The new stick insect genus Pterulina gen. nov., a second winged Clitumninae genus from Vietnam with a new combination and a new species (Phasmida, Phasmatidae, Clitumninae, Clitumn…

Article *in* Belgian Journal of Entomology · June 2020

CITATIONS
0

READS
1,328

2 authors:

Joachim Bresseel
Royal Belgian Institute of Natural Sciences
28 PUBLICATIONS **140** CITATIONS
SEE PROFILE

Jérôme Constant
Royal Belgian Institute of Natural Sciences
126 PUBLICATIONS **509** CITATIONS
SEE PROFILE

Belgian Journal of Entomology 96: 1–30 (2020) ISSN: 2295-0214
www.srbe-kbve.be

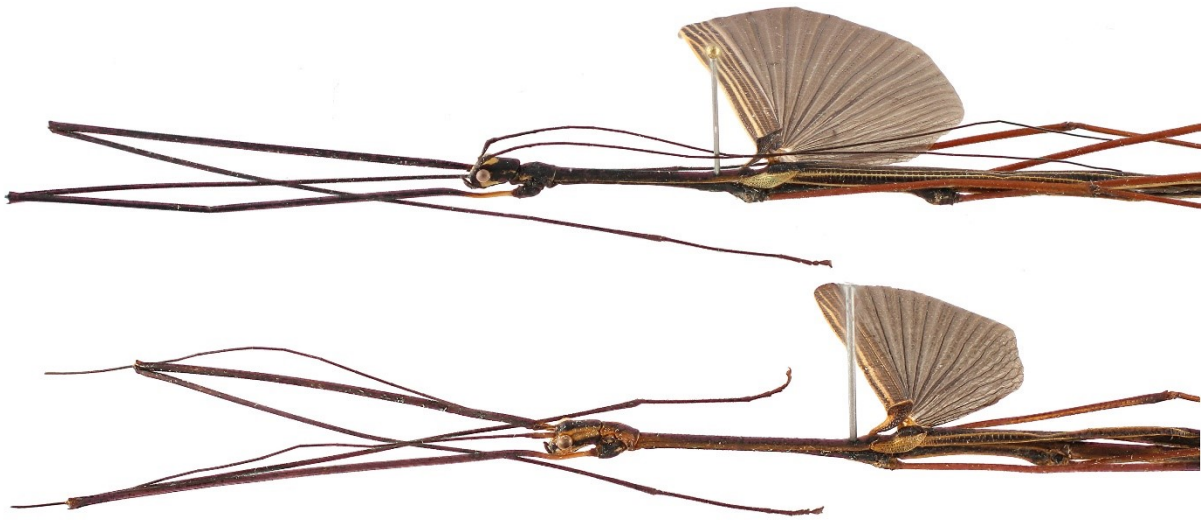
urn:lsid:zoobank.org:pub:86A63507-90DC-445B-96A7-0BCA112D6C4D

Belgian Journal of Entomology

The new stick insect genus *Pterulina* gen. nov., a second winged Clitumninae genus from Vietnam with a new combination and a new species (Phasmida, Phasmatidae, Clitumninae, Clitumnini)

Joachim BRESSEEL[1] & Jérôme CONSTANT[2]

[1, 2] Royal Belgian Institute of Natural Sciences, O.D. Phylogeny and Taxonomy, Entomology, Vautier street 29, B-1000 Brussels, Belgium
[1] E-mail:joachimbresseel@gmail.com (corresponding author)
urn:lsid:zoobank.org:author:3C4EF358-9716-46F0-8575-26BE1EDE4349
[2] E-mail: jerome.constant@naturalsciences.be
urn:lsid:zoobank.org:author:6E6072A1-9415-4C8D-8E60-2504444DB290



Published: Brussels, June 29, 2020

Citation: BRESSEEL J. & CONSTANT J., 2020. - The new stick insect genus *Pterulina* gen. nov., a second winged Clitumninae genus from Vietnam with a new combination and a new species (Phasmida, Phasmatidae, Clitumninae, Clitumnini). *Belgian Journal of Entomology,* 96: 1–30.

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

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

Head office: Vautier street 29, B-1000 Brussels.

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

In compliance with Article 8.6 of the ICZN, printed versions of all papers are deposited in the following libraries:

- Royal Library of Belgium, Boulevard de l'Empereur 4, B-1000 Brussels.
- Library of the Royal Belgian Institute of Natural Sciences, Vautier street 29, B-1000 Brussels.
- American Museum of Natural History Library, Central Park West at 79th street, New York, NY 10024-5192, USA.
- Central library of the Museum national d'Histoire naturelle, rue Geoffroy SaintHilaire 38, F-75005 Paris, France.
- Library of the Muséum d'Histoire naturelle de Genève, route de Malagnou 1, CH-1208 Genève, Suisse.
- Zoological Record, Thomson Reuters, Publication Processing, 1500 Spring Garden Street, Fourth Floor, Philadelphia PA 19130, USA.

Front cover: Head and thorax lateral view; top: *Pterulina distinctissima* (Redtenbacher, 1908) comb. nov., male; bottom: *Pterulina simoensi* sp. nov., male.

Belgian Journal of Entomology 96: 1–30 (2020)

The new stick insect genus *Pterulina* gen. nov., a second winged Clitumninae genus from Vietnam with a new combination and a new species (Phasmida, Phasmatidae, Clitumninae, Clitumnini)

Joachim BRESSEEL[1] & Jérôme CONSTANT[2]

Royal Belgian Institute of Natural Sciences, O.D. Phylogeny and Taxonomy, Entomology, Vautier street 29, B-1000 Brussels, Belgium
[1] E-mail:joachimbresseel@gmail.com (corresponding author)
urn:lsid:zoobank.org:author:3C4EF358-9716-46F0-8575-26BE1EDE4349
[2] E-mail: jerome.constant@naturalsciences.be
urn:lsid:zoobank.org:author:6E6072A1-9415-4C8D-8E60-2504444DB290

Abstract

Pterulina gen. nov. is erected to include *Sipyloidea distinctissima* Redtenbacher, 1908 from the central Annamite mountains and *Pterulina simoensi* sp. nov. from the southern Annamites. *Pterulina distinctissima* (Redtenbacher, 1908) comb. nov., the type species of the newly erected genus, is redescribed and figured from both sexes and egg. The species was misplaced in *Sipyloidea* Brunner von Wattenwyl, 1893, a genus of Necrosciinae (Lonchodidae) and is here transferred to a newly described genus of Clitumninae (Phasmatidae). The new species *Pterulina simoensi* sp. nov. is described based on male, female and egg. The taxonomic placement and the biogeography of this winged genus in Clitumnini is discussed. A key and distribution map are provided for its species.

Keywords: Da Lat Plateau, Global Taxonomy Initiative, Indochina, Kon Tum Plateau, *Lobofemora,* Phasmatodea.

Introduction

The identification of specimens of stick insects collected in the framework of the Global Taxonomy Initiative project "A step further in the entomodiversity of Vietnam" revealed a new genus including a species previously attributed to *Sipyloidea* Brunner von Wattenwyl, 1893. The new genus is described below as *Pterulina* gen. nov. and can be differentiated from other genera of Clitumnini by having the median segment about as long as or longer than the metanotum, the lack of an ovipositor in females and antennae longer than the profemora as well as the presence of wings in males.

New genera are rarely described in the species rich tribe Clitumnini which currently counts 231 species including 159 currently attributed to *Ramulus* Saussure, 1862. The stick-like body with fairly few or subtle diagnostic characters makes species hard to distinguish at generic level.
The new genus *Pterulina* gen. nov. is only the seventh genus described in over a hundred years (BROCK *et al*., 2019), the third one by the authors (BRESSEEL & CONSTANT, 2015; BRESSEEL & CONSTANT, 2019) and after *Lobofemora* Bresseel & Constant, 2015, the second winged genus known within the tribe.

The present paper aims to describe and differentiate *Pterulina* gen. nov., to propose the new combination *Pterulina distinctissima* (Redtenbacher, 1908) comb. nov., with an update on the distribution of the species and to describe a new species *Pterulina simoensi* sp. nov. from the Dac Lac Plateau in the southern Annamites.

Material & methods

Due to their nocturnal behaviour, the specimens of *Pterulina* gen. nov. were collected at night. A light-weight and water-proof Petzl MYO RXP head torch was used during collecting. Females were kept alive in a mesh pop up cage (exo terra explorarium™) for producing eggs. The specimens were euthanized by an injection with ethanol, then stored in airtight plastic "zip"-bags in wood chips (used in rodent cages) and sprinkled with etylacetate (EtOAc) to prevent rotting, mould and to keep the specimens flexible. The bags were frozen on arrival and the specimens mounted later on.

For each picture of the new species, a number of photographs were taken with a Canon 700D camera equipped with a Sigma 50 mm Macro lens (for adults), or with a Leica EZ4W stereomicroscope with integrated camera (for eggs), stacked with CombineZ software and optimized with Adobe Photoshop CS3. The distribution map was produced with SimpleMappr (SHORTHOUSE, 2010). Observations were done with a Leica EZ4W stereomicroscope and measurements were taken with an electronic calliper.

The nomenclature of the morphological characters follows BRAGG (2001); the egg morphology follows that of CLARCK-SELLICK (1997; 1998). The description of the colouration is based on live and dried specimens.

Acronyms used for the collections:

MNHN = Muséum National d'Histoire Naturelle, Paris, France.

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

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

Abbreviations:

N.P.: National Park;
N.R.: Nature Reserve;
HT: holotype;
PT: paratype.

Taxonomy

Family Phasmatidae Leach, 1815
Subfamily Clitumninae Brunner von Wattenwyl, 1893
Tribe Clitumnini Brunner von Wattenwyl, 1893
Genus *Pterulina* gen. nov.

urn:lsid:zoobank.org:act:F36B15B0-CD0C-4084-B77D-3FD3FC4B0FEE

TYPE SPECIES: *Sipyloidea distinctissima* Redtenbacher; 1908 by present designation.

ETYMOLOGY. The genus name is the combination of *pter-*, from the Greek word *pteron* meaning wing, and *-ulina*, the ending of *Cuniculina* Brunner von Wattenwyl, 1907 illustrating the close relationship between these genera.

