Belgian Journal of Entomology

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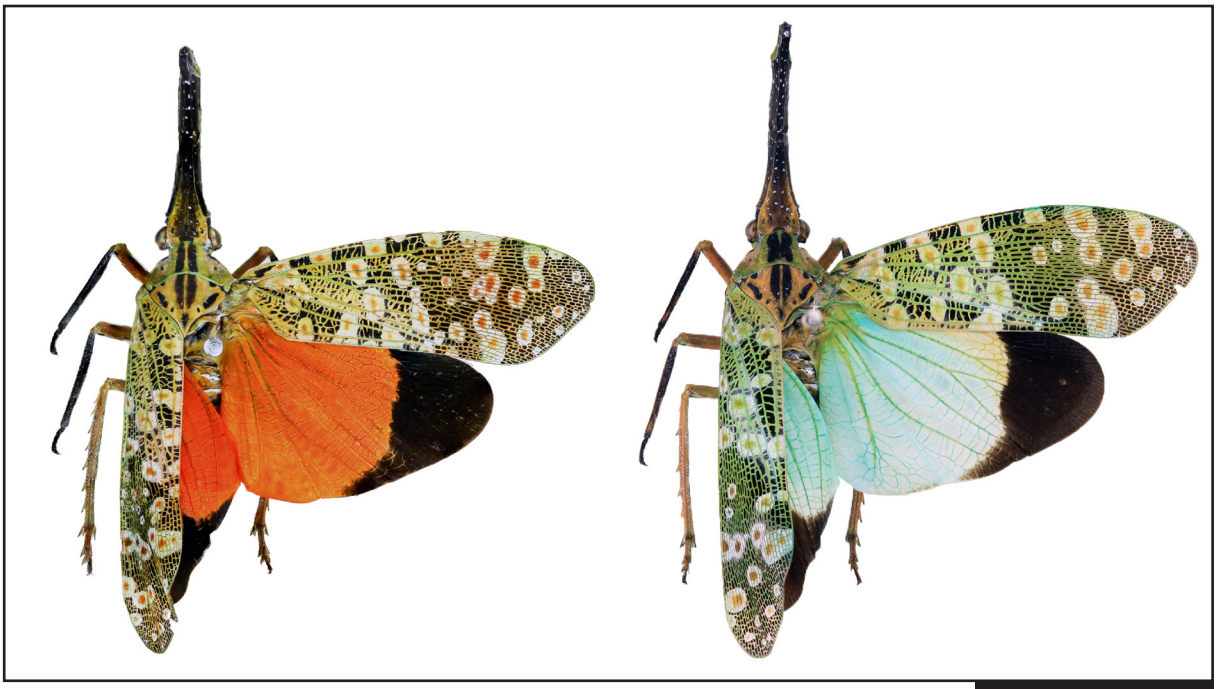
Kawin Jiaranaisakul, Itsarapong Voraphab & Jérôme Constant



Volume 136

2023

Citation: Jiaranaisakul K., Voraphab I. & Constant J., 2023. Redescription of *Pyrops condorinus* with new distribution records from Thailand and notes on *P. spinolae* (Hemiptera: Fulgoridae). *Belgian Journal of Entomology* 136: 1–15.

urn:lsid:zoobank.org:pub:791C3380-B668-4B97-8584-DE091205F71D

ISSN: 1374-5514 (Print Edition)
ISSN: 2295-0214 (Online Edition)

Published: 24 May 2023

The Belgian Journal of Entomology is published by the Royal Belgian Society of Entomology, a non-profit association established on April 9, 1855.

www.srbe-kbve.be
Head office: Vautier street 29, B-1000 Brussels.
N° d'entreprise SRBE : 0408709597
RPM Bruxelles

The publications of the Society are partly sponsored by the University Foundation of Belgium.

Front cover: *Pyrops condorinus* (Lallemand, 1960): male (left) and female (right). © Itsarapong Voraphab.

Redescription of *Pyrops condorinus* with new distribution records from Thailand and notes on *P. spinolae* (Hemiptera: Fulgoridae)

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Abstract

A redescription of *Pyrops condorinus* (Lallemand, 1960) including the male genitalia is provided and the species is recorded from Thailand for the first time with new host plant data. The species is compared with its closest relative *P. spinolae* (Westwood, 1842). The contribution of citizen science and the intraspecific variation of *P. spinolae* are also discussed.

Keywords: Fulgoromorpha, lanternfly, Planthopper, new record

Introduction

The genus *Pyrops* Spinola, 1839 is widely distributed across Southeast Asia and contains 70 described species within 6 species groups (Nagai & Porion, 1996; Constant, 2015; Yap *et al*., 2017; Bourgoin, 2022; Constant & Pham, 2022). There are 13 species of the genus *Pyrops* which were recorded from Thailand: *Pyrops atroalbus* (Distant, 1918), *P. candelaria* (Linnaeus, 1758), *P. clavatus* (Westwood, 1839), *P. connectens* (Atkinson, 1885), *P. ducalis* (Stål, 1863), *P. itoi* (Satô & Nagai, 1994), *P. karenius* (Distant, 1891), *P. lathburii* (Kirby, 1818), *P. oculatus* (Westwood, 1838), *P. peguensis* (Schmidt,1911), *P. pyrorhynchus* (Donovan, 1800), *P. spinolae* (Westwood, 1842) and *P. viridirostris* (Westwood, 1848) (Constant *et al.,* 2016; Constant & Pham, 2017; Jiaranaisakul & Constant, 2021; Jiaranaisakul & Wonglersak, 2021).

Pyrops condorinus (Lallemand, 1960) was described by Lallemand (1960) as a subspecies of *P. spinolae* and was later treated as a distinct species by Nagai & Porion (1996). Constant & Pham (2022) examined the type specimen and documented the intraspecific variation of the hind wings in this species. The male genitalia of the species were not described or illustrated to date. This study aims to provide illustrations of habitus, a description of the external morphology and male genitalia and to compare the species with *P. spinolae*. New distribution and host plant records from Thailand are also provided.

