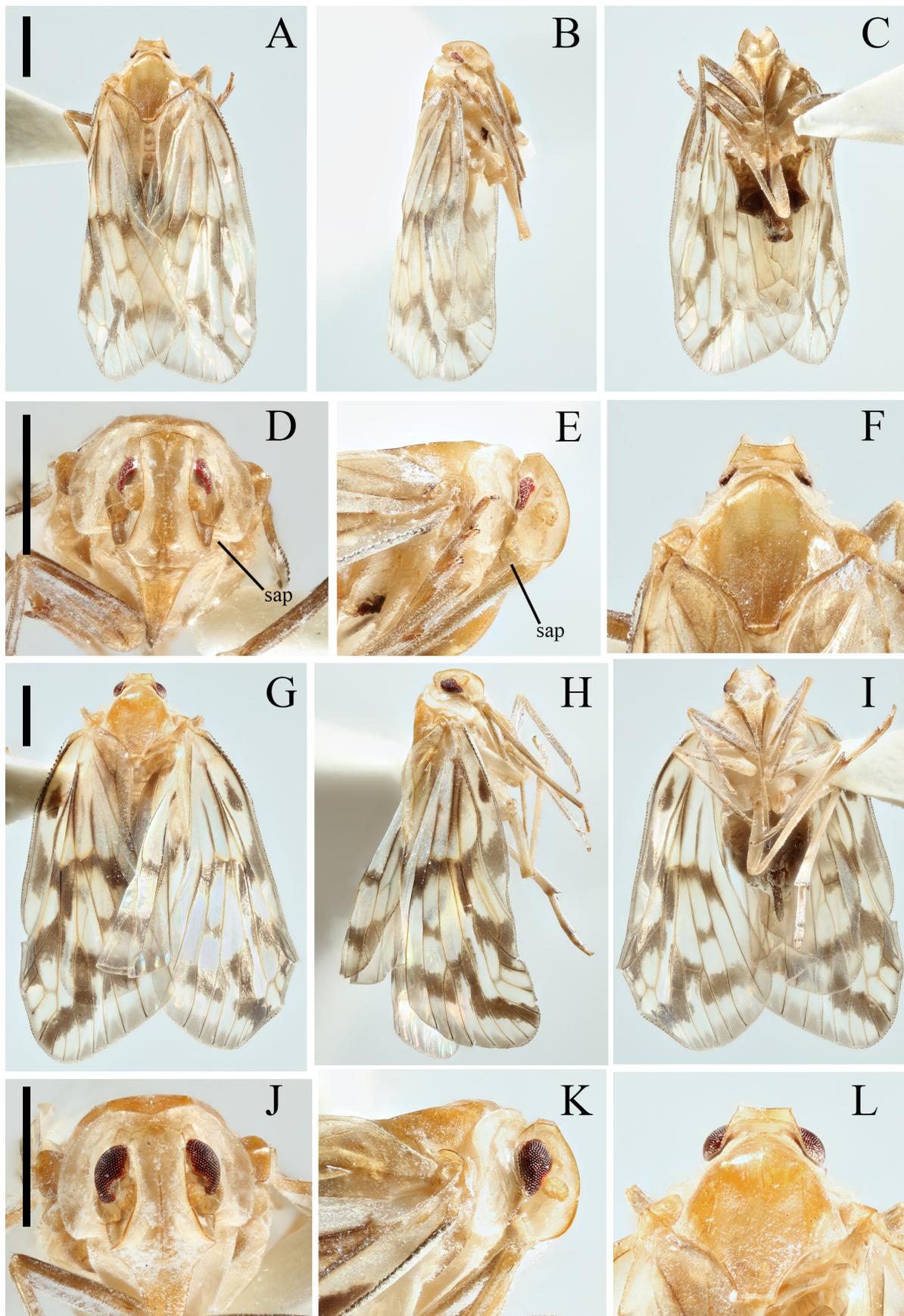


FIGURE 1. *Borysthenes hainanensis* sp. n. collected in lava tube. A–F, male paratype (A) dorsal, (B) right lateral, (C) ventral, (D) frontal, (E) head and thorax lateral, (F) head and thorax dorsal. G–L, female paratype (G) dorsal, (H) lateral, (I) ventral, (J) frontal, (K) head and thorax lateral, (L) head and thorax dorsal. Scale bar: 1 mm. sap: subantennal process.

