

The Rapismatidae (Neuroptera): montane lacewings of the oriental region

P. C. BARNARD Department of Entomology, British Museum (Natural History), London

ABSTRACT. The rare neuropteran family Rapismatidae, known only from the highlands of India and Nepal, S.E. Asia and Indonesia, is reviewed, and the affinities of the family are discussed. Nine species are recognized, of which seven are here described as new: two new synonymies are established.

Introduction

The Rapismatidae are a little-known group of large-sized lacewings confined to the mountainous regions of India, Nepal, S.E. Asia and Borneo. They have a strikingly primitive neuropterous facies, with broad wings (usually greenish or brownish), a complex network of veins, a broad body and small head retracted under the prothorax. The group has had a chequered history in the literature: the morphology has never been studied in detail and the taxonomic relationships of *Rapisma* have always been in doubt. Several authors have commented on the affinities of the genus, and referred it to different families, often without having examined any material.

In terms of numbers of specimens the Rapismatidae must be the rarest neuropteran family. I have been able to trace only twenty-one specimens: these represent nine species, all of which are known only from one sex (five are known only from single specimens). The male and female genitalia of the family are described here for the first time, and I have attempted to clarify the affinities of the group. It is apparent, however, that much work remains to be carried out on the higher classification of the Neuroptera: most of the existing classifications are based on shared primitive characters (i.e. symplesiomorphies).

Correspondence: Dr P. C. Barnard, Department of Entomology, British Museum (Natural History), Cromwell Road, London SW7 5BD.

Walker (1853) described the first rapismatid species and placed it in the genus *Hemerobius* which was a much broader group at that time; McLachlan (1866), in describing the genus *Rapisma*, retained it in the Hemerobiidae while noting its similarities with the Australian genus *Ithone*. Banks (1913) retained the genus in the Hemerobiidae, again in the broad sense, but Tillyard (1916) was the first to exclude it from this family (along with the nearctic genus *Oliarces*), suggesting that a new family was needed for these two genera. In his study of insect wing venation Comstock (1918) suggested the provisional inclusion of *Rapisma* in the Ithonidae: his figure of the venation of *R. viridipenne* was the first published figure of the group. Tillyard (1919) disagreed with Comstock's suggestion and excluded *Rapisma* from this revision of the Ithonidae, but he later (1926) included both *Rapisma* and *Oliarces* in this family again.

The first worker to tackle seriously the problem of the affinities of *Rapisma* was Navás (1929). Although now renowned for his rather poor taxonomic work and for the introduction of literally hundreds of synonyms to the literature on Neuroptera, he was the first to realize that *Rapisma* deserved family status, despite its superficial similarities with *Ithone*. He gave a comprehensive diagnosis for the family which was substantially correct, yet his paper seems to have been overlooked or ignored by virtually all subsequent authors. Carpenter (1951), having definitely placed

Oliarces in the Ithonidae, refers only to Tillyard's exclusion of *Rapisma* from this family, and the only later author to comment on its systematic position was Riek (1974). Riek makes the entirely unsubstantiated remark that '... on the basis of wing venation I refer the genus to the Brongniartiellidae, as the only recent genus of this otherwise Mesozoic family.' Since *Rapisma* hardly conforms with any of the diagnostic characters of this fossil family (see, for example, Martynova, 1962) I think that Riek's comment can be safely ignored.

Methods

All the drawings in this paper were made with a camera lucida attachment on a stereo-microscope. Genitalia preparations were made by macerating with KOH solution, and drawings made of unflattened material in glycerine. The only numerical measurement used in this study is here called the EI ratio, obtained by dividing E by I, E being the maximum eye diameter and I the minimum interocular distance (Fig. 5).

The naming of the wing-veins follows Wootton's (1979) system, and I have accepted Martynov's (1928) interpretation of the apparent proximal branch of the radial sector as having the anterior media fused with it. This is probably true for all the Neuroptera and is accepted by most workers (e.g. Carpenter, 1940) though not all (e.g. Tjeder, 1967).

The nomenclature of the components of the male genitalia follows Acker (1960) with Adams's (1969) modifications.

Abbreviations

The following abbreviations are used in the figures: as, antennal socket; e, eye; E, maximum eye diameter; gcx, gonocoxite; gl, gonapophyses laterales; gs, gonarcus; hi, hypandrium internum; I, minimum interocular distance; lml, lower mediuncus lobe; msc, mesoscutum; mtsc, metascutum; mu, mediuncus; pn, pronotum; sgp, ♀ subgenital plate; sp, spermatheca; tr, trichosor; uml, upper mediuncus lobe; v, vertex of head.

Museums are abbreviated as follows: BMNH, British Museum (Natural History),

London; MCSN, Museo Civico di Storia Naturale, Genoa, Italy; UM, University Museum, Manchester, England; ZM, Zoologisk Museum, Copenhagen, Denmark.

RAPISMATIDAE Navás, nom.emend.

Rhapismidae Navás, 1929: 376. Type-genus: *Rapisma* McLachlan.

Description

Head partially retracted under prothorax. Antennae moniliform, rarely serrate, much shorter than wings (4–11 mm). Eyes globose, ocelli absent. Mouthparts mandibulate, mandibles short and broad (Fig. 27), margin of labrum excised.

Thorax stout, covered with fine hairs, prothorax very broad and shield-like. Legs densely hairy but without spines or spurs. Length of tarsal segments in approximate ratio 1.0 (basal):0.4:0.35:0.25:0.85 (distal). Tarsal claws broad at base with slight projection on inner side (Fig. 7).

Forewing large and broad, 19–35 mm long, greenish, yellow or brown. Costa rising steeply at base, jugal lobe present. Rudimentary trichosors present along costal margin (Fig. 4). Costal area very broad, particularly at base; subcostal accessory veins usually forked at costa, often linked by cross-veins in proximal half of wing, sometimes forming complex network near wing-base. Recurrent humeral cross-vein present, with several branches. Sc running free to wing margin, forked once or twice at extreme apex. Rs+MA arising very near base of R; R linked to Sc by many unbranched cross-veins. Rs with 3–9 pectinate branches. MA arising near base of Rs and forking repeatedly. MP forking near base, MP₂ usually forking more than MP₁. CuA forking only distally, CuP usually dividing nearer base. Three anal veins, greatly divided: simple jugal vein present. Whole venation with large number of cross-veins, forming irregular network.

Hind wing 16–30 mm long, hyaline, similar to forewing except as follows. Subcostal accessory veins less often forked or connected by cross-veins (but recurrent humeral cross-vein present and branched); costal area not enlarged. Rs with 2–6 pectinate branches.

Both fore and hind wing with single nygma between bases of Rs + MA and MP.

Male genitalia with well-developed gonarcus, gonocoxites articulating laterally on ends of gonarcus, sometimes bilobed; lobes with or without spines. Mediuncus lobes prominent, fused, but often showing paired origin. Hypandrium internum usually present, but often small and difficult to see. Female genitalia with broadly triangular subgenital plate, notched distally. Spermatheca simple and cylindrical; gonapophyses laterales rounded. Trichobothria present in both sexes but ill-defined.

Remarks

As stated in the introduction, many authors have commented on the similarity of the Rapismatidae with the Ithonidae, principally in the broad body, retracted head and large, broad wings with a relatively complete venation. However, I believe that most of these similarities are symplesiomorphies. There are several important differences between these two families, as detailed in Table 1. The larvae of the Ithonidae are so specialized for their soil-burrowing existence (Riek, 1970) that this is certain to constitute a further difference between the families, when rapismatid larvae are eventually discovered.

