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Belgian Journal of Entomology

***Sogana cysana* sp. nov., a new tropiduchid planthopper from Chu Yang Sin National Park in Vietnam and key to Vietnamese species of the genus (Hemiptera: Fulgoromorpha: Tropiduchidae)**

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Front cover: *Sogana cysana* sp. nov., holotype ♂. © Jérôme Constant (RBINS).

***Sogana cysana* sp. nov., a new tropiduchid planthopper from Chu Yang Sin National Park in Vietnam and key to Vietnamese species of the genus (Hemiptera: Fulgoromorpha: Tropiduchidae)**

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Abstract

A new species of *Sogana* Matsumura, 1914 *S. cysana* sp. nov. from Chu Yang Sin National Park in southern Central Vietnam, is described. Illustrations of the holotype and male genitalia are provided. Updated identification key and distribution map are provided for the six species of *Sogana* documented from Vietnam. The genus *Sogana* now contains 14 species.

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

Introduction

The family Tropiduchidae contains about 670 species according to the FLOW database (Fulgoromorpha Lists On the Web – BOURGOIN, 2020), representing less than 5 % of the species of Fulgoromorpha globally. In Vietnam the family currently includes 20 species, which is much more than Cambodia (2 species) or Thailand (4), but less than China (48) (BOURGOIN, 2020). A recent expedition to southern Central Vietnam in the framework of the Global taxonomy Initiative (GTI) project “A step further in the entomodiversity of Vietnam” allowed the discovery of an additional new species of *Sogana* Matsumura, 1914. FENNAH (1982) placed this genus in the Oriental tribe Isporisini Fennah, 1982 with three other genera: *Eilithya* Distant, 1912, *Isporisa* Walker, 1857 and *Isporisella* Baker, 1927. Thirteen species of *Sogana* are described (LIANG & WANG, 2008; CONSTANT, 2010; CONSTANT & PHAM, 2013, 2019; CONSTANT, 2019), including five from Vietnam: *S. bachmana* Constant & Pham, 2019, *S. baviana* Constant & Pham, 2019, *S. longiceps* Fennah, 1978, *S. condaoana* Constant & Pham, 2013 and *S. cucphuongana* Constant & Pham, 2013 (CONSTANT & PHAM, 2019). *Sogana extrema* Melichar, 1914, described from Myanmar, was recorded by LALLEMAND (1942) from China or Vietnam but this record requires confirmation as noted by LIANG & WANG (2008) and CONSTANT & PHAM (2013) and is not considered here.

The aim of this paper is to describe the new species of *Sogana*, *S. cysana* sp. nov. as an addition to the biodiversity of Vietnam and to provide an updated identification key and a distribution map for the six Vietnamese species of *Sogana*.

Material & 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 wing 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 specimens and genitalia 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 SimpleMappr (SHORTHOUSE, 2010).

Acronym used for collections:

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

VNMN = Vietnam National Museum of Nature, Hanoi, Vietnam.

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; CONSTANT & PHAM, 2019: 4.

FLOW, 2020:

<https://www.hemiptera-bases.org/flow/?page=explorer&db=flow&lang=en&card=taxon&rank=genus&id=8083>

SPECIES INCLUDED (TYPE LOCALITY):

Sogana bachmana Constant & Pham, 2019 (Vietnam);

