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On some *Ctenarytaina* species (Hemiptera, Psylloidea) from Gunung Kinabalu (Malaysia, Sabah)

Daniel Burckhardt[1]

1 *Naturhistorisches Museum, Augustinergasse 2, 4001 Basel, Switzerland*

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Corresponding author: Daniel Burckhardt (daniel.burckhardt@bs.ch)

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Abstract

Gunung Kinabalu is famous for its exceptionally diverse fauna and flora, rich in endemism. An example is the psyllid genus *Ctenarytaina* that is represented by four, apparently endemic species. Here two new *Ctenarytaina* species, *C. lienhardi* **sp. nov.** and *C. smetanai* **sp. nov.**, are described from Gunung Kinabalu. The new taxa are diagnosed, illustrated and their relationships to other species in the genus are discussed. *Ctenarytaina daleae* Burckhardt is redescribed. The species develops on *Leptospermum* species (Myrtaceae) and not *Syzygium* as previously suggested.

Key Words

Sternorrhyncha, Aphalaridae, Spondyliaspidinae, systematics, phytophagy, distribution

Introduction

Gunung (=Mount) Kinabalu, with an elevation of around 4100 m, is the highest mountain between the peaks of the eastern flank of the Himalaya in Burma and Mount Wilhelm in Papua New Guinea. It is famous for its exceptionally diverse flora, rich in endemism. The lower slopes were originally covered in lowland dipterocarp forest, most of which has disappeared through human activities. The lowland and montane forests up to about 2500 m altitude are characterised by Oriental floral elements. At altitudes above 2500 m, plant taxa shared with the Himalayan (e.g. Ericaceae) and Australian floras (e.g. Myrtaceae) become more dominant (Cockburn 1978; Corner 1978; Beaman and Beaman 1990). Similar but less well-documented relationships can also be found in phytophagous insects such as the phloem feeding, generally host specific psyllids. This group of Sternorrhyncha includes over 4000 described species worldwide. It is most species-rich in the tropics and south temperate regions (Burckhardt et al. 2021).

Fifteen psyllid species have been reported from Gunung Kinabalu. Four *Paurocephala* species (Liviidae, Liviinae) are associated with species of *Pterospermum* (Malvaceae), *Artocarpus* and *Ficus* (Moraceae) (Mifsud and Burckhardt 2002). They are characteristic Oriental taxa. The other 11 species are members of the subfamily Spondyliaspidinae (Aphalaridae) and are associated with Myrtaceae. They belong to the genera *Boreioglycaspis* (7 spp. on *Syzygium* and *Tristaniopsis*) (Burckhardt 1991) and *Ctenarytaina* (4 spp. presumed to be associated with *Syzygium*) (Burckhardt et al. 2020). As their hosts, these psyllids represent Australian biogeographical elements.

The Spondyliaspidinae is a species-rich subfamily of 23 recognised genera (Burckhardt et al. 2021) mostly restricted to the Australian biogeographical realm and associated with hosts in the Myrtaceae (Burckhardt 1991). *Boreioglycaspis* and *Ctenarytaina* are exceptional in that they occur also outside the Australian region. *Ctenarytaina* comprises 29 described species originating from tropical Asia (12 spp.), Australia (9 spp.), Oceania (6 spp.) and Africa (2 spp.) (Burckhardt et al. 2020). Two Australian species, *C. eucalypti* (Ferris & Klyver) and *C. spatulata* Taylor, are economically important invasive pests in eucalypt plantations in Africa, Europe and the Americas were they are adventive (Queiroz et al. 2012; Makunde et al.

2020). Host plants are mostly Myrtaceae, but one species each develops on *Boronia* (Rutaceae), *Eurya* (Theaceae) and *Fuchsia* (Onagraceae), respectively.

Apart from the four species allegedly associated with *Syzygium* (Burckhardt et al. 2020), two undescribed *Ctenarytaina* species were collected on Gunung Kinabalu that are described in the present paper. The taxonomy of *Ctenarytaina daleae* Burckhardt is revised and its host relationships are discussed.

Material and methods

Material is deposited in the Muséum d'histoire naturelle, Genève, Switzerland (**MHNG**) and Naturhistorisches Museum, Basel, Switzerland (**NHMB**). The morphological terminology follows Halbert and Burckhardt (2020). Measurements were taken as follows: adult body length from dry mounted specimens measuring the distance between fore margin of head and tip of forewings when folded over body; the other measurements were taken from slide mounted specimens. The measurements and ratios are given as range. The plant nomenclature accords with the World Flora Online (2021).

Results

Taxonomy

***Ctenarytaina daleae* Burckhardt, 2020**

Figs 1, 4, 5, 10–14

Ctenarytaina daleae Burckhardt: Burckhardt et al. (2020: 44), p.p. [description and figures ♂, key]

Type locality. Malaysia, Sabah, Ranau, Gunung Kinabalu, 6.0428°N, 116.5587°E, 2600 m.