Although Riek (1970) does not define his superfamily classification too clearly, the Rapismatidae would seem to fit satisfactorily into his Osmyloidea, because of the presence of nygmata and on features of the wing venation: however, several characters of this superfamily are probably symplesiomorphies.

Trichosors are generally found in the more primitive neuropteran families and are probably a ground-plan feature of the order. They have been independently lost in several advanced families (the Mantispidae in the Mantispoidea, the Chrysopidae in the Hemerobioidea, most of the Myrmeleontoidea, and the Coniopterygidae). Their partial appearance in the Rapismatidae (Fig. 4) would suggest that they are in the process of being lost in his family. Similarly, the recurrent humeral cross-vein is probably a primitive neuropteran feature, having been lost in several families independently. Its presence is probably a mechanical necessity in large wings with a broad costal margin, as it tends to be lost in groups of smaller sized species with correspondingly narrow costal areas. Incidentally, McLachlan (1866) mistakenly described *Rapisma* as lacking the recurrent humeral cross-vein. He later (1867: 270) corrected this error, but Esben-Petersen (1915) evidently overlooked this correction.

The family name is here emended to Rapismatidae because of the stem of the Greek word *ράπισμα*, -τος.

Distribution

The family is known from isolated localities in India, Nepal, Burma, Thailand, West Malaysia and Borneo (Sabah) (Fig. 1). All the species seem to be confined to relatively high ground, and in many cases each locality has a single endemic species, effectively isolated from its neighbours by lowlands. It is probable that further collecting in the montane regions of S.E. Asia will yield further species, and it is likely that the family will be found represented

TABLE 1. Comparison of Rapismatidae and Ithonidae

	Rapismatidae	Ithonidae (Riek, 1974)
Tarsal claws	Broad, with small projection (Fig. 7)	Elongate, simple
Legs	Densely hairy, no spurs	Spiny, with tibial spurs
Nygmata	One on each wing (Fig. 3)	Two on forewing, one on hindwing
Trichosors	Very reduced (Fig. 4)	Well developed
Base of MA	Usually obsolete (Fig. 3)	Usually present
Mandibles	Short and broad (Fig. 27)	Elongate
♂ gonarcus	Complete, arched (Fig. 24)	Paired or triangular (Acker, 1960)
♀ genitalia	Subgenital plate large, ninth segment unmodified (Figs. 8 and 9)	Subgenital plate reduced, ninth segment forming psammarotrum

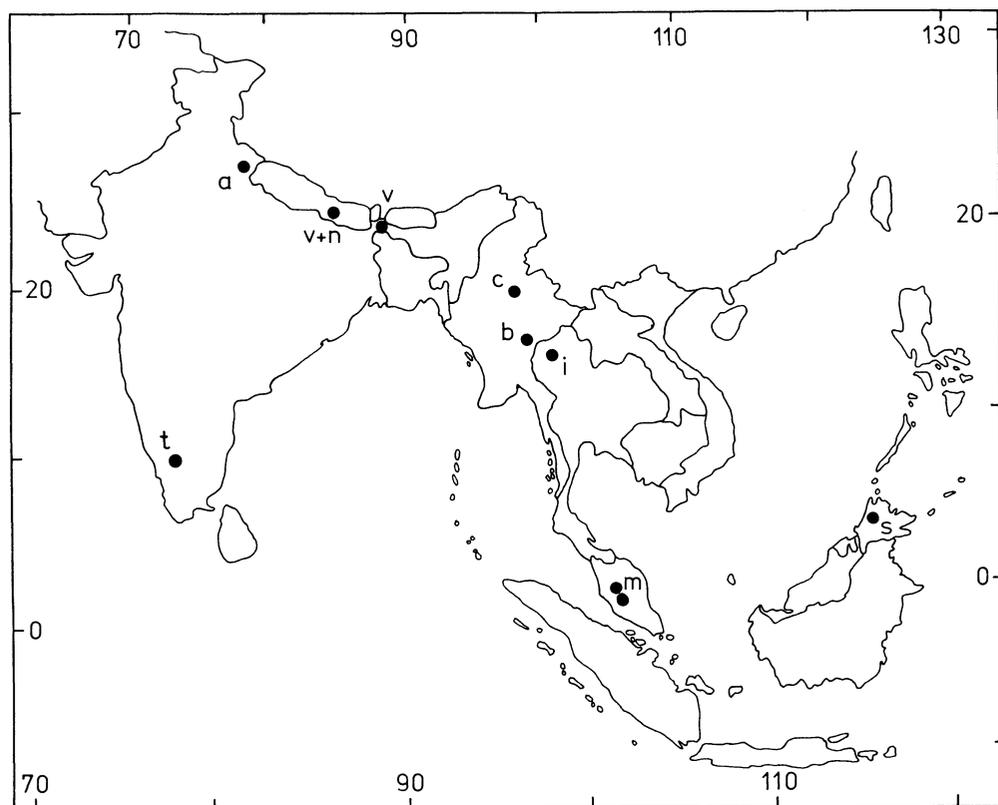


FIG. 1. Distribution map of *Rapisma* species. a = *almoranum*, b = *burmanum*, c = *corundum*, i = *intanonum*, m = *malayanum*, n = *nepalense*, s = *sabahnum*, t = *tamilanum*, v = *viridipenne*.

in Java and Sumatra, as well as in the central highlands of Borneo and Sarawak.

Biology

The larvae of the Rapismatidae have yet to be discovered, and this is therefore the only neuropteran family whose larvae are completely unknown. Despite the superficial similarity with the Ithonidae, the latter family has highly specialized scarabeiform larvae, adapted for a subterranean existence in dry, sandy soils (Riek, 1970).

All of the known specimens of Rapismatidae were collected at moderately high altitudes (900–2595 m) and the larvae are probably living in the damp leaf litter in these montane or 'moss' forests. They are presumably of a fairly large size, judging from the size of the adults, and are probably generalized predators on a variety of soft-bodied prey.

Check-list of species of *Rapisma*

- viridipenne* Walker
- magnum* Esben-Petersen *syn.n.*
- nepalense* *sp.n.*
- almoranum* *sp.n.*
- burmanum* Navás
- weelei* Navás *syn.n.*
- corundum* *sp.n.*
- tamilanum* *sp.n.*
- malayanum* *sp.n.*
- intanonum* *sp.n.*
- sabahnum* *sp.n.*

The family Rapismatidae contains the single genus *Rapisma*.

Rapisma McLachlan

Rapisma McLachlan, 1866: 353. Type-species: *Hemerobius viridipennis* Walker, by original designation and monotypy.

Rhapisma Navás, 1929: 376 [Unjustified emendation].

Description

As for the family, described above.

Remarks

Because of the derivation of the generic name from the Greek neuter noun *ῥάπισμα* Navás (1929) suggested that *Rapisma* should be spelt with an initial 'Rh'. Although this spelling is undoubtedly the correct transliteration it must be considered an unjustified emendation for the purposes of nomenclature.