DIAGNOSIS AND DIFFERENTIATION. Differing from all other known genera of Clitumnini Brunner von Wattenwyl, 1893 by the following combination of characters:

1) Presence of tegmina and alae in male.
2) Antennae in males strongly elongated, distinctly projecting over profemora.
3) Females with a distinct praeopercular organ.
4) Median segment about as long as or longer than metanotum.

5) Hemi-tergites of males strongly elongated and tapering into a point.
6) Egg capsule elongated, polar area incised; micropylar plate spear shaped.

As usual for stick insects that have wings in one or both sexes, the median segment in *Pterulina* gen. nov. is fairly long in relation to the metanotum and the mesothorax is shorter than twice the combined length of head and prothorax. Both features are only shared with *Lobofemora* Bresseel & Constant, 2015 and distinguish these two genera from all currently known representatives of Clitumnini. Females are easily distinguished from *Lobofemora* by the presence of a distinct praeopercular organ on sternum VII and by lacking a beak-like ovipositor that is shaped by the elongated subgenital plate and epiproct. Males are distinguished by the longer antennae, distinctly projecting over profemora; the presence of longer hind wings, reaching at least to posterior margin of tergum III and by the distinctly elongated and slender hemi-tergites (very short and broad in *Lobofemora*).

The eggs somewhat resemble those of *Cuniculina* Brunner von Wattenwyl, 1907, in having an elongate minutely granulose capsule with the polar area incised and the operculum inserted in a distinct negative opercular angle. It can be differentiated by the absence of an elongated coronal rim and by the spear-shaped micropylar plate.

DESCRIPTION

MALE AND FEMALE

Body: Stick-like with females apterous and males winged. Females vary in colouration to a certain degree, colouration in males constant.

Head: Longer than wide, slightly narrowing towards the posterior and smooth. Vertex slightly elongated and flattened, back of head indented medially and submedially creating four indistinct humps. Eyes circular and projecting hemispherically. Antennae black, males with antennae projecting over profemora; females with short antennae reaching about halfway profemora.

Thorax: Pronotum shorter than head, more or less rectangular; anterior margin concave and slightly thickened; posterior margin slightly rounded. Mesonotum elongated, cylindrical in cross-section. Metanotum short, about one third of median segment in males and slightly longer than median segment in females.

Wings: Males with tegmina projecting over posterior margin metanotum, with definite hump and broadening towards the posterior, apex broadly rounded. Alae projecting at least over posterior margin of tergum III.

Legs: Profemora laterally flattened and curved basally, all carinae present; females have the anterodorsal carina serrated and the posterodorsal carina with triangular teeth and have the mesofemora with both dorsal carina armed with three evenly spaced minute to triangular teeth. Metafemora as mesofemora.

Abdomen: Elongated and cylindrical in cross-section. Apical portion of abdomen in males with anal segment distinctly longer than tergum IX, apically split into two elongated and slender hemi-tergites. Inner portion of hemi-tergite armed with black hook-like teeth. Apical portion of abdomen in females with anal segment concave apically, lateral margins rounded, angular posterolaterally. Short triangular epiproct visible, slightly projecting over apex of anal segment with mediolongitudinal carina. Sternum VII with a distinct praeopercular organ. Subgenital plate laterally compressed with a mediolongitudinal carina in the posterior portion. Posterior margin rounded.

SPECIES INCLUDED

Pterulina distinctissima (Redtenbacher, 1908) comb. nov.
Pterulina simoensi sp. nov.

Keys to the species of *Pterulina* gen. nov.

MALES

1. Wings reaching posterior margin of tergum III, head with mediolongitudinal black stripe dorsally ..... ***Pterulina simoensi* sp. nov.**

- Wings projecting over posterior margin of tergum IV, head with a distinct round yellow marking between the eyes.....***Pterulina distinctissima* comb. nov.**

FEMALES

1. Praeopercular organ tapering towards the posterior with posterior margin rounded, not projecting over anterior margin of subgenital plate..... ***Pterulina simoensi* sp. nov.**

- Praeopercular organ strongly tapering towards the posterior, resulting into a single spine projecting over anterior margin of subgenital plate.....***Pterulina distinctissima* comb. nov.**

DISTRIBUTION. Central Vietnam (Fig. 1). The genus is restricted to the Truong Son Range with *Pterulina distinctissima* (Redtenbacher, 1908) comb. nov. from the Kon tum Plateau and *Pterulina simoensi* sp. nov. from the Dac Lac Plateau.

COMMENT: The Kon Tum and Dac Lac Plateaus of the Truong Son Range are both recognized as areas of high endemism. (STERLING & HURLEY, 2005).

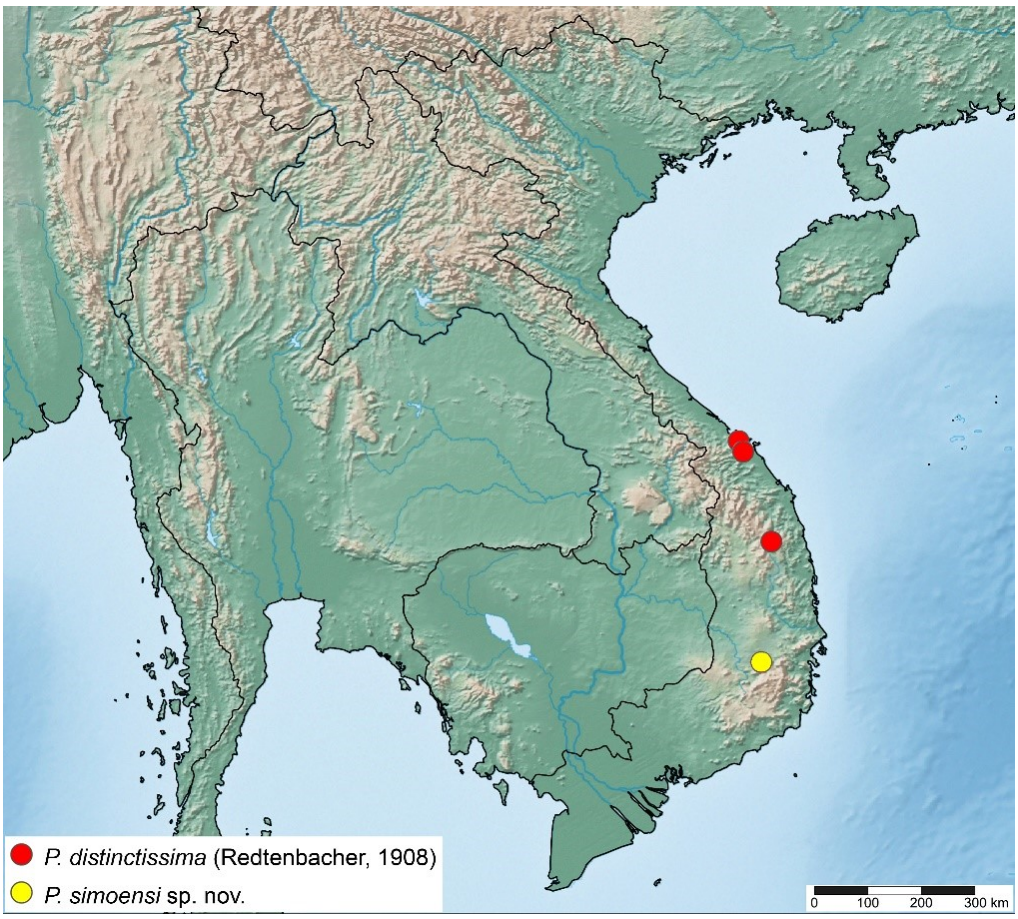


Fig. 1. *Pterulina* spp. distribution map.

***Pterulina distinctissima* (Redtenbacher, 1908) comb. nov.**
(Figs 1–10)

Sipyloidea distinctissima REDTENBACHER, 1908: 546 [described].

Sipyloidea distinctissima – OTTE & BROCK, 2005: 317 [catalogued]; DELFOSSE ET AL., 2019: 199 [catalogued].

MATERIAL EXAMINED

TYPE MATERIAL (examined from detailed photographs): Vietnam: Holotype ♂: Cochinchine, Deyrolle, 1861, MNHN-EO-PHAS355 (MNHN).