Sogana baviana Constant & Pham, 2019 (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 cysana sp. nov. (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. 1 B, D), ratio LV/BV < 0.85; apical margin of anal tube roundly notched apically in dorsal view (Fig. 1 N, O); aedeagus with strong, deeply furcate or strongly dentate process on left side (Fig. 1 S–T, 3 F) **2**
 - Vertex elongate (Fig. 1 A, C, E), ratio LV/BV > 0.85; apical margin of anal tube rounded or oblique apically in dorsal view, not notched (Fig. 1 K–M); aedeagus without strong furcate process (Fig. 1 P–R)..... **4**
2. Tegmina more elongate, LTg/BTg = 3.8, with 18–19 apical cells (Fig. 1 I); vertex more elongate, LV/BV = 0.8 (Fig. 1 B); ventral process of periandrium ended in a hook (Fig. 1 X)..... ***S. baviana* Constant & Pham, 2019**
 - Tegmina less elongate, LTg/BTg = 3.3–3.5, with 13 (Fig. 2 E) or 19–21 apical cells (Fig. 1 J); vertex shorter, LV/BV = 0.63–0.7 (Figs. 1 D, 2 G); ventral process of periandrium not ended in a hook (Fig. 1 Y) **3**
3. Size smaller, ♂ LT = 8.8 mm; tegmina more elongate, LTg/BTg = 3.5, with 13 apical cells (Fig. 2 E); vertex slightly more elongate, LV/BV = 0.7 (Fig. 2 G); right dorsal process of periandrium not furcate (Fig. 3 E, H); apical projections of anal tube pointed (Fig. 3 A–C) ***S. cysana* sp. nov.**
 - Size larger, ♂ LT = 13 mm; tegmina less elongate, LTg/BTg = 3.3, with 19–21 apical cells (Fig. 1 J); vertex shorter, LV/BV = 0.63 (Fig. 1 D); right dorsal process of periandrium furcate (Fig. 1 T); apical projections of anal tube not pointed (Fig. 1 O) ***S. cucphuongana* Constant & Pham, 2013**
4. Vertex more elongate, ratio LV/BV = 1.15 (Fig. 1 E); aedeagus with two elongate dorsal processes ending in a single point (Fig. 1 R, W)..... ***S. longiceps* Fennah, 1978**
 - Vertex less elongate, ratio LV/BV = 0.9 (Fig. 1 A, C); aedeagus with dorsal processes with multiple teeth or crenulations apically (Fig. 1 P–Q) **5**
5. Tegmina more elongate, LTg/BTg = 3.6 (Fig. 1 F); tegmina with 14 apical cells (Fig. 1 F); clypeus mostly pale yellow-brown; dorsal processes of aedeagus with left one strongly sinuate and directed anteroventrally and right one spatulate apically and directed mostly dorsally (Fig. 1 P)..... ***S. bachmana* Constant & Pham, 2019**
 - Tegmina less elongate, LTg/BTg = 3.0 (Fig. 1 G); tegmina with 18 apical cells (Fig. 1 G); clypeus mostly pale brown; dorsal processes of aedeagus both nearly straight and directed anterodorsally (Fig. 1 Q) ***S. condaoana* Constant & Pham, 2013**