In order to investigate the inter-relationships of the nine species of *Rapisma*, it was intended to carry out a phylogenetic analysis of the group, but only seven reliable characters were discovered. Some of these are features of the genitalia and, since all the species are known from only one sex, the limitations are obvious. Several species seem to show distinguishing characters of wing venation, but with such a limited number of specimens (only one of some species) the extent of intraspecific variation cannot be determined. In his description of *R. burmanum* and *weelei* Navás (1929) described such characters as the numbers of cross-veins and branches of the main veins. A study of these characters in *R. viridipenne*, for which a series of ten specimens was available, showed considerable variation. For example, the number of branches of Rs varied from 3 to 8 in the forewing, 2–6 in the hindwing; the number of cross-veins between Sc and R from 24 to 31 in the forewing, 18–24 in the hindwing; and the cross-veins between R and Rs 17–27 in the forewing, 11–17 in the hindwing.

The seven characters used to investigate specific relationships are presented as a character matrix in Fig. 2. Presumed apomorphic states are shown as filled circles, and the evidence for this is derived from comparisons with representatives of the other families in the Osmyloidea *sensu* Riek (1970), namely the Ithonidae, Dilaridae, Osmylidae, Neurorthidae and Polystoechotidae. The characters are as follows:

1. The presence of a dark transverse band on the head is an apomorphic character.
2. The central projection in the apical notch of the female subgenital plate is apomorphic.

Species	Character number						
	1	2	3	4	5	6	7
<i>viridipenne</i>	●	●	—	●	○	○	—
<i>nepalense</i>	●	—	●	—	○	○	○
<i>almoranum</i>	●	—	●	●	○	○	○
<i>burmanum</i>	●	●	—	○	○	○	—
<i>corundum</i>	○	—	○	○	●	●	●
<i>tamilanum</i>	○	—	○	○	●	●	●
<i>malayanum</i>	○	—	○	○	●	○	○
<i>intanonum</i>	○	○	—	○	○	○	—
<i>sabahnum</i>	○	○	—	○	○	○	—

FIG. 2. Character matrix for species of *Rapisma*. Filled circles are presumed apomorphies, open circles presumed plesiomorphies, dashes unknown characters. Numbered characters are explained in text.

3. The smooth male gonocoxite lobes are apomorphic. Setose lobes are considered plesiomorphic in the Neuroptera (Adams, 1969).
4. Relatively few antennal segments (less than 40) is regarded as apomorphic. The species of *Rapisma* fall clearly into two groups using this character.
5. Large eyes (EI ratio 1.0–1.1) are considered apomorphic. Again the genus splits into distinct groups, those with small eyes having an EI ratio of 0.7–0.85.
6. Serrate antennal segments are clearly apomorphic; virtually all the Osmyloidea have moniliform or filiform antennae.
7. Bilobed male gonocoxites are considered apomorphic, compared with the simple unbranched condition.

On the basis of these apomorphic characters four species emerge as a discrete group, namely *viridipenne*, *nepalense*, *almoranum* and *burmanum* (Fig. 2). *R. corundum* and *tamilanum* would seem to form another group, possibly also including *malayanum*, but the relationships of *intanonum* and *sabahnum* cannot yet be determined, neither species sharing an apomorphy with any other species. The gaps in the table, which in most cases

indicate one sex of a species yet to be discovered, imply certain predictions about that sex, such as smooth gonocoxite lobes in the male of *viridipenne*, and so on. The eventual discovery of the males of *intanonum* and *sabahnum* will hopefully elucidate their affinities with other species. It should be noted that although all of the species are known from only one sex, the distinct groupings for characters 4 and 5 are not sex-linked, as both sexes are represented in the two character states in each case.

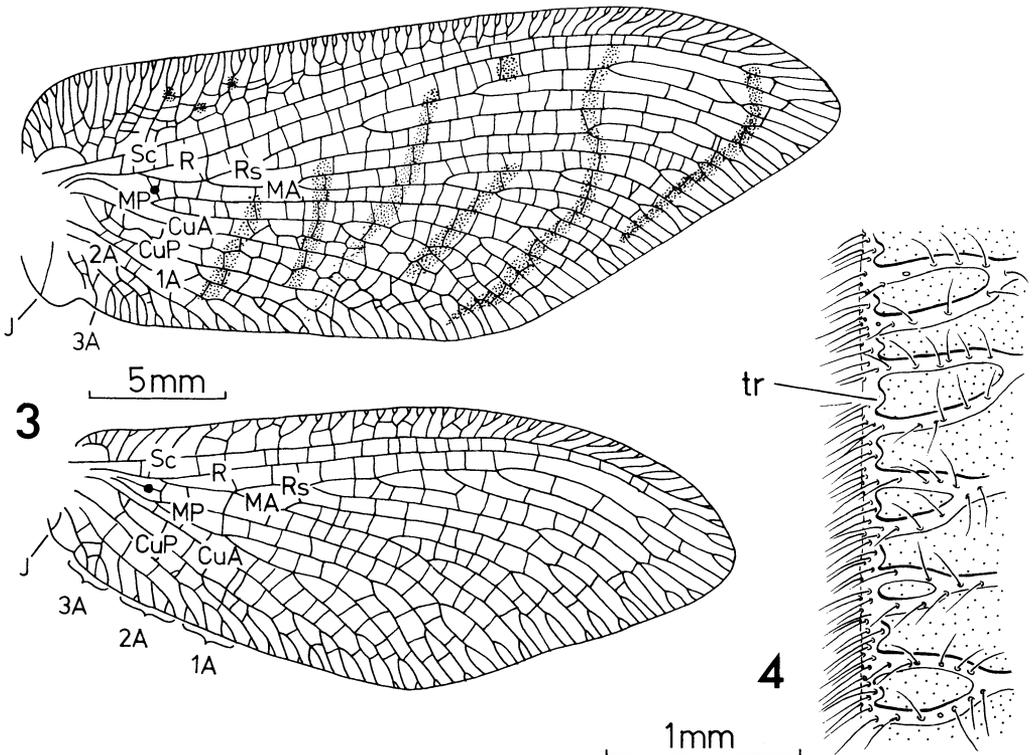
It seems likely that the group arose somewhere on the Indochina peninsula, possibly in Burma, and evolved westwards along the Himalayas and eastwards towards Borneo. In the Himalayas *R. viridipenne* is an extreme form, with its great size and distinctive wing shape, and in Borneo *sabahnum* also seems a rather isolated species, morphologically as well as geographically. *R. tamilanum* in southern India is a puzzle, as it is most closely related to *corundum* in Burma, rather than to the Himalayan *viridipenne* group, and how it

arrived at its present locality is a matter for conjecture.

In the following key to species only external features are used, lack of suitable specimens precluding the use of genitalic characters. The key is presented with some reservations: the dire shortage of material of most species means that it is virtually a key to holotypes rather than to species.

Key to species of *Rapisma*

- 1 Dark band across front of head (Figs. 5, 11) . . . 2
- No dark band on head 5
- 2 Brown spot in centre of frons (Fig. 11) (Nepal) *nepalense*
- No spot on frons 3
- 3 Dark triangular marking on prothorax (Fig. 14) (N. India) *almoranum*
- No marking on prothorax 4
- 4 Outer (apical) margin of forewing straight or slightly concave, anal margin pronounced (Fig. 3) (Nepal, N. India) *viridipenne*



FIGS. 3-4. *Rapisma viridipenne* ♀. 3, wings; 4, enlarged view of forewing costa.