Material and methods

External morphology was observed under a stereoscopic microscope and measures were taken with a digital vernier caliper. The male genitalia were dissected and soaked in a 10% solution of potassium hydroxide (KOH) for one night. The whole was then rinsed and placed in glycerine

for preservation in a tube attached to the pin of the corresponding specimen. Photographs of the specimens were taken with a Canon EOS 7D camera with Canon EF 100mm f/2.8 Macro USM lens, and stacked using Adobe Photoshop CC software. Photographs of the male 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).

Measurements were taken as in Constant (2004) with additions from Constant (2015) and the following acronyms used:

BF = maximum breadth of the frons

BTg = maximum breadth of the tegmen

BPrH = breadth of the cephalic process at half length

LF = length of the frons in median line (excluding cephalic process)

LPr = length of the cephalic process

LTg = maximum length of the tegmen

TL = total length (apex of head to apex of tegmina)

(LF, LPr and TL measured to/from anteocular carina at the base of the cephalic process)

Acronyms used for the collections.

DNPT = Department of National Park, Wildlife and Plant Conservation, Bangkok, Thailand.

FSAG = University of Liège, Gembloux Agro-Bio Technologies, Gembloux, Belgium.

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

THNHM = Thailand Natural History Museum, National Science Museum, Pathum Thani Thailand.

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

Taxonomy

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

Genus ***Pyrops*** Spinola, 1839

Pyrops Spinola, 1839: 231.

Type species: *Pyrops candelaria* (Linnaeus, 1758) by subsequent designation by Duponchel (1840: 200).

Hotinus Amyot & Serville, 1843: 490 [synonymized by Blanchard 1845: 425].

Type species: *Pyrops candelaria* (Linnaeus, 1758) by original designation.

See also Constant (2015) for a historical review of the genus-level nomenclature of *Pyrops*.

Pyrops condorinus (Lallemand, 1960) **(new country record)**
Figs 1A, C, E, G, 2-6

Fulgora spinolae condorina – Lallemand, 1960: 7 (described).

Fulgora spinolae f. *condorina* – Lallemand, 1963: 76 (keyed).

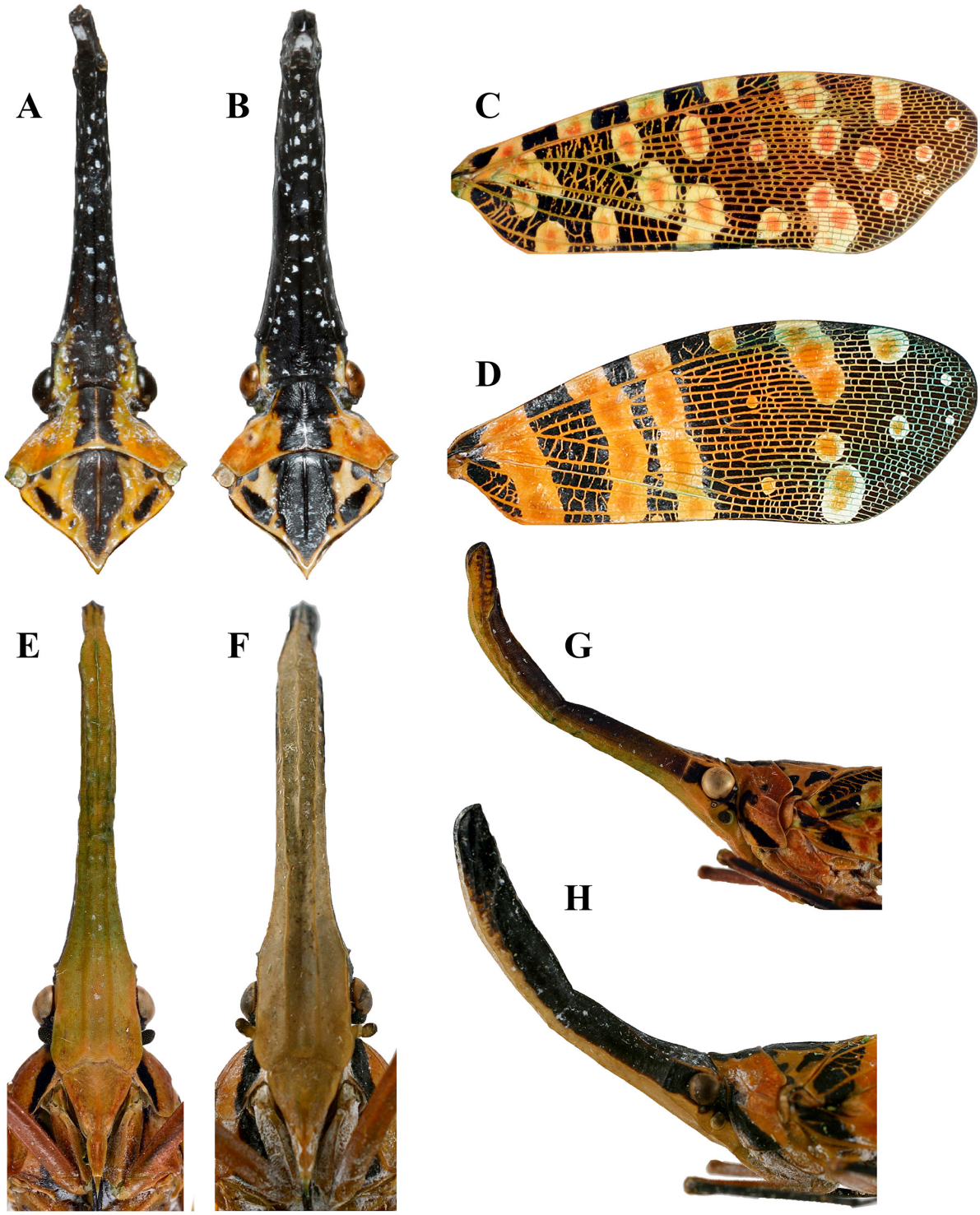

Fig. 1. Diagnostic characters. **A**, **C**, **E**, **G**, *Pyrops condorinus* (Lallemand, 1960). **B**, **D**,**F**, **H**, *P. spinolae* (Westwood, 1842). **A-B**, head, dorsal view. **C-D**, forewing. **E-F**, frons and cephalic process, ventral view. **G-H**, head, lateral view.

