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The planthopper genus *Sogana* Matsumura, 1914 in Vietnam: Two new species, new records and identification key (Hemiptera: Fulgoromorpha: Tropiduchidae)

Jérôme CONSTANT¹ & Hong Thai PHAM²

¹ Royal Belgian Institute of Natural Sciences, O.D. Phylogeny and Taxonomy, Entomology, Vautier street 29, B-1000 Brussels, Belgium. E-mail: jerome.constant@naturalsciences.be (corresponding author)
urn:lsid:zoobank.org:author:6E6072A1-9415-4C8D-8E60-2504444DB290

² Vietnam National Museum of Nature, Vietnam Academy of Science and Technology, 18 Hoang Quoc Viet Street, Hanoi, Vietnam. Email: phamthai@vnmn.vast.vn
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Front cover: *Sogana baviana* sp. nov., holotype ♂ in Ba Vi National Park, 25.VI.2015 (photograph © J. Constant).

**The planthopper genus
Sogana Matsumura, 1914 in Vietnam:
Two new species, new records and identification key
(Hemiptera: Fulgoromorpha: Tropiduchidae)**

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¹ Royal Belgian Institute of Natural Sciences, O.D. Phylogeny and Taxonomy, Entomology, Vautier street 29, B-1000 Brussels, Belgium. E-mail: jerome.constant@naturalsciences.be (corresponding author)
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² Vietnam National Museum of Nature, Vietnam Academy of Science and Technology, 18 Hoang Quoc Viet Street, Hanoi, Vietnam. Email: phamthai@vnmn.vast.vn
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Abstract

Two new species of *Sogana* Matsumura, 1914 *S. bachmana* sp. nov. from Bach Ma National Park in Central Vietnam and *S. baviana* sp. nov. from Ba Vi National Park in North Vietnam are described. Illustrations of the holotype and male genitalia are provided for the new species and for *S. longiceps* Fennah, 1978 for comparison. New records from Hoa Binh Province are given for *S. cucphuongana* Constant & Pham, 2013. Photographs of a live *S. baviana* sp. nov. are provided. An identification key and a distribution map are provided for the five species of *Sogana* documented from Vietnam. The genus *Sogana* now contains 13 species.

Keywords: Fulgoroidea, Auchenorrhyncha, Tonkin, Indochina, Annam.

Introduction

The family Tropiduchidae contains about 660 species according to the FLOW database (Fulgoromorpha Lists On the Web – BOURGOIN, 2019), representing less than 5 % of the species of Fulgoromorpha. The Vietnamese Tropiduchidae currently includes 18 species, which is much more than Cambodia (2 species) or Thailand (4), but less than China (48) (BOURGOIN, 2019). Two new species of *Sogana* Matsumura, 1914 were recognized from recent material from Vietnam in the collections of the Royal Belgian Institute of Natural Sciences, Brussels, Belgium (RBINS), in the framework of the Global taxonomy Initiative (GTI) project “A step further in the entomodiversity of Vietnam”. This genus was placed by FENNAH (1982) in the tribe Isporisini Fennah, 1982, together with three other genera from Southeast Asia: *Eilithya* Distant, 1912, *Isporisa* Walker, 1857 and *Isporisella* Baker, 1927. The genus *Sogana* presently contains 11 species (LIANG & WANG, 2008; CONSTANT, 2010; CONSTANT & PHAM, 2013; CONSTANT, 2019) distributed in Southeast Asia, with three of them described from Vietnam: *S. longiceps* Fennah, 1978, *S. condaoana* Constant & Pham, 2013 and *S. cucphuongana* Constant & Pham, 2013 (CONSTANT & PHAM, 2013). Another species, *S. extrema* Melichar, 1914, originally described from Myanmar, was recorded by LALLEMAND (1942) from China or Vietnam but this doubtful record requires verification as noted by LIANG & WANG (2008) and CONSTANT & PHAM (2013) and will not be considered in this paper. Three species were recently described from countries adjacent to Vietnam: *S. clara* Liang & Wang, 2008 and *S. pseudohopponis* Liang & Wang, 2008 from Laos: (LIANG & WANG, 2008) and *S. chartieri* Constant, 2019 from Cambodia (CONSTANT, 2019).

The aim of this paper is to describe two new species of Tropiduchidae, *Sogana bachmana* sp. nov. and *S. baviana* sp. nov., as an addition to the biodiversity of Vietnam and to provide an identification key and a distribution map for the five species of *Sogana* from this country.

Material and methods

The male genitalia were extracted after boiling the abdomen several minutes in a 10% solution of potassium hydroxide (KOH) at about 100°C. The pygofer was separated from the abdomen and the aedeagus dissected with a needle blade for examination. The whole was then placed in glycerine for preservation in a tube attached to the pin of the specimen. The metatibiotarsal formula gives the number of spines on (side of metatibia) apex of metatibia/apex of first metatarsus/apex of second metatarsus. The terminology of the wings venation follows BOURGOIN *et al.* (2015), apical cells of the tegmina were counted along margin from vein ScP to CuP.

The measurements were taken as in CONSTANT (2004) and the following acronyms are used:

BF = maximum breadth of the frons
 BTg = maximum breadth of the tegmen
 BV = maximum breadth of the vertex
 LF = length of the frons in median line
 LTg = maximum length of the tegmen
 LT = total length (apex of head to apex of tegmina)
 LV = length of the vertex in median line

The photographs of the collection specimen were taken with a Leica EZ4W stereomicroscope with integrated camera, stacked with CombineZ software and optimized with Adobe Photoshop CS3. The distribution map was produced with SimpleMapp (SHORTHOUSE, 2010).

Acronym used for collections:

RBINS = Royal Belgian Institute of Natural Sciences, Brussels, Belgium.

ZMPA = Polish Academy of Sciences, Museum of the Institute of Zoology, Warsaw, Poland.

Abbreviation:

GTI = Global Taxonomy Initiative.

Results

Order **Hemiptera** Linnaeus, 1758
 Suborder **Auchenorrhyncha** Duméril, 1806
 Infra-order **Fulgoromorpha** Evans, 1946
 Superfamily **Fulgoroidea** Latreille, 1807
 Family **Tropiduchidae** Stål, 1866
 Subfamily **Tropiduchinae** Stål, 1866
 Tribe **Isporisini** Fennah, 1982

Genus ***Sogana*** Matsumura, 1914

Sogana MATSUMURA, 1914: 268. Type species: *Sogana hopponis* Matsumura, 1914, by monotypy.

Sogana – MELICHAR, 1914: 194; DISTANT, 1916: 54; METCALF, 1954: 130; TSAUR, 1990: 245; LIANG & WANG 2008: 30; CONSTANT 2010: 64; CONSTANT & PHAM 2013: 72; CONSTANT, 2019: 4.

SPECIES INCLUDED (TYPE LOCALITY)

Sogana bachmana sp. nov. (Vietnam)
Sogana baviana sp. nov. (Vietnam)
Sogana chartieri Constant, 2019 (Cambodia)
Sogana clara Liang & Wang, 2008 (Laos)
Sogana condaoana Constant & Pham, 2013 (Vietnam)
Sogana cucphuongana Constant & Pham, 2013 (Vietnam)
Sogana extrema Melichar, 1914 (Myanmar)
Sogana floreni Constant, 2010 (Borneo)
Sogana hopponis Matsumura, 1914 (Taiwan)
Sogana longiceps Fennah, 1978 (Vietnam)
Sogana pseudohopponis Liang & Wang, 2008 (Laos)
Sogana robustocarina Liang & Wang, 2008 (Borneo)
Sogana stimulata Melichar, 1914 (Mentawai Islands)