Material examined. Malaysia: ***Holotype*** ♂, Sabah: Ranau, Gunung Kinabalu, 6.0428°N, 116.5587°E, 2600 m, 2.v.1987, *Syzygium korthalsianum* (D. Burckhardt & I. Löbl) #8751 (MNHG, slide mounted). – Malaysia: 6 ♂, 8 ♀, same but summit trail, 3230 m, *Leptospermum* sp., 29.iv.1982, *Leptospermum* scrub (D. Burckhardt) #8277; 10 ♂, 12 ♀, same but 3230 m, *Leptospermum recurvum*, #8278; 1 ♂, 1 ♀, same but 2600 m, 1.v.1987 (D. Burckhardt & I. Löbl) #8735; 21 ♂, 36 ♀, same but 2600 m, 2.v.1987, *Leptospermum recurvum*, #8747, #8748, #8749; 6 ♂, 6 ♀, same but 2600 m, 2.v.1987, general sweeping of vegetation, #8752; 2 ♂, 9 ♀, same but 2600 m, 2.v.1987, *Leptospermum javanicum*, #8753; 12 ♂, 13 ♀, same but 3300 m, 4.v.1987, *Leptospermum recurvum*, #8756; 4 ♂, 4 ♀, same but below Layang Layang, 2600 m, 2–8.v.1987, interception trap (A. Smetana); 7 ♂, 11 ♀, same but below Laban Rata, 3155 m, 5.v.1987; 1 ♂, 5 ♀, same but Laban Rata, 3200 m, 4–8.v.1987, interception trap; 8 ♂, 7 ♀, same but 3200 m, 9–20.v.1987, interception trap (MHNG, NHMB, dry and slide mounted).

Diagnosis. Genal processes 0.3 times as long as vertex along mid-line, irregularly rounded anteriorly. Forewing oblong oval, widest in the middle, 2.3–2.7 times as long as broad, broadly rounded apically; vein C+Sc mostly straight, weakly concave in proximal third, cell c+sc narrow. Surface spinules present in all cells, forming cellular pattern; in cell r_2 above bifurcation of vein M, the cells are irregularly hexagonal consisting of two indistinct rows of spinules. No extra pore fields developed on abdominal intersegmental membrane. Basal segment of proctiger weakly curved posteriorly, hind margin with a row of stout setae; apical segment 0.2–0.3 times as long as basal segment. Paramere digitiform. Distal segment of aedeagus cuneate. Female terminalia strongly narrowed medially, bearing each an apical process on proctiger and subgenital plate, female proctiger dorsally serrate.

Redescription. Adult. Colouration. Head and thorax light reddish brown. Vertex with dark brown dot in the middle of either half; genal processes dark brown at base, yellow apically. Antenna light orange brown at base, getting gradually darker from segment 6 to apex which is dark brown or black. Pronotum with each two submedian dark dots and mesopraescutum with each one submedian dark dot along fore margin on either side. Legs yellow; profemora light greyish brown. Forewings light ochreous or amber-coloured, slightly lighter along fore margin; veins concolourous with membrane. Abdomen yellow or orange; base of female proctiger light brown. Younger specimens with less extended dark colour.

Structure. Conforming to the generic description of Burckhardt et al. (2020). Body length ♂ 1.4–1.5 mm, ♀ 1.5–1.9 mm (6 ♂, 6 ♀). Head deflexed 45° from longitudinal axis of body. Vertex rhomboidal, weakly concave at base; preocular sclerite forming flat tubercule; genal processes 0.3 times as long as vertex along mid-line, irregularly rounded anteriorly, contiguous medially; eyes weakly 'stalked' (Fig. 1). Antenna 0.6–1.0 times as long as head width. Metatibia 0.5–0.7 times as long as head width, weakly widening to apex, with 5 irregularly spaced apical spurs. Forewing (Fig. 4) oblong oval, widest in the middle, 2.3–3.0 times as long as head width, 2.3–2.7 times as long as broad, broadly rounded apically; pterostigma, at base narrower than adjacent part of cell r_1, regularly narrowing to apex, ending at apical fifth of wing; vein C+Sc mostly straight, weakly concave in proximal third, cell c+sc narrow; vein Rs almost straight, vein M long, with short, weakly diverging branches, vein Cu_{1a} relatively straight, reaching the wing margin distinctly distal to bifurcation of vein M. Surface spinules present in all cells, forming cellular pattern; in cell r_2 above bifurcation of vein M, the cells are irregularly hexagonal consisting of two indistinct rows of spinules (Fig. 5). No extra pore fields developed on abdominal intersegmental membrane. Male terminalia as in Figs 10–12. Proctiger 0.4–0.6 times as long as head width; basal segment, in profile, weakly curved posteriorly, irregularly beset with fine setae, hind margin with a row of stout setae; apical segment tubular, 0.2–0.3 times as long as basal segment. Subgenital plate,

in profile, triangular, with almost straight dorsal margin; sparsely beset with short setae. Paramere, in profile, digitiform, almost straight anteriorly, wavy posteriorly, broadly rounded apically; inner face densely coverd in moderately long bristles. Distal portion of aedeagus slender in basal half, widening towards apex which is rounded; sclerotised end tube of ductus ejaculatorius small, weakly curved. Female terminalia as in Fig. 13. Proctiger 0.8–1.0 times as long as head width, 2.3–3.7 times as long as circumanal ring, cuneate; strongly narrowed medially, bearing an apical process, apical third serrate dorsally, subacute apically; sparsely beset with short setae, with a longitudinal lateral row of slightly longer setae in apical third and 2 longitudinal rows of peg setae near ventral margin in apical half. Subgenital plate 0.7–0.8 times as long as proctiger, in profile, bearing narrow, apically pointed process. Valvulae dorsalis and ventralis straight (Fig. 14); valvula lateralis pointed apically.

