Review of the genus *Hemielimaea* Brunner von Wattenwyl, 1878 (Orthoptera, Tettigoniidae)

Sigfrid Ingrisch & Andrej V. Gorochov

The type species of the genus *Hemielimaea*, *H. chinensis* Brunner von Wattenwyl, 1878 is redescribed and a lectotype for *H. chinensis* is selected. Three species are described as new: *Hemielimaea (H.) caricercata* Ingrisch sp. n. and *H. (H.) kuatun* Ingrisch sp. n., both from Fujian, China, and *H. (H.) omeishanica* Gorochov sp. n. from Sichuan, China. *Hemielimaea (H.) mannhardti* (Krausze, 1903) is restored to full species status. *Hemielimaea (Pseudelimaea) cucullata* Ingrisch, 1990 is synonymised with *H. (P.) procera* Ingrisch, 1990. A deviating stridulatory file with a distinctive fold near posterior end is described for *Hemielimaea (H.) tonkinensis* Dohrn, 1906. A tabular identification key for the species of *Hemielimaea* is provided. The principle structures used for differentiation of the species are male phallic sclerite, male stridulatory apparatus comprising both tegmina, details of the stridulatory file, male cerci, male and female subgenital plates, and base of ovipositor. The distribution of the *Hemielimaea* species is discussed and mapped.
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Introduction

The genus *Hemielimaea* Brunner von Wattenwyl, 1878 formed part of the group Elimaeae Brunner, 1878, that is now regarded as a tribe (Otte et al. 2006) containing only three genera *Elimaea* Stål, 1874, *Ectadia* Brunner von Wattenwyl, 1878 and *Hemielimaea* (Brunner von Wattenwyl 1878).

The type species of *Hemielimaea* is *H. chinensis* Brunner von Wattenwyl, 1878. This species was described from China without exact location with syntypes in both, the museum of Budapest and Brunner's collection. Unfortunately Gorochov (2004) supposed the syntypes of *H. chinensis* to be lost and selected a neotype from Omeishan in Sichuan Prov. of China. Studying Tettigoniidae of the old collection of Klapperich from Fujian, China (collected 1937–1938), which is now in part in the Research-Museum Alexander Koenig in Bonn (ZFMK), the senior author found a small series of *Hemielimaea* agreeing fairly well with Brunner von Wattenwyl's, (1878) description of *H. chinensis* but not with that in Gorochov (2004). That gave initiation of searching for the original types in the Vienna collection (NHMW) and to re-evaluate the status of previously described taxa. Moreover, in the Klapperich collection there are two more undescribed *Hemielimaea* species. Those facts stimulated us to write another contribution on *Hemielimaea*.

Material and methods

All images were prepared with a digital, 8000 megapixel, camera with macro function for habitus images or a 4500 megapixel camera mounted on a stereomicroscope for detail images. Occasionally, detail photographs were shot through the ocular of a stereomicroscope. Images were then processed with standard image editing and layout software.

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Depositories and their abbreviations

CI	Collection Ingrisch
EMBT	Department of Agriculture, Kasetsaht University, Bangkok, Thailand
MHNG	Musèum d'Histoire naturelle de Genève, Switzerland
MIZP	Muzeum i Institut Zoologii, Polska Akademia Nauk, Warszawa, Poland
NHMW	Naturhistorisches Museum, Vienna, Austria
SMF	Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt/M, Germany
ZFMK	Zoological Research Museum "Alexander Koenig", Bonn, Germany
ZIAS	Zoological Institute, Russian Academy of Science, St. Petersburg, Russia

Systematic part

Hemielimaea Brunner von Wattenwyl

Hemielimaea Brunner von Wattenwyl, 1878: 103. Typus generis: *H. chinensis* Brunner von Wattenwyl, 1878, by monotypy.
Elimaea (Hemielimaea); Ingrisch, 1998: 76.
Hemielimaea; Gorochov, 2004: 359.

Discussion

Hemielimaea differs from *Elimaea* by the tibial tympana being open on external side and covered with a conchate fold on internal side, while in *Elimaea* they are covered on both sides. Later Karny (1926) divided *Elimaea* in three subgenera based on the fore femur being straight or curved and on the furcation of the radius in the forewing. In a review of the Elimaeini, it was found that both *Hemielimaea* and the subgenus *Rhaebelimaea* Karny, 1926 possess phallic sclerites while in *Elimaea* s.str. and the subgenus *Orthelimaea* Karny, 1926 they are absent (Ingrisch 1998). The author discussed three phylogenetic hypotheses of relationships between the genera and subgenera of Elimaeini. As a result, it was proposed to include *Hemielimaea* as a subgenus in *Elimaea*. The alternative was to raise all subgenera of *Elimaea* to full genera.

The tribal division of Phaneropterinae is far from settled. Therefore, Ragge (1980) did not propose any tribal classification in his review of African Phaneropterinae. Recently, Gorochov & Kang (2002) studying Chinese genera of Ducetiini, discussed the close relationship of those genera to Elimaeini based on the possession of an "additional stridulatory area" behind the stridulatory area proper that is most distinct on the lower, right tegmen. Moreover males of Elimaeini have the abdominal apex very similar to that of *Ducetia* Stål, 1874, *Prohimerta* Hebard, 1922 and *Shirakisotima* Furukawa, 1963. Ducetiini have open tympana on both sides. It is impossible to exclude that the appearance of covered tympana in different genera or of Elimaeini is the result of convergence and that some of the subgenera of *Elimaea* are different genera (Gorochov 2004). He thus gave *Hemielimaea* generic status again. Moreover, he divided it into two subgenera: *Hemielimaea* s.str. and *Pseudelimaea* Gorochov, 2004; the latter with *Hemielimaea tonkinensis* Dohrn, 1906 as type species.

The two subgenera, *Hemielimaea* s.str. and *Pseudelimaea*, differ in the shape of the subgenital plates of both sexes and the structure of the male phallic sclerites. In *Hemielimaea* s.str. the apices of the distal lateral lobes of the male subgenital plate are deviating; the male phallic sclerite is unpaired with bifurcate distal part and usually provided with a ventral keel-like apodeme, the female subgenital plate is deeply divided in distal part resulting in two long angular lobes with acute apex. In *Pseudelimaea* the distal lobes of the male subgenital plate are almost completely parallel to each other without deviating apices, the male phallic sclerites are paired with stick-like basal and semicircular distal parts; the female subgenital plate is rounded, truncate or slightly emarginated at apex.

Identification of species

Ingrisch (1998) introduced the use of the stridulatory file as diagnostic character for Elimaeini and used it together with cerci, subgenital plate, phallic sclerite and others for separation of the species. Gorochov (2004) used the structure of the stridulatory area of the lower (= right) tegmen and the phallic sclerite as the main diagnostic characters together with the cerci and the apex of the subgenital plate. In the current paper we add the shape of the stridulatory area of the upper (= left) tegmen and its relations to other areas of the tegmen. No identification tools that cover most of the *Hemielimaea* species are so far published. We suspect that more species will be discovered. Thus we provide a tabular key of the main diagnostic characters (table 1) that can be easily extended.

It should be noted that we did not see any specimen of *H. formosana*. The original description, which is the only available, does not allow extracting all the characters necessary for comparison with the other species. Three species are only known in one sex: of *H. reducta* only males are known, and of *H. sergeii* and *H. nigerrima* only females.