Pyrops condorina – Nagai & Porion, 1996: 24 (catalogued); 29 (taxonomic note); pl. 12 fig. 170 (type illustrated).

Pyrops spinolae condorinus – Liang, 1998: 45 (taxonomic note).

Pyrops condorinus – Constant *et al.*, 2016: 10 (recorded from Cambodia, taxonomy, host plant), fig. 3E – Constant & Pham, 2022: 131 (catalogued), fig. 4 (type illustrated), fig. 5 (pale winged form illustrated), 138 (keyed).

Differential diagnosis.

The most closely resembling species is *Pyrops spinolae* (Westwood, 1842), which superficially looks rather similar to the yellow-orange hind winged form of *P. condorinus* (other hind wings colour forms are immediately separated from *P. spinolae* based on this character).

From *P. spinolae*, individuals of *P. condorinus* can be separated by the following combination of characters:

(1) cephalic process strongly elongate and slender: LPr/BPrH > 8.96 (broader in *P. spinolae*: LPr/BPrH < 8) (Fig. 1A-B, E-H);

(2) head black or greenish brown. Median carina of mesonotum yellowish orange (median carina of mesonotum black in *P. spinolae*) (Fig. 1A-B);

(3) tegmina narrower: LTg/BTg = 2.93; black with light green veins; yellow spots not fused into bands (tegmina broader in *P. spinolae*: LTg/BTg = 2.53; yellow spots fused into bands) (Fig. 1C-D);

(4) hind wings variable: orange, yellow or pale blue basally (always bright yellow-orange basally in *P. spinolae*).

Materiel Examined.

Holotype

VIETNAM • ♂ of *Fulgora spinolae* f. *condorina* Lallemand, 1960 (dissected) (Fig. 4); Cochinchine, P. Condore; [8°41′28″N, 106°35′23″E]; 14 Aug. 1924; R. Vitalis de Salvaza leg.; “Cochinchine, P. Condore, le 14.VIII.1924, R. Vitalis de Salvaza”, “Type”, “Holotype ♂ *Fulgora spinolae* f. *condorina* Lallemand, 1960, Jérôme Constant det.”; FSAG.

Additional material.

THAILAND • 1♂, 1♀; Nakhon Ratchasima, Mu Si District; 14°30’39.9”N 101°22’35.6”E; 24.IX.2019; leg. K. Jiaranaisakul; THNHM • 2♂♂, 2♀♀; Sa Kaeo, Pang Sida National Park; 13°59’50.75”N 102°12’18.68”E; 30.VII.2020; leg. I. Voraphab; DNPT • 2♂♂; Nakhon Ratchasima, Mu Si District; 14°30’39.9”N 101°22’35.6”E; 31.VIII.2020; leg. K. Jiaranaisakul; THNHM.

VIETNAM • 1♂; Kiên Giang Province, Phu Quoc National Park; 10°19′30″N, 103°57′00″ E; 14 Apr. 2013; H.T. Pham leg.; VNMN.

Material examined from photographs.

THAILAND • 1 ex. (Fig. 5A): Chonburi, Chan Ta Ten Waterfall; 3.VI.2013; N. Phansuwan • 1 ex. (Fig. 5B); Chonburi, Chan Ta Ten Waterfall; 7.VII.2022; K. Jiaranaisakul • 2 ex. (Fig. 5C); Nakhon Ratchasima, Khao Yai National Park; 4.X.2016; U. Boonyaprakob • 1 ex. (Fig. 5D); Nakhon Ratchasima, Khao Yai National Park; 13.VII.2017; K. Jiaranaisakul • 1 ex. (Fig. 5E); Nakhon Ratchasima, Khao Yai National Park; 9.VIII.2020; W. Muttigo • 2 ex. (Fig. 5F);