- Outer margin of forewing evenly rounded, convex (Fig. 16) (Burma) *burmanum*
- 5 Antennal segments serrate, asymmetrical (Figs. 20 and 23) 6
- Antennal segments moniliform (Fig. 6) 7
- 6 Antennal segments strongly asymmetrical, with short setae (Fig. 20); forewing almost unmarked (Fig. 19) (Burma) *corundum*
- Antennal segments moderately asymmetrical, with long setae (Fig. 23); forewing quite strongly marked (Fig. 22) (S. India) *tamilanum*
- 7 Eyes large, EI ratio 1.0–1.1; antennae about 11 mm long (Malaysia) *malayanum*
- Eyes small, EI ratio 0.8–0.85; antennae 5–7 mm long 8
- 8 Forewing unmarked except for dark spot centred on nygma (Fig. 30) (Thailand) *intanonum*
- Forewing strongly speckled (Fig. 32) (Sabah) *sabahnium*

***Rapisma viridipenne* (Walker) (Figs. 3–9)**

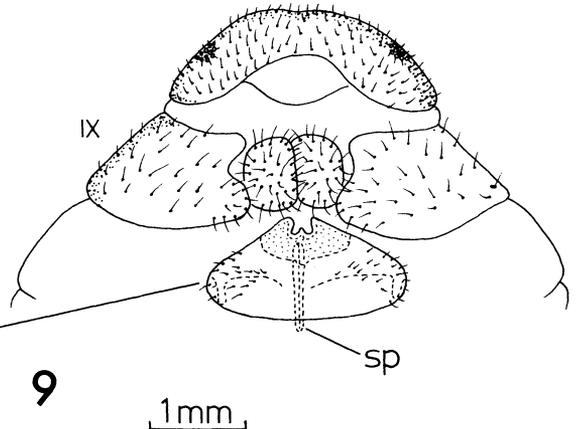
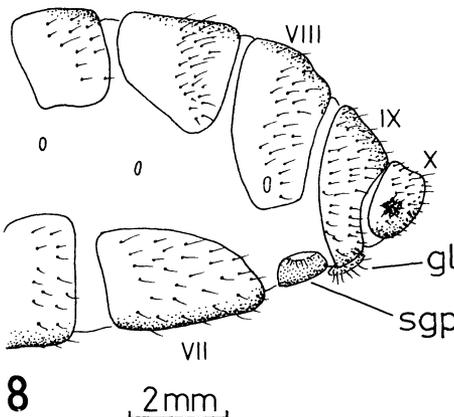
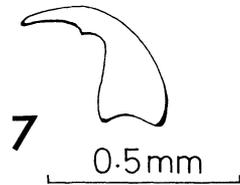
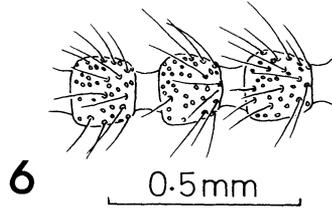
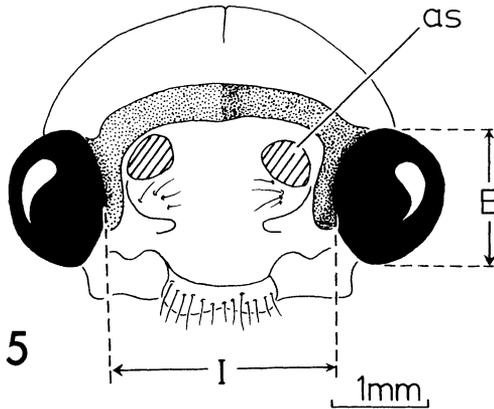
Hemerobius viridipennis Walker, 1853: 276.
 Holotype ♀, INDIA [not East Indies, as stated by Walker] (*Stevens*) (BMNH) [examined].

Rapisma viridipennis (Walker); McLachlan, 1866: 353.

Rapisma magna Esben-Petersen, 1915: 177.
 Holotype ♀, [?NEPAL], Himalayas, Westermann coll. (ZM, Copenhagen) [examined]. **Syn.n.**

Male. Unknown.

Female. General body colour yellowish brown. Head with dark brown crescent on inner side of each eye, connected by band above antennal sockets (Fig. 5). Eyes small, EI



FIGS. 5–9. *Rapisma viridipenne* ♀. 5, head, frontal view, antennae removed; 6, antennal segments; 7, hind tarsal claw; 8, genitalia, lateral view; 9, genitalia, ventral view.

ratio 0.7. Antennae 5 mm long; 31–35 segments, moniliform, with long setae (Fig. 6).

Venation as in Fig. 3. Forewing greenish yellow with very faint pinkish brown irregular stripes; outer (apical) margin straight or slightly concave. Hindwing hyaline, similar shape to forewing but more rounded. Forewing length 28–35 mm, hind wing 24–30 mm.

Genitalia ♀ (Figs. 8 and 9). Subgenital plate broadly triangular, apical notch narrow, almost parallel-sided, with central projection.

Remarks

This is the most striking species in the family, easily recognized by the wing shape and large size. Walker (1853) described the type-locality as 'East Indies', but this was a misinterpretation of the label 'E. Ind.' From the currently known distribution this should obviously read 'East India'. This has confused several subsequent authors, and is one reason why Esben-Petersen (1915) described *magnum* as a new species. Although the holotype of *magnum* is exceptionally large, it has the same head markings and form of subgenital plate as typical *viridipenne*. The specimen is so old and faded that no wing

markings can be seen, but these are often extremely faint even in fresher examples. The number of cross-veins and branches of Rs of the holotype of *magnum* fall well within the range for *viridipenne* (see 'Remarks' under *Rapisma*).

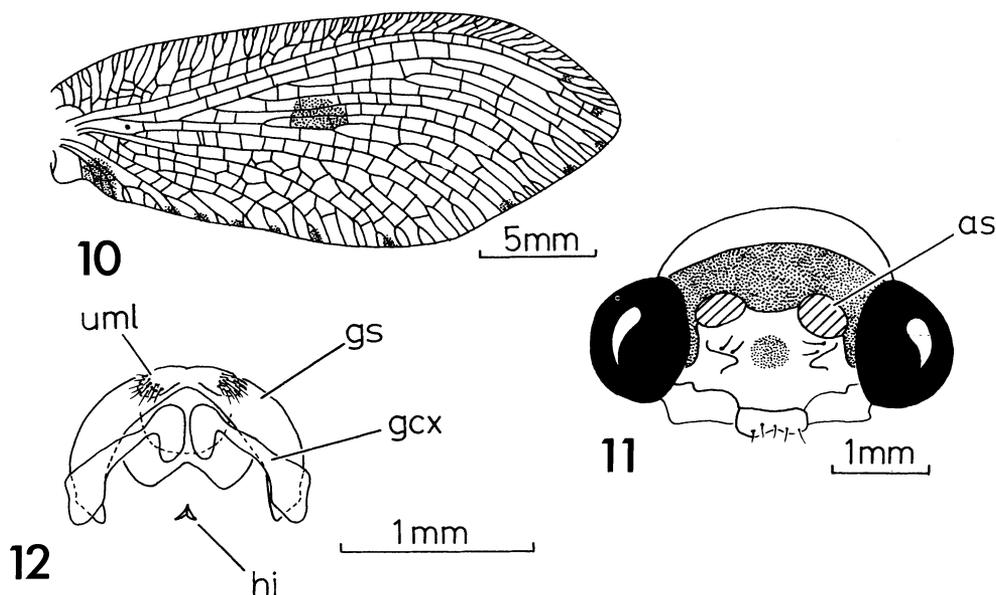
Distribution (Fig. 1). N.E. India, Nepal.