The male phallic sclerites and the stridulatory areas of both left and right tegmina are illustrated in Figs 34–69. Additional illustrations of diagnostic characters as e.g. the female subgenital plate can be found in Gorochov (2004).

Hemielimaea (Hemielimaea) chinensis Brunner von Wattenwyl

Figs 3–4, 7, 10, 13, 18, 23, 27, 29, 34, 54, 60

Hemielimaea chinensis Brunner von Wattenwyl 1878: 104. Lectotype ♂ (here designated): labeled "Coll. Br. v. W. | China | *Frivaldsky*", "det. Br. v. W. | *Hemielimaea* | *chinensis Br.*" and "*10.727*" [handwritten text in italics, remainder printed]. (NHMW) [examined].

Elimaea (Hemielimaea) chinensis; Ingrisch 1998: 69.

Re-description

Male. Stridulatory vein 3.5–3.6 mm, strongly bulging on dorsal side of tegmen (Fig. 4); as long as or slightly longer than greatest width of pronotal disc in posterior area (3.3–3.5 mm). Stridulatory teeth on underside of left tegmen numerous (circa 330–380 teeth) and densely packed (95–108 teeth per mm, Fig. 10). Mirror of right (= lower) tegmen wider than long (2.1–2.2 against 1.8–2.0 mm); distance between proximal heavily sclerotized vein and apex of mirror 2.3–2.4 mm; maximal width of dorsal tegminal part behind mirror rather narrow (2.5 mm, Fig. 7). Cerci 4.2 mm long, with straight basal part and curved and slightly compressed apical part (Fig. 18). Subgenital plate curved in an almost 90°-angle, upcurved area dived and apical parts deviating (Fig. 13). Phallic sclerite with long, narrow furcae (Fig. 23), dorsal margin in lateral view sinuate, serrate (Fig. 27); ventral apodeme present, keel-like.

Coloration. Yellowish brown (probably green when alive). Head with a dark brown medial band between eyes to occiput, interrupted by three narrow light lines and bordered on both sides by a fine light line. Antennae dark brown (especially on dorsal side when antennae directed anteriorly) with spaced white annulation. Pronotum with disc dark to medium brown, lateral lobes yellow. Tegmen with a black spot at base of stridulatory area; otherwise stridulatory area light in anterior, dark brown in posterior area; stridulatory vein light; mirror of right tegmen transparent; dorsal area behind stridulatory area dark brown with light venules; remainder of tegmen yellow with piles of dark dots in cells of medial and cubital fields. Remainder of body almost unicolorous.

Female. Right (= lower) tegmen with basal area of dorsal field carrying short rows of small teeth on the veinlets running into the inner margin. Subgenital plate deeply notched in middle; resulting lobes covering base of ovipositor laterally and terminating into one, two or three spines (Fig. 29). Ovipositor sickle-shaped with rounded apex; dorsal margin and apex of ventral margin serrulate; gonangulum simply angular. Coloration as in male, but middle of occiput and anterior margin of disc of pronotum can be light.

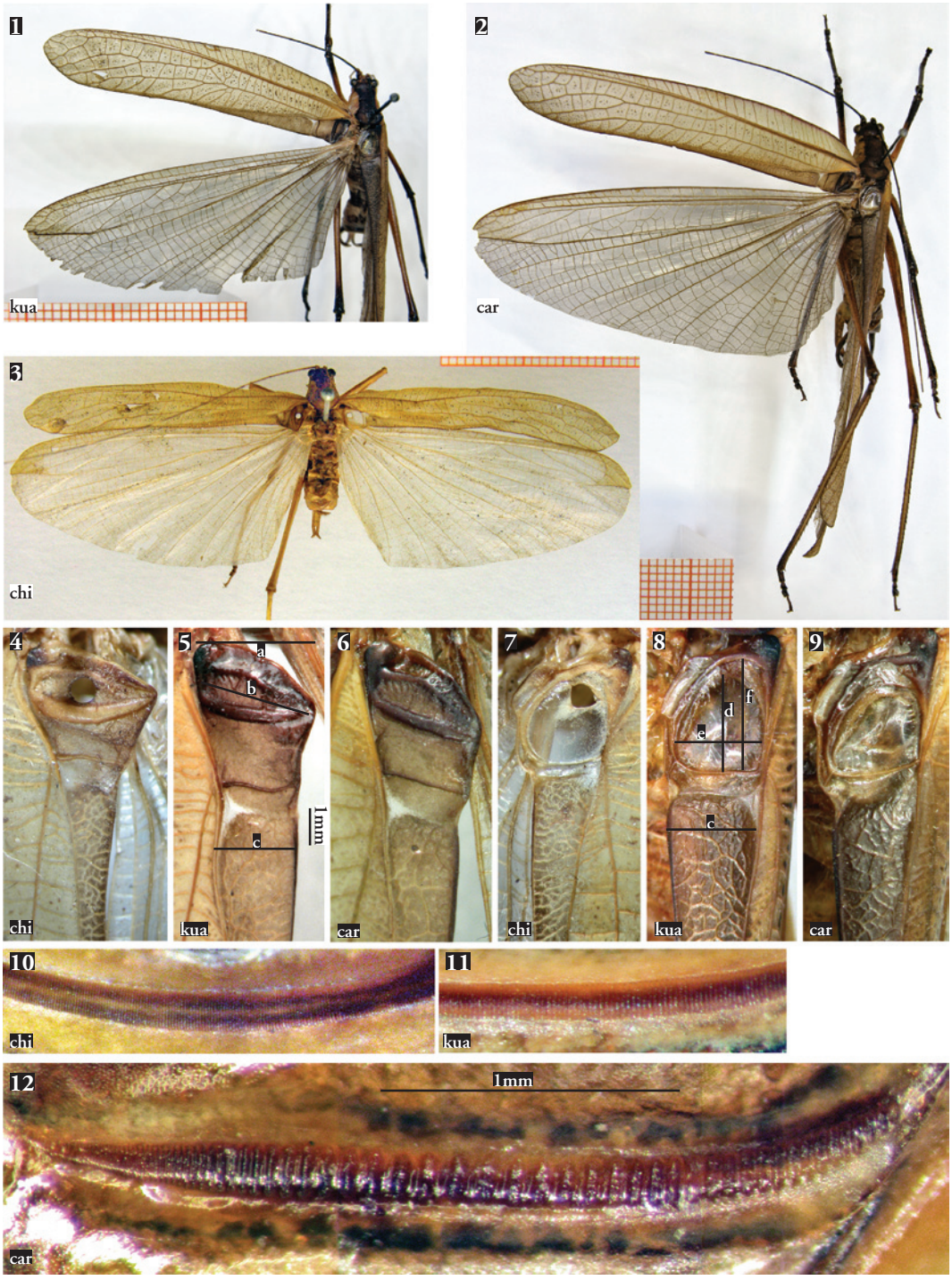
Measurements. (2♂, 2♀): Body with wings ♂ 48–52, ♀ 48–50; body without wings ♂ 25–26, ♀ 26; pronotum ♂ 4.8–5.3, ♀ 4.9–5.1; tegmen ♂ 38–40, ♀ 36–38; tegmen width ♂ 7.2–7.7, ♀ 7.2–7.3; hind femur ♂ 23.5–25.5, ♀ 24.5–25.5; ovipositor ♀ 6.5 mm. – Ratio tegmen length to width ♂ 5.19–5.28, ♀ 5.00–5.21.

