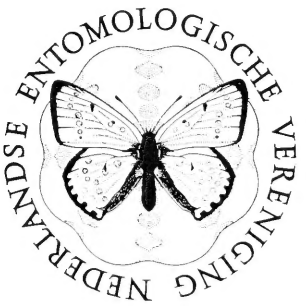
# TIJDSCHRIFT VOOR ENTOMOLOGIE

UITGEGEVEN DOOR

DE NEDERLANDSE ENTOMOLOGISCHE VERENIGING

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# INHOUD

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*(Synonyms in italics)*

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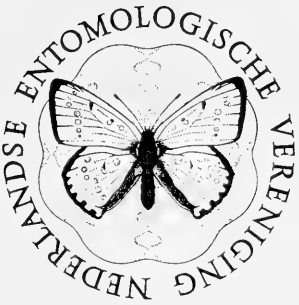


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# TRIDACTYLIDS AND TETRIGIDS (ORTHOPTERA) FROM SULAWESI, INDONESIA

by

R. E. BLACKITH and R. M. BLACKITH
*Trinity College, Dublin, Ireland*

Abstract

The tridactylids and tetrigids from the Project Wallace and other expeditions to Sulawesi are identified and where available notes on their biology are appended. Two widespread south-east Asian species constitute the surprisingly small tridactylid fauna so far known. Four tetrigid species new to science are described, six new to Sulawesi are listed, and the presence of 13 previously recorded there is confirmed. Two tetrigid species described from Sulawesi are synonymised. The tetrigid faunas of North, Central, and South Sulawesi are distinct; they may have arrived on different fragments of continental plate and failed to mix appreciably. The prospects for a radical revision of the Tetrigidae of the region are outlined.

## Introduction

Hancock (1915) lists 47 Indian tetrigid specimens which he reworked after Kirby (1914) had determined them. They agreed fully on the identity of only two specimens; moreover, of the nine specimens which Kirby labelled *Hedotettix gracilis* De Haan, Hancock deemed there to be six species in four genera (none of them *Hedotettix*). Again, within the 13 specimens which Kirby regarded as *Euparatettix personatus* (Bolivar), Hancock found eleven species in five genera. These discrepancies suggest that not only are tetrigids a "difficult group" but that one of the difficulties is the wide disparity between one worker's appreciation of infra-specific variation and another's.

A successful revision of the group, now overdue, may depend on establishing a numerical basis for deciding what constitutes variation within species, genera etc. We hope to use the long series which were collected during Project Wallace to this end. If no such basis is established, further revisions may simply pit another set of concepts against those implicit in previous revisions, and add to the synonymy. There are so few reliable characters that recourse to a multivariate ordination, using numerous characters in combination, is a possible solution.

A particular difficulty with tetrigids from the islands of the Oriental Region is that many species are weak flyers or apterous, so that gene flow between the islands is likely to be far below that once thought needed for genetic cohesion between the populations. The large number of endemic genera is one obvious consequence, but we also meet instances where a species found on one island is very similar, but not identical, to a related species from another island. Whether it should be described as new becomes an existentialist problem, where decisions are made with inadequate evidence to support them. In view of the high degree of endemism in south-east Asian tetrigids, the attribution of a given specific name to material from widely separated continents is questionable.

Cousin (1961) has drawn attention to the existence of "sibling" species (espèces sosies) in gryllids, whereby populations doubtfully separable morphologically but long isolated geographically, e.g. in Africa and South America, may be capable of hybridising and giving rise to fertile offspring. White (1978: 32) questions the role of cohesive forces (gene-flow) in preventing speciation, and notes that we have no means of measuring them even approximately. He considers it legitimate to regard the origin of genetic isolating mechanisms rather than subdivision of the gene-pool as the prime cause of speciation. Since tetrigids have, superficially at least, uniform caryotypes the prospects for unequivocal resolution of their taxonomic problems by cytogenetic analysis seem remote. However, the shapes of different species are characteristic, and

susceptible to numerical analysis.

A partial revision of south-east Asian tetrigids is under way, based on the multivariate analysis of 80 morphological characters assessed on each specimen. This analysis will be described elsewhere. Provisional identifications are offered here for tetrigids, as Kevan (1966) recommends, although tridactylids are definitively identified from the male genitalia (Blackith & Blackith, 1979). To avoid repetition, all collecting localities are Indonesia, Sulawesi and unless otherwise stated, in the Dumoga-Bone National Park, Sulawesi Utara. All material collected by us is dated between 3.i.1985 and 28.iii.1985; for long-lived insects in an almost unvarying habitat on the equator, with, locally, no clear rainy season, further precision as to dates seems pointless.

For biogeographical purposes we consider Sulawesi to be divided into three regions; north of the equator; central (between the equator and latitude 4°S); and south of latitude 4°S. These arbitrary divisions are based on major gaps between areas where collecting has been done.

Anatomical nomenclature follows Albrecht (1953) except that the armament of the hind tibiae is called teeth, rather than spinules, which implies articulation. Several characters useful in tetrigid taxonomy have received little or no attention in the literature; two that are used here are the organisation of the thoracic pleura (fig. 1) particularly the presence or absence of a visible suture on the mesepisternum, and the arrangement of prominent sensilla on the inner face of the hind femora, proximal to the genicular region (fig. 2). These sensilla are often arranged in two groups, a central cluster roughly half-way between the dorsal and ventral margins of the inner face, and a row or cluster much nearer the dorsal margin. In some species, there is a process or fold in the dorsal carena of the hind femur here called the pregenicular fold, proximal to the ante-genicular tooth (fig. 2b). Two characters that our long series show to be sufficiently unreliable to be more of a hindrance than a help are the colour pattern and the relative lengths of the pulvilli on the first segment of the hind tarsi.

Abbreviations: BMNH = British Museum (Natural History); LEM = Lyman Entomological Museum (Macdonald College of McGill Univ., Quebec); MB = Museum Bogorensis, Java, Indonesia; MNHNP = Muséum National d'Histoire Naturelle, Paris; NMI = National Museum of Ireland, Dublin; RNHL = Rijksmuseum van Natuurlijke Historie, Leiden.

## TRIDACTYLOIDEA: Tridactylidae

### **Tridactylus riparius** Saussure, 1877

Material studied: 10♂, 10♀ (Blackith); 5♀, 7.vii.1985 (Butlin); 3♂, 5♀, 15—18.ix.1985 (Ashe).

There is no discernable variation in the abundance of this species over the nine months covered by these collections, the first ever made, so far as we can judge, from Sulawesi.

*T. riparius* occurs on silt and silt-filled gravel banks along the Dumoga, Bone, Toraut, Tumpah and Pononontuna Rivers. A creek on the left bank of the Toraut upstream from the Maze was chosen for a capture – recapture experiment. This was an area of 12 sq. m. covered with long sparse grass and inhabited by frogs and water-snakes. On 2.ii.85, 25 males and 18 females were marked with a spot of yellow oil paint on the pronotum and released. Two days later 102 males and 55 females were captured of which four and one respectively, were marked. A simple Lincoln Index calculation suggests that the population contained 637 males and 990 females, roughly 128 individuals per sq. metre. We think this is as dense a population as occurs in the region.

### **Tridactylus opacus** Walker, 1871

Material studied: 2♂, 15-18.ix.1985 (Ashe).

These few specimens were taken in a Malaise trap near "The Maze" on the Toraut River.

Both species of *Tridactylus* range from India to Sulawesi, but neither occurs in Australia (K. K. Günther, 1978).

## TETRIGOIDEA: Tetrigidae

As there is no substantially complete or agreed classification of this family into sub-families it will be treated provisionally as an entity.

### **Diotarus pupus** Bolivar, 1887 (fig. 2d)

Material studied: 4♂, 4♀, Edwards' Camp; 1♂, '1440' summit; 1♂, 1♀, Gunung Muat, on crests of ridges in forest, among leaf litter (Blackith).

New to Sulawesi, but occurs in the Philippines.

### **Hirrius montanus** Günther, 1937

Material studied: 1♂, Sulawesi Tengah, Mount Tambusiasi, 1200 m, 3-13.iv.1980 (Brendell) (BMNH).

Described from south Sulawesi.

**Eucriotettix** aff. **dammermanni** Günther, 1938 (fig. 2c)

Material studied: 10♂, 18♀, widely distributed within the Dumoga-Bone National Park (Blackith); 1♂, 28.vi.1985 (Butlin); 2♂, 18.ii.1985 (Holloway); 1♀, Plot A (BMNH Fogging Team) (BMNH).

This is a strong flyer and was often taken at lights.

Kevan (1966) comments that the taxonomy of the large genus *Eucriotettix* Hebard is "in rather a chaotic state so that accurate determinations are virtually impossible". *E. dammermanni* was described from Sevesi Island (between Java and Sumatra) and, if the identification is correct, is new to Sulawesi where it seems to be associated with running water.

**Eucriotettix ridleyi** Günther, 1938

Material studied: 1 ♂, 1 ♀, Hog's Back Camp, on forest floor (Blackith); 1 ♂, same data, on logs, 29.vi.1985 (Butlin).

Described from Singapore. If the identification is correct, it is new to Sulawesi. The species is unusual in having no sensilla immediately proximal to the genicular area inside the hind legs.

**Scelimena celebica** (Bolivar, 1887)

Material studied: 3♂, 5♀ (Blackith).

This is the only species of Günther's "Scelimenae verae" found during the expedition. It inhabits rock-strewn river banks and gullies with running water in rain-forest, often at low light intensities where no other riverine tetrigid can survive. As Humbert, quoted by Bolivar (1887) notes, it swims and takes off from water, flashing its striking blue wings. We collected it wherever there was permanent running water in deep shade and boulders with a matrix sufficiently porous to allow continuous algal growth on which it feeds (Blackith, in press). Described previously from North Sulawesi, where it is apparently endemic.

Between 28.i.85 and 25.iii.85 an isolated population in a deep gully about 5 m below the forest floor, through which a stream runs into the left bank of the Toraut in the Maze, was subjected to five successive capture-recapture experiments. A different coloured or positioned mark was placed on the pronotum on each occasion, using dots of oil-paints. Between 24 and 47 adults were marked on each occasion. Numbers, rates of immigration, and death, were calculated by Jolly's method as programmed by Davies (1971).

The population was enclosed by areas inhospitable to the species except up-stream, and a few individuals including one marked specimen, were found 150 m away from the experimental area, which occupied 12 sq. m. of the stream bed. By the end of the experiment, about half the individuals bore paint. The maximum population was estimated as 214, with standard error of 64. Probabilities of survival were never significantly less than unity, and estimates of recruitment or loss never significantly greater than zero.

Our impression is that the population is remarkedly stable, with long-lived adults, much more than three months, and few nymphs. It is hard to conceive of environmental factors likely to trigger substantial change, apart from non-seasonal phenomena such as vulcanicity, windblows, or man's activity.

However, Dr. R. Butlin (personal communication), who took part in Project Wallace between June and August 1985, examined the population several times during that period and saw no marked individuals. Various currently unverifiable explanations suggest themselves; there may have been a sharp onset of mortality, or the marks may have worn off.

**Tondanotettix modestus** Günther, 1937

Material studied: 1♂, Edwards' Camp, on ridge in leaf litter (Blackith); 2♂, 2♀, Gunung Mogogonipa, on logs, 5.vii.1985 (Butlin).

Described from north Sulawesi. The metepisternum has a large (0.25 mm) rounded process with no obvious sensilla, apparently engaging with the ventral margin of the pronotum.

**Tegotettix corniculatus celebensis** Günther, 1937

Material studied: 1♀, Sulawesi Tengah, Ramu River Area, nr. Morowali (Brendell) (BMNH).

Described by Günther, as a subspecies of *Tegotettix corniculatus* (Stål), from south Sulawesi.

**Euparatettix celebicus** (Hancock, 1907)

Material studied: 2♀, Sulawesi Tengah, Ramu River Area, nr. Morowali, 27.i—20.iv.1980 (Brendell) (BMNH).

Described from south Sulawesi in the genus *Hedotettix* Hancock, this species is said by Günther (1937) to be closely allied to *E. personatus*, *E. tricarinatus*, and *Paratettix histricus*, all three of which occur on the island, and may have speciated there.

**Euparatettix personatus** (Bolivar, 1887)

Material studied: 2♂, 2♀, Sulawesi Tengah, Ramu River Area, nr. Morowali, 27.i—20.iv.1980 (Brendell) (BMNH).

Recorded by Günther (1937) from south Sulawesi.

**Paratettix tricarinatus** Bolivar, 1887

Material studied: 3♂, 3♀, Sulawesi Tengah, Ramu Camp, Kolonodale area, at black light, 29.i.1980 (P. G. Kevan) (LEM); 1♂, 3♀, Sulawesi Utara, Gua Kapur, on Limestone with grass cover, 7.viii.1985 (Butlin).

The Ramu Camp specimens bear a label with the same determination by D. K. McE. Kevan. Described from the Philippines, new to Sulawesi.

**Paratettix** aff. **mimus** Bolivar, 1887

Material studied: 5♂, Sulawesi Tengah, Ramu Camp, Kolonodale Area (P. G. Kevan) (LEM).

*P. mimus* was described from the Philippines, but is new to Sulawesi.

**Hedotettix costatus** Hancock, 1912

Material studied: 1♂, 1♀, 1.vii.1985 (Butlin); 5♀, Sulawesi Utara, nr. Dolodua, from egret's crop, 5.iv.1986 (C. Vermeulen).

These specimens might well be *H. gracilis* De Haan and *H. costatus* may itself be a synonym of *H. gracilis*; *H. costatus* is recorded by Günther (1937) from south Sulawesi. The species seems to be adapting to life in paddy fields.

**Loxilobus insidiosus** Bolivar, 1887

Material studied: 1♂, 2♀, Lombongo Village (Blackith); 2♂, 2♀, Lombongo Village, 6.viii.1985 (Butlin); 2♀, Manado (Blackith).

Kevan (1966) notes that the genus *Loxilobus* Bolivar is almost certainly polyphyletic and its taxonomy chaotic. The above species has a wide range from Malaysia to the Philippines, and Günther (1937) records it from north Sulawesi.

**Loxilobus rugosus celebensis** Günther, 1937

Material studied: 3♂, 3♀, Lombongo Village, along tributaries of the Bone River (Blackith).

Günther (1937) described this form as a subspecies of *L. rugosus* Bolivar, which is a Bornean species. However, during the description he calls it *L. celebensis*, probably indicating that it had virtually specific rank in his mind. The type locality is south Sulawesi.

**Systolederus ophthalmicus** Bolivar, 1887

*S. carli celebensis* Günther, 1937: 189. **Syn. nov.**
*S. fruhstorferi* Günther, 1937: 189. **Syn. nov.**

Material studied: 8♂, 10♀ (Blackith); 2♂, 6.viii.1985 (Butlin); 1♀, 28.viii.1985 (Kirk-Spriggs) (BMNH); 1♂, x.1985 (Ashe).

Günther (1937) erected *S. carli celebensis* and *S. fruhstorferi* because of differences in the relative lengths of the pulvilli on the first segment of the hind tarsi and in colour patterns. He was unable to see the type of *S. ophthalmicus* and had to rely on Bolivar's limited description based on a single female. Inspection of this type and of a long series of specimens from the Toraut region of Minahassa shows that colour pattern and the relative lengths of the pulvilli fall into the category of characters which are collectively useful but individually unreliable.

There is an apparently continuous range of relative lengths (denoting the lengths of the pulvilli seriatim by pl, p2 and p3) from pl = p2 = p3 (as Bolivar claims for the type of *S. ophthalmicus*), through p3 = pl + p2 (as in the description of *S. carli celebensis*) to rare specimens with p3 > pl + p2 as in the description of *S. fruhstorferi*. In fact, careful measurement of Bolivar's type shows that pl = p2 = 0.20, but p3 = 0.25 mm on both legs.

No character has been found to distinguish forms within this range, although the sensory pads on the tips of the maxillary palps (when examined at X 160) do appear to be smaller and more elliptical in the one specimen we have attributable on Günther's description to *S. fruhstorferi*; this may be idiosyncratic.

The locally common species inhabits boulders in fairly open rivers, not in deep shade, particularly the Tumpah River and a waterfall some 4

km north-east of Lombongo. Aspects of its biology have been described by Blackith (in press), and it appears to be endemic to north Sulawesi.

**Coptotettix alfurus** Günther, 1937

Material studied: 3♂, 4♀, Huntuk trail and '1440' summit (Blackith); 6♂, 7♀, Gunung Poniki, leaf-litter and sphagnum, 14—15.viii.1985 (Butlin); 1♂, 3♀, Gunung Mogogonipa, 30.vii.1985 (Butlin); 1♀, Gunung Poniki, 18.x.1985 (Monk) (BMNH).

An apterous, high altitude, form living in leaf-litter, with several colour patterns. Described from south Sulawesi.

**Coptotettix interruptus** Bolivar, 1887

Material studied: 4♂, 3♀, streams feeding the Bone River (Blackith); 1♂, 6.vii.1985 (Kirk-Spriggs) (BMNH); 1♀, Gunung Muat, Lakes Bungalow, 14.vii.1985 (Butlin).

The possibility that this is the alate form of *C. alfurus* seems to be discounted by the fact that the two forms live in quite different habitats, at different altitudes. Described from Java, previously recorded from Sulawesi by Günther (1937).

**Hyboella overbecki** Günther, 1939

Material studied: 1♂, Gua Kapur, nr Gorontalo, leaf litter in woods on limestone, 7.viii.1985 (Butlin); 1♂, Gunung Poniki, Ice Station Zebra, 14.viii.1985 (Butlin).

Previously recorded from Java and Sumatra (Günther, 1955) and new to Sulawesi. The Gua Kapur specimen is teneral.

**Probolotettix corticolus** sp. n.
(figs. 2b, 3)

Holotype, ♀, Indonesia: Sulawesi Utara, Dumoga-Bone National Park, 13.iii.1985 (Blackith) (RNHL).
Paratypes, 2♂, 2♀, same data (Blackith) (BMNH; LEM; NMI; MB).

Head and anterior segments of pronotum as in fig. 3. Vertex (4.7 mm). wider than eye (4.0 mm). Frons visible throughout, in side view, between eyes. Scape dorso-ventrally compressed, pedicel sub-spherical. Lateral carenae of vertex joining median carena of fastigium, terminating caudad in small black horns adpressed to inner

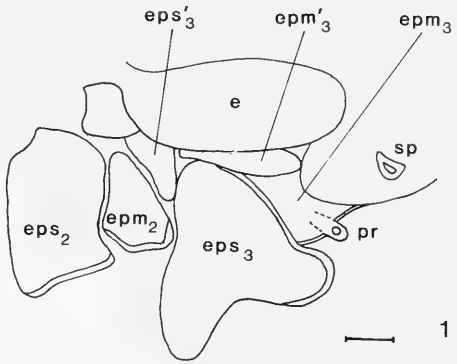



Fig. 1. *Probolotettix kevani* sp. n. Organisation of pleural segments of meso- and metathorax. e = elytron, sp = spiracle, $eps_2$ = mesepisternum, $epm_2$ = mesepimeron, $eps'_3$ = meta-anepisternum, $eps_3$ = metakatepisternum, $epm'_3$ = meta-anepimeron, $epm_3$ = metakatepimeron, pr = (proprioceptive) process on metakatepimeron. Scala-line 0.25 mm.

eye margins. Palps only slightly elliptical in cross section.

Vertical furrows of pronotum c and d deep, becoming obsolete towards median carena, linked at base by deep transverse furrow k. Furrow e obsolete. Prozonum upturned against back of head. Infrascapular area (viewed × 160) with smooth lower carena. Pronotal disc brown, maculate black. Elytra elliptical (1.6 mm × 0.6 mm). Wings fully developed, exceeding pronotum by about 1.4 mm. Cells in cubital area black, cross-veins white. Transverse suture on mesepisternum weakly developed.

Ventral carenae of fore-and mid-femora without fringe of long golden hairs. Fore-femora lobed. Hind femora with eight fragae on outer face, but no callosities. Five conspicuous white sensilla on inner face of hind femora, proximal to genicular area. The largest sensillum measures 0.6 mm × 0.45 mm. Hind tibia with six teeth on outer, five on inner, margins. Pulvilli on first segment of hind tarsi 0.6, 0.6 and 1.4 mm long. Ovipositor valves slender (upper valve 1.2 mm × 0.3 mm).

Other material studied: 2♂, 3♀ standing over a label "*Criotettix* sp." in the National Museum of Ireland have more robust ovipositor valves (0.9 × 0.5 mm) and are from Java. It seems unwise to designate these specimens as paratypes although they appear to belong to *P. corticolus*.

This species was found on the bark of trees, whether upright or fallen, in deep forest along

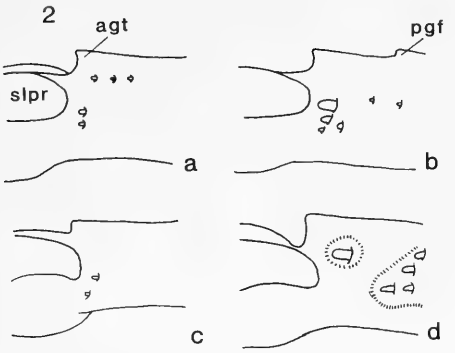



Fig. 2. Arrangement of sensilla on internal face of hind tibia. (Diagrammatic). slpr = semilunar process, agt = antegenicular tooth, pgf = pre-genicular fold; a, *Probolotettix kevani* sp. n.; b, *Probolotettix corticolus* sp. n.; c, *Eucriotettix* aff. *dammermanni* Günther; d, *Diotarus pupus* Bolivar. Scala-line 0.5 mm.

the Huntuk trail in the area between the Toraut and Tumpah rivers. Records of partly corticolous tetrigid species are scattered throughout the literature, but in this case the species has been found only on bark.

**Probolotettix kevani** sp. n.
(figs. 1, 2a, 4)

Holotype, ♂, Indonesia: Sulawesi Tengah, Ramu Camp, Kolonodale area, 5.ii.1980 (P. G. Kevan) (LEM).

Paratypes, 4♂, 2♀, Sulawesi Utara, Dumoga-Bone National Park (Blackith); (BMNH, NMI, MB, MNHNP); 1♂, 2♀, same locality, 17.v—16.vii.1985 (Butlin) (LEM, BMNH, NMI); 1♀, same data, at light, 19.vii.1985 (Butlin) (RNHL); 1♂, Gunung Poniki, at light, 15.viii.1985 (Butlin) (RNHL); 1♀, same locality, 6.vii.1985 (Kirk-Spriggs) (BMNH).

Body colour brown, dorsal areas of epimera black, raised pronotal disc bordered russet, pigmented across pronotum, anterior part black, posterior yellow. Eyes globular, ocelli large (0.18 × 0.12 mm) frons arcuate in profile, prozonal carenae of pronotum divergent cephalad, mesepisternal suture obsolete, elytra 1.1 × 0.5 mm, wings exceeding pronotum by 2 mm.

Fringe of white setae on ventral carena of mid-femora. Hind tibia with eight teeth on inner, seven on outer, margins. Sensilla on inner face of hind femora as fig. 2a, pregenicular fold on dorsal carena. Pulvilli on first segment of hind tarsi produced into sharp points. The species is distinguished from *P. corticolus* by the arcuate frons, and the lateral carenae of the vertex which are distinctly higher than the median carena in profile (fig. 4).

The species differs from all those assigned to the genus by Günther (1939) in having the vertex visible between the eyes in profile, a feature which it shares with *P. corticolus*. It is, however, very similar to *P. sundaicus* Günther from which it differs, apart from the projection of the vertex, in size, although *P. sundaicus* appears to be confined to western Indonesia.

The species is widespread in Sulawesi Utara and inhabits river banks together with *S. ophthalmicus*. It flies strongly and comes to light readily.

*P. kevani* is also the predominant species recovered from the crops of egrets and herons feeding in and around paddy fields in areas of north Sulawesi from which forest had been cleared. It appears to be able to thrive in rice-growing areas. These specimens, recovered by Dr. Charlotte Vermeulen, were sent to me accompanied by specimens collected directly from the paddy fields, many of which proved to be *P. kevani*.