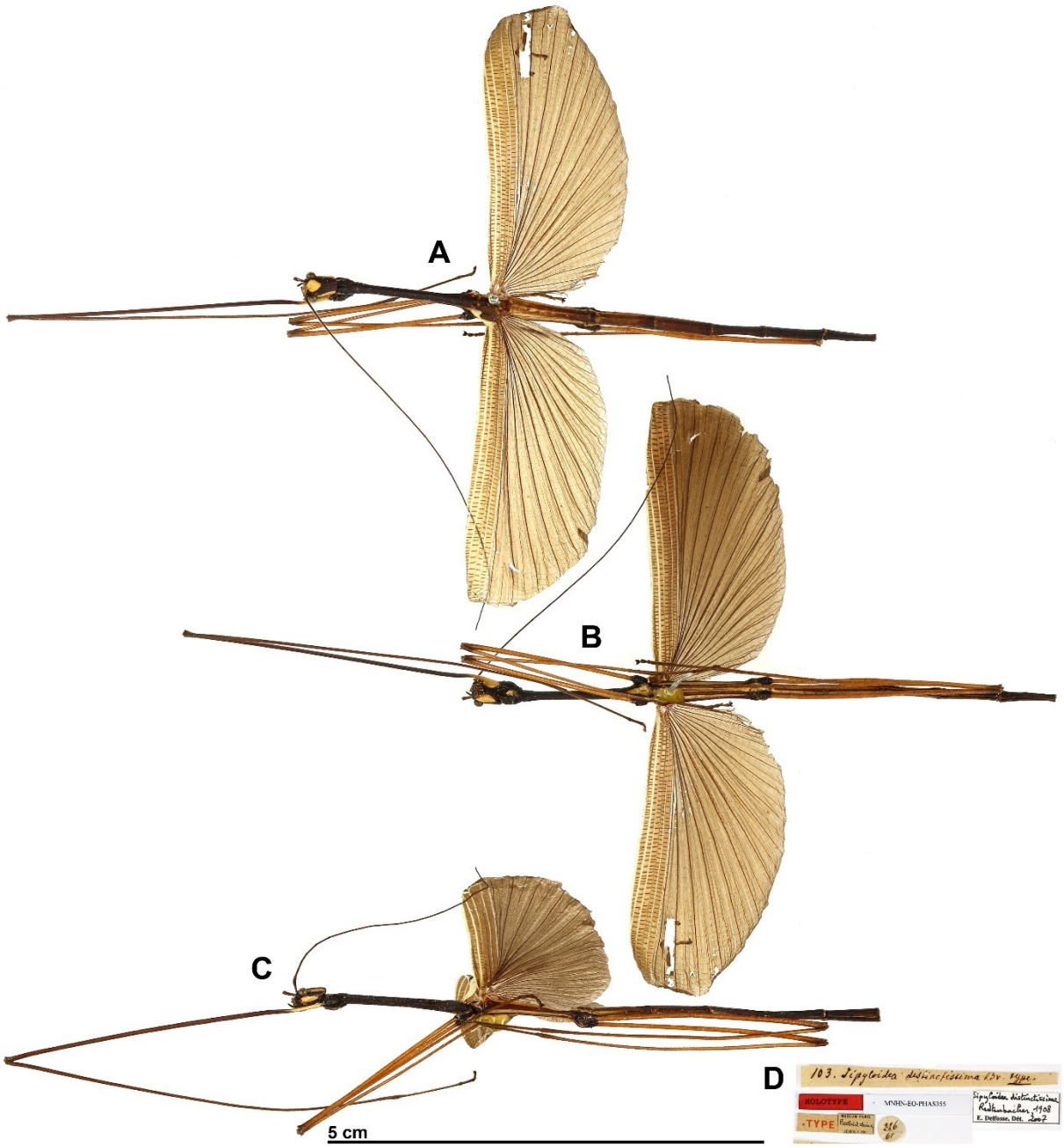


Fig. 2. *Sipyloidea distinctissima* Redtenbacher, 1908, holotype ♂. © MNHN. A, habitus, dorsal view. B, habitus, ventral view. C, habitus, lateral view. D, labels.

ADDITIONAL MATERIAL: ♀: 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 (RBINS); ♂: C Vietnam, Bach Ma N. P., 16°12'N 107°52'E, 12–17.VII.2011, leg. J. Constant & J. Bresseel, I.G.: 31.933 (RBINS); 7♂♂, 10♀♀, eggs: Vietnam, Gia Lai prov. Kon Chu Rang N.R., 600–1200m, 13–20.vii.2018, GTI project, 14°28'28"N 108°32'27"E, Leg. J. Constant, J. Bresseel & X. Vermeersch, I.G.:33.769 (5♂♂, 8♀♀: RBINS; 2♂♂, 2♀♀: VNMN).

COMMENTS: REDTENBACHER (1908) described the species in *Sipyloidea* Brunner von Wattenwyl, 1893 based on a single male specimen lacking the abdomen at the time of description (Fig. 2). Redtenbacher, not having seen the apex of the abdomen, nor the female, probably placed the species in *Sipyloidea* because of the presence of wings, the slender appearance and the relatively long antennae. However, these are not surpassing the front legs like in *Sipyloidea.*

DESCRIPTION. The colouration is described based on dried and live specimens. Measurements: see table 1.

MALE (Figs 2–5, 6 A, C–D).

Colouration: Body colouration constant, head and thorax predominantly black with a distinct yellowish circular marking between eyes slightly tapering towards the back and yellow postocular line; genae yellow, mouthparts black. Pro-, meso- and metanotum with lateral margins with a narrow indistinct yellowish line; prosternum black with distinct yellow marking anteriorly, profurcasternum black; mesosternum black, mesofurcasternum yellow; metasternum with broad cream yellow longitudinal band, lateral margins black. Metapleura black with longitudinal cream-yellow line at lateral margins. Abdominal terga black with indistinct cream-yellow lateral margins, yellowish margins broader on tergum VIII–IX. Abdominal sterna II–V with two parallel longitudinal cream-yellow lines submedially, other portions black; other sterna predominantly black. Profemora black with yellow base. Mid and hind legs with coxae and trochanter black, femora and tibiae reddish brown (orange brown in dried specimens). Tegmina with cream-yellow outer margins, otherwise blackish; alae with costal area black and major veins yellowish; anal area translucent brown, sometimes with few transparent cells.

Head: Longer than wide, slightly narrowing towards the posterior and smooth. Vertex slightly elongated and flattened, back of head indented medially and submedially creating four indistinct humps. Area between eyes slightly raised. Eyes circular and strongly projecting hemispherically. Antennae black, distinctly projecting over profemora. Antennae with 23–25 segments, scapus strongly dorsoventrally flattened, slightly swollen towards the posterior and only slightly broader than antennomeres. Pedicellus very short, knob-like and cylindrical. Antennomeres fairly elongated and covered in minute setae, except for apical antennomere.

Thorax: Pronotum shorter than head, more or less rectangular, lateral margins indistinctly sinuate; anterior margin concave and slightly thickened, followed by a transverse depression; medially with longitudinal line, not reaching posterior margin; transverse central depression not reaching lateral margins. Posterior margin slightly concave to more or less straight. Mesonotum about five times longer than pronotum, first slightly narrowing, but later slightly widening in the posterior portion; faintly granulose with fine mediolongitudinal carina. Metanotum short, about one third of median segment.

Wings: Tegmina projecting over posterior margin of metanotum, with definite basal hump and broadening towards the posterior, apex broadly rounded. Alae projecting over posterior margin of tergum IV.

Fig. 3. *Pterulina distinctissima* (Redtenbacher, 1908) comb. nov., ♂. A, habitus, dorsal view. B. habitus, ventral view. C, head and thorax, dorsal view. D, head and thorax, ventral view. E, habitus, lateral view. F, head and thorax, lateral view.

Legs: Profemora laterally flattened and curved basally; about as long as head and thorax, including median segment, combined; all carinae present, medioventral carina indistinct. All carinae armed with minute stiff black setae. Mesofemora about two thirds as long as profemora; straight basally, medioventral carina absent, other features as in profemora. Metafemora longer than mesofemora but shorter than profemora, otherwise like mesofemora. Protibiae about one third longer than profemora, with all carinae armed with minute stiff black setae. Mesotibiae slightly longer than mesofemora; shaped as protibiae, but carinae with few minute, but acute spines in posterior portion. Metatibiae about as long as profemora, shaped as mesotibiae, but with minute spines more numerous, especially towards the posterior.

Fig. 4. *Pterulina distinctissima* (Redtenbacher, 1908) comb. nov., ♂ terminalia. A, dorsal view. B, lateral view. C, laterodorsal view. D, ventral view.

Abdomen: Abdominal terga smooth with a faint median, longitudinal line. Median segment longest of all abdominal terga. Abdominal terga II–VI more or less the same length, VII–IX distinctly decreasing in length. Tergum VIII slightly broadening towards the posterior, IX shorter than VIII and tectiform. Anal segment distinctly longer than tergum IX, about as long as VII and with median with longitudinal carina; apically split into two hemi-tergites. Inner

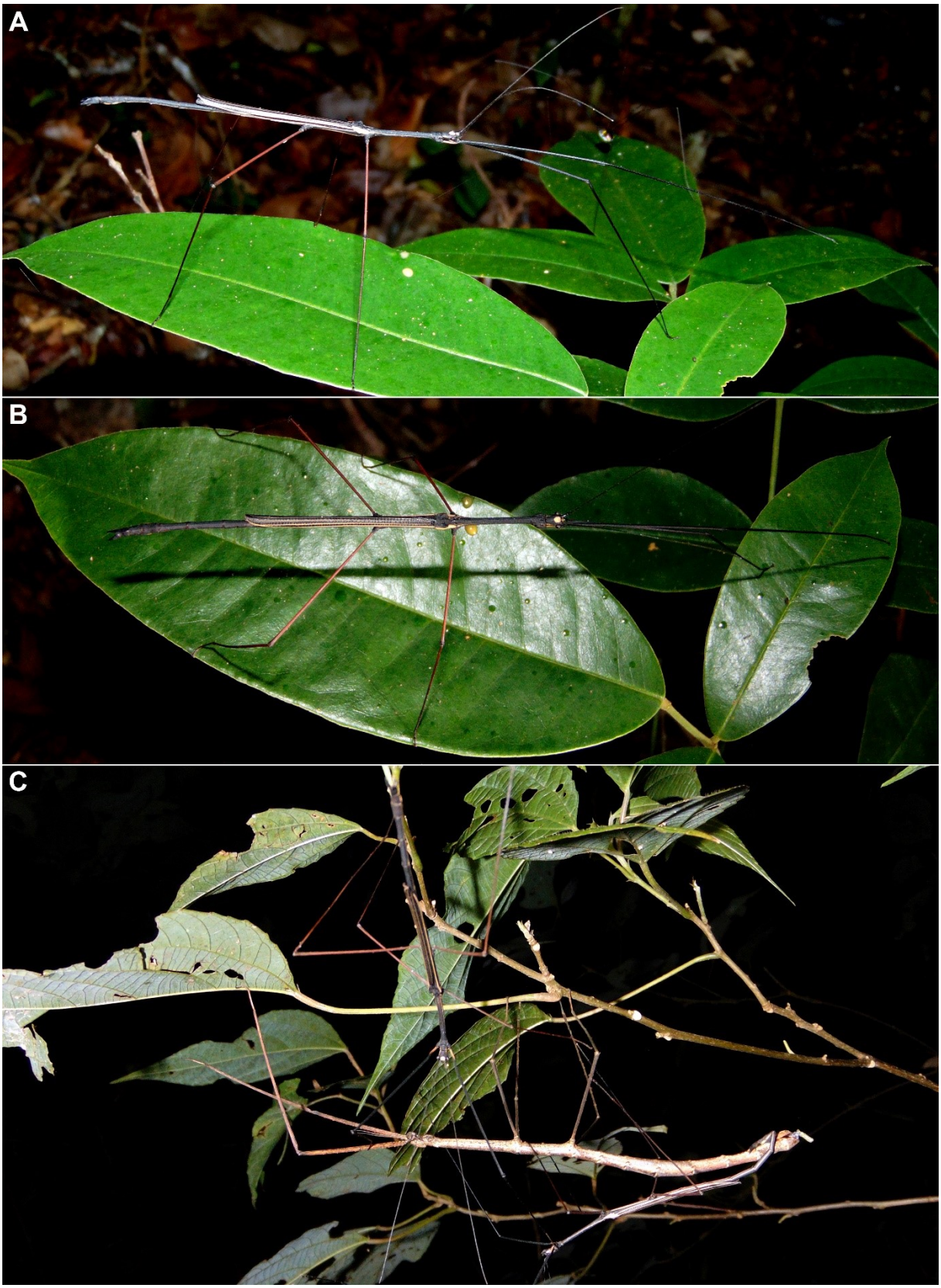


Fig. 5. *Pterulina distinctissima* (Redtenbacher, 1908) comb. nov., live ♂ in situ in Kon Chu Rang N.R.. A, lateral view. B, dorsal view. C, multiple males with female.

portion of hemi-tergite armed with black hook-like teeth; hemi-tergites very elongate, slender and tapered towards a narrow apex; gently curving downwards. Poculum moderately elongated, gently rounded with a mediolongitudinal carina in the apical half, slightly projecting over apex of abdominal tergum IX. Apex of poculum narrow, more or less triangular in ventral view. Cerci short, not reaching apex of anal segment, round in cross-section, indistinctly incurving with apex rounded.