Measurements in mm (5 ♂, 6 ♀). Head width 0.44–0.58; antenna length 0.34–0.50; forewing length 1.08–1.48; length of male proctiger 0.20–0.24; paramere length 0.16–0.18; length of distal portion of aedeagus 0.10–0.14; female proctiger length 0.42–046.

Fifth instar immature unknown.

Distribution. Malaysia: Sabah, probably endemic to Gunung Kinabalu.

Host plant, biology and habitat. Adults were collected in large numbers on *Leptospermum javanicum* Blume (= *L. flavescens* auct.) and *L. recurvum* Hook.f. (Myrtaceae) suggesting that these two species constitute hosts. *Leptospermum javanicum* is widely distributed from Burma and southern Thailand to the Philippines, Malucu and Lesser Sunda Islands, and *L. recurvum*, is endemic to Gunung Kinabalu (Thompson 1989). It has been suggested that *L. recurvum* has split from the former after the last Pleistocene glaciation (Lee and Lowry 1980). The species occurs as a tree and at high altitudes as prostrate shrub on an outcrop of ultra basic rocks. It is one of the main shrub species of the summit zone above 3200 m altitude (Cockburn 1978; Corner 1978). A singe male was collected also on *Syzygium korthalsianum* (Miq.) Miq. (Myrtaceae), which is an unlikely host contrary to the statement by Burckhardt et al. (2020).

Comments. *Ctenarytaina daleae* is most similar to *C. insularis* Martoni & Armstrong in the posteriorly weakly lobed male proctiger, the digitiform paramere, the female terminalia, which are strongly narrowed medially and bear each an apical process on the proctiger and subgenital plate as well as the dorsally serrate female proctiger. It differs from the latter in the surface spinules forming rings consisting of two rows of spinules, the distal aedeagal segment which is evenly widening to apex rather than with a slender stalk and inflated apical part, the dorsally less concave female proctiger and the host plant: *Leptospermum* versus *Syzygium*.

Ctenarytaina daleae was described based on the male holotype and two female paratypes (Burckhardt et al. 2020). The examination of a long series of material from the summit region of Gunung Kinabalu collected on *Leptospermum* spp. shows that the holotype of *C. daleae* corresponds to the species from *Leptospermum* but not the females which belong to *C. smetanai* sp. nov. described below. *Ctenarytaina daleae* and *C. smetanai* sp. nov. are similar in the head and forewing structure (Figs 1, 3, 4, 8) but differ in the male and female terminalia (Figs 10–14, 18–20, 23, 24).

Ctenarytaina lienhardi sp. nov.

http://zoobank.org/A84EAD53-7419-4D7B-89C8-26811D4493A4

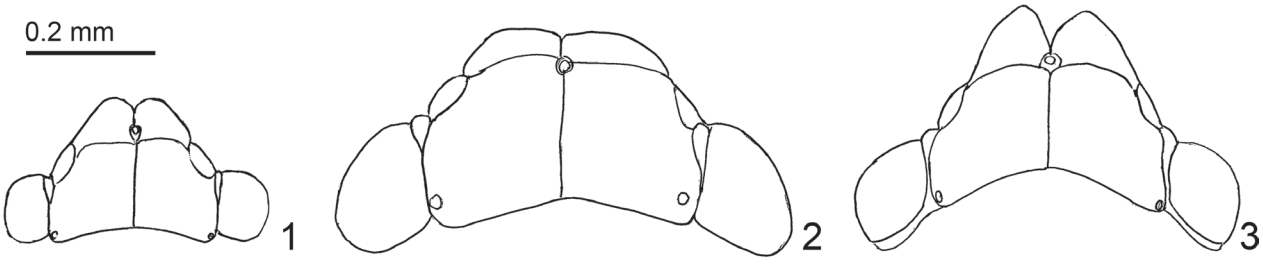
Figs 2, 6, 7, 15–17, 21, 22

Type locality. Malaysia, Sabah, Ranau, Gunung Kinabalu, 1750–1800 m.