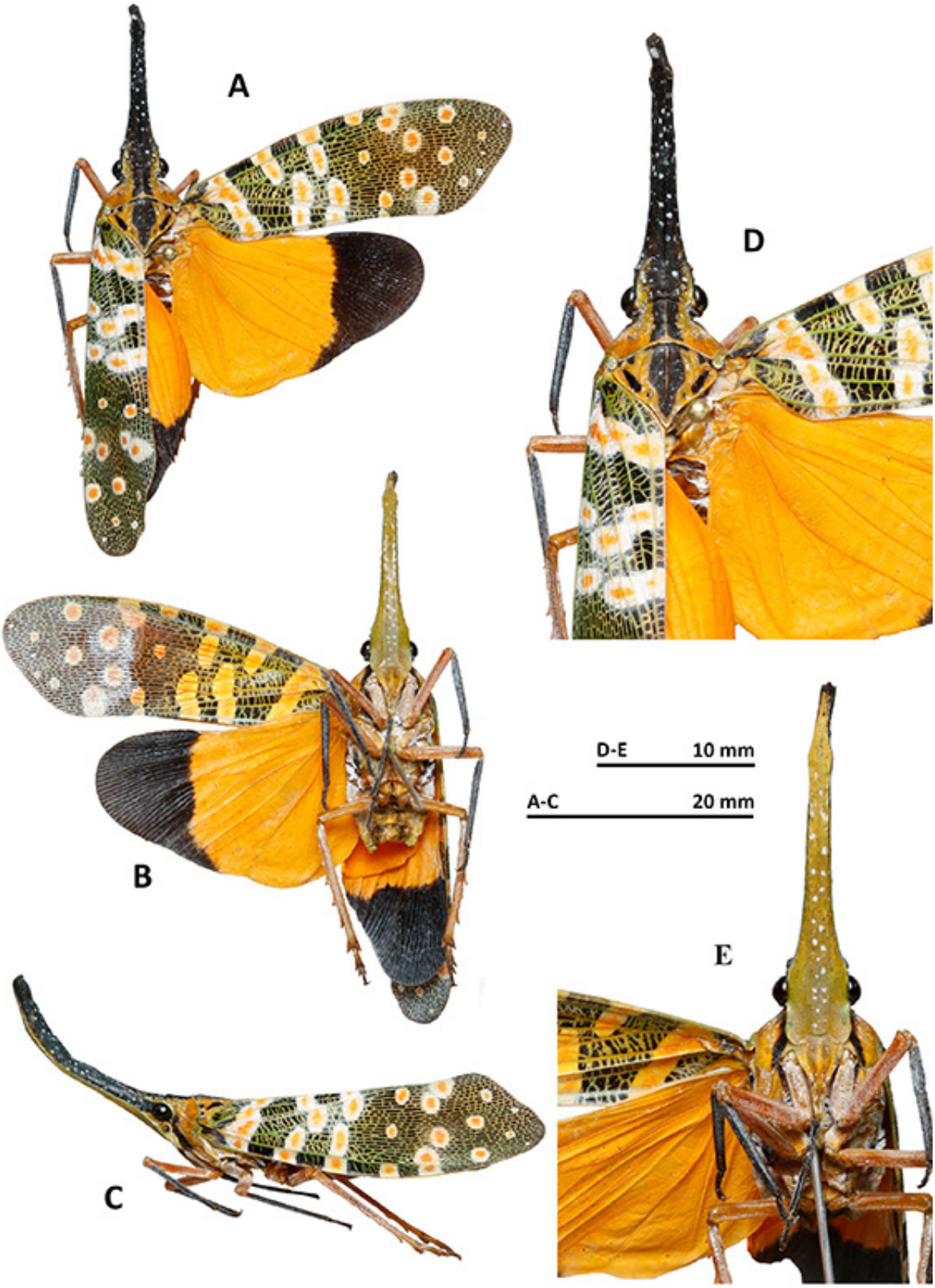

Fig. 2. *Pyrops condorinus* (Lallemand, 1960), male from Nakhon Ratchasima (THNHM). **A**, habitus, dorsal view. **B**, habitus, ventral view. **C**, habitus, lateral view. **D**, head and thorax, dorsal view. **E**, head, perpendicular view of frons.

Nakhon Ratchasima, Khao Yai National Park; 31.VIII.2020; K. Jiaranaisakul • 1 ex. (Fig. 5G); Sa Kaeo, Pang Sida National Park; VI.2018; P. Dokchan • 1 ex. (Fig. 5H); Sa Kaeo, Pang Sida National Park; 22.VI.2019; U. Rodprasert • 1 ex. (Fig. 5I); Sa Kaeo, Pang Sida National Park; 19.VII.2020; K. Jiaranaisakul.

Redescription.

Measurements and ratios

TL: ♂ (n = 3): 26.3 mm; ♀ (n = 1): 39.6 mm; TL+process: ♂ (n = 3): 49.3 mm; LTg/BTg = 2.93; BF/BPrH = 2.42; LPr/LF = 3.11; LPr/BPrH = 8.96.

Head: black with greenish brown marking over eyes extending from posterior margin of head along to base of lateral carinae of vertex; frons dark yellow or greenish brown extending from clypeus and including genae, to apex of cephalic process (Fig. 2C-E). Cephalic process elongated and slender, sometimes slightly straight (Fig. 2C); more than 2.5 times as long as frons and clypeus combined in perpendicular view of frons (Fig. 2E). Two longitudinal carinae on frons extending on sides of cephalic process up to apex; median, ventral carina on apical half of cephalic process (Fig. 2D); apical half slightly dilated and rather broad in lateral view (Fig. 2C). Frons subquadrate (Fig. 2E). Clypeus elongated, slightly darker than frons and with smooth median carina (Fig. 2E).

Thorax: (Fig. 2C-D) pronotum yellowish orange with broad longitudinal black band along median carina; median carina yellowish orange; side of prothorax with black lines between dorsolateral and lateral carinae, black band directed posteroventrally on ventrolateral lobe under lateral carina. Mesonotum yellowish orange including scutellum, broad black band along median carina with short black markings, median carina yellowish orange. Pro- and mesonotum slightly wrinkled in middle. Tegulae greenish orange.

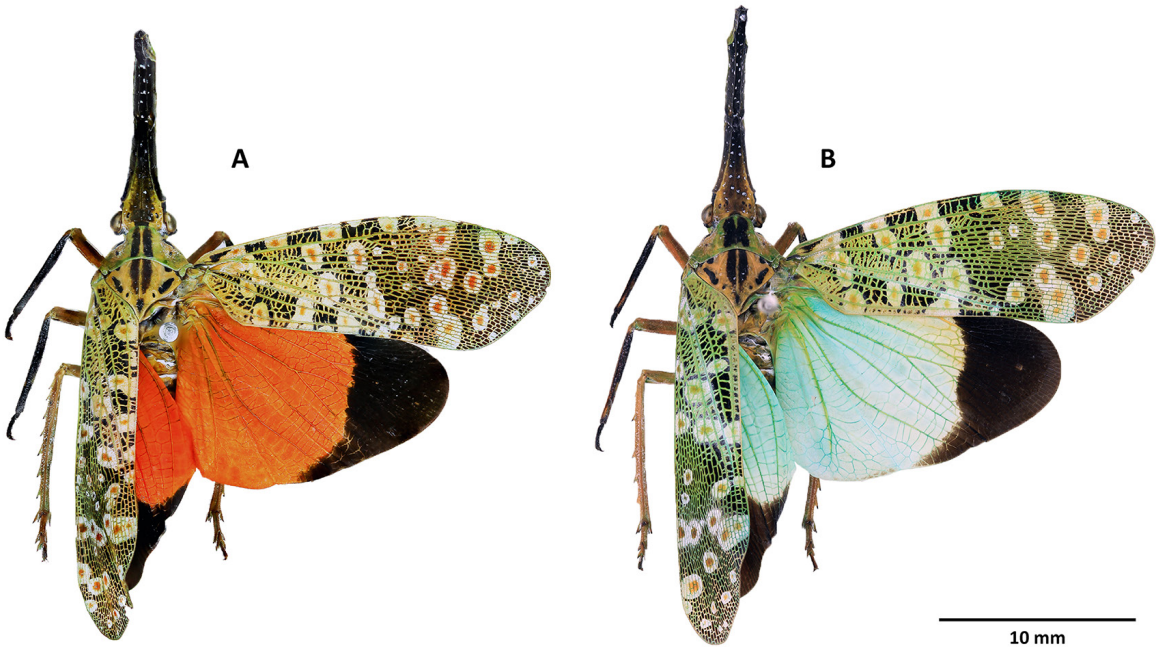

Fig. 3. *Pyrops condorinus* (Lallemand, 1960), intraspecific variation of the colour of the hind wings from Pang Sida National Park (DNPT). **A**, male habitus, dorsal view. **B**, female habitus, dorsal view.