FEMALE (Figs 5 C, 6 B, 7–8).

Colouration: Body and head with different shades of brown with darker speckles. Front legs coloured like body, mid- and hind legs distinctly paler, from pale brown to reddish brown.

Head: Longer than wide, slightly narrowing towards the posterior and slightly granulose. Vertex slightly elongated and flattened, back of head indented medially and submedially creating four indistinct humps. Area between eyes slightly raised with transverse black marking. Eyes circular and strongly projecting hemispherically. Antennae coloured as head; short, reaching slightly over halfway along profemora. Antennae with 23–25 segments, scapus strongly dorsoventrally flattened, laterally rounded, distinctly broader than pedicellus and antennomeres. Pedicellus very short, more than three times shorter than scapus, dorsoventrally

Fig. 6. *Pterulina distinctissima* (Redtenbacher, 1908) comb. nov. A, ♂, head and pronotum dorsal view. B, ♀, head and pronotum dorsal view. C, ♂ wings, dorsal view. D, ♂ wings, laterodorsal view. © T. Bollens.

Fig. 7. *Pterulina distinctissima* (Redtenbacher, 1908) comb. nov., ♀ from Kon Chu Rang N.R.. A, habitus, dorsal view. B, habitus, lateral view. C, habitus, ventral view. D, head and thorax, dorsal view. E, terminalia, dorsal view. F, terminalia ventral view. G, terminalia, lateral view. H, head and thorax, lateral view.

flattened and laterally rounded. Apical antennomeres distinctly shorter than anterior antennomeres, apical antennomere elongated, club-like.

Thorax: Pronotum sparsely granulose, distinctly shorter and narrower than head. Lateral margins slightly sinuate; anterior margin concave and slightly thickened, followed by transverse depression; medially with longitudinal line, not reaching posterior margin; transverse central depression not reaching lateral margins; posterior margin slightly concave. Mesonotum about six times longer than pronotum, slightly widening in posterior portion; faintly granulose with slightly larger, evenly spaced granules laterally and with fine mediolongitudinal line. Metanotum slightly longer than median segment with fine mediolongitudinal line, posterolaterally with minute expansion; anterior and posterior margins straight.

Legs: Profemora slightly longer than pro-, meso- and metanotum combined; compressed and strongly curved basally. All carinae present; anterodorsal carina with small teeth, decreasing towards the posterior; posterodorsal carina with one to four spaced triangular teeth. Mesofemora slightly longer than mesonotum, both dorsal carinae armed with three evenly spaced minute to triangular teeth. Metafemora reaching halfway along tergum V, armed like mesofemora. Protibiae carinate, distinctly longer than profemora. Dorsal carinae close to each other, posterodorsal carina with one to five triangular teeth. Posteroventral carina with few minute, acute teeth; medioventral carina slightly raised and laterally flattened. Mesotibiae about as long as mesofemora; posterodorsal carina variable, sometimes with few minute spines or with up to three triangular teeth; anterodorsal carina often with minute spine subapically; ventral carinae with few minute spines, more numerous towards the posterior. Metatibiae slightly longer than metafemora; all carinae armed with minute spines; anterodorsal carina sometimes with few triangular teeth.

Abdomen: Abdominal terga sparsely granulose with faint mediolongitudinal line. Median segment slightly shorter than metanotum. Abdominal terga II-V slightly gradually increasing in length; VI–X gradually decreasing. Anal segment concave apically, lateral margins rounded, posterolateral angles about 90°. Short triangular epiproct visible, slightly projecting over apex of anal segment with mediolongitudinal carina. Sternum VII with distinct praeopercular organ. Praeopercular organ strongly tapering towards the posterior, terminating in a single spiniform swelling projecting over anterior margin of subgenital plate. Subgenital plate strongly keeled, laterally compressed with a mediolongitudinal carina in posterior portion. Posterior margin rounded.

NYMPH (Fig 9). Newly hatched nymphs are slender and predominantly light green. Head bigger than pronotum, with black postocular line. Abdomen tipped black. Legs dark with pale markings. Older nymphs brown or a combination of green and brown.

EGG (Fig 10). Measurements (in mm): length: ~7; width: ~1.2; height: ~2.7.

Capsule predominantly dark brown, distinctly paler dorsally; strongly elongated and laterally flattened. Ventral margin convex, dorsal margin more or less straight. Capsule minutely and densely granulose with two more densely granulose, small, pale spots near posteroventral and posterodorsal margins and two elongate, pale granulose markings on polar area. Anterodorsal margin longer than anteroventral one in lateral view. Polar area distinctly notched in lateral view; posterodorsal and posteroventral angles rounded, posteroventral margin slightly longer. Operculum pale, egg-shaped with a central oval, brown hole from anterior view; surface pale with distinct granulation; opercular rim distinctly paler than capsule, incurving and granulose. Micropylar plate distinct, smooth, coloured as capsule with indistinct paler marking anteriorly of the micropylar cup; elongate spear-shaped and almost completely restricted to dorsal surface;

Fig. 8. *Pterulina distinctissima* (Redtenbacher, 1908) comb. nov., live ♀ in situ. A, dorsal view in Ba Na-Nui Chua N.R. B, laterodorsal view, head and thorax in Ba Na-Nui Chua N.R. C, nymph in Kon Chu Rang N.R. D, dorsal view in Kon Chu Rang N.R. E, dorsal view head and thorax in Kon Chu Rang N.R.

Fig. 9. *Pterulina distinctissima* (Redtenbacher, 1908) comb. nov., newly hatched nymph. A, dorsolateral view, B-C, dorsal view. © T. Bollens.

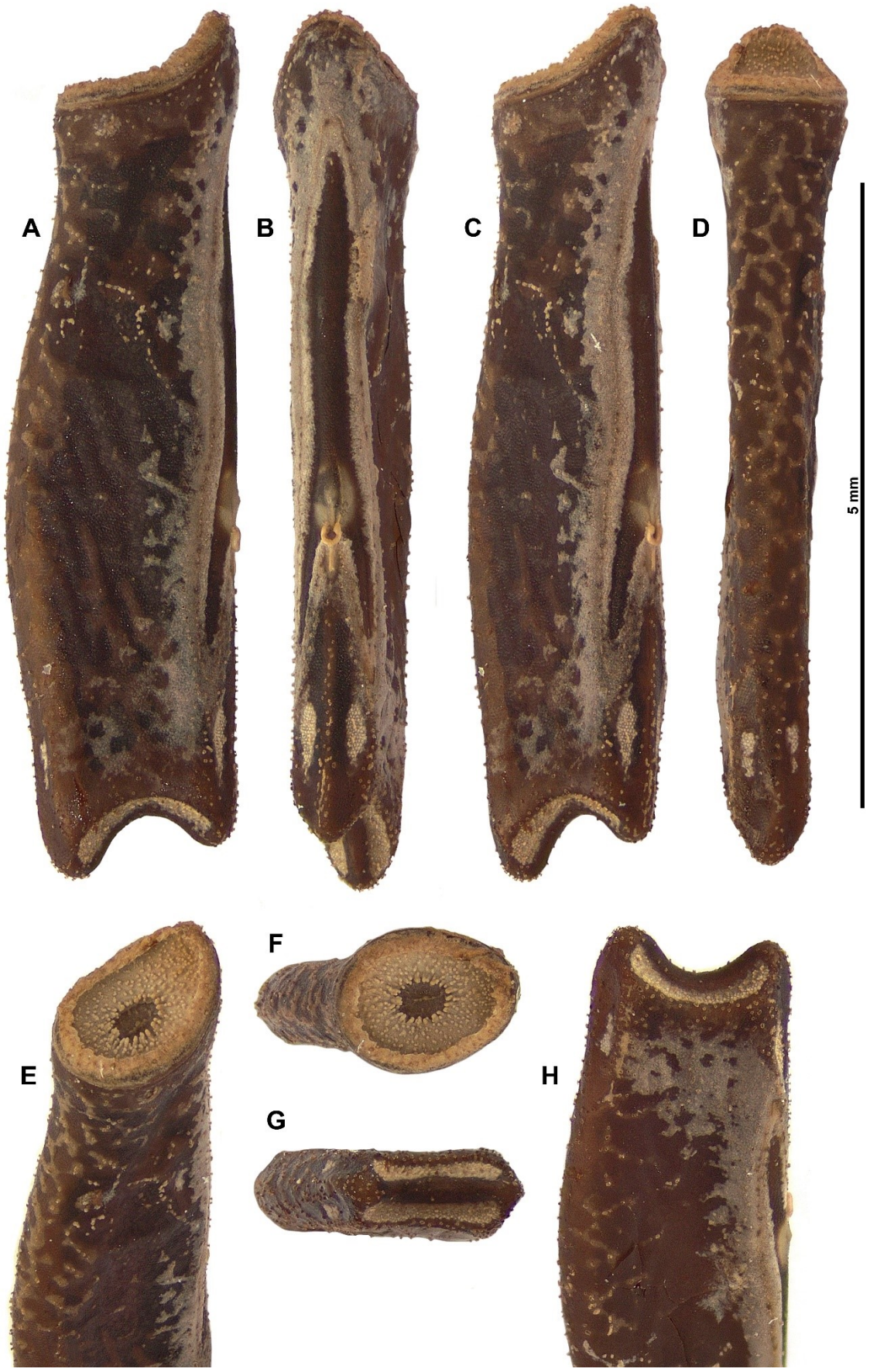


Fig. 10. *Pterulina distinctissima* (Redtenbacher, 1908) comb. nov. egg. A, lateral view. B, dorsal view. C, latero-dorsal view. D, ventral view. E, anterolateral view. F, operculum. G, polar view. H, polar area, lateral view.

margins broad and pale. Micropylar cup small, yellowish, an almost completely circular swelling with short median line.