Discussion

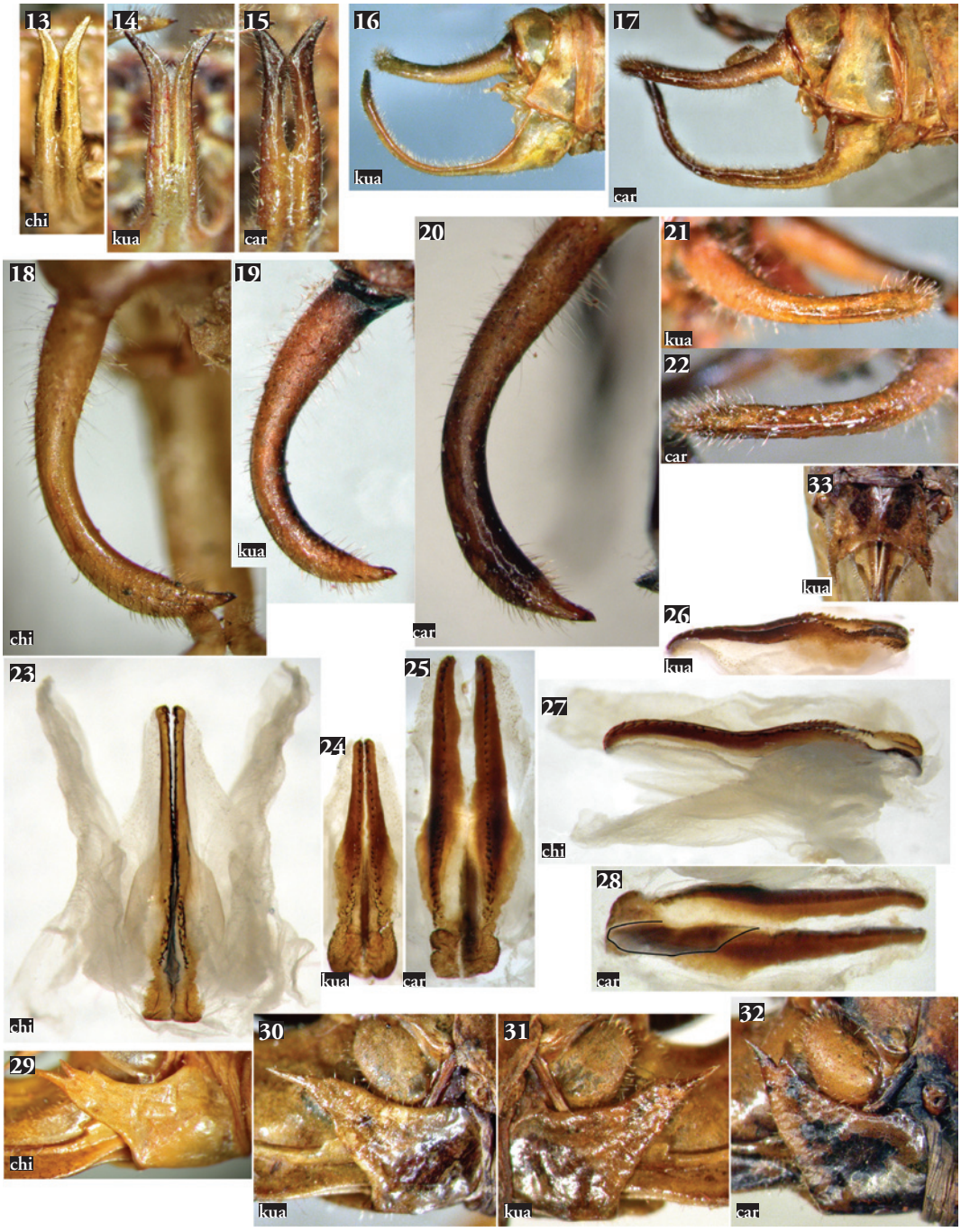
The species is characterized by the strongly, angularly projecting stridulatory area of the male tegmen, the dorsal area of the tegmen behind the stridulatory area not widened, and the long stridulatory vein with a very high number of densely packed teeth. Those characters are so far unique within *Hemielimaea* and make *H. chinensis* easily recognizable. *H. chinensis* was described after an unknown number of syntypes deposited in the museums in Budapest and in the Brunner von Wattenwyl collection now in NHMW. The specimens in Budapest are probably lost but there are three males and two females in NHMW. No type labels are attached to the specimens. All five specimens are labeled "Coll. Br. v. W. | China | *Frivaldsky*" and "det. Br. v. W. | *Hemielimaea* | *chinensis Br.*". Additionally, one male and one female carry a green label "6." and one female "5.". One male carries a blue label with Brunner's collection number '10.727' that was explicitly mentioned with the original description. This male is selected here as the lectotype of *H. chinensis*. Gorochov (2004) selected a neotype for *H. chinensis*, which is however invalid as at least part of the type series still exists. *H. chinensis* was so far known from China without precise locality. The specimens from the Klapperich collection in ZFMK Bonn come from the Wuyi Shan Mountains in Fujian and are the first precise localization of the distribution area of the species.

H. chinensis is similar to *H. omeishanica* and *H. mannhardti*. It differs strikingly by the male stridulatory apparatus.

Material examined. 4♀ 5♂. **China:** China, Frivaldsky 2♂ paralectotypes, 2♀ paralectotypes (NHMW); Fujian, Wuyi Shan Mountains, Shaowu, 500 m, 27°18' N, 117°30' E, 21.v.1937, leg. J. Klapperich 2♂ 3♀ (ZFMK).



Figs 1–12. *Hemielimaea* males: 1, 5, 8, 11, *H. kuatun* (holotype); 2, 6, 9, 12, *H. caricercata* (holotype); 3–4, 7, 10, *H. chinensis* (lectotype). – 1–3, Habitus dorsal view; 4–6, stridulatory area of left (= upper) tegmen; 7–9, stridulatory area of right (= lower) tegmen; 10–11, central part of stridulatory file on underside of left tegmen; 12, full stridulatory file. Marked lines indicate how measurements were taken: a, width of stridulatory area; b, length of stridulatory vein (also measured on underside of tegmen to calculate the number of teeth per mm); c, greatest width of dorsal field behind stridulatory area; d, length of mirror; e, width of mirror; f, distance between proximal heavily sclerotized vein and apex of mirror.