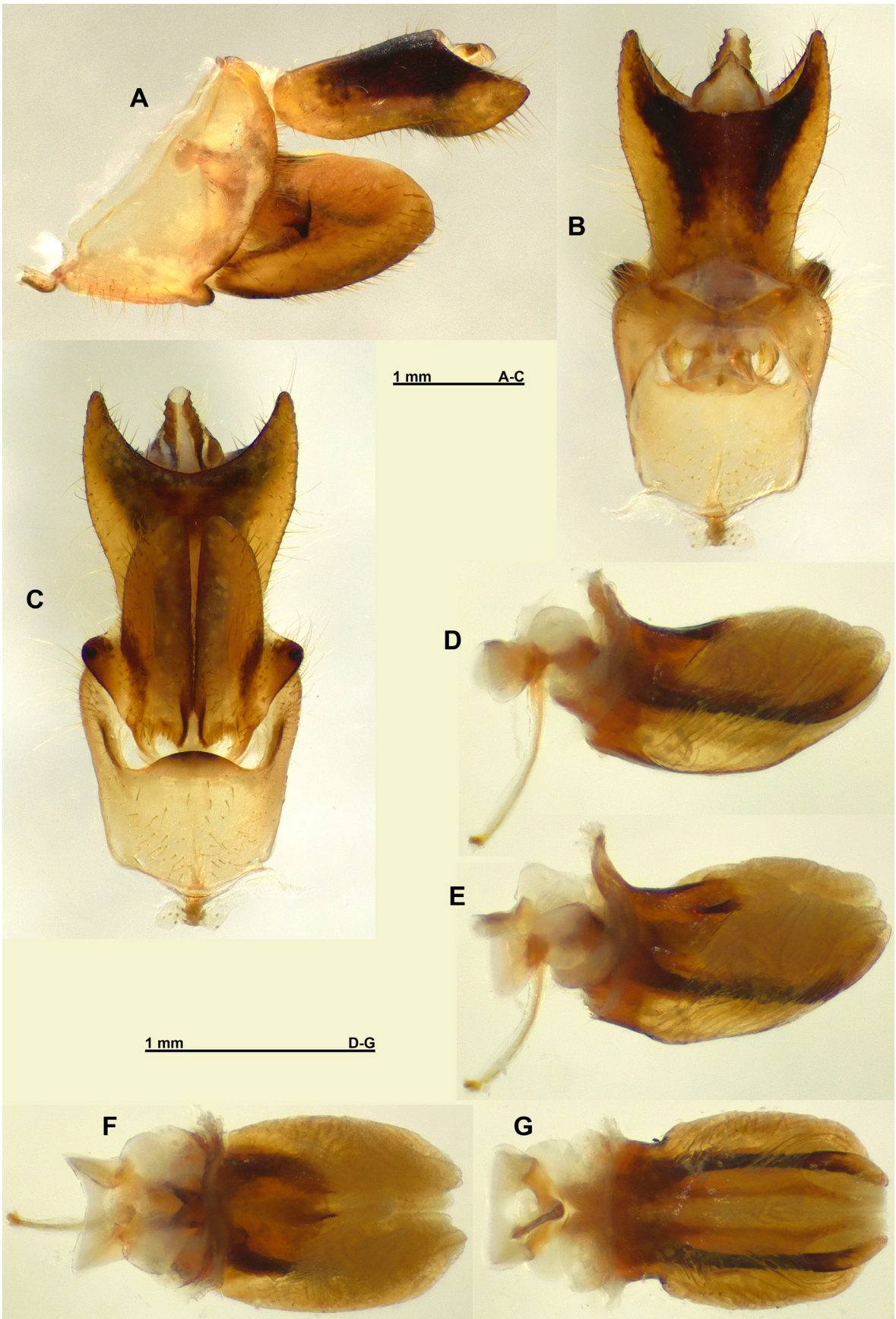

Fig. 4. *Pyrops condorinus* (Lallemand, 1960), male genitalia, specimen from Vietnam, Phu Quoc Island (VNMN). **A-C**, pygofer, gonostyli and anal tube. **A**, lateral view. **B**, dorsal view. **C**, ventral view. **D-G**, aedeagus. **D**, lateral view. **E**, dorsolateral view. **F**, dorsal view. **G**, ventral view.

Tegmina: (Fig. 2A) black with dense network of light green longitudinal and cross veins; corium with three subparallel transverse rows formed with irregular pale orange spots with white rim, subbasal row slightly straight, the next two rows irregular, not fused into bands; membrane with sparse orange spots. Tegmina elongate, broadening from base towards apex, rather narrow, with costal margin broadly rounded, apical margin oblique with angles slightly rounded.

Hind wings: (Figs 2A-B, 3A-B) bright yellow, orange, or pale blue with apical 1/3 black-brown, apex slightly rounded. Hind wings broader than tegmina.

Legs: (Fig. 2B) coxae pale orange brown, femora orange brown turning darker at apex including femorotibial joint; pro- and mesotibiae dark brown, metatibiae pale brown turning darker at the apex. Metatibiae with 5–7 lateral spines.

Abdomen: (Fig. 2A-B) terga brown; sterna yellowish orange.