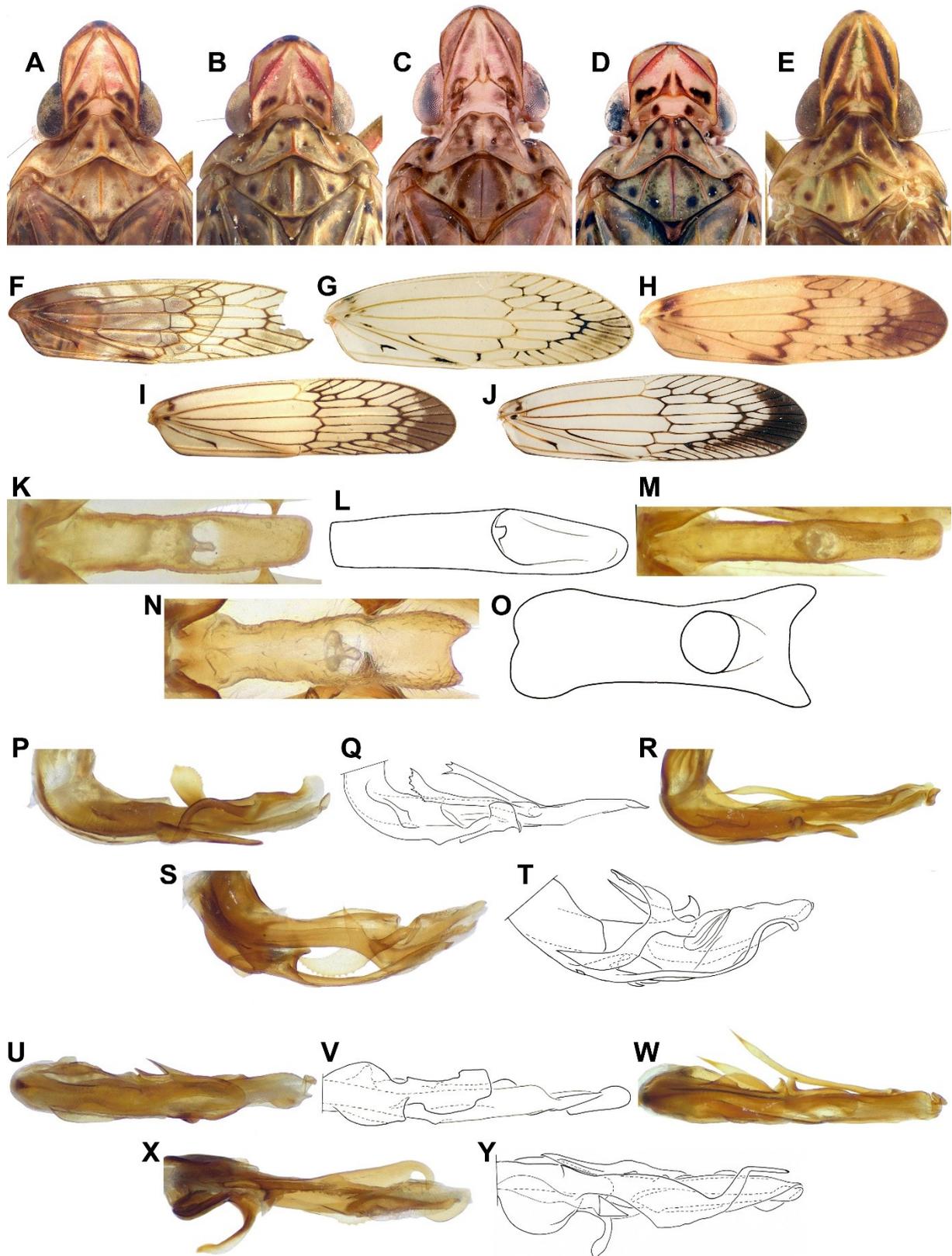


Fig. 1. *Sogana* spp., diagnostic characters. A–E, head and thorax, dorsal view. F–J, right tegmen. K–O, anal tube, dorsal view. P–T, aedeagus, left lateral view. U–Y, aedeagus, ventral view.

S. bachmana: A, F, K, P, U; *S. baviana*: B, I, N, S, X; *S. condaoana*: C, G, L, Q, V; *S. cucphuongana*: D, J, O, T, Y; *S. longiceps*: E, H, M, R, W.

Sogana cysana sp. nov.

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(Figs 2–5)

ETYMOLOGY. The species epithet refers to the type locality, Chu Yang Sin National Park in Central Vietnam, with “cys” formed from the initials of “Chu Yang Sin”.