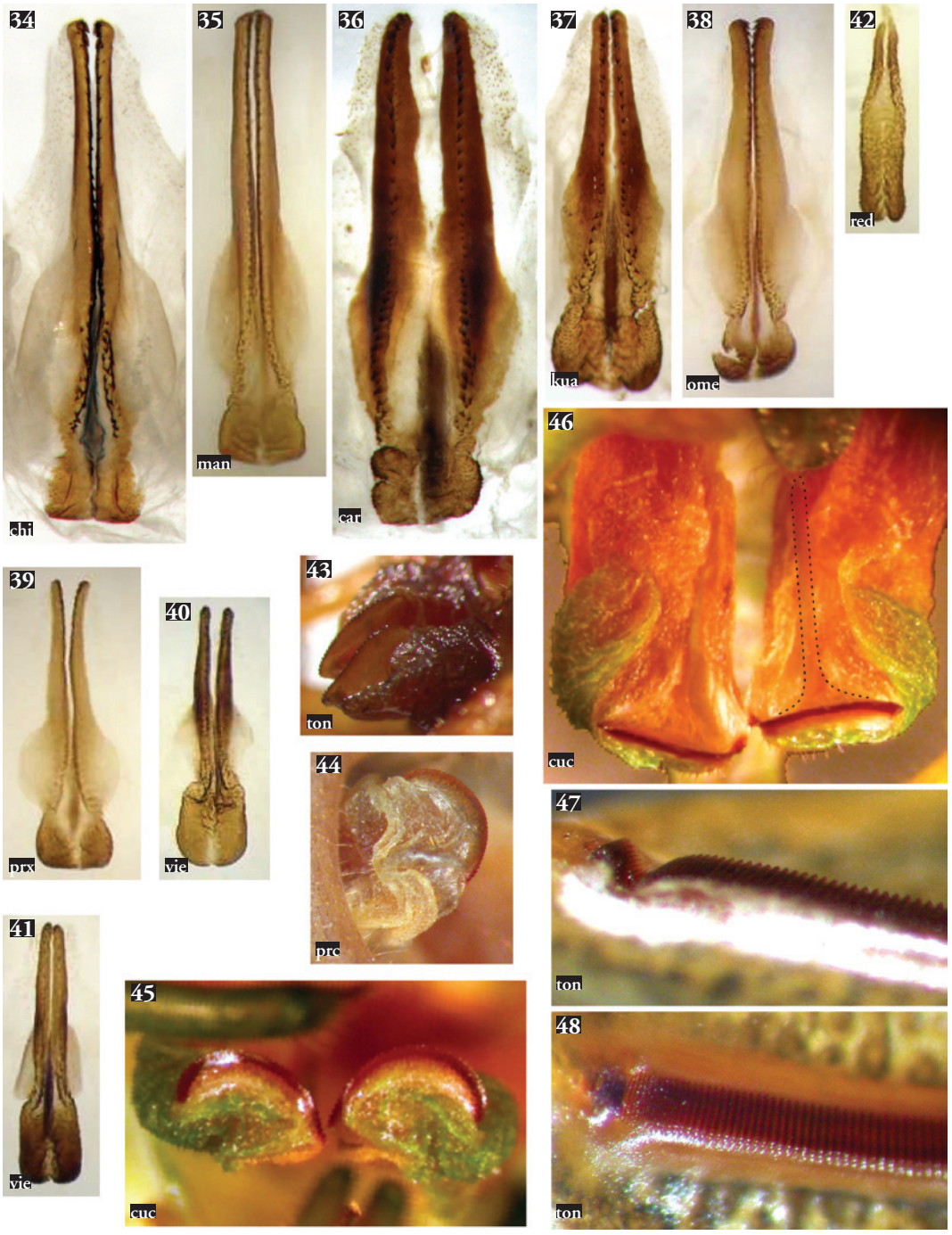
Figs 13–33. *Hemielimaea* species: 13, 18, 23, 27, 29, *H. chinensis* (13, 18, lectotype; 23, 27, male from Shaowu; 29, paralectotype); 14, 16, 19, 21, 24, 26, 30–31, 33, *H. kuatun* (14, 16, holotype; 19, 21, 24, 26, male paratype; 30–31, 33, female paratype); 15, 17, 20, 22, 25, 28, 32, *H. caricercata* (15, 17, 20, 22, 25, 28, holotype; 32, paratype). – 13–15, Apical area of male subgenital plate; 16–17, male abdominal apex in lateral view; 18–20, male cercus in dorsal view; 21–22, distal area of male cercus in apico-lateral view (arrows pointing to external angle); 23–25, male phallic sclerite in dorsal view (23, including membranous parts of phallus); 26–27, male phallic sclerite in lateral view (27, including membranous parts of phallus); 28, male phallic sclerite in ventral view (outline of apodeme contrasted by stippled line); 29–32, female subgenital plate in lateral view; 33, do. in ventral view. Scales = 1 mm.

Table 1. Synoptic table of characters for identification of species of the genus *Hemielimaea.* [spread]

Subgenus	*Hemielimaea*					
Species	*H. chinensis*	*H. caricercata*	*H. kuatun*	*H. mannhardti*	*H. omeishanica*	*H. proxima*
Characters male:						
Subgenital plate[1] with distal part curved dorsad in	80-90°	80°	60°	80-90°	90°	60-70°
Subgenital plate distal lobes	deviating at apex, angular	deviating at apex, angular	deviating at apex, angular	deviating at apex, angular	deviating at apex, angular	deviating at apex, angular
Phallic complex with	unpaired bifurcate sclerite	unpaired bifurcate sclerite	unpaired bifurcate sclerite	unpaired bifurcate sclerite	unpaired bifurcate sclerite	unpaired bifurcate sclerite
Genital sclerite with	keel-like medial apodeme	keel-like medial apodeme	keel-like medial apodeme	keel-like medial apodeme	keel-like medial apodeme	keel-like medial apodeme
Stridulatory area of left tegmen with inner margin	strongly projecting	moderately projecting	moderately projecting	little projecting	moderately projecting	little projecting
Length of stridulatory vein	3.5–3.6 mm	2.9 mm	2.8–2.9 mm	3.8 mm	4.4 mm	3.2 mm
Number of teeth on stridulatory file	330–380	87	235–252	110–120	340–350	200
Teeth per mm	95–108	29.8	83–87			
Teeth per mm in middle of file	85–116	13	66–71	18–20	49–50	44
Stridulatory teeth	narrow throughout	wide in proximal, narrow in distal area	narrow throughout	simple	narrow throughout	narrow throughout
Index stridulatory file / max. width of dorsal field behind strid. area	2.51–2.94 [2.54, 2.67]	1.60	1.17-1.32	1.44	1.65	1.29
Mirror of right tegmen length to width	0.85–0.91	0.97	1.04–1.14	1.00	1.10	1.07
Max. width of dorsal area behind mirror	2.5 mm	1.9 mm	2.1–2.4 mm	3.4 mm	3.5 mm	3.0 mm
Cerci length	4.2 mm	5.2 mm	3.5–3.7 mm	5 mm	5 mm	4 mm
Cerci external margin in apical area	angular	angular	angular	angular	angular	angular
Female:						
Subgenital plate	divided into 2 lobes with acute apex	divided into 2 lobes with acute apex	divided into 2 lobes with acute apex	divided into 2 lobes with acute apex	divided into 2 lobes with acute apex	divided into 2 lobes with acute apex
Lobes of subgenital plate at external margin		with 1 acute projection	with a step (constriction)		with 1–2 acute projections	with 1–3 tuberculate projections
Ovipositor ventral valves						

[1] in lateral view
[2] only the male is known
[3] only the female is known
[4] species not known to either of us; information compiled from original description
[5] synonym of *H. procera*; listed separate to support the synonymy