Identification key to the species of *Sogana* from Vietnam

1. Vertex more or less subquadrate (Fig. 4 I; CONSTANT & PHAM, 2013, fig. 2 B), ratio LV/BV < 0.85; apical margin of anal tube roundly notched apically in dorsal view (Fig. 5 D); aedeagus with strong, deeply furcate process on left side (Fig. 5 F; CONSTANT & PHAM, 2013, fig. 4 D)..... **2**
-. Vertex elongate, ratio LV/BV > 0.85; apical margin of anal tube rounded or oblique apically in dorsal view, not notched; aedeagus without strong furcate process..... **3**
2. Tegmina more elongate, LTg/BTg = 3.8, with 18–19 apical cells (Fig. 4 E); vertex more elongate, LV/BV = 0.8 (Fig. 4 I); right dorsal process of aedeagus not furcate (Fig. 5 E, G–H); ventral process of periandrium ended in a hook (Fig. 5 I)..... ***S. baviana* sp. nov.**
-. Tegmina less elongate, LTg/BTg = 3.3, with 19–21 apical cells (CONSTANT & PHAM, 2013, fig. 2 E); vertex shorter, LV/BV = 0.63 (CONSTANT & PHAM, 2013, fig. 2 B); right dorsal process of periandrium furcate (CONSTANT & PHAM, 2013, fig. 4 E); ventral process of periandrium strongly elongate and sinuate apically.....
.....***S. cucphuongana* Constant & Pham, 2013**
3. Vertex more elongate, ratio LV/BV = 1.15 (Fig. 7 E); aedeagus with two elongate dorsal processes ending in a single point (Fig. 8 E–H).....***S. longiceps* Fennah, 1978**
-. Vertex less elongate, ratio LV/BV = 0.9 (Fig. 1 G); aedeagus with dorsal processes with multiple teeth or crenulations apically (Fig. 2 E–F, H; CONSTANT & PHAM, 2013, fig. 3 D–E)..... **4**
4. Tegmina more elongate, LTg/BTg = 3.6 (Fig. 1 E); tegmina with 14 apical cells (Fig. 1 E); clypeus mostly pale yellow-brown (Fig. 1 F); dorsal processes of aedeagus with left one strongly sinuate and directed anteroventrally and right one spatulate apically and directed mostly dorsally (Fig. 2 E–F, H).....***S. bachmana* sp. nov.**
-. Tegmina less elongate, LTg/BTg = 3.0 (CONSTANT & PHAM, 2013, fig. 1 E); tegmina with 18 apical cells (CONSTANT & PHAM, 2013, fig. 1 E); clypeus mostly pale brown (CONSTANT & PHAM, 2013, fig. 1 D); dorsal processes of aedeagus both nearly straight and directed anterodorsally (CONSTANT & PHAM, 2013, fig. D–E).....
.....***S. condaoana* Constant & Pham, 2013**

***Sogana bachmana* sp. nov.**

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Figs 1–3

ETYMOLOGY. The species epithet refers to the type locality, Bach Ma National Park in Central Vietnam.

TYPE MATERIAL. VIETNAM: holotype ♂: Coll. I.R.Sc.N.B., Vietnam, Bach Ma N.P., summit, 16°12'N 107°52'E, 15-16.VII.2011, day collecting, leg. J. Constant & J. Bresseel, I.G.: 31.933 (RBINS). Dissected, genitalia in glycerine.

DIAGNOSIS. The species can be separated from the other *Sogana* species by the combination of the following characters:

1. median carina of vertex reduced to two convergent, brown carinae departing from basal margin and not joining, limited to basal 1/3 of vertex.
2. frons with six red transverse fasciae interrupted in the middle and an additional narrow one along frontoclypeal suture; median carina reaching ventral margin and interrupted before dorsal margin.
3. clypeus pale yellow-brown with sides black-brown apically.
4. tegmina with 14 apical cells.
5. anal tube elongate and narrow with apical margin oblique with angles rounded in dorsal view.
6. aedeagus with pointed processes dorsally; right dorsal process directed anterodorsally, spatulate and with margins crenulate; left dorsal process strongly sinuate and pointing anteroventrally with apex slightly flattened laterally and with margin crenulate.
7. periandrium ventrally with a broad, elongate, slightly sinuate and apically rounded process.

Additionally, in the key proposed by LIANG & WANG (2008) used with the addendum provided by CONSTANT (2010), the species runs to *S. clara* Liang & Wang, 2008, from which it can be separated by the more elongate vertex ($LV/BV = 0.9$; in *S. clara* $LV/BV = 0.82$) and frons ($LF/BF = 1.6$; in *S. clara* $LF/BF = 1.49$) and by the shape of the dorsal processes of the aedeagus with the left process strongly sinuate and pointing anteroventrally and the right one directed anterodorsally (processes directed anteriorly in *S. clara*).

DESCRIPTION.

Measurements and ratios: LT: ♂ (n = 1): 10.2 mm; LTg/BTg = 3.6; LV/BV = 0.9; LF/BF = 1.6.

Head: (Fig. 1 F–I) elongate with apex roundly pointed in dorsal view. Vertex excavate between carinae; latero-discal carinae oblique and strong, brown and joining lateral margin before half of eye length; median carina reduced to 2 convergent, brown carinae departing from caudal margin and not joining, limited to caudal 1/3 of vertex; vertex pale yellow-brown with C-shaped black-brown marking at laterobasal angles. Posterior face of head with 2 black-brown spots. Frons slightly sinuate in lateral view, with dorsal portion projecting anteriorly; median carina brown, extending to apex of clypeus but not reaching dorsal margin of frons; frons pale yellow-brown with 6 transverse red bands on each side of median carina, an additional very narrow band along fronto-clypeal suture; anterior margin of frons with 4 black-brown markings. Genae pale yellow-brown with narrow brown line along dorsal margin, slightly anteriorly to eye. Clypeus pale yellow-brown with sides brown towards apex.

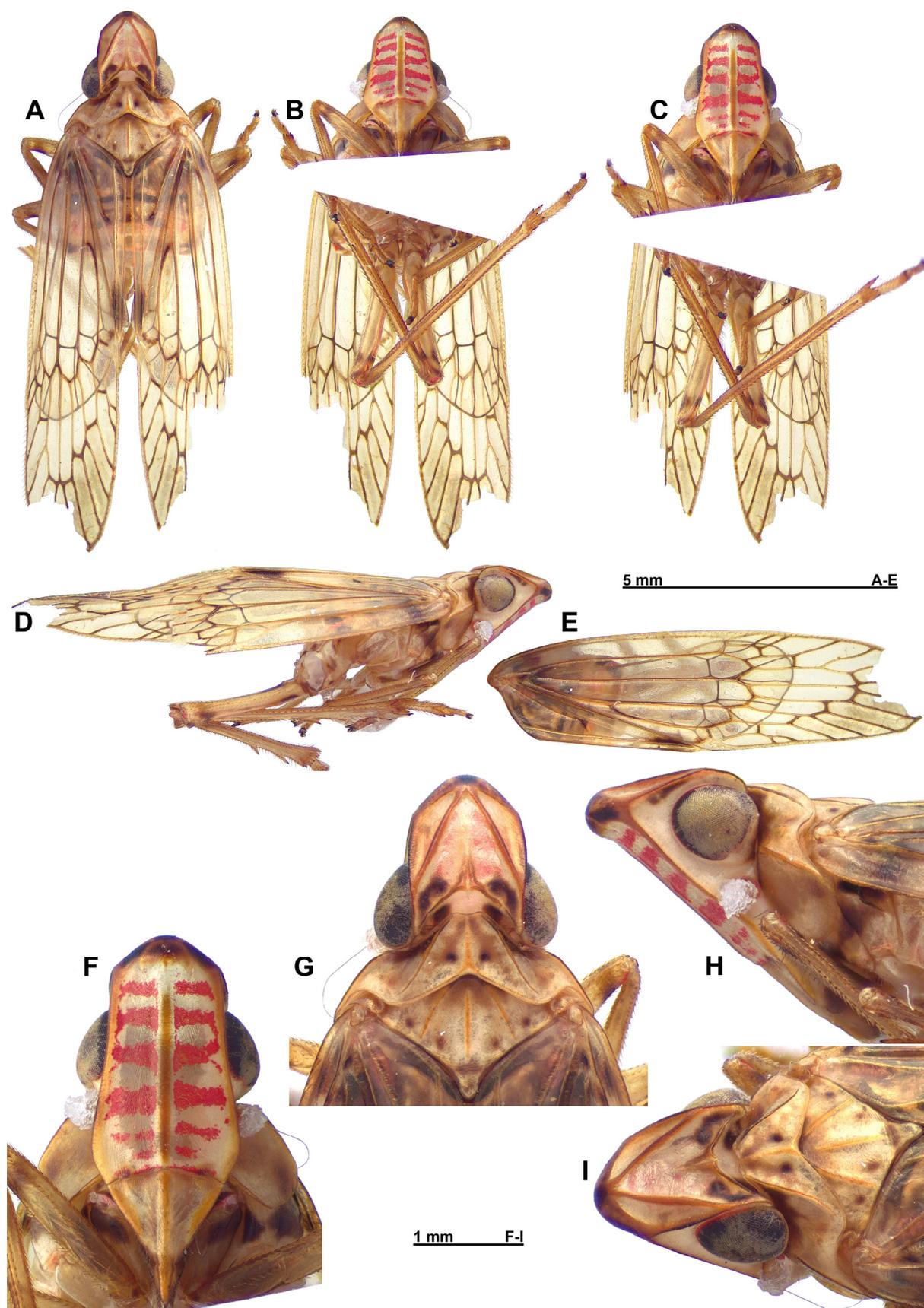


Fig. 1. *Sogana bachmana* sp. nov., holotype ♂. A, habitus dorsal view. B, habitus, ventral view. C, habitus, perpendicular view of frons. D, habitus, lateral view. E, right tegmen. F, frons, normal view right posterior wing. G, head and thorax, dorsal view. H, head and thorax, lateral view. I, head and thorax, laterodorsal view.