Male terminalia: (Fig. 4) Pygofer higher than long, with posterior margin broadly rounded, with a short ventral process directed posteriorly in lateral view (Fig. 4A). Gonostyli (Fig. 4A, C) elongate, 1.6 times longer than high in lateral view, not surpassing apex of anal tube; dorsal and ventral margins broadly rounded; in lateral view, apical margin rounded; fused ventrally on basal 1/5; lateral hooks of gonostyli short, moderately curved and pointing lateroventrally. Aedeagus (Fig. 4D-G) membranous with pair of elongate ventral endosomal processes widening on distal half (Fig. 4D, G); connective rod-shaped (Fig. 4D); tectiductus moderately developed, subtriangular with anterior margin concave in dorsal view, strongly concave ventrally (Fig. 4D-G). Anal tube (Fig. 4A-C) elongate and dorsoventrally flattened, 1.16 times

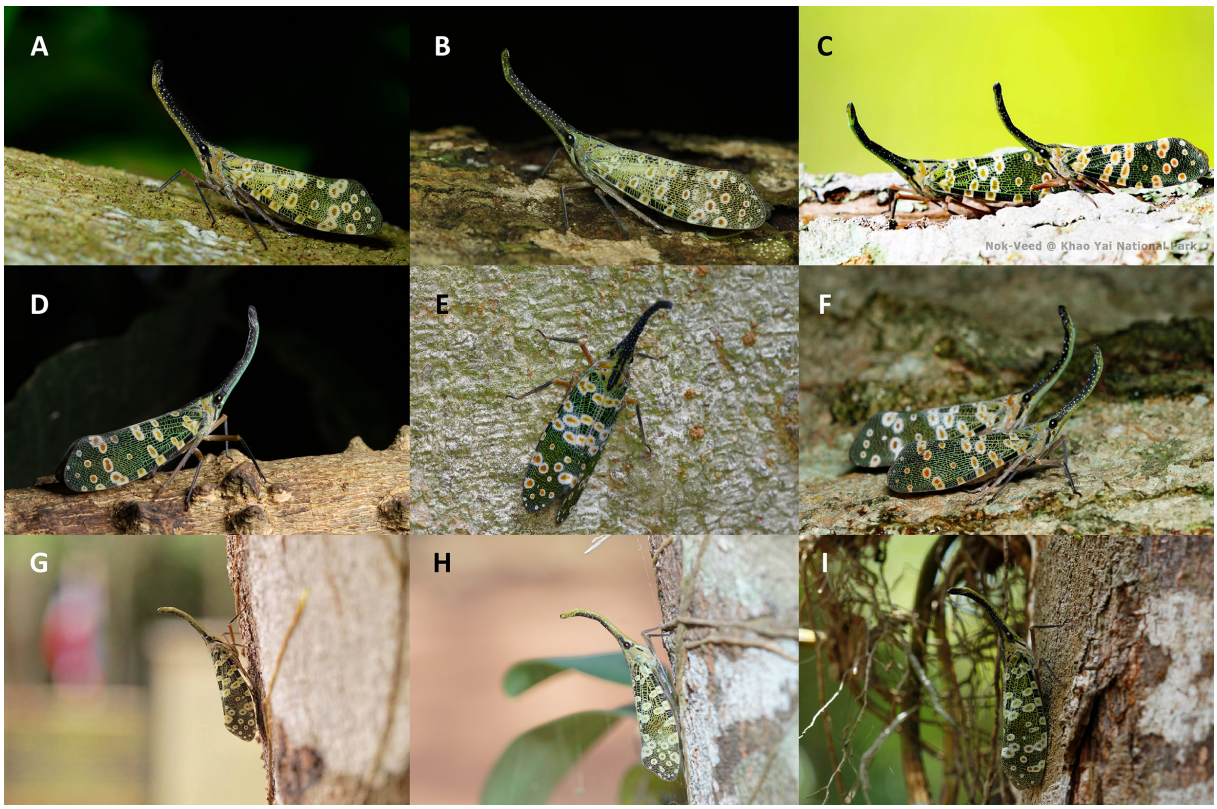

Fig. 5. *Pyrops condorinus* (Lallemand, 1960) in nature. **A-B**, Chonburi Province, Chan Ta Ten Waterfall. **A**, 3.VI.2013. © N. Phansuwan. **B**, 7.VII.2022. © K. Jiaranaisakul. **C-F**, Nakhon Ratchasima Province, Khao Yai National Park. **C**, 4.X.2016. © U. Boonyaprakob. **D**, 13.VII.2017. © K. Jiaranaisakul. **E**, 9.VIII.2020. © W. Muttigo. **F**, 31.VIII.2020. © K. Jiaranaisakul. **G-I**, Sa Kaeo Province, Pang Sida National Park. **G**, VI.2018. © P. Dokchan. **H**, 22.VI.2019. © U. Rodprasert. **I**, 19.VII.2020. © K. Jiaranaisakul.

longer than broad in dorsal view (about 1.5 times wider than long as broad as long in median line), broadest at 3/4 of total length (Fig. 4B); lateral margins sinuate (Fig. 4B) and apical margin deeply, roundly notched in dorsal view (Fig. 4B-C); anal column elongate and narrow, surpassing anal tube posteriorly (Fig. 4B-C).

Distribution.

Vietnam, Cambodia and Thailand (new country record -Fig.6).