H. reducta[2]	*H. vietnamensis*	*H. formosana*[4]	*Pseudelimaea* *H. tonkinensis*	*H. procera*	*H. cucullata*[5]	*H. sergeii*[3]	*H. nigerrima*[3]
30-40°	30-40°		straight	20-30°	20-30°	./.	./.
deviating at apex, angular	deviating at apex, angular	deviating at apex, angular	parallel, apex obtuse	parallel, apex obtuse	parallel, apex obtuse	./.	./.
unpaired bifurcate sclerite largely reduced	unpaired bifurcate sclerite		paired sclerites with serrate ovoid apex	paired sclerites with serrate disc-like apex	paired sclerites with serrate disc-like apex	./.	./.
	keel-like medial apodeme		basal stick-like part curved	basal stick-like part straight	basal stick-like part straight	./.	./.
moderately projecting	moderately projecting	little projecting	moderately projecting	little projecting	little projecting	./.	./.
2.5 mm	3 mm		3.8 mm	2.4 mm	2.4 mm	./.	./.
320–330	120		113	99	90–109	./.	./.
			29. 7	41 (mean)	44.7 (mean)	./.	./.
90	18 (middle) 45-46 (distal)		41	20.5 (proximal) 65 (distal)	20 (proximal) 65 (distal)	./.	./.
narrow throughout	wide in proximal, narrow in distal area		file with subapical fold with 20 teeth	wide in proximal, narrow in distal area, separated by a step	wide in proximal, narrow in distal area, separated by a step	./.	./.
1.69	1.55		1.44	1.60	1.58	./.	./.
0.81	0.92		0.95	1.04	1.00	./.	./.
2 mm	2.7 mm		2.7 mm	2.1 mm	1.9 mm	./.	./.
3.7 mm	3.8 mm		3.4 mm	4.0 mm	3.8 mm	./.	./.
angular	angular		rounded	rounded	rounded	./.	./.
./.	divided into 2 lobes with acute apex	divided into 2 lobes with acute apex	entire, apex rounded [narrow]	entire, apex [narrow] faintly emarginate	entire, apex truncate	entire, apex [wide] emarginate	entire, apex [wide] little emarginate
./.	smooth	smooth	./.	./.	./.	./.	./.
./.			with long stiff lobules at base	with short lobules at base	with short lobules at base	provided with lobules at base	without lobules at base



Figs 34–48. Male phallic sclerites of *Hemielimaea* species: 34, *H. chinensis* (male from Shaowu); 35, *H. mannhardti* (neotype); 36, *H. caricercata* (holotype); 37, *H. kuatun* (paratype); 38, *H. omeishanica* (holotype); 39, *H. proxima* (holotype); 40–41, *H. vietnamensis* (holotype); 42, *H. reducta* (holotype); 43, 47–48, *H. tonkinensis* (Than-Moi, MHNG); 44–46, *H. procera* (44, holotype; 45–46, topotype of *H. cucullata*). – 34–42, 46, phallic sclerites in dorsal view (cleaned, only 46 in situ); 43, do. in oblique dorsal view (in situ); 44–45, do. in apical view (in situ); 47, posterior end of stridulatory file in oblique lateral view; 48, do. in ventral view.

Figs 49–69. Stridulatory area of male tegmina of *Hemielimaea* species: 49, 63, *H. omeishanica* (holotype); 50, 64, *H. mannhardti* (neotype); 51, 65, *H. proxima* (holotype); 52, 66, *H. vietnamensis* (holotype); 53, 67, *H. reducta* (holotype); 54, 60, *H. chinensis* (lectotype); 55, 61, *H. kuatun* (holotype); 56, 62, *H. caricercata* (holotype); 57, 68, *H. tonkinensis* (Than-Moi, MHNG); 58–59, 69, *H. procera* (59, holotype; 58, 69, topotype of *H. cucullata*). – 49–59, dorsal area of left male tegmen with stridulatory area; 60–69, mirror area and following part of dorsal area of male right tegmen. Images 35, 38–42, 49–53, 63–67 by A.V. Gorochov, remainder by S. Ingrisch.

Hemielimaea (H.) caricercata Ingrisch **sp. n.**

Figs 2, 6, 9, 12, 15, 17, 20, 22, 25, 28, 32, 36, 56, 62

Type material. Holotype (♂): China: Fujian, Wuyi Shan Mts., labeled "Kuatun (2300m) 27,40n.Br. | 117,40ö.L. J. Klapperich | *6.7.*1938 (Fukien)", "HOLOTYPE ♂ | Hemielimaea (H.) caricercata | det. S. Ingrisch 2006 | ID: OThemhemS03" (ZFMK).
Paratypes: same data as holotype, 21.vii.1938, 1♀ (ZFMK).

Description

Male. Stridulatory vein 2.9 mm long (Fig. 6), shorter than greatest width of pronotal disc in posterior area (3.6 mm). Stridulatory vein on underside of left tegmen with about 87 teeth (29.8 teeth per mm) of two different types: about half of the teeth large and well separated, the remainder in posterior area narrow and densely arranged; a short transient zone in between (Fig. 12). Mirror of right tegmen very little wider than long (2.2 against 2.1 mm); distance between proximal heavily sclerotized vein and apex of mirror 2.7 mm; maximal width of dorsal tegminal part behind mirror 1.9 mm (Fig. 9). Cerci 5.2 mm long (Fig. 20), with straight, rounded basal part which is slightly descending and slightly narrowed at end; in apical half curved mediad and external area triangularly compressed forming an acute angle (Fig. 22); before apex suddenly narrowed and strongly compressed forming a blade with acute tip. Subgenital plate curved in an about 80°-angle (Fig. 17), upcurved area dived and apical parts deviating (Fig. 15). Phallic sclerite with long, stout furcae (Fig. 25), dorsal margin in lateral view sinuate, serrate; ventral apodeme present, keel-like (Fig. 28).
Coloration. Yellowish brown with a faint tinge of green (probably green when alive) and with contrasting dark brown markings. Head: Face with frons and eyes medium brown; genae and mandibles yellow; vertex dark brown with a short light stroke behind compound eyes. Antennae black with very sparse white annulation. Pronotum with disc dark brown with a short light stroke laterally at both sides at anterior margin; lateral lobes yellow. Tegmen greenish yellow with piles of dark brown dots in cells; anterior margin, the narrow space between subcosta and radius in basal half and including part of these veins, and all of the dorsal area dark brown; stridulatory vein on dorsal side of left tegmen blackish-brown; mirror on right tegmen transparent. Legs yellowish brown; fore and mid legs with ventral margin and apical third of femur and all of tibia and tarsus blackish brown; hind leg with apical area of tibia and lateral areas of first and second tarsal segments and all of third tarsal segment dark brown. Apical margin of tenth abdominal tergite in lateral areas, cerci except for apical blade, and apical area of subgenital plate dark brown.
Female. The single female at hand is not in good condition. Subgenital plate greatly notched in middle, resulting lobes acute-angular; external margin with a preapical tooth (Fig. 32). Ovipositor as in *H. chinensis*. Coloration as in male. Vertex with five light lines. Legs largely damaged. Epiproct with a black dot in ventro-basal area. Cerci dark brown from above, yellow from below. Ovipositor medium brown with a dark brown band along ventral margin.
Measurements. (1♂, 1♀). Body with wings: ♂ 55, ♀ 51; body without wings: ♂ 30, ♀ 24; pronotum: ♂ 5.2, ♀ 5.0; tegmen: ♂ 42, ♀ 49; tegmen width: ♂ 7.5, ♀ 7.8; hind femur: ♂ 25, ♀ 26; ovipositor: ♀ 6.8 mm. – Ratio tegmen length to width: ♂ 5.60, ♀ 6.28.

