Extension of the lanternfly genus *Neoalcathous* Wang & Huang, 1989 to Vietnam with a new species and new subfamily placement (Hemiptera: Fulgoromorpha: Fulgoridae)

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Abstract

A new species of *Neoalcathous* Wang & Huang, 1989, *N. annamica* sp. nov., is described from Central Vietnam, extending the distribution of the genus to this country. A translation of the description of the genus originally in Chinese is given and the genus is transferred to the subfamily Aphaeninae. The habitus and male genitalia of the species are comprehensively illustrated and an identification key to the species of the genus is provided, as well as a distribution map. A specimen from China, Yunnan, is also recorded from photographs.

Keywords: Indochina, Lanternbug, Fulgoroidea, Homoptera, Planthopper

Introduction

The genus *Neoalcathous* was erected by WANG & HUANG (1989) to accommodate two species from China, *N. huangshanana* Wang & Huang, 1989 (type species) and *N. wuyishanana* Wang & Huang, 1989. It was placed in the subfamily Amyclinae, most probably based on its proximity with the genus *Alcathous* Stål, 1863 and the classification of the latter.

The study of recent material of Fulgoridae from Vietnam collected during fieldwork in the framework of our Global Taxonomic Initiative project "A Step further in the Entomodiversity of Vietnam", allowed the discovery of a new species of *Neoalcathous* which represents the first record of the genus in the country.

An additional record of the genus from southern China (Yunnan) from photographs of a living specimen which possibly represents a new species was found by browsing the internet for photographs of Fulgoridae.

The present paper aims to describe a new species of *Neoalcathous* and to provide an identification key to the described species of the genus, as well as a distribution map.

Material and methods

The male genitalia were dissected as follows: the pygofer was cut from the abdomen of the softened specimen with a needle blade, then boiled for about one hour in a 10% solution of potassium hydroxide (KOH). The phallic complex was dissected with a needle blade and all

pieces examined in ethanol, the whole placed in glycerine for preservation. The metatibiotarsal formula gives the number of spines on (side of metatibia) apex of metatibia/apex of first metatarsus/apex of second metatarsus. Observations were done with a Leica MZ8 stereomicroscope. Pictures were taken with a Canon EOS 700 D camera with Sigma DG Macro lens, stacked with CombineZ software and optimized with Adobe Photoshop CS3.
For the transcription of the labels of the types, the wording on each single label is delimited by square brackets.
The distribution map was produced with SimpleMappr (SHORTHOUSE, 2010).
The measurements were taken following CONSTANT (2004, 2015) and the following abbreviations are used:

BF = breadth of the frons.
BTg = breadth of the tegmen.
BPrH = breadth of the cephalic process at half length.
LF = length of the frons.
LTg = length of the tegmen.
LPr = length of the cephalic process.
TL = total length.
(LF, LPr and TL measured to/from ante-ocular carina at the base of the cephalic process)

Acronyms used for the collections

RBINS = Royal Belgian Institute of Natural Sciences, Brussels, Belgium
VNMN = Vietnam National Museum of Nature, Hanoi, Vietnam

Results

Taxonomy

Order **Hemiptera** Linnaeus, 1758
Suborder **Auchenorrhyncha** Duméril, 1806
Infra-order **Fulgoromorpha** Evans, 1946
Superfamily **Fulgoroidea** Latreille, 1807
Family **Fulgoridae** Latreille, 1807
Subfamily **Aphaeninae** Blanchard, 1847

Genus ***Neoalcathous*** Wang & Huang, 1989

Neoalcathous WANG & HUANG, 1989: 127.
Type species: *N. huangshanana* Wang & Huang, 1989 by original designation.

The original description of the genus is in Chinese and we propose the following translation, courtesy of S. Chen (pers. comm., XI.2017): “the new genus is very similar to *Alcathous* Stål, 1863, however, the head is significantly narrower than the thorax and protrudes upwardly in a horn. Vertex broader near base, with three carinae and basal margin carinate; clypeus carinate; labium thin and long, almost surpassing the apex of abdomen. Antennae short with scape broad and apex oblique. Pronotum with a carina, mesonotum with three carinae, and about 1.5–1.7 times longer than pronotum. Tegmina rather narrow and elongate with apical margin

oblique, main veins with few secondary branches. Tegmina and hind wings with venation reticulate on distal half. Metatibiae with 6 lateral spines.
The genus *Alcathous* differs by its pronotum without carina, the mesonotum about twice as long as the pronotum, and the tegmina and hind wings with venation reticulate only on apical third."