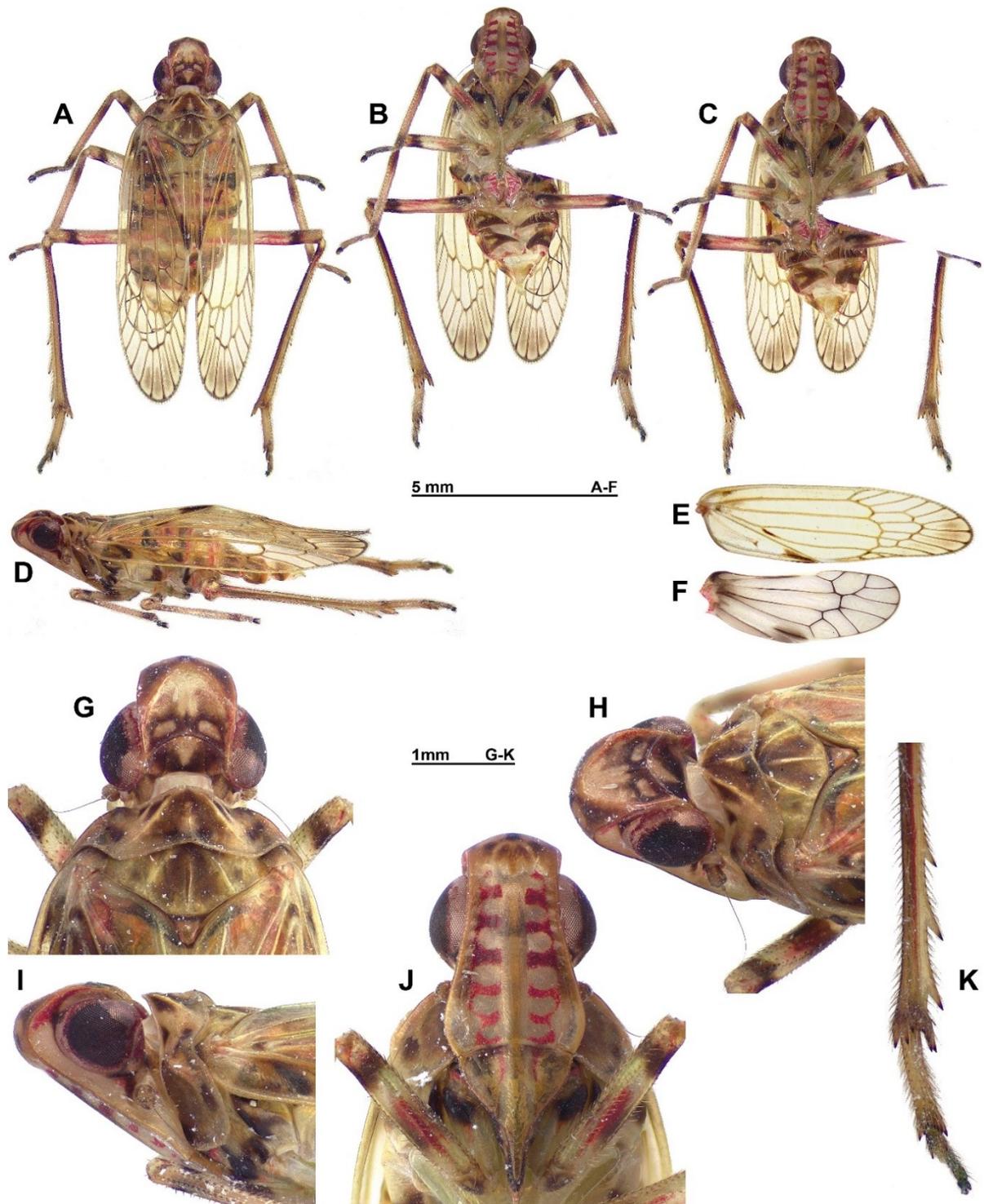


Fig. 2. *Sogana cysana* sp. nov., holotype ♂ (RBINS). A, habitus dorsal view. B, habitus, ventral view. C, habitus, perpendicular view of frons. D, habitus, lateral view. E, right tegmen. F, right posterior wing. G, head and thorax, dorsal view. H, head and thorax, laterodorsal view. I, head and thorax, lateral view. J, frons, perpendicular view. K, distal portion of left posterior leg, ventral view.

TYPE MATERIAL. VIETNAM: holotype ♂ (Figs 2, 3): Coll. I.R.Sc.N.B., Vietnam, Dak Lak prov., Chu Yang Sin N.P., 650-1000m, 12°27'24"N 108°22'15"E, 9-15.viii.2019, GTI Project, Leg. J. Constant & J. Bresseel, I.G.: 34.048 (RBINS). Dissected, genitalia in glycerine, right hind wing mounted.

Paratype ♀: same collection data as holotype (VNMN).

NOTE. The female paratype was slightly damaged during collecting; especially, the broken apex of tegmina do not allow taking precise measurements, which are hence not given in description below.