Discussion

The new species has the lateral angle of the male cerci strongly expressed (Fig. 22). In other species of the subgenus this character is less obvious while in *Pseudelimaea* the lateral surface of the male cerci is rounded. *H. caricercata* has with 87 teeth the lowest number of stridulatory teeth so far reported in the genus, although the difference to *H. mannhardti*, *H. vietnamensis* and *Pseudelimaea* species, which have just above 100 teeth, is not high (Tab. 1). It differs by the stridulatory area of left and right tegmina. The phallic sclerite is similar to those of *H. chinensis* and *H. mannhardti* (Figs 34–36). The new species differs by the stridulatory apparatus (Figs 49, 50, 56).

Etymology

Named for the angulated external surface of the male cerci, which is very distinctive in this species.

Hemielimaea (H.) kuatun Ingrisch **sp. n.**

Figs 1, 5, 8, 11, 14, 16, 19, 21, 24, 26, 30–31, 33, 37, 55, 61

Type material. Holotype (♂): China: Fujian, Wuyi Shan Mts., labeled "Kuatun (2300m) 27,40n.Br. | 117,40ö.L. J. Klapperich | 1.7.1938 (Fukien)", "HOLOTYPE ♂ | Hemielimaea (H.) kuatun | det. S. Ingrisch 2006 | ID: OThemhemS01" (ZFMK).
Paratypes: China: Fujian, Wuyi Shan Mts., Kuatun, 2300 m, 27°40' N, 117°40' E, leg. J. Klapperich, 30 May 1938, 1♀; same locality, 12.vi.1938, 1♂; 13.vi.1938, 1♀, 1♂; 16.vi.1938, 1♀; 19.vi.1938, 1♀; 23.vi.1938, 1♀; 1.vii.1938, 1♀, 1♂; 11.vii.1938, 1♀; 24.vii.1938, 1♀; 26.vii.1938, 1♀; 30.vii.1938, 2♀; 6.viii.1938, 4♀; Kwangtseh (= Hangchuan), 27°30' N, 117°24' E, leg.

J. Klapperich, 18.vii.1937, 1♀; same locality, 18.viii.1937, 1♀; Fukien, without locality label, 1937–1938, leg. J. Klapperich, 1♀, 1♂ (all ZFMK).

Description

Male. Stridulatory vein 2.8–2.9 mm long (Fig. 5), little shorter than greatest width of pronotal disc in posterior area (3.0–3.7 mm). Stridulatory teeth on underside of left tegmen numerous (circa 235–252 teeth) and moderately dense (83–87 teeth per mm, Fig. 11). Mirror of right (= lower) tegmen little longer than wide (2.3–2.5 against 2.2–2.3 mm); distance between proximal heavily sclerotized vein and apex of mirror 2.8–3.0 mm; maximal width of dorsal tegminal part behind mirror 2.1–2.4 mm (Fig. 8). Cerci rather short (3.5–3.7 mm; Fig. 19), narrowed behind basal third, curved mediad and faintly widened again in subapical area; external surface in subapical area angular (Fig. 21). Subgenital plate in lateral view curved in an about 60°-angle (Fig. 16), upcurved area dived and apical parts deviating (Fig. 14). Phallic sclerite with moderately long and narrow furcae (Fig. 24), dorsal margin in lateral view sinuate, serrate (Fig. 26); ventral apodeme present, keel-like.

Coloration. Yellowish brown (probably green when alive). Head with compound eyes and vertex dark brown, the latter interrupted by four light lines: medial pair running from fastigium verticis to occiput; lateral lines behind eyes. Antennae black with white annulation; scapus and pedicellus on ventral (= anterior) side medium brown. Pronotum with disc dark brown with a short light stroke laterally at both sides at anterior margin; lateral lobes yellow. Tegmen yellow with piles of dark dots in cells; anterior margin and dorsal area dark brown; stridulatory vein on dorsal side of left tegmen dark brown; mirror area on right tegmen transparent. Legs yellowish brown; fore legs with apical area of femur, basal and apical area and ventral margin of tibia, and first three segments of tarsus dark brown. Mid legs with apical area of femur, basal and apical areas of tibia, and all tarsal segments dark brown. Hind legs with apical area of tibia and all of tarsus dark brown. Epiproct in both sexes with a black spot in middle of basal area. Male cerci at very base black; dorsal side of cerci (except at apex) slightly infumate, especially at internal margin in apical half.

Female. Subgenital plate greatly notched in middle (Fig. 33), resulting lobes acute-angular; external margin with a pre-apical step-like constriction sometimes forming a small tooth; constriction sometimes missing (Figs 30–31). Ovipositor as in *H. chinensis*. Coloration as in male. Cerci infumate on dorsal side.

Variation. In dark specimens fore and mid legs from apical third of femur to tip of tarsus completely dark brown; hind knees infumate. Vertex sometimes with a fifth white line in middle; in few specimens vertex almost yellow in middle, brown on both sides. Tegmen in female with dorsal area dark brown but veinlets yellow making the area appear light; anterior margin of tegmen in those specimens also yellow.

Measurements. (5♂, 18♀). Body with wings ♂ 45–48, ♀ 47–52; body without wings ♂ 22–24, ♀ 20–31; pronotum ♂ 4.8–5.1, ♀ 4.5–5.5; tegmen ♂ 35.5–37.5, ♀ 35.1–40.0; tegmen width ♂ 7.4–8.0 ♀ 6.6–8.0; hind femur ♂ 21.7–24.0, ♀ 22.5–26.0; antenna ♀ 76; ovipositor ♀ 6.1–7.0 mm. – Ratio tegmen length to width ♂ 4.50–4.93, ♀ 4.62–5.48.

Discussion

The new species is similar to *H. proxima* Gorochov, 2004. The stridulatory apparatus is similar between both species, but the number of stridulatory teeth little higher and the dorsal area of the right tegmen behind the mirror narrower in *H. kuatan* than in *H. proxima* (Tab. 1). More striking differences are found in the phallic sclerite with longer and stouter apical branches in *H. kuatan* (Figs 37, 39). The females differ by the subgenital plate (Tab. 1). The stridulatory area of the other species shows greater differences to the new species and the number of stridulatory teeth is either much higher or much lower (Tab. 1). The phallic sclerite of *H. kuatun* is most similar to that of *H. omeishanica* (Figs 37, 38). It differs by details of the stridulatory area, male cerci and female subgenital plate (Tab. 1, Figs 49, 55, 61, 63).

Etymology

Named after the type locality; noun in apposition.

Hemielimaea (H.) omeishanica Gorochov **sp. n.**

Figs 38, 49, 63

Hemielimaea (H.) chinensis chinensis nec Brunner von Wattenwyl; Gorochov 2004: 361.

Type material. Holotype (♂): China: labeled "Omeishan, 580 m | Sichuan, 26 VI 1955" [in Russian], "*Neotypus Hemi-* | *elimaea chinen-* |*sis Br.-W., 1878*", "Neotypus | *design. Gorochov*", "Holotypus *Hemi-* | *elimaea (s. str.)* | *omeishanica sp. n.*"; 29°32' N, 103°19' E (ZIAS).