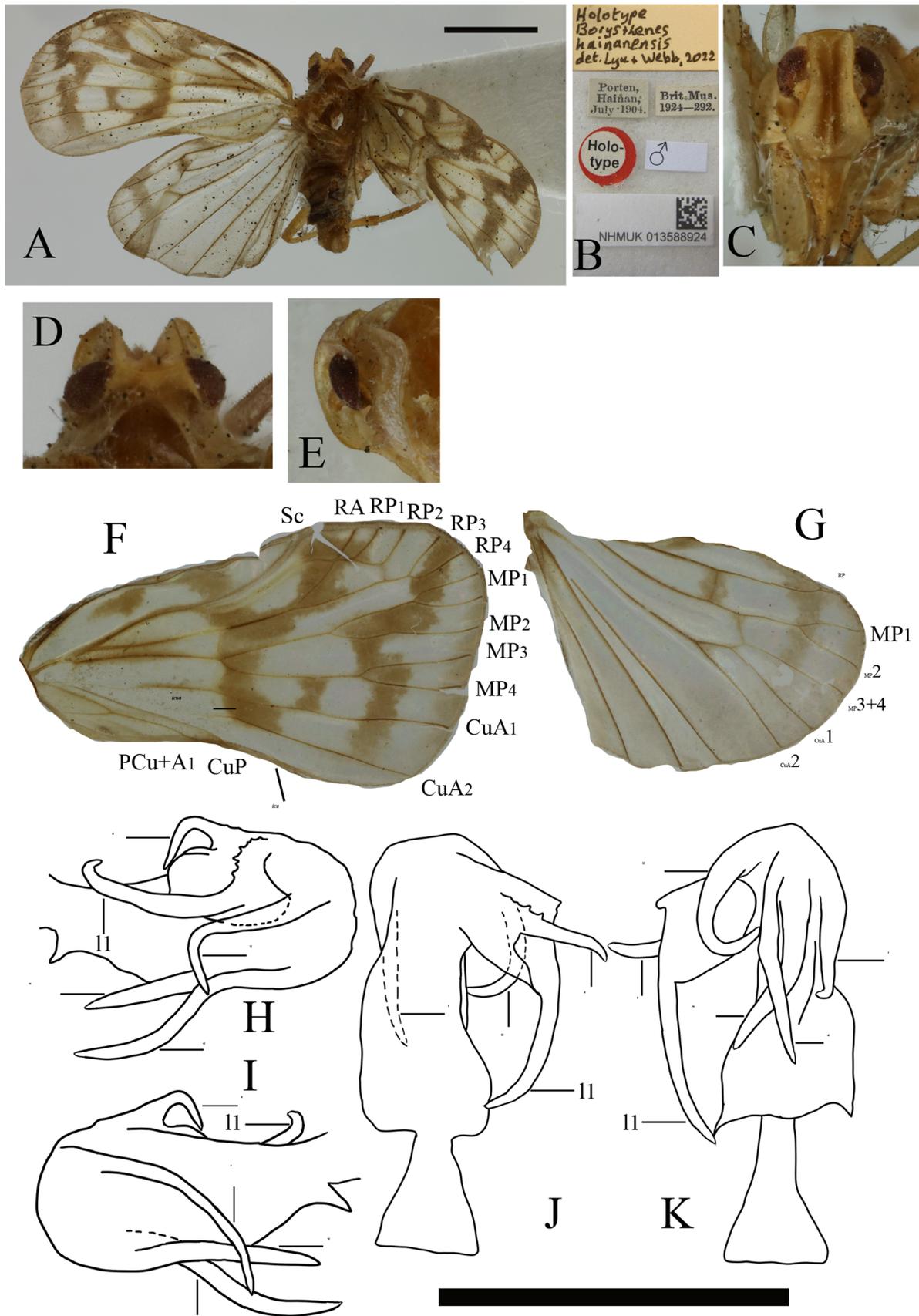


FIGURE 2. *Borysthenes hainanensis* sp. n., A–G, male collected in epigeal habitat. A–E, holotype male (A) dorsal, (B) labels, (C) frontal; (D) head (E) head, lateral; F–G, paratype male (F) right tegmina, (G) right hindwing. H–K, line drawings of aedeagus of *B. hainanensis* male paratype (cave). (H) left lateral view, (I) right lateral view, (J) dorsal view, (K) ventral view. Scale bar: 0.5 mm. Abbreviations: see Description. Scale bar: (A) 1 mm; (H)–(K) 0.5 mm.