BIOLOGY. The species was collected in mountainous tropical evergreen rainforest, at medium altitude (600–1200 m). The specimens were observed on lower vegetation and small trees up to 3 m and seemed to feed on a variety of plant species. Males are able to fly and fly away when disturbed during day time. The wings are also used to stridulate by rubbing the outer margins of the tegmina against the subcostal and radial veins of the alae, which bear numerous tooth-like structures. The eggs are dropped to the ground. In captivity, the species accepts *Rubus* spp., other Rosaceae and *Carpinus betulus* L. (Betulaceae) as alternative food-plants.

Table 1. Measurements [mm] of *Pterulina distinctissima* (Redtenbacher, 1908) comb. nov.

Length of	**HT*** ♂	♂♂	♀♀
Body:		75.2–87.3	109.7–112.7
Head:		3.4–4.1	5.5–6.1
Pronotum:		2.5–2.7	3.7–3.9
Mesonotum:	9	13.2–14.9	23.2–23.7
Metanotum:	8.5	3.5–4.0	8.3–8.5
Median segment:		11.0–11.8	7.3–7.5
Tegmina:		3.9–4.8	
Alae:		33.7–38.0	
Profemora:	36	32.9–37.6	37.9–38.4
Mesofemora:	22	20.3–25.4	23.7–24.9
Metafemora:	27	24.6–30.9	28.3–28.9
Protibiae:		42.1–50.5	41.2–44.6
Mesotibiae:		23.8–27.9	24.1–26.0
Metatibiae:		31.3–38.9	32.4–34.0

* After REDTENBACHER (1908)

DISTRIBUTION (Fig. 1). Known from Bach Ma N.P., Ba Na-Nui Chua N.P., and Kon Chu Rang N.R. in the central Annamite Mountains.

***Pterulina simoensi* sp. nov.**

urn:lsid:zoobank.org:act:A45C70AF-8519-4582-AA4B-BEE5BB333560

Figs (1, 11–17)

ETYMOLOGY. The species is named after Mr. Rob Simoens (Veurne, Belgium) acknowledging his help and support with the authors' study over many years.

TYPE MATERIAL: Holotype ♂: Vietnam, Dak Lak prov., Chu Yang Sin N.P., 650–1000 m,12°27'24"N 108°22'15"E, 9–15.VIII.2019, GTI Project, Leg. J. Constant & J. Bresseel, I.G.:34.048 (RBINS).

Paratypes (4♂♂, 7♀♀): 1♂, 3♀♀: same data as holotype. (RBINS); 3♂♂, 3♀♀: same data as holotype, ex breeding T. Bollens, 2020 (2♂♂, 5♀♀: RBINS; 2♂♂, 2♀♀: VNMN).

ADDITIONAL MATERIAL: Eggs: same data as holotype, ex breeding T. Bollens, 2020 (RBINS).

DIAGNOSIS. The new species much resembles the only other species in the genus: *Pterulina distinctissima* (Redtenbacher, 1908) comb. nov., but is distinctly smaller and more slender.

Males can stridulate but have wings that only reach the posterior margin of tergum III; the distinct colouration of head and body can easily separate them. Females have the colouration like *Pterulina distinctissima* (Redtenbacher,1908) comb. nov. and also have the strongly keeled and laterally flattened subgenital plate, but can easily be distinguished by the apically rounded praeopercular organ, not projecting over posterior margin of sternum VII.

DESCRIPTION. The colouration is described from dried specimens and pictures of live specimens. Measurements: see table 2.

MALE (Figs 11–12, 13A, C–E, 14A).

Colouration: Body colouration constant. Head with black oval area between eyes continued by a broad, black mediolongitudinal stripe; postocular line black starting at base of eye; area between dorsal line and postocular line and beneath postocular line coloured cream-yellow. Pronotum yellowish brown with broad, black mediolongitudinal stripe; prosternum yellowish brown. Mesonotum coloured as metanotum, but with black mediolongitudinal stripe distinctly broader. Mesosternum black, mesofurcasternum yellowish brown; metasternum black with mediolongitudinal pale line. Abdominal terga IV–VIII light brown with outer margins black and with mediolongitudinal black line, IX darker, hemi-tergites almost completely black. Fore legs black with yellowish brown base. Mid and hind legs with femora and tibiae reddish brown (orange brown in dried specimens), apices dark. Tegmina with cream-yellow outer margin, otherwise blackish; alae with costal area black with major veins yellowish, anal area translucent brown.

Head: Longer than wide, slightly narrowing towards the posterior and smooth. Dorsally with faint median line. Vertex slightly elongated and flattened, back of head indented medially and submedially creating four indistinct humps. Area between eyes slightly raised. Eyes circular and strongly projecting hemispherically. Antennae black, projecting over profemora. Antennae with 20–23 segments; scapus strongly dorsoventrally flattened, slightly swollen towards the posterior and broader than antennomeres. Pedicellus very short, knob-like and cylindrical. Antennomeres elongated and covered in minute setae.

Thorax: Pronotum shorter than head, more or less rectangular, with lateral margins indistinctly sinuate; anterior margin concave and slightly raised, followed by transverse depression; medially with longitudinal line, not reaching posterior margin; transverse central depression not reaching lateral margins. Posterior margin more or less straight. Mesonotum more than 5 times longer than pronotum, first slightly narrowing, but later slightly widening in posterior portion; faintly granulose with fine mediolongitudinal carina. Metanotum short, about one third of median segment.

Wings: Tegmina blackish dorsally and yellowish laterally with definite basal hump; broadening towards the posterior, apex broadly rounded. Alae reaching posterior margin of tergum III.

Legs: Profemora laterally flattened and curved basally; about as long as head and thorax (including median segment) combined; all carinae present, medioventral carina indistinct. All carinae armed with minute stiff black setae. Mesofemora about two thirds as long as profemora; straight basally, carinae less distinct; medioventral carina absent, other features as in profemora. Metafemora longer than mesofemora but shorter than profemora, shaped as mesofemora. Protibiae slightly longer than profemora, with all carinae armed with minute stiff black setae. Mesotibiae about as long as mesofemora; shaped as protibiae, but carinae with few minute, but acute spines distally. Metatibiae shorter profemora, shaped as mesotibiae.

Abdomen: Abdominal terga smooth with faint median, longitudinal line. Median segment longest of all abdominal terga. Abdominal terga II–VI more or less the same length, VII–IX

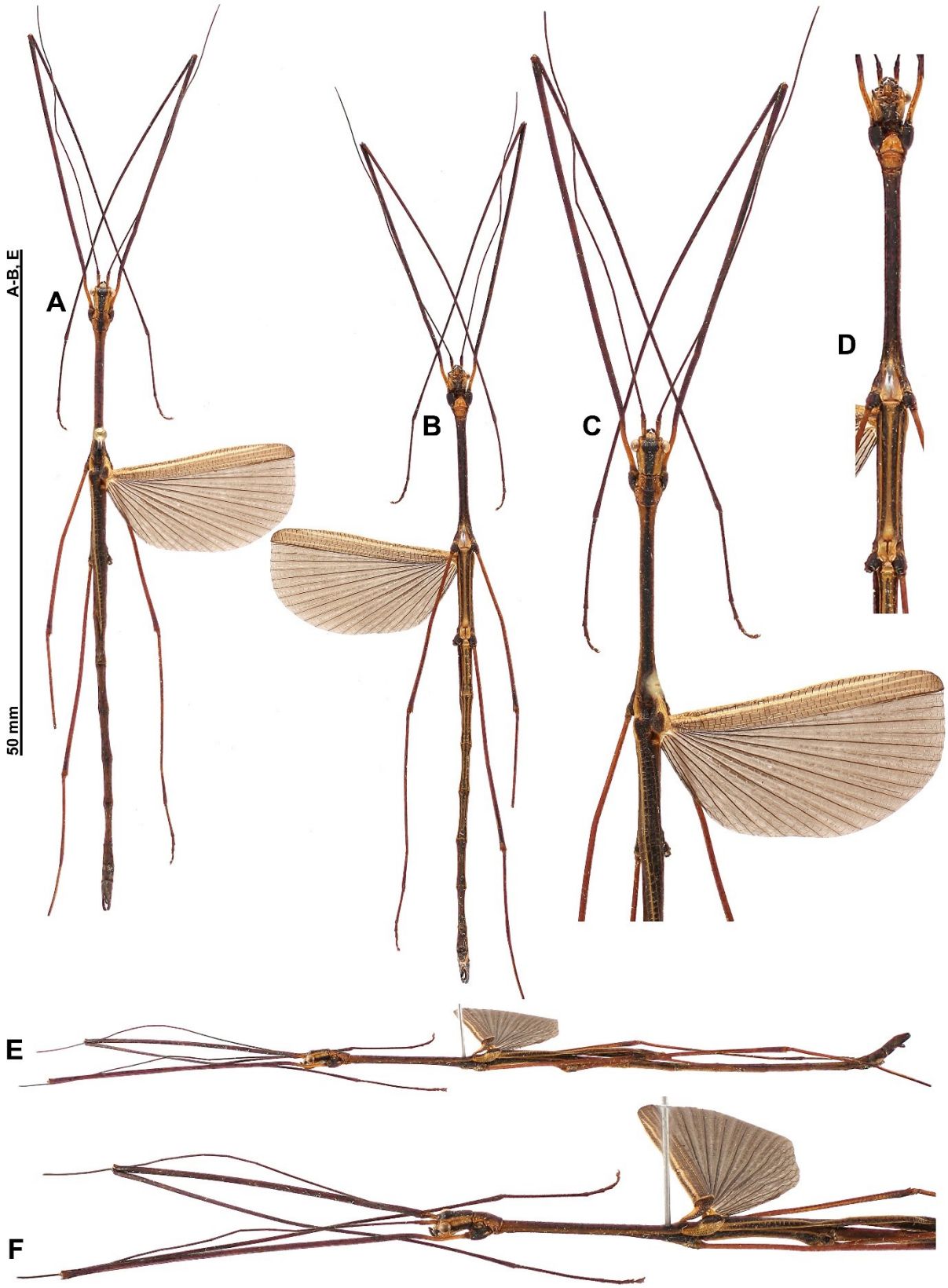


Fig. 11. *Pterulina simoensi* sp. nov., holotype ♂. A, habitus, dorsal view. B. habitus, ventral view. C, head and thorax, dorsal view. D, head and thorax, ventral view. E, habitus, lateral view. F, head and thorax, lateral view.