Paratype: same locality as holotype (ZIAS).

Diagnosis and discussion

The description of those specimens was already published by Gorochov (2004: p. 361–362) under

the name *H. (H.) chinensis chinensis*. Here, it is only necessary to add that the species is most similar to *H. proxima*; but *H. omeishanica* is well distinguished by the longer stridulatory vein of the left (= upper) tegmen which is longer than the maximal width of the pronotal disc while in *H. proxima*, the vein is shorter than the maximal width of the pronotal disc. The stridulatory teeth are more numerous and dense (about 350 teeth with 50 teeth per mm in central part of the vein) while in *H. proxima* the number is about 200 with 45 teeth per mm. The male subgenital plate is more strongly curved; the apical parts of the male phallic sclerite are wider (for comparison see Tab. 1 and Gorochov, 2004: Figs 1, 2, 23–26 and 4, 5, 31–34). From *H. mannhardti* stat. rest., the new species differs in the much more numerous and dense stridulatory teeth (Tab. 1; in *H. mannhardti* about 120 teeth with 20 teeth per mm). From true *H. chinensis*, the new species differs by the distinctly wider dorsal area of both tegmina behind the stridulatory area (compare Figs 49, 63 with 54, 60), the stridulatory area much less angularly projecting mediad (Fig. 54), and the shorter phallic sclerite (Fig. 38). From all other congeners, it differs in the shape of the male phallic sclerites and/or female subgenital plate (see Gorochov, 2004: Figs 2, 7, 13, 14, 19, 21, 23, 35, 36, 41, 42, 46).

Hemielimaea (H.) mannhardti (Krausze) **stat. rev.**

Figs 35, 50, 64

Elimaea mannhardti Krausze 1903: 372. Neotype ♂: labeled "Vietnam, Vinh Phu Prov., Tamdao, 800–900 m, edge of primary forest (at light), 1–11.VI.1995, A. Gorochov", "*Hemielimaea (Hemielimaea) chinensis mannhardti (Krausze, 1903) det. Gorochov*", "*Neotypus | design. Gorochov*" (ZIAS)

Hemielimaea (H.) chinensis mannhardti Gorochov 2004: 362, Figs. 2, 7, 13, 14, 19, 21, 27, 35, 36, 41, 42, 46.

Discussion

This species was recently redescribed by Gorochov (2004: p. 362) as *H. (H.) chinensis mannhardti* (Krausze). In the same paper, a neotype was designated. The study of the stridulatory vein shows that instead it is a distinct species well distinguished from *H. omeishanica*, *H. proxima*, and true *H. chinensis* by much less numerous and dense stridulatory teeth (see diagnosis of *H. omeishanica* above). From all other congeners, *H. mannhardti* differs in the shape of the male phallic sclerites and the female subgenital plate. The female subgenital plate is however almost identical with that of *H. omeishanica* (see Gorochov, 2004: Fig. 2).

Hemielimaea (Pseudelimaea) procera Ingrisch

Figs 44–46, 58–59, 69

Hemielimaea procera Ingrisch 1990: 94. Holotype ♂: labeled "Thailand | Khao Soi Dao | Urwaldstraße | 31.5.1986 | S. Ingrisch", "*Hemielimaea procera Ing.* ♂ | Tettigoniidae | det. S.Ingrisch", "Typus", and later added "DORSA | FThemproHTM" (SMF).

Elimaea (Hemielimaea) procera; Ingrisch 1998: 76.

Hemielimaea (Pseudelimaea) procera; Gorochov 2004: 363.

Hemielimaea cucullata Ingrisch 1990: 96. Holotype ♀: labeled "Thailand | Kanchanaburi | Erawan Falls | Grasfläche am Waldrand | 17/19.6.1986 | S. Ingrisch", "*Hemielimaea cucullata Ing.* ♀ | Tettigoniidae | det. S.Ingrisch", "Typus", and later added "DORSA | FThemcucHTF" (SMF) **syn. n.**

Elimaea (Hemielimaea) cucullata; Ingrisch 1998: 76.

Hemielimaea (Pseudelimaea) cucullata; Gorochov 2004: 364.

Discussion

H. procera was described after a male from Khao Soi Dao (Chanthaburi province, East Thailand) and *H. cucullata* after a female from the Erawan falls (Kanchanaburi province, West Thailand). Differences in size and shape of the wings made it look likely that both belong to different species. Meanwhile, the opposite sexes of both taxa became known from the type localities. It proved that there is no significant difference in the male stridulatory apparatus or the male phallic sclerite (Tab. 1, Figs 44–45, 58–59). The differences in size and wings should thus be regarded as due to sexual dimorphism and individual variation. Accordingly, *H. cucullata* becomes a synonym of *H. procera*.

Material examined. Thailand: Chanthaburi, Khao Soi Dao, 13° 0' N, 102° 13' E, 12–13.vi.1988, S. Ingrisch, 3♀ (CI); Kanchanaburi, near Erawan Waterfall, 14° 20' N, 99° 8' E, 1–3.vi.1988, S. Ingrisch, 1♀, 2♂ (CI); same locality, 9.iv.1994, 1♂ (CI); Nakhon Ratchasima, 14° 58' N, 102° 7' E, 24.vi.1958, 2♀ (EMBT, Lot 2463); Saraburi, 14° 32' N, 100° 55' E, 13.vii.1957, 1♀ (EMBT); Sukhothai, 17° 0' N, 99° 50' E, 1.viii.1936, Buller, 1♂ (EMBT, Lot 334); Tak, Sam Ngao, 17° 15' N, 99° 2' E, 4.vi.1959, 1♂ (EMBT, Lot 2522).

Hemielimaea (Pseudelimaea) tonkinensis Dohrn

Figs 44, 47–48, 57, 68

Hemielimaea tonkinensis Dohrn 1906: 350. Lectotype ♂: Vietnam, labeled "Tonkin | Than-Moi | Juni-Juli | H. Fruhstorfer", "Typ", "tonkinensis Dohrn" (MIZP).

Hemielimaea (Pseudelimaea) tonkinensis Gorochov 2004: 363.