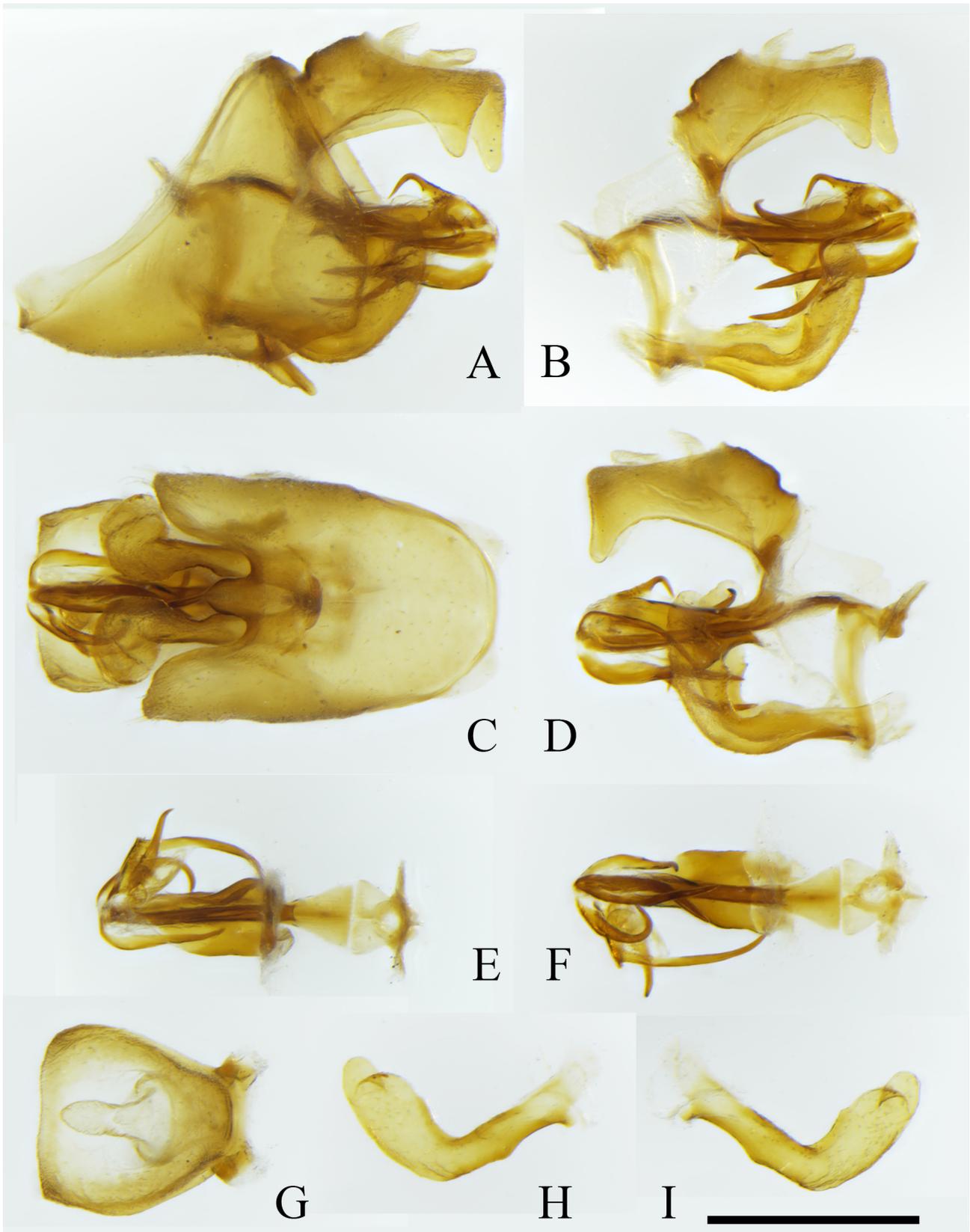


FIGURE 3. Male terminalia of *Borysthenes hainanensis* sp. n., male paratype (cave). (A) genital capsule, (B) genitalia and anal segment, left lateral view, (C) genital capsule ventral view, (D) genitalia and anal segment, right lateral view; (E) aedeagus dorsal view, (F) aedeagus ventral view; (G) anal segment dorsal view; (H) right gonostyli, outer view, maximum width, (I) right gonostyli, inner view, maximum width. Scale bar: 0.5 mm.