distinctly getting shorter. Tergum VIII slightly broadening towards the posterior, IX shorter than VIII and tectiform. Anal segment distinctly longer than tergum IX, slightly shorter than VII and with median longitudinal carina; apically split into two hemi-tergites. Inner portion of hemi-tergite armed with black hook-like spines. Hemi-tergites very elongate, slender and tapered towards pointed apex. Poculum moderately elongated, gently rounded, reaching posterior margin of tergum IX; apex narrow, more or less triangular from ventral view. Cerci short, not reaching apex of anal segment, round in cross-section, indistinctly incurving with apices rounded.

FEMALE (Figs 13B, 14B–C, 15).

Colouration: Body and head in different shades of brown, sometimes with darker or paler markings or speckles. Mid- and hind legs distinctly paler than front legs.

Head: Longer than wide, slightly narrowing towards the posterior and granulose with a pair of small tubercles between eyes; vertex slightly elongated and flattened; back of head indented medially and submedially creating four indistinct humps. Eyes circular and strongly projecting hemispherically. Antennae coloured as head; short, slightly projecting over halfway profemora. Antennae with 24–26 segments; scapus strongly dorsoventrally flattened, laterally rounded, distinctly broader than pedicellus and antennomeres. Pedicellus very short, more than three times shorter than scapus; dorsoventrally flattened and laterally rounded. Distal antennomeres distinctly shorter than proximal ones, apical antennomere elongated, club-like.

Fig. 12. *Pterulina simoensi* sp. nov., holotype ♂, terminalia. A, dorsal view. B, lateral view. C, ventral view.

Thorax: Pronotum sparsely granulose, distinctly shorter and narrower than head. Lateral margins slightly sinuate; anterior margin concave and slightly thickened, followed by a transverse depression; medially with longitudinal line, not reaching posterior margin; transverse central depression not reaching lateral margins; prozona with a raised elongate area on each side of mediolongitudinal impression. Posterior margin slightly concave. Mesonotum about six times longer than pronotum, slightly widening in posterior portion; faintly granulose with slightly larger, evenly spaced granules laterally and with fine mediolongitudinal line. Metanotum slightly longer than median segment with fine mediolongitudinal line; anterior and posterior margins straight.

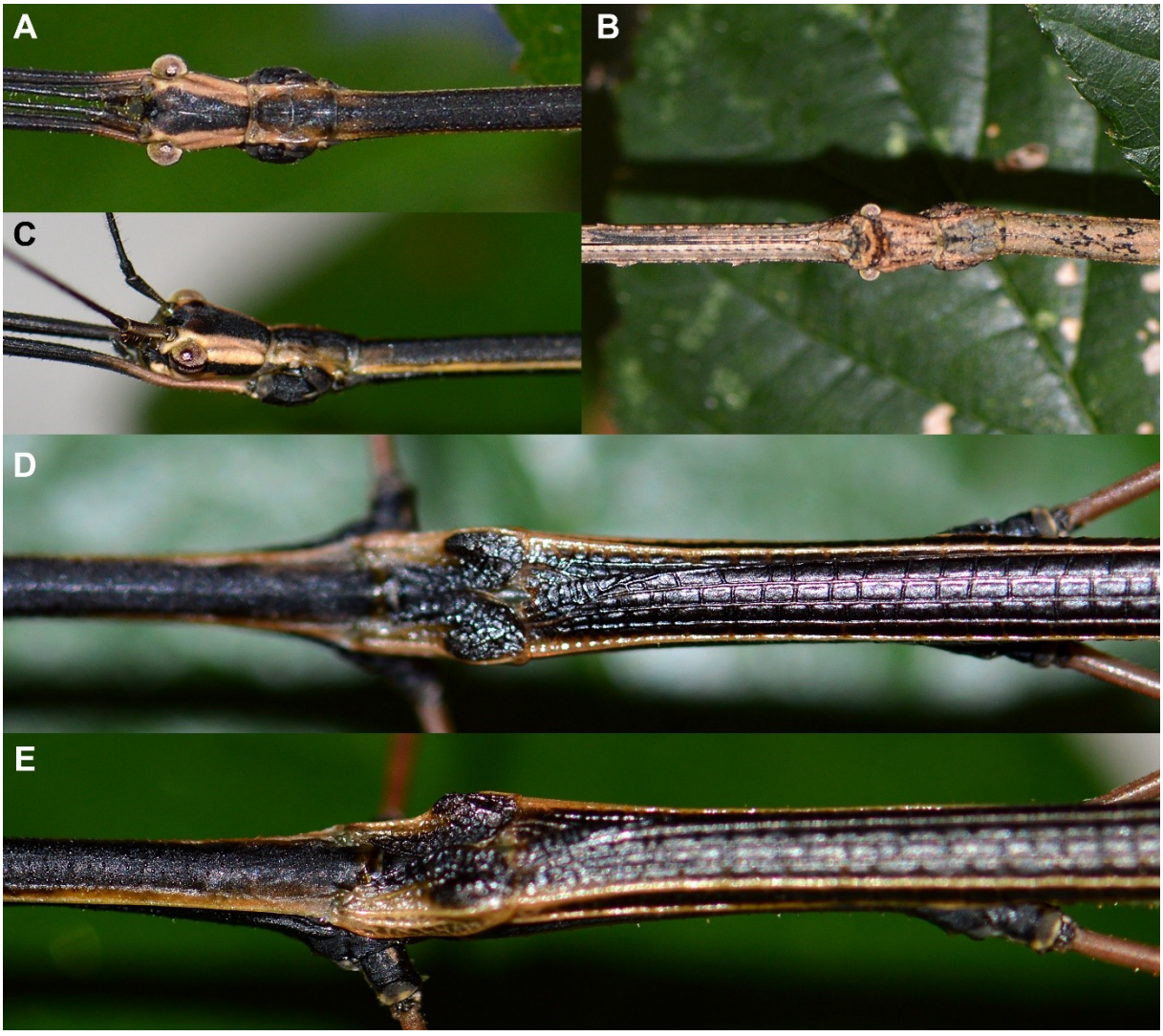


Fig. 13. *Pterulina simoensi* sp. nov. live specimens. A, ♂, head and pronotum, dorsal view. B, ♀, head and pronotum, dorsal view. C, ♂, head and pronotum, lateral view. D, ♂, wings, dorsal view. E, ♂ wings, laterodorsal view.

Legs: Profemora slightly shorter than pro-, meso- and metanotum combined; compressed and strongly curved basally; all carinae present; anterodorsal carina with small teeth, decreasing in number towards the posterior; posterodorsal carina with one to four spaced saw-like spines. Mesofemora distinctly shorter than mesonotum, both dorsal carinae armed with three evenly spaced minute spines. Metafemora projecting over posterior margin of tergum IV, armed as mesofemora. Protibiae carinate, distinctly longer than profemora. Dorsal carinae close to each other, posterodorsal carina with four triangular teeth, one subbasally, one medially and two

Fig. 14. *Pterulina simoensi* sp. nov., live specimens in situ in Chu Yang Sin N.P., A, ♂, dorsal view, 1000 m. B, ♀ nymph, dorsal view, 1600 m. C, ♀, dorsal view, 1000 m.

posteriorly. Posteroventral carina with few minute, acute teeth; medioventral carina slightly raised and laterally flattened. Mesotibiae about as long as mesofemora; posterodorsal carina with few minute spines, anterodorsal carina with minute spine subapically; ventral carinae with few minute spines, more numerous towards the posterior. Metatibiae slightly longer than metafemora, with all carinae armed with minute spines.

Table 2. Measurements [mm] of *Pterulina simoensi* sp. nov.

Length of	**HT** ♂	♂♂	♀♀
Body:	60.8	54.6	82.0–85.1
Head:	3.0	2.8	4.6–4.7
Pronotum:	2.1	2.1	3.2–3.7
Mesonotum:	13.1	11.0	18.7–19.1
Metanotum:	2.7		5.9–6.2
Median segment:	7.3		5.0–5.4
Tegmina:	3.0	2.8	
Alae:	18.9	17.0	
Profemora:	27.5	26.5	21.3–25.2
Mesofemora:	16.9	16.8	15.4–15.5
Metafemora:	21.0	20.6	18.4–18.8
Protibiae:	31.8	29.8	27.1–28.3
Mesotibiae:	17.3	17.2	15.6–15.9
Metatibiae:		24.3	21.7–22.1

Abdomen: Abdominal terga sparsely granulose with faint median, longitudinal line. Median segment slightly shorter than metanotum. Abdominal terga II–V indistinctly gradually increasing in length; VI–X gradually getting shorter. Anal segment concave apically, with lateral margins rounded, posterolateral angles about 90°. Short triangular epiproct visible, slightly projecting over apex; anal segment with mediolongitudinal carina. Sternum VII with a distinct praeopercular organ. Praeopercular organ tapering towards the posterior; anterior portion raised, posterior portion sulcate with posterior margin rounded and not projecting over anterior margin of subgenital plate. Subgenital plate boat-shaped, laterally compressed with mediolongitudinal carina in posterior portion; posterior margin rounded.