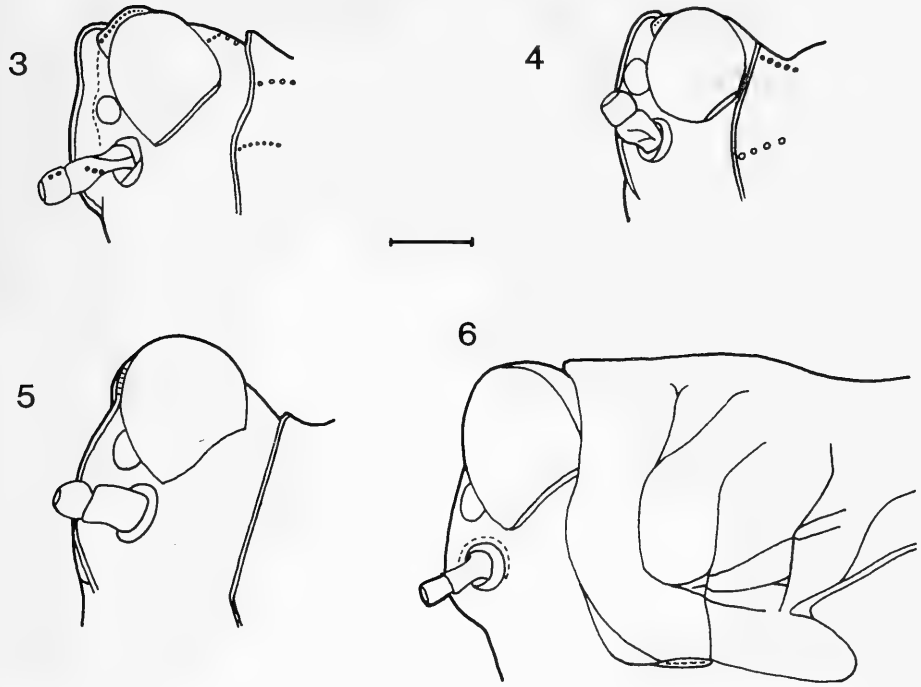
Although there is some overlap, the number of teeth on the inner and outer margins of the hind tibiae of *P. kevani* is greater (6—11, modal value 9) than in *P. corticolus* (5—7, modal value 6). This result is unexpected, because Descamps (1976) found that corticolous species generally had more hind tibial teeth than other acridids.

**Mazarredia celebica** Bolivar, 1887

Material studied: 1♂, '1440' summit, 4.x.1985 (K. Monk) (BMNH); 1♂, Gunung Ambang, 1200 m, Fog 7, 18.ii.1985 (BMNH fogging team) (BMNH).

The genus *Mazarredia* Bolivar was erected for 13 south-east Asian species ranging from Sri Lanka to the Philippines. One of these, *M. celebica*, was described from a single female from north Sulawesi. Bolivar notes that the depressions behind the "shoulders" of the pronotum, characteristic of the genus, are weakly developed in this small species, which makes it a passage form to several other genera of the region.

Later, Bolivar (1909) segregated *M. celebica* into the genus *Xistrella* Bolivar. However, Günther (1955) expresses the view that *Xistrella* should be returned to a group of genera includ-




Figs. 3—6. Upper part of head in profile of: 3, *Probolotettix corticolus* sp. n., holotype ♀; 4, *P. kevani* sp. n., paratype ♀; 5, *Mazarredia bolivari* sp. n., paratype ♀; 6, *Thoradonta butlini* sp. n., head and anterior part of pronotum, holotype ♀. Scala-line 0.5 mm.

ing *Mazarredia* pending further revision, with which we provisionally concur. Günther's earlier major revision of 1938—1939 had been unable to include *M. celebica* as the type was unavailable to him.

We have been able to examine Bolivar's type and compare it with two specimens from the Project Wallace expedition. The 80-character morphometric analysis shows that the Project Wallace specimens are virtually identical with the type. It seems that this is a high-altitude species of some rarity, in view of the paucity of specimens discovered.

Sulawesian species of *Mazarredia* can be distinguished from those of *Probolotettix* by the absence, in *Mazarredia*, of sensilla proximal to the genicular area of the internal face of the hind femora. However, the boundaries of these genera need clarification. *M. celebica* has patches of scabrous cuticle on either side of the unpaired ocellus, possibly homologous with the fastigial foveolae of gomphocerine acridids.

**Mazarredia bolivari** sp. n.
(fig. 5)

Holotype, ♀, Indonesia, Sulawesi Utara, Dumoga-Bone National Park, at u-v. light, 30.i.1985 (Holloway) (BMNH).

Paratypes, 4♂, 5♀, same data (Blackith) (BMNH; LEM; NMI; MB; MNHNP; RNHL); 1♀, Sulawesi Tengah, nr. Morowali, Ramu River at light, 27.i—20.iv.1980 (Brendell) (BMHN).

Leaden grey body colour flecked with dull yellow. Head slightly exserted, eyes raised just above the pronotum. Frons just visible before upper part of eyes. Vertex slightly narrower than an eye, with minute horns on lateral carenae. Maxillary palps compressed. Anterior margin of pronotum tilted sharply upwards towards head. Pronotum weakly depressed behind shoulders. Panier (saddle-bag)-shaped processes

on mesozonum. Lateral carena of pronotum interrupted by shallow protuberance (grey against brown pronotal disc) cephalad of which the lateral carenae are obsolescent. Transverse carena on episternum of mesothorax. Metasternal pits and sutures deeply incised. Elytra 1.45 × 0.50 mm. Ocelli 0.20 × 0.17 mm. Wings exceeding pronotum by 1.5 mm. Pronotal length 10.5 mm, hind femoral length 4.9 mm. Long (0.2 mm) golden setae spaced at a distance about equal to their length along ventral carena of fore- and mid-femora and proximal half of hind femora. Hind tibiae with six teeth on inner, five on outer margin.

This species is distinguished from *M. celebica* in which the lateral carenae of the pronotum are percurrent, and in which the wings are subequal to the pronotum; the ocelli of *M. bolivari* are distinctly larger (0.17 mm wide against 0.11 mm for *M. celebica*).

This species is a strong flyer and comes to light. It is abundant along the water-courses draining the Dumoga and Bone valleys. The species is often found on vegetation some 20 cm above the ground, an unusual position for a tetrigid.

We name this species to celebrate the centenary (1.xi.1987) of Ignacio Bolivar's seminal "Essay" on the tetrigids.

Table 1. Distribution of tetrigids on Sulawesi (+ = material identified by us but not recorded by Günther, 1937; (+) = material seen by us, and recorded by Günther, 1937; ( ) = material not seen by us, but recorded by Günther, 1937; − = material not recorded from the area)

| SPECIES | NORTH | CENTRAL | SOUTH |
|---|---|---|---|
| *Diotarus pupus* Bolivar | + | − | − |
| *Kraengia apicalis* Bolivar | − | − | ( ) |
| *Ophiotettix cygnicollis* Walker | ( ) | − | − |
| *Hirrius sarasinorum* Günther | ( ) | − | − |
| *Hirrius scrobiculatus* Günther | ( ) | − | − |
| *Hirrius montanus* Günther | − | + | ( ) |
| *Criotettix bispinosus* Dalman | − | − | ( ) |
| *Eucriotettix dammermanni* Günther | + | − | − |
| *Eucriotettix ridleyi* Günther | + | − | − |
| *Scelemina celebica* (Bolivar) | (+) | − | ( ) |
| *Tegotettix armatus* Hancock | ( ) | − | − |
| *Tegotettix c. celebensis* Günther | − | + | ( ) |
| *Bullaetettix sarasinorum* Günther | − | ( ) | ( ) |
| *Tondanotettix meridionalis* Günther | − | − | ( ) |
| *Tondanotettix modestus* Günter | (+) | − | − |
| *Pseudoparatettix luwuensis* Günther | − | ( ) | − |
| *Euparatettix celebicus* Hancock | − | + | ( ) |
| *Euparatettix personatus* Bolivar | − | + | ( ) |
| *Paratettix tricarinatus* Bolivar | + | + | − |
| *Paratettix mimus* Bolivar | − | + | − |
| *Paratettix femoralis* Bolivar | − | − | ( ) |
| *Paratettix histricus* Stål | − | − | ( ) |
| *Hedotettix costatus* Hancock | + | − | ( ) |
| *Indatettix* sp. | ( ) | − | − |
| *Loxilobus insidiosus* Bolivar | (+) | − | − |
| *Loxilobus r. celebensis* Günther | + | − | ( ) |
| *Spadotettix heinrichi* Günther | ( ) | − | − |
| *Systolederus ophthalmicus* Bolivar | (+) | − | ( ) |
| *Coptotettix alfurus* Günther | + | − | ( ) |
| *Coptotettix interruptus* Bolivar | + | − | ( ) |
| *Hyboella overbecki* Günther | + | − | − |
| *Probolotettix corticolus* sp. n. | + | − | − |
| *Probolotettix kevani* sp. n. | + | + | − |
| *Mazarredia celebica* Bolivar | (+) | − | − |
| *Mazarredia bolivari* sp. n. | + | + | − |
| *Thoradonta butlini* sp. n. | − | − | |

**Thoradonta butlini** sp. n.
(fig. 6)

Holotype, ♀, Indonesia, Sulawesi Utara, Dumoga-Bone National Park, '1440' summit, 24.vii.1985 (Butlin) (BMNH).

Pronotal disc flavous, sides and legs darker, scabrous white, fragae on hind femora suffused with pink. Sooty black patches well behind shoulders of pronotum. Head and anterior part of pronotum as fig. 6. Frons almost straight, vertex, top of eyes and prozonum of pronotum colinear. Antennae set well below eyes, upper margin of scape 0.3 mm lower than lowest margin of eyes. Terminal antennal segments fuscous and compressed, pedicel roughly square in profile (0.13 × 0.13 mm).

Prozonum of pronotum projecting slightly over occiput. Grooves c, d and e all cut lateral carenae of pronotum anterior to the shoulders where the carenae are obsolescent, marked by change of colour. Infra-scapular area of pronotum wide (0.25 mm). Pronotum 6 mm long. Apterous. Hind femora 4.3 × 1.7 mm, with 17 fragae on dorsal external segment and 14 on midsegment. No visible suture on episternum of mesonotum, no sensilla on internal face of hind femora proximal to the genicular area. Hind tibia with seven teeth on inner margin, six on outer margin. Hind femora just projecting beyond pronotum. Metaspinal pits exceptionally deep and wide.

This species is unique among known members of the genus, which is allied to *Mazarredia*, in having the lateral lobes of the pronotum smoothly rounded, but is otherwise representative of the genus, with modifications appropriate to an apterous species.

## Discussion

There is little biogeographical information to be gleaned from the tridactylids, both species of which are widespread from India to Indonesia. The paucity of species, and the apparent absence of records from expeditions earlier than Project Wallace in Minahassa, suggests that the tridactyloids may have reached Sulawesi only recently, as the distribution is grossly unbalanced.

The comparison of tetrigid records in the three regions (table 1) into which we divide the island is striking; only two species are recorded from both the north and centre, only five species are common to centre and south, and only six species to north and south, out of a total 36 tetrigid species recorded from the island. This finding strongly suggests that the tetrigid faunas of the three areas are distinct. Audley-Charles (1981) reviews the evidence suggesting that the three regions of Sulawesi may be derived from distinct fragments of continental plate coming together as part of the tectonic upheavals of the sea-floor in that region, and each fragment may have brought its own fauna with it. Mixing of the faunas, in the dense forest cover of the island, may have been very slow.

However, there are probably biasses in these records. Of the 25 species mentioned in Günther's 1937 paper only 13 have been found on Sulawesi again. Moreover, only six of Günther's 28 records have been confirmed both as to species and region, as table 1 shows. Various reasons suggest themselves, including the possibility that some species are very local and that their habitat(s) may have been destroyed by forest clearing. It is also possible that some species may have been misidentified. Nevertheless, the fact that only 13 species out of 36 listed from Sulawesi (table 1) were recorded both by Günther and subsequently suggests that the collecting effort required to establish the tetrigid fauna with any precision is much greater than has been available so far.

A curious bias is the apparent predominance of small forms in the Sulawesian tetrigid faunas. It is hard to know quite what size distribution to expect, but forms with a pronotum length of more than 12 mm seem notably wanting. Only two of the usually large "scelimenae verae" with pronotum lengths ranging from 15 to 25 mm are confirmed as present on the island. If it is true that tridactylids have arrived on the island relatively recently it may also be true that part of the tetrigid fauna was also late in arriving geologically speaking and that there has not been time for all available niches to be occupied.

It seems that there are (at least) three distinct tetrigid faunas on the island which have not fully mixed. Since this conclusion is likely to hold, to some extent, for other orthopteroids, it may help to explain Ramme's (1940) conclusion when writing of orthopteran biogeography "Aber noch immer ist Celebes in vieler Bezeihung einer Sphinx" (Even today, the Celebes is in many ways a Sphinx).

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# REVIEW OF THE MALAGASY SPECIES OF *BELONOGASTER* SAUSSURE (HYMENOPTERA, VESPIDAE)

by

R. V. HENSEN

*I. B. Bakkerlaan 69-III, 3582 VV Utrecht*

and

L. H. M. BLOMMERS

*Herenstraat 102, 3911 JH Rhenen*

Abstract

The Malagasy species of the Afrotropical wasp genus *Belonogaster* are reviewed and keyed. Twenty-one species are recognized, of which twelve are newly described: *B. ambiko*, *B. betsileo*, *B. dayi*, *B. discifera*, *B. erythrocephala*, *B. fanemitra*, *B. mandraka*, *B. scutifera*, *B. tanosy*, *B. tipuliformis*, *B. trandraka*, and *B. vadoni*. *B. malagassa* Saussure is newly synonymized with *B. bicolor* Saussure, *B. keiseri* Richards with *B. madecassa* (Saussure). The male of *B. maromandia* is described for the first time. Lectotypes are designated for *B. malagassa* Saussure, *B. ornata* Saussure and *B. pomicolor* Saussure.

## Introduction

The Malagasy and the Afrotropical species of *Belonogaster* were recently revised by the late O. W. Richards (1982). As Richards (1982: 101) already suspected, the material available to him was in fact too limited to permit a thorough treatment of the Malagasy species. The present study was based primarily on material collected by the authors (resp. in 1984 and 1971-1973), which appeared to contain several new and imperfectly known species. At a later stage, the collection of the Paris Museum has been examined, including the material of the Seyrig collection, and most of this material is treated here as well. It seems that Richards misinterpreted some species, and overlooked some characters of major diagnostic value. Therefore we feel obliged to give a new key, and to list the species again, with the most important references.

We wish to thank the authorities of the following museums for enabling us to study the material under their care.

BMNH British Museum (Natural History), London, England (Mr C. O. Vardy & Dr M. C. Day)

KMMA Koninklijk Museum voor Midden Afrika, Tervuren, Belgium (Dr E. de Cooninck)

MHNG Muséum d'Histoire Naturelle, Geneva, Switzerland (Dr C. Besuchet)

MNHN Muséum National d'Histoire Naturelle, Paris, France, (Mme. J. Casevitz-Weulersse)

RMNH Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands (Dr C. van Achterberg)

SEM Snow Entomological Museum, Lawrence, Kansas, USA (Dr R. W. Brooks)

Specimens collected by the second author will be deposited in the Zoologisch Museum, Amsterdam, The Netherlands (ZMA), those of the first author are part of his private collection (CH).

## Morphology

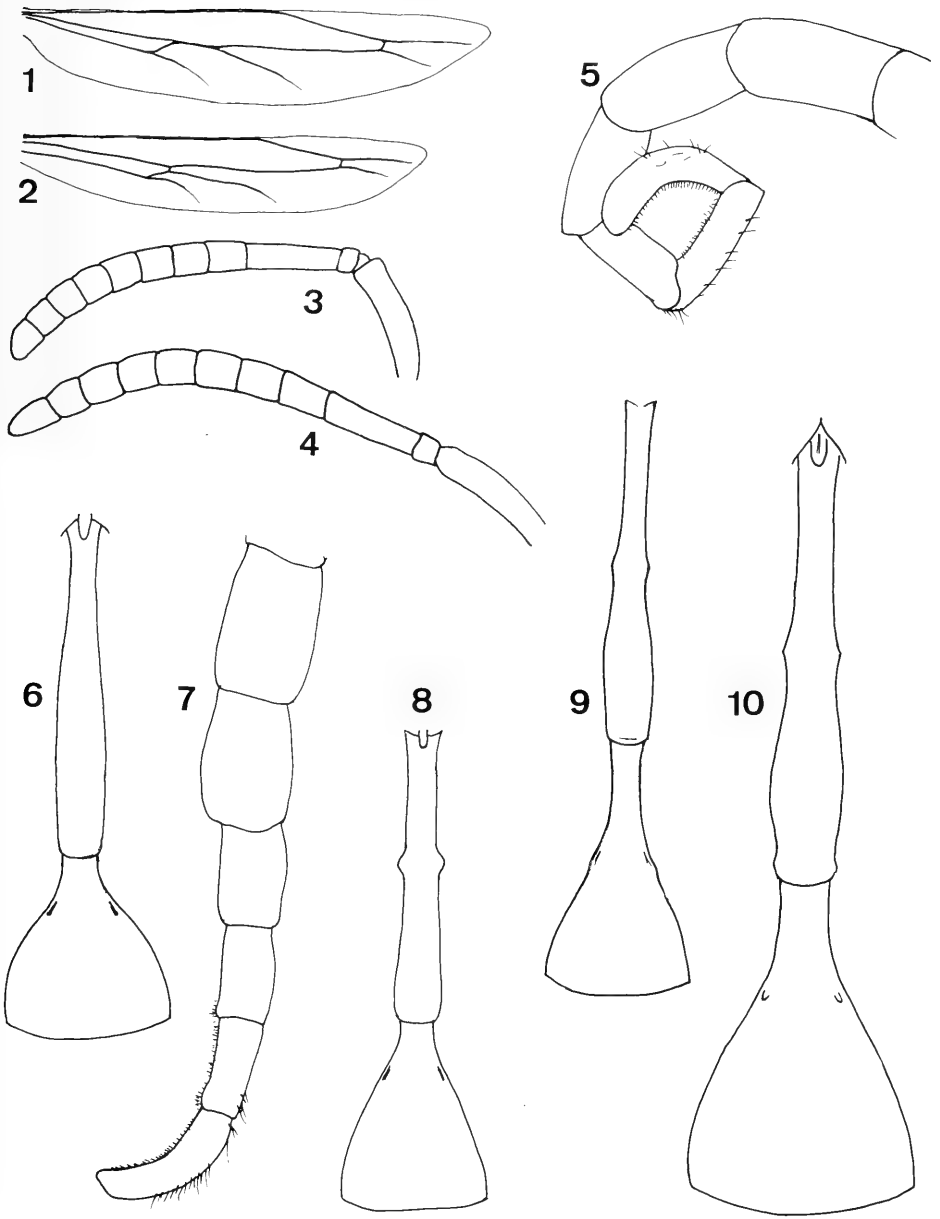
One of the most important characters in *Belonogaster* is the length of the stalk of the second metasomal tergite. The character, however, is not easily appreciated, if not explicitly defined, because there is no discontinuity between the stalk and the remaining part of the tergite. For the length of the stalk we have taken the distance between the anterior margin of the

stalk and the point were the tergite has the same width as anteriorly; the width is measured were the stalk is at its narrowest, usually just before the middle.

The males of *Belonogaster* have excellent diagnostic characters in the shape of their terminal flagellomeres, and therefore we have selected males for holo- and lectotypes, as far as possible. The females are often less easily identifiable. The colour pattern of most species is characteristic, but it may prove to be less constant than the limited material available to us suggests.

## KEY TO THE MALAGASY SPECIES OF *BELONOGASTER*

1. Hindwing: M + Cu divides after cu-a (fig. 1) ..... 2
— Hindwing: M + Cu divides before cu-a (fig. 2) ..... 3
2. Body yellowish to brown; first flagellomere nearly as long as second + third + fourth (fig. 3); no tubercle present between antennal insertions. ..... *madecassum* Saussure
— Body with vivid green, whitish-yellow and brown markings; first flagellomere only slightly longer than second + third (fig. 4); frons with rounded tubercle between antennal insertions; ..... *dayi* sp. n.
3. Petiolus ventrally transversely striate ... 4
— Petiolus ventrally smooth ..... 5
4. Petiolus comparatively short (fig. 12); cephalic foveae small, as large as surrounding punctation; male: head black, clypeus, scapes ventrally, fore and middle coxae and femora ventrally white .... *brevipetiolata* Saussure
— Petiolus longer, more slender (fig. 15); cephalic foveae larger than surrounding punctation; head of ♂ ferruginous, with broad white bands along inner orbits; legs without white markings, partly reddish ..... ..... *erythrocephala* sp. n.
5. Mesoscutum strongly, rather densely punctate, and with long black setosity; metapleural flange produced into a short tooth, immediately behind the spiracle (fig. 33); legs dark green to black, without yellow pattern ..... 6
— Mesoscutum at most sparsely, weakly punctate, and without long black setosity; metapleural flange without tooth; legs usually partly yellow ..... 7
6. Mesonotum nearly smooth and shiny between the punctures; setae of mesoscutum as long as flagellar width; mesosoma largely black, mesopleuron, metapleuron ventrally, scutellum and metanotum ferruginous; ♀ unknown ..... *ambiko* sp. n.
— Mesonotum dull, finely reticulate between the punctures; setae of mesoscutum half as long as flagellar width; mesosoma ferruginous; ♂ unknown ..... *trandraka* sp. n.
7. Stalk of second metasomal tergite half as long as wide (fig. 8); meso- and metasoma entirely black; mesoscutum longer than wide; length of forewing 14 mm; ♀ unknown .... ..... *betsileo* sp. n.
— Stalk of second metasomal tergite at least 1.4 times as long as wide; meso- and metasoma usually at least partly green; mesoscutum as long as wide, or larger species ..... 8
8. Mesoscutum 1.1—1.2 times as long as wide; length of forewing 14.5—29 mm ..... 9
— Mesoscutum as long as wide; length of forewing 10—14 mm ..... 18
9. Fore coxae and mesopleuron ventrally with numerous long black setae among the shorter white pubescence or tomentum ..... 10
— Fore coxae with white pubescence, rarely with a few longer dark setae ..... 15
10. Length of forewing 25—29 mm; body and legs entirely ferruginous *guerini* Saussure
— Length of forewing 16—21 mm; body and legs partly black and/or yellow .....11
11. Propodeum with impressed median line over its entire length; wings yellowish hyaline; mesosoma ferruginous; stalk of second metasomal tergite 3 times as long as wide; ♂ unknown ..... *bicolor* Saussure
— Propodeum without impressed median line; coloration of body and wings different 12
12. Forewing greyish with the apical third light yellow; head and mesosoma bright yellow and green; stalk of second metasomal segment 3.5 times as long as wide; ♂ unknown ..... *tipuliformis* sp. n.
— Forewing uniformly yellow to brown; head and mesosoma ferruginous to fuscous or nearly entirely yellow; stalk of second segment at most three times as long as wide ..... 13
13. Stalk of second metasomal tergite nearly three times as long as wide (fig. 28); mesoscutum distinctly punctate; legs and mesosoma dark ferruginous; wings brown ..... ..... ♀ *scutifera* sp. n.
— Stalk of second tergite at most twice as long as wide (fig. 23); punctures of mesoscutum




Figs. 1—10. 1, *B. madecassa*, ♀, right hindwing. 2, *B. eumenoides*, ♀, right hindwing. 3, *B. madecassa*, ♀, left antenna. 4, *B. dayi*, ♀, left antenna. 5—6, *B. ambiko*, ♂. 5, apical antennal segments; 6, metasomal basis. 7—8, *B. betsileo*, ♂. 7, apical antennal segments; 8, metasomal basis. 9, *B. dayi*, ♀, metasomal basis; 10, *B. bicolor*, ♀, metasomal basis. 1, 2, 6—10: 9 ×; 3, 4: 18 ×; 5: 36 ×.

hardly discernible; coloration different; ♂ unknown ..... 14

14. Mesosoma yellow, pronotum laterally with green spots; legs yellow; wings yellow ..... *vadoni* sp. n.
— Mesosoma ferruginous, dorsally infuscated; legs black; wings brown *mandraka* sp. n.