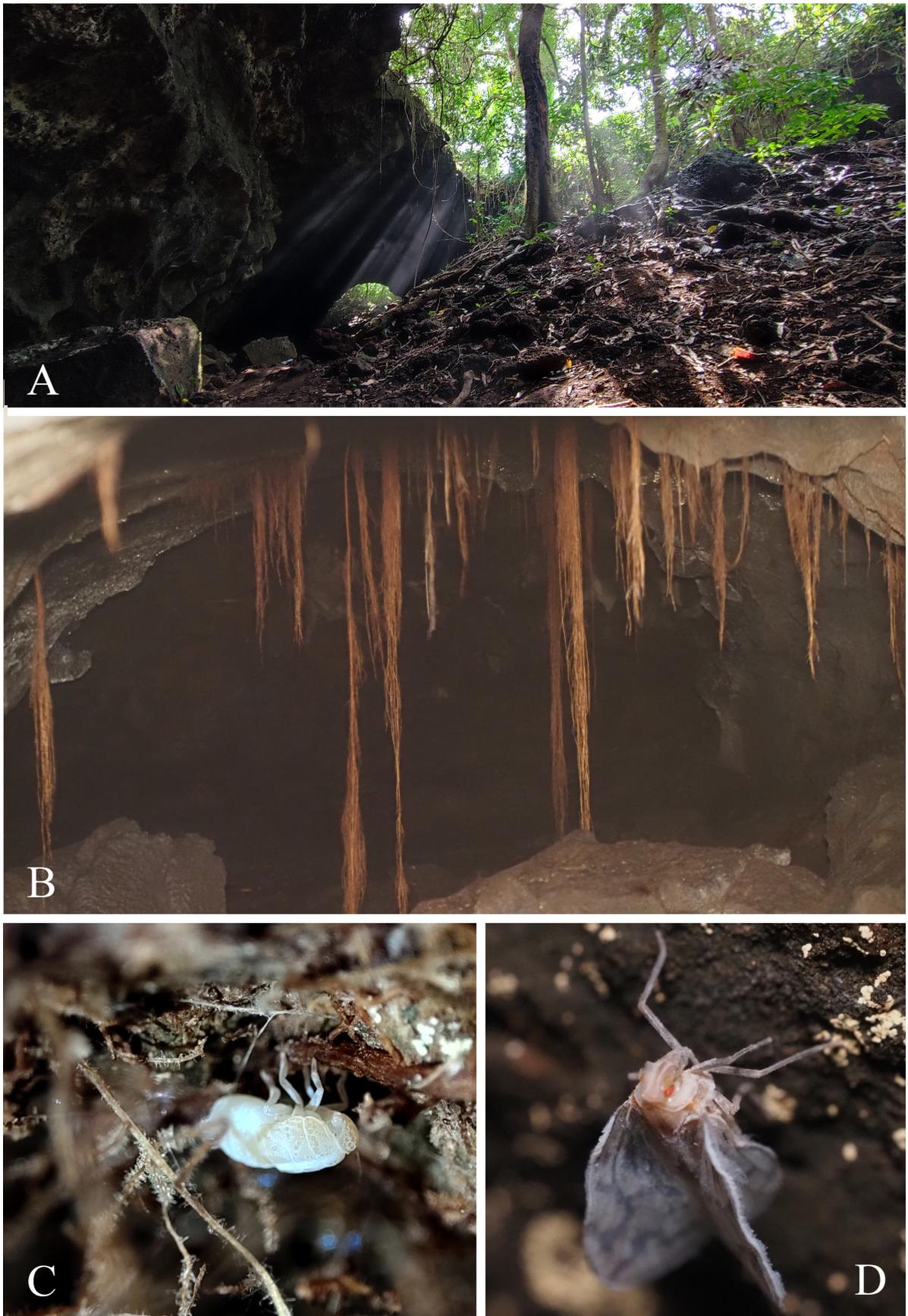


FIGURE 4. Habitat of *Borysthenes hainanensis* **sp. n.** from cave. (A) “skylights” and epigeal vegetation of Qisherdong lava tube, (B) deeper zone of the lava tube, paratype locality, (C) possible nymphs of *B. hainanensis*; (D) male paratype of *B. hainanensis*.