NYMPH (Fig. 16). Newly hatched nymphs slender and predominantly light green. Head bigger than pronotum, with black postocular line. Abdomen tipped black. Legs dark with pale markings. Older nymphs brown or a combination of green and brown.

EGG (Fig. 17). Measurements (in mm): length: ~6.5; width: ~1.1; height: ~1.6.

Capsule predominantly dark brown with indistinct pale network, distinctly paler towards micropylar plate; strongly elongated and laterally flattened. Ventral margin convex, dorsal margin more or less straight. Capsule minutely granulose, with two small pale spots near posterodorsal margin and four pale spots on polar area. Polar area distinctly notched in lateral view; posterodorsal and posteroventral angles rounded. Operculum pale, oval with central oval, brown hole in anterior view; surface pale with distinct granulation; opercular rim distinctly paler than capsule, incurving and granulose. Micropylar plate distinct, smooth, coloured as capsule with pale oval marking anteriorly of micropylar cup; margins broad and pale; spear-shaped and almost completely restricted to dorsal surface. Micropylar cup small, yellowish, an almost completely circular swelling with short median line.

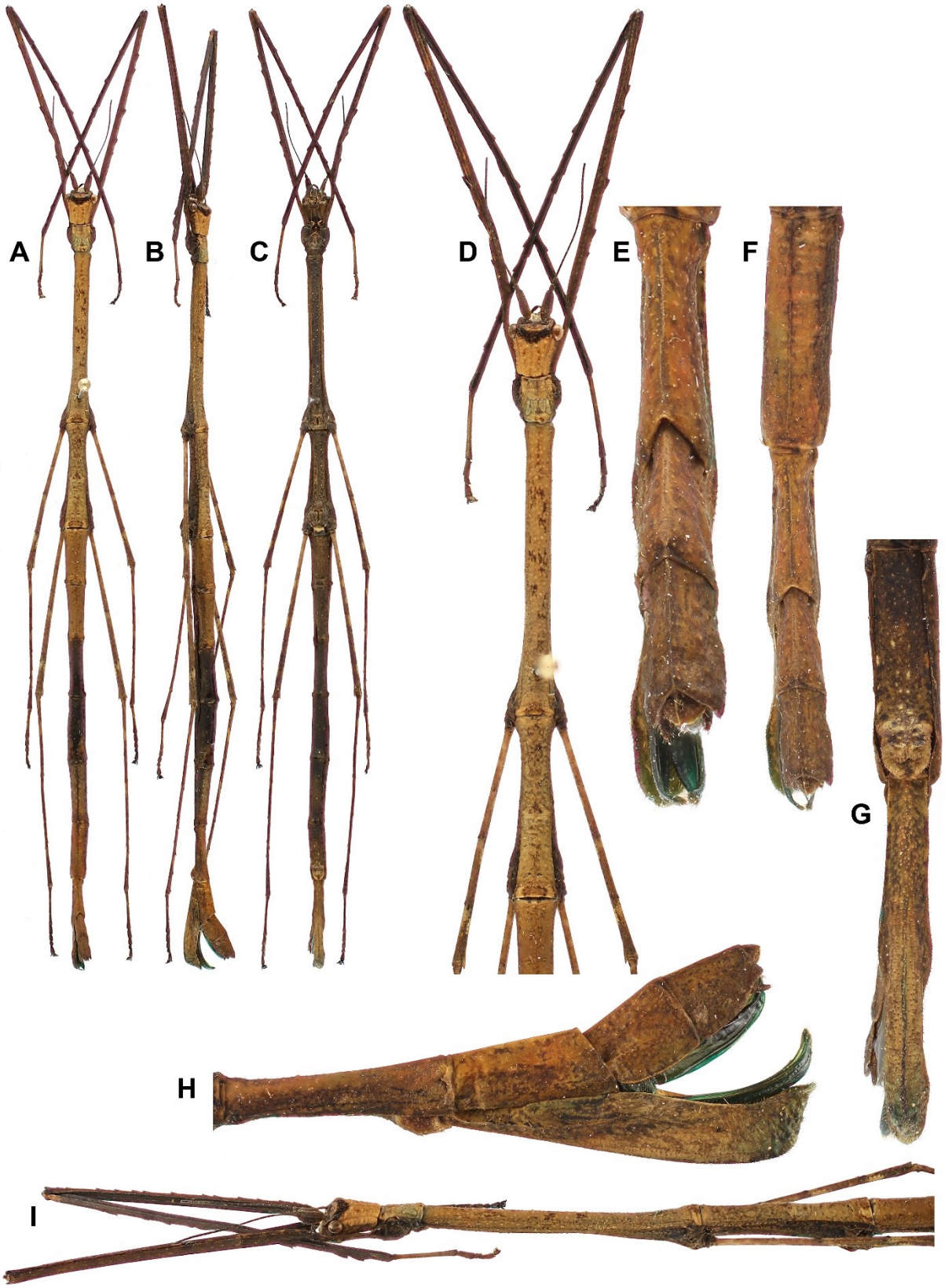


Fig. 15. *Pterulina simoensi* sp. nov., ♀. A, habitus, dorsal view. B. habitus, lateral view. C, habitus, ventral view. D, head and thorax, dorsal view. E, terminalia, anterodorsal view. F, terminalia, dorsal view. G, terminalia ventral view. H, terminalia, lateral view. I, head and thorax, lateral view.

Fig. 16. *Pterulina simoensi* sp. nov., newly hatched nymph. A, dorsal view. B, laterodorsal view. C, detail of head. © T. Bollens.

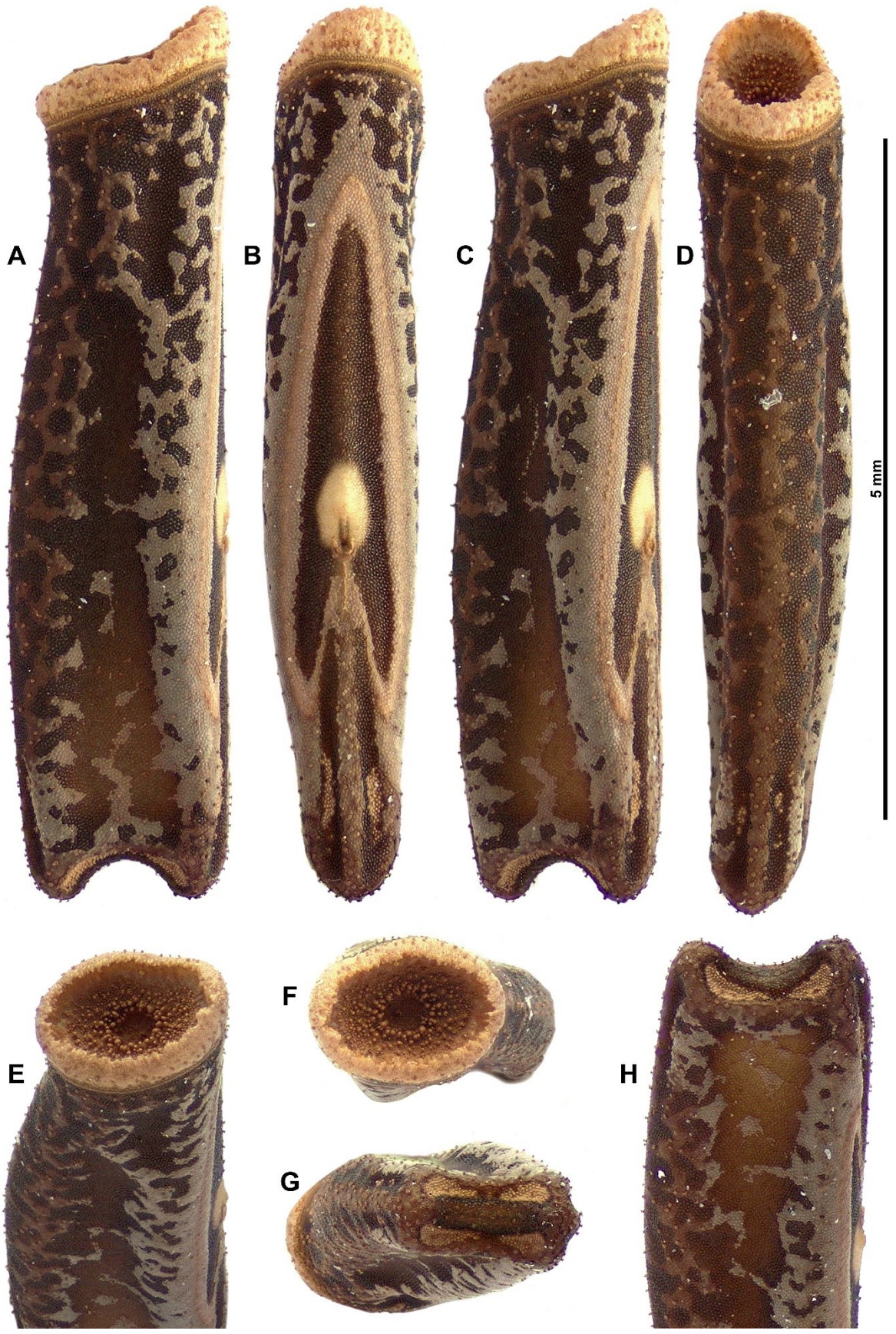


Fig. 17. *Pterulina simoensi* sp. nov., egg. A, lateral view. B, dorsal view. C, laterodorsal view. D. Ventral view. E, anterolateral view. F, operculum. G, polar view. H, polar area, lateral view.

BIOLOGY. The species was collected in mountainous tropical evergreen rainforest, at medium to high altitude (1000–1600 m). The specimens were observed on lower vegetation and seemed to feed on a variety of plant species. Males can stridulate. The eggs are dropped to the ground. In captivity, the species accepts *Rubus* spp. and other Rosaceae as alternative food-plants.

DISTRIBUTION (Fig. 2). This species is only known from Chu Yang Sin N.P. in the southern Annamites.