15. Forewing dark grey, with the tip light red-brown; mesosoma black; ♂ unknown ..... *apicalis* Saussure
— Forewing uniformly yellow to brown; mesosoma never entirely black ..... 16

16. Fifth segment of fore tarsi of ♂ not dilated; last antennal segment of ♂ weakly curved, apically broad and hardly pointed; mesosoma bright green and reddish yellow ..... *prasina* Saussure
— Fifth segment of foretarsi of ♂ dilated and flattened (fig. 27); last antennal segment of ♂ strongly curved, apically sharply pointed (fig. 26); mesosoma ferruginous to fuscous or very dark green, with at most metanotum and part of propodeum yellow ..... 17

17. Fifth segment of fore tarsi of ♂ longer than wide (fig. 41); mesosoma dorsally fuscous to dark green, metanotum usually yellowish, mid and hind tibiae yellow ..... *maromandia* Richards
— Fifth segment of fore tarsi of ♂ wider than long (fig. 27); mesosoma entirely ferruginous, mid and hind tibiae brown with white streak ..... ♂ *scutifera* sp. n.

18. Forewing of ♀ greyish, apical third bright yellow; antenna of ♂ with dense pubescence on inner side (fig. 38); apical segment of foretarsus of ♂ dilated, black (fig. 39); mesosoma, including propodeal valves nearly entirely green ..... *fanemitra* sp. n.
— Forewing of ♀ uniformly yellow to brownish; antenna of ♂ with insignificant pubescence on inner side; apical segment of foretarsus of ♂ not dilated, not darker than preceding segments; mesosoma never entirely green, propodeal valves always whitish ..... 19

19. Last flagellar segement of ♂ strongly dilated and flattened, dark brown in contrast to preceding segments (fig. 13); female: distance between antennal insertions as long as distance between antennal insertion and inner orbit ..... *discifera* sp. n.
— Last flagellar segment of ♂ not dilated, yellowish like preceding segments; female: distance between antennal insertions longer than distance between antennal insertion and inner orbit ..... 20

20. Mesosoma finely punctulate-reticulate, without coarser punctures, and without any black setosity ..... *hildebrandti* Saussure
— Mesosoma finely punctulate-reticulate, with some distinct larger punctures, which bear black setae, at least in ♀ ..... 21

21. Terminal flagellomere of ♂ dorsiventrally flattened and strongly curved (fig. 30); malar space of ♀ short, shorter than width of flagellum (fig. 29); gena of ♀ in lateral view 0.4 times as wide as eye ..... *tanosy* sp. n.
— Terminal flagellomere of ♂ slightly flattened laterally, less strongly curved; malar space of ♀ long, longer than flagellar width (fig. 18); gena of ♀ in lateral view 0.5—0.7 times as wide eye ..... 22

22. Terminal flagellomere of ♂ rather strongly curved, widest subapically (fig. 25); coloration: mesosoma green, with the mesopleuron and usually the metanotum yellow to yellowish ferruginous; tibiae nearly entirely yellow ..... *ornata* Sausure
— Terminal flagellomere of ♂ weakly curved, widest subbasally (fig. 17); coloration: mesosoma ferruginous to fuscous; tibiae ferruginous, in ♂ with white longitudinal streaks ..... *eumenoides* Saussure

## ANNOTATED LIST OF THE MALAGASY SPECIES OF *BELONOGASTER* SAUSSURE

### Belonogaster ambiko sp. n.
(figs. 5, 6)

Male.

Body length 18.8 mm, length of forewing 13.5 mm.

Coloration. — Head ferruginous, mandibles and clypeus apically pale yellow, face with pale yellow side stripes along inner orbits, and spot between antennal insertions; vertex nearly black. Antennae black, scape ventrally greenish yellow, flagellum ventrally, apical three segments entirely yellowish. Mesosoma black, pronotum ventrally, mesopleuron largely, metapleuron ventrally, scutellum and metanotum ferruginous, propodeal valves pale yellow. Legs dark green, fore coxae anteriorly pale yellow, fore and middle tibiae anteriorly with white streaks, middle and hind tibiae and all tarsi black. Wings hyaline. Metasoma black, petiolus anteriorly and ventrally dark green, posterior tergites and sternites dark ferruginous.

Pubescence. — Clypeus with rather dense white tomentum, and rather long black setae; frons, mesosoma and fore coxae with very long

black setae (as long as flagellum width); mesosoma with sparse white tomentum; mid and hind femora ventrally only proximally with a few pale setae; metasoma with short black setae on tergites, third to seventh sternite only with white tomentum.

Head. — Clypeus bluntly angled below, angle about 130°; gena 0.4 times as wide as eye in lateral view; cephalic foveae absent; clypeus sparsely finely punctate, vertex sparsely rather strongly punctate, shiny; third antennal segment 0.8 times as long as fourth + fifth, these both 2.3 times as long as wide; eighth segment 1.7 times as long as wide, terminal segment long, slender, strongly curved (fig. 5).

Mesosoma. — Mesoscutum as long as wide; scutellum without median impressed line; metapleural flange produced into a flat tooth, behind the mesopleural spiracular lobe; propodeum with anterior depression small, but deep, median impressed line weak, fading near the small posterior depression; integument shiny, rather densely strongly punctate, punctulation dense, but shallow; propodeum with a few transverse striae above the posterior depression. Hindwing: M + Cu divides before cu—a.

Metasoma. — Petiolus 1.3 times as long as hind tibia, ventrally not transversely striate, posteriorly not swollen, spiracles not prominent (fig. 6); stalk of second tergite 0.5 times as long as wide; seventh sternite truncate.

Holotype. — ♂, "Madagascar; (Tamat.); Périnet; 950 m; 48°16 E, 18°56 S; 10.v.1984; leg. R. Hensen & A. Aptroot" (RMHN).

Etymology. — "Ambiko" is one of the peculiar Malagasy hedgehogs, of the family Tenrecidae. The name is chosen to illustrate the long pubescence of *B. ambiko*, and its more or less similar colour.

### **Belonogaster apicalis** Saussure

*Belonogaster apicalis* Saussure, 1900: 207, 208; Richards, 1982: 47, 105, figs. 85, 86.

It seems very doubtful whether the two males in the RMNH, examined and mentioned by Richards (1982) indeed belong to this species.

### **Belonogaster betsileo** sp. n.
(figs. 7, 8)

*Belonogaster brevipetiolata*, Richards, 1982: 101, 102, fig. 80 (partim).

Description.

Body length 18.9 mm, length of forewing 14.3 mm.

Coloration. — Black, the following parts ferruginous: mandibles, clypeus, frons including eye emargination, ventral side of scape, apical three flagellomeres, fore legs except the tarsi. Face along inner orbits yellowish. Wings yellowish hyaline, veins and stigma yellow.

Pubescence. — Clypeus with short white pubescence, frons and vertex with long fine grey-brown setae; mesosoma with sparse white tomentum, and long fine grey-brown setae; fore coxae with short white pubescence, and some longer grey setae; mid and hind femora with short white pubescence ventrally; metasoma with short white pubescence.

Head. — Clypeus bluntly angled below, angle about 150°; gena 0.4 times as wide as eye in lateral view; cephalic foveae absent; clypeus shiny, punctulate, with sparse fine punctures; vertex shiny, sparsely punctulate, and with distinct punctation; third antennal segment 0.9 times as long as fourth + fifth, these resp. 1.9 and 1.8 times as long as wide; eighth segment 1.7 times as long as wide (fig. 7); third to ninth ventrally keeled; last segment slender, strongly curved (fig. 7).

Mesosoma. — Mesoscutum 1.1 times as long as wide; scutellum without median impressed line; metapleural flange without tooth; propodeum with distinct anterior pit, without median impressed line; posterior depression well-developed; integument shiny, punctulate and rather sparsely punctate, punctures fine but very distinct. Hindwing: M + Cu divides before cu—a.

Metasoma. — Petiolus 1.2 times as long as hind tibia, ventrally not transversely striate, posteriorly hardly swollen, spiracles strongly prominent (fig. 8); stalk of second tergite 0.5 times as long as wide; seventh sternite truncate.

Holotype. — ♂, "Betsileo, Madagascar, 82—30" (BMNH). The specimen bears Richards' identification label, and his description and figure of ♂ *B. brevipetiolata* appear to have been based on this specimen.

Etymology. — Named after the Betsileo, one of the original Malagasy tribes, inhabiting roughly the highland region between Antsirabe and Fianarantsoa.

**Belonogaster bicolor** Saussure
(fig. 10)

*Belonogaster bicolor* Saussure, 1900: 207, 208; Richards, 1982: 47, 104.
*Belonogaster malagassus* Saussure, 1900: 210. **New synonymy.**

Types. — The lectotype of *B. malagassus*, by present designation, is a female, labelled "Madagascar, F. Sikora". It evidently belongs to *B. bicolor*, and is the only one of the four specimens standing under *B. malagassus* in the MHNG agreeing completely with the description. The two paralectotypes are labelled "Madagasc.", resp. "Nossible". The fourth specimen, labelled "Madagasc., Annanarive" agrees in no way with the description, being smaller and nearly entirely black, and cannot be considered a syntype. It seems to belong to a still undescribed species, related to *B. mandraka* sp. n.

Material examined. — 1 ♀, without locality (BMNH); 1♀, Ifanadiana, Ranomafana, 900 m, 29.xii.1971, L. & R. Blommers (ZMA); ♀, Région d'Ambanja, A. Seyrig (MNHN).

**Belonogaster brevipetiolata** Saussure
(figs. 11, 12)

*Belonogaster brevipetiolata* Saussure, 1891: 98, pl. 4, fig. 1 (partim); Richards, 1982: 101, figs. 79, 80 (partim).

Most specimens examined by Richards belong to the related species *B. erythrocephala* sp. n., which was regarded as a variety by Saussure (1891: 98). The two possible syntypes, seen by Richards in the Paris Museum, belong indeed to the present *B. brevipetiolata*. The ♂ identified and described by Richards (1982) as *B. brevipetiolata* belongs to a third species, *B. betsileo* sp. n.

Diagnosis. — Like *B. erythrocephala*, except for the following. Coloration: head and mesosoma without red markings; ♂ with clypeus and part of frons, scapes ventrally, fore and middle coxae and femora ventrally white. Cephalic foveae small, as large as surrounding punctures on vertex. Terminal flagellomere of ♂ more slender (fig. 11), finely pubescent on inner side. Petiolus distinctly shorter and stouter (fig. 12), as long as hind tibia.

Material examined. — 1 ♀, without locality (BMNH); 1 ♀, Périnet, 20.xii.1955, E. McC. Callan (BMNH); 1 ♂, Manjakandriana, Mandraka, 1200 m, 12.xii.1971, L. & R. Blommers (ZMA); 1 ♀, Fampanambo, 1962, 1 ♀, N. E. Madagascar, Ambodivoangy, i.1962, both J. Vadon (KMMA).

**Belonogaster dayi** sp. n.
(figs. 9, 36, 37, 42)

Male.

Body length 17.5 mm, length of forewing 12.5 mm.

Coloration. — Head yellow, vertex green, antennae ferruginous. Mesosoma green, meso- and metapleuron, posterior margin of scutellum, metanotum, propodeum along median line and apically yellow. Legs yellow, hind coxae and all femora green, tarsi ferruginous to fuscous, last segment of fore tarsi proximally white, last segment of mid and hind tarsi light, contrasting with darker preceding tarsomeres. Metasoma green, second to sixth tergite and sternite with broad yellow band apically. Wings proximally grey-brown, hyaline, veins brown, apical third yellow, veins yellow.

Pubescence. — Clypeus with dense white pubescence, vertex and mesosoma dorsally with sparse brownish setae; fore coxae with dense white pubescence and a few longer dark setae; mid and hind femora with dense white pubescence beneath; metasoma posteriorly without dark setosity.

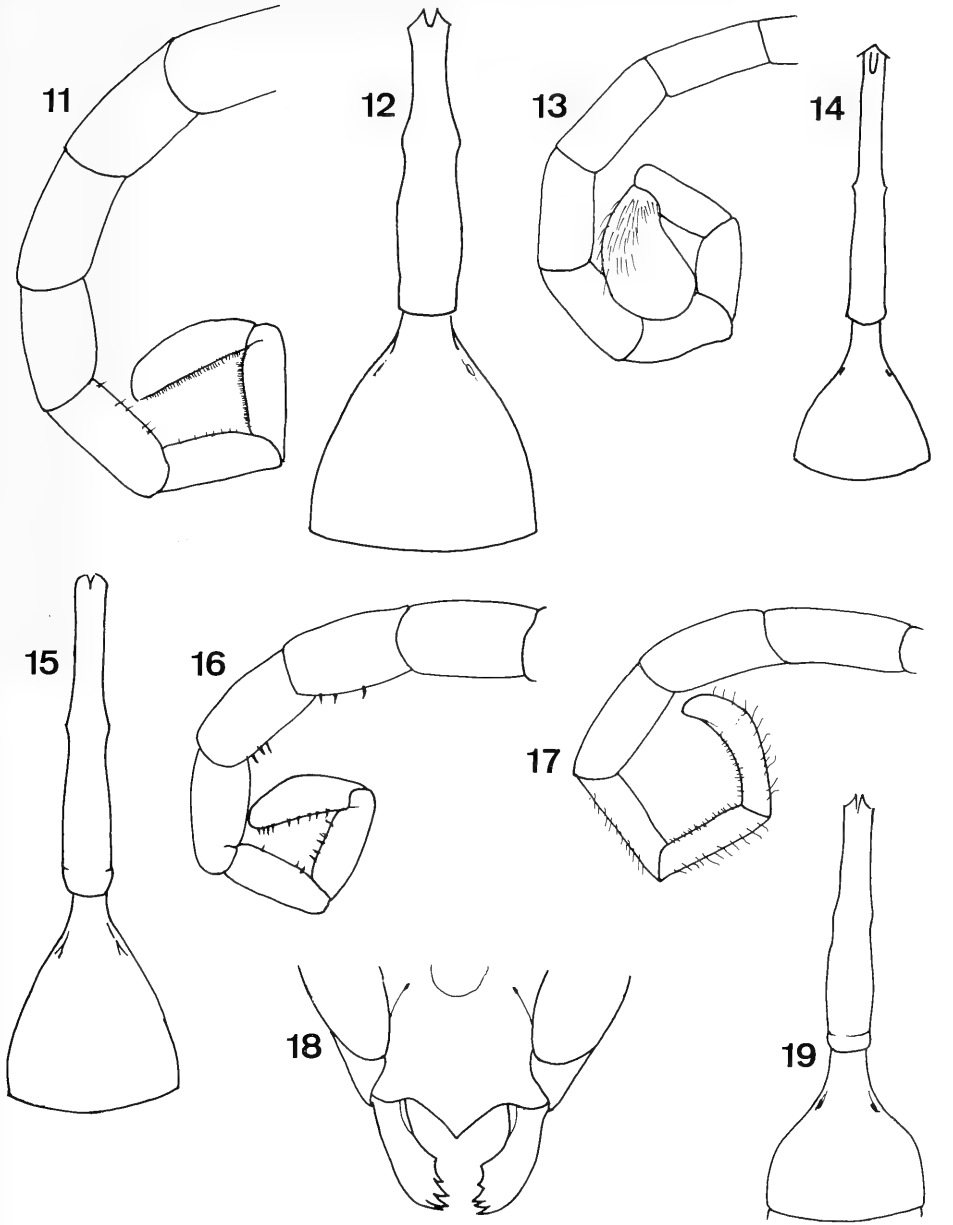
Head. — Clypeus bluntly angled below, angle about 140°; gena about 0.4 times as wide as eye in lateral view; cephalic foveae absent; clypeus sparsely punctate; vertex densely punctulate, with a few indistinct punctures; third antennal segment 0.85 times as long as fourth + fifth, these resp. 2.9 and 2.6 times as long as wide; eighth segment twice as long as wide; third to eleventh ventrally keeled; last segment comparatively short and broad, weakly curved (fig. 36).

Mesosoma. — Mesoscutum 1.1 times as long as wide; scutellum only posteriorly with median impressed line; metapleural flange without tooth; propodeum with anterior depression small (propodeum damaged, other details not observable); integument punctulate-reticulate, mesopleuron with some weak punctures, propodeum with fine transverse striae. Foreleg: last tarsomere strongly dilated and flatened (fig. 37). Hindwing: M + Cu divides after cu—a.

Metasoma. — Petiolus 1.15 times as long as hind tibia, ventrally not striate, posteriorly distinctly swollen, spiracles prominent; stalk of second tergite 2.5 times as long as wide; seventh sternite trunctate.

Female.

Body length 19.5—22.3 mm, length of fore-




Figs. 11—19. 11—12, *B. brevipetiolata*. 11, ♂, apical antennal segments; 12, ♀, metasomal basis. 13—14, *B. discifera*. 13, ♂, apical antennal segments; 14, ♀, metasomal basis. 15—16, *B. erythrocephala*. 15, ♀, metasomal basis; 16, ♂, apical antennal segments. 17—19, *B. eumenoides*. 17, ♂, apical antennal segments; 18, ♀, head; 19, ♀, metasomal basis. 12, 14, 15, 19: 9 ×; 18: 18 ×; 11, 13, 16, 17: 36 ×.

wing 15.2—15.7 mm (holotype: largest specimen).

Coloration. — Head green, mandibles, clypeus apically, frons along inner orbits below antennal insertions, large part of genae yellow. Antennae fuscous, scape ventrally green, flagellum ventrally and apically bright ferruginous. Mesosoma green, meso- and metapleuron, scutellum laterally, metanotum, propodeum along median line and apically yellow; tegulae and post-spiracular plate ferruginous. Legs green, coxae, trochanters, tibiae and last segment of all tarsi yellowish; remaining part of tarsi black, pulvilli white. Metasoma green, stalk of second tergite fuscous, second to fifth tergites and sternites, with whitish-yellow apical band, which is medially more or less interrupted by a brownish hyaline part; sixth segment whitish-yellow. Wings proximally grey-brown, hyaline, veins brown, apical third yellow, veins yellow, stigma yellow.

Pubescence. — Clypeus ventrally with brown setae, vertex and mesosoma dorsally with sparse, short curved setae, fore coxae with rather dense white pubescence, and many longer black setae; mid and hind femora with some white setae beneath; sixth tergite and sternite posteriorly with some black setae.

Head. — Clypeus acute below, angle about 100°; gena half as wide as eye in lateral view; cephalic foveae absent; clypeus sparsely punctate, dorsal two thirds densely punctulate; vertex punctulate- reticulate, with a few indistinct punctures; third antennal segment as long as fourth + fifth, these resp. 1.3 and 1.2 times as long as wide; eighth segment 1.1 times as long as wide.

Mesosoma. — Scutellum without median impressed line; propodeum with anterior depression small, posterior impressed line extending slightly more than half length of propodeum; last tarsomere of foreleg not dilated; otherwise as in the male.

Metasoma. — As in the male.

Holotype. — ♀, "Madagascar: Tamat.; Périnet; 27.iv—3.v.1983; J. S. Noyes, M. C. Day; BM 1983—201" (BMNH).

Paratypes. — 1 ♀, same data as holotype (CH); 1♀, Perinet, 20.xii.1955, E. McC. Calllan (BMNH); 1 ♀, Rogez, Forêt côte Est, i.1937, 3♀, Périnet, Forêt côte Est, ii.1939, 1 ♂, Périnet, ii.1931, all A. Seyrig (MNHN, 1 ♀ CH).

Note. — The following account on the nest (fig. 42) and behaviour was sent by Dr Day.

"John Noyes and I stayed at the Station Hotel at Andasibe for a week at the start of the winter rains. We collected near the Lemur reserve, a kilometre south, and also on a small hill to the immediate south of the Hotel, where I sited three malaise traps. After erecting the second of these in an area specially cleared adjacent to a path, I noticed a green *Belonogaster* fly languidly past. It flew rather like a tipulid, but inaccessible amongst the vegetation, so I could not get at it with a net. On each and every subsequent visit to the trap, sometimes several times a day, one or more of these green *Belonogaster* would materialise and fly away from me, in various directions. I became aware that they appeared only when I was on one particular side of the trap and that their flight paths radiated from that point! After considerable search, seven days later I finally found the nest (photo, fig. 42), which depended from a twig into open space at head height. It consisted of a single filament with twelve radially arranged cells, one above the other, much like some Oriental Stenogaster nests. A maximum of 13 wasps was seen clustered in a regular fashion about the filament; the photograph shows eight. So far I could tell, all were female. Their position and behaviour were such that the nest was virtually indetectable, giving the impression of leguminous seed heads or some such plant material. Even when coordinate sight lines were given to observers so that it was clear they must have been looking at the nest, they nevertheless did not see it for between several seconds and close to a minute. Coupled with the non-agressive "decoy" behaviour, this species exhibits very sophisticate adaptations for the maintenance of open free-hanging colonies."

**Belonogaster discifera** sp. n.
(figs. 13, 14)

Male.

Body length 16.1 mm, length of forewing 12.2 mm.

Coloration. — Ferruginous; antenna dorsally dark, ventrally pale green, second to third flagellomere dorsally infuscated, last flagellomere dark brown; mandibles white; lateral thirds of clypeus and frons, and area between antennal insertions white; legs dark green, fore and middle coxae anteriorly white, rest of fore coxae ferruginous, tibiae and mid femur anteriorly with pale green streak, apical tarsomeres ferruginous; propodeum greenish, propodeal valves white; petiolus and anterior half of second metasomal

segment dark green. Wings yellowish hyaline, veins and stigma brownish yellow.

Pubescence. — Clypeus with dense white pubescence; vertex and mesosoma dorsally with many rather long black setae; fore coxae with dense white pubescence and a few longer black setae; mid and hind femora ventrally without erect setosity; metasoma posteriorly without dark setae.

Head. — Clypeus acute below, angle about 120°; gena 0.4 times as wide as eye in lateral view; cephalic foveae absent; clypeus punctulate; vertex punctulate-reticulate, with a few indistinct punctures; third antennal segment 0.8 times as long as fourth + fifth, these resp. 2.6 and 2.4 times as long as wide; eighth segment 2.2 times as long as wide; seventh to eleventh with raised line on inner side, twelfth strongly dilated and flattened (fig. 13), about 1.4 times as long as wide.

Mesosoma. — Mesoscutum as long as wide; scutellum without median impressed line; metapleural flange without tooth; propodeum with anterior depression distinct, without impressed median line, posterior depression small, shallow; integument punctulate-reticulate, and sparsely shallowly punctate, punctures most distinct on mesopleuron. Hindwing: M + Cu divides before cu—a.

Metasoma. — Petiolus 1.15 times as long as hind tibia, ventrally not striate, posteriorly not swollen, spiracles prominent (cf. fig. 14); stalk of second tergite 1.6 times as long as wide; seventh sternite truncate.

Female.

Body length 16.4 mm, length of forewing 12.3 mm.

Coloration. — Ferruginous; vertex, flagellum dorsally, propodeum and metasoma infuscated; scape, legs except the fore coxae, trochanters and tarsi, petiolus and stalk of second metasomal tergite black with greenish shine; propodeal valves white. Wings yellowish hyaline, veins and stigma brownish yellow.

Pubescence. — Clypeus with yellow setae on ventral half; vertex and mesosoma dorsally with many rather long black setae; fore coxae with long black setae; mid and hind femur with a few outstanding white setae ventrally; metasoma apically without dark setosity.

Head. — Clypeus acute below, angle about 100°; gena 0.5 times as wide as eye in lateral view; cephalic foveae absent; clypeus on ventral two fifth granulate, with coarse punctures, dorsally punctulate, with sparse fine punctures; vertex punctulate-reticulate, with a few indistinct punctures; third antennal segment 1.2 times as long as fourth + fifth, these resp. 1.5 and 1.3 times as long as wide, eighth segment 0.9 times as long as wide.

Meso- and metasoma like in the ♂.

Holotype. — ♂, "Rép. Malgache, Manjakandriana, Mandraka, 1300 m, 11.iii.1973, L. & R. Blommers", "nest nr. 73.15" (ZMA).

Paratypes. — 1 ♀, 5 ♂, same data as holotype (ZMA; 1 ♂ RMNH); 1 ♀, Sambirano, Manongarivo, 1150 m, xii.1960, P. Griveaud (MNHN).

Note. — Most specimens were collected from an old nest, with practically no cell walls left, hanging in a tuft of grass on top of a road bank facing south.

**Belonogaster erythrocephala** sp. n.
(figs. 15, 16)

*Belonogaster brevipetiolata;* Saussure, 1891: 98, pl. 4, fig. 1 (partim); Richards,, 1982: 101, 102, figs. 79, 80 (partim).