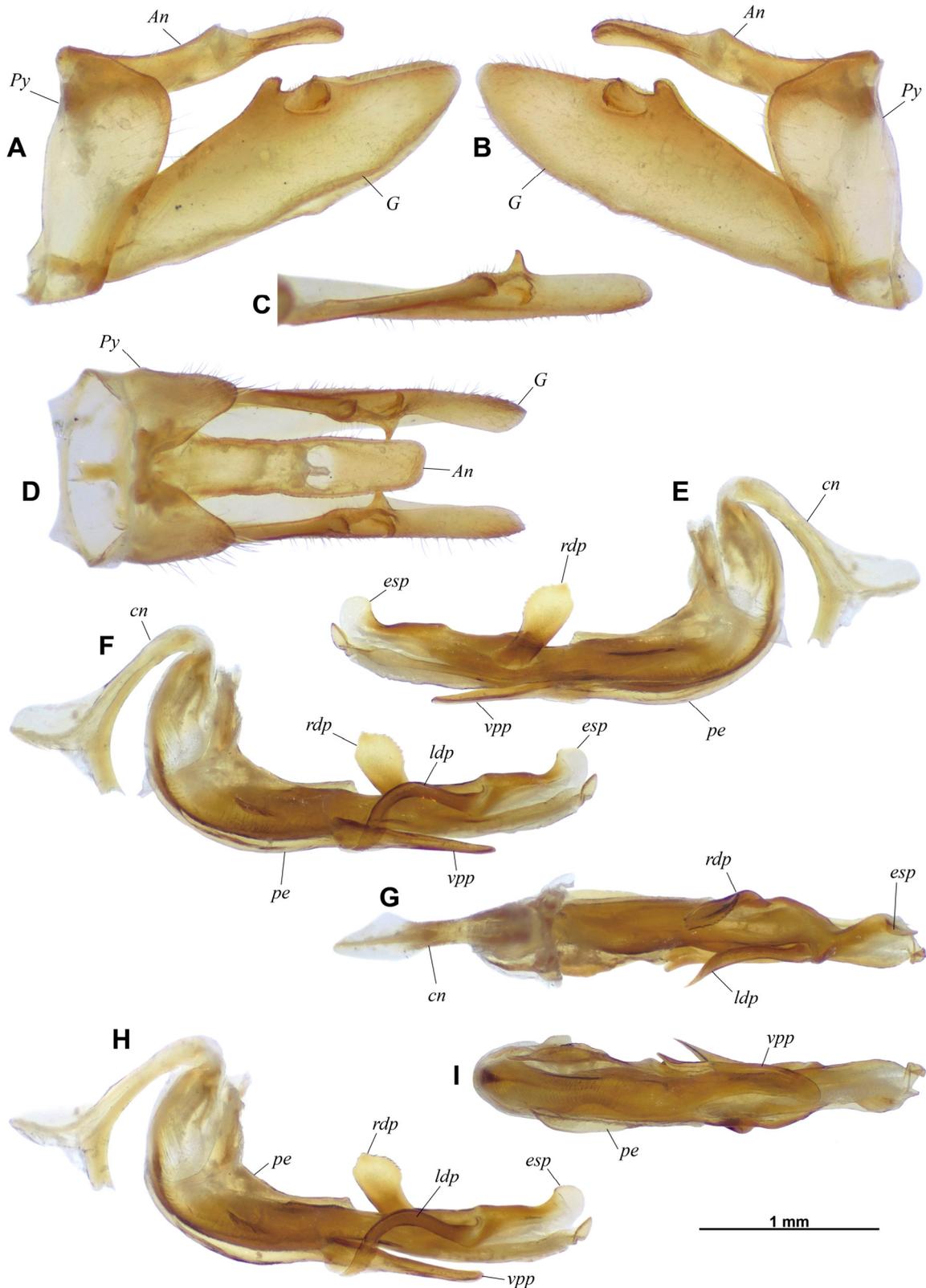


Fig. 2. *Sogana bachmana* sp. nov., holotype ♂. A, pygofer, anal tube and gonostyli, left lateral view. B, pygofer, anal tube and gonostyli, right lateral view. C, left gonostylus, dorsal view. D, pygofer, anal tube and gonostyli, dorsal view. E, aedeagus, right lateral view. F, aedeagus, left lateral view. G, aedeagus, dorsal view. H, aedeagus, left posterolateral view. I, aedeagus, ventral view.

An: anal tube – cn: connective – esp: ear-shaped process of aedeagus – G: gonostylus – ldp: left dorsal process of aedeagus – pe: perianthrium – Py: pygofer – rdp: right dorsal process of aedeagus – vpp: ventral process of perianthrium.

Thorax: (Fig. 1 F–I) pronotum pale yellow-brown with irregular light brown markings on disc and behind eyes; anterior and posterior margins emarginate; median carina sharp, weakening anteriorly, reaching anterior margin; black impressed point on each side of median carina; carinae brown; lateral carinae strong; paranotal lobes rounded. Mesonotum pale yellow-brown with median and discal carinae brown; discal carinae joining anteriorly, median carina not reaching anterior and posterior margins; 4 black-brown spots along posterior margin; base of scutellum black-brown; tegulae pale yellow-brown; lateral pleura of mesothorax with black-brown markings forming a line with the markings on anterior coxae and clypeus.

Tegmina: (Fig. 1 A, D–E) elongate, subhyaline; weak black-brown marking near base of postcostal cell, extending in a brown patch at base of radial cell; vein CuA₂ dark brown on basal 1/3; elongate black-brown marking at apical angle of clavus; apex of PCu with dark brown marking. Veins ScP+R and MP not forked before nodal line; CuA forked once before nodal line. 7 subapical and 14 apical cells; apical cells 6–11 infusate on distal 2/3.

Hind wings: hyaline with veins mostly dark brown; postclaval margin emarginate and infusate along vein CuP.

Legs: (Fig. 1 A–D) pale yellow-brown with base of pro- and mesotibiae slightly infusate; all femora with dark brown ante-apical ring and with dorsal portion partly brown on basal half; base of procoxae black-brown; metatibiae with 3 lateral and 7 apical spines; first hind tarsomere with 9 apical spines. Metatibiotarsal formula: (3) 7/9/2.

Abdomen: brown; terminalia dark brown.

Terminalia ♂: (Fig. 2) pygofer narrow with posterior margin roundly projecting on dorsal 2/3; anterior and posterior margins sinuate in lateral view (Fig. 2 A–B); posterior margin deeply V-shaped notched in dorsal view. Gonostyli (Fig. 2 A–D) very elongate, laterally compressed, with apex narrowly rounded; 3 hooked processes on dorsal margin slightly posteriorly to half length. Aedeagus (Fig. 2 E–I) elongate and narrow, with 2 processes dorsally, with left one more posterior than right one; right dorsal process directed dorsally and slightly anteriorly, laterally compressed, slightly spatulate with margin crenulate on apical half; left dorsal process strongly sinuate, curved ventrolaterad on distal half, more or less round in cross section with distal ¼ laterally compressed and with small teeth ventrally; dorsal ear-shaped process at apex; periandrium strongly asymmetrical, ventrally with left side elongate in a broad smoothly sinuate dorsoventrally flattened process rounded apically. Anal tube (Fig. 2 A–B, D) elongate and narrow, slightly more developed to the right side in dorsal view, with sides subparallel and apical angles roundly angular; slightly sinuate in lateral view; anal column situated slightly beyond half length.

BIOLOGY. The specimen was collected in mountain tropical evergreen forest, at 1200–1400m in altitude.