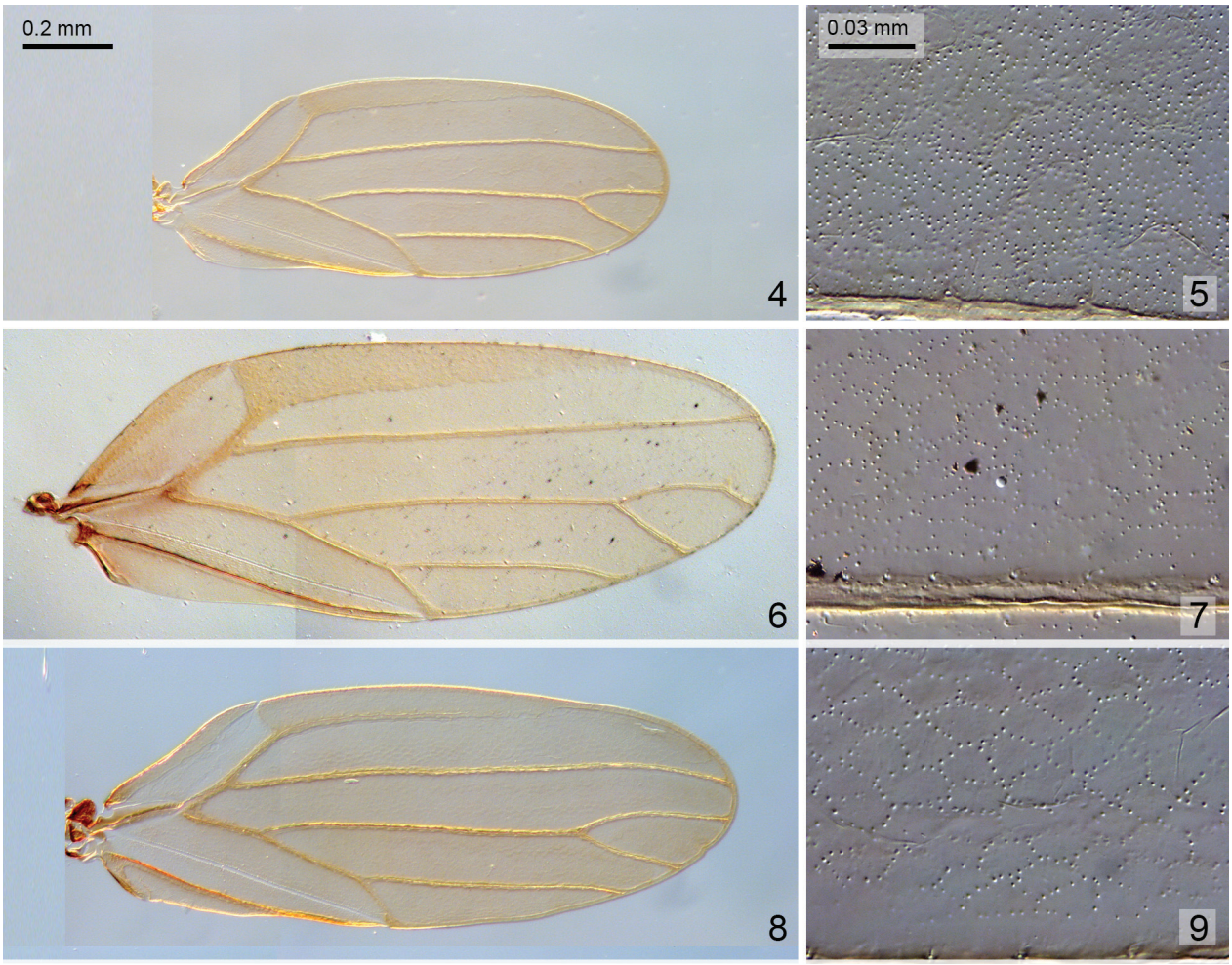
Material examined. ***Holotype*** ♂, Malaysia: Sabah: Ranau, Gunung Kinabalu, 1750–1800 m, 22.iii.1983 (C. Lienhard) #Pal-83/47 (MHNG, dry mounted).

***Paratypes*:** Malaysia: 1 ♂, 2 ♀, same data as holotype; 1 ♀, same but, 1750 m, 27.iv.1987, *Tristaniopsis* (D. Burckhardt and I. Löbl) #8722; 1 ♀, same but, 1750–1850 m, 20.iii.1983 (C. Lienhard) #Pal-83/34 (MHNG, NHMB, dry and slide mounted).

Diagnosis. Genal processes 0.3 times as long as vertex along mid-line, irregularly rounded anteriorly. Forewing oblong oval, widest in the middle, 2.3–2.5 times as long as broad, narrowly rounded apically; vein C+Sc mostly straight, cell c+sc narrow. Surface spinules present in all cells, forming cellular pattern; in cell r_2 above bifurcation of vein M, the cells are irregularly hexagonal consisting of one or two indistinct rows of spinules. Extra pore fields developed on abdominal intersegmental membrane. Basal segment of proctiger weakly curved posteriorly, hind margin with a row of stout setae; apical segment 0.2 times as long as basal segment. Paramere weakly cuneate; inner face densely beset with long bristles. Distal portion of aedeagus slender in basal half, weakly inflated in apical



Figures 1–3. *Ctenarytaina* spp., head, in dorsal view. **1.** *C. daleae*; **2.** *C. lienhardi* sp. nov.; **3.** *C. smetanai* sp. nov.