NOTES:
(1) the character of the carina of the pronotum in *Alcathous* given by WANG & HUANG (1989) is not correct: *Alcathous* specimens do have a median carina on pronotum.
(2) after comparison with the classification and key proposed by METCALF (1938), the genus *Neoalcathous* is here transferred to the subfamily Aphaeninae, a placement supported by the conclusions of the DNA study by URBAN & CRYAN (2009) which showed, based on molecular data, that Fulgoridae can be separated in two main clades, one grouping all New World taxa, and another containing all the Old World taxa.

SPECIES INCLUDED.

Neoalcathous annamica sp. nov.
Neoalcathous huangshanana Wang & Huang, 1989 type species.
Neoalcathous wuyishanana Wang & Huang, 1989.

Identification key to the species of *Neoalcathous*

1 Cephalic process obviously longer than pronotum in median line (Figs 1 C–D, 2 B, F); cephalic process gently curved dorsally, with angle between axis of body and cephalic process < 45° (Figs 1 D, 2 F)..... **2**
- Cephalic process about as long as pronotum in median line; cephalic process strongly curved dorsally, with angle between axis of body and cephalic process > 45°..... ..... ***N. huangshanana*** Wang & Huang, 1989

2 Carina above eye strongly projecting dorsally (Fig. 1 D); area between lateral carinae of prothorax without black marking (Fig. 1 D) ..... ***N. wuyishanana*** Wang & Huang, 1989
- Carina above eye poorly developed dorsally (Fig. 2 F); area between lateral carinae of prothorax with a large black marking (Fig. 2 D, F)..... ***N. annamica*** sp. nov.

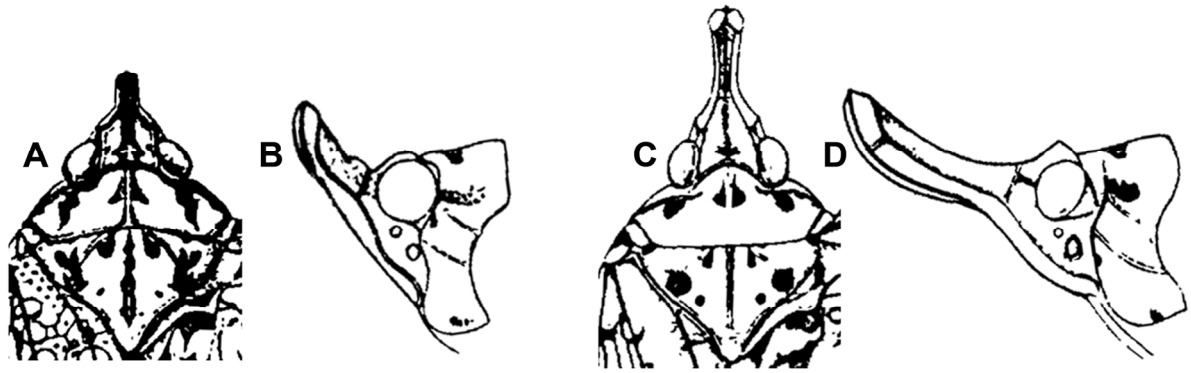

Fig. 1. *Neoalcathous* spp. A–B, *N. huangshanana* Wang & Huang, 1989. A, head and thorax, dorsal view. B, head and pronotum, lateral view. C–D, *N. wuyishanana* Wang & Huang, 1989. C, head and thorax, dorsal view. D, head and pronotum, lateral view. (modified from WANG & HUANG, 1989)

Neoalcathous annamica sp. nov.

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Figs 2–4

ETYMOLOGY. The species epithet refers to the type location, central Vietnam, also named Annam.

TYPE MATERIAL. VIETNAM: Holotype ♂: [Coll. I.R.Sc.N.B., Vietnam, Thừa Thiên-Huế prov., Bach Ma N.P. 16°12'N 107°52'E, 10-16.iv.2017 leg. J. Constant & J. Bresseel, I.G.: 33.447] (RBINS).
Paratype ♂: [Coll. I.R.Sc.N.B., Vietnam, Da Nang prov., Ba Na-Nui Chua Nat. Res., 18°09'N 105°55'E, 16-19.vii.2017, GTI Project, Leg. J. Constant & J. Bresseel, I.G.: 33.498] (VNMN).