Material examined. INDIA: 3 ♀, labelled respectively 'Ind[ia]', 'E. Ind[ia]' and 'North India', no further data; 1 ♀, Darjeeling, Gopaldhara, 1030–1400 m, vi. 19-- (H. Stevens). NEPAL: 4 ♀, Nagarkot, 1950–2100 m, 20.v.–20.vii.1935, 25.vii.1937 (F. M. Bailey). (All specimens in BMNH.)

Rapisma nepalense sp.n. (Figs. 10–12)

Male (holotype only). General body colour pale yellowish brown. Head with dark brown crescent on inner side of each eye, linked by broad band above antennal sockets; brown spot in centre of frons (Fig. 11). Eyes small, EI ratio 0.75. Antennal length greater than 5 mm (broken), segments moniliform with long setae.

Venation as in Fig. 10. Forewing broad, slightly pointed apically, pale yellow with several small brown spots around margin of apex and on inner (anal) margin; large elongate



FIGS. 10–12. *Rapisma nepalense* ♂ (holotype). 10, forewing; 11, head, frontal view, antennae removed; 12, genitalia, ventro-posterior view.

spot in centre of wing on MA and posterior branch of Rs, another at base of inner margin on 2A and 3A. Hind wing hyaline, similar in shape to forewing. Forewing length 20 mm, hindwing 17 mm.

Female. Unknown.

Genitalia ♂ (Fig. 12). Gonocoxites terminating in elongate rounded lobes, lacking spines or hairs. Upper mediuncus lobes well developed. Hypandrium internum very small.

Remarks

It is possible that this species is the male of *viridipenne*, as the holotype was collected on the same day and locality as a female of *viridipenne*. However, the smaller size, different wing shape and distinctive markings of *nepalense* would suggest that the two represent distinct taxa.

Distribution (Fig. 1). Nepal.

Holotype ♂. NEPAL, Nagarkot, 2100 m, 25.vii.1937 (*F. M. Bailey*) (BMNH).

Rapisma almoratum sp.n. (Figs. 13–15)

Male (holotype only). General body colour yellowish brown. Head with dark brown rings round eyes, linked by broad band above antennae (Fig. 13). Eyes small, EI ratio 0.75. Antennae 4 mm long; 31–32 segments,

moniliform, with long setae. Thorax yellowish brown with dark brown triangular marking on prothorax (Fig. 14).

Venation and wing shape similar to *nepalense* (cf. Fig. 10). Forewing very pale yellow, with irregular very pale brown bands as in *viridipenne* (cf. Fig. 3). Forewing length 19 mm, hindwing 16 mm.

Female. Unknown.

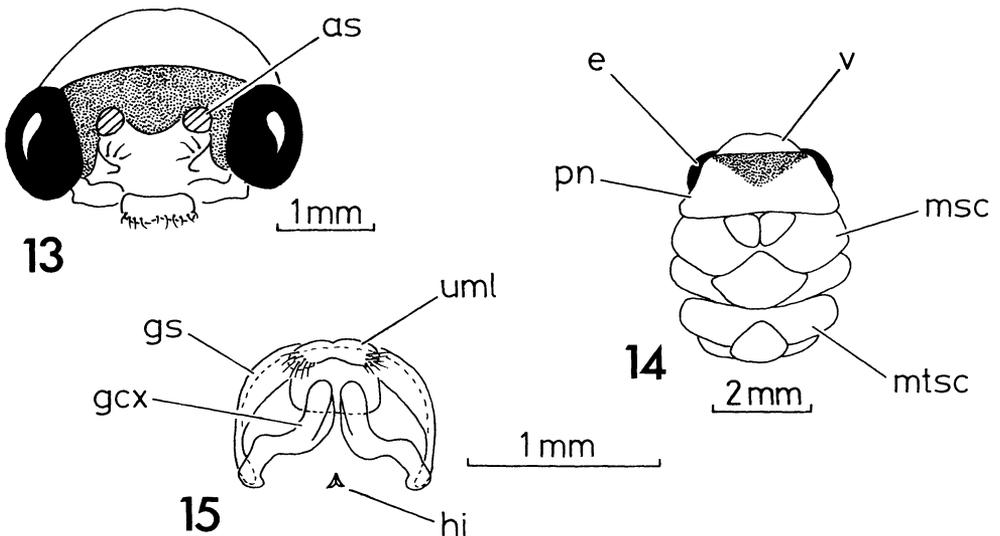
Genitalia ♂ (Fig. 15). Gonocoxites terminating in narrow rounded lobes, lacking spines or hairs. Upper mediuncus lobes well developed. Hypandrium internum very small.

Remarks

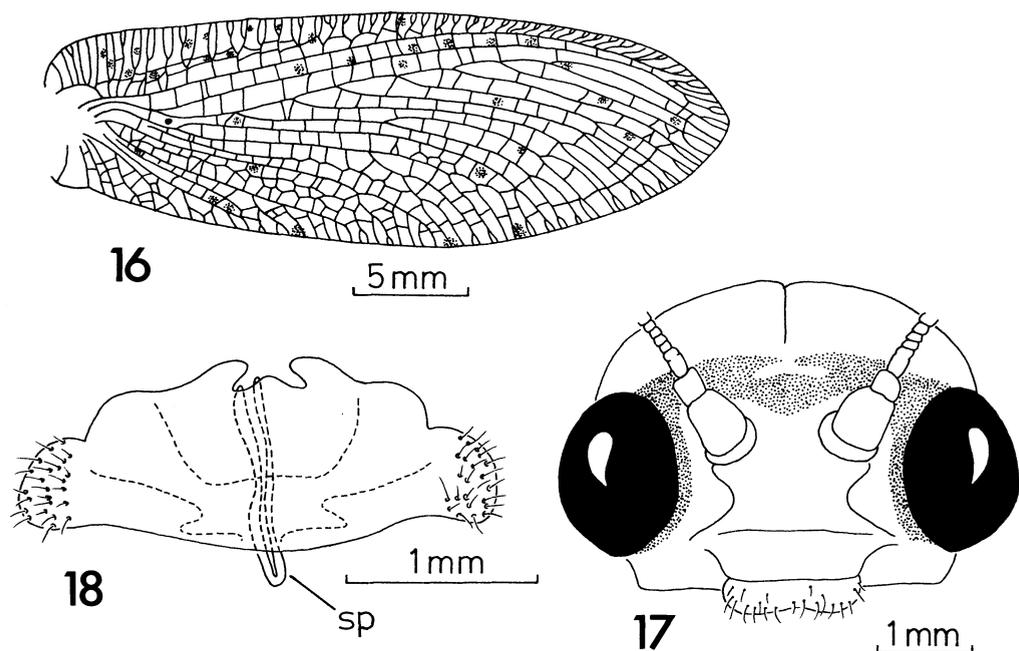
As with *nepalense*, this species may be the male of *viridipenne*, although I have seen no specimens of *viridipenne* from as far west as the type locality of *almoranum*. The wing markings are very similar to those of *viridipenne*, but the holotype is in very poor condition. The genitalia are extremely similar to those of *nepalense*, differing only in the relatively narrower gonocoxites. Externally this species is distinguishable from *nepalense* by the marking on the pronotum and in the absence of the markings on the forewings and on the frons.