Discussion

PLACEMENT IN THE CLITUMNINI

BRUNNER VON WATTENWYL (1893) first erected the tribe under the name Clitumnidae which he later corrected to Clitumnini (BRUNNER VON WATTENWYL, 1907). It was in this last publication that the Clitumnini were described and diagnosed from characters like the absence of wings; the short antennae not surpassing the profemora; the short and roughly cylindrical cerci; the medially split anal segment in males and the keeled subgenital plate in females.

HENNEMANN & CONLE (2008) upgraded the tribe to subfamily level which currently includes Pharnaciini Günther, 1953, Medaurini Hennemann & Conle, 2008 and Clitumnini; the tribe was re-diagnosed and revised on the generic level.

The traditional definition of Clitumnini was recently adapted (BRESSEEL & CONSTANT, 2015) to include *Lobofemora* Bresseel & Constant, 2015 which has a comparatively longer median segment, and possesses tegmina and vestigial or short alae in the males.

The tribal placement of *Pterulina* gen. nov. proposed herein is based on a set of characters which key out to Clitumnini following HENNEMANN & CONLE (2008) and BRESSEEL & CONSTANT (2015): Very slender and stick-like insects with elongated legs, sexual dimorphism distinct; head with antennae with less than 28 segments. It has the mesothorax less than 2.5x the combined length of head and prothorax in females, and has tegmina and short alae in the males. Cerci are small, distinctly shorter than the anal segment and circular in cross-section. Males have the anal segment consisting of two movable hemitergites which are minutely toothed interiorly and lack an external, sclerotized vomer; females have a convex and boat-shaped subgenital plate which slightly extends over the anal segment. The armature of the legs is strongly reduced and the medioventral carina of the meso- and metafemora is indistinct and unarmed.

The eggs are elongated, laterally flattened, more or less parallel-sided and seed-like with a specialised rim on the outer border of the operculum, a character shared with several other Clitumnini like *Ramulus* Saussure, 1862 and *Cuniculina* Brunner von Wattenwyl, 1907.

The new genus violates a key character for Clitumnini with males having the antennae distinctly longer than the profemora. The length of antennae in Clitumnini is subject to variation to a certain degree; in several species of *Ramulus* saussure, 1862 the antennae reach two thirds along profemora; but they are almost as long as the profemora in *Cuniculina cunicula* Brunner von Wattenwyl, 1907 (HENNEMANN, 2002). The definition of Clitumnini is therefore expanded in terms of males with antennae at best projecting over profemora, not reaching halfway along the protibiae.

STRIDULATION

Males in both species of *Pterulina* gen. nov. are able to stridulate. To produce sound they use the same stridulation mechanism as *Lobofemora* Bresseel & Constant, 2015. They rubb the

outer margins of the tegmina against the subcostal and radial veins of the alae, which bear numerous very minute tooth-like structures (BRESSEEL & CONSTANT, 2015). The stridulation occurs when the specimens are disturbed.

BIOGEOGRAPHY

The northernmost distribution data of *Pterulina* gen. nov. is Bach Ma National Park which is situated in the central Annamite Mountains and lies on a high mountain ridge that runs west-east from the Laotian border to the East Sea at the Hai Van pass. It acts as a biogeographical border between north and south Vietnam. This can also be observed in the distribution pattern of certain genera of stick insects, e.g. *Neohirasea* Rehn, 1904, *Micadina* Redtenbacher, 1908 and *Pachyscia* Redtenbacher, 1908 have their southern distribution limit at Bach Ma N.P. (HO, 2018a, b; Bresseel & Constant, unpublished data) while *Pterulina* gen. nov., *Lobofemora* Bresseel & Constant, 2015 and *Phamartes* Bresseel & Constant, 2013 have their northernmost distribution limit a this same place (BRESSEEL & CONSTANT, 2013, 2015, unpublished data).

The Annamite Range, the region's dominant upland formation, runs from northwest to southeast through Laos, Vietnam, and northeastern Cambodia for roughly 1200 km. It represents an area (or areas) of high endemism and its origin lies with a series of folding events, the Indosinian Orogeny that took place 400–350 Mya, establishing mountains that would later become parts of the Hoang Lien Son and the northern Annamite ranges. This was followed 350–300 Mya by the formation of uplands in Vietnam's Central and Southern Annamites. The Southern Annamites consist of a suite of plateaus that are isolated geographically from the Central Annamites. It is also a younger formation created by different orogenies than those that uplifted the Central Annamites (BAIN & HURLEY, 1966). *Pterulina distinctissima* (Redtenbacher, 1908) comb. nov. and *P. simoensi* sp. nov. occur in the Central and Southern Annamites respectively.

It could be hypothesised that populations of the ancestors of *Pterulina* gen. nov. got isolated during this period of uplifting, which resulted in the evolution of different species.

Acknowledgments

We thank Dr Hong Thai Pham (VNMN) and his colleagues: Mr Van Dat Nguyen, Mr Thanh Trung Vu, Mrs Thi Thu Huong Nguyen, Mrs Thi Man Nguyen and Mr Hoang Vu Tru (IEBR), and Mr Xavier Vermeersch (collaborator, RBINS) for all their help and friendship during the collecting trips; the authorities of the protected areas where we have sampled, for supporting our studies. We are deeply indebted to Tim Bollens (Herselt, Belgium) for breeding and photographing both species and providing additional material. Mr Emmanuel Delfosse and Dr Tony Robillard (MNHN) are thanked for their help during our visit to MNHN; Dr Patrick Grootaert, Dr Yves Samyn and Dr Marie-Lucie Susini (RBINS) for their permanent support to our projects in Vietnam and Miss Mado Berthet (RBINS) for adjusting the plates illustrating the paper. This paper is a result of the projects "A step further in the Entomodiversity of Vietnam" (2010–2019) supported through a grant issued by the capacity building Programme of the Belgian Global Taxonomy Initiative National Focal Point that runs under the CEBioS programme with financial support from the Belgian Directorate-General for Development Cooperation (DGD).

References

BAIN R.H. & HURLEY M.M., 1966 - A biogeographic synthesis of the amphibians and reptiles of Indochina. *Bulletin of the American Museum of Natural History*, 360(360): 1–138.

BRESSEEL J. & CONSTANT J., 2013. - *Phamartes coronatus* gen. nov. sp. nov. a new genus and species of stick insect from Bach Ma National Park, central Vietnam (Phasmida, Diapheromeridae, Necrosciinae). *Zootaxa,* 3741(1): 141–150.

BRESSEEL J. & CONSTANT J., 2015. - The new genus of stick insect *Lobofemora* from Vietnam, with the description of three new species (Phasmida: Phasmatidae: Clitumnini). *European Journal of Taxonomy*, 115: 1–25. http://dx.doi.org/10.5852/ejt.2015.115.

BRESSEEL J. & CONSTANT. J., 2019. - The new Oriental stick insect genus *Baculomia* gen. nov. with two new species from Vietnam including the first stick insect feeding on sugarcane (Phasmida, Phasmatidae, Clitumninae, Clitumnini). *Belgian Journal of Entomology*, 87: 1–25.

BROCK P.D., BÜSCHER T. & BAKER E., 2020. - Phasmida Species File Online. Version 5.0/5.0. [03-11-16]. http://Phasmida.SpeciesFile.org (accessed 20.IV.2020).

BRUNNER VON WATTENWYL K., 1893. - Révision du Système des Orthoptères et description des espèces rapportées par M. Leonardo Fea de Birmanie.*Annali del Museo Civico di Storia Naturale Giacomo Doria, Genova,* (2)13(33): 1–230.

BRUNNER VON WATTENWYL K., 1907. - *Die Insektenfamilie der Phasmiden. II. Phasmidae Anareolatae (Clitumnini, Lonchodini, Bacunculini).* Verlag W. Engelmann, Leipzig. pp. 181–340.

CLARK-SELLICK J.T., 1997. - Descriptive terminology of the phasmid egg capsule, with an extended key to the phasmid genera based on egg structure. *Systematic Entomology*, 22(2): 97–122.

CLARK-SELLICK J.T., 1998. - The micropylar plate of the eggs of Phasmida, with a survey of the range of plate form within the order. *Systematic Entomology*, 23: 203–228.

DELFOSSE E., CLIQUENNOIS N., DEPRAETERE M. & ROBILLARD T., 2019. - Catalogue des types de la collection de phasmes du Muséum national d'Histoire naturelle de Paris (Insecta, Phasmatodea). *Zoosystema,* 41(11): 181–235.

HENNEMANN F., 2002. - Notes on the Phasmatodea of Sri Lanka (Orthoptera). *Mitteilungen der Münchner Entomologischen Gesellschaft,* 92: 37–78.

HENNEMANN F.H. & CONLE O.V., 2008. - Revision of Oriental Phasmatodea: The tribe Pharnaciini Günther, 1953, including the description of the world's longest insect, and a survey of the family Phasmatidae Gray, 1835 with keys to the subfamilies and tribes (Phasmatodea: "Anareolatae": Phasmatidae). *Zootaxa,* 1906: 1–316.

HO G.W.C., 2018a. - The genus *Neohirasea* Rehn (Phasmatodea: Diapheromeridae: Necrosciinae) from Vietnam. *Zoological Systematics*. 43(1): 37–51.

HO G.W.C., 2018b. - First report of the genus *Micadina* Redtenbacher (Phasmatodea: Diapheromeridae) from Vietnam, with description of a new species. *Entomotaxonomia*. 40(4): 253–256.

OTTE D. & BROCK P.D., 2005. - *Phasmida Species File. Catalog of Stick and Leaf Insects of the world, 2nd Edition*. The Insect Diversity Association and the Academy of Natural Sciences, Philadelphia, CafePress.com.

REDTENBACHER J., 1908. - *Die Insektenfamilie der Phasmiden. III. Phasmidae Anareolatae (Phibalosomini, Acrophyllini, Necrosciini).* Leipzig, 3: 339–589.

SHORTHOUSE D.P., 2010. - SimpleMappr, an online tool to produce publication-quality point maps. [Retrieved from http://www.simplemappr.net. Accessed 11.I.2020].

STERLING E.J. & HURLEY M.M., 2005. - Conserving Biodiversity in Vietnam: Applying Biogeography to Conservation Research. *Proceedings of the California Academy of Sciences*, 56(9): 98–114.