DISTRIBUTION. Vietnam: Thua Thien-Hue Province, Bach Ma National Park (Fig. 3).

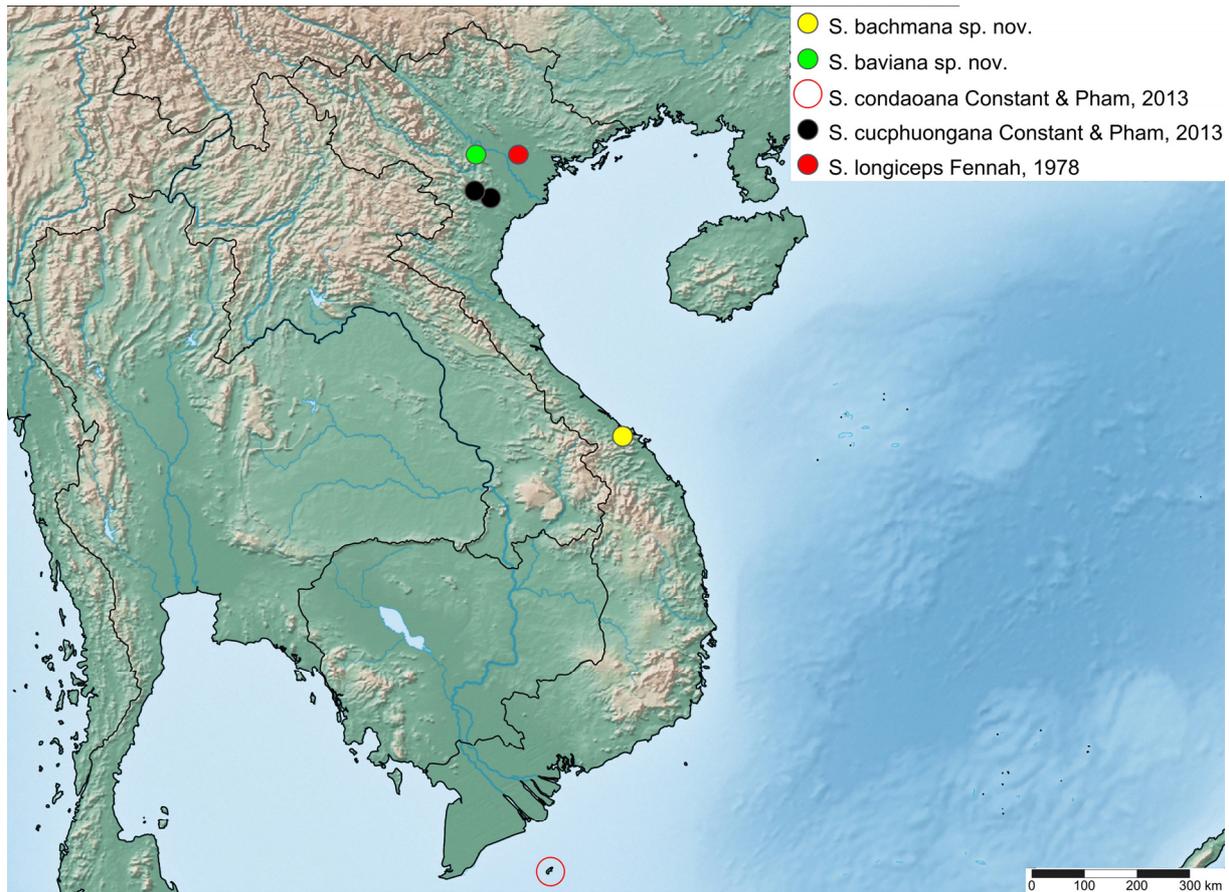


Fig. 3. *Sogana* spp. of Vietnam, distribution map.

***Sogana baviana* sp. nov.**

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Figs 3–6

ETYMOLOGY. The species epithet refers to the type location: Ba Vi National Park in North Vietnam.

TYPE MATERIAL. VIETNAM: holotype ♂: Coll. I.R.Sc.N.B., Vietnam, Hanoi prov., BaVi N.P., 21°4'4"N 105°21'30"E, 25-29.VI.2015, leg. J. Constant & J. Bresseel, I.G.: 33.092 (RBINS). Dissected, genitalia in glycerine; right hind wing mounted, glued on cardboard.

DIAGNOSIS. The species can be separated from the other *Sogana* species by the combination of the following characters:

1. median carina of vertex reduced to two convergent, brown carinae departing from basal margin and joining at about half length of vertex.
2. frons with six red transverse fasciae interrupted in the middle and an additional narrow one along frontoclypeal joint, and median carina reaching basal margin and interrupted before apical margin.
3. clypeus pale yellow-brown with sides black-brown apically.
4. tegmina with 18–19 apical cells.
5. anal tube elongate and narrow with apical margin roundly notched in dorsal view.
6. aedeagus with right dorsal process laminate and folded anteriorly, with margins crenulate; left dorsal process strongly furcate and directed anteroventrally with ventral portion more developed, pointed apically and with ventral margin crenulate, and with dorsal portion pointed dorsally with dorsal margin oblique and crenulate.

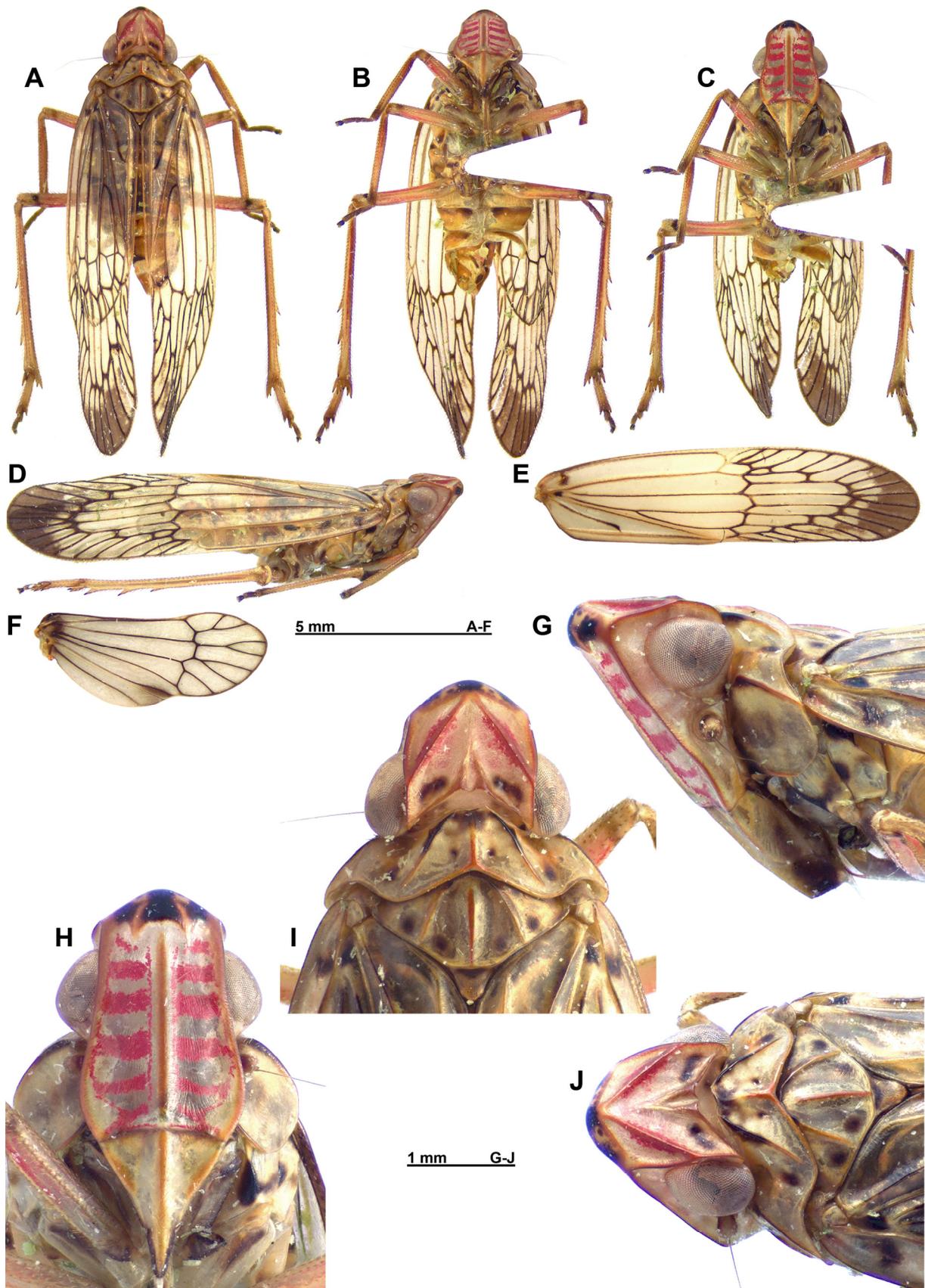


Fig. 4. *Sogana baviana* sp. nov., holotype ♂. A, habitus dorsal view. B, habitus, ventral view. C, habitus, normal view of frons. D, habitus, lateral view. E, right tegmen. F, right posterior wing. G, head and thorax, lateral view. H, frons, perpendicular view. I, head and thorax, dorsal view. J, head and thorax, laterodorsal view.