Distribution (Fig. 1). N. India.

Holotype ♂. INDIA, W. Almora, Kumaun (*H. G. Champion*) (BMNH).



FIGS. 13–15. *Rapisma almoratum* ♂ (holotype). 13, head, frontal view, antennae removed; 14, thorax, dorsal view; 15, genitalia, ventro-posterior view.



FIGS. 16–18. *Rapisma burmanum* ♀ (holotype). 16, forewing (holotype of *weelei*); 17, head, frontal view; 18, subgenital plate.

***Rapisma burmanum* Navás (Figs. 16–18)**

Rhapisma burmana Navás, 1929: 377. Holotype ♀, BURMA, Carin Chebà [Karen distr., Kayah St.], 900–1100 m, v.–xii. 1888 (*Fea*) (MCSN, Genoa) [examined].

Rhapisma weelei Navás, 1929: 378. Holotype ♀, same data as holotype of *burmana* (MCSN, Genoa) [examined]. **Syn.n.**

Male. Unknown.

Female. General body colour pale yellowish brown. Head with blackish brown rings round eyes, joined by fairly broad band above antennae, broader in centre and interrupted mid-dorsally by yellow crescent-shaped marking (Fig. 17). Eyes small, EI ratio 0.7–0.8. Antennae 7 mm long; about 60 segments, moniliform, with long setae.

Venation as in Fig. 16; wings long and narrow, rounded apically. Forewing pale yellow with pale brown spots in costal area, other paler spots scattered irregularly over wing (barely visible in holotype of *burmanum*). Hindwing hyaline. Forewing length 25–29 mm, hindwing 20–24 mm.

Genitalia ♀ (Fig. 18). Subgenital plate very broad, hind margins sinuous; apical notch

broad, with broadly rounded central projection.

Remarks

Although the holotypes of *burmanum* and *weelei* look somewhat different superficially, I am here synonymizing the two species. As well as being collected at the same locality, the female genitalia are identical (and are very different from other females in the genus), and the distinctive head markings are the same. Many of the wing markings visible in the type of *weelei* are very faint or even absent in the type of *burmanum*, but those that are present are similar in form and position in both specimens. Navás's (1929) separation of these two species is somewhat misleading: the wing pattern is admittedly different, but some of the venational characters listed by Navás are inaccurate, e.g. 17 subcostal cross-veins in the forewing of *weelei*, which should be 24. Variation in the numbers of cross-veins and the branches of Rs in *viridipenne* shows that this is insufficient for specific separation (see 'Remarks' under generic description). Navás also described

differences in the subgenital plate of the two holotypes, but his description and figures refer to the seventh abdominal sternite, which are seen to be identical in the cleared abdomens.

It is difficult to discover the exact type-locality of this species as I cannot find the name 'Carin Chebà' in any atlas or gazetteer. However, it would appear to be in the Karen Hills, Kayah State, and is apparently at about $19^{\circ}40'N$, $97^{\circ}17'E$, from the account of Leonardo Fea's travels in Burma by Gestro (1904).

Distribution (Fig. 1). E. Burma.

Material examined. Holotypes of *burmanum* and *weelei* only.

Rapisma corundum sp.n. (Figs. 19–21)

Male (holotype only). General body colour yellowish brown, head with no dark markings. Eyes large, EI ratio 1.0. Antennae 9 mm long, with about 50 segments; segments serrate, markedly asymmetrical, setae short (Fig. 20).

Venation as in Fig. 19; wings broad, slightly pointed apically. Forewing pale yellow, no markings except for slight shading

round several cross-veins; hind wing hyaline. Forewing length 23 mm, hindwing 20 mm.

Female. Unknown.

Genitalia ♂ (Fig. 21). Mediuncus large, prominent, subrectangular. Gonocoxites bilobed apically, each lobe with many short thick spines. Hypandrium internum large.

Remarks

This species is easily distinguished by the broad, unmarked wings and the serrate antennae. The male gonocoxites show the most complex development within the family, and the mediuncus shows virtually no sign of its bifid origin.

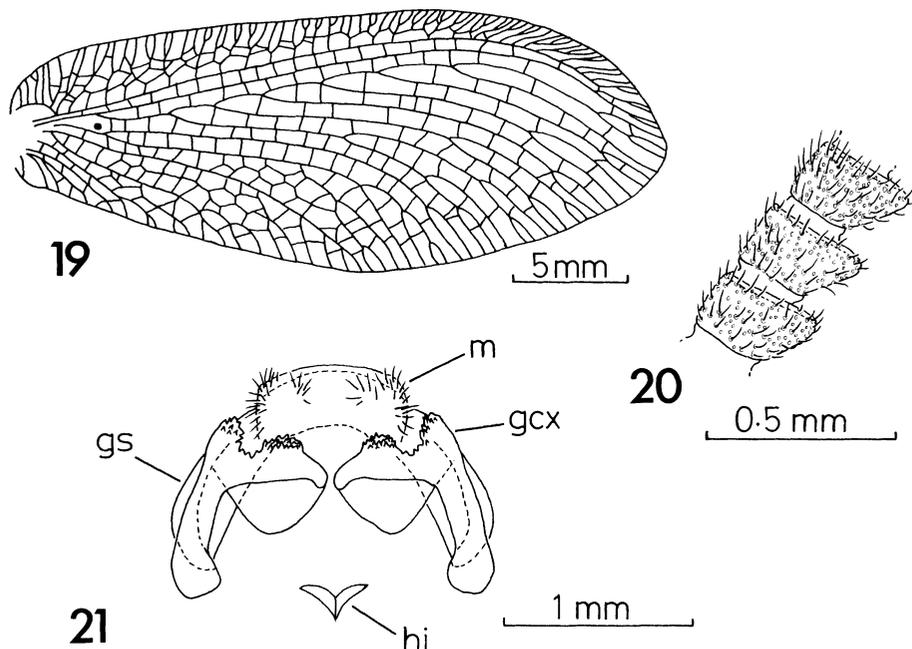
The type-locality of this species is rather vague, the Ruby Mines district of Burma being between approximately $22^{\circ}42'$ to $24^{\circ}N$, and 96° to $96^{\circ}45'E$.

Distribution (Fig. 1). N. Burma.