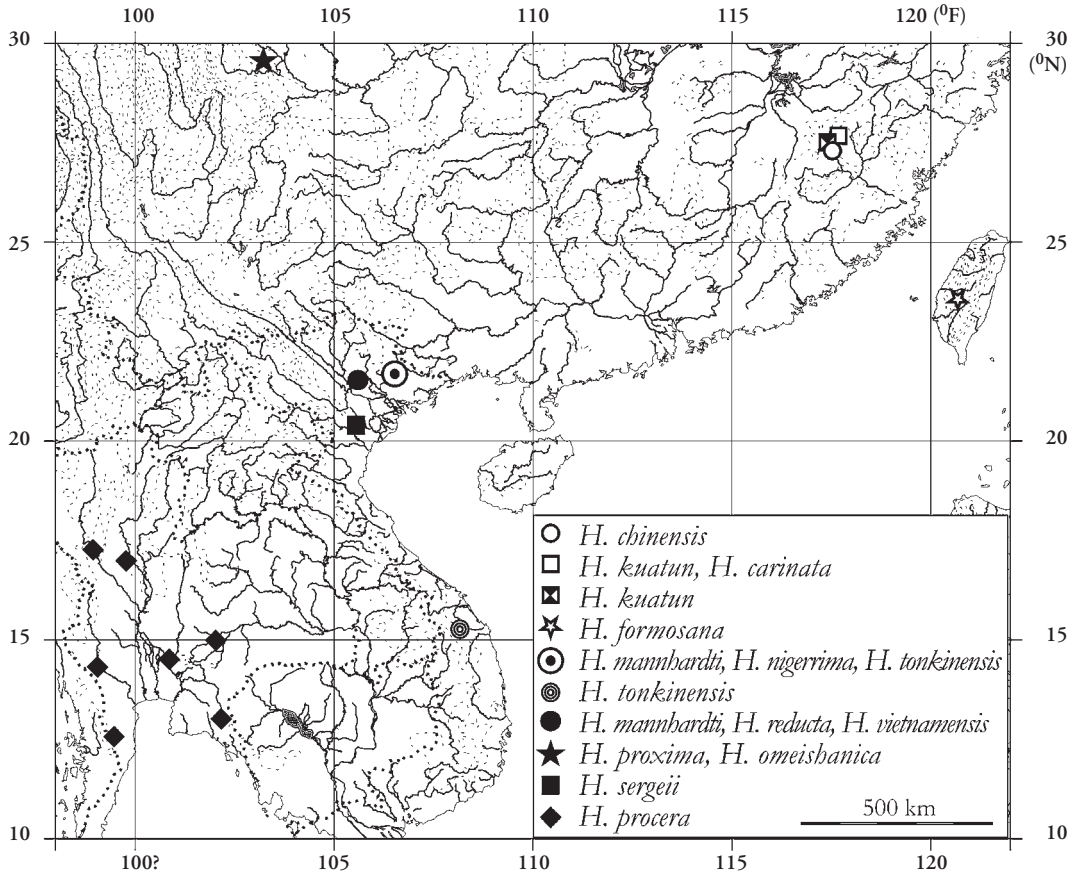


Fig. 70. Distribution of *Hemielimaea* species in South East Asia. (Map outline with OMC http://www.aquarius.geomar.de/, modified). Localities as published in Gorochov (2004), this paper and with the original descriptions.

Discussion

The species is mentioned here for the distinctive stridulatory file. The file has a distinctive fold or groove just before the posterior end (Figs 47–48). Both sides and the bottom of the groove are provided with stridulatory teeth. Thus the groove may have an - unknown - function in stridulation. Both males in MHNG have this stridulatory file. It is thus unlikely to be an artifact. In one of the males (from Than-Moi) the number of teeth was counted. There are a total of 113 stridulatory teeth, of which 20 teeth are in the subapical fold (Table 1).

Material examined. 3♂ and 3♀ from Tonkin (Than-Moi) were reported in the original publication. They are conserved in MIZP (Gorochov 2004). One 1♂ and 2♀ from the same collector (H. Fruhstorfer) and locality (Than-Moi) and 1♂ from the same collector but from Annam (Phuc-Son) are conserved in MHNG. They agree completely with the redescription of the type of *H. tonkinensis* in Gorochov (2004).

Geographical distribution

The localities of the *Hemielimaea* species are illustrated in Fig. 70. It is clear that the distribution is insufficiently known. Most species are reported from a single locality or two nearby localities. They are less commonly found than species of the genus *Elimaea* (e.g. Ingrisch 1998). On the other hand, there are several places where two or even three *Hemielimaea* species occur in the same locality or at least in the same closer area although they may differ with regard to the ecological niches, altitudinal distribution or dispersal within vegetation. Unfortunately, almost

nothing is known on the life history of the species. Thus we cannot interpret those facts. It may be that *Hemielimaea* species have limited distribution ranges or are restricted to specialized habitats. It might also be that they show a distinct seasonality only appearing in certain seasons of the year, or they life in higher vegetation strata where they are overlooked if not attracted to the light. *Hemielimaea* species are fully winged and strong flyers (own observation with *H. procera*) that make them not easy to collect.

Species of the subgenus *Hemielimaea* are so far known from China (provinces Fujian and Sichuan), Taiwan, and Vietnam, those of *Pseudelimaea* from Vietnam and Thailand (Gorochov 2004). It seems that both subgenera have a vicariant distribution overlapping in northern Vietnam.

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List of species currently included in *Hemielimaea* together with label data of type specimens and acronyms as used in figures:

car *Hemielimaea (H.) caricercata* Ingrisch, sp. n. – holotype ♂: China, Fujian, Wuyi Shan Mts., Kuatun, 2300 m, 27°40' N, 117°40' E (ZFMK)

chi *Hemielimaea (H.) chinensis* Brunner von Wattenwyl, 1878 – lectotype ♂: China (NHMW)

for *Hemielimaea (H.) formosana* Shiraki, 1930 – syntypes ♂, ♀: Taiwan, Arisan Mt (Ent. Mus. Govern. Res. Inst., Taiwan)

kua *Hemielimaea (H.) kuatun* Ingrisch, sp. n. – holotype ♂: China, Fujian, Wuyi Shan Mts., 2300 m, 27°40' N, 117°40' E (ZFMK)

man *Hemielimaea (H.) mannhardti* (Krausze, 1903) – neotype ♂ (Gorochov 2004): Vietnam, Vinh Phu Prov., Tamdao, 800–900 m (ZIAS)

ome *Hemielimaea (H.) omeishanica* Gorochov, sp. n. – holotype ♂: China, Sichuan Prov., Omeishan, 580 m, 29°32' N, 103°19' E (ZIAS)

prx *Hemielimaea (H.) proxima* Gorochov, 2004 – holotype ♂: China, Sichuan Prov., Omeishan, 580 m, 29°32' N, 103°19' E (ZIAS)

red *Hemielimaea (H.) reducta* Gorochov, 2004 – holotype ♂: Northern Vietnam, Vinh Phu Prov., Tamdao, 800–900 m (ZIAS)

vie *Hemielimaea (H.) vietnamensis* Gorochov, 2004 – holotype ♂: Northern Vietnam, Vinh Phu Prov., Tamdao, 800–900 m (ZIAS)

cuc *Hemielimaea (Pseudelimaea) cucullata* Ingrisch, 1990 nov. syn. of *H. procera* – holotype ♀: Thailand, Kanchanaburi prov., Erawan falls, 17–19.VI.1986 (SMF)

nig *Hemielimaea (Pseudelimaea) nigerrima* (Krausze, 1903) – neotype ♀ (Gorochov 2004): Tonkin, Than-Moi (MIZP)

prc *Hemielimaea (Pseudelimaea) procera* Ingrisch, 1990 – holotype ♂: Thailand, Chanthaburi prov., Khao Soi Dao, 31.V.1986 (SMF)

ser *Hemielimaea (Pseudelimaea) sergeii* Gorochov, 2004 – holotype ♀: North Vietnam: Hoa Binh Prov., Yen Thuy Distr., Lac Thinh, Cuc Phuong National Park 20°23' N, 105°34' E, 300 m (ZIAS)

ton *Hemielimaea (Pseudelimaea) tonkinensis* Dohrn, 1906 – lectotype ♂ (Gorochov 2004): Tonkin, Than-Moi (MIZP)