DIAGNOSIS. The species can be separated from the other known species of the genus by the combination of the following characters:
(1) cephalic process longer than pronotum in median line and very slightly projecting dorsally (Fig. 2 F);
(2) carina above eye very slightly developed, nearly obsolete (Fig. 2 B, F);
(3) area between lateral carinae of prothorax with a large black marking (Fig. 2 F).

DESCRIPTION.
Measurements and ratios
TL: ♂ (n = 2): 23.75 mm (23.7–23.8); TL+process: ♂ (n = 2): 27.8 mm; LTg/BTg = 3.0; BF/BPrH = 2.75; LPr/LF = 1.76; LPr/BPrH = 4.0.

Head: brown with vertex, base of frons and clypeus yellow-brown and small pale spots covered in white wax (Fig. 2 B, D, F); median black marking on vertex along posterior carina, small black marking before eye and inverted T-shaped black marking dorsally near apex of cephalic process (Fig. 2 B, F); brown-black median marking on anteclypeus (Fig. 2 D); labium yellow-brown, largely surpassing metacoxae (Fig. 2 C): antennae black (Fig. 2 D, F). Cephalic process elongate and robust, longer than frons in median line, slightly folded dorsally near base and slightly swollen apically (Fig. 2 B, D, F); median carina dorsally from middle of vertex along cephalic process but not reaching apex (Fig. 2 B); lateral carinae of vertex prolongated as laterodorsal carinae on cephalic process, fused with superior lateral carinae before apex (Fig. 2 B); lateral margins of frons prolongated as superior lateral carinae along side of cephalic process, strongly sinuate dorsally before apex, then fused together and with inferior lateral carinae subapically (Fig. 2 B, D); frons with 2 obsolete longitudinal carinae on disc prolongated as inferior lateral carinae along side of cephalic process, subparallel to superior lateral carinae on most of length then diverging and fused together subapically (Fig. 2 B, D, F); frons broader basally and with basal angles impressed (Fig. 2 D); cephalic process with numerous ring-shaped grooves along all its length and with apex rounded (Fig. 2 B, D, F); base of cephalic process marked with a lateral, vertical carina before eye (Fig. 2 B, F); posterior margin of vertex carinate and curved, lateral margins carinate with carina slightly developed and visible above eye in lateral view only along anterior half of eye (Fig. 2 B, F); eyes large and hemispherically protruding, ocelli present, under eyes (Fig. 2 B, F); clypeus narrower and longer than frons, with a median carina obsolete on anteclypeus and well marked on postclypeus (Fig. 2 D); postclypeus not surpassing procoxae (Fig. 2 D); antennae with scape short and cylindrical and pedicel bulbous (Fig. 2 D, F).