FIGURE 5. Type specimens of *Borysthenes* species (CAS): A–F, *B. acuminatus* Fennah (A) dorsal, (B) left lateral; male genitalia (C) anal segment, (D) aedeagus and gonostyli, (E) pygofer; (F) labels. G–J, *B. deflexus* Fennah (G) dorsal, (H) left lateral; (I) male genitalia; (J) labels. K–O, *B. emarginatus* Fennah (K) dorsal, (L) right lateral; M–N, male genitalia (M) anal segment, aedeagus and gonostyli, (N) pygofer; (O) labels. Images taken by Chris Grinter, CAS 2022.

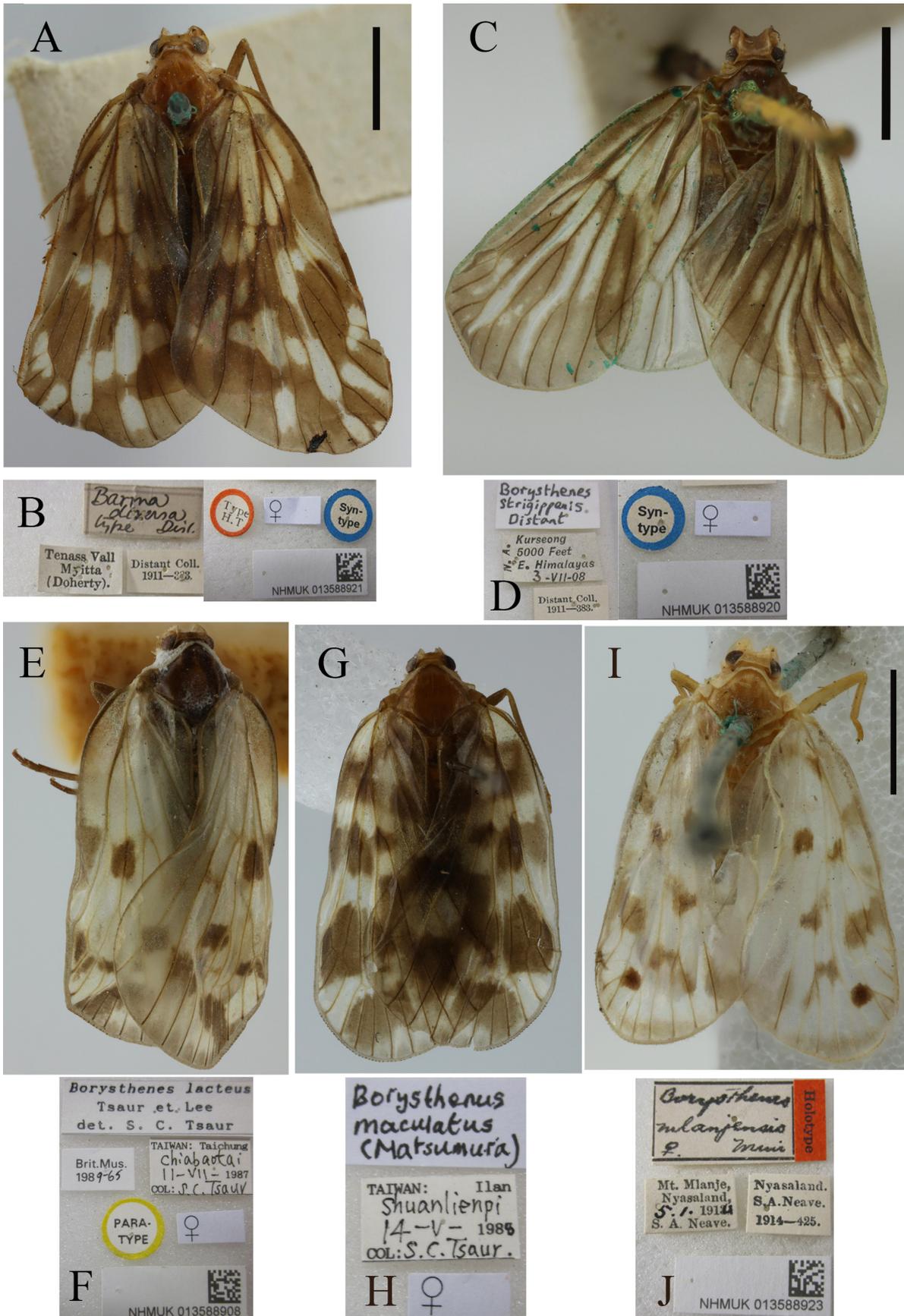


FIGURE 6. Type specimens (except where indicated) of *Borysthenes* species (NHM): A–B, *B. diversa* Distant (A) dorsal, (B) labels; C–D, *B. strigipennis* Distant (C) dorsal (D) labels; E–F, *B. lacteus* Tsaur & Lee (E) dorsal, (F) labels, G–H, *B. maculatus* (Matsumura) (none-type) (G) dorsal, (H) labels; I–J, *B. mlanjensis* Muir (NHM) (I) dorsal, (J) labels. Scale bar: 1 mm.