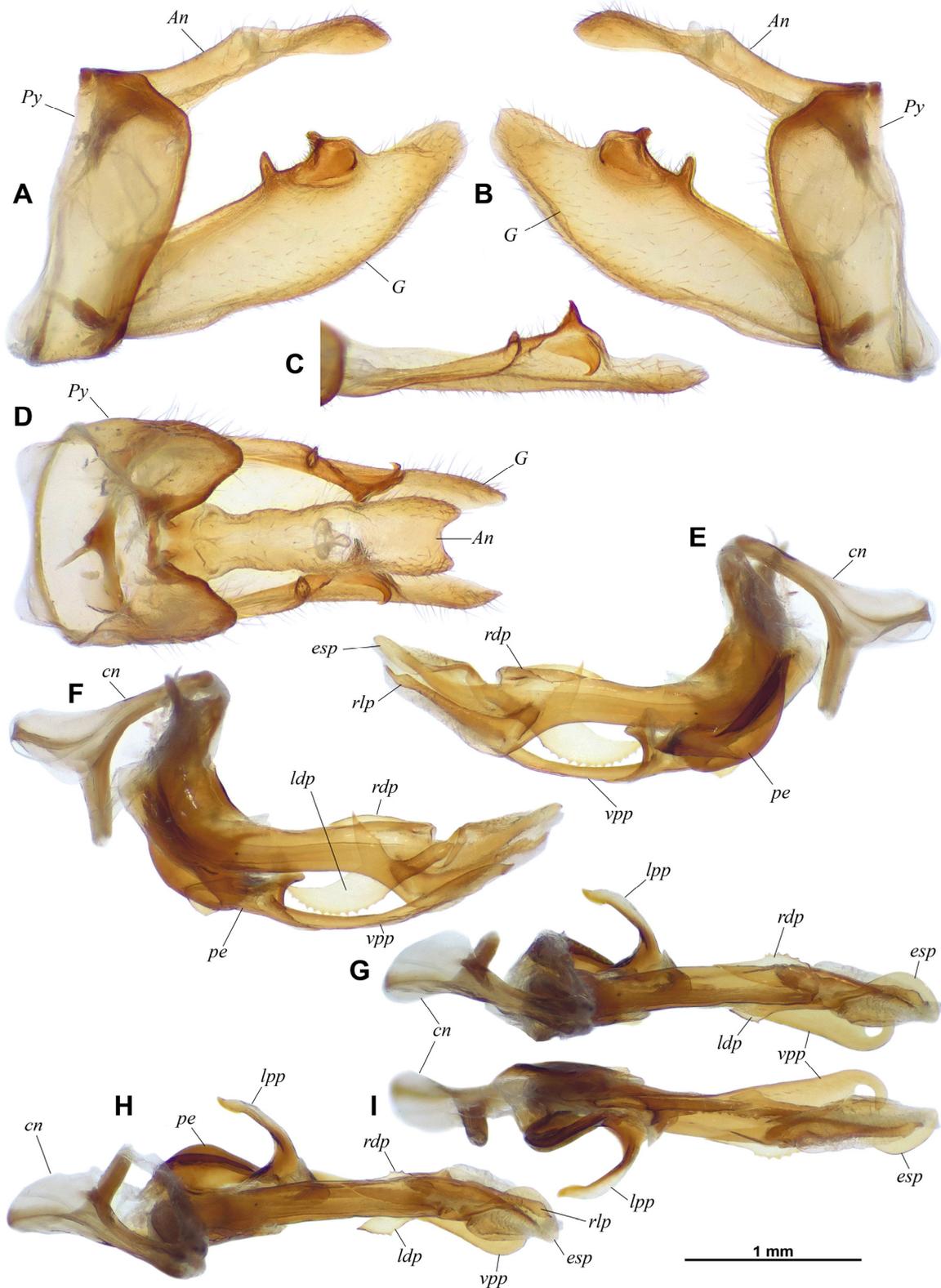


Fig. 5. *Sogana baviana* sp. nov., holotype ♂. A, pygofer, anal tube and gonostyli, left lateral view. B, pygofer, anal tube and gonostyli, right lateral view. C, left gonostylus, dorsal view. D, pygofer, anal tube and gonostyli, dorsal view. E, aedeagus, right lateral view. F, aedeagus, left lateral view. G, aedeagus, dorsal view. H, aedeagus, left posterolateral view. I, aedeagus, ventral view.

An: anal tube – cn: connective – esp: ear-shaped process of aedeagus – G: gonostylus – ldp: left dorsal process of aedeagus – lpp: lateral process of periandrium – pe: periandrium – Py: pygofer – rdp: right dorsal process of aedeagus – rlp: right lateral process of aedeagus – vpp: ventral process of periandrium.

7. periandrium ventrally with elongate, laminate, slightly sinuate process strongly hooked apically.

Additionally, in the key proposed by LIANG & WANG (2008) used with the addendum provided by CONSTANT (2010), the species runs to *S. clara* Liang & Wang, 2008, from which it can be separated by the more numerous apical cells of the tegmina (18–19; 14 in *S. clara*) and red bands of frons (6; 5 in *S. clara*) and by the shape of the left dorsal processes of the aedeagus strongly furcate and directed anteroventrally (not furcate and directed anteriorly in *S. clara*).

DESCRIPTION.

Measurements and ratios: LT: ♂ (n = 1): 11.7 mm; LTg/BTg = 3.8; LV/BV = 0.8; LF/BF = 1.45.

Head: (Fig. 4 G–J) elongate with apex broadly rounded in dorsal view. Vertex excavate between carinae; latero-discal carinae oblique and rather strong, extensively red and joining lateral margin slightly before half of eye length; median carina reduced to 2 convergent, brown carinae departing from basal margin and joining at about half length of vertex; vertex pale yellow-brown with slightly oblique black-brown marking at laterobasal angles. Posterior face of head with 2 weak brown markings. Frons nearly straight in lateral view, with dorsal portion slightly projecting anteriorly; median carina brown, extending to apex of clypeus but not reaching dorsal margin of frons; frons pale yellow-brown with 6 transverse red bands on each side of median carina, an additional very narrow band along fronto-clypeal suture and a narrow red longitudinal line along median carina and along lateral margins; anterior margin of frons with 3 black-brown markings, central one larger. Genae entirely pale yellow-brown. Clypeus pale yellow-brown with sides brown towards apex.

Thorax: (Fig. 2 G–J) pronotum pale yellow-brown with brown marking along anterior margin between peridiscal carinae; anterior and posterior margins emarginate; median carina sharp, weakening anteriorly, reaching anterior margin, brown on anterior 1/3 and with posterior 2/3 reddish brown; peridiscal carinae light brown, black on anterior half; black impressed point on each side of median carina; black dot between peridiscal and lateral carinae; lateral carinae black along anterior half; paranotal fields infusate in middle. Mesonotum pale yellow-brown with median carina reddish brown and discal carinae pale brown; discal carinae joining anteriorly, median carina not reaching anterior and posterior margins; 4 black-brown spots along posterior margin; base of scutellum black-brown; scutellar groove rather strong; tegulae pale yellow-brown; lateral pleura of mesothorax with black-brown markings forming an interrupted line with the markings on anterior coxae and clypeus.

Tegmina: (Fig. 4 A, D–E) elongate, subhyaline; black-brown marking near base of postcostal cell, small black spot at base of median cell; no black-brown marking at apical angle of clavus; apex of PCu with dark brown marking. Veins ScP+R and MP not forked before nodal line; CuA forked once before nodal line. 6–7 subapical and 18–19 apical cells; apical cells 6 or 7–12 or 13 extensively infusate.