This species was regarded as a variety of *B. brevipetiolata* by the Saussure, and Richards did not make any distinction at all. Both sexes can easily be separated on basis of the characters given in the key.

Male.

Body length 21.0 mm, length of forewing 14.2 mm.

Coloration. — Black; head ferruginous, face with broad pale-yellow side stripes along inner orbits and spot between antennal insertions; ocelli surrounded by black rings; pronotum, sides of scutellum and metanotum, and fore femur and tibia ferruginous. Wings hyaline, veins and stigma yellow.

Pubescence. — Clypeus with distinct white tomentum and longer black setae; frons and vertex with rather long black setae; mesosoma with sparse white tomentum, mesoscutum and mid and hind femora ventrally with short black setae; fore coxae with long black setae; all tergites and sternites with sparse short brown setosity.

Head. — Clypeus acute below, angle less than 90°; gena 0.85 times as wide as an eye in lateral view; cephalic foveae present, larger than surrounding punctures; clypeus sparsely rather strongly punctate, dorsal two thirds very finely punctulate; vertex punctulate-reticulate, more densely punctate; third antennal segment 1.3

times as long as fourth + fifth, these resp. 1.1 and 0.9 times as long as wide; eighth segment 0.85 times as long as wide; terminal segments (fig. 16) with sparse dark setosity on inner side.

Mesosoma. — Mesoscutum 1.2 times as long as wide; scutellum with median impressed line; metapleural flange without tooth; propodeum with anterior depression small, median impressed line extending hardly farther than the small posterior depression; integument dull, very finely punctulate-reticulate, and with sparse, rather strong punctation. Hindwing: M + Cu divides after cu—a.

Metasoma. — Petiolus 1.1 times as long as hind tibia, ventrally transversely striate, posteriorly hardly swollen, spiracles rather prominent (cf. fig. 15); stalk of second tergite 0.7 times as long as wide.

Female

Like the male, except for the following. Body length 21.5 mm, length of forewing 17.6 mm. Head without yellow pattern; mesosoma black; legs black, coxae, particularly the fore coxae, and base of fore tibiae dark ferruginous. Clypeus with brown setosity. Petiolus 1.1 times as long as hind tibia.

Holotype. — ♂, "Rép. Malgache, Nosy Be, Dzamandzar, 8/10.i. 1972, L. & R. Blommers" (ZMA).

Paratypes. — 1 ♀, same data as holotype (ZMA); 1 ♀, Nosy Be, 0—100 m, 5.vi.1984, R. Hensen & A. Aptroot (CH); 1 ♀, Fampanambo, 19.xi.1957, F. Keiser (BMNH).

### **Belonogaster eumenoides** Saussure
(figs. 2, 17—19, 43)

*Belonogaster eumenoides* Saussure, 1891: 94; Richards, 1982: 47, 110, figs. 91, 92 (partim).

This species is according to Richards (1982: 110) a very variable one. We think that in fact a mixture of species was recognized under the name *B. eumenoides*. For one of these species two names of Saussure (1900) appear to be available: *B. ornata* and *B. pomicolor*. This species is redescribed here under the name *B. ornata*. Furthermore, *B. tanosy*, *B. fanemitra*, and *B. discifera* fall in this category. *B. malagassa*, placed by Richards (1982: 110) in the synonymy of *B. eumenoides*, is a synonym of *B. bicolor* (q. v.).

The type material of *B. malagassa*, *B. ornata* and *B. pomicolor* was kindly sent to us by Dr Besuchet, Geneva, and only this allowed us to solve these taxonomic problems.

Male.

Body length 17.6 mm, length of forewing 11.2 mm.

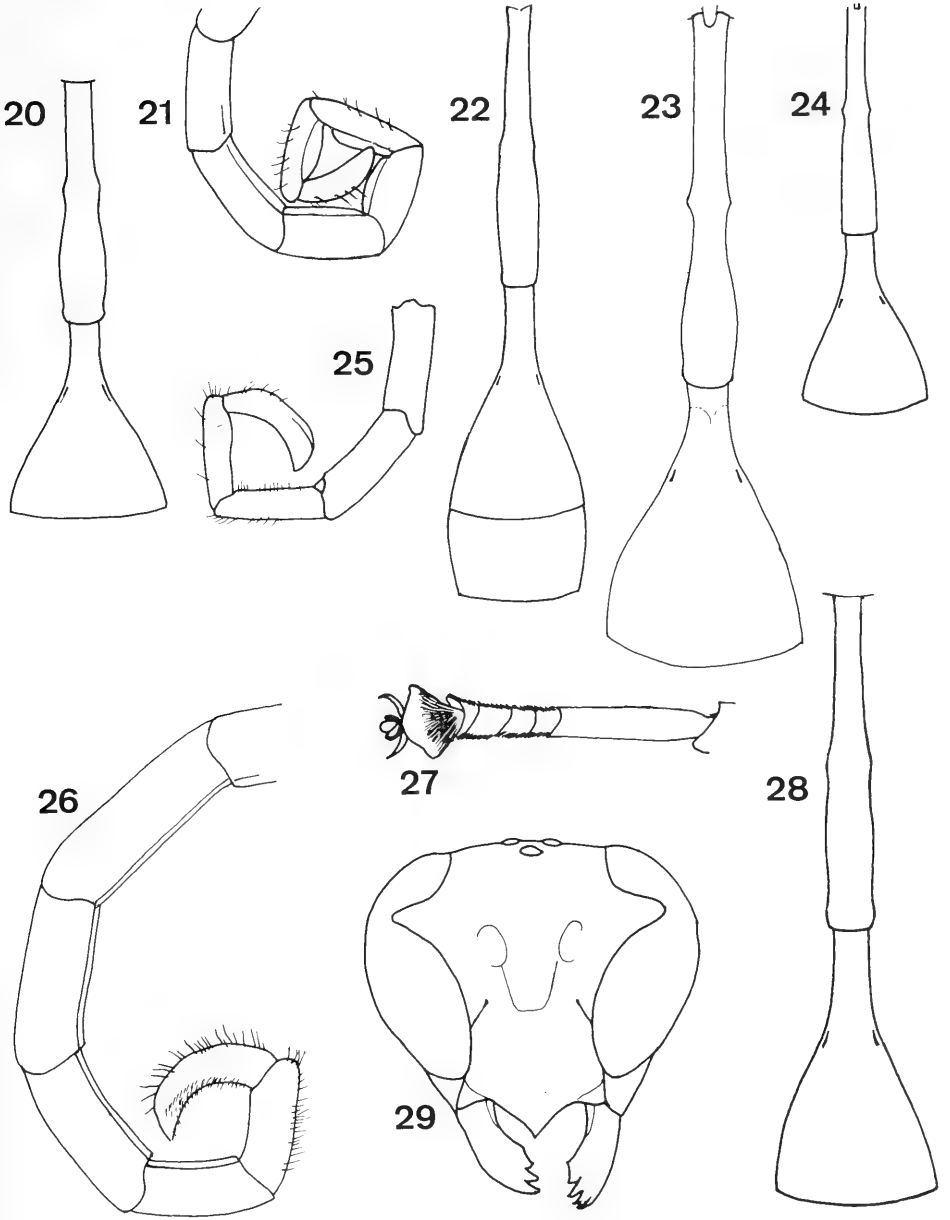
Coloration. — Ferruginous; the following parts pale yellow. Clypeus and frons, except for a median stripe below antennal insertions, mandibles, scapes ventrally, narrow transverse line on pronotum, humeral plates, propodeal valves, fore and mid coxae anteriorly. Pale yellow stripes along hind coxae, fore and mid femora, all tibiae; last tarsal segments yellow. Black lines present along edges of mesoscutum, scutellum, metanotum, metapleuron, and along median line and parapsidal grooves of mesoscutum. Metasoma except the petiolus fuscous, second tergite with yellow apical band in one specimen. Wings yellowish hyaline, veins yellow.

Pubescence. — Clypeus with short white pubescence; vertex with long black setae; mesosoma dorsally with sparse rather long black setosity; fore coxae with white pubescence, and a few black setae; mid and hind femora without longer setae; metasoma with short black setosity on posterior tergites.

Head. — Clypeus bluntly angled below, the angle about 120°; clypeus as long as wide; gena 0.4 times as wide as eye in lateral view; cephalic foveae absent; interocular width on vertex slightly longer than third antennal segment; clypeus shiny, finely punctulate; vertex more closely and strongly punctulate, and with sparse shallow larger punctures; third antennal segment 0.77 times as long as fourth + fifth, these resp. 2.8 and 2.5 times as long as wide; eighth segment 2.0 times as long as wide; third to eleventh with raised longitudinal line ventrally; last segment slightly flattened bilaterally, medially and subapically equally wide, weakly curved (fig. 17).

Mesosoma. — Mesoscutum as long as wide; pronotal keel absent; scutellum without impressed median line; metapleural flange without tooth; propodeum with anterior depression small; posterior depression shallow, small, continued in short impressed median line dorsally; integument dull, closely punctulate-reticulate, and with sparse shallow punctation. Hindwing: M + Cu divides before cu-a.

Metasoma. — Petiolus 1.1—1.2 times as long as hind tibia, ventrally not transversely striate, posteriorly hardly swollen, spiracles weakly




Figs. 20—29. 20, *B. fanemitra*, ♀, metasomal basis. 21—22, *B. madecassa*. 21, ♂, apical antennal segments; 22, ♀, metasomal basis. 23, *B. mandraka*, ♂, metasomal basis. 24—25, *B. ornata*, ♂. 24, metasomal basis, 25, apical antennal segments. 26—28, *B. scutifera*. 26, ♂, apical antennal segments; 27, ♂, left fore tarsus, dorsal view; 28, ♀, metasomal basis. 29, *B. tanosy*, ♀, head. 20, 22—24, 28: 9 ×; 27, 29: 18 ×; 21, 25, 26: 36 ×.

prominent (cf. fig. 19); stalk of second tergite 1.5 times as long as wide; seventh sternite truncate.

Female.

Body length 16.8—17.5 mm, length of forewing 12.7—13.0 mm.

Coloration. — Ferruginous, the following parts more or less darkened. Antennae dorsally, mesoscutum, propodeum, mid and hind legs, and metasoma. Propodeal valves pale yellow. Wings brownish hyaline, veins yellow. The palest specimen has only the metasoma posteriorly darkened. The darkest specimens (two from original type-series) are entirely black, with greenish shine, and the petiolus green.

Pubescence. — Clypeus ventrally with yellow setae; vertex and mesosoma dorsally with rather short black setosity; fore coxae with rather dense white pubescence, and many longer black setae; mid and hind femora ventrally with short sparse white pubescence; metasoma with short brown pubescence on posterior tergites.

Head. — Clypeus acute below, angle about 90°; clypeus 1.2 times as long as wide; malar space as long as maximal flagellar width; gena 0.5-0.7 times as wide as eye in lateral view; cephalic foveae absent; apical third of clypeus sparsely fovealate, proximal two thirds punctulate and with sparse larger punctures; vertex dull, punctulate-reticulate, with sparse shallow punctures; interocular distance on vertex as long third + fourth + fifth antennal segment, or a little more or less; third antennal segment 1.1 times as long as fourth + fifth, these resp. 1.3 and 1.1 times as long as wide; eighth segment 0.8 times as long as wide.

Mesosoma. — Pronotal keel distinct, often rather strong; otherwise like the male.

Metasoma. — Petiolus 1.1—1.2 times as long as hind tibia, ventrally not striate, posteriorly weakly or not swollen, spiracles weakly or hardly prominent (fig. 19); stalk of second tergite 1.4—1.6 times as long as wide.

Material examined. — 5 ♀ 1 ♂, Manjakandriana, Mandraka, 1350 m, 11.iii.1973, L. & R. Blommers, "Nest Nr. 73.19", 1♂ , same data, "uit nest Nr. 73.19", 3 ♀, same data, "Nest Nr. 73.20", 2♀, same data, "uit nest Nr. 73.19/20 (ZMA); 1 ♀, Périnet, 10.v.1984, R. Hensen & A. Aptroot (CH); 1♀ , Betsileo, 82-30 (BMNH); 2 ♀, Tananarive-E., 1350 m, 14.iv.1984, R. Hensen & A. Aptroot (CH); 1 ♀, Périnet, 900 m, 16.ii.1972, L. & R. Blommers (ZMA); 7 ♀ 1 ♂, Andragoloaka, 4 ♀, Annanarivo (original type-series, including lectotype; MNHG); 2 ♀, Mandjakandriana, Angavokely, 1600 m, 17.vi.1972, 1 ♀, same locality, 17.i.1973, L. & R. Blommers (ZMA); 3 ♀, 17 km W. Ambatolampy, 1650 m, 30.i.1985, J. Wenzel (SEM); 1 ♀, Tananarive, Parc de Tzimbazaza, 29.x.1984, R. Brooks (SEM).

Note. — The brown-coloured nests (nrs. 73.19 and 73.20; fig. 43) were found both attached to a loose tree root, on a steep bank along the highway near the hamlet Ambatoloana. Specimens marked "Nest nr. ..." have been collected as adults with the nest, those marked "uit nest nr. ..." (= from nest nr. ...) emerged later. Two females from Angavokely were caught very close to a similar, more greyish nest (nr. 72.30), fixed to bare rock at 2.5 meters above the ground.

**Belonogaster fanemitra** sp. n.
(fig. 20, 38, 39)

Male.

Body length 16.0 mm, length of forewing 12.2 mm.

Coloration. — Head and mesosoma green, mandibles and sides of face whitish, flagellum brown, apical flagellomeres ferruginous. Legs green, fore and mid tibiae suffused with white, fore tarsi with second to fourth segment whitish, fifth fuscous, mid tarsi more or less similar, hind tarsi entirely fuscous. Metasoma fuscous, proximal half of petiolus green, stalk of second tergite greenish white. Wings brownish, apically paler.

Morphology. — Like male of *B. eumenoides*, except for the following. Flagellum strongly pubescent ventrally (fig. 38); metasoma without black setosity. Vertex without discernable punctation; third antennal segment 0.9 times as long as fourth + fifth; these resp. 2.0 and 1.9 times as long as wide; eighth 1.5 times as long as wide; third to eighth ventrally keeled; last segment cylindrical, rather strongly curved (fig. 38). Propodeum without impressed median line; mesoscutum without discernable punctation. Last segment of fore tarsi dilated, hardly longer than wide (fig. 39). Petiolus 1.3 times as long as hind tibia, posteriorly swollen, spiracles prominent; stalk of second tergite about twice as long as wide.

Female.

Body length 16.7 mm, length of forewing 14.0 mm.

Coloration. — Head and mesosoma dark green, mandibles and apex of clypeus ferrug-

inous, flagellum ferruginous, proximally dark, apically lighter; mesoscutum infuscated. Legs green, tarsi largely fuscous. Metasoma fuscous, basal half of petiolus green, stalk whitish green. Wings yellowish grey, apex of forewing bright yellow.

Morphology. — Like female of *B. eumenoides*, except for the following. Gena 0.6 times as wide as eye in lateral view; vertex without discernable punctation; interocular distance on vertex as long as third + fourth antennal segment; third antennal segment 1.1 times as long as fourth + fifth, these resp. 1.3 and 1.2 times as long as wide; eighth segment 0.9 times as long as wide. Pronotal keel absent; punctures of mesoscutum not discernable; propodeum with posterior depression shallow, semicircular, not continued in impressed line dorsally. Petiolus 1.2 times as long as hind tibia, posteriorly a little swollen, spiracles weakly prominent (fig. 20); stalk of second tergite twice as long as wide.

Holotype. — ♀, "Madagascar, Sambirano, Manongarivo, 1150 m, P. Griveaud, xii.1960" (MNHN).

Paratype. — ♂, Périnet, 21.iii.1931, A. Seyrig (MNHN). The specimen is in bad condition.

Etymology. — "Fanemitra" is the Malagasy word for "aculeate wasp".

**Belonogaster guerini** (Saussure)
(fig. 44)

*Raphigaster guerini* Saussure, 1853: 17, pl. 2, fig. 3.
*Belonogaster guerini*; Smith, 1857: 94; Richards, 1982: 46, 102, fig. 81.

A photograph of the nest is given in fig. 44.

Material examined. — 2 ♀, Ambohimanga, 1600 m, 17.iv. 1984, 1 ♀, Tamatave, sealevel, 19.v.1984, 1 ♀, Périnet, 950 m, 10.v.1984, all R. Hensen & A. Aptroot (CH); 1 ♀, Fort Dauphin, 24.iii.1966, J. Gutierrez (ZMA); 2 ♂ Brickaville, Ambila-Lemaitso, 10.x.1971, 2 ♀, Fénérive-Est, 15.x.1971, 1 ♀, Ifanadiana, Ranomafana, 29.xii — 2.i.1971/72, 1 ♀, Tamatave, Fanandrana, 5.ii.1972, all L. & R. Blommers (ZMA).

**Belonogaster hildebrandti** Saussure

*Belonogaster hildebrandti* Saussure, 1891: 95, pl. 17, fig. 11; Richards, 1982: 47, 108, fig. 90.

Known only from the type series, and two specimens in the BMNH, identified by Richards, which we have examined. It seems doubtful if these two, a ♀ and a ♂, are conspecific indeed.

**Belonogaster madecassa** (Saussure)
(figs. 1, 3, 21, 22, 45)

*Raphigaster madecassus* Saussure, 1853: 16, pl. 2, fig. 7.
*Belonogaster madecassus*; Smith, 1857: 94.
*Belonogaster longestylus* Saussure, 1891: 97.
*Belonogaster madecassa*; Richards, 1982: 46, 103, figs. 82, 83.
*Belonogaster keiseri* Richards, 1982: 46, 104, fig. 84. **New synonymy.**

Synonymy. — Richards saw only two males of this species, and described one of these as the new species *B. keiseri*. Examination of the type, and several more males, including a nest-series, convinced us that there are no specific differences between *B. madecassa* and *B. keiseri*.

Distribution. — This species appears to inhabit the entire island of Madagascar, and occurs as well on the Comores (here recorded for the first time).

Material examined. — 2 ♀, Tamatave, sealevel, 19.v.1984, 1 ♀, Ambanja, 50 m, 3.vi.1984, both R. Hensen & A. Aptroot (CH); 1 ♀, Tamatave, Ivoloina, 11.ii.1972, 10 ♀ 3 ♂, Tsaramandroso, Ampijoroa, 1.v.1972, nest 72.23, all L. & R. Blommers (ZMA); 1 ♀, Bereboka, 60 km NE Morondava, 18—23.v.1983, J. S. Noyes, M. C. Day (BMNH); 1 ♀, Grande Comore, Mitsoudje, xii.1970, J. Brunhes (ZMA); 1 ♀, Mandjakandriana, Mandraka, 900 m, 10.ii.1973, 2 ♀, Nosy Be, Dzamandzar, 8—10.i.1972, 1 ♀, Fénérive-Est, Foulpointe, 11—12.ii.1972, 1 ♀, Ifanadiana, Ranomafana, 29.xii—2.i.1971/72, all L. & R. Blommers (ZMA); 1 ♀, Andriba, RN 4, kp 220, 600 m, 25.i.1973, 2 ♀, Tamatave, Fanadrana, 5.ii.1972, all L. Blommers (ZMA); 8 ♀, Région d'Ambanja, 1 ♀, Fort Dauphin, viii.1940, 1 ♀, Ihosy, 1 ♀, Tampika, vi.1929, 1 ♀, Bekily, iii.1930, 1 ♂, Fort Dauphin, v.1937, all A. Seyrig (MNHN); 2 ♀, Prov. d'Ananalava, Maromandia, R. Decary, 1923 (MNHN).

Note. — Nest nr. 72.23 (fig. 45) was attached to the underside of a mango (Mangifera indica) leaf at about 1.75 m above the ground.

**Belonogaster mandraka** sp. n.
(fig. 23)

Female.

Body length 24.3 mm, length of forewing 19.5 mm.

Coloration. — Ferruginous; the following

parts darkened: antennae except the apical segments, pronotum, mesonotum and metanotum. Legs fuscous, fore coxae, trochanters and femora greenish; metasoma fuscous, petiolus before the spiracles green, stalk of second metasomal tergite anteriorly pale yellow, posteriorly green. Wings light brown, veins and stigma brown.

Pubescence. — Clypeus and vertex with rather long black setae; metasoma dorsally with many rather short curved black setae; fore coxae with long black setosity; mid and hind femora ventrally with rather long black setosity; metasoma with black setae on all tergites and sternites.

Head. — Clypeus ventrally acute, angle about 95°; gena in lateral view 0.6 times as wide as eye; cephalic foveae absent; clypeus with ventral third granulate, with sparse coarse punctures, dorsally punctulate, with sparse finer punctures; vertex punctulate-reticulate, punctures not discernable. Third antennal segment 1.1 times as long as fourth + fifth, these resp. 1.6 and 1.4 times as long as wide; eighth segment 1.2 times as long as wide.

Mesosoma. — Mesoscutum 1.1 times as long as wide; metapleural flange without tooth; propodeum with anterior depression indistinct, without median impressed line, posterior depression shallow; integument punctulate-reticulate, punctures on mesoscutum indistinct, on mesopleuron well discernable; propodeum with some transverse striae above posterior depression. Hindwing: M + Cu divides before cu—a.

Metasoma. — Petiolus 1.2 times as long as hind tibia, ventrally not striate, posteriorly slightly swollen, spiracles prominent (fig. 23); stalk of second tergite 1.9 times as long as wide.

Holotype. — ♀, "Rép. Malgache, Manjakandriana, Mandraka, 1200 m, 26.v.1972, L. & R. Blommers" (ZMA).

The type and only specimen of this species is stylopized, and its morphology may therefore differ from the normal situation. Important characters, like the absence of an impressed line on the propodeum, the short stalk of the second tergite, the aberrant colour pattern, and the strong setosity, which separate *B. mandraka* from its closest relatives, viz., *B. bicolor, B. apicalis* and *B. maromandia*, indicate that the type cannot be regarded as an anomalic specimen of one of the known species.

**Belonogaster maromandia** Richards
(figs. 40—41)

*Belonogaster maromandia* Richards, 1982: 47, 108.

The species was described by Richards on basis of two females. The male is described here for the first time, and some remarks on the types and other females are given below.

Male.

Body length 20.0—24.0 mm, length of forewing 14.5—15.5 mm.

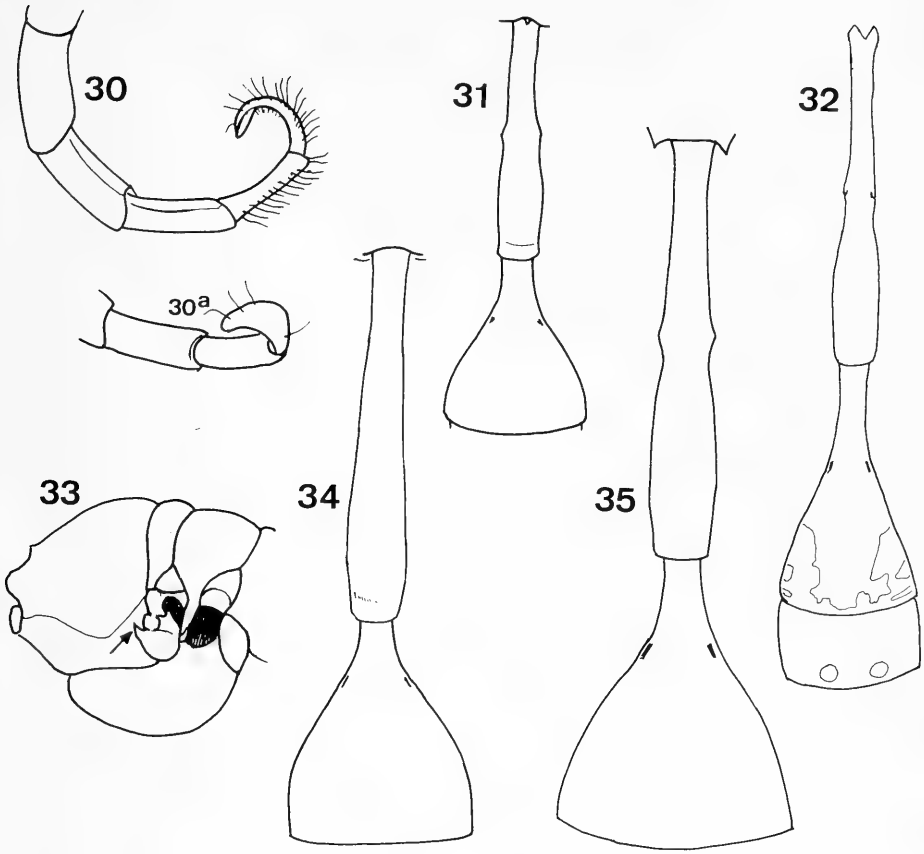
Coloration. — Head ferruginous, mandibles, sides of face and antenna ventrally pale yellow. Mesosoma ferruginous, dorsally infuscated, mesopleuron ventrally pale yellow. Legs ferruginous, all coxae and fore and mid femora ventrally white, mid and hind tibiae and tarsi yellow. Metasoma ferruginous, partly infuscated. Wings reddish yellow.