Figures 4–9. *Ctenarytaina* spp. **4, 6, 8.** Forewing; **5, 7, 9.** Surface spinules in cell r_2 above bifurcation of vein M. **4, 5.** *C. daleae*; **6, 7.** *C. lienhardi* sp. nov.; **8, 9.** *C. smetanai* sp. nov.

half. Female terminalia cuneate; proctiger blade-shaped distal to circumanal ring, smooth dorsally, blunt apically.

Description. Adult. Colouration. Head and thorax light reddish brown. Vertex with dark brown dot in the middle of either half; genal processes dark brown at base, yellow apically. Antenna light orange brown at base, getting gradually darker from segment 6 to apex which is dark brown or black. Pronotum with each two submedian dark dots and mesopraescutum with each one submedian dark dot along fore margin on either side. Legs yellow; profemora light greyish brown. Forewings light ochreous or amber-coloured, slightly lighter along fore margin; veins concolourous with membrane. Abdomen yellow or orange; base of female proctiger light brown. Younger specimens with less extended dark colour.

Structure. Conforming to the generic description of Burckhardt et al. (2020). Body length ♂ 2.0 mm, ♀ 2.4 mm (1 ♂, 1 ♀). Head deflexed 45° from longitudinal axis of body. Vertex rhomboidal, weakly concave at base; preocular sclerite forming small tubercule; genal processes 0.3 times as long as vertex along mid-line, irregularly rounded anteriorly, contiguous medially; eyes weakly 'stalked' (Fig. 2). Antenna 0.8 times as long as head width. Metatibia 0.5–0.6 times as long as head width, weakly widening to apex, with 5 irregularly spaced apical spurs. Forewing (Fig. 6) oblong oval, widest in the middle, 2.3–2.5 times as long as head width, 2.5–2.6 times as long as broad, narrowly rounded apically; pterostigma, at base wider than adjacent part of cell r_1, regularly narrowing to apex, ending at apical quarter of wing; vein C+Sc mostly straight, cell c+sc narrow; vein Rs almost straight, vein M long, with short, weakly diverging branches, vein Cu_{1a} relatively straight, reaching the wing margin at bifurcation of vein M. Surface spinules present in all cells, forming cellular pattern; in cell r_2 above bifurcation of vein M, the cells are irregularly hexagonal consisting of one or two rows of surface spinules (Fig. 7). Extra pore fields present on abdominal intersegmental membrane. Male terminalia as in Figs 15–17. Proctiger 0.5 times as long as head width; basal segment, in profile, weakly curved posteriorly; irregularly beset with fine setae, bearing a row of short bristles along hind margin; apical segment tubular, 0.2 times as long as basal segment. Subgenital plate, in profile, triangular, slightly elongate, with weakly concave dorsal margin; sparsely beset with short setae. Paramere, in profile, weakly cuneate, relatively straight, narrowly rounded apically; inner face densely beset with long bristles. Distal portion of aedeagus slender in basal half, weakly inflated in apical half; sclerotised end tube of ductus ejaculatorius small, almost straight. Female ter-

minalia as in Fig. 21. Proctiger 1.0 times as long as head width, 2.7–2.8 times as long as circumanal ring, cuneate; dorsal margin of proctiger concave, blade-shaped distal to circumanal ring, smooth dorsally, blunt apically; sparsely beset with short setae, with a longitudinal lateral row of slightly longer setae in apical half and 3 longitudinal rows of peg setae near ventral margin in apical half. Subgenital plate 0.7–0.8 times as long as proctiger, in profile, forming narrow process in apical half, pointed apically. Valvulae dorsalis and ventralis weakly curved (Fig. 22); valvula lateralis narrowly rounded apically.

Measurements in mm (1 ♂, 2 ♀). Head width 0.64–0.74; antenna length 0.60; forewing length 1.54–1.84; length of male proctiger 0.38; paramere length 0.28; length of distal portion of aedeagus 0.16; female proctiger length 0.64–0.72.

Fifth instar immature unknown.

Etymology. Named after C. Lienhard, Genève, eminent specialist of Psocodea and collector of most of the type series.

Distribution. Malaysia: Sabah, probably endemic to Mount Kinabalu.

Host plant, biology and habitat. Unknown; a single female was collected on *Tristaniopsis* (Myrtaceae).

Comments. *Ctenarytaina lienhardi* sp. nov. shares with *C. daleae*, *C. insularis* and *C. taylori* the narrow forewings and the posteriorly weakly curved male proctiger. It differs from the two former species in the blade-shaped, dorsally smooth female proctiger and from the latter in the lack of a dark brown basal patch on the forewing.

Ctenarytaina smetanai sp. nov.

http://zoobank.org/092F93CA-08C5-4D4A-90D7-5EC57A98B9F0

Figs 3, 8, 9, 18–20, 23, 24

Ctenarytaina daleae Burckhardt: Burckhardt et al. (2020: 44), p.p., misidentification [description and figures ♀, key]

Type locality. Malaysia, Sabah, Ranau, Gunung Kinabalu, below Layang Layang, 2600 m.