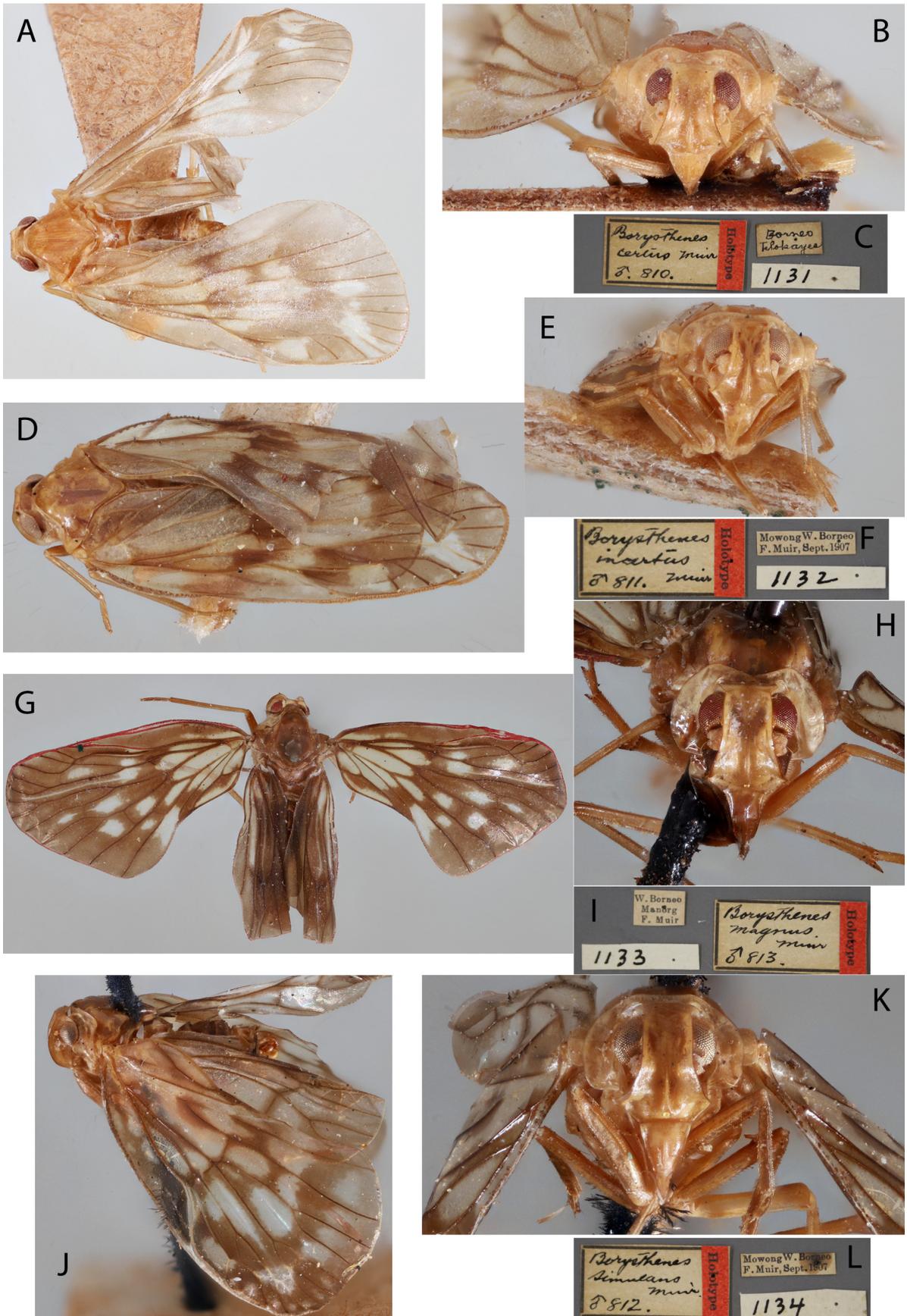


FIGURE 7. Type specimens of *Borysthene* species (BPBM): A–C, *B. certus* Muir (A) dorsal, (B) frontal view, (C) labels. D–F, *B. incertus* Muir (D) dorsal, (E) frontal (F) labels. G–I, *B. magnus* Muir (G) dorsal, (H) frontal view, (I) labels. J–L, *B. simulans* Muir (J) lateral, (K) frontal view, (L) labels. Images taken by Jeremy Frank (BPBM).