Hind wings: hyaline with basal black-brown marking and with veins mostly dark brown; postclaval margin emarginate and infusate along vein CuP.

Legs: (Fig. 1 A–D) pale yellow-brown with base of pro- and mesotibiae slightly infusate; all femora slightly reddish with dark brown ante-apical ring; base of coxae with black-brown marking; pro- and mesotarsi brown; metatibiae with 3 lateral and 7 apical spines; first hind tarsomere with 9 apical spines. Metatibiotarsal formula: (3) 7/9/2.

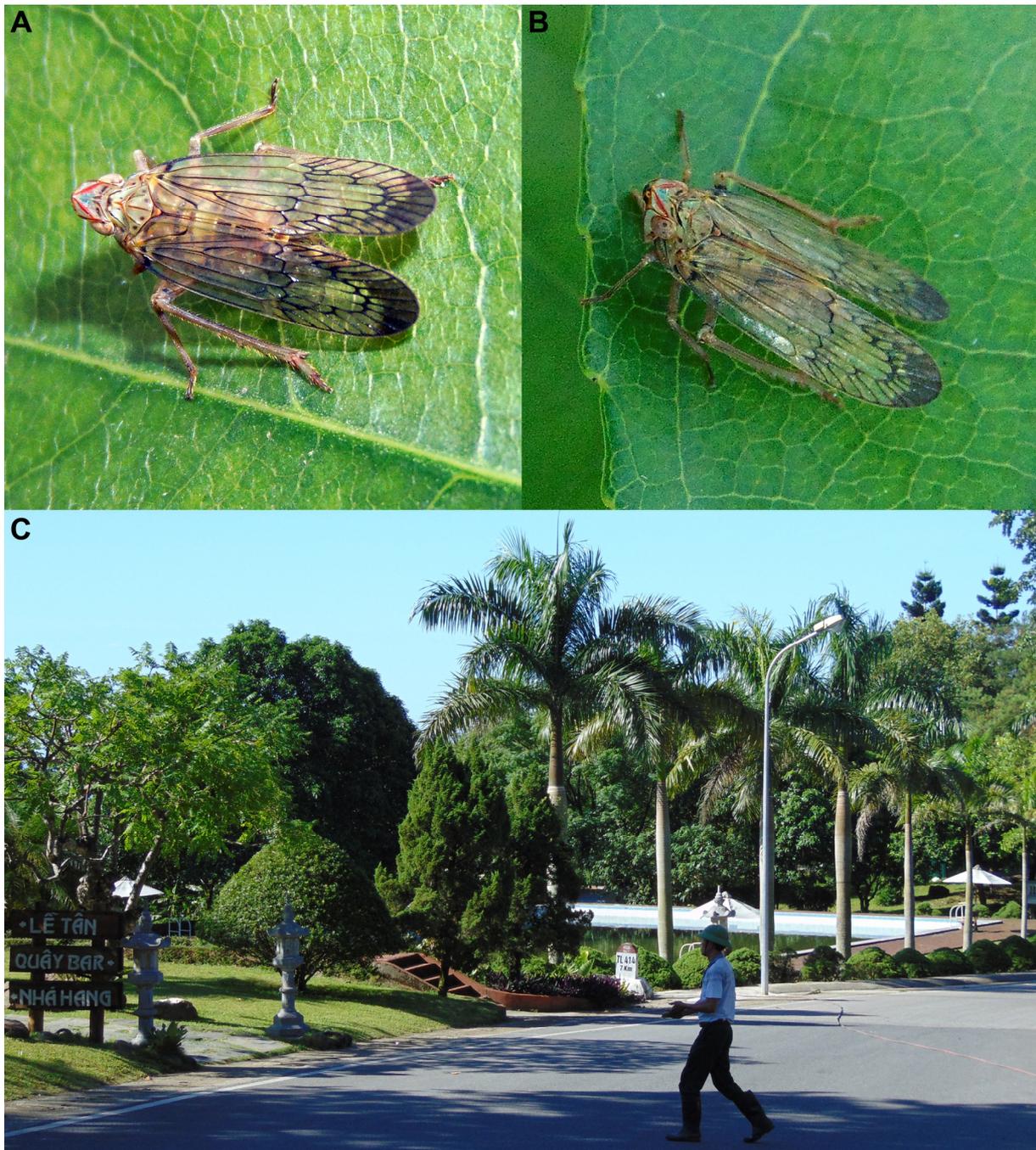


Fig. 6. *Sogana baviana* sp. nov. A–B, holotype ♂ in Ba Vi National Park, 25.VI.2015. C, habitat (photographs © J. Constant).

Abdomen: pale brown with darker markings dorsally; terminalia dark brown.

Terminalia ♂: (Fig. 5) pygofer narrow with posterodorsal angle roundly angular in lateral view; anterior and posterior margins sinuate in lateral view (Fig. 5 A–B); posterior margin deeply V-shaped notched dorsally (Fig. 5 D). Gonostyli (Fig. 5 A–D) very elongate, laterally compressed, with apex narrowly rounded; 3 hooked processes on dorsal margin at about 2/3 of gonostylus length; dorsal margin excavate at hooked processes. Aedeagus (Fig. 5 E–I) elongate and narrow, with 2 processes dorsally, with left one more posterior and larger than right one, and one lateral process on right side; right dorsal process strongly folded anteriorly, dorsoventrally flattened and with right margin crenulate; left dorsal process projecting anteroventrally, strongly furcate with ventral portion larger than dorsal one, ventral margin of

ventral portion rounded and crenulate, dorsal margin of dorsal portion oblique and crenulate, apex of both dorsal and ventral portions pointed (Fig. 5 E–G); right lateral process more or less round in cross section directed posteroventrally, then curved posterodorsally, narrowing regularly towards apex and slightly inflated antepically, apex pointed (Fig. 5 E, H); apex of aedeagus with twisted ear-shaped process (Fig. 5 E, G–I). Periandrium with laminate incurved process on left side (Fig. 5 F) and strong lateral process largely curved lateroanteriorly on right side (Fig. 5 G–I); elongate, dorsoventrally flattened process ventrally not reaching apex of aedeagus and ended in a narrow strongly curved hook (Fig. 5 E–F, I). Anal tube (Fig. 5 A–B, D) elongate and narrow, slightly more developed to the right side in dorsal view, with sides subparallel and apical angles roundly notched; slightly sinuate in lateral view; anal column slightly posterior to half length.

BIOLOGY. The specimen was sitting on the ground near the swimming pool situated near the National Park guest houses (Fig. 6 C) at an altitude of about 400 m. The vegetation at this place is a garden with ornamental and wild shrubs and small trees as well as palm trees, with a rather dense ground cover.

DISTRIBUTION. Vietnam: Hanoi Province, Ba Vi National Park (Fig. 3).

***Sogana cucphuongana* Constant & Pham, 2013**

Fig. 3

Sogana cucphuongana CONSTANT & PHAM, 2013: 73, figs 2, 4, 6 [described; habitus, details, male genitalia and distribution illustrated].

ADDITIONAL MATERIAL EXAMINED. VIETNAM. 1♂: Ninh Binh prov., Cuc Phuong Nat. Park, 20°20'53"N 105°35'52"E, 31.VII-3.VIII.2016, GTI Project, leg. J. Constant & J. Bresseel, I.G.: 33.282 (RBINS); 2♂♂, 2♀♀: Hoa Binh prov., Ngo Luong Nat. Res., 20°26'16"N 105°20'15"E, 25-30.VII.2016, GTI Project, leg. J. Constant & J. Bresseel, I.G.: 33.282 (RBINS).

Note

The species was previously recorded only from Cuc Phuong National Park in Ninh Binh Province. We add here a new record for the province of Hoa Binh. However this new data is not surprising as Ngoc Son-Ngo Luong Nature Reserve is very close to Cuc Phuong National Park (Fig. 3).

***Sogana longiceps* Fennah, 1978**

Figs 3, 7–8

Sogana longiceps FENNAH, 1978: 262, figs 219–226 [described; habitus, details, male genitalia and distribution illustrated].

Sogana longiceps – LIANG & WANG, 2008: 33 [keyed], 37 [described based on FENNAH, 1978] (based on erroneous identification according to CONSTANT & PHAM, 2013). — CONSTANT & PHAM, 2013: 72 [keyed], 76 [notes on data from China], fig. 5 [male genitalia illustrated based on FENNAH, 1978], fig. 6 [distribution map].