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

1. Median carina of vertex departing from basal margin and limited to basal 1/2 of vertex (Fig. 2 G–H).
2. Frons with seven red transverse fasciae interrupted in the middle and linked on external side by longitudinal narrow red line; median carina reaching ventral margin and interrupted before dorsal margin (Fig. 2 J).
3. Clypeus pale yellow-brown with basal narrow red line on each side of median carina and sides black-brown apically (Fig. 2 J).
4. Tegmina with 13 apical cells (Fig. 2 E).
5. Anal tube elongate and narrow with apical margin emarginate with angles pointed in dorsal view (Fig. 3 C).
6. Aedeagus with dorsal process near base, divided in 2 lateral parts curved lateroventrally; right part less developed and ended in a tooth directed caudad; left part with 5 teeth directed caudad, second one from base much larger than others (Fig. 3 E–I).
7. Periandrium with 3 ventral processes near base, directed caudad, with right one slightly shorter than left one, and median one longer and laterally flattened (Fig. 3 E–F, I–J).

Additionally, in the key proposed by LIANG & WANG (2008) combined with the additional couplet provided by CONSTANT (2010), the new species runs to the couplet treating *S. robustocarina* Liang & Wang, 2008 and *S. floreni* Constant, 2010, from which it can be very easily separated by the much less elongate vertex ($LV/BV = 0.7$; in *S. robustocarina* $LV/BV = 1.1$; in *S. floreni* $LV/BV = 1.2$) and by the shape of the anal tube apically emarginated and with pointed apicolateral angles (apical margin oblique in dorsal view in *S. robustocarina* and *S. floreni*).

DESCRIPTION. *Measurements and ratios*: LT: ♂ ($n = 1$): 8.8 mm. LTg/BTg = 3.5; LV/BV = 0.7; LF/BF = 1.5.

Head: (Fig. 2 G–J) moderately elongate with apex rounded in dorsal view. Vertex excavate in middle; laterodiscal carinae oblique and strong, joining lateral margin near anterior margin of eye; area between laterodiscal carina and lateral margin of head flat, not excavate; median carina departing from caudal margin and limited to caudal 1/2 of vertex; vertex brown with anteromedian and two basolateral pale yellowish markings. Posterior face of head brown with median triangular pale yellowish marking. Frons straight in lateral view, with dorsal portion projecting anteriorly; median carina yellowish extending to apex of clypeus but not reaching dorsal margin of frons; frons pale yellow-brown with 7 transverse red bands on each side of median carina and linked on external side by longitudinal narrow red line; anterior margin of frons with 3 black-brown markings. Genae pale yellow-brown with narrow red line along dorsal