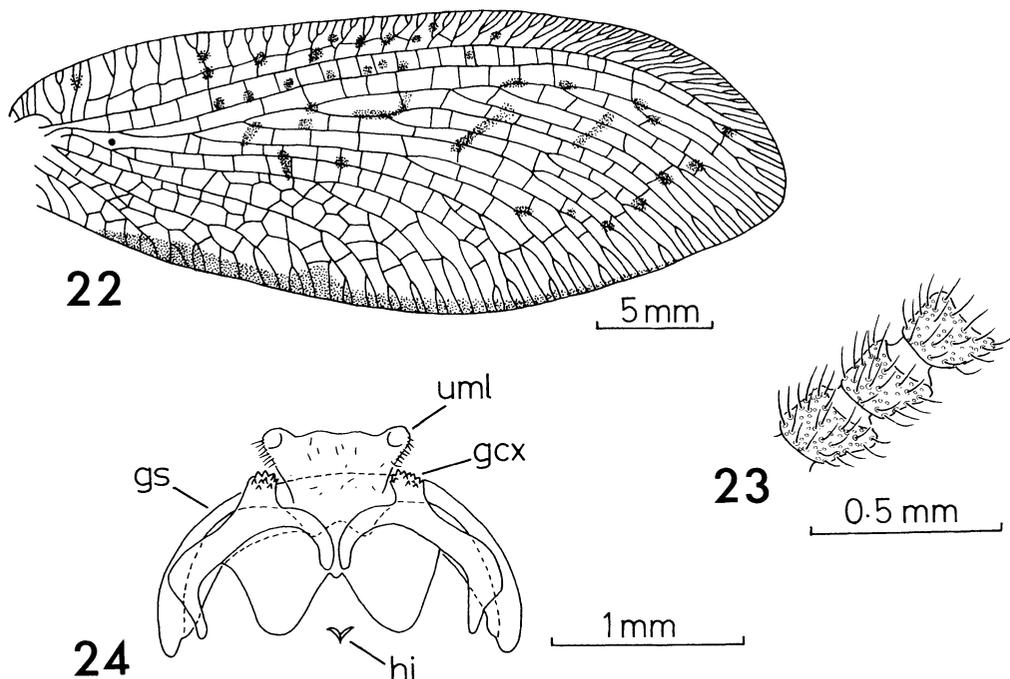
Holotype ♂, BURMA, Ruby Mines, 1650–2100 m, 1890 (BMNH).

Rapisma tamilanum sp.n. (Figs. 22–24)

Male. General body colour pale yellowish brown, head with no dark markings. Eyes



FIGS. 19–21. *Rapisma corundum* ♂ (holotype). 19, forewing; 20, antennal segments; 21, genitalia, ventro-posterior view.



FIGS. 22–24. *Rapsima tamilanum* ♂. 22, forewing; 23, antennal segments; 24, genitalia, ventro-posterior view.

large, EI ratio 1.0. Antennae 9–10 mm long, 56–62 segments, serrate, with long setae (Fig. 23).

Venation as in Fig. 22. Forewing narrow, pointed apically, pale yellow, with several scattered greyish brown markings, especially concentrated along inner (anal) margin to form a greyish band. Hindwing hyaline, similar in shape to forewing. Forewing length 27–28 mm, hindwing 23–24 mm.

Female. Unknown.

Genitalia ♂ (Fig. 24). Upper mediuncus lobes prominent and rounded. Gonocoxites bilobed apically, posterior lobes armed with short thick spines.

Remarks

This species is most closely related to *corundum* from Burma and seems to be derived from this branch of the family rather than from the Himalayan *viridipenne* group (Fig. 2). How the species reached its isolated locality in S. India is unknown. It can be distinguished from *corundum* by the distinctive

wing markings and by the long setae on the antennal segments, which are serrate as in *corundum* although less markedly asymmetrical.

Distribution (Fig. 1). S. India (Nilgiri Hills).

Holotype ♂, INDIA, Madras, Nilgiri Hills, Devala, 960 m, v.1961 (*P. S. Nathan*) (UM, Manchester).

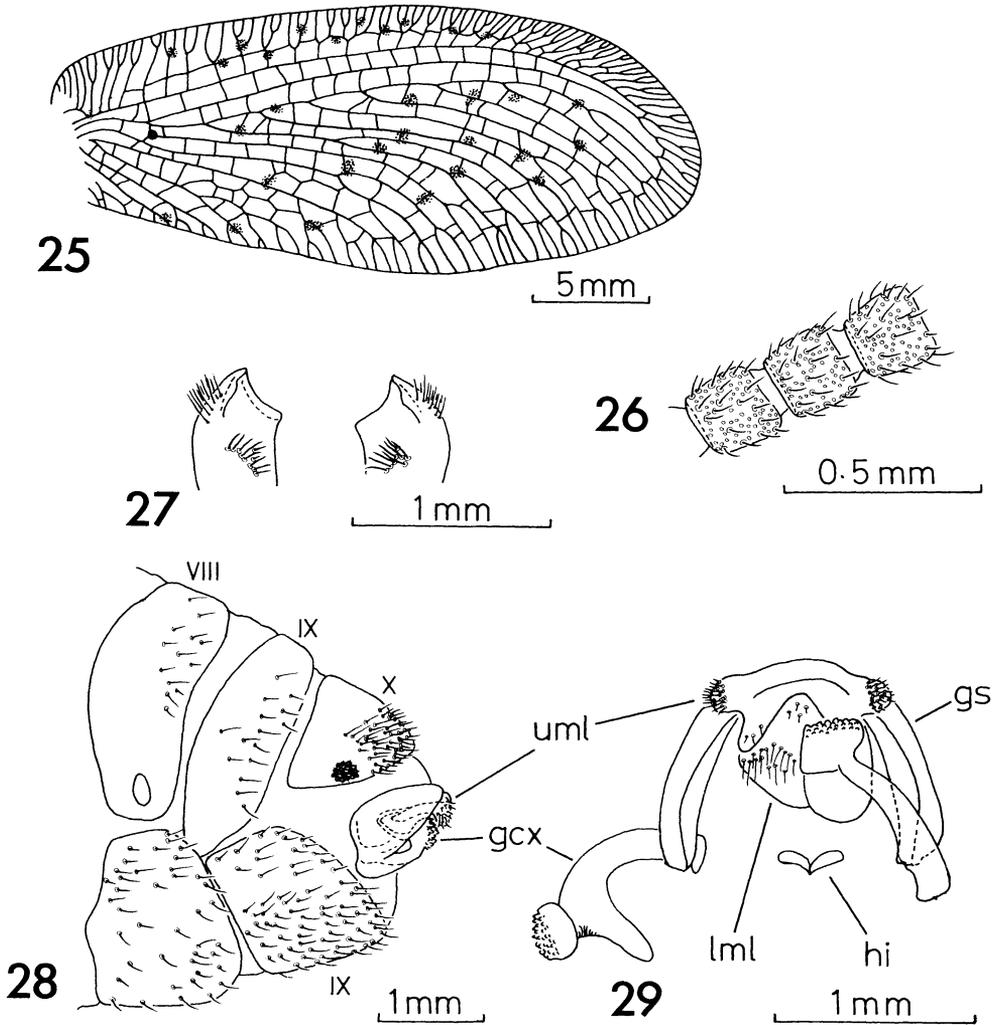
Paratype, INDIA: 1 ♂, data as holotype (BMNH).

Rapsima malayanum sp.n. (Figs. 25–29)

[*Rapsima viridipennis* (Walker); Banks, 1931: 379. Misidentification.]

Male. General body colour yellowish brown; head unmarked. Eyes large, EI ratio 1.0–1.1. Antennae 11 mm long; 63–65 segments, moniliform, setae fairly short (Fig. 26).

Venation as in Fig. 25; wings fairly broad with a rounded tip. Forewing pale yellow with scattered brown markings; hindwing hyaline. Forewing length 25–27 mm, hindwing 21–24 mm.



FIGS. 25–29. *Rapisma malayanum* ♂. 25, forewing; 26, antennal segments; 27, mandibles; 28, genitalia, lateral view; 29, genitalia, ventro-posterior view, left gonocoxite reflexed.

Female. Unknown.