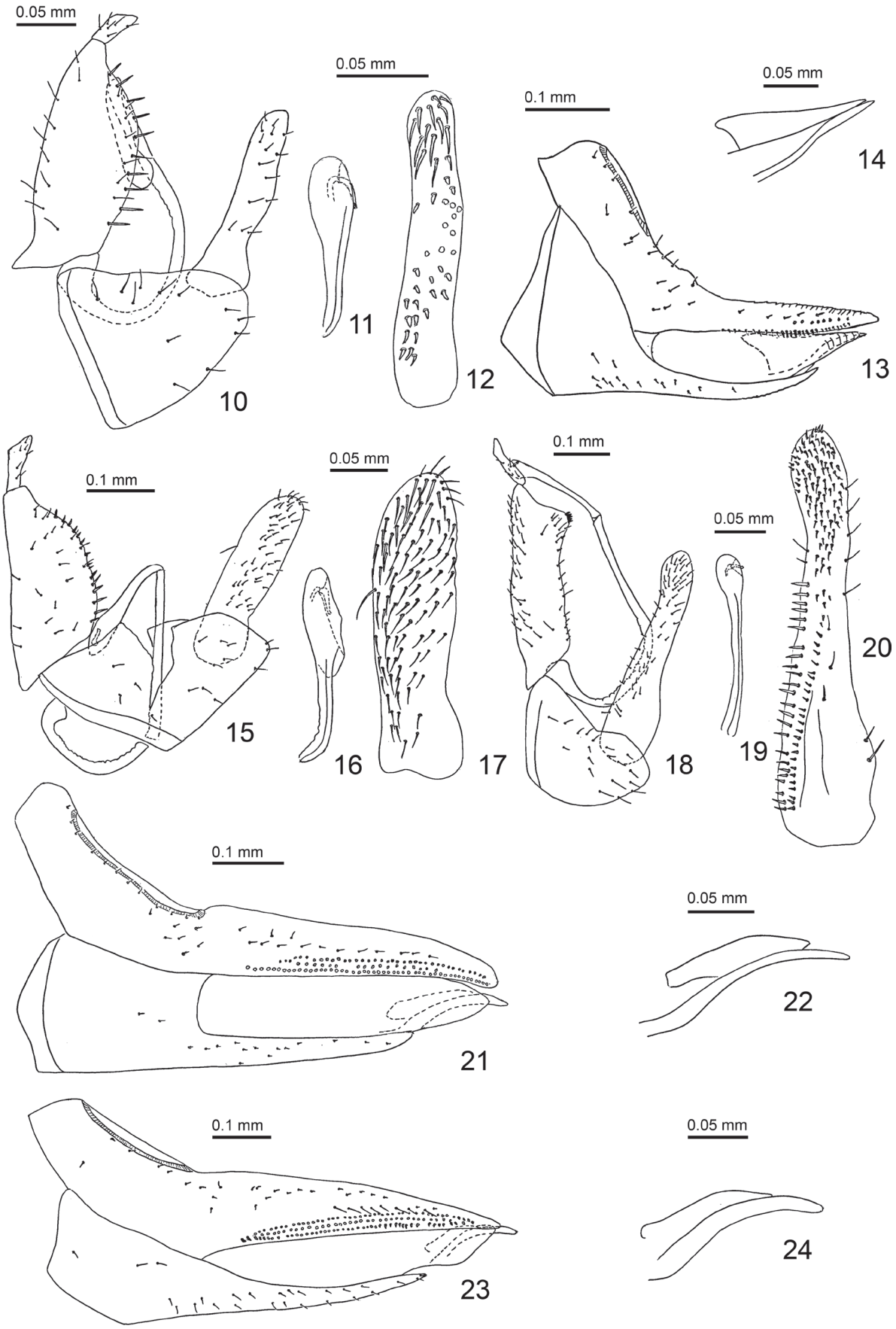
Material examined. ***Holotype*** ♂. Malaysia: Sabah: Ranau, Gunung Kinabalu, below Layang Layang, 2600 m, 2–8.v.1987, interception trap (A. Smetana) (MHNG, slide mounted).

***Paratypes*.** Malaysia, 1 ♀, Sabah, Ranau, Gunung Kinabalu, same as holotype (dry mounted); 1 ♀, same but 2600 m, 1.v.1987, *Syzygium punctilimbum* (D. Burckhardt & I. Löbl) #8737 (MNHG, slide mounted); 1 ♀, same but Gunung Kinabalu, 6.0195°N, 116.5385°E, 1700 m, 22.iii.1983 (S. Nagai) #Pal-83/46 (MHNG, dry mounted).