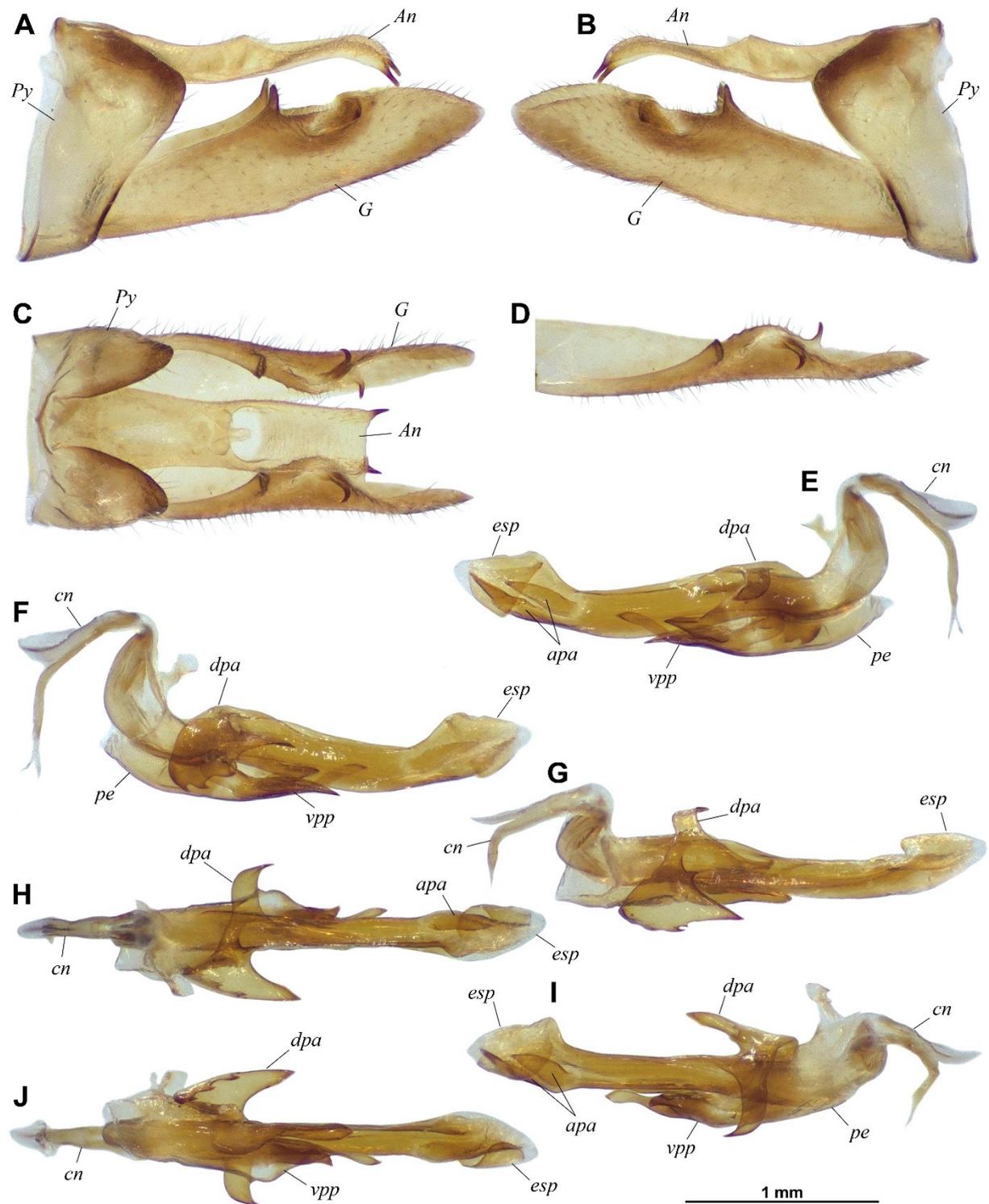


Fig. 3. *Sogana cysana* sp. nov., holotype ♂. A, pygofer, anal tube and gonostyli, left lateral view. B, pygofer, anal tube and gonostyli, right lateral view. C, pygofer, anal tube and gonostyli, dorsal view. D, left gonostylus, dorsal view. E, aedeagus, right lateral view. F, aedeagus, left lateral view. G, aedeagus, left laterodorsal view. H, aedeagus, dorsal view. I, aedeagus, left laterodorsal view. J, aedeagus, ventral view.

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

margin, slightly anteriorly to eye and brown marking at base of antennae. Clypeus pale yellow-brown with basal narrow red line on each side of median carina and sides black-brown apically.

Thorax: (Fig. 2 G–J) pronotum brown with yellowish markings on disc along carinae and behind eyes and darker markings basally on each side of median carina and on lateral fields; anterior margin bisinuate, rounded and carinate in middle; posterior margin bisinuate, emarginate in middle; median carina weakening anteriorly, extending only on caudal 2/3; black impressed point on each side of median carina; lateral carinae strong, yellowish; paranotal lobes rounded caudoventrally. Mesonotum pale yellow-brown with median carina and area comprised between discal carinae brown; discal carinae joining anteriorly, median carina rather smooth, not reaching anterior and posterior margins; 4 darker spots along posterior margin; scutellum brown with base black-brown; tegulae yellow-brown; lateral pleura of mesothorax with black-brown markings aligned with the markings on anterior coxae and clypeus.