Pubescence. — Clypeus with dense white tomentum; vertex and mesosomal dorsum with short black setae; fore coxae with dense white pubescence and a few brown setae; mid and hind femora ventrally with dense white setosity.

Head. — Clypeus bluntly angled below, angle about 120°; gena 0.4 times as wide as eye in lateral view; cephalic foveae absent; clypeus sparsely finely punctate, shiny, vertex densely punctulate, dull, with a few coarse punctures; third antennal segment 0.78 times as long as fourth + fifth; these resp. 3.4 and 3 times as long as wide; eighth segment 2.3 times as long as wide; sixth to tenth keeled on inner side; last segment apically pointed (fig. 40).

Mesosoma. — Mesoscutum 1.2 times as long as wide; scutellum with median impressed line; metapleural flange without tooth; propodeum with anterior depression small, median impressed line absent, posterior depression weak; integument dull, finely punctulate-reticulate, with sparse punctation, punctures of mesoscutum distinct. Fifth segment of fore tarsi dilated and flattened (though less than in *B. scutifera*) (fig. 41). Hindwing: M + Cu divides before cu-a.

Metasoma. — Petiolus 1.25 times as long as hind tibia, ventrally not striate, posteriorly little swollen, spiracles prominent; stalk of second tergite 2.4 times as long as wide; seventh sternite truncate.




Figs. 30—35. 30—31, *B. tanosy*. 30, ♂, apical antennal segments (posterior view; 30a, dorsal view); 31, ♀, metasomal basis. 32, *B. tipuliformis*, ♀, metasomal basis. 33—34, *B. trandraka*, ♀. 33, posterior part of metasoma, right side, lateral view, with tooth of metapleural flange indicated (wings omitted); 34, metasomal basis. 35, *B. vadoni*, ♀, metasomal basis. 31—35: 9 ×; 30: 36 ×.

Female

The coloration is rather variable; mesosoma dark green with metanotum yellow to ferruginous, and mesopleuron ventrally, metapleuron and propodeum to a variable extent ferruginous; legs black to greenish, the tibiae and tarsi always light ferruginous. The fore coxae and ventral side of mesopleuron may bear some brown setosity. Typically the propodeum bears some oblique striae apically; these are absent in some specimens.

Material examined. — 6 ♀ 2 ♂, Région d'Ambanja, A. Seyrig (MNHN; 1♀ CH, 1 ♀ ZMA); 1 ♀, Prov. d'Analalava, Maromandia, R. Decary, 1923 (MNHN; paratype).

**Belonogaster ornata** Saussure
(figs. 24, 25)

*Belonogaster ornata* Saussure, 1900: 209.
*Belonogaster pomicolor* Saussure, 1900: 209.
*Belonogaster eumenoides*; Richards, 1982: 47, 110, figs. 91, 92 (partim).

It is possible that *B. pomicolor* is a distinct

species, but as long as the male is not known we prefer to leave it in the synonymy of *B. ornata.*

Male.

Body length 14.0 mm, length of forewing 9.7 mm.

Coloration. — Head pale yellow, vertex green; antennae ferruginous, scape ventrally yellow, dorsally green. Mesosoma green, meso- and metapleuron yellowish ferruginous; posterior margin of scutellum and large parts of metanotum yellow; tegula ferruginous; propodeal valves white. Legs green, fore coxae and middle coxae anteriorly and lines along fore and middle femora and tibiae white; posterior tibiae yellow, proximally and apically infuscated; tarsi fuscous. Petiolus and second metasomal tergite green, rest of metasoma brown, second tergite with white band apically, third to sixth tergite and second to fifth sternite with white lateral spots apically. Wings light brownish hyaline, veins light brown.

Morphology. — Like the male of *B. eumenoides*, except for the following. Gena 0.3 times as wide as eye in lateral view; interocular distance on vertex slightly shorter than third antennal segment; third antennal segment 0.7 times as long as fourth + fifth, these resp. 3.3 and 3.0 times as long as wide; eighth segment 3 times as long as wide; third to eleventh with raised longitudinal line ventrally; last segment strongly curved, widest subapically (fig. 25); pronotal keel absent; petiolus 1.2 times as long as hind tibia, spiracles weakly prominent; stalk of second tergite two times as long as wide (fig. 24).

Female.

Body length 15.2—16.8 mm, length of forewing 10.6—12.9 mm.

Coloration. — Head green, mandibles and genae, and often clypeus and frons yellow; antennae green, scapes ventrally often yellow, flagellum ferruginous. Mesosoma dark green, mesopleuron and often metapleuron, metanotum yellow to ferruginous, propodeum often ferruginous; propodeal valves whitish. Legs green, with at least fore and mid tibiae, often also hind tibiae yellow. Coloration of metasoma variable: fuscous to green, with or without yellow spots. Wings light brownish hyaline to yellow, veins and stigma light brown to yellow.

Morphology. — Like female *B. eumenoides*, except for the following. Gena 0.55 times as wide as eye in lateral view; interocular distance on vertex as long as third + fourth antennal segment; third antennal segment 1.1 times as long as fourth + fifth, these resp. 1.6 and 1.3 times as long as wide; eighth segment as long as wide. Pronotal carina weak. Petiolus 1.1—1.2 times as long as hind tibia, spiracles weakly prominent; stalk of second tergite 1.8—2.0 times as long as wide.

Types. — The lectotype of *B. ornata*, by present designation, is a ♂, "Madagasc.", "*ornatus* Sauss., ♂" (MHNG). Paralectotypes are 5 ♀ , 4 ♂, all MHNG. The lectotype of *B. pomicolor*, by present designation, is a ♀, labelled "Madagasc" (MHNG); paralectotypes are 5 ♀, all MHNG.

Other specimens. — 1 ♂ 1 ♀, Fampanambo, x.1962, J. Vadon (KMMA); 2♀, Périnet, 950 m, 10.v.1984; R. Hensen & A. Aptroot (CH); 5 ♀, Ivondro, i.1941, 1 ♀, Fort Dauphin, viii.1940, all A. Seyrig (MNHN; 1 ♀ CH).

### Belonogaster prasina Saussure

*Belonogaster prasinus* Saussure, 1891: 92, pl. 19, fig. 5; Richards, 1982: 47, 107, figs. 87—89.

Some specimens have the mesosoma nearly entirely yellow. The metasoma usually exhibits well defined yellow bands but sometimes it is entirely light ferruginous. Variation in size is considerable: forewing of female 14.5—21.0 mm.

Material examined. — 1 ♀, Fampanambo, i.1959, J. Vadon (KMMA); 2 ♀, Ifanadiana, Ranomafana, 900 m, 29.xii.1971, 2 ♀, Nosy Be, Dzamandzar, 8/11.i.1971, all L. & R. Blommers (ZMA); 2 ♂ 5 ♀, Fort Dauphin, v.1937, 1 ♀ 2 ♀, Région d'Ambanja, 7 ♀, Sambirano, 1 ♀, Périnet, ii.1931, all A. Seyrig (MNHN, 1 ♂ 3 ♀ CH).

### Belonogaster scutifera sp. n.

(figs. 26—28)

Male.

Body length 20.2 mm, length of forewing 16.1 mm.

Coloration. — Ferruginous; the following parts pale yellow: mandibles, clypeus except for a median stripe, frons except medially below antennal insertions, ventral half of eye emarginations, propodeal valves, all coxae ventrally, fore and middle trochanters and all femora anteriorly, small apical spots on fore tibiae, streak anteriorly on middle and hind tibiae, fifth segment of fore tarsi proximally; remaining part of fore tarsi black; antennae dorsally darkened; metasoma behind stalk darkened, except broad

apical margins of second to fifth segment. Wings yellowish hyaline, veins yellow.

Pubescence. — Clypeus with dense white tomentum, and sparse black setae; vertex with rather long black setae; mesosoma with sparse white tomentum and sparse very short black setae; mid and hind femora ventrally with black setae, particularly along the posterior margins.

Head. — Clypeus bluntly angled below, angle about 120°; gena 0.35 times as wide as eye in lateral view; cephalic foveae absent; clypeus sparsely finely punctulate, shiny, vertex densely punctulate, dull, with a few coarse punctures; third antennal segment 0.8 times as long as fourth + fifth, these resp. 4 and 3.5 times as long as wide; eighth segment 1.6 times as long as wide; ninth and tenth segment keeled on inner side, last segment apically pointed (fig. 26).

Mesosoma. — Mesoscutum 1.15 times as long as wide; scutellum with median impressed line; metapleural flange without tooth; propodeum with anterior depression obsolete, median impressed line absent, posterior depression weak; integument dull, finely punctulate-reticulate, with sparse punctation, punctures of mesoscutum distinct, though shallow. Legs: fifth segment of fore tarsi strongly dilated and flattened, shield-like (fig. 27). Hindwing: M + Cu divides before cu—a.

Metasoma. — Petiolus 1.15 times as long as hind tibia, ventrally not transversely striate, posteriorly swollen, spiracles prominent; stalk of second tergite three times as long as wide; seventh sternite truncate.

Female.

Body length 23.0 mm, length of forewing 17.8 mm.

Coloration. — Ferruginous, femora and tibiae and antennae dorsally darkened; propodeal valves reddish yellow; sixth sternite black.

Pubescence. — Like the male, but clypeus only with black setae and some tomentum, mid and hind femora ventrally with many black setae, metasoma with brown to black setae on tergites and sternites behind the petiolus, setosity of sixth sternite rather long and dense.

Head. — Clypeus acute ventrally, angle about 100°; gena 0.5 times as wide as eye in lateral view; cephalic foveae absent; clypeus finely punctulate, and sparsely strongly punctate; vertex dull, punctulate-reticulate, and with sparse shallow punctures; third antennal segment as long as fourth + fifth, these resp. 1.4 and 1.6 times as long as wide, eighth segment 1.1 times as long as wide.

Mesosoma. — Like the male but fifth tarsal segment not dilated.

Metasoma. — Petiolus 1.2 times as long as hind tibia, ventrally not striate, posteriorly weakly swollen, spiracles slightly prominent (fig. 28); stalk of second tergite 3 times as long as wide.

Holotype. — ♂, "Mus. Roy. Afr. Centr., Madagascar Est: Ambodivoangy, v.1960, J. Vadon" (KMMA).

Paratype. — ♀, Fampanambo, ii.1961, J. Vadon (KMMA).

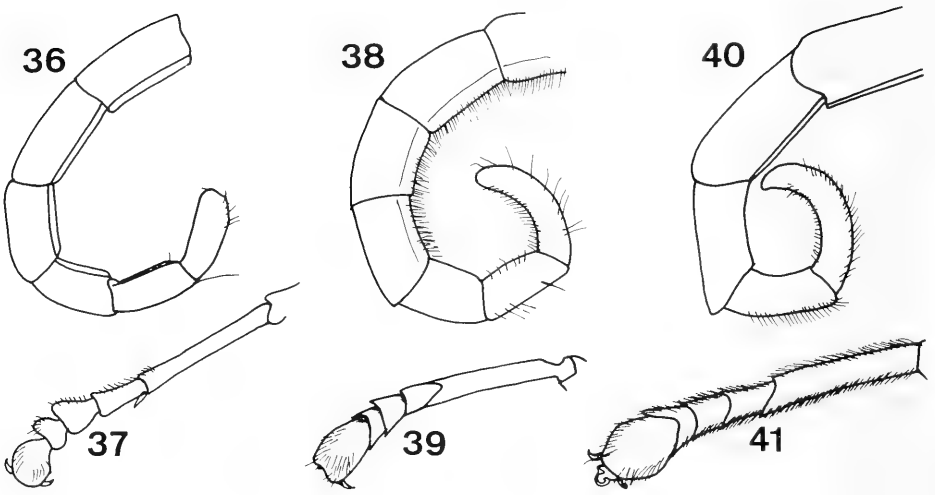
### **Belonogaster tanosy** sp. n.
(figs. 29—31)

Male.

Body length 15.4—17.0 mm, length of forewing 10.9—11.3 mm (holotype: largest specimen).

Coloration. — Head pale yellow, vertex dark greenish brown; mandibles pale yellow; antennae yellowish ferruginous, first three segments with greenish tinge. Mesosoma dark green, pronotum laterally, mesopleuron, metapleuron, posterior margin of scutellum, metanotum laterally and propodeal valves pale yellow; tegulae greenish brown; fore legs and mid coxae pale yellow, mid and hind legs green, with the last tarsomeres ferruginous. Metasoma fuscous, petiolus and stalk of second tergite dark green. Wings yellowish hyaline, veins yellow.

Morphology. — Like the male of *B. eumenoides*, except for the following. Clypeus 1.1 times as long as dorsally wide; gena 0.3 times as wide as eye in lateral view; interocular width on vertex as long as third antennal segment; third antennal segment 0.79 times as long as fourth + fifth, these resp. 3.1 and 2.8 times as long as wide; eighth segment 2.1 times as long as wide; third to tenth with raised longitudinal line ventrally, the ones on the apical segments flattened and polished; last two segments dorsiventrally flattened and concave on inner side; last segment strongly curved (fig. 30); pronotal keel weak; petiolus 1.05 times as long as hind tibia, posteriorly distinctly swollen, spiracles strongly prominent (cf. fig. 31) weakly prominent in some of the paratypes); stalk of second tergite 1.5 times as long as wide.




Figs. 36—41. 36—37, *B. dayi*, ♂. 36, apical antennal segments; 37, fore tarsus. 38—39, *B. fanemitra*, ♂. 38, apical antennal segments; 39, fore tarsus. 40—41, *B. maromandia*, ♂. 40, apical antennal segments; 41, fore tarsus. 37, 39, 41: 18 ×; 36, 38, 40: 36 ×.

Female.

Body length 14.7—15.4 mm; length of forewing 9.7—10.4 mm.

Coloration. — Head ferruginous, clypeus medially and ventrally, and sides of frons yellow; vertex dark fuscous; scape greenish black, flagellum dark ferruginous. Mesosoma ferruginous, pronotum, mesoscutum and scutellum anteriorly fuscous; propodeum medially darkened, propodeal valves yellow. Legs dark green, fore coxae ferruginous, mid coxae dark ferruginous. Wings yellowish hyaline, veins yellow. Metasoma fuscous, anterior half of petiolus and stalk of second tergite green.

Specimens from other than the type locality differ as follows: propodeum green; fore and mid tibiae and fore tarsi yellow, mid tarsi and hind tibiae and tarsi fuscous; second metasomal tergite with a pair of yellow spots apically.

Morphology. — Like female *B. eumenoides*, except for the following. Malar space shorter than maximal flagellar width; gena 0.4 times as wide as eye in lateral view; interocular distance on vertex nearly as long as third + fourth + fifth antennal segment; third antennal segment 1.1 times as long as fourth + fifth, these resp. 1.2 and 1.1 times as long as wide; eighth segment 0.9 times as long as wide. Pronotal keel weak. Petiolus (fig. 31) 1.3 times as long as hind tibia, posteriorly distinctly swollen, spiracles rather strongly prominent; stalk of second tergite 1.4 times as long as wide.

Holotype. — ♂, "Madagascar, Fort Dauphin, 500 m, 15.iv.1968, K. M. Guichard" (BMNH).

Paratypes. — 1 ♀ 2 ♂, same data as holotype (BMNH, 1 ♂ CH); 1 ♀, Fénérive, 22.xii.1955, E. McC Callan (BMNH); 3 ♀, Fénérive-Est, 15.x.1971, L. & R. Blommers (ZMA); 8 ♀, Sambirano, 1 ♀, Fort Dauphin, vii.1940, all A. Seyrig (MNHN, 1 ♀ CH, 1 ♀ RMNH).

### **Belonogaster tipuliformis** sp. n.
(fig. 32)

Female.

Body length 19.2 mm, length of forewing 14.5 mm.

Coloration. — Head green, mandibles, genae and sides of clypeus and frons yellow; antennae ferruginous, scape green. Mesosoma yellow, pronotum except ventral corners, mesoscutum and propodeum anterodorsally green. Legs yellow, mid and hind coxae pale green, femora green, tarsi largely black. Metasoma fuscous, petiolus anterodorsally and ventrally, and stalk of second tergite green, second to sixth tergite with apical yellow band which is interrupted in the middle on second to fourth; second to sixth sternite largely yellow. Wings proximally yellowish grey, apical third bright yellow.

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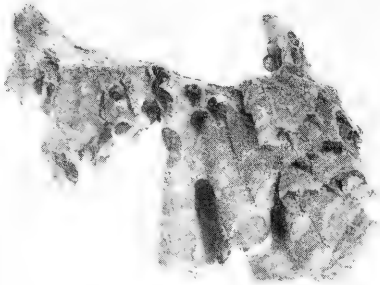

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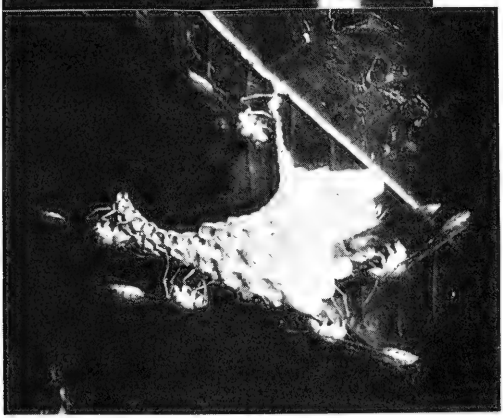

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Figs. 42—45. Nests of *Belonogaster*. 42, *B. dayi*, at Périnet (courtesy of Dr W. G. d'Arcy, Missouri); 43, *B. eumenoides*, at Manjakandriana, Mandraka, nest nr. 73.20; 44, *B. guerini*, at Fénérive, nest nr. 71.58; 45, *B. madecassa*, at Tsaramandroso, nest nr. 72.23.

Pubescence. — Clypeus ventrally with brown setae, vertex and mesosoma dorsally with sparse short yellowish setae; fore coxa with dense white pubescence, and several longer black setae; mid and hind femora with some white setae beneath; metasoma without black setosity.

Head. — Clypeus acute below, angle about 100°; gena 0.7 times as wide as eye in lateral view; cephalic foveae absent; clypeus sparsely punctate, dorsal two thirds densely punctulate; vertex densely punctulate, with a few indistinct punctures; third antennal segment 1.1 times as long as fourth + fifth, these resp. 1.5 and 1.4

times as long as wide; eighth segment 1.1 times as long as wide.

Mesosoma. — Mesoscutum 1.1 times as long as wide; metapleural flange without tooth; propodeum with anterior depression small, posterior depression small but deep, impressed median line very short; integument punctulate-reticulate, sparsely shallowly punctate, fairly shiny. Hindwing: M + Cu divides after cu-a.

Metasoma. — Petiolus 1.2 times as long as hind tibia, ventrally not striate, posteriorly distinctly swollen, spiracles prominent (fig. 32); stalk of second tergite 3.5 times as long as wide.

Holotype. — ♀, "Madagascar; (Tamat.); Périnet; 950 m; 48°16 E, 18° 56 S; 10.v.1984; leg. R. Hensen & A. Aptroot" (RMNH).

Paratypes. — 1 ♀, "Madagascar, collection le Moult", 1 ♀, Sambirano, Manongarivo, 1150 m, xii.1960, P. Griveaud (both MNHN).

**Belonogaster trandraka** sp. n.
(figs. 33, 34)

Female.

Body length 20.6 mm, length of forewing 14.2 mm.

Coloration. — Ferruginous; antennae infuscated, except the apical segments ventrally; legs dark brown, but fore coxae ferruginous, mid coxae, fore and mid femora and fore tibiae greenish; propodeal valves pale yellow; metasoma fuscous, petiolus ventrally and dorsally on anterior half green. Wings light brown, veins and stigma yellowish to reddish ferruginous.

Pubescence. — Clypeus with rather long yellow setae; vertex and mesosoma dorsally with long rather dense black setosity, setae half as long as flagellar width; fore coxae only with short white pubescence; mid and hind femora ventrally with sparse white pubescence; setosity of posterior tergites and sternites light brownish, comparatively short.

Head. — Clypeus acute below, angle about 100°; gena in lateral view 0.6 times as wide as eye; cephalic foveae absent; ventral third of clypeus granulate, sparsely foveolate, dorsal two thirds punctulate, with sparse coarse punctures; vertex punctulate-reticulate, with distinct punctation. Third antennal segment 1.1 times as long as fourth + fifth, these resp. 1.1 and 1.0 times as long as wide; eighth segment 0.9 times as long as wide.

Mesosoma. — Mesoscutum as long as wide; scutellum without impressed median line; mesopleural flange produced into a flat tooth, behind the mesopleural spiracular lobe (fig. 33); propodeum with distinct anterior depression, impressed median line only present just above the small, shallow posterior depression. Integument punctulate-reticulate, and densely, rather coarsely punctate, interspaces as large as the punctures on the mesoscutum. Hindwing: M + Cu divides before cu—a.

Metasoma. — Petiolus 1.5 times as long as hind tibia, ventrally not striate, posteriorly hardly swollen, spiracles not prominent (fig. 34); stalk of second tergite as long as wide.

Holotype. — ♀, "Mus. Roy. Afr. Centr., Madagascar Est: Ambodivoangy, v.1960, J. Vadon" (KMMA).

Etymology. — "Trandraka" is the local name for one of the peculiar Malagasy hedgehogs, or Tenrecs, insectivorous mammals of the family Tenrecidae. The name is chosen because of the long erect pubescence and similar colour of the wasp.

**Belonogaster vadoni** sp. n.
(fig. 35)

Female.

Body length 26.3 mm, length of forewing 17.7 mm.

Coloration. — Yellow, antennae bright ferruginous, pronotum dorsally with a pair of green markings; petiolus suffused with green, second and third tergite anteriorly green. Wings yellow, veins and stigma yellow.

Pubescence. — Clypeus with yellow, frons and vertex with conspicuous short black setae; mesosoma with black setosity, on mesonotum rather dense and long; fore coxae with long dense black setosity, and white tomentum; mid and hind femora ventrally only with short pale pubescence; metasoma with yellowish tomentum and yellow setae.

Head. — Clypeus acute below, angle about 90°; gena 0.7 times as wide as eye in lateral view; cephalic foveae absent; clypeus ventrally coarsely punctate, dorsal three-fifth densely punctulate and sparsely rather finely punctate; vertex dull, punctulate-reticulate, punctation indistinct; third antennal segment 1.1 times as long as fourth + fifth, these both 1.2 times as long as wide, eighth segment 0.9 times as long as wide.

Mesosoma. — Mesoscutum 1.1 times as long as wide; scutellum with median line weakly impressed on posterior half; metapleural flange

without tooth; propodeum without anterior depression, median impressed line indicated on posterior half, posterior depression well developed; integument dull, finely punctulate-reticulate, with sparse shallow, indistinct punctation; propodeum with strong oblique striae above the posterior depression. Hindwing: M + Cu divides before cu—a.

Metasoma. — Petiolus 1.3 times as long as hind tibia, ventrally not transversely striate, posteriorly swollen, spiracles prominent (fig. 35); stalk of second tergite 1.7 times as long as wide.

Holotype. — ♀, "Coll. Mus Tervuren, N. E. Madagascar, Fampanambo, i.1959, J. Vadon" (KMMA).