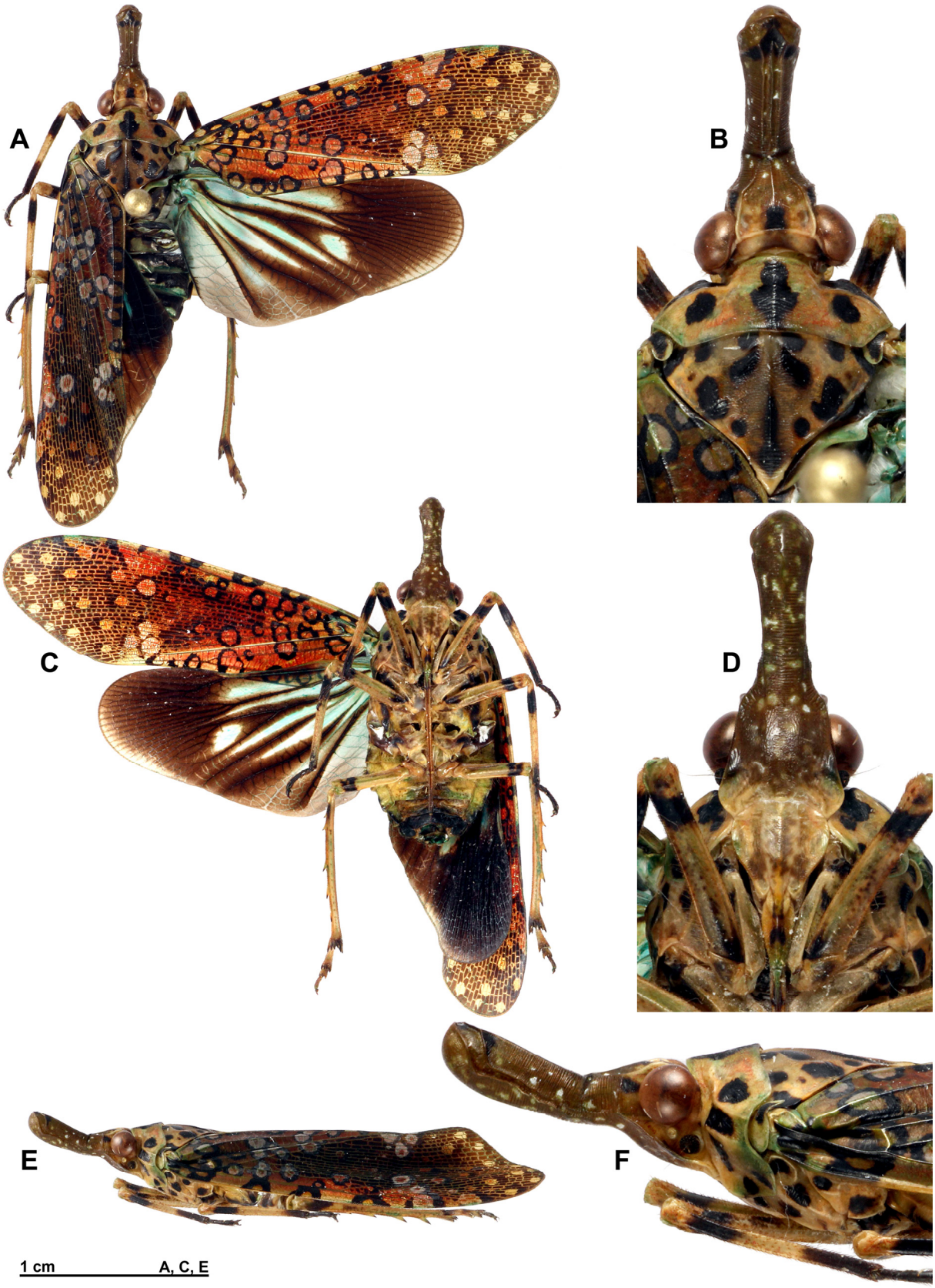

Fig. 2. *Neoalcathous annamica* sp. nov. A, habitus, dorsal view. B, head, pro and mesonotum, dorsal view. C, habitus, ventral view. D, frons, normal view. E, habitus, lateral view. F, head and thorax, lateral view.

Thorax: pale yellow brown suffused with reddish (Fig. 2 B, D, F). Pronotum with smooth median carina; black marking broader in middle on carina and one big black spot on each side of disc; an impressed point on each side of carina; two longitudinal carinae on lateral lobes of pronotum, the more ventral one not reaching anterior margin of prothorax (Fig. 2 B, D, F); large black marking on anterior 2/3 of the area limited by lateral carinae extending ventrally along anterior margin of pronotum and 2 smaller black spots at posteroventral angle of pronotal lobes (Fig. 2 D, F). Mesonotum with median carina stopped before scutellum, and slightly marked peridiscal carinae, disc transversely wrinkled; black line along posterior half of median carina, not reaching apex of scutellum, and black spots distributed as follows: one at each lateral angle, 4 behind posterior margin of pronotum, one rather large on each side of basal third of median carina, two on each side along posterior margin, the more basal one larger; apex of sctutellum paler (Fig. 2 B). Tegulae pale yellow-brown with rather large black marking on dorsal portion, not reaching margins (Fig. 2 B, F).

Tegmina: (Fig. 2 A) elongate and narrow, broader at nodal line; costal margin nearly straight, cubital margin sinuate, apical margin obliquely cut with angles rounded; reddish brown with membrane brown and with numerous ocellated spots, paler than background colour and circled in black, more distal spots with black circle reduced or missing, some black cells on median portion, veins and cross-veins pale yellowish on membrane.

Hind wings: (Fig. 2 A, C) broader than tegmina and rounded apically, black-brown narrowly margined with whitish posterodistally, large pale blue area basally extending between veins on basal half and an isolated blue spot near nodal line between branches of CuA.