Diagnosis. Genal processes 0.5 times as long as vertex along mid-line, irregularly rounded anteriorly. Forewing oblong oval, widest in the middle, 1.9–2.8 times as long as broad, narrowly rounded apically; vein C+Sc mostly straight, weakly concave in proximal third, cell c+sc narrow. Surface spinules present in all cells, forming cellular pattern; in cell r_2 above bifurcation of vein M, the cells are irregularly hexagonal consisting of one row of spinules. No extra pore fields developed on abdominal intersegmental membrane. Basal segment trapezoidal, hind margin with subapical angle bearing 5 short peg setae; apical segment 0.2–0.3 times as long as basal segment. Paramere very long and slender. Distal portion of aedeagus slender, weakly inflated apically. Female terminalia cuneate; dorsal margin of proctiger angularly concave at caudal end of circumanal ring, from there to pointed apex weakly convex, smooth.

Description. Adult. Colouration. Head and thorax dark reddish brown to almost black. Genal processes lighter than vertex, ochreous to brown. Antennal segments 1 and 2 light brown, segments 3–5 and basal third of segment 6 yellow to ochreous, apical two thirds of segment 6 and segments 7–10 dark brown to almost black. Mesoscutum with a broader median and two narrower submedian reddish brown longitudinal stripes. Fore and mid legs brown, tarsi and hind legs, including metacoxae, dirty yellowish. Forewings amber-coloured or light brown; veins concolourous with membrane. Hindwings whitish. Abdomen reddish brown to almost black dorsally, black ventrally; male and female terminalia light brown.

Structure. Conforming to the generic description of Burckhardt et al. (2020). Body length ♂ 1.9 mm, ♀ 2.0–2.2 mm (1 ♂, 2 ♀). Head deflexed 45° from longitudinal axis of body. Vertex rhomboidal, concave at base; preocular sclerite forming small tubercule; genal processes 0.5 times as long as vertex along mid-line, irregularly rounded anteriorly, well separated medially; eyes moderately 'stalked' (Fig. 3). Antenna 0.9–1.1 times as long as head width. Metatibia 0.5 times as long as head width, weakly widening to apex, with 5 irregularly spaced apical spurs. Forewing (Fig. 8) oblong oval, widest in the middle, 2.3–2.4 times as long as head width, 1.9–2.8 times as long as broad, narrowly rounded apically; pterostigma, at base narrower than adjacent part of cell r_1, regularly narrowing to apex, ending at apical third of wing; vein C+Sc mostly straight, weakly concave in proximal third, cell c+sc narrow; vein Rs almost straight, vein M long, with short, weakly diverging branches, vein Cu_{1a} relatively straight, reaching the wing margin distinctly distal to bifurcation of vein M. Surface spinules present in all cells, forming cellular pattern; in cell r_2 above bifurcation of vein M, the cells are irregularly hexagonal consisting of one row of spinules (Fig. 9). No extra pore fields developed on abdominal intersegmental membrane. Male terminalia as in Figs 18–20. Proctiger 0.7 times as long as head width; basal segment, in profile, trapezoidal; irregularly beset with setae along anterior and posterior margins, hind margin with subapical angle bearing 5 short peg setae; apical segment tubular, 0.3 times as long as basal segment. Subgenital plate, in profile, elongate, with wavy dorsal margin; sparsely beset with short setae. Paramere, in profile, very long and slender, slightly narrowed in apical third, narrowly rounded apically; inner face with moderately long bristles in apical third and with two rows of bristles in basal two thirds. Distal portion of aedeagus slender, weakly inflated apically; sclerotised end tube of ductus ejaculatorius small, relatively straight.



Figures 10–24. *Ctenarytaina* spp., terminalia. **10, 15, 18.** Male terminalia, in profile; **11, 16, 19.** Distal portion of aedeagus; **12, 17, 20.** Inner face of paramere; **13, 21, 23.** Female terminalia, in profile; **14, 22, 24.** Dorsal and ventral valvulae. **10–14** *C. daleae*; **15–17, 21, 22.** *C. lienhardi* sp. nov.; **18–20, 23, 24.** *C. smetanai* sp. nov.

Female terminalia as in Fig. 23. Proctiger 1.1 times as long as head width, 2.9 times as long as circumanal ring, cuneate; dorsal margin of proctiger angularly concave at caudal end of circumanal ring, from there to pointed apex weakly convex, smooth; weakly beset with short setae, with a longitudinal lateral row of long setae in apical third and 2–3 longitudinal rows of peg setae near ventral margin in apical half. Subgenital plate 0.7 times as long as proctiger, in profile, evenly narrowing to pointed apex. Valvulae dorsalis and ventralis curved (Fig. 24).

Measurements in mm (1 ♂, 1 ♀). Head width 0.62–0.72; antenna length 0.64–0.66; forewing length 1.46–1.68; length of male proctiger 0.46; paramere length 0.44; length of distal portion of aedeagus 0.20; female proctiger length 0.82.

Fifth instar immature unknown.

Etymology. Named after the late A. Smetana, Ottawa, eminent staphylinid specialist and collector of the holotype.

Distribution. Malaysia: Sabah, probably endemic to Mount Kinabalu.

Host plant, biology and habitat. One female was swept from *Syzygium punctilimbum* (Merr.) Merr. & L.M.Perry (Myrtaceae), a possible host, in moss forest. One male and one female were collected in an interception trap and one female was taken by sweeping vegetation.