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# MORPHOLOGIE DER LARVEN UND PUPPEN EINIGER *PHYLIDOREA*-ARTEN (DIPTERA, LIMONIIDAE)

von

JOLANTA WIEDEŃSKA

*Instytut Biologii Środowiskowej, Lódź, Polen*

Abstract

Die Larven und Puppen von vier Arten der Gattung *Phylidorea* Bigot (Limoniidae, Hexatominae) werden beschrieben, *Phylidorea* (s. str.) *nigricollis* (Mg.) und *Phylidorea* (*Euphylidorea*) *nigronotata* (Siebke) zum ersten Mal. Die Beschreibungen und Illustrationen von *Phylidorea* (s. str.) *squalens* Zett. und *Phylidorea* (*Euphylidorea*) *fulvonervosa* (Schumm.) sind umfassender und genauer als frühere.

Als Material für die Beschreibungen wurden die Exuvien von Larven des 4. Stadiums und von Puppen benutzt.

## Einleitung

In Europa wurde bisher das Vorkommen von 15 Arten der Gattung *Phylidorea* Bigot (sensu Alexander, 1972) festgestellt. Dagegen sind nur sieben Arten in den Praeimaginalstadien bekannt.

Die Beschreibungen der Larven und Puppen von diesen Arten sind meist unvollständig (Beling, 1878, 1886; De Meijere, 1916; Lévy, 1918; Brindle, 1958, 1967; Hennig, 1968). Die Autoren dieser Arbeiten haben oft solche Merkmale berücksichtigt, die für die ganze Gattung oder viele *Phylidorea*-Arten zutreffen, deshalb sind diese Charakteristiken keine guten diagnostischen Beschreibungen. Von grösserer Bedeutung sind die von Brindle und Bryce (1960) zusammengestellten Bestimmungstabellen, weil sie nicht nur den Analsegmentbau sondern auch den Kopfkapselbau berücksichtigen. Diese Bestimmungstabellen werden jedoch von den Autoren selbst für ziemlich provisorisch gehalten, weil sie nicht alle Arten enthalten und die angegebenen Merkmale meistens keine diagnostischen Merkmale einzelner Arten sind. Alle bisher bekannten Jugendstadien der Limoniiden sind in den Bestimmungstabellen von Rozkošný und Pokorný (1980) enthalten.

Meine Arbeit betrifft die Larvenmorphologie des 4. Stadiums und die Morphologie der männlichen Puppen von vier Arten der Gattung *Phylidorea* Bigot. Zwei Arten werden zum ersten Mal von mir beschrieben, nämlich *Phylidorea* (s. str.) *nigricollis* (Mg.) und *Phylidorea* (*Euphylidorea*) *nigronotata* (Siebke). Die Beschreibungen von *Phylidorea* (s. str.) *squalens* Zett. und *Phylidorea* (*Euphylidorea*) *fulvonervosa* (Schumm.) dagegen enthalten neue, bisher in der Literatur unbekannte Einzelheiten.

Es wurde die Taxonomie von *Phylidorea* Bigot nach Alexander (1972) und Mendl (1978) angewandt, obwohl Starý (1981) und Savtshenko (1986a, b) innerhalb dieser Gattung wesentliche Veränderungen vorschlägen.

Herrn Doz. Dr. Krzysztof Jażdżewski danke ich sehr herzlich für wertvolle Anregungen zu meiner Arbeit.

## Material und Methoden

Die Untersuchungen wurden von Herbst 1980 bis Herbst 1983 durchgeführt. Das Material wurde im Lubrzanka-Fluss (rechter Nebenfluss des Czarna Nida-Fluss, Świętokrzyskie Gebirge) und im Grabia-Fluss (rechter Nebenfluss des Widawka-Fluss, Central Polen) gesammelt.

Die Larven des 4. Stadiums leben im Uferschlamm an der Wasserlinie. Sie wurden mit einem hydrobiologischen Netz (Maschenweite: 0,5 mm) entnommen, vorsichtig ausgespült und in Thermosflaschen in das Laboratorium transportiert. Dort wurde jede Larve einzeln in einer Kunstoffschale mit sauberem Sand und Flusswasser bis zur Imago zogen. Beobachtungen an

lebenden Tieren erfolgten durch den Schalendeckel.

Imago, zugehörige Exuvien der Puppe und des letzten Larvenstadiums wurden nach dem Schlüpfen in 75% Alkohol konserviert. Die Kopfkapseln der Larvenexuvien wurden in mikroskopischen Dauernpräparaten in Canadabalsam verarbeitet.

Von etwa 90 züchteten Larven haben sich acht zur Imago entwickelt, weitere acht haben sich verpuppt, die übrigen erreichten das 4. Stadium. Für meine Beschreibungen benutzte ich nur Exemplare, die sich zumindest bis zur Puppe entwickelt hatten.

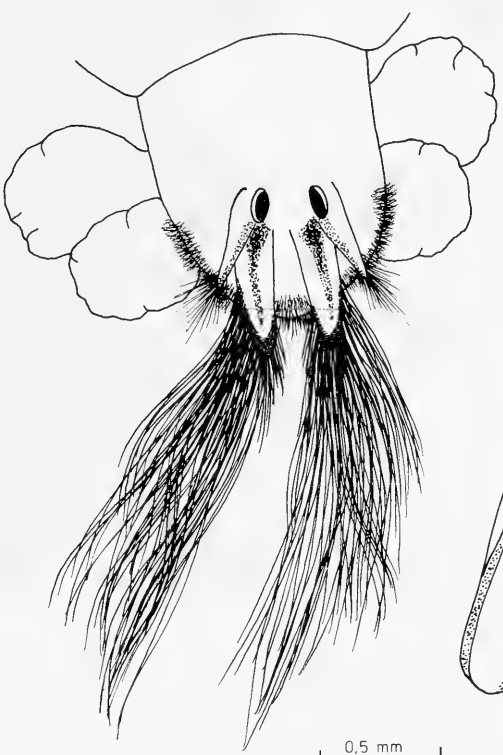
Dieser Material bildet nur ein Teil meiner von Świętokrzyskie Gebirge bearbeitenen Sammlung/Wiedeńska 1986/. Auf diesem Gebiet habe ich das Vorkommen von 7 Arten der Gattung Phylidorea Bigot festgestellt, aber nur vier Arten habe ich bis zur Imago oder Puppe züchten können.

### Phylidorea (Ph.) nigricollis (Mg.)

*Limnobia nigricollis* Meigen, 1830: 276.
*Limnophila nigricollis* (Mg.); de Meijere, 1921: 85.
*Limnophila* (*Phylidorea*) *nigricollis* (Mg.); Starý, 1970: 146.

Verbreitung: Mittel- und Nordeuropa (Starý 1970; Savtshenko 1986 b).

Material: 3 ♂, 5 ♀. Lubrzanka-Fluss: Zagnańsk — Gruszka, 1 Larve: 22.xi.1980 gesammelt, 29.xii.1980, ♂ geschlüpft; Marzysz, 1 Larve: 20.v.1981 gesammelt, 30.v.1981, ♀ geschlüpft; Marzysz, 1 Larve: 20.v.1981 gesammelt, 21.v.1981, ♂ verpuppt; Marzysz, 1 Larve: 14.v.1982 gesammelt, 21.v.1982, ♂ verpuppt. Grabia-

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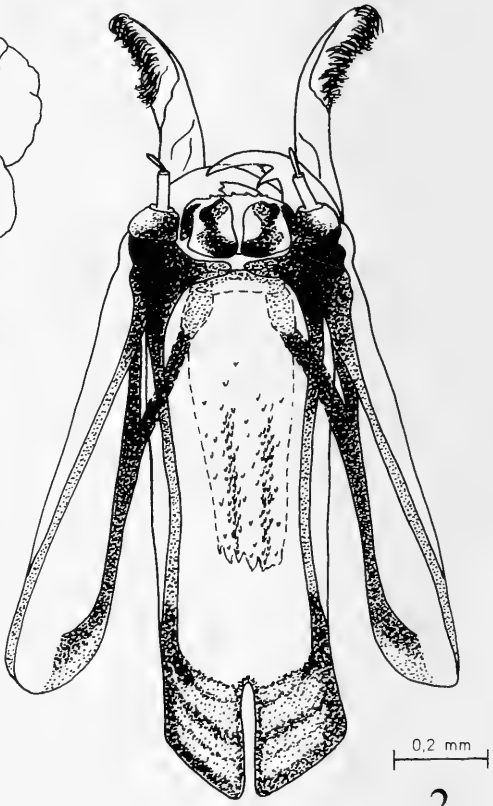


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Fig. 1. Analsegment von *Phylidorea* (*Ph.*) *nigricollis*. Dorsalansicht. Fig. 2. Kopfkapsel *Phylidorea* (*Ph.*) *nigricollis*. Dorsalansicht.

Fluss: Grabica, 1 Larve: 18.v.1982 gesammelt, 06.vi.1982, ♀ geschlüpft; Grabica, 1 Larve: 06.v.1983 gesammelt, 19.v.1983, ♀ geschlüpft; Zamość, 1 Larve: 12.iv.1983 gesammelt, 22.iv.1983, ♀ geschlüpft; Zamość, 1 Larve: 12.v.1983 gesammelt, 23.v.1983, ♀ geschlüpft.

Länge der Larven des 4. Stadiums 17—20 mm. Körper bedeckt mit sehr kurzer und zarter, aber dichter brauner und schillernder Behaarung. Verletztes Segment charakteristisch angeschwollen.

Auf der Ventralseite des Analsegments (Fig. 1) vier ziemlich grosse, ovale Analpapillen. Stigmenfeld auf der Dorsalseite gelegen, Stigmen deutlich pigmentiert, oval. Vier Randlappen: die zwei Ventrallappen lang und breit, die beiden Laterallappen kurz und stämmig, nur etwa halb so lang wie die Ventrallappen. Randlappen mit hellbraunen Streifen (schmale auf den Laterallappen, breite an der Basis auf den Ventrallappen), die sich auf dem Stigmenfeld nicht mit einander verbinden. Distalränder der Ventrallappen fast schwarz, stark sklerotisiert, mit einer dichten Reihe langer und weicher Haare gesäumt. Das Stigmenfeld nackt.

Kopfkapsel (Fig. 2), wie bei anderen *Phylidorea*-Arten schwach und zart sklerotisiert. Länge: 1,5—1,9 mm. Die Lateralplatten mit den tiefen Dorsalspalten in Externo- und Internolateralia geteilt. Internolateralia hinter der Frontalplatte verbunden, am Hinterrand der Kopfkapsel durch die schmale, nicht sehr tiefe Coronalspalte geteilt. Alle Platten fein und fast durchsichtig; stark sklerotisiert sind nur die Leisten, die die Ränder dieser Platten bilden. Die Externolateralia rinnenförmig, auf der Ventralseite durch starke Leisten mit dem Hypopharynx verbunden. Die Verbindungsstelle der länglichen Leisten, die die Antennen und Mundgliedmassen tragen, ist am kräftigsten sklerotisiert.

Antennen (Fig. 3a) zweigliederig. Basalglied 75,7—100,7 µm lang, 22,2—30,7 µm breit. Apikalglied 41,5—56,9 µm lang, 6,3—7,9 µm breit, fein gestreift. Auf dem Basalglied zwei schlanke Sensillen und eine Borste, die etwa halb so lang wie das Apikalglied ist. Sockel breit, stark sklerotisiert, unregelmässig geformt.

Clypeolabrum (Fig. 4a): Länge 149,6—174,1 µm. Breite 290,2—340,3 µm, ziemlich stark sklerotisiert. Sutur zwischen Clypeus und Labrum undeutlich. Lateralränder mit stark sklerotisierten "Flügelchen". Am Vorderrand des Clypeolabrums (Fig. 5a) verschiedenartige Strukturen,

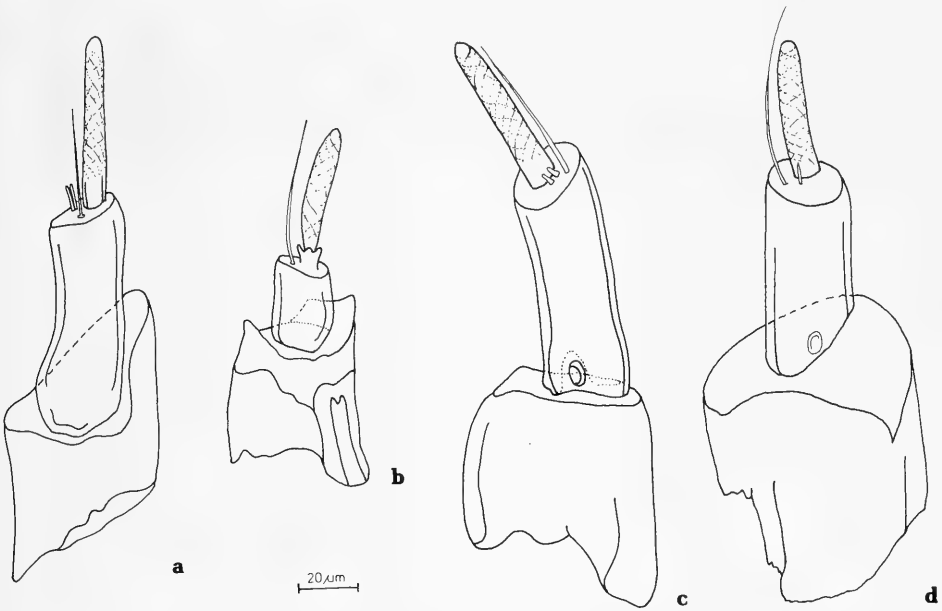


Fig. 3. Antennen *Phylidorea*-Larven: a, *Ph.* (*Ph.*) *nigricollis*; b, *Ph.* (*Ph.*) *squalens*; c, *Ph.* (*E.*) *nigronotata*; d, *Ph.* (*E.*) *fulvonervosa*.

die symmetrisch angeordnet sind: links und rechts von der Medianen zwei kräftige, etwas abgestumpfte Dorne; seitlich davon, auf vorstehenden Erhöhungen, je drei fingerförmige, nebeneinander liegende Fortsätze; daneben je zwei feine Sensillen (finger- und lanzettförmig) und auf den am weitesten lateral gelegenen, deutlichen Erhöhungen je drei Fortsätze mit schartigen Rändern. Auf der Fläche etwas vom Vorderrand entfernt, lateral je ein selbst ziemlich kräftig sklerotisierter Fortsatz mit unregelmässigen Rändern auf stark sklerotisierten Erhebungen. Daneben, zur Medianen hin, zwei weiche, streitkolbenförmige, niedrige Warzen.

Epipharynx (Fig. 5b) auf der Ventralseite des Clypeolabrums gelegen. Symmetrisch zur Körperachse befinden sich von vorn nach hinten: ein Paar zweigliederige, fingerförmige Fortsätze und drei Paar Sensillen. Ausserhalb dieser Reihen auf sehr kräftig sklerotisierten, ausgedehnten Erhöhungen zwei lange, steife Borsten, die an der Rändern dieser Erhöhungen liegen. Näher zum Aussenrand des Epipharynx ein kleines Büschel niedriger, dicker Haare.

Mandibeln (Fig. 6a, e) 352,8—405,1 µm lang, 129,2—156,5 µm breit. Ziemlich stark sklerotisiert, besonders im unregelmässigen und ziemlich bauchigen Proximalteil. Der Apikalteil dorso-ventral abgeflacht, mit langem, gleichmässig verjüngtem und zur Mitte umgebogenem Zahn. Am Innerrand dieses Zahns nahe seiner Basis eine schwach sklerotisierte, fast durchsichtige, schmale Klinge, die fast die Hälfte der Zahnlänge erreicht. Unter dem ersten, dem Apikalzahn, noch vier Zähne: der zweite und dritte Zahn blättrig, fein, in der Höhe ausgebreitet; der vierte Zahn dreieckig, spitz endend und stark sklerotisiert; der fünfte Zahn klein, schmal, abgestutzt, mit unregelmässigem Rand. Die Kanalmündungen befinden sich an der Basis des zweiten Zahns und auf dem Basalvorsprung der Mandibel weit unterhalb des fünften Zahns. Auf der Aussenfläche der Mandibel, ein Drittel von der Basis entfernt, zwei lange Borsten.

Maxillen (Fig. 7a): etwa 500 µm lang, an der Basis 106,4— 169,9 µm breit. Im Basalteil ziemlich stark sklerotisiert, zur Spitze hin schwächer. Der membranartige Apikalteil an den stark skle-

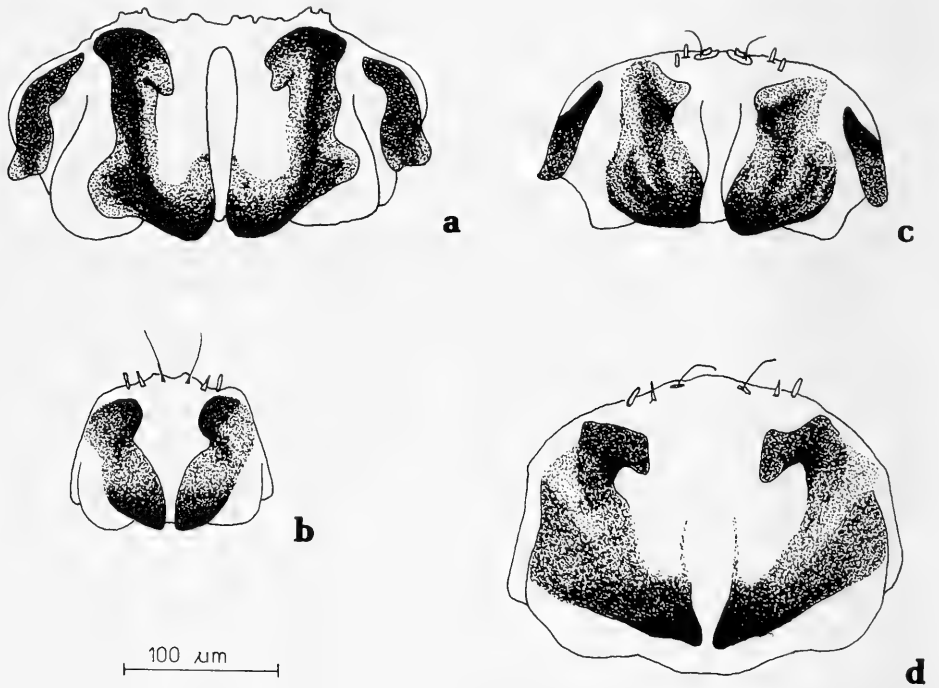


Fig. 4. Clypeolabrum der *Phylidorea*-Larven: a, *Ph.* (*Ph.*) *nigricollis*; b, *Ph.* (*Ph.*) *squalens*; c, *Ph.* (*E.*) *nigronotata*; d, *Ph.* (*E.*) *fulvonervosa*.

rotisierten, spitze zulaufenden Keil angelehnt. Die Innenflächen der Maxillen im Apikalteil dicht behaart.

Hypopharynx (Fig. 8a, b) membranös, von der Querbrücke und zwei Lateralarmen begrenzt. Am Vorderrand lateral zwei säulenartige Labialpalpen, von 34,7—35,9 µm Höhe; die Entfernung zwischen beiden beträgt 58,3—63,7 µm. Auf der platten Apikalfläche des Palpus eine schlanke Papille (Länge 10,8—12,5 µm). Die Querbrücke (Länge 44,4—72,8 µm, Breite 195,2—228,7 µm) ist stark gleichmässig sklerotisiert, mit fast parallelen Rändern. Die Lateralarme (Länge 177,0—215,7 µm, Breite 130,9—172,4 µm) sind unregelmässig und platt. Ihre Aussen- und Vorderränder sind umgebogen und stärker sklerotisiert als die übrigen Teile.

Hypostomium nicht entwickelt.

Die unbewegliche Puppe ist dunkelbraun, hell nur an den Segmentgrenzen. Die Länge der männlichen Puppe beträgt etwa 15 mm, der weiblichen etwa 17 mm.

Die Kopfscheide (Fig. 9a) ist flach, dunkler als der Puppenkörper. Die Labralscheide (Breite 344—358 µm) ist gläschenförmig, etwas vor die Labialscheide vorgeschoben. Die Maxillentasterscheiden (Länge etwa 630 µm) sind allmählich zur Spitze hin verschmälert, etwas nach oben gekrümmt. Die Labialtasterscheiden (Länge etwa 230 µm) sind schlank, von charakteristischer Gestalt: im Mittelteil stark gewölbt, im Distalteil dagegen abrupt verengt.

Pronotalhörner (Fig. 10a) 900—930 µm lang, röhrchenförmig, an der Basis rund, im Apikalteil abgeplattet. Oberfläche mit sklerotisierten Lamellen bedeckt, sehr fein gekerbt. Die Ränder

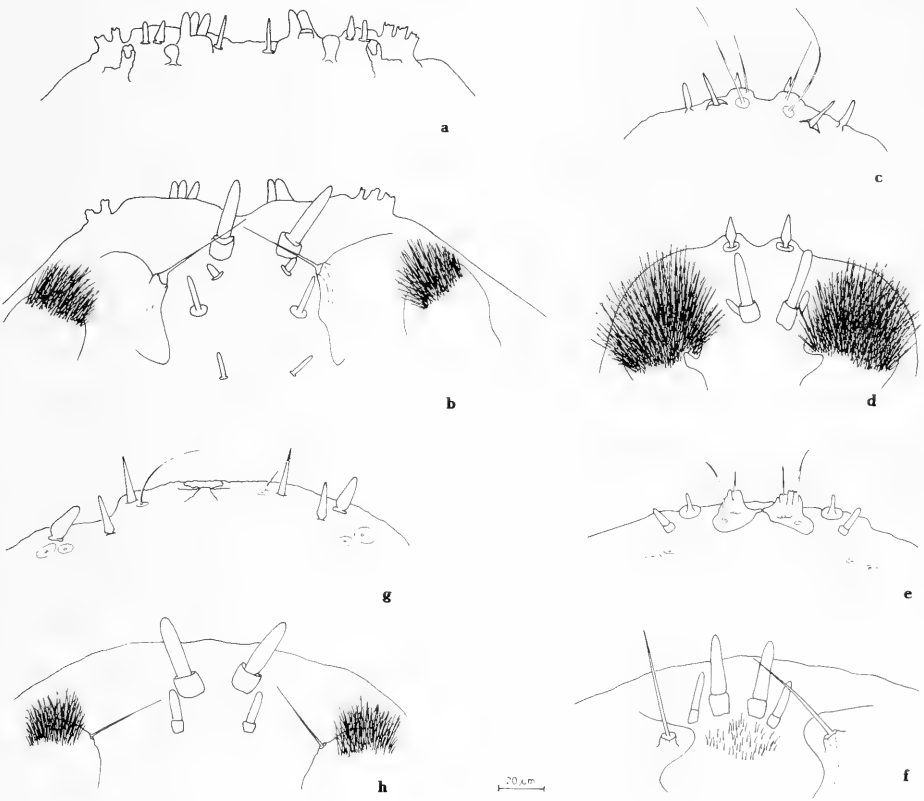


Fig. 5. Vorderrand des Clypeolabrums (a, c, e, g) und Vorderteil des Epipharynx (b, d, f, h) der *Phylidorea*-Larven: a—b, *Ph.* (*Ph.*) *nigricollis*; c—d, *Ph.*(*Ph.*) *squalens*; e—f, *Ph.* (*E.*) *nigronotata*; g—h, *Ph.* (*E.*) *fulvonervosa*.

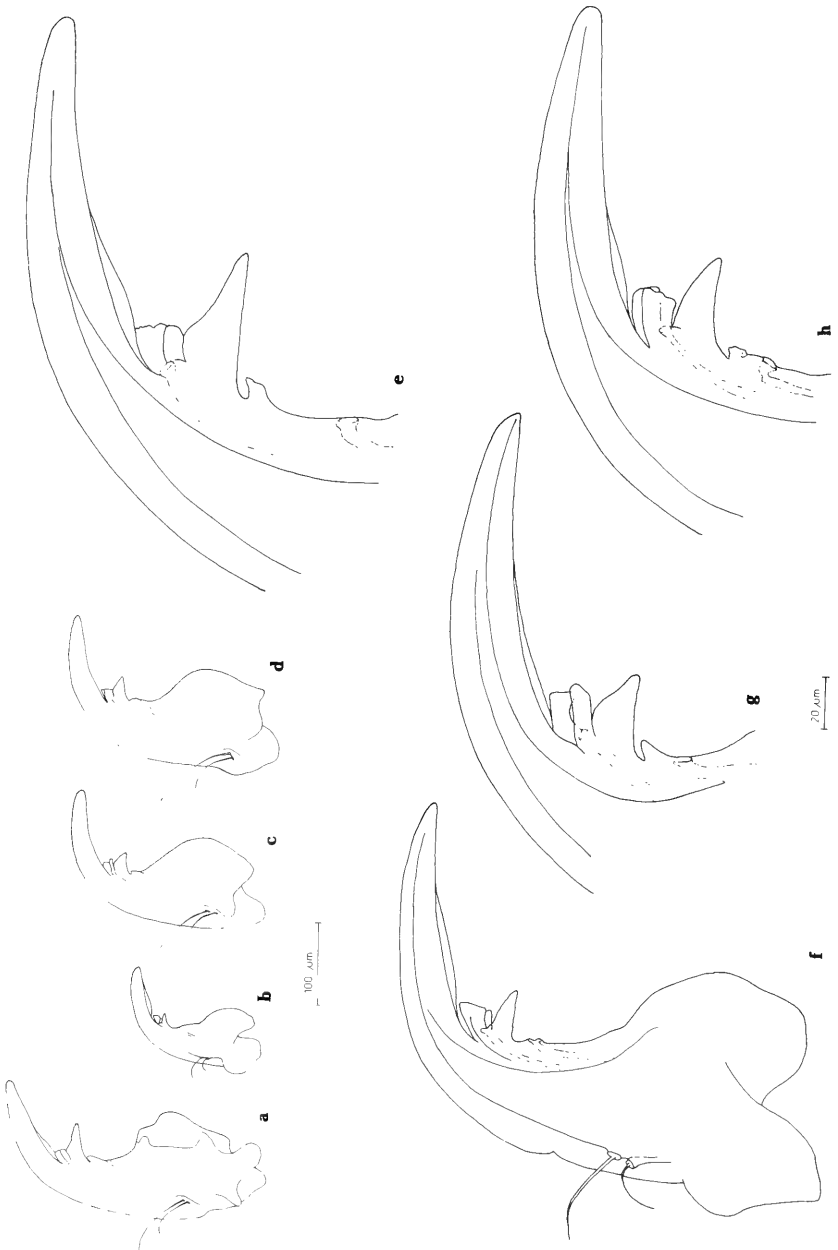


Fig. 6. Mandibeln der *Phyllodorea*-Larven: a, e, *Pb.* (*Pb.*) *nigricollis*; b, f, *Pb.* (*Pb.*) *squalens*; c, g, *Pb.* (*E.*) *nigronotata*; d, h, *Pb.* (*E.*) *fulvonervosa*.

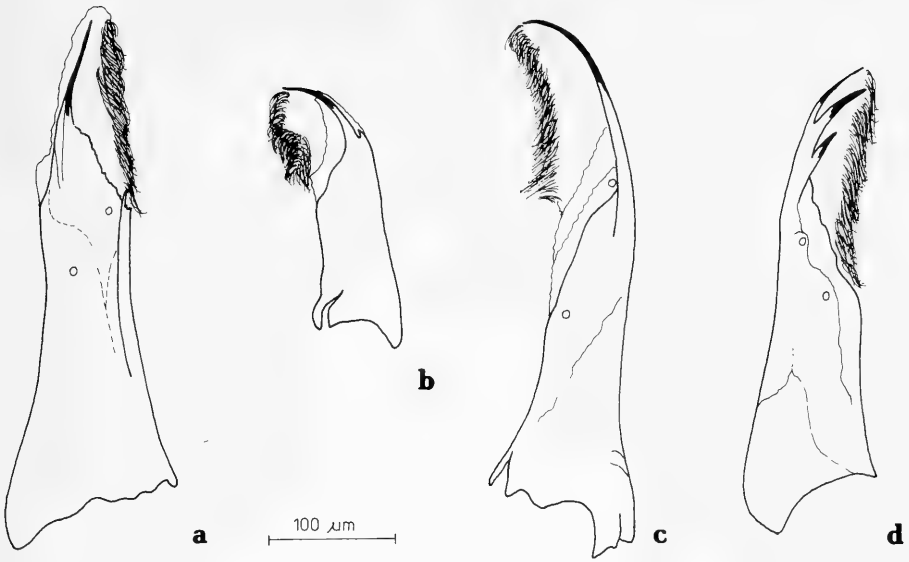


Fig. 7. Maxillen der *Phylidorea*-Larven: a, *Ph.* (*Ph.*) *nigricollis*; b, *Ph.* (*Ph.*) *squalens*; c, *Ph.* (*E.*) *nigronotata*; d, *Ph.* (*E.*) *fulvonervosa*.

der Atmungsspalte membranartig, mit spitz gefranstem Chitin verstärkt. Da die Sklerotisierung der Pronotalhörner stark ist, sind Tracheenstamm und Atmungskammer unsichtbar.

Die Flügelscheiden reichen bis zum Ende des 2. Abdominalsegments. Die gleichartigen Beinscheiden reichen fast bis zum Ende des 3. Abdominalsegments.

Die Abdominaltergite und -sternite sind mit unregelmässigen Plättchen bedeckt (Fig. 11a), die ein ziemlich symmetrisches Muster bilden: zwei horizontale Reihen mit dicht nebeneinander angeordneten Plättchen und zwei vertikale Reihen an den Segmentseiten bilden ein Rechteck, dessen Fläche unregelmässig mit Plättchen bedeckt ist. Die Sternite sind dichter als die Tergite mit Plättchen bedeckt. In der Mitte von Tergit und Sternit befindet sich das unpaare Stigma.

Am Hinterrand des vorletzten Abdominalsegments steht eine Reihe dicht angeordneter, spitzer Dorne.

Analsegment des ♂ (Fig. 12a) schlank mit einem Paar unregelmässiger und ziemlich weicher Lateralvorsprünge (L). Zwei Paar Dorsalvorsprünge: die Anterodorsalvorsprünge (AD) sind klein, die Posterodorsalvorsprünge (PD) dagegen grösser und stämmig. Die Analvorsprünge (AN) an dem gemeinsamen Stamm sind lang und schlank.

### Phylidorea (Ph.) squalens (Zett.)

*Limnobia squalens* Zetterstedt, 1838: 834.
*Limnophila bicolor* (Zett.); Lundström, 1912: 63.
*Limnophila squalens* (Zett.); de Meijere, 1921: 73.
*Limnophila* (*Phylidorea*) *squalens* (Zett.); Starý, 1970: 147.

Praeimaginalstadien:

*Limnophila* (*Phylidorea*) *squalens* (Zett.); Brindle & Bryce, 1960: 217, Fig. 13 (Analsegment); Brindle 1967: 199, Fig. 48, 52 (Analsegment), Fig. 123 (Pronotalhorn).

Verbreitung: Mittel- und Nordeuropa, Nord- und Ostsibirien (Starý, 1970; Savtshenko, 1986b).

Material: 2 ♂. Lubrzanka-Fluss: Ameliówka, 1 Larve: 20.v.1981 gesammelt, 25.v.1981, ♂ verpuppt; Zagnańsk — Jaworze, 1 Larve: 23.iv.1983 gesammelt, 04.v.1983, ♂ geschlüpft.

Die Länge der Larven des 4. Stadiums beträgt etwa 10—12 mm. Bei makroskopischer Betrachtung ist die Larve anderen *Phylidorea*-Arten ähnlich, aber bedeutend kleiner. Ihr Körper ist mit einer dunkelbraunen und intensiv schillernden Behaarung bedeckt. Analpapillen klein und ku-

gelförmig. Ventrallappen lang und breit an der Basis. Laterallappen fast so lang wie die Ventrallappen. Randbehaarung sehr lang, pigmentierte Streifen auf den Randlappen deutlich und breit.

Die Länge der Kopfkapsel beträgt 0.9—1,3 mm.

Antennen (Fig. 3b): Basalglied 24,6 µm lang, 17,7 µm breit; Apikalglied 35,3 µm lang, 6,3 µm breit. Das Apikalglied ist fein gestreift und sitzt auf dem Basalglied versenkt in einer kragenförmigen Krause. Auf der Distalfläche des Basalglieds eine steifen Borste, die etwas länger als das Apikalglied ist. Sensillen fehlen.

Clypeolabrum (Fig. 4b) 111,0—145,1 µm lang, 146,8—207,8 µm breit, trapezförmig mit sanft abgegrundeten Ecken. Lateralränder ohne sklerotisierte "Flügelchen". Am Vorderrand (Fig. 5c) zwei Paar stärkerer Borsten, seitlich davon scharfe, in einer Vertiefung angelegte Dorne, flankiert von einer Papille.

Epipharynx (Fig. 5d) am Vorderrand nahe des Medianen mit einem Paar lanzettförmiger Papil-

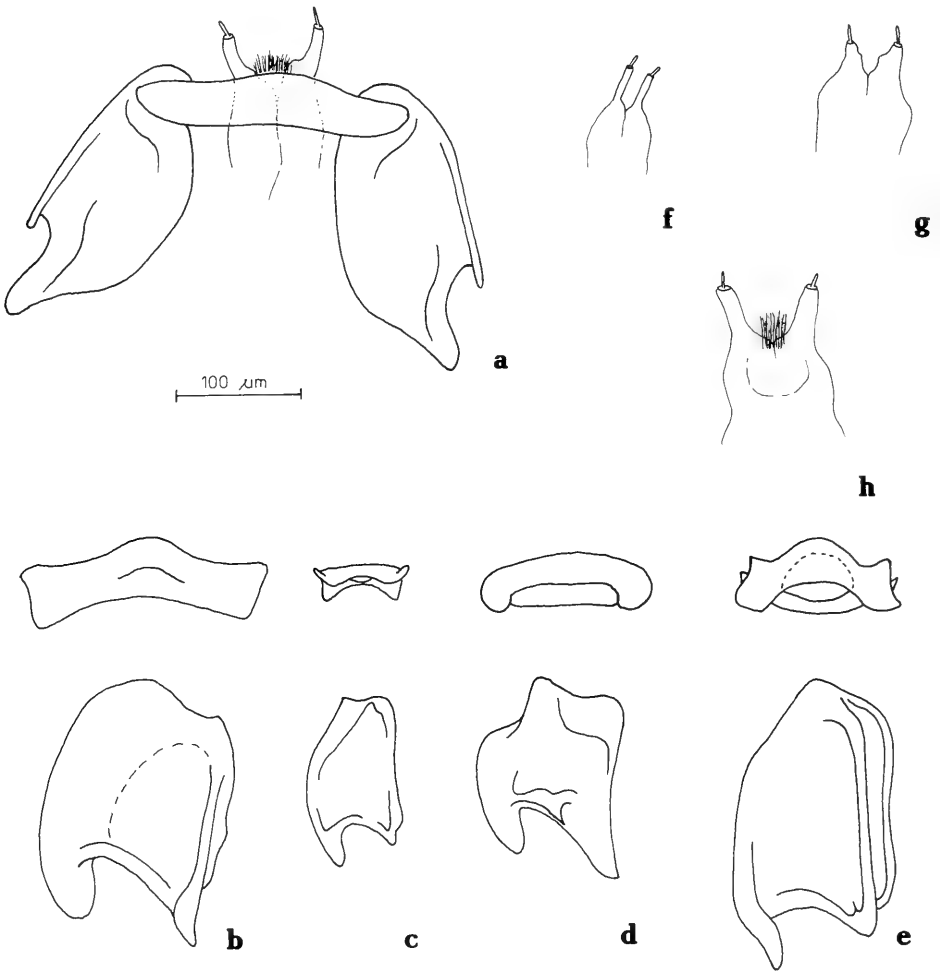


Fig. 8. Hypopharynx der *Phylidorea*-Larven und seine Grundbestandteile: a, Hypopharynx von *Ph.* (*Ph.*) *nigricollis*; b, Querbrücke und Lateralarm von *Ph.* (*Ph.*) *nigricollis*; c, *Ph.* (*Ph.*) *squalens*; d, *Ph.* (*E.*) *nigronotata*; e, *Ph.* (*E.*) *fulvonervosa*; f, Labium von *Ph.* (*Ph.*) *squalens*; g, *Ph.* (*E.*) *nigronotata*; h, *Ph.* (*E.*) *fulvonervosa*.

len, dahinter ein Paar zweigliederige Fortsätze mit kleines Papille an der Basis, seitlich davon zwei stark sklerotisierte Erhöhungen mit dichter Behaarung. Einzeln stehende Borsten fehlen.

Mandibeln (Fig. 6b, f) nur 196,6—273,1 µm lang und 84,2—114,9 µm breit. Die schlanke und durchsichtige Klinge am Innenrand des Apikalzahns erreicht fast zwei Drittel seiner Länge. Der zweite Zahn ist platt mit einer ziemlich breiten Klinge, der dritte bedeutend kleiner und schlank. Anstelle des fünften Zahns steht eine geringe Erhöhung mit der Kanalmündung. Auf der Aussenfläche der Mandibel befindet sich zwei unterschiedlich lange, ziemlich dicke aber weiche Borsten.

Maxillen (Fig. 7b) etwa 250 µm lang und etwa 100 µm breit, fast auf ganzer Länge gleich breit.

Hypopharynx (Fig. 8c, f): die Querbrücke 22,2 µm lang in der Mitte, 84,8 µm breit; die Lateralarme 155,3—191,2 µm lang und 69,4—101,3 µm breit. Die Querbrücke ist unterschiedlich stark sklerotisiert, am schwächsten in der Vertiefung in der Mitte. Die Labialpalpen 29,6 µm, die Papillen 10,8 µm hoch.

Hypostomium nicht entwickelt.

Die Puppe ist hellbraun, ihre Länge beträgt etwa 9 mm.

Die Kopfscheide (Fig. 9b) hat dieselbe Farbe wie der Körper. Die Labralscheide (Breite 200 µm) ist oval, lang und deutlich sichtbar ausserhalb vor die Basis der Labialtasterscheiden vorgeschoben. Die Maxillentasterscheiden (Länge: etwa 340 µm) wirken untersetzt, sie sind allmählich zur Spitze hinverschmälert. Die Labialtasterscheiden (Länge: etwa 140 µm) sind kurz, untersetzt, schaufelförmig.

Die Pronotalhörner (Fig. 10b) (Länge 230—270 µm) sind klein, untersetzt, kegelstumpfförmig, mit gerundeten Ecken. Im Durchmesser sind sie an der Basis rund, bauchig, dagegen im Apikalteil abgeflacht. Ihre Fläche ist eben. Die Atmungskammer und der Tracheenstamm scheinen durch.

Die Flügelscheiden reichen bis zum Ende des 2. Abdominalsegments, die Beinscheiden fast bis zum Ende des 3. Abdominalsegments.

Die kutikulare Oberflächenstruktur auf Tergiten und Sterniten (Fig. 11b) besteht aus spitzen Dornen, die ein Rechteck bilden. Seine Fläche ist unregelmässig mit Dornen bedeckt. An den Lateralrändern der Tergite und Sternite befinden sich unregelmässige, dunkelbraune Pigmentstreifen. Im Distalteil und in einem Zweitel der Länge jedes Abdominalpleurits steht ein grosser Dorn.

Analsegment ♂ (Fig. 12b) kurz und untersetzt mit zwei Paar Lateralversprüngen und zwei Paar verschiedenartigen kegelförmigen Dorsalvorsprüngen. Vor jedem Anterodorsalvorsprung eine kräftige, kurze, spitze Borste. Die beiden kurzen Analvorsprünge haben separate Stämme.

### Phylidorea (Euphylidorea) nigronotata (Siebke)

*Limnobia nigronotata* Siebke, 1870: 305.
*Phylidorea* (*Macrolabina*) *nigronotata* (Siebke); Savtshenko, 1986 a: 20.

Verbreitung: Nord- und Mitteleuropa, Sibirien, Zentralasien (Savtshenko 1986 a).

Material: 3 ♂. Lubrzanka-Fluss: Marzysz, 1 Larve: 01.iv.1982 gesammelt, 13.iv.1982 ♂ verpuppt. Grabia-Fluss: Zamość, 1 Larve: 07.iv.1982 gesammelt, 13.iv.1982 ♂ verpuppt: Zimne Wody, 1 Larve: 06.v.1983 gesammelt, 08.v.1983 ♂ verpuppt.

Die Larven des 4. Stadiums 15—20 mm lang. Ihr Körper ist sehr zart und schillernd behaart. Das vorletzte Segment ist — wie bei allen *Phylidorea*-Arten — angeschwollen.

Die Analpapillen sind lang und sehr faltig. Alle vier Randlappen sind lang und schlank, die Laterallappen erreichen zwei Drittel der Ventrallappenlänge. Randlappen mit sehr blass pigmentierten Streifen und ziemlich langer Randbehaarung.

Die Kopfkapsel ist 1,7—1,8 mm lang und schwach sklerotisiert.

Antennen (Fig. 3c): Basalglied 51,2—73,4 µm lang, 23,9—26,7 µm breit; Apikalglied fein gestreift, 37,0—47,8 µm lang, 8,0—9,7 µm breit. Sockel besonders gross, breit und sklerotisiert. Im Proximalteil des Basalglieds ein Porus; auf der Distalfläche zwei geringe, untersetzte Sensillen und eine starke steife Borste, die etwas kürzer als das Apikalglied ist.

Clypeolabrum (Fig. 4c): 133,7—140,5 µm lang, 263,1—260,6 µm breit, ziemlich stark sklerotisiert. Lateralränder mit stark sklerotisierten "Flügelchen". Am Vorderrand (Fig. 5e) median zwei stark sklerotisierte Plättchen von unregelmässiger Form zum Vorderrand hin hochgebogen, mit ausgefransten Oberkanten. Auf diesen Plättchen je zwei Borsten: eine kurze steife und daneben eine lange schwanke. Symmetrisch zu den Seiten hin je zwei verschiedengebaute Sensillen: eine zylindrisch abgestumpft, mit breiter Basis, die andere zweigliedrig mit schmalern Basalglied. Und etwas weiter auf die Fläche gerückt stehen je zwei Sinnesgruben.

Epipharynx (Fig. 5f) auf der Ventralseite des

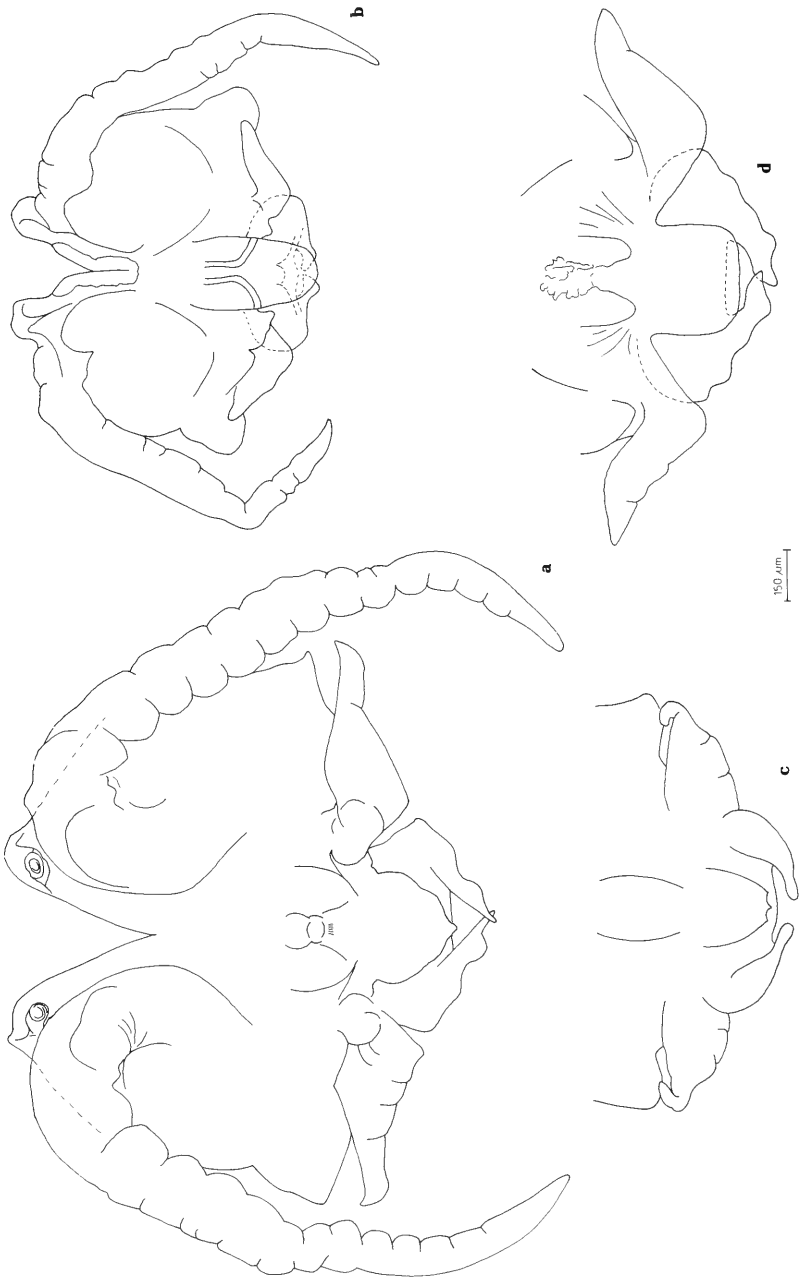


Fig. 9. Kopfscheiden der *Phyllodrea*-Puppen: a, *Ph. (Ph.) nigricollis*; b, *Ph. (Ph.) squalens*; c, *Ph. (E.) nigronotata*; d, *Ph. (E.) fulvonervosa*.

Clypeolabrums gelegen. Ausgerüstet mit zwei Paaren zweigliedriger, verschiedenlanger, fingerförmiger Fortsätze. An deren Basis ein zartes Haarfeld. Auf den seitlichen Erhebungen steht je eine lange steife Borste.

Mandibeln (Fig. 6c, g): 302,7—315,7 µm lang, 115,5—135,4 µm breit. Die schmale Klinge am Innenrand des Apikalzahns ist mehr als halb so lang wie der Apikalzahn. Der zweite und dritte Zahn sind schmal, mit fast parallelen Rändern. Der vierte Zahn ist kegelförmig, an der Spitze abgestutzt, ziemlich kräftig entwickelt. Die Kanalmündungen liegen an der Basis des zweites Zahns und etwas unterhalb des kleinen fünftes Zahns.

Maxillen (Fig. 7c): etwa 450—500 µ lang und

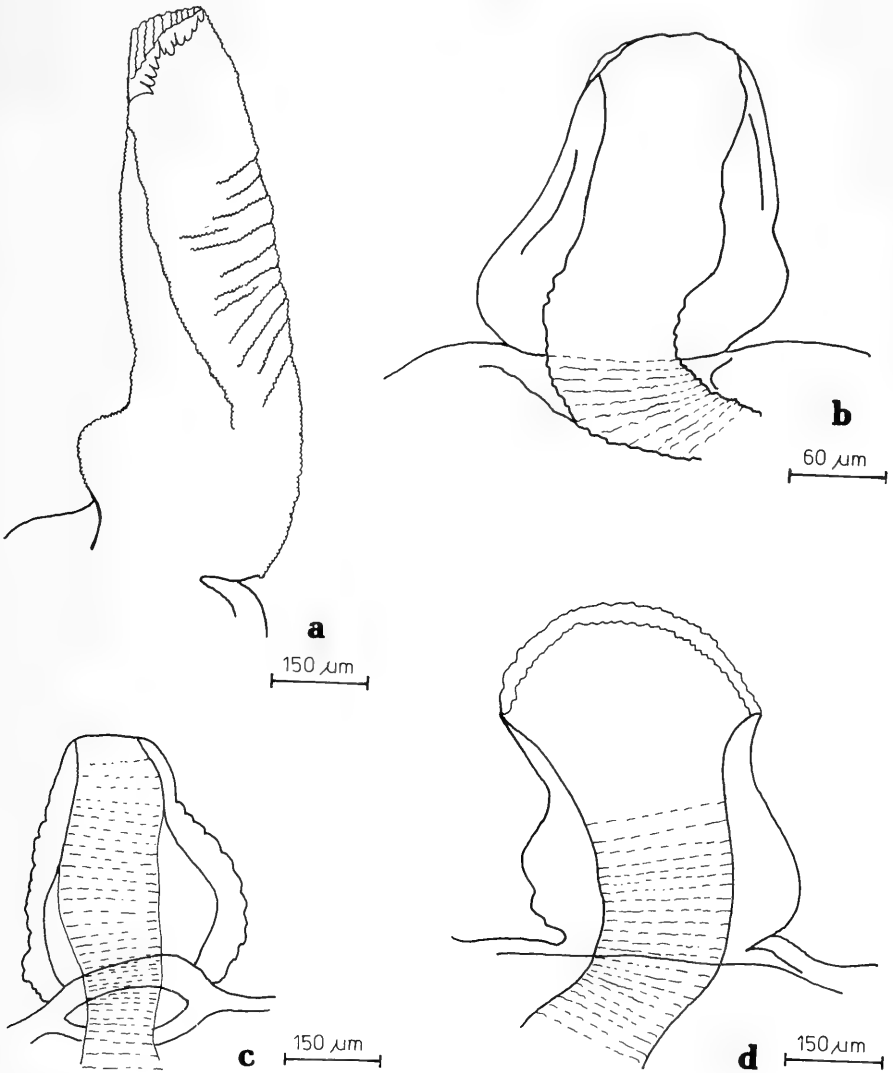


Fig. 10. Pronotalhörner der *Phylidorea*-Puppen: a, *Ph.* (*Ph.*) *nigricollis*; b, *Ph.* (*Ph.*) *squalens*; c, *Ph.* (*E.*) *nigronotata*; d, *Ph.* (*E.*) *fulvonervosa*.

etwa 130 µ breit, lang und schlank. Der dunkel sklerotisierte Keil, der den häutigen Apikalteil stützt, ist sehr lang.

Hypopharynx (Fig. 8d, g): Querbrücke 26,7—50,6 µm lang, 156,5—162,7 µm breit; Lateralarm 176,4—190,6 µm lang, 129,7—138,8 µm breit. Die Querbrücke ist oval mit biskuitförmig verbreiterten Enden. Der Lateralarm ist sehr unregelmässig geformt. Die Höhe der Labialpalpen misst 13,1 µm und die der Papillen 12,5 µm; die Entfernung zwischen den Labialpalpen beträgt 43,8 µm.

Hypostomium nicht entwickelt.

Die Puppe ist dunkelbraun und etwa 17 mm lang. Der Kopf wirkt ziemlich schmal im Verhältnis zum Körper. Die Mundgliedmassenscheiden sind in Fig. 9c abgebildet. Die Labralscheide (Breite etwa 250 µm) ist im vorderen Teil etwas verengt; ihre leicht konkav gebogener Rand reicht nicht an die Basis den Labialtaster heran. Die Maxillentasterscheiden (Länge etwa 470 µm) sind an der Basis breit, bauchig und im Distalteil stark verschmälert. Die Labialtasterscheiden (Länge etwa 300 µm) sind untersetzt, keulenförmig.

Die Pronotalhörner (Fig. 10c) sind schwach sklerotisiert, so dass Tracheenstamm und Atmungskammer durchscheinen. Ihre Form ist kegelstumpfartig, im Durchmesser sind sie an der Basis rund, zum Apikalteil hinabgeflacht oval, die Spitze ist abgestumpft. Ihre Länge beträgt etwa 450 µm.

Die Flügelsscheiden reichen bis zum Ende des 2. Abdominalsegments, die Beinscheiden fast bis zum Ende des 3. Segments.

Die Musterung auf den Abdominalsegmenten

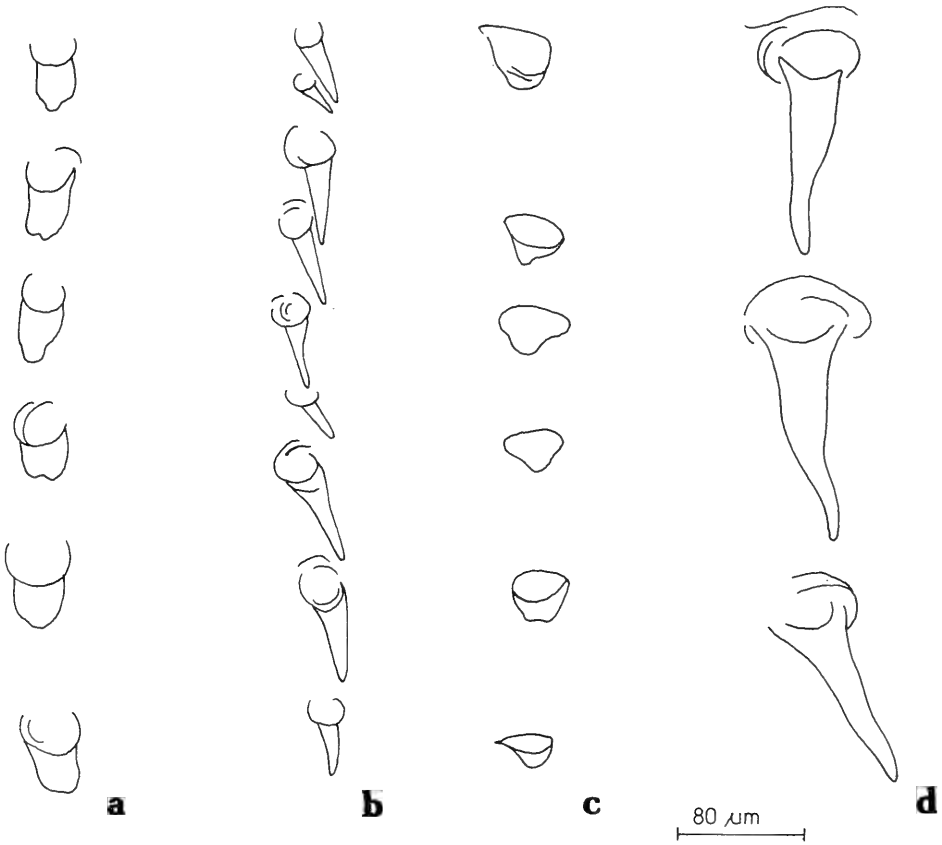


Fig. 11. Kutikulare Oberflaächenstruktur von *Phylidorea*-Puppen: a, *Ph.6Ph.*) *nigricollis*; b, *Ph.* (*Ph.*) *squalens*; c. *Ph.* (*E.*) *nigronotata*; d, *Ph.* (*E.*) *fulvonervosa*.

ist unterschiedlich. Auf den Tergiten ist nur jeweils eine Reihe Plättchen am Distelrand deutlich zu erkennen. Auf den Sterniten ist die übliche Musterung in Form von Rechtecken ausgebildet. Die Plättchen sind breit, ziemlich flach und unterschiedlicher Grösse (Fig. 11c). Nahe der Distalränder sind sie gross und stehen recht dicht in Reihen, auf der übrigen Fläche sind nur einzelne Plättchen anzutreffen. Am Distalrand des vorletzten Abdominalsegments stehen grosse, starke, dicht nebeneinander ansetzende Dornen; ein kleineren Dorn auch imm Distalteil jedes Pleurits.

Analsegment ♂ (Fig. 12c) ist lang und schlank. Lateralvorsprünge fehlen. Die Dorsalvorsprünge sind kegelförmig: die Anterodorsalvorsprünge kleiner, die Posterodorsalvorsprünge grösser. Zwischen den Anterodorsalvorsprüngen liegt eine nicht allzugrosse sklerotisierte Erhöhung mit zwei Larvalstigmenresten. Die Analvorsprünge sind lang, schlank, scharf zugespitzt und gehen von einem gemeinsamen Stamm aus. Die Spitzen aller Vorsprünge sind schwarz pigmentiert.

### Phylidorea (Euphylidorea) fulvonervosa (Schumm.)

*Limnobia fulvonervosa* Schummel, 1829: 164.
*Limnophila fulvonervosa* (Schumm.): de Meijere, 1921: 82.

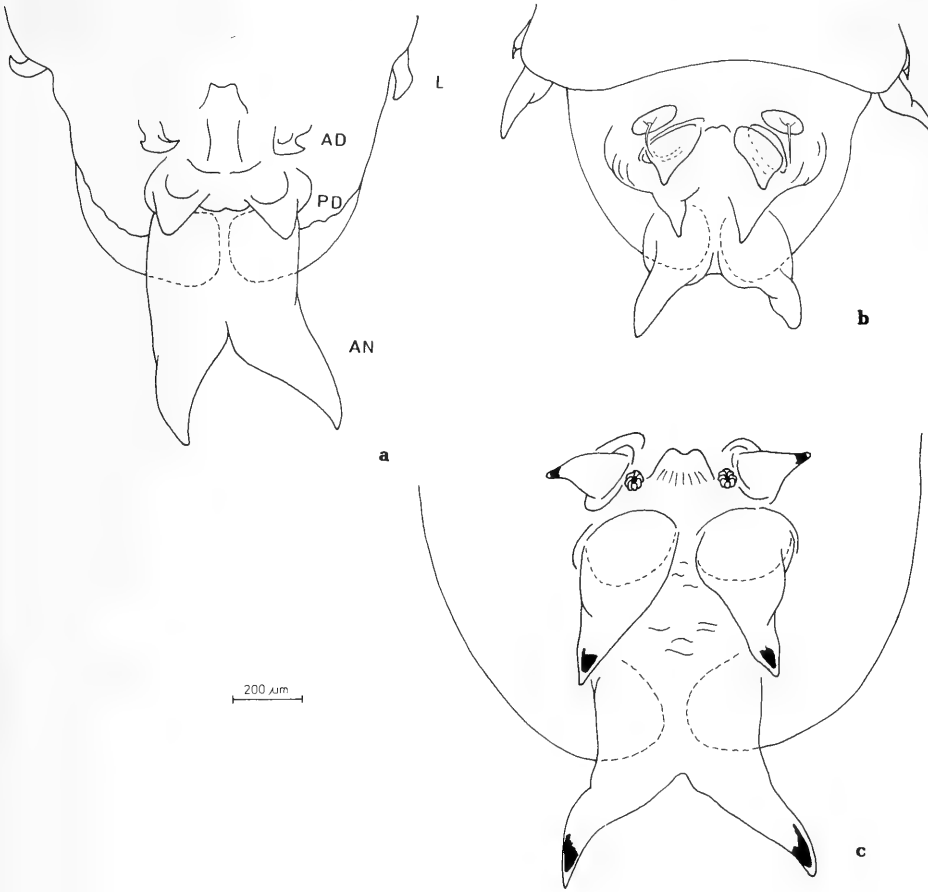


Fig. 12. Analsegment ♂ der *Phylidorea*-Puppen. Dorsalansicht. a, *Ph.* (*Ph.*) *nigricollis*; b, *PH.* (*Ph.*) *squalens*; c, *Ph.* (*E.*) *nigronotata.*

*Limnophila* (*Phylidorea*) *fulvonervosa* (Schumm.); Starý, 1970: 145.
*Phylidorea* (*Paraphylidorea*) *fulvonervosa* (Schumm.); Savtshenko 1986b: 290.
Praeimaginalstadien:
*Limnophila* (*Phylidorea*) *fulvonervosa* (Schumm.); Brindle & Bryce, 1960: 217, Fig. 13 (Analsegment und Antenna); Brindle, 1967: 199, Fig. 46 (Analsegment).

Verbreitung: Europa (Starý 1970; Savtshenko 1986 b).

Material: 2 ♂, 1 ♀. Lubrzanka-Fluss, Zagnańsk-Jaworze: 1 Larve: 12.xi.1981 gesammelt, 08.xii. 1981, ♂ verpuppt; 1 Larve: 23.iv.1983 gesammelt, 04.v.1983, ♀ geschlüpft; 1 Larve: 23.iv.1983 gesammelt, 09.v.1983, ♂ verpuppt.

Lärvenlänge des 4. Stadiums 15—20 mm. Körperbehaarung sehr zart, fast unsichtbar. Ventrallappen lang, mit langer Randbehaarung und breit gestreuten Pigmentstreifen. Die Laterallappen sind kurz, etwa halb so lang wie die Ventrallappen.

Die Kopfkapsellänge beträgt etwa 1,6 mm.

Antennen (Fig. 3d): Basalglied 52,9—55,2 µm lang und 25,6—29,6 µm breit; Apikalglied 33,6—37,6 µm lang und 5,1—9,1 µm breit, deutlich gestreift. Auf der distalen Fläche des Basalglieds, nahe am Anzatz des Apikalglieds, stehen eine Papille und eine lange, steife Borste (Länge 65,4—68,3 µm). An der Basalgliedbasis ist ein Porenring auf der Innenfläche der Antenne zu erkennen.

Clypeolabrum (Fig. 4d): 158,2—194,6 µm lang, 245,2—261,2 µm breit, trapezeförmig. "Flügelchen" fehlen. Am Vorderrand (Fig. 5g) in der Mitte eine stark sklerotisierte Erhöhung, symmetrisch zu den Seiten hin je eine lange, schwanke Borste, je eine spitze Dorne und je zwei flache Papillen: eine spitzlanzettförmige und eine fingerförmige. Etwas weiter hinten lateral je zwei Sinnesgruben.

Epipharynx (Fig. 5h) mit zwei Paar zweigliederiger Papillen: die Papillen des ersten Paares sind grösser als die des zweiten. Lateral stark sklerotisierte Erhöhungen mit kurzer Behaarung. Am inneren Rand beider Erhöhungen eine kurze, steife Borste.

Mandibeln (Fig. 6d, h): 290,2—352,8 µm lang, 128,0—143,4 µm breit. Die helle Klinge am Innenrand des Apikalzahns ist ziemlich kurz; sie erreicht nicht die Hälfte der Apikalzahnlänge. Zweiter und dritter Zahn sind blattförmig (bei den einzelnen Exemplaren unterschiedlich ausgeprägt). Die Kanalmündungen liegen an der Basis des drittes Zahns und dicht unter dem fünften Zahn. Auf der Aussenfläche der Mandibel, nahe an ihrer Basis, inseriren zwei schwanke, unterschiedlich lange Borsten.

Maxillen (Fig. 7d): etwa 480 µm lang und 150 µm breit. Im Apikalteil ein, zwei oder drei keilförmige Sklerotisierungen, die den unregelmässig geformten, membranösen Teil verstärken.

Hypopharynx (Fig. 8e, h): Querbrücke 35,3—63,7 µm lang, 130,9—148,5 µm breit; Lateralarm 245,8—270,8 µm lang, 134,3—150,2 µm breit. Die Querbrücke ist unregelmässig geformt, in der Mitte mit einer tiefen, schwach sklerotisierten Vertiefung. Der Lateralarm ist platt, im Mittelteil stark sklerotisiert, verstärkt durch parallele Leisten. Die Höhe der Labialpalpen beträgt 41,5—49,5 µm, ihre Entfernung voneinander 56,9—64,3 µm. Die Höhe der Papillen beträgt 10,2—11,2 µm.

Hypostomium nicht entwickelt.

Die Puppe ist hellbraun. Die Länge einer weiblichen Puppe beträgt etwa 17 mm. Die Mundgliedmassenscheiden sind in Fig. 9d dargestellt. Die Labralscheide ist breit 344 µm, fast quadratisch mit sanft gerundeten Ecken und etwas unter die Labialtasterbasis gezogen. Die Maxillentasterscheiden (Länge: etwa 630 µm) sind an der Basis eng, im Mittelteil deutlich verbreitert und zum Distalteil hin sanft zugespitzt. Die Labialtasterscheiden (Länge: etwa 190 µm) wirken untersetzt; ihr Ansatz am Labium ist sehr breit, ihr Apikalteil hat eine charakteristische Gestalt — er gleicht einem Fuss in Seitenansicht.

Pronotalhörner (Fig. 10d) etwa 600 µm lang, kelchförmig, an der Basis rund, im Apikalteil abgeflacht. Die Atmungsspalte ist sehr breit, halbkreisförmig, Atmungskammer und Tracheenstamm scheinen durch.

Die Flügelscheiden reichen bis zum Ende des 2. Abdominalsegments, die Beinscheiden fast bist zum Ende des 3. Segments.

Die abdominalen Tergite und Sternite sind mit langen, spitzen, markant breit ansetzenden Dornen bedeckt (Fig. 11d), die eine regelmässige Rechteck-Musterung bilden. Am dichtesten stehen die Dorne im capitad weisenden Teil jedes Rechtecks. Lateral, an Tergiten und Sterniten entlang, ziehen sich unregelmässige, längliche dunkelbraune Flecke hin.

Die Abdominalspitzen der männlichen Puppenexuvien sind bei der Aufzucht leider verlorengegangen.

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*Anschrift des Verfassers*: *Dr Jolanta Wiedeńska, Instytut Biologii Środowiskowej, Uniwersytet Lódzki, 90—237 Lódź, ul. Banacha 12/16, Polen.*

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# A REVISION OF WESTERN PALAEARCTIC OXYTORINE GENERA. PART VI. (HYMENOPTERA, ICHNEUMONIDAE)

by

G. VAN ROSSEM
*Berkenlaan 25, Ede, The Netherlands*

## Introduction

A taxonomic guide and a key to the genera of the Oxytorinae was given by Townes (1971). A generic key to the Palaearctic Oxytorinae was published by Van Rossem (1982). Almost all the type-species of the genera are specified by Townes (1971). This part of the revision of western European Oxytorinae includes a survey of the genus *Hemiphanes* Förster together with the record of three new species, viz., *H. hortense*, *H. inusitatum* and *H. montanum*.

The genus *Apoclima* Förster is re-introduced with the description of one new species, *A. haeselbarthi*.

One new species of *Pantisarthrus* Förster is described, *P. gracilis*.

The Förster (1871) and Thomson (1888) type material of the genus *Plectiscidea* Viereck was studied. Two new subgenera, *Plectiscidea* and *Fugatrix*, are introduced and five new species, *P. indomita*, *P. foersteri*, *P. substantiva*, *P. blandita* and *P. ventosa* are proposed. *Plectiscidea nemorensis* is a nomen novum for *Ephalmator subsimilis* Van Rossem. The *Plectiscidea* species described from males by Förster l.c. are regarded as species inquirendae, for at present it is impossible to find the matching females.

The name *Gnathochorisis* Förster, 1869, takes priority over *Laepserus* Förster, 1869. *Gnathochorisis crassulus* (Thomson), that was presumed (Van Rossem, 1980) to be a colour from of *Gnathochorisis dentifer* (Thomson), is now considered to be a separate species.

A new approach to the genus *Eusterinx* Förster is presented with the recognition of six new subgenera.

Of the genus *Helictes* Haliday a revision of the type material, males only, is published, including two newly described species, *H. incongruens* and *H. fabularis*. At present the recognition of the females is not possible.

The name of the genus *Phosphorus* Van Rossem, 1980, is preoccupied. It is proposed to replace it by *Phosphoriana* nomen novum.

A new species is introduced in the genus *Proeliator* Van Rossem: *P. invictus*.

Of the genera *Oxytorus*, *Cylloceria* and *Megastylus* type material has become available, which allowed me to make some remarks.

## Materials and methods

All observations were made with a Zeiss binocular compound microscope. The length of the front wing was measured with the ocular micrometer at 10 X enlargement. The length of the ovipositor was taken from the apex of the gaster.

For the terms used, see Townes (1969: 36—48).

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## Genus **Hemiphanes** Förster

*Hemiphanes* Förster, 1871: 101—102.
*Hemiphanes*; Townes, 1971: 184—185.
*Hemiphanes*; Van Rossem, 1980: 85—88.

The species described below include three hitherto unknown. I regret that I have only one specimen of each, two of them in rather poor condition. I consider the gender of *Hemiphanes* to be neuter.

Key to *Hemiphanes* males
(The male of *H. montanum* is unknown)

1. Hind aspect of head deeply concave ..... 2
— Hind aspect of head not concave ..... 3
2. Tyloids on flagellar segments 9—12. Occipital carina interrupted. Postpetiole striate ... ..... *H. gravator* Förster
— No tyloids present. Occipital carina not present. First tergite with different longitudinal sculpture ... *H. hortense* spec. nov.
3. Postanellus conspicuously stout, 3.0 times as long as apical width. No tyloids present ..... *H. inusitatum* spec. nov.
— Postanellus not stout, 5.0—7.6 times as long as apical width ..... 4
4. No tyloids present. Nervulus opposite basal vein ..... *H. townesi* Van Rossem
— Tyloids on flagellar segments 9—10 (or 9—11), running over the whole length of the segment. Nervulus slightly basally of basal vein ..... *H. flavipes* Förster

Key to *Hemiphanes* females
(The females of *H. gravator*, *H. hortense* and *H. inusitatum* are unknown)

1. Apical margin of clypeus with a deep median semicircular notch. Upper and lower teeth of mandible equal in length ..... ..... *H. montanum* spec. nov.
— Apical margin of clypeus only weakly indented. Lower tooth of mandible shorter than upper ..... 2
2. Lateral lobes of mesoscutum with close adpressed hairs. Gaster more fuscous, with yellowish spots medially on tergites two and three ..... *H. townesi* Van Rossem
— Lateral lobes of mesoscutum hairless except for some hairs proximally and laterally. The gaster from tergite three yellow ..... ..... *H. flavipes* Förster

### **Hemiphanes flavipes** Förster

*Hemiphanes flavipes* Förster, 1871: 101.
*Hemiphanes flavipes;* Van Rossem, 1980: 86.

Characteristics of the male: Front wing 4.5—5.3 mm. Mandible yellow, lower tooth shorter than the upper. Clypeus yellow, margin truncate. Anterior tentorial pits open. Antenna long, reaching length of body, scape rather swollen, pedicel large, yellow. Tyloids on flagellar segments 9—11. Postannellus 5.2—6.0 times as long as apical width. Apical corners of prothorax and tegulae yellow. Front parts of notauli deep. Median lobe of mesoscutum with adpressed hairs, lateral lobes polished. Epomia present. Apex of scutellum with some rough sculpture. Propodeum with apical transverse carina strong. Basal transverse carina absent. Median longitudinal carinae present. Front wing without areolet. Nervelus placed basally of basal vein. Nervellus about vertical, intercepted low, discoidella present. Legs, including coxae, yellow, hind coxae comparatively large. Hind femur 5.0—5.7 times as long as wide in the middle, rather short and slender. First gastral segment wide towards apex, end of first sternite and spiracles situated in the middle.

Characteristics of the female: Front wing 5.4—6.0 mm. Clypeus 2.0 times as wide as long. Postanellus 8.0 times as long as apical width. Gena, temple and vertex polished. Occipital carina closed. Pronotum for the greater part polished, epomia weak, with some parallel running ridges. Notauli running beyond centre of mesoscutum. Mesopleurum polished, prepectal cari-

na reaching subtegular ridge. Lateral parts of first tergite with longitudinal striation and with some continuation on tergite two. Following tergites polished. Ovipositor slightly protruding beyond tip of gaster. Gaster rather depressed towards apical part. Otherwise as the male.

Distribution. — Germany. Sweden up to Lapland (Van Rossem, 1980).

### **Hemiphanes gravator** Förster

*Hemiphanes gravator* Förster, 1871: 102.
*Hemiphanes gravator;* Van Rossem, 1980: 86.

The female is unknown.

Characteristics of the male: Front wing 4.0—5.0 mm. Mandible yellow, the lower tooth shorter and narrower than upper. Apical margin of clypeus yellow, truncate. Anterior tentorial pits open. Face rather protuberant below the antennal base (more than in *H. flavipes*). Hind aspect of head deeply concave. Occipital carina interrupted. Scape ventrally yellow. Postannellus 5.0—6.0 times as long as apical width. Tyloids situated on flagellar segments 9—12. Notauli present. Scutellum flat, closely punctured. Wing without areolet. Nervulus somewhat distally of basal vein. Legs, including coxae, yellow. Hind femur 4.7—6.0 times as long as wide. Propodeum with only apical transverse carina present, more smoothly sculptured than in *H. flavipes*. First gastral segment wide towards apex, postpetiole striate, with yellow spot. Sternite in front of the middle. Second tergite striate, with brown spots laterally.

Distribution. — Austria. Germany. Sweden (Van Rossem, 1980).

### **Hemiphanes townesi** Van Rossem

*Hemiphanes townesi* Van Rossem, 1980: 86—87.

Characteristics of the male: Front wing about 5.8 mm. Mandible whitish, teeth brown. The lower tooth about 0.5 times shorter than upper. Clypeus about 2.4 times as wide as long, whitish to brownish, convex, margin truncate. No groove between clypeus and face. Face below antennal sockets closely punctured, with adpressed long, silvery hairs. Malar space wide, about 1.5 times the width of mandibular base, polished. Scape globular, pedicel large, whitish to brownish. Postannellus slender, about 8.0 times as long as apical width. Antenna without tyloids. Frons, vertex, temple