Tegmina: (Fig. 2 A, D–E) elongate, subhyaline with veins slightly darker; weak black-brown marking near base of postcostal cell; small brown patch at base of median cell; vein CuA_2 dark brown on basal 1/6; elongate black-brown marking at apical angle of clavus including apex of vein $Pcu+A_1$; vein PCu distally slightly forked and brown. Veins $ScP+R$ and MP not forked before nodal line; CuA forked once before nodal line, at about basal 1/4 of tegmen. Four subapical and 13 apical cells; apical cells 6–9 infuscate on distal 2/3.

Hind wings: (Fig. 2 F) hyaline with veins mostly dark brown, slightly notched at CuP apex; infuscate along vein CuP ; 8 apical cells.



Fig. 4. *Sogana cysana* sp. nov., habitat in Chu Yang Sin National Park, August 2019. © Jérôme Constant.

Legs: (Fig. 2 A–D, K) pale yellow-brown with base and apex of pro- and mesotibiae slightly infuscate; all femora with dark brown ante-apical ring, with irregular reddish marking in middle portion and with darker zone near base; base of pro- and mesocoxae brown; metatibiae with 3 lateral and 7 apical spines; first hind tarsomere with 9 apical spines. Metatibiotarsal formula: (3) 7/9/2.

Abdomen: brown with terminalia darker.