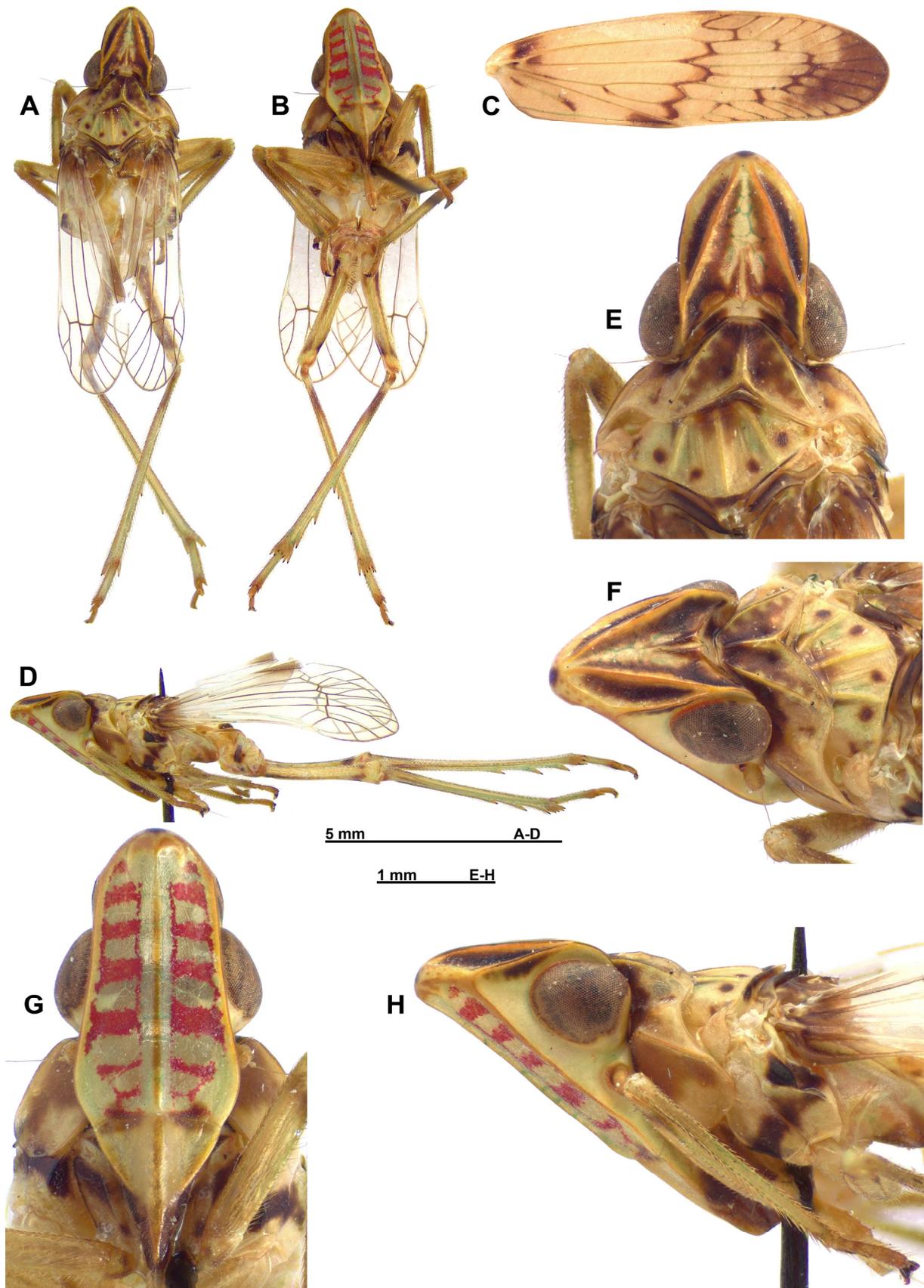


Fig. 7. *Sogana longiceps* Fennah, 1978, holotype ♂. A, habitus dorsal view. B, habitus, ventral view. C, right tegmen. D, habitus, lateral view. E, head and thorax, dorsal view. F, head and thorax, laterodorsal view. G, frons, perpendicular view. H, head and thorax, lateral view.

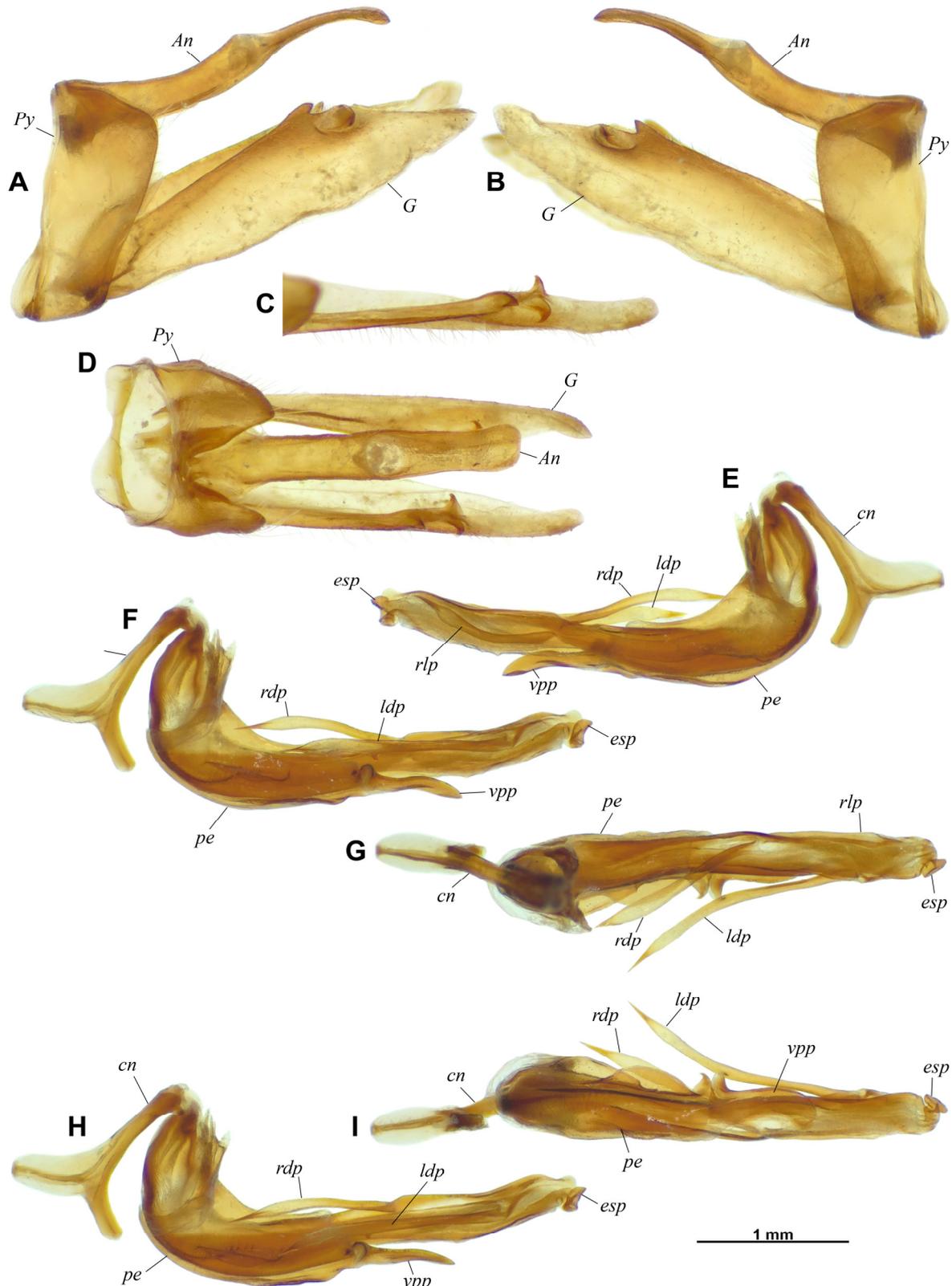


Fig. 8. *Sogana longiceps* Fennah, 1978, holotype ♂. A, pygofer, anal tube and gonostyli, left lateral view. B, pygofer, anal tube and gonostyli, right lateral view. C, left gonostylus, dorsal view. D, pygofer, anal tube and gonostyli, dorsal view. E, aedeagus, right lateral view. F, aedeagus, left lateral view. G, aedeagus, dorsal view. H, aedeagus, left posterolateral view. I, aedeagus, ventral view.