Legs: (Fig. 2 A, C) all legs elongate and slender, pale yellow-brown; pro-and mesofemora with basal marking and subapical ring black; pro- and mesotibiae with subbasal ring and apex black, apical black portion larger on protibiae; pro- and mesotarsi black; metafemora with subapical back ring; metatibiae with subbasal incomplete black-brown ring and apex black-brown. Metatibiotarsal formula: (5) 7/9/9.

Abdomen: (Fig. 2 A, C) dorsum black with triangular pale yellow-brown marking extending from posterolateral angle nearly to median line; sterna pale yellow-brown with distal and genital segments dark brown.

Male genitalia: pygofer higher than long in lateral view (Fig. 3 A); dorsolateral process on each side projecting lateroposteriorly (Fig. 3 A–B); processes regularly narrowing towards apex and roundly pointed apically (Fig. 3 A–C); dorsal portion strongly notched in middle; posterior margin of pygofer ventrally with a short, rounded, laminate process projecting posteroventrally (Fig. 3 A, C). Anal tube in lateral view elongate, straight, broadening from base to 2/3 of length, then narrowing and rounded apically (Fig. 3 A); in dorsal view, lateral margin sightly diverging on basal half, then subparallel and slightly converging distally; distal margin deeply, roundly emarginate dorsally (Fig. 3 B). Gonostyli elongate, convex and separated basally (Fig. 3 A, C); in lateral view, dorsal margin curved, broadly rounded in middle, apical margin rounded and ventral margin nearly straight (Fig. 3 A). At basal 1/3 under dorsal margin, pointed tooth projecting lateroventrally (Fig. 3 A, C) with its base extending to basoventral portion of gonostylus (Fig. 3 C).

DISTRIBUTION. Central Vietnam (Fig. 4).

BIOLOGY. Both type specimens were collected on tree trunks, in moist evergreen tropical mountain forest at an altitude between 1200 and 1400 m a.s.l.

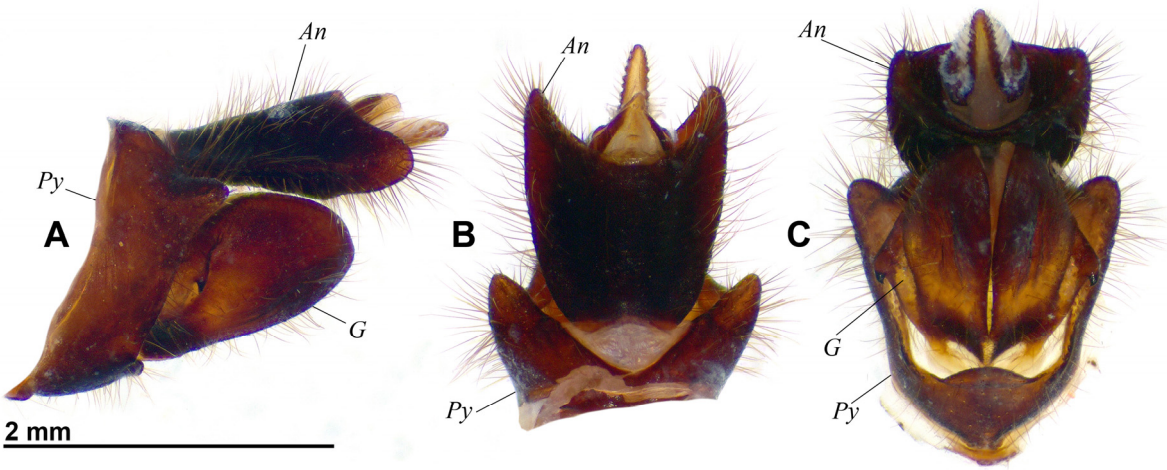

Fig. 3. *Neoalcathous annamica* sp. nov. A, pygofer, anal tube and gonostylus, left lateral view. B, anal tube and pygofer, dorsal view. C, pygofer, anal tube and gonostyli, posteroventral view. – *An*, anal tube. – *Py*, pygofer. – *G*, gonostylus.

Fig. 4. *Neoalcathous* spp., distribution map.