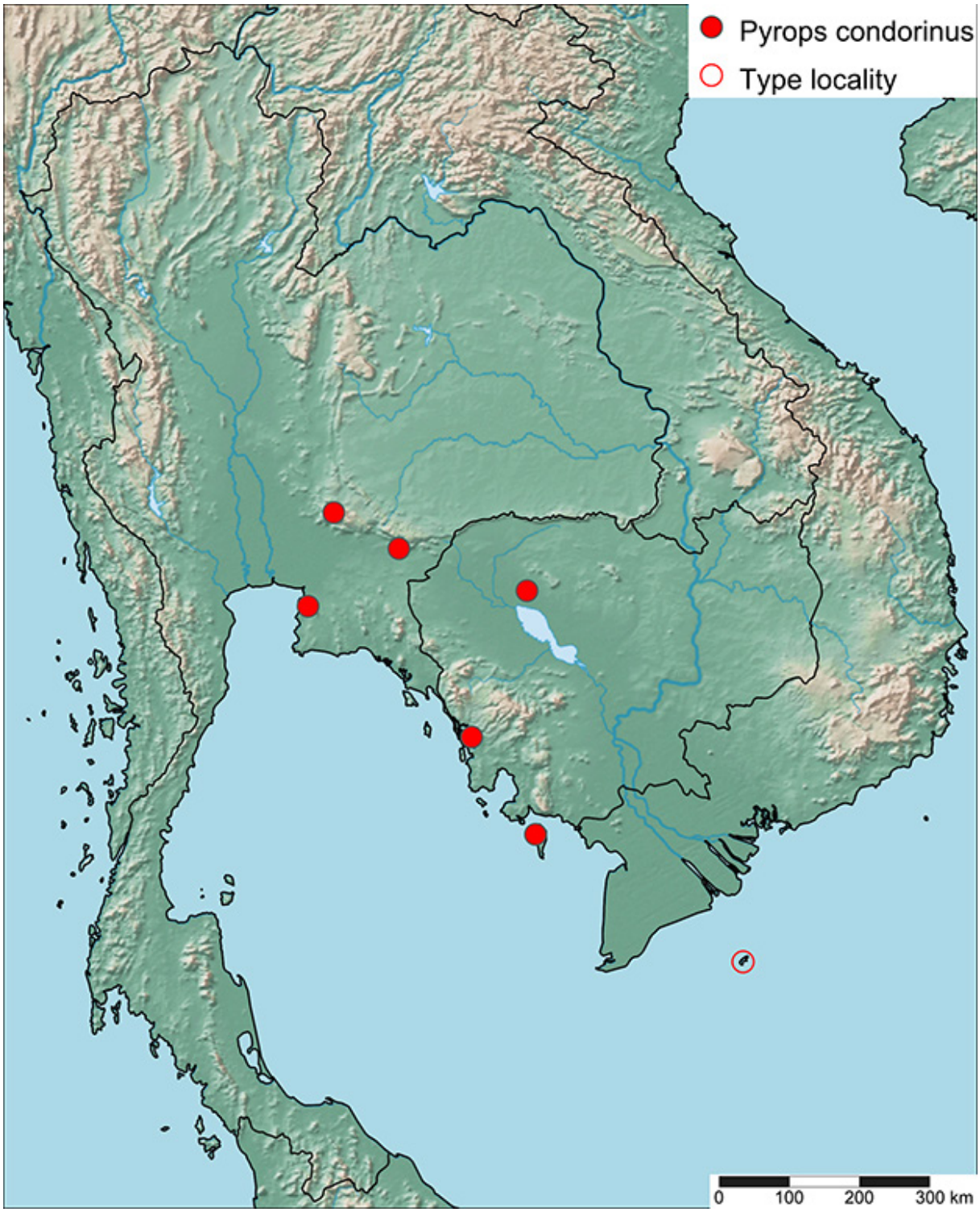

Fig. 6. *Pyrops condorinus* (Lallemand, 1960), distribution map.

Biology.

This species was observed on *Sandoricum koetjape* (Burm.f.) Merr. (Meliaceae) in Cambodia (Constant *et al*., 2016) and *Acrocarpus fraxinifolius* Wight ex Arn. (Fabaceae) (new host plant record) in Thailand. The specimens from Chonburi Province were observed on an unidentified tree that belongs to the order Sapindales (K. Jiaranaisakul pers. obs.)

Pyrops spinolae (Westwood, 1842)
Figs 1B, D, F, H, 7-8

Materiel Examined.

VIETNAM • 1 ♂; Quang Tri Province, Da Krong National Park; 16°37′00″N, 106°47′00″ E; 5-10.VII.2011; J. Constant & J. Bresseel leg.; I.G. 31.933; RBINS.

Materiel Examined from photographs.

THAILAND • 1 ex. (Fig. 7A): Surat Thani Province, Khlong Sok District; 28.III.2021, K. Jiaranaisakul • 1 ex. (Fig. 7B): Phetchaburi Province, Kaeng Krachan National Park; 11.VI.2021; K. Jiaranaisakul • 1 ex. (Fig. 7C): Chanthaburi Province, Khao Soi Dao Wildlife Sanctuary; 10.VII.2022; K. Jiaranaisakul • 1 ex. (Fig. 7D): Chiang Rai Province, Wiang Pa Pao District; 23.V.2022; K. Jiaranaisakul.

Supplementary description.

Male terminalia: (Fig. 8) Pygofer higher than long, with posterior margin weakly rounded, with a short ventral process directed posteriorly in lateral view (Fig. 8A). Gonostyli (Fig. 8A, C)

Fig. 7. Intraspecific variation of *Pyrops spinolae* (Westwood, 1842). **A**, Surat Thani Province, Khlong Sok District; 28.III.2021. **B**, Phetchaburi Province, Kaeng Krachan National Park; 11.VI.2021. **C**, Chanthaburi Province, Khao Soi Dao Wildlife Sanctuary; 10.VII.2022. **D**, Chiang Rai Province, Wiang Pa Pao District; 23.V.2022.