An: anal tube – cn: connective – esp: ear-shaped process of aedeagus – G: gonostylus – ldp: left dorsal process of aedeagus – pe: periandrium – Py: pygofer – rdp: right dorsal process of aedeagus – rlp: right lateral process of aedeagus – vpp: ventral process of periandrium.

non *Sogana longiceps* – CHOU *et al.*, 1985: 40 [described, listed from China], fig. 36 [habitus and frons illustrated] (based on erroneous identification according to CONSTANT & PHAM, 2013). — LIANG & WANG, 2008: 37 [listed from China], fig. 4 [habitus illustrated] (based on erroneous identification according to CONSTANT & PHAM, 2013).

TYPE MATERIAL EXAMINED. VIETNAM: holotype ♂: [Vietnam, Chine aa Hanoi, 25.6.1959, leg. B. Pisarski & I. Proszynski (5868)], [Inst. Zool. P.A.N., Warszawa, 58/59], [Holo- type], [*Sogana longiceps* det. R.G. Fennah] (ZMPA).

Note

The type specimen, that was not available for our previous study (CONSTANT & PHAM, 2013), was later located in the collections of ZMPA.

AMENDED DESCRIPTION

Measurements and ratios: LT: ♂ (extrapolated – n = 1): 11.7 mm; LTg/BTg = 3.4; LV/BV = 1.15; LF/BF = 1.7.

Terminalia ♂: (Fig. 8) pygofer narrow with posterodorsal angle roundly angular in lateral view; anterior and posterior margins sinuate in lateral view (Fig. 8 A–B); posterior margin deeply V-shaped notched dorsally (Fig. 8 D). Gonostyli (Fig. 8 A–D) very elongate, laterally compressed, with apex roundly pointed; 3 hooked processes on dorsal margin at about 2/3 of gonostylus length. Aedeagus (Fig. 8 E–I) elongate and narrow, with 2 dorsal processes, with left one more posterior and longer than right one, and one lateral process on right side; right dorsal process long, directed anteriorly, more or less rounded in cross section, slightly dilated before apex and pointed apically; left dorsal process very long, projecting anterodorsally, more or less rounded in cross section, slightly dilated before apex and pointed apically (Fig. 8 E–G); right lateral process more or less round in cross section gently curved posterodorsally, slightly inflated antepically, apex pointed (Fig. 8 E, G); apex of aedeagus with small ear-shaped process (Fig. 8 E–I). Periandrium with flat laminate process on left side (Fig. 8 G) and short strongly hooked lateral process on left side (Fig. 8 I); elongate, dorsoventrally flattened process ventrally not reaching apex of aedeagus with laterobasal hooked process, curved to the right and rounded apically (Fig. 8 E–H). Anal tube (Fig. 8 A–B, D) very elongate and narrow, slightly more developed to the right side in dorsal view, with sides subparallel, slightly constricted before apex and with apical angles rounded; sinuate in lateral view; anal column situated slightly beyond half length.

Discussion

With five species recorded from the 13 currently described, Vietnam is home to nearly 40% of the species of *Sogana*. However we are convinced that this is an artifact of recent collecting and study efforts in the framework of Global Taxonomy Initiative projects (CONSTANT *et al.*, 2018) that allowed the discovery of all four recently described species. The specimens were collected by net but other collecting techniques like canopy fogging (CONSTANT, 2010) would certainly allow the discovery of additional species.

The Vietnamese fauna of Tropiduchidae now counts 20 species, including 5 species of the genus *Sogana* alone, representing 25% of the species of the Tropiduchidae of the country. These figures represent only a fraction of the real diversity of Tropiduchidae of Vietnam, which contains numerous additional new species and new genera awaiting description, e.g. in the collections of RBINS and VNMN (Constant & Pham, unpublished data).

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References

- BOURGOIN T., 2019. - FLOW (Fulgoromorpha Lists on The Web): a world knowledge base dedicated to Fulgoromorpha. V.8, updated [III.2019]. <http://hemiptera-databases.org/flow/> [Accessed March 2nd, 2019].
- BOURGOIN T., WANG R.R., ASCHE M., HOCH H., SOULIER-PERKINS A., STROINSKI A., YAP S. & SZWEDO J., 2015. - From micropterism to hyperpterism: recognition strategy and standardized homology-driven terminology of the fore wing venation patterns in planthoppers (Hemiptera: Fulgoromorpha). *Zoomorphology*, 134(1): 63–77.
- CHOU I., LU J.S., HUANG J. & WANG S.Z., 1985. - *Economic Insect Fauna of China*. Fasc. 36. Homoptera: Fulgoroidea. Science Press, Beijing, China, 152 pp., 2 pls. [In Chinese, English summary p. 137.]
- CONSTANT J., 2004. - Révision des Eurybrachidae (I). Le genre *Amychodes* Karsch, 1895 (Homoptera: Fulgoromorpha: Eurybrachidae). *Bulletin de l'Institut royal des Sciences naturelles de Belgique*, 74: 11–27.
- CONSTANT J., 2010. - *Sogana* from the Greater Sunda (Hemiptera: Fulgoromorpha: Tropiduchidae). *Zootaxa*, 2693: 63–68.
- CONSTANT J., 2019. - First record of the tropiduchid planthopper genus *Sogana* Matsumura, 1914 from Cambodia with one new species (Hemiptera: Fulgoromorpha: Tropiduchidae). *Belgian Journal of Entomology*, 82: 1–11.
- CONSTANT J., BOURGOIN T., BARTOLOZZI L., BRESSEEL J., GUILBERT E., SOULIER-PERKINS A., PHAM H.T., SUSINI ONDAFE M.-L., JANSSENS DE BISTHOVEN L., LORN S. & KHEAM S., 2018. - Vietnam, a champion for insect biodiversity: a win-win commitment. *CEBioS PB*, 6: 1–4. Available from <https://www.researchgate.net/publication/322557227>
- CONSTANT J. & PHAM H.T., 2013. - Two new species of *Sogana* Matsumura, 1914 (Hemiptera: Fulgoromorpha: Tropiduchidae) with an identification key to the hitherto known species from Vietnam. *Annales Zoologici*, 63(1): 71–77.
- DISTANT W.L., 1916. - *The Fauna of British India, including Ceylon and Burma. Rhynchota 6 (Homoptera: Appendix)*. Taylor & Francis, London. pp. 17–145.
- FENNAH R.G., 1978. - Fulgoroidea (Homoptera) from Vietnam. *Annales Zoologici*, 34(9): 207–279.
- FENNAH R.G., 1982. - A tribal classification of the Tropiduchidae (Homoptera: Fulgoroidea), with the description of a new species on tea in Malaysia. *Bulletin of Entomological Research*, 72: 631–643.
- LALLEMAND V., 1942. - Notes sur quelques espèces recueillies par le R. Piel (Musée Heude, Shanghai) et le R. P. de Cooman (Hoa Binh, Tonkin). *Notes d'Entomologie Chinoise*, 9(4): 69–77.
- LIANG A.-P. & WANG R.R., 2008. - A review of the Oriental planthopper genus *Sogana* Matsumura 1914 (Hemiptera: Fulgoromorpha: Tropiduchidae) with description of three new species. *Zootaxa*, 1732: 29–44.
- MATSUMURA S., 1914. - Beitrag zur kenntnis der Fulgoriden Japans. *Annales Historico-Naturales Musei Nationalis Hungarici*, 12: 261–305.
- MELICHAR L., 1914. - Monographie der Tropiduchiden. *Verhandlungen des naturforschenden Vereines in Brünn*, 53: 1–145.
- METCALF Z.P., 1954. - *General Catalogue of the Homoptera. Fasc. IV. Fulgoroidea. Part 11. Tropiduchidae*. North Carolina State College, Raleigh, NC, USA. 167 pp.
- SHORTHOUSE D.P., 2010. - SimpleMapp, an online tool to produce publication-quality point maps. [Retrieved from <http://www.simplemapp.net> Accessed January 15, 2019].
- TSAUR S.-C., 1990. - Tropiduchidae of Taiwan (Homoptera: Fulgoroidea), supplement. *Bulletin of the Institute of Zoology, Academia Sinica*, 29 (4), 243–248.