Genitalia ♂ (Figs. 28 and 29). Upper mediuncus lobes well separated but prominent. Gonocoxites with large square lobes bearing short thick spines apically. Hypandrium internum moderately large.

Remarks

This species most closely resembles *corundum* and *burmanum* in general appearance but is distinguished from *burmanum* by the lack of head markings, and from *corundum* by the

moniliform antennae. The male genitalia are diagnostic.

The location of the specimen from Thailand mentioned by Banks (1931) is unknown. As it was collected on Khao Lung, Nakhon Si Thammarat, in the extreme south of the country, it probably represents the same species as the W. Malaysian specimens. Banks's misidentification of this species is partly explained by Walker's (1853) misinterpretation of the type-locality of *viridipenne* as East Indies (see 'Remarks' under *viridipenne*, above).

Distribution (Fig. 1). W. Malaysia (probably also S. Thailand).

Holotype ♂, W. MALAYSIA, Pahang, Fraser's Hill, 1200 m, v.1935 (BMNH).

Paratypes, W. MALAYSIA: 1♂, Pahang, Sungei Renglet, 1050 m, 11.iii.1925 (BMNH); 1 specimen (abdomen missing), Pahang, Fraser's Hill, 1200 m, 5.ix.1923 (BMNH).

***Rapisma intanonum* sp.n.** (Figs. 30 and 31)

Male. Unknown.

Female (holotype only). General body colour yellowish brown, head unmarked. Eyes small, EI ratio 0.85. Antennae 7 mm long; about 60 segments, moniliform, with long setae.

Venation as in Fig. 30; wings long and narrow, rounded apically. Forewing pale green with dark brown spot at nygma, some other very pale spots in costal field. Hindwing hyaline. Forewing length 22 mm, hindwing 18 mm.

Genitalia ♀ (Fig. 31). Subgenital plate broadly triangular, anterior margin with broad projecting lobe and hind margins sinuous; apical notch narrow, parallel-sided, with no central projection.

Remarks

Externally this species most closely resembles *burmanum*, which is also the nearest species geographically (Fig. 1), but can be distinguished by the lack of markings on

the head and the form of the female subgenital plate.

This is the only species for which I have detailed notes on behaviour and habitat. The collector, Mr Kosol Charernsom (personal communication) saw the specimen near the top of Doi Intanon (the highest peak in Thailand) resting on a leaf at about 1 p.m. in relatively cold conditions (c. 16°C). It was resting with the wings held roof-like in a typical neuropterous fashion, and was noticeably very bright green. The specimen showed no inclination to fly and was easily captured by hand.

Distribution (Fig. 1). N.W. Thailand.

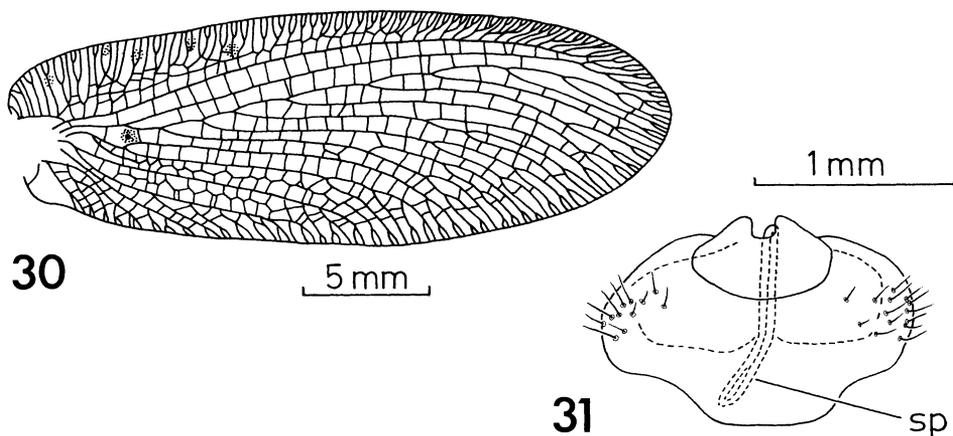
Holotype ♀, THAILAND, Doi Intanon [2595 m], 3.vii.1976 (Kosol Charernsom) (BMNH).

***Rapisma sabahnum* sp.n.** (Figs. 32–34)

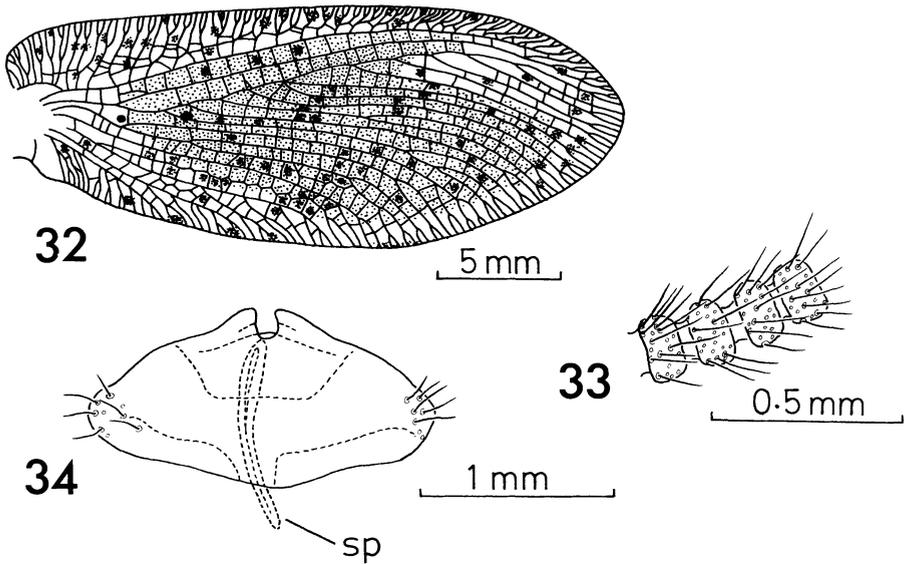
Male. Unknown.

Female (holotype only). General body colour pale yellowish brown, head with no dark markings. Eyes small, EI ratio 0.8. Antennae 5 mm long, dark yellowish brown, becoming dark brown towards tip; 55–60 segments, moniliform, setae very long (Fig. 33).

Venation as in Fig. 32; wings moderately narrow, rounded; hindwing proportionately broader. Forewing pale greyish yellow, with brownish suffusion across centre, strongly speckled with dark brown markings; hindwing



FIGS. 30–31. *Rapisma intanonum* ♀ (holotype). 30, forewing; 31, subgenital plate.



FIGS. 32-34. *Rapisma sabahnum* ♀ (holotype). 32, forewing; 33, antennal segments; 34, subgenital plate.

hyaline. Forewing length 23 mm, hindwing 18 mm.

Genitalia ♀ (Fig. 34). Subgenital plate broadly triangular, with sinuous hind margins; apical notch narrow, sides incurved, with no central projection.

Remarks

This species is easily distinguished from all the other species by the strongly speckled wings. In the holotype the nygma is lacking in both hindwings but I doubt if this is significant, as the nygmata tend to be fainter in the hind wings of several species, and are occasionally present on one side only.

Distribution (Fig. 1). Borneo (Sabah).

Holotype ♀, BORNEO, Sabah, Mt Kinabalu, Mesilau Camp, 1500 m, 15.iii.1964 (*S. Kueh, Royal Society Expedition*) (BMNH).

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