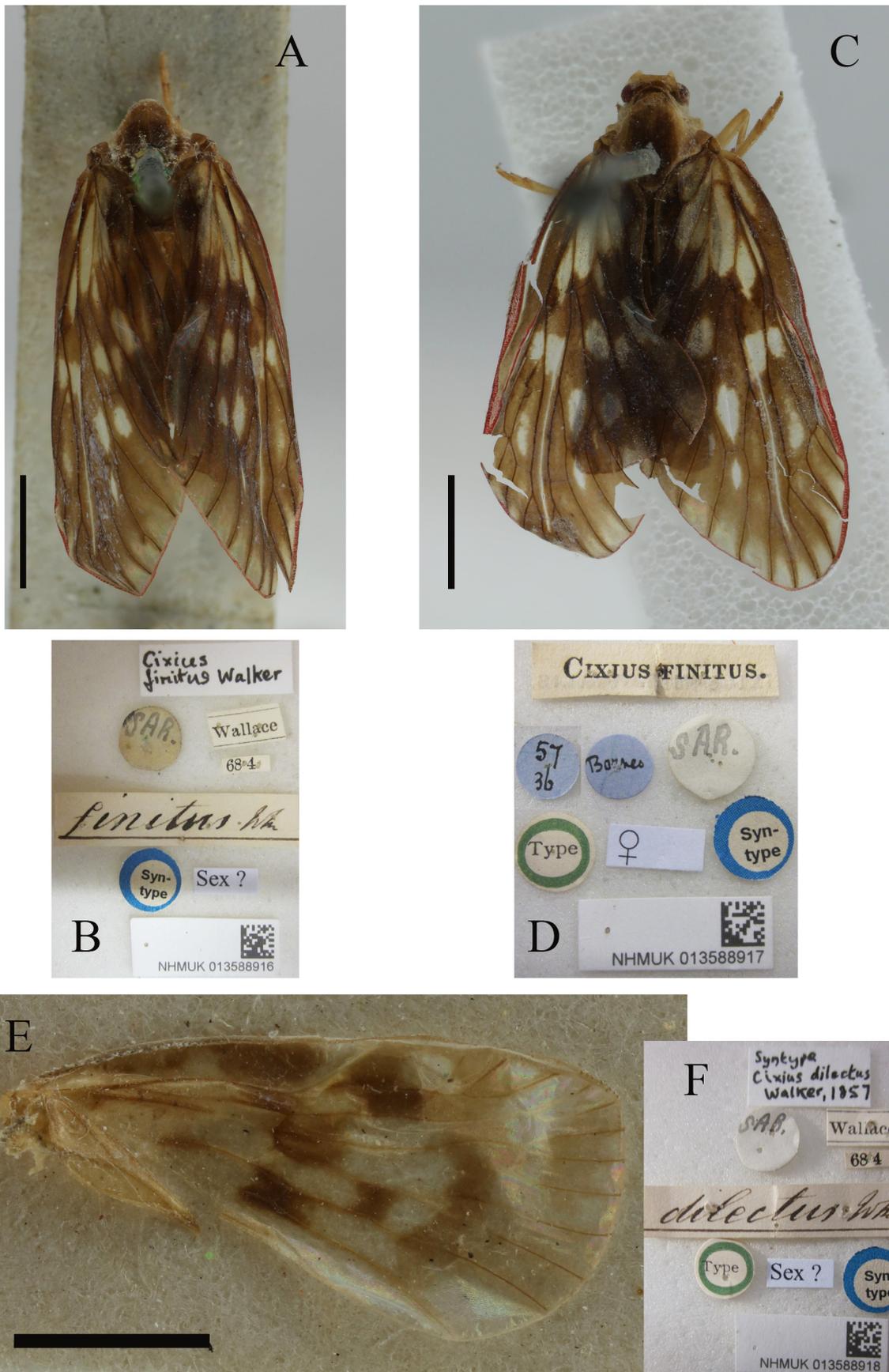


FIGURE 8. Types of *Borysthenes* species (NHM): A–B, *B. finitus* Walker (A) dorsal, (B) labels; C–D, *B. finitus* (C) dorsal, (D) labels. E–F, *B. dilectus* (Walker) (E) tegmina (other body parts lost), (F) labels. Scale bar: 1 mm.