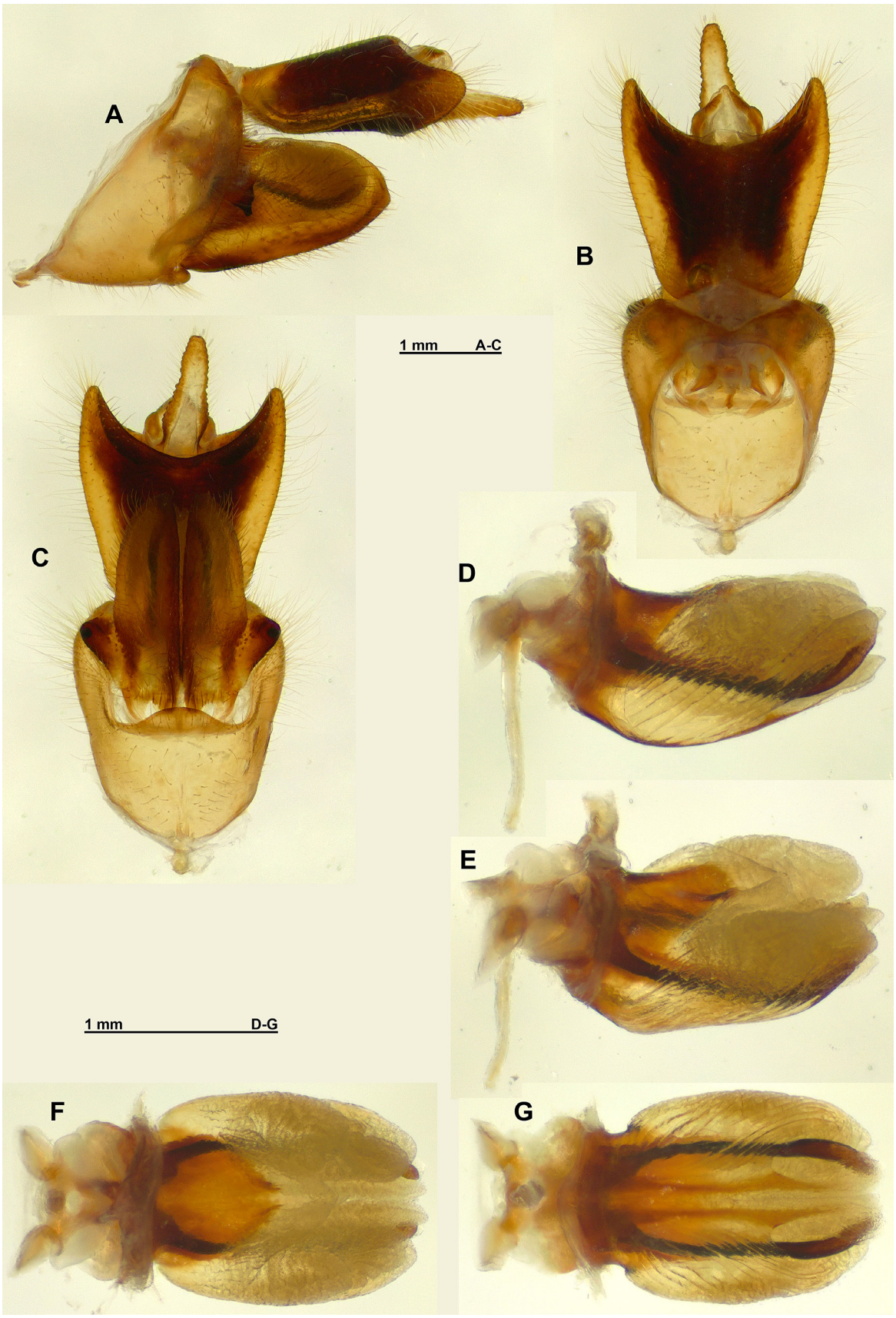

Fig. 8. *Pyrops spinolae* (Westwood, 1842), male genitalia, specimen from Vietnam, Quang Tri Province, Da Krong National Park. **A-C**, pygofer, gonostyli and anal tube. **A**, lateral view. **B**, dorsal view. **C**, ventral view. **D-G**, aedeagus. **D**, lateral view. **E**, dorsolateral view. **F**, dorsal view. **G**, ventral view.

elongate, 1.8 times longer than high in lateral view, not surpassing apex of anal tube; dorsal margin broadly rounded, ventral margin mostly straight; in lateral view, apical margin rounded with small rounded projection; fused ventrally on basal 1/6; lateral hooks of gonostyli short, moderately curved and pointing lateroventrally. Aedeagus (Fig. 8 D-G) membranous with pair of elongate ventral endosomal processes widening on distal third (Fig. 8 D, G); connective rod-shaped (Fig. 8 D); tectiductus moderately developed, subtriangular with anterior margin concave in dorsal view, strongly concave ventrally (Fig. 8 D-G). Anal tube (Fig. 8 A-C) elongate and dorsoventrally flattened, 1.05 times longer than broad in dorsal view (about 1.4 times as broad as long in median line), broadest at 4/5 of total length (Fig. 8 B); lateral margins broadly rounded (Fig. 8 B) and apical margin deeply, roundly notched in dorsal view (Fig. 8 B-C); anal column elongate and narrow, surpassing anal tube posteriorly (Fig. 8 B-C).

Note.

This species shows different patterns of intraspecific variation on the tegmina. The specimen from Surat Thani Province shows brownish orange veins and veinlets (Fig. 7 A). The tegmina of the specimen from Chiang Rai Province shows yellow spots (Fig. 7 D). The specimens from Phetchaburi and Chanthaburi Province are quite the same but the spots on the tegmina of the latter are smaller and not fused to transverse bands (Fig. 7 C).

Discussion

A full description of the external morphology and male genitalia of *Pyrops condorinus* is here provided and the species is also recorded for the first time from Thailand by citizen scientists. This brings the Fulgoridae fauna of Thailand to expand to 35 species with 14 species of the genus *Pyrops*. In addition, *P. condorinus* seems widely distributed from Vietnam westward to Thailand and the presence of *P. coelestinus* (Stål, 1863), currently known from Southern Vietnam and Cambodia (Constant *et al*., 2016), might be expected in Thailand. In Chonburi Province, more than 10 specimens of *P. condorinus* were observed on the same unidentified tree species. The intraspecific variation of *P. spinolae* is documented for the first time and its male genitalia are illustrated and described for comparison. Based on the data and photographs from citizens scientists, the specimens with brownish orange veins are only distributed in Nakhon Si Thammarat and Surat Thani provinces, South Thailand (iNaturalist, 2022). This might be related to the specific characteristics of each population. However, a molecular study would be necessary for confirmation of this hypothesis. In addition to collaborating with citizen scientists who contribute data about the distribution of many species, collaborating also with botanists is also necessary. Indeed host-plant identification is part of the important associated biological data that needs to be documented for obligatory phytophagous insects such as planthoppers. Identification of host plants might help scientists to find and track *Pyrops* easier and may reveal valuable data as about their life history and phenology.

Acknowledgments

We thank Mr Nuwat Phansuwan (Thailand), Mr Paradorn Dokchan (Thailand), Mr Ukadej Boonyaprakorb (Thailand), Mr Upaipol Rodprasert (Thailand) and Mrs Warinthorn Muttigo (Thailand) for providing photographs of specimen in nature; Mrs Jeannine Bortels (FSAG) and Dr Hong Thai Pham (VNMN) for the loan of the examined material. The survey is part of the "Natural Communication Project" offered by the Rabbit in the Moon Foundation (Thailand). The second author would like to thank the staff of Pang Sida National Parks for their splendid hospitality whilst we were on field trips; Ms. Narinphak Thiratveeranan and Ms. Waritsara Chanthieng (DNPT) are thank for their help with fieldwork.

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