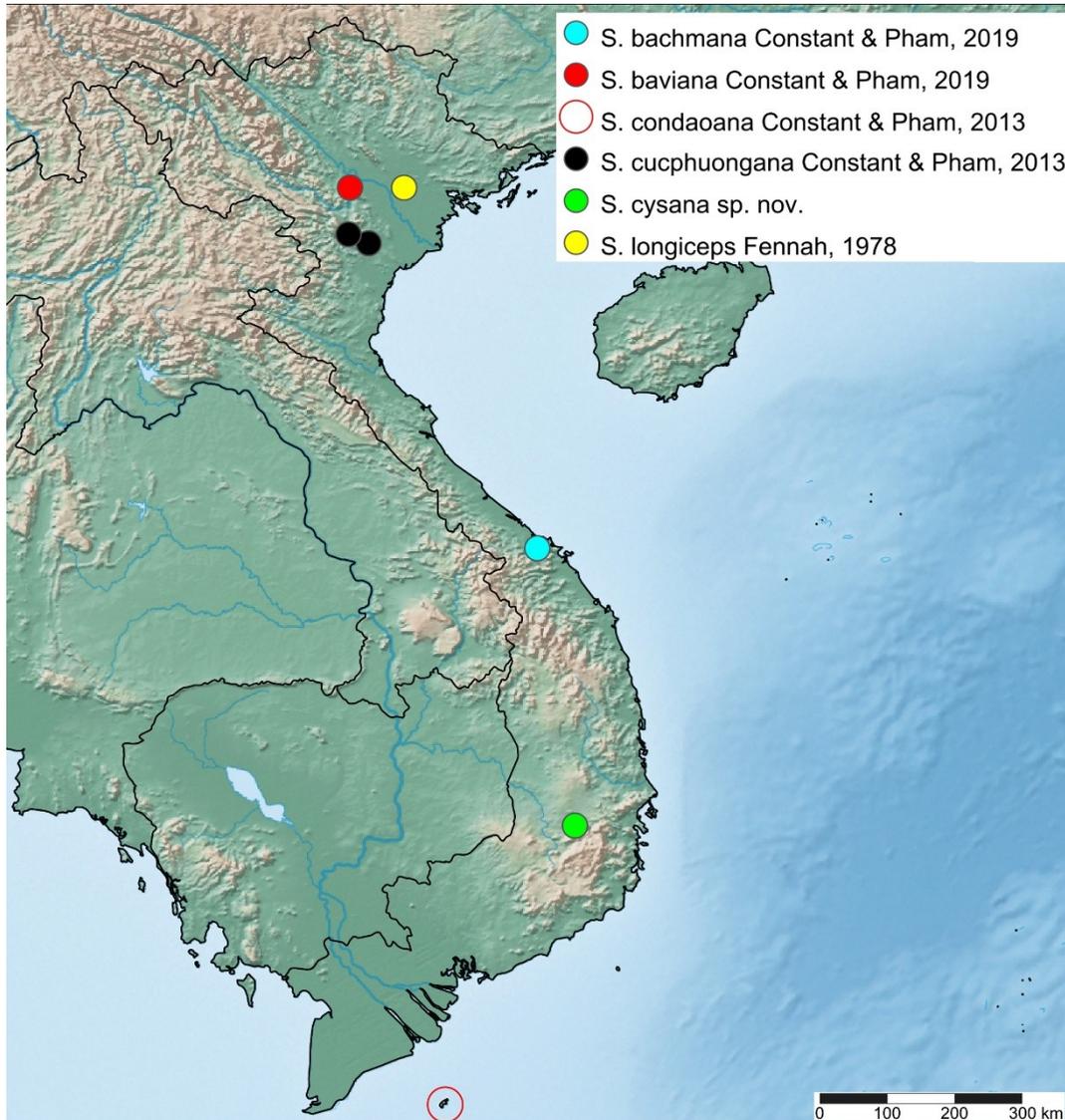


Fig. 5. *Sogana* spp. of Vietnam, distribution map.

Terminalia ♂: (Fig. 3) pygofer with posterior margin roundly projecting on dorsal 3/4 in lateral view, 1.75 times higher than long in lateral view; anterior and posterior margins sinuate in lateral view (Fig. 3 A–B); posterior margin deeply V-shaped notched in dorsal view (Fig. 3 C). Gonostyli (Fig. 3 A–D) very elongate, about 4.25 longer than high in lateral view (measured without dorsal process), laterally compressed, with apex narrowly rounded; 3 hooked processes on dorsal margin slightly posteriorly to half length; basal one directed dorsally, middle one directed lateroventrally, caudal one directed centrally. Aedeagus (Fig. 3 E–J) asymmetrical, elongate and narrow, with a dorsal process near base, divided in 2 lateral parts, one left and one right, curved lateroventrally; right part of dorsal process less developed than left one, and ended in a tooth directed caudad; left part of dorsal process with 5 teeth directed caudad, second one

from base much larger than others; perianthium with 3 ventral processes near base, directed caudad, with right one slightly shorter than left one, and median one longer and laterally flattened; dorsal ear-shaped process at apex, coiled on right side and covering 2 apical teeth directed dorsocaudad. Anal tube (Fig. 3 A–C) elongate and narrow, about 4.1 times longer than wide in dorsal view, slightly widening at level of epiproct in dorsal view, rather strongly sinuate with apex pointing ventrally in lateral view; apex emarginate in dorsal view with apical angles pointed; anal column situated slightly beyond half length.

BIOLOGY. The specimens were collected in mountain tropical evergreen forest, at 800–1000m in altitude (Fig. 4).

DISTRIBUTION. Vietnam: Dak Lak Province, Chu Yang Sin National Park (Fig. 5).

Discussion

More than 40% (6 out of 14) of the species of *Sogana* were described from Vietnam, mostly in the recent years in the framework of our Global Taxonomy Initiative project which allowed building the relevant expertise on this genus combined with an up-to-date systematics, keys to rapid recognition and description of new species (CONSTANT & PHAM, 2013, 2019). As already stated in our previous treatment of the genus (CONSTANT & PHAM, 2019), the high species diversity of the genus in Vietnam probably only mirrors the lack of efforts in collecting and studying the Tropiciduchidae, and more generally the planthopper fauna in most Southeast Asian countries.

The Vietnamese fauna of Tropiciduchidae now counts 21 species, including 6 species of the genus *Sogana* alone, representing 28.5% of the species of the Tropiciduchidae of the country. These figures represent only a fraction of the real diversity of Tropiciduchidae 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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