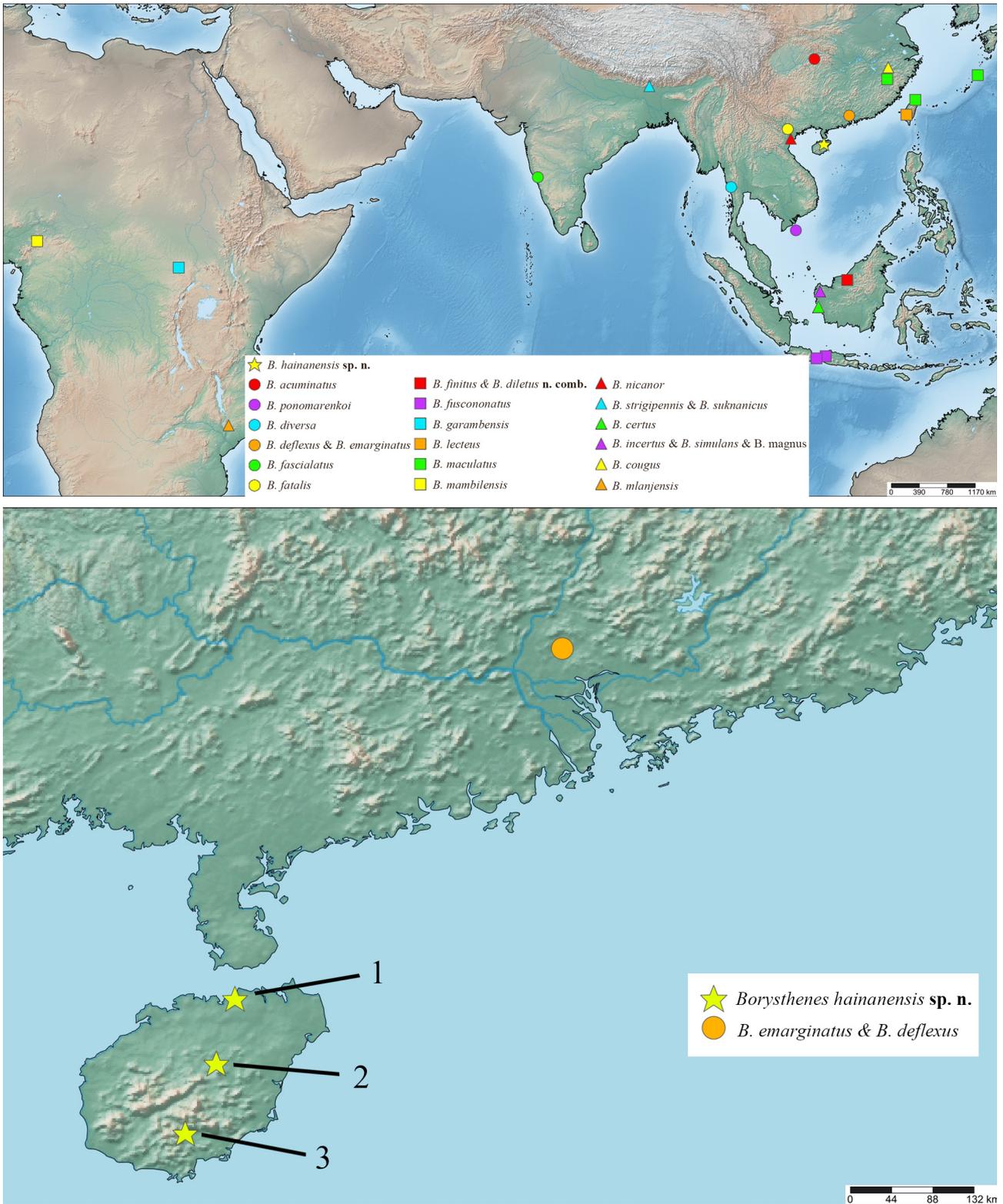


FIGURE 9. Upper: distribution map of all known species of *Borysthenes*. Lower: localities of *B. hainanensis* sp. n. 1: Qishierdong lava tube, Haikou; 2: “Taipin” (“Dwabi” by Gressitt (1936), probably now Dabian village, or adjacent Dafeng, North Mt. Limu, Qiongzong Li and Miao Autonomous County); 3: “Porten” (probably now Baoting).

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