Comments. *Ctenarytaina smetanai* sp. nov. differs from other congeners in the basal segment of the male proctiger which is trapezoidal and bears 5 short peg setae on the subapical angle of hind margin (Fig. 18).

Discussion and conclusions

Within the subfamily Spondyliaspidinae, which is almost entirely restricted to Australia, *Ctenarytaina* is exceptional in that it occurs also in Asia, Africa and Oceania. In fact, more than a third of the known species are native to Asia and only slightly less than a third is Australian. Among the 12 species known from Asia, the following four are apparently endemic to Gunung Kinabalu: *Ctenarytaina baliota* Burckhardt (on *Syzygium punctilimbum*), *C. daleae* (on *Leptospermum javanicum* and *L. recurvum*), *C. loebli* Burckhardt (on *Syzygium* sp.) and *C. taylori* Burckhardt (on *Syzygium* sp.). Here another two species are added, viz. *C. lienhardi* sp. nov. and *C. taylori smetanai* sp. nov. (both without host records), reflecting the species richness of the fauna of Gunung Kinabalu. All six *Ctenarytaina* species from this mountain appear to be endemic, a feature that is relatively rare in psyllids (Burckhardt and Queiroz 2021).

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References

Beaman JH, Beaman RS (1990) Diversity and distribution patterns in the flora of Mount Kinabalu. In: Baas P, Kalkman K, Geesink R (Eds) The plant diversity of Malesia. Springer, Dordrecht, 147–160. https://doi.org/10.1007/978-94-009-2107-8_14

Burckhardt D (1991) *Boreioglycaspis* and Spondyliaspidine classification (Homoptera: Psylloidea). Raffles Bulletin of Zoology 39: 15–52.

Burckhardt D, Giliomee JH, Hamilton-Attwell VL, Queiroz DL (2020) A review of jumping plant lice of the genus *Ctenarytaina* (Hemiptera, Psylloidea, Aphalaridae) associated with *Syzygium* (Myrtaceae). Journal of Insect Biodiversity 20(2): 35–58. https://doi.org/10.12976/jib/2020.20.2.1

Burckhardt D, Ouvrard D, Percy DM (2021) An updated classification of the jumping plant-lice (Hemiptera: Psylloidea) based on molecular and morphological evidence. European Journal of Taxonomy 736: 137–182. https://doi.org/10.5852/ejt.2021.736.1257

Burckhardt D, Queiroz DL (2021) *Mitrapsylla rupestris* sp. nov., a psyllid (Hemiptera, Psylloidea) associated with *Poiretia bahiana* (Fabaceae) endemic to the Espinhaço mountain range (Brazil, Bahía). Alpine Entomology 5: 69–75. https://doi.org/10.3897/alpento.5.70640

Cockburn PF (1978) Chapter 7, Flora. In: Luping M, Wen C, Dingley ER (Eds) Kinabalu: Summit of Borneo. Sabah Society Monograph 1978. Sabah Society, Kota Kinabalu, Sabah, Malaysia, 179–190.

Corner EJH (1978) Chapter 6, Plant life. In: Luping M, Wen C, Dingley ER (Eds) Kinabalu: Summit of Borneo. Sabah Society Monograph 1978. Sabah Society, Kota Kinabalu, Sabah, Malaysia, 112–178.

Halbert SE, Burckhardt D (2020) The psyllids (Hemiptera: Psylloidea) of Florida: newly established and rarely collected taxa and checklist. Insecta Mundi 0788: 1–88. https://centerforsystematicentomology.org/insectamundi/0788_HalbertandBurckhardt_2020.pdf

Lee DW, Lowry JB (1980) Plant speciation on tropical mountains: *Leptospermum* (Myrtaceae) on Mount Kinabalu, Borneo. Botanical Journal of the Linnean Society 80: 223–242. https://doi.org/10.1111/j.1095-8339.1980.tb01987.x

Makunde PT, Slippers B, Burckhardt D, Queiroz DL, Lawson SA, Hurley BP (2020) Current and potential threat of psyllids (Hemiptera: Psylloidea) on eucalypts. Southern Forests: a Journal of Forest Science 82(3): 233–242. https://doi.org/10.2989/20702620.2020.1813650

Mifsud D, Burckhardt D (2002) Taxonomy and phylogeny of the Old World jumping plant-louse genus *Paurocephala* (Insecta, Hemiptera, Psylloidea). Journal of Natural History 36: 1887–1986. https://doi.org/10.1080/00222930110048909

Queiroz DL, Burckhardt D, Majer JD (2012) Integrated pest management of eucalypt psyllids (Insecta, Hemiptera, Psylloidea). In: Larramendy ML, Soloneski S (Eds) Integrated Pest management and Pest Control – Current and future tatics. IntechOpen, Rijeka, 385–412. https://doi.org/10.5772/32631

Thompson J (1989) A revision of the genus *Leptospermum* (Myrtaceae). Telopea 3: 301–449. https://doi.org/10.7751/telopea19894902

World Flora Online (2021) World Flora Online. http://www.worldfloraonline.org/ [accessed 6 November 2021]