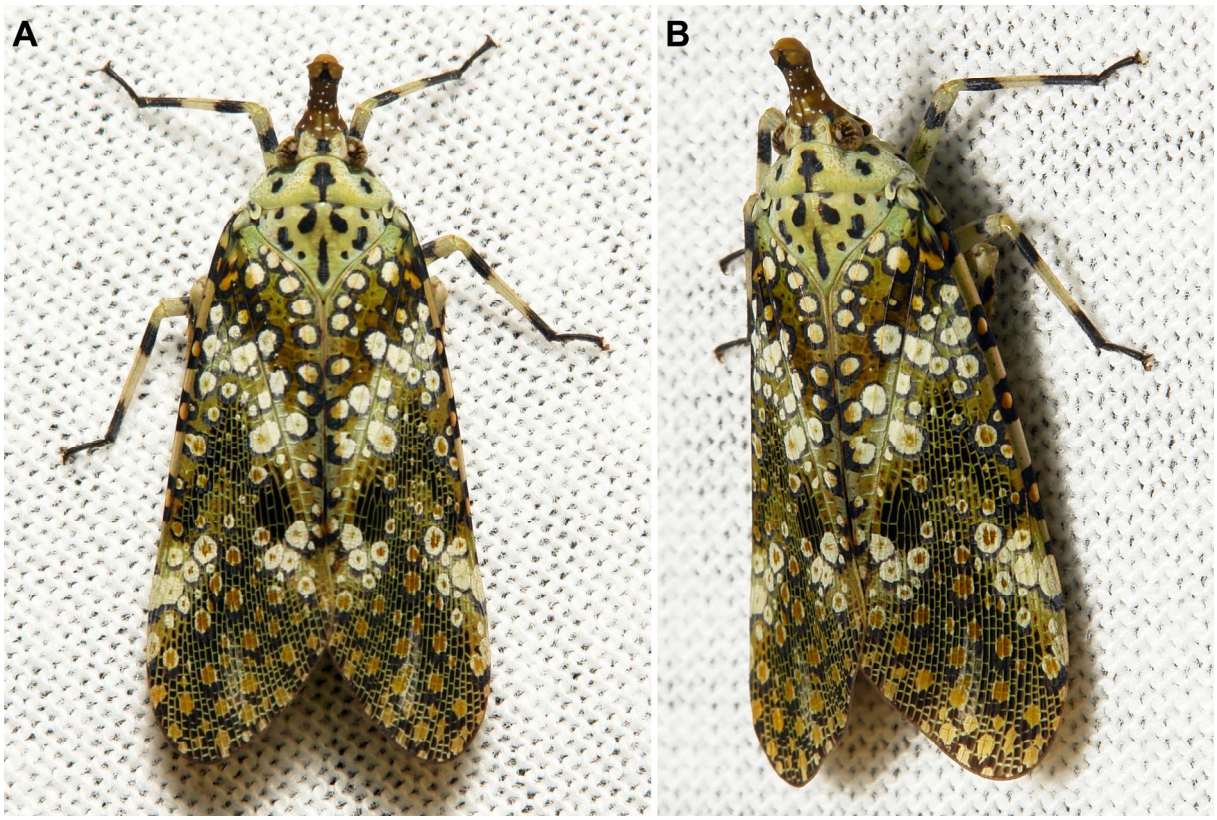

Fig. 5. *Neoalcathous* sp., China, Yunnan, Pu'er, 7.X.2015, mercury vapour light (photograph © J. Horstman).

Neoalcathous sp.

Figs 4–5

MATERIAL EXAMINED FROM PHOTOGRAPHS IN NATURE. CHINA: 1 ex.: Yunnan, Pu'er, 22°47'N 100°58'E, 7.X.2015, mercury vapour light, J. Horstman.

NOTE. The specimen was attracted to a light trap and is the only one observed so far despite regular surveys in the area (J. Horstman pers. comm. 2016).

Discussion

The present paper adds a genus and species to the list of Fulgoridae from Vietnam, after the recent addition of three species of *Polydictya* Guérin-Méneville, 1844 described from Vietnam (CONSTANT & PHAM 2008, 2017), proving once again the need of taxonomic effort to provide an accurate knowledge of insect biodiversity. Considering the extension of the known distribution of the genus *Neoalcathous*, the discovery of more new species can be expected in the future. The new record from Yunnan possibly represents a new species. The lack of a specimen, preferably a male, prevents us from describing the species. However, it seems important to attract the attention on the wider than expected distribution of the genus and the probable existence of additional species. Due to their cryptic colouration, *Neoalcathous* specimens are very difficult to spot on the tree trunks covered in mosses and lichens, and a lot of field work is necessary to provide just a few specimens.

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