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What is *Ecdyonurus sumatranus* Ulmer, 1939? A contribution to the knowledge of the genus *Rhithrogena* in the Oriental Region (Ephemeroptera, Heptageniidae)

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Abstract

The species *Ecdyonurus sumatranus* Ulmer, 1939 was described from Sumatra based on a female imago and a single nymph. It was designated as the type-species of the genus *Ecdyonuroides* Dang, 1967, erected because of the peculiar morphology of the nymph. This genus was put into synonymy later and the species is currently known as *Thalerosphyrus sumatranus* (Ulmer, 1939). The female imago holotype of *Ecdyonurus sumatranus* Ulmer, 1939 is reinvestigated and revealed to belong to the genus *Rhithrogena* Eaton, 1881. The combination *Rhithrogena sumatrana* (Ulmer, 1939) **comb. nov.** is thus proposed. The nymphs described by Ulmer (1939) from Java sub. nom. *Rhithrogena parva* (?) are associated to this species, and are redescribed with new material coming from Java and Lombok. *Rhithrogena parva* (Ulmer, 1912) is redescribed based on the syntype series from Taiwan and male genitalia are illustrated for the first time. Supplementary description is provided for the nymph of *Rh. parva* and for the one of *Rh. ampla* Kang & Yang, 1994, also from Taiwan. The status of the subgenus *Tumungula* Zhou & Peters, 2004 is briefly discussed. The nymph associated by Ulmer (1939) to *Ecdyonurus sumatranus* is renamed *Thalerosphyrus lamuriensis* **sp. nov.** The genus *Ecdyonuroides* Dang, 1967 is considered as a synonym of *Rhithrogena* **syn. nov.**

Key words: Java, Sumatra, Lombok, Taiwan, *Rhithrogena*, *Thalerosphyrus*, *Ecdyonuroides*, *Tumungula*, new combination, new synonym, new species

Introduction

In his work devoted to the Ephemeroptera of the Sunda Islands, Ulmer (1939) described the species *Ecdyonurus sumatranus* (Heptageniidae), based only on two specimens; a female imago (type specimen) from south Sumatra and a half grown nymph from western Sumatra. Based on Ulmer's writing, he would not have described this species on this scarce material if he was not convinced that both specimens belonged to the genus *Ecdyonurus*. Despite this statement, he recognized that the nymph did not possess all characteristics of the genus *Ecdyonurus*, especially by the absence of posterolateral expansions of the prothorax, but he suggested it could be due to the fact that the nymph was only half grown. This specimen possesses peculiar structures, such as the unique highly-developed posterolateral expansions of the sternites V–VIII. The scattered setae on the galea-lacinia (Ulmer 1939, fig. 436) are characteristic of the subfamily Ecdyonurinae.

Dang (1967) proposed a new genus from Vietnam, called *Ecdyonuroides*, to accommodate a peculiar nymph of the family Heptageniidae, with long posterolateral abdominal expansions, he called *Ecdyonuroides vietnamensis*. He recognized the similarities between his nymph and the one described by Ulmer (1939), transferred the latter to his new genus as *Ecdyonuroides sumatrensis*, (misspelling!) and designated *E. sumatranus* as the type species of the genus *Ecdyonuroides*.

Later, Braasch & Soldán (1984) suggested to put *Ecdyonuroides* in synonymy with *Thalerosphyrus* Eaton, 1881, because the rearing of a nymph of *Ecdyonuroides vietnamensis* gave an adult similar to the genus *Thalerosphyrus*. They proposed the new combinations *Thalerosphyrus vietnamensis* (Dang, erroneously spelled Thanh) and they put in synonymy *Th. sumatranus* (Ulmer) with *Th. sinuosus* (Navás, 1933) without more explanations.

This synonymy was apparently not followed by later authors (eg. Kluge 2004; Wang & McCafferty 2004; Webb *et al.* 2006), and although the synonymy of *Ecdyonuroides* with *Thalerosphyrus* was accepted by most authors (e.g. Webb & McCafferty 2008), it was rejected by Tomka & Zurwerra (1985) because the hind leg proportions were not compatible between the male imago of *Th. determinatus* (type species of the genus) and *Ecdyonuroides vietnamensis*.

The major problem when dealing with *Thalerosphyrus* is that I have no idea of what it is exactly. The genus was created by Eaton (1881) to accommodate the species *Thalerosphyrus determinatus* (Walker, 1853) from Java known as male imago. According to Kimmins (1960), “most of the abdomen is missing and only one leg remains” of the holotype deposited in the Natural History Museum in London. Kluge (2004) considered therefore the genus *Thalerosphyrus* as *incertae sedis*, and referred only to *Ecdyonuroides/g(1)* when dealing with the species *vietnamensis* and *sumatranus*. Relationships of *Thalerosphyrus/Ecdyonuroides* with other members of the subfamily Ecdyonurinae need also to be investigated. A revision of what mayfly workers call *Thalerosphyrus* is thus required, but will not be treated here, although a redescription of the type specimen of the so-called *Thalerosphyrus sumatranus* (Ulmer) is proposed here below.

Material and methods

Original material studied here is deposited in the following institutions:

ZMH	Zoologisches Museum und Biozentrum Grindel, Hamburg, Germany
MZL	Musée cantonal de zoologie, Lausanne, Switzerland
LIPI	Lembaga Ilmu Pengetahuan Indonesia (Indonesian Institute of Sciences), Museum of Zoology, Bogor, Indonesia

Drawings were made with the help of a camera lucida taken from stereomicroscope Leica DM 750 or pictures from microscope Zeiss Axioscop 2. Final digital drawings were performed on Adobe Illustrator CS6. For scanning electronic microscope (SEM) pictures, the eggs were dehydrated, carbon coated, and observed under a LEO 1525 at 5.00kV. Final plates were assembled in Adobe Photoshop CS6.

Results

Rhithrogena sumatrana (Ulmer, 1939) **comb. nov.**

Ecdyonurus sumatranus Ulmer, 1939, holotype female only, not nymph

Rhithrogena parva (?) Ulmer, 1939, nymph, not imago

Ecdyonuroides sumatrensis [sic] Dang, 1967, type species of the genus *Ecdyonuroides*

Ecdyonurus sumatranus Kluge, 1989

Thalerosphyrus sumatranus Wang & McCafferty, 2004

Material. One female imago holotype: Indonesia, South Sumatra [actual province of Bengkulu], Tjurup [Curup], at light trap, 7.V.1929, Prof. Feuerborn leg. [ZMH]

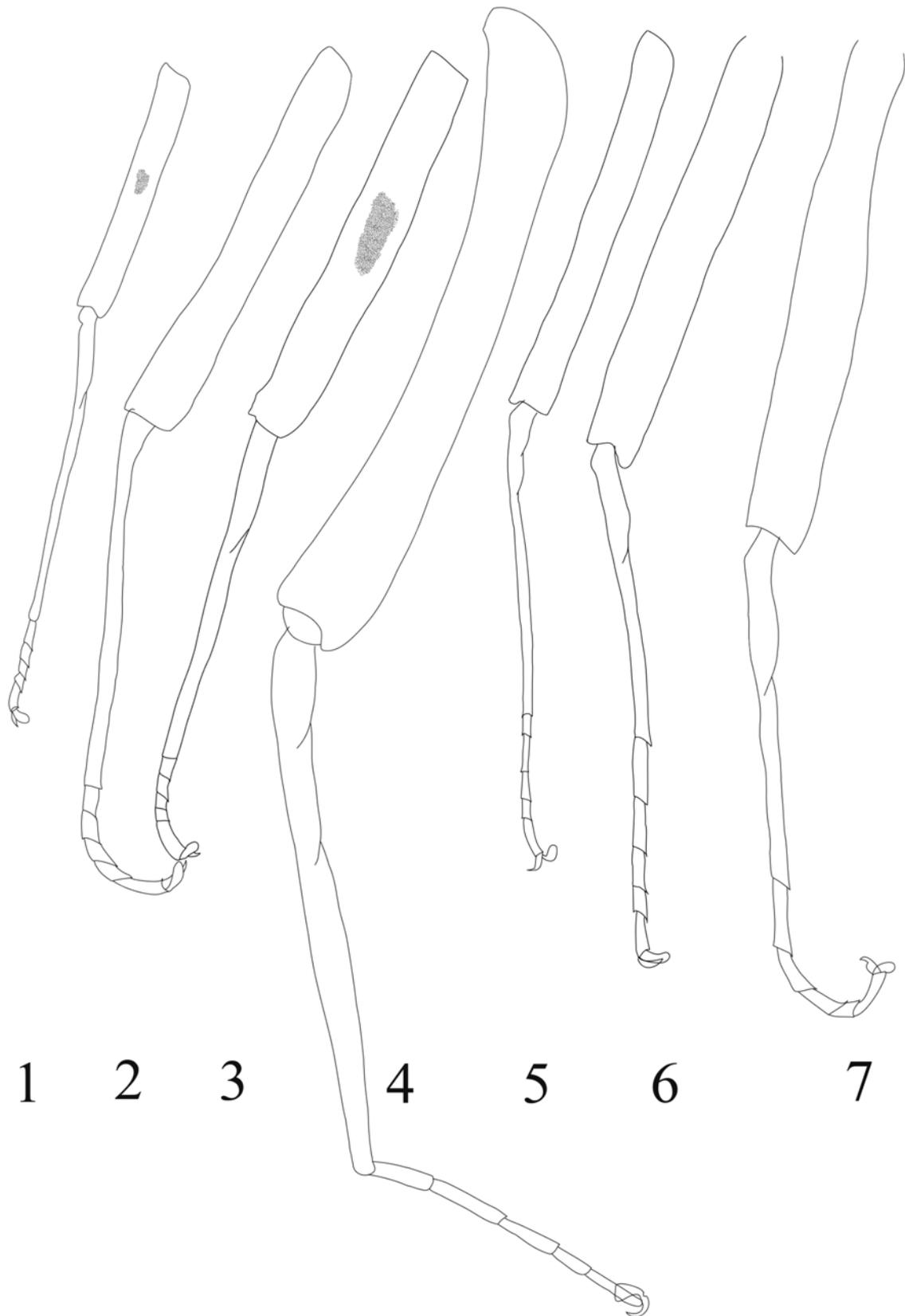
Specimen kept in alcohol, except one hindleg mounted on slide in Canada balsam.

Seven nymphs: Indonesia, Java, Kali Kemantan in Kari Highlands, mountain stream at ca 1500 m, P2, 18.X.1928, Prof. Thienemann leg. [ZMH, MZL]

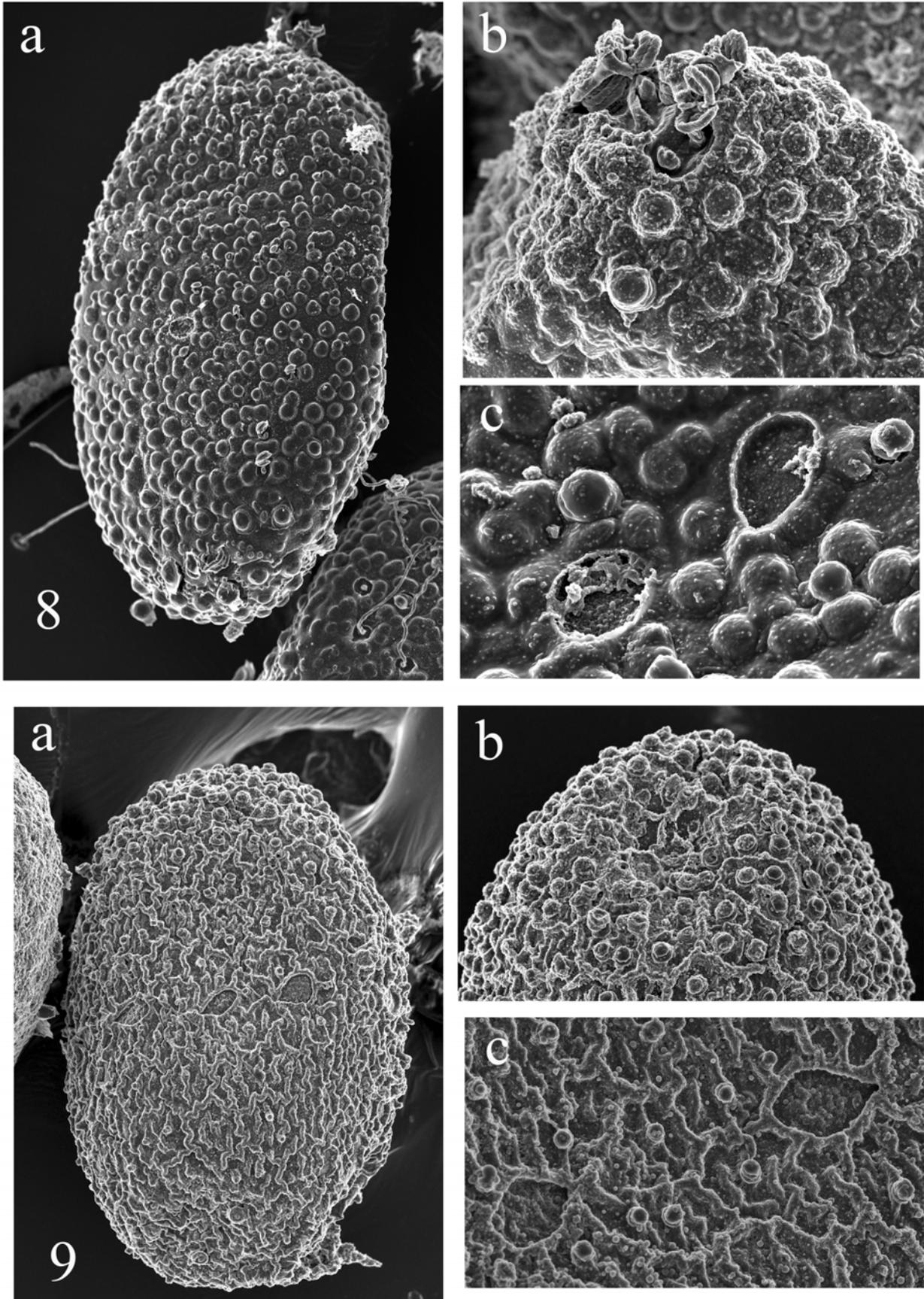
Specimens in alcohol, one specimen partially mounted on two slides by Ulmer (Ulmer 1939, figs 467–469) in ZMH, one other specimen entirely mounted on microscopic slide [MZL]

One nymph: Indonesia, Java, Buitenzorg in Tjiliwung River, FB3, 25.V.1929, Prof. Feuerborn leg. [ZMH]

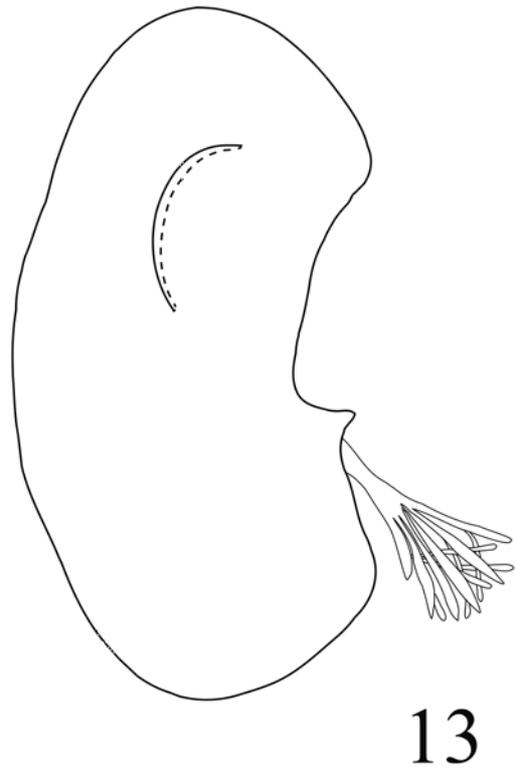
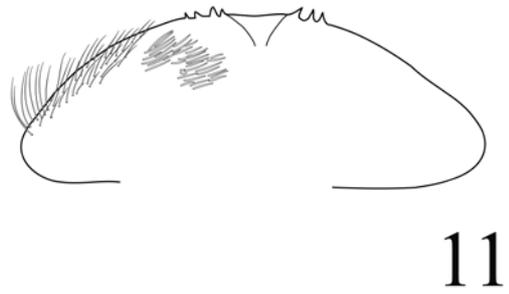
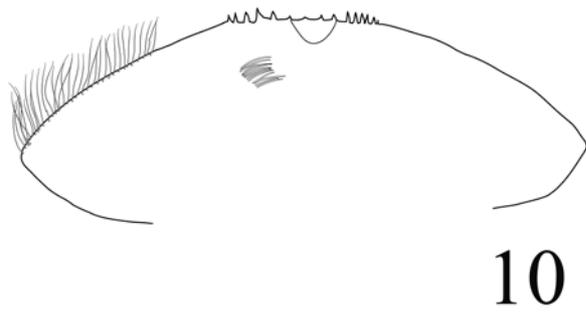
One nymph entirely mounted on microscopic slide: Indonesia, Java, Malang Batu Jalang, forested stream with waterfall, 9.V.2010, J.-M. Elouard leg. [MZL]



FIGURES 1–7. Hind legs of different Heptageniidae female imagos. Fig. 1: *Rhithrogena sumatrana*; Fig. 2: *Rhithrogena cf. hybrida*; Fig. 3: *Rhithrogena parva*; Fig. 4: *Paegniodes cupulatus* (all Rhithrogeninae); Fig. 5: *Heptagenia sulphurea* (Heptageniinae); Fig. 6: “*Thalerosphyrus*” *sinuosus*; Fig. 7: “*Thalerosphyrus*” *determinatus* (Ecdyonurinae). All at the same scale



FIGURES 8–9. Egg structures of *Rh. sumatrana* (Fig. 8) and *Paegniodes cupulatus* (Fig. 9). a: egg in toto; b: detail of the pole; c: micropyle area.



FIGURES 10–13. Larval structures of *Rh. sumatrana* (Figs 10 and 12) and *Rhithrogena parva* (Figs 11 and 13). Figs 10–11: labrum in dorsal position; Figs 12–13: gill I

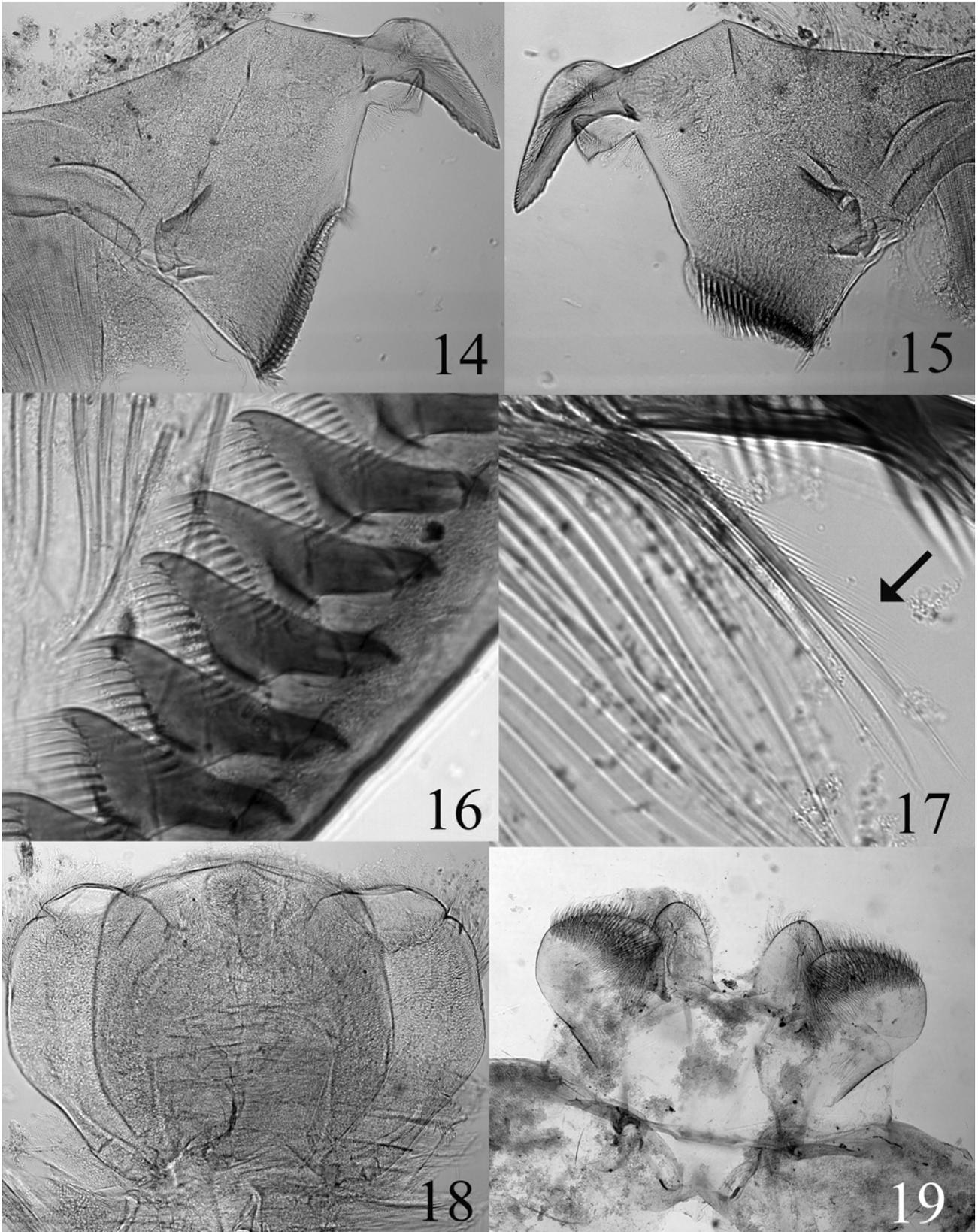
Two nymphs, one entirely mounted on microscopic slide: Indonesia, Lombok, Nusa Tenggara Barat, Aik Jud River, 1 km north of Sesaot, 350 m, 23.X.1985, J.T & D.A. Polhemus leg. [MZL].

Supplementary description of the female holotype. Ulmer (1939, p. 558, figs 129–131) gave a detailed description of this specimen, which is correct. As usual with Ulmer’s collection, the specimen is entirely faded, so coloration pattern is not more visible, except for the hindleg on slide.

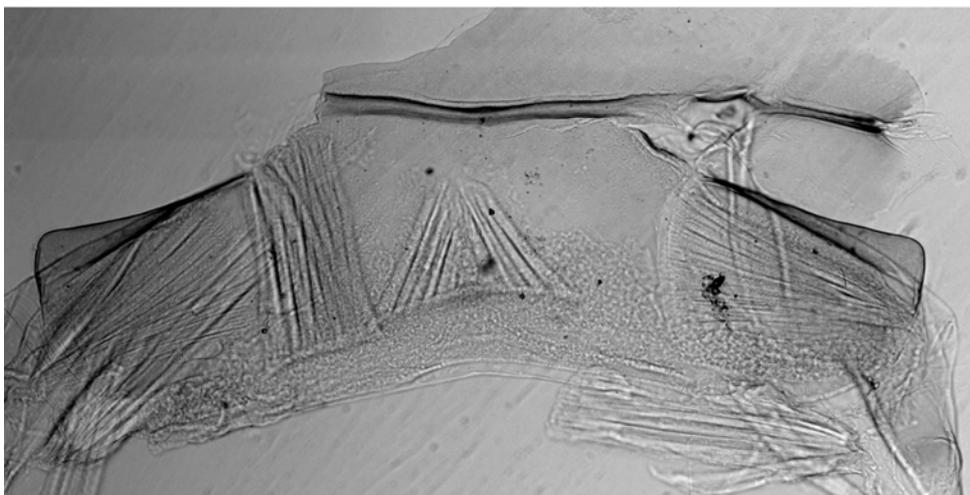
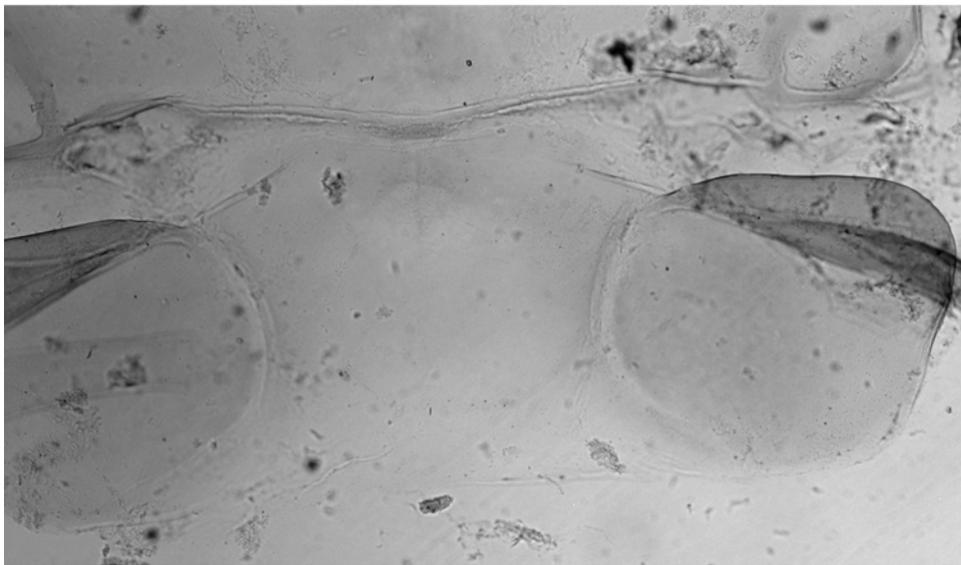
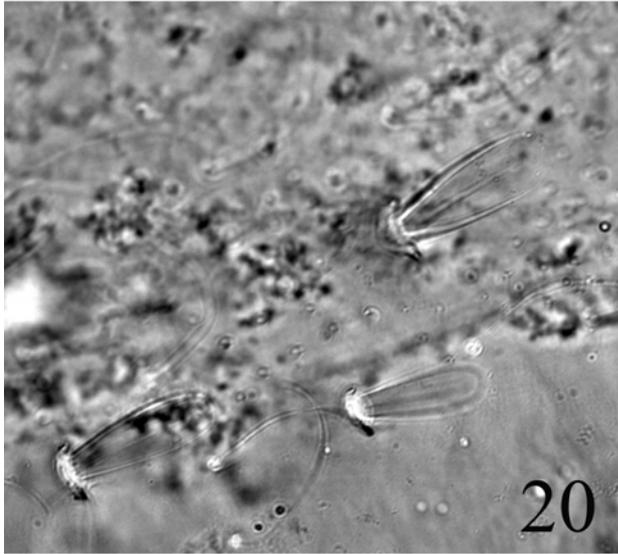
Of importance are the following characters: the dorsal face of femora bears a dark macula (Ulmer 1939, p. 559: ... mit hell honigfarbenen Schenkeln, die in der Mitte einen deutlichen schwarzen Punkt haben”); the hind tarsi are short, reported as one third the length of the tibia by Ulmer (1939, p. 559), they are in fact closer to one fourth (Fig. 1); the subanal plate is deeply cleft and bilobate.

Not mentioned by Ulmer are the following details of the thorax: mesonotum with a transverse suture; medial depression of mesothoracic furcasternum is narrowed anteriorly.

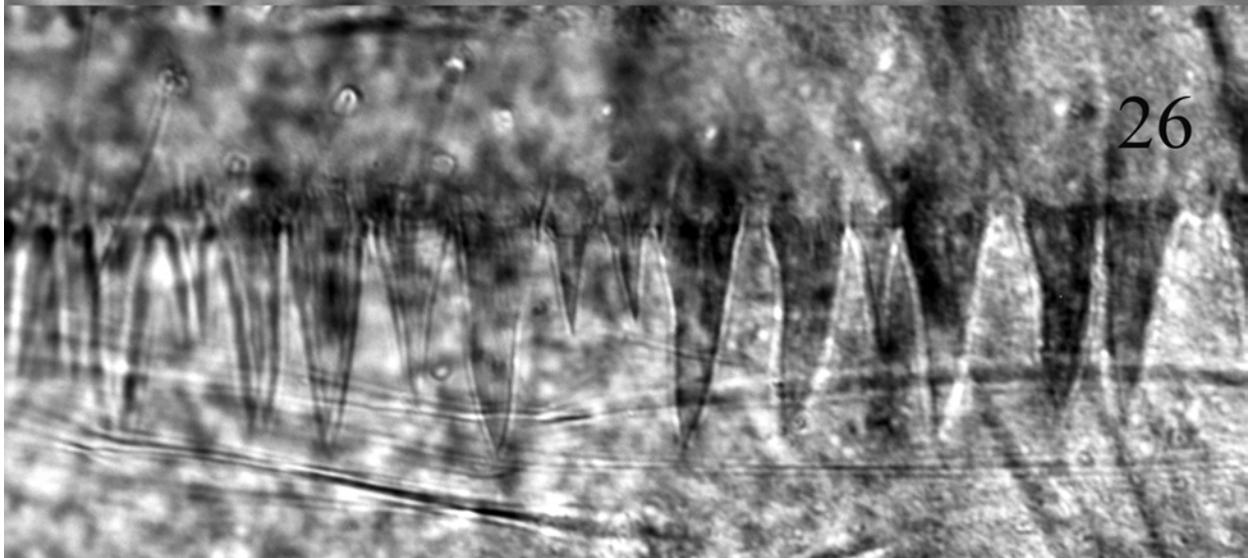
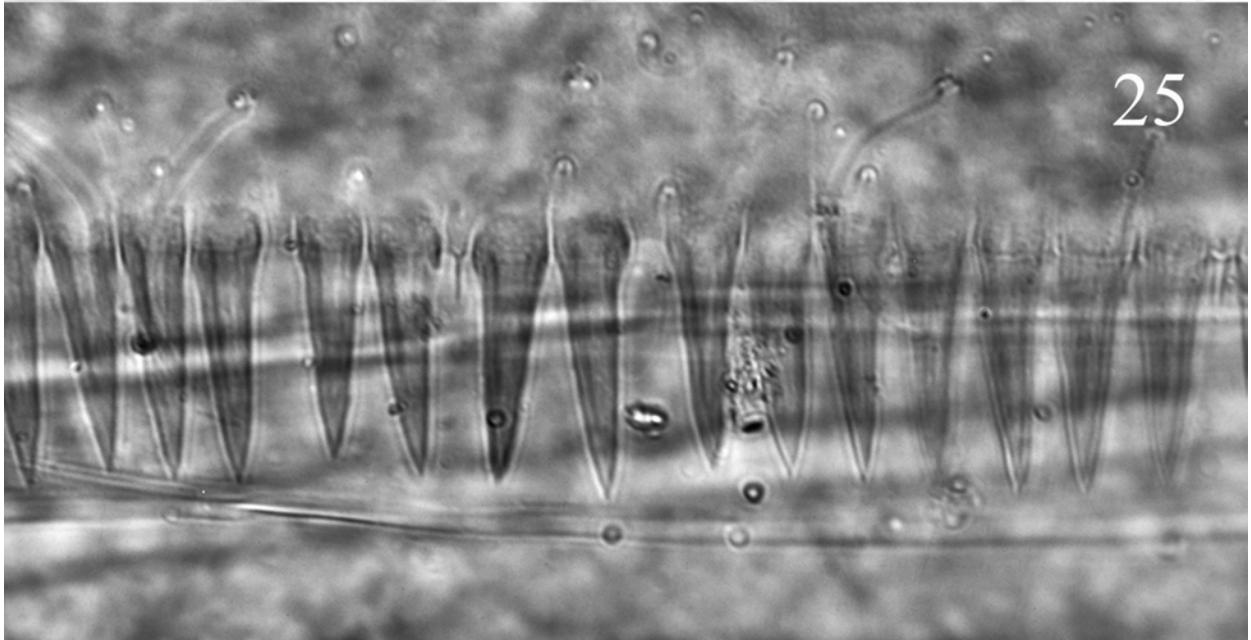
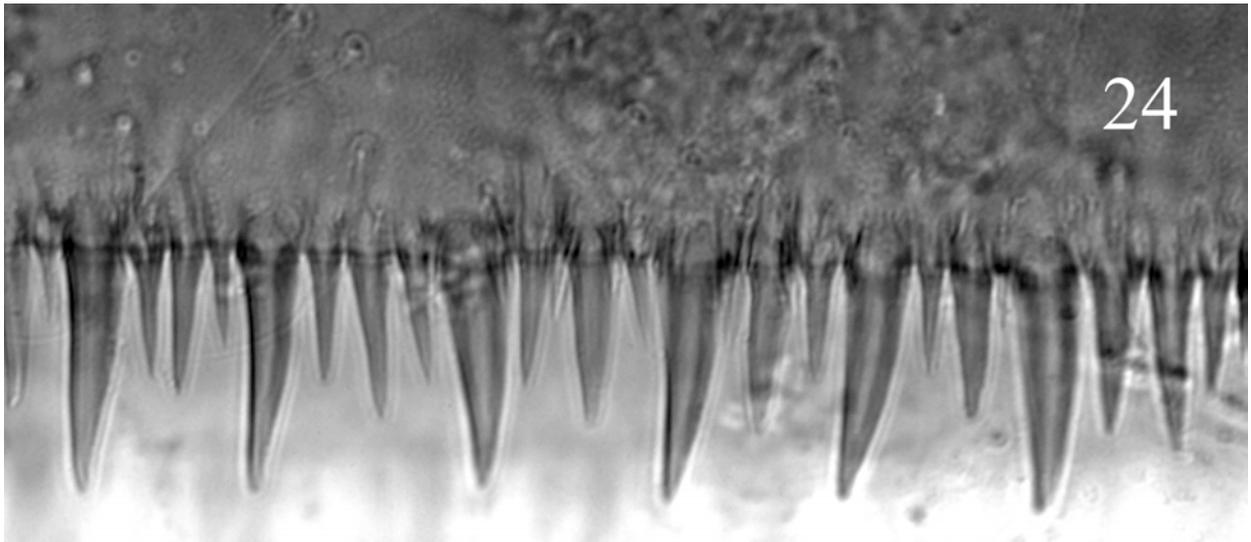
Description of the eggs. Size: ca 150 μm x 80 μm , regularly ovoid (Fig. 8a). Chorionic surface covered by macrogranulae; macrogranulae asymmetrical and elongated (ca 3.5 μm x 2 μm), each directed toward one pole. Opposite pole covered with large KCTs (ca 5 μm in diameter), smaller KCT’s present between macrogranulae (2.5–3 μm in diameter) (Fig. 8b). Micropyles oval (ca 8 μm x 5 μm) and located in equatorial area, with smooth margins (Fig. 8c).



FIGURES 14–19. Mouthparts of *Rh. sumatrana*. Fig. 14: left mandible; Fig. 15: right mandible; Fig. 16: comb-shape setae on the galea-lacinia; Fig. 17: outer dentisetum (arrow); Fig. 18: hypopharynx; Fig. 19: labium.



FIGURES 20–23. Leg larval structures of *Rh. sumatrana*. Fig. 20: bristles on the dorsal face of hind femora; Fig. 21: tarsal claw. Shape of the lateral sclerites on the first abdominal sternite. Fig. 22: *Rh. sumatrana*; Fig. 23: *Rh. parva*.



FIGURES 24–26. Posterior margin of abdominal tergites IV–V. Fig. 24: *Rh. sumatrana*; Fig. 25: *Rh. parva*; Fig. 26: *Rh. ampla*.

Supplementary description of the supposed nymph. Described under the name *Rhithrogena parva* (?) by Ulmer (1939), supplementary information is as follows.

Labrum ca 2.5x wider than long (Fig. 10); lateral margins slightly angled, anteromedian emargination small and rounded, presence of irregular and pointed teeth in median area; anterior margin covered with long and thin setae up to two thirds of margin; tuft of short and thin setae in median position. Mandibles (Figs 14–15) with outer margin covered with long and thin setae, outer incisor ca 2–2.5 times longer than wide at base, below inner incisor one row of thin setae decreasing in length and ending ca at half distance to mola. Left mandible (Fig. 14) with tuft of dense and thin setae above mola and one row of numerous thin and long setae below mola. Right mandible (Fig. 15) without tuft of dense and thin setae above mola, and with row of numerous thin and long setae below mola. Galea-lacinia of maxillae with ca 12 comb-shape setae, median one composed of ca 13–15 teeth (Fig. 16). Outer dentiseta fringed on its outer margin (Fig. 17). Hypopharynx (Fig. 18) with stout and almost quadratic lingua, without distal emargination, with one row of thin and short setae anteriorly, superlinguae oval, bearing one row of thin and long setae down to ca ¼ margin. Labium (Fig. 19) with glossae rib-shaped, 1.5 times longer than wide at base; paraglossae quadrangular with well-marked inner angle and outer margin rounded.

Each leg with distinct blackish rounded macula in middle of dorsal face of femora. Bristles on dorsal face elongated, with slightly divergent margins, and with rounded apex (Fig. 20). Tibio-patellar suture on hind tibiae with row of ca 8–10 spatulate bristles. Tarsal claw with 2–4 teeth (Fig. 21).

Gill I (Fig. 12) with regularly crenulated margin, and with very long and thick plica; gills II–VII with entire, smooth margin. First abdominal sternite with lateral sclerites directed perpendicular to body axis (Fig. 22). Posterior margin of abdominal tergites (Fig. 24) with one row of irregular teeth, some long and thick, others smaller and thinner, and some submarginal microdenticles present.

Discussion. According to Kluge (1989) and Webb & McCafferty (2008), the structure of the female furcasternum reveals that this species cannot belong to the subfamily Ecdyonurinae, and thus cannot be associated with *Thalerosphyrus*. Other characters which are never found in *Thalerosphyrus* include the presence of a macula on the dorsal face of the femora, the subanal plate being bilobate and hind tarsi that are so short (Figs 1–7).

So if the specimen at hand is not a member of Ecdyonurinae, to which subfamily does this female belong? The subfamily Heptageniinae has very few species in Southeast Asia. The only genus known for certain is *Trichogenia* Braasch & Soldán, 1988, represented by 3 species known only as larvae from Thailand, Vietnam, Sumatra, Borneo and Sulawesi (Braasch & Soldán 1988; Webb *et al.* 2006). Webb *et al.* (2006) proposed to include also in this genus the species *Heptagenia nasuta* Ulmer, 1939, known only from the imaginal stage, on the basis that no other Heptageniinae has ever been collected in the area, and the similarity in the tinted violet tinge found on the *H. nasuta* forewing and on a dissected wingpad of a *Trichogenia* nymph. Whether or not correct, our female does not match any *Trichogenia* species because the latter all lack dark maculae on the femora; the shape of the subanal plate resembles the one of the *H. nasuta* female (Ulmer 1939, fig. 158), but the proportions of the hindlegs are completely different, with hind tarsi ca. 8.0x the size of the tibia, compared to 0.33x maximum in my specimen. The subfamily Rhithrogeninae, however, remains a candidate for placement of this taxon under study, of which three genera are recorded from Southeast Asia: *Epeorus* Eaton, 1881; *Paegniodes* Eaton, 1881 and *Rhithrogena* Eaton, 1881. The presence of a transverse suture on the mesonotum excludes *Epeorus* as a possibility (Webb & McCafferty 2008). The female of *Paegniodes cupulatus* (Eaton, 1871) possesses hind tibiae ca 2x the length of the tarsi that have a segment composition, in decreasing order, of 2=5>3>1>4 (Fig. 4), whereas it is 1=5>2>3>4 in the examined female (Fig. 1). Moreover, the subanal plate of *P. cupulatus* is entire and not cleft, and the femora do not possess dark maculae (Eaton 1885). Additionally, the eggs of *Paegniodes* do not present the same chorionic arrangement as those of *Rhithrogena* species, in particular those of *Rh. sumatrana* (Fig. 9).

Thus *Rhithrogena* is the best candidate to accommodate *Ecdyonurus sumatranus*. All the mentioned characters are, or can be, found in members of *Rhithrogena*., which is a diverse genus encompassing more than 150 species, most of which have Holarctic distributions (Barber-James *et al.* 2008).

Five species of *Rhithrogena* are known from Southeast Asia

- *Rh. parva* (Ulmer, 1912), male and female imagoes described from Formosa (Taiwan) under the name *Ecdyonurus parvus*, recombined later without more comment (Ulmer 1920). Nymphs mentioned for the first time from Java (Ulmer 1939) under the name *Rhithrogena parva* ? Nymphs and eggs illustrated from

Taiwan by Kang & Yang (1994), without mentioning on which basis they associate their nymph with Ulmer's species;

- *Rh. diehliana* Braasch & Soldán, 1986, a single male subimago poorly described from northern Sumatra;
- *Rh. ampla* Kang & Yang, 1994, nymphs described from Taiwan, which are barely distinguishable from those of *Rh. parva*, but present egg chorionic structure differences, and may live in higher altitudes;
- *Rh. unica* Zhou & Peters, 2004, all stages described from southern China, and type-species of *Tumungula* Zhou & Peters, 2004 (see below);
- *Rh. siamensis* Braasch & Boonsoong, 2009, all stages described from Thailand and placed by the authors in the subgenus *Tumungula*

Rh. ornata (Ulmer, 1939) is not listed here because I cannot accept the synonymy with *Rhithrogeniella* Ulmer, 1939 (type species *Rhithrogeniella ornata*, Ulmer, 1939 from Java and Sumatra) proposed by Wang & McCafferty (2004). Examination of the type material show *Rhithrogeniella* is not a Rhithrogeninae because the depression of the furcasternum is not narrowed anteriorly and consequently cannot be a synonym of *Rhithrogena*. Its exact status will be treated elsewhere (Sartori 2014a).

All these species present a dark macula on the femora. The female of *Rh. sumatrana* can be compared to those of *Rh. unica* and *Rh. siamensis*, with which it shares the short hind tarsi (between one third and one fourth the length of the tibia), and the subanal plate deeply cleft. It differs from *Rh. siamensis* by the egg chorionic structure (Boonsoong & Braasch 2013), those of *Rh. unica* being unfortunately undescribed. The female of *Rh. parva* is incompletely described, but based on its redescription (see below), *Rh. sumatrana* differs by the hind tibiae being much longer than the femora (subequal in *Rh. parva*, compare Figs 1 and 3), by the tarsal composition and by the subanal plate being not so cleft. It remains a possibility that *Rh. diehliana* is a junior synonym of *Rh. sumatrana*, but due to the scarcity of data, more material is needed.

In the absence of mature female nymphs, the association between the female adult and the nymphs described here is based on the following interpretations. In Southeast Asia, the genus *Rhithrogena* is not only poorly diversified, but is also very rare and uncommon in stream and rivers. The genus appears to be absent from Vietnam, Malaysia and the Philippines. *Rhithrogena* of the Sunda Islands are known from Sumatra, Java and Lombok; the conspecificity of the populations of Lombok and Java, which are located on each side of the Wallace line, makes the conspecificity of the populations of Java and Sumatra credible, although no *Rhithrogena* nymphs have been collected or reported from Sumatra (contrary to what was stated by Zhou & Peters 2004). Both islands share several mayfly species in common, such as *Compsoeuria spectabilis* Eaton, 1881; *Compsoeurilla thienemanni* Ulmer, 1939, both in the Heptageniidae (Sartori, unpublished); *Rhoenanthus speciosus* Eaton, 1881 in the Potamanthidae (Bae & McCafferty 1991); *Potamanthellus caenoides* (Ulmer, 1939) in Neophemeridae, with this species' range of distribution also including Lombok (Bae & McCafferty 1998); and *Dudgeodes ulmeri* Sartori, 2008 in Teloganodidae, recently also reported from Bali (Sartori *et al.* 2008; Sartori 2014b).

The nymph of *Rh. sumatrana* is easily separated from all other Southeast Asian species by the numerous crenulations of the gill I. The mandible illustrated by Ulmer (1939: Fig. 467) is much more elongated than the one showed here, because on his slide preparation the mandible has been folded, appearing much more slender than it is actually.

It is impossible to know if *Rh. sumatrana* belongs to the subgenus *Tumungula* Zhou & Peters, 2004 or to the subgenus *Rhithrogena*, s.s. *Tumungula* is characterized by several unique apomorphies which are present only on the male imago, such as a hypertrophied foreleg claw, the first segment of the fore tarsi longer than the second, and various details of the genitalia. Zhou & Peters (2004) mentioned anyway, in the diagnosis of the subgenus, the presence of an incised subanal plate, as in *Rh. sumatrana*. This is also the case not only in the species *Rhithrogena* (*Tumugula*) *siamensis* as illustrated by Braasch & Boonsoong (2009), but also in some *Rhithrogena* s.s. species such as *Rh. paulinae* (Sartori & Sowa 1992) from Iran. This character is rather rare within the genus *Rhithrogena*, where most of the Holarctic species possess an oval to ellipsoidal subanal plate that is entire or slightly concave (e.g. Needham *et al.* 1935; Sartori 1992; Sowa *et al.* 1985; Sowa & Soldán 1986). As in *Rh. (Tumungula) unica*, the first sternite of the nymph possesses lateral sclerites perpendicular to the body axis, contrary to *Rh. parva* and *Rh. ampla* (see below); the same also occurs in *Rh. (Tumungula) siamensis* (B. Boonsoong, pers. comm.). The combination of gill VII with a smooth margin, and lateral sclerites perpendicular to the body axis (and to some extent the maculae on the femora) may support the monophyly of these three species (hence the validity of the

subgenus *Tumungula*), as it has been shown also to some extent for European species (Sowa 1984; Vuataz *et al.* 2011).

***Rhithrogena parva* (Ulmer, 1912)**

Ecdyonurus parvus Ulmer, 1912, male and female imagos

Rhithrogena parva Ulmer 1920

nec *Rhithrogena parva* (?) Ulmer, 1939, nymphs

Rhithrogena parva Kang & Yang, 1994, nymphs and eggs

Material. 22 pinned syntype specimens (20 males and 2 females): Formosa [Taiwan], Taihorin (= Taihorinsho) [currently known as Dalin, Chiayi County], 16 males, 1 female, VIII. 1909; 1 male, IX.1909; 1 female, VIII.1910; 3 males, XI.1910, H. Sauter leg. [ZMH]

Two males from VIII.1909 [one now in MZL] and the female from VIII.1910 have been rehydrated and are currently in ethanol.

2 nymphs, one entirely mounted on microscopic slide: Taiwan, Fuyan, Juisui, Hualien Hsien, 280 m, 02.I.1991, C.K. Kang leg [MZL]

Male imago. Body length: ca 8 mm; forewing length: ca 8.5 mm.

General coloration medium to dark brown, without specific patterns; abdominal sternites lighter than tergites; forelegs dark brown, mid- and hindlegs medium brown, upper face of femora with large elongated dark macula in middle (Fig. 3); coxae of mid- and hindlegs blackish; cerci entirely medium brown.

Wings translucent, longitudinal veins medium brown. Forewings with apex of the costal and subcostal fields tinted in medium brown; pterostigmatic area with 13–15 simple cross veins.

Forelegs as described and illustrated by Ulmer (1912: Fig. 8), tarsal composition 2>3>4>5>1; segment 1 ca 0.20–0.25x length of segment 2. Tarsal claw with enlarged paddle-like ungula and reduced claw-like one (Fig. 31).

Styliger plate straight to slightly concave, with two lateral rounded, asymmetrical processes (Fig. 27); gonopods 4-segmented, terminal segment slightly smaller than penultimate segment. Penis lobes V-shaped, cylindrical; in ventral view, apical sclerite with small tooth near large and elongate gonopore (Fig. 28); titillators stout and composed of 2–3 teeth at apex and with others scattered on its face (Fig. 28); in dorsal or lateral view (Figs 29–30), large and acute spine at apex, not visible in ventral view.

Female imago. Body length: ca 9 mm; forewing length: ca 10.5 mm.

General coloration as in male, coxae medium brown, wing coloration similar.

Hind leg with very short tarsi, about 0.25x length of tibia; tarsal composition 5>2>1>3=4 (Fig. 3).

Subanal plate clearly concave, median incision shallow (Fig. 32).

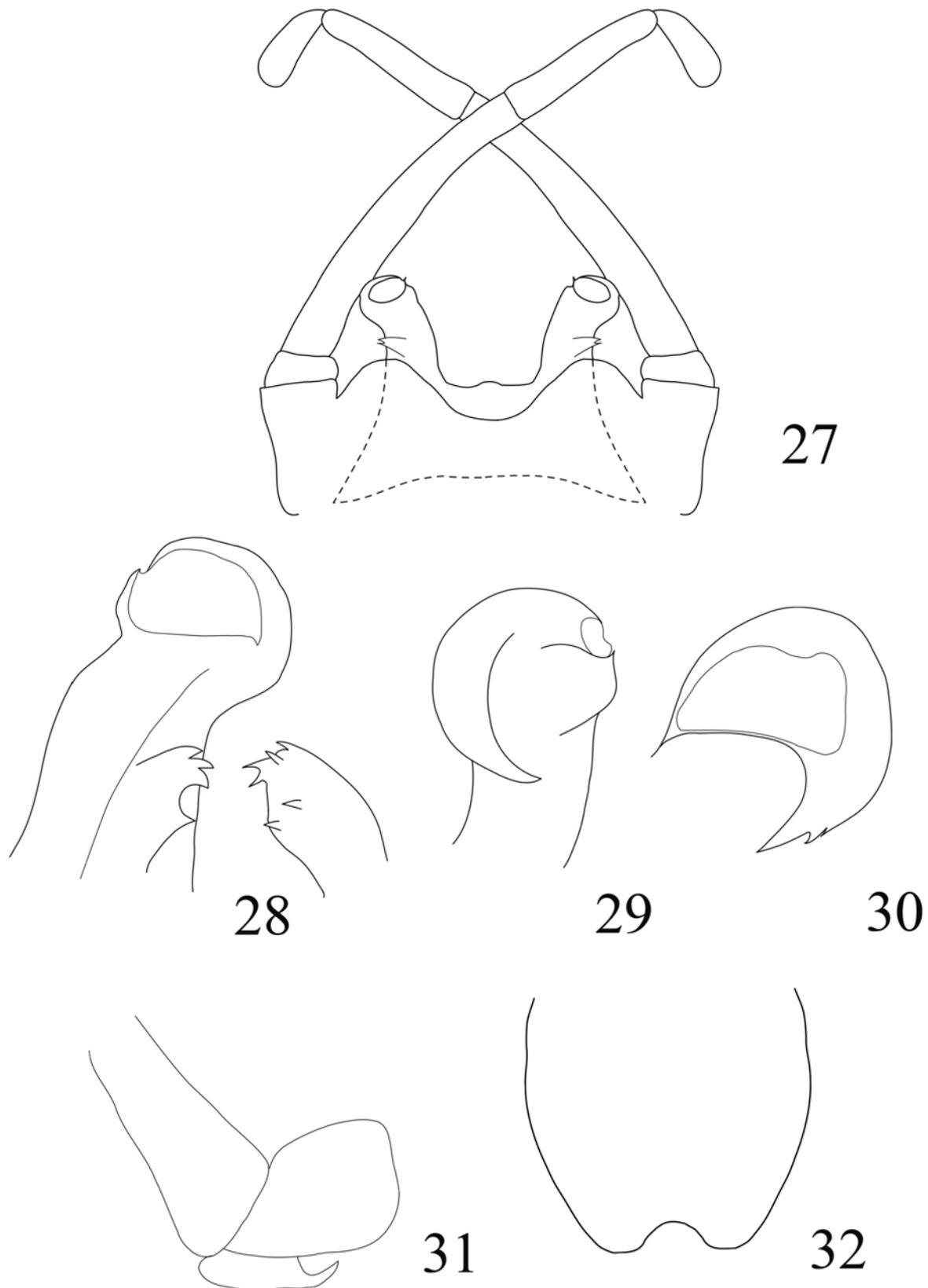
Nymph. Described already by Kang & Yang (1994), supplementary information is as follows.

Labrum similar to that of *Rh. sumatrana*, but tuft of thin and short setae in median position much larger (Fig. 11). Mandibles with row of setae below inner incisor short and not reaching middle of distance to mola (Figs 33–34). Presence of ca 10 comb-shape setae on crown of galea-lacinia, median ones bearing 9–10 teeth. Labium similar, inner angle of paraglossae even more pronounced than in *Rh. sumatrana*.

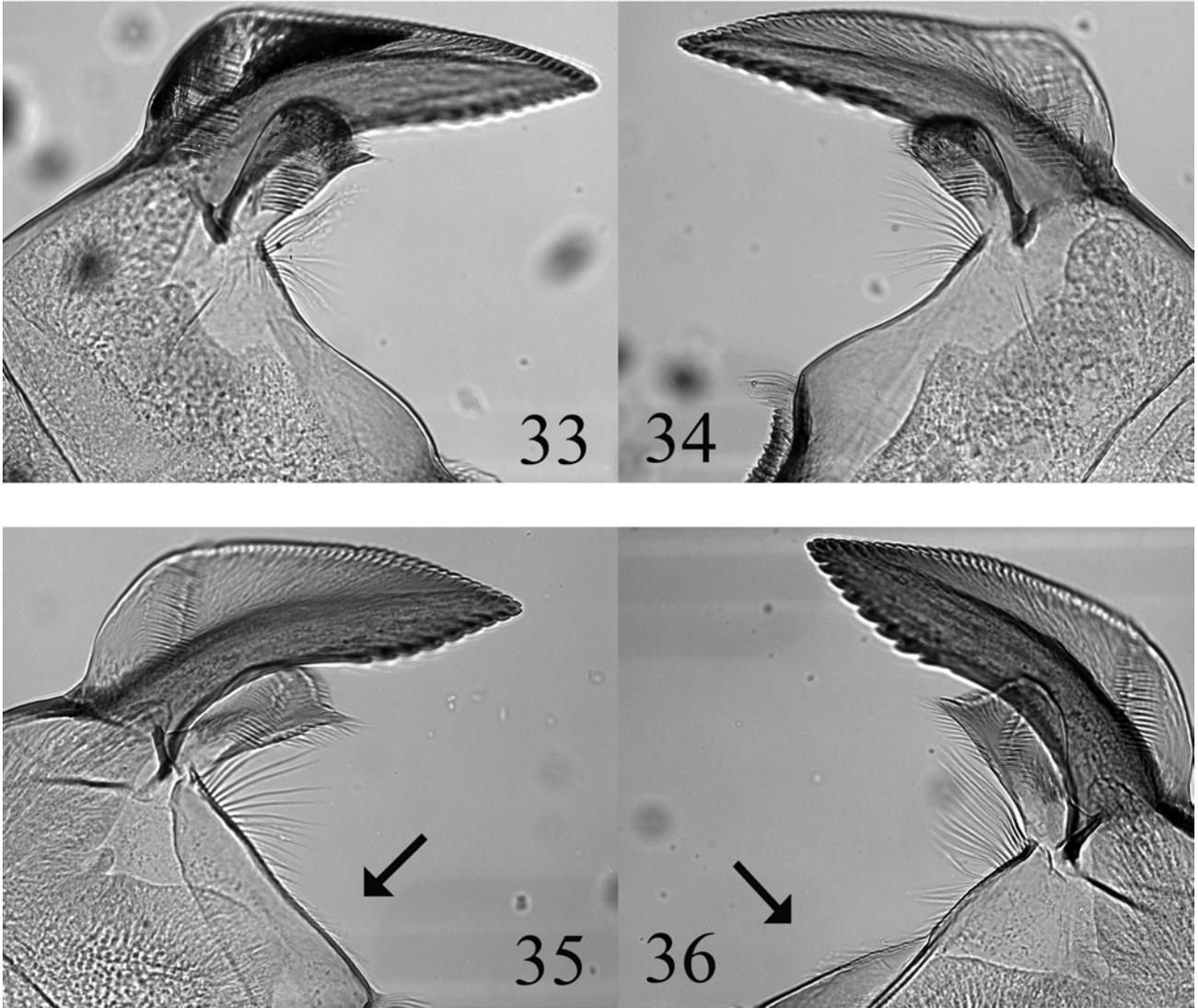
Bristles on dorsal face of femora similar to those of *Rh. sumatrana*, Hind tibiae with tibio-pattellar suture shorter.

Gill I with margin entire and smooth (Fig. 13); plica thin and much shorter than in *Rh. sumatrana*. Gills II–VII with margin entire. Lateral sclerites of first abdominal sternite directed posteriorly (Fig. 23). Posterior margin of abdominal tergites with row of regular pointed teeth; submarginal microdenticles absent (Fig. 25).

Discussion. *Rh. parva* clearly possesses all the attributes of the genus *Rhithrogena*. This is evidenced by the genitalia that are described for the first time, above. The male styliger plate possesses two large humps that are more pronounced than those seen in European species, for instance; the presence of a small ventral apical spine and a larger dorsal one, together with robust titillators, are well-known genital structures within the genus. On the contrary, the cylindrical shape of the penis lobes is somewhat unusual, most of the species having a stronger penis base.



FIGURES 27–32. *Rh. parva* male and female imagos. Fig. 27: male genitalia; Fig. 28: penis lobe in ventral position, with a drawing of the other titillators; Fig. 29: the same in dorso-lateral position; Fig. 30: the same in dorso-apical position; Fig. 31: detail of the fore tarsal claw of the male imago; Fig. 32: outline of the female subanal plate.



FIGURES 33–36. Details of the mandibles of *Rh. parva* (Figs 33–34) and *Rh. ampla* (Fig. 35–36). Figs 33 and 35: right mandible; Figs 34 and 36: left mandible; arrow indicates the row of thin and short setae.

The foreleg claw of the male is also intriguing because it resembles the one found in the subgenus *Tumungula*; in *Rh. parva*, the paddle-like claw is greatly enlarged, much more than in other species of *Rhithrogena* s.s. In *Rh. (Tumungula) unica*, the second claw is described as “small, blunt, plate-shaped”, whereas in *Rh. parva* it retains the hooked form as in other legs. The tarsal composition of the foreleg, with the first segment greatly reduced, the absence of acute processes on the styliiger margin, and the presence of genital titillators are typical of *Rhithrogena* s.s.

The nymph of *Rh. parva* is easily told from the one of *Rh. sumatrana* by the shape of the gill I, the shape of the lateral sclerites of the first abdominal sternite, the number of teeth of the comb-shape structures of the galea lacinia, the setation of the labrum, and also by the ornamentation of the abdominal tergites.

***Rhithrogena ampla* Kang & Yang, 1994**

Rhithrogena ampla Kang & Yang, 1994, nymphs and eggs

Material. 2 nymphs paratypes, one entirely mounted on microscopic slide: Taiwan, Tzuenchiao, Hsiulin, Hualin Hsien, 2010 m, 04.IV.1991, C.K. Kang leg [MZL]

Supplementary description. Kang & Yang (1994) mentioned that this species is very close to *Rh. parva* and hardly distinguishable in the larval stage, the discriminating features being the chorionic structure of the eggs and the altitudinal zonation.

I can confirm the assertion that both species are very similar. However, the setation of the mandibles (Figs 35–36) of *Rh. ampla* continues almost up to the mola (not reaching the middle of the distance to the mola in *Rh. parva*), and the posterior margin of abdominal tergites bear irregular teeth similar to those of *Rh. sumatrana* (Fig. 26).

All other characters examined are similar between *Rh. parva* and *Rh. ampla*.

Taxonomic outcomes. The reassignment of *Ecdyonurus sumatranus* to the genus *Rhithrogena* has important taxonomic consequences.

First, the nymph described as either *Ecdyonurus sumatranus* (listed by some as *Ecdyonuroides* or *Thalerosphyrus*), belongs to Ecdyonurinae and cannot be the nymph of *Rhithrogena sumatrana*. To my knowledge, there are no valid junior synonyms for this taxon, and consequently, a new name should be provided.

***Thalerosphyrus lamuriensis* sp. nov.**

Ecdyonurus sumatranus Ulmer, 1939, nymph only, not female imago

Ecdyonuroides sumatrensis [sic] Dang, 1967, nymph only

Thalerosphyrus sumatranus Braasch & Soldán, 1984 and auct. seq. nymph

Material. Holotype: one male nymph, Indonesia, Western Sumatra, stream in primary forest at the Subang pass, 1000 m., 4.III.1929, Prof. Feuerborn leg. [ZMH]

Specimen kept in alcohol, except hindleg, gills and mouthparts mounted on 3 microscopic slides.

Paratypes: 32 nymphs, Indonesia, Sumatra Barat, Bukit Barisan, above Padang, creek, 1047m, 00° 56.739'S 100 32.730'E, (UN3), 8.XI.2011, M. Balke leg. [MZL, ZMH, LIPI]; 4 nymphs, Indonesia, Sumatra Barat, Harau Canyon, stream, 540m, 0° 04.428'S 100° 38.002'E, (SUM009), 27.IX.2009, M. Balke & D. Amran leg. [MZL, LIPI]; 5 nymphs, Indonesia, Sumatra Barat, Universitas Andalas campus, forest stream, 360m, 00° 54.666'S 100° 28.379'E, (UN1), 8.XI.2011, M. Balke leg. [MZL]; 2 nymphs, Indonesia, Sumatra Barat, Bukit Tinggi to Palupuh, 680m, 0° 08.128'S 100° 15.514'E, (SUM010), 28.IX.2009, M. Balke & D. Amran leg. [ZMH]; 6 nymphs, Indonesia, Sumatra Barat, Solok, Alahan Panjank Road, 1190m, 0° 56.345'S 100° 46.411'E, (SUM003), 24.IX.2009, M. Balke & D. Amran leg. [MZL]

Etymology. From Lamuri, an old Arabic name for the island of Sumatra.

Description. See Ulmer 1939, p.669, figs. 429–439. A supplementary description based on the paratype material will be published elsewhere.

Distribution. Only known from the island of Sumatra.

Discussion. Dang (1967) designated *E. sumatranus* as the type species of the genus *Ecdyonuroides*. There is little question that he had in mind the nymph of *E. sumatranus* when establishing the new genus, and not the female. But the holotype of *E. sumatranus* is the female imago designated explicitly by Ulmer (1939) and thus represents the name-bearing type. With its current assignment as *Rhithrogena sumatrana*, *Ecdyonuroides* Dang, 1967 must be considered as a junior subjective synonym of *Rhithrogena* Eaton, 1881 **syn. nov.** If the concept of *Ecdyonuroides* proposed by Dang (1967) later proves to be valid and different from the one of *Thalerosphyrus*, then another genus name should be proposed to encompass the affected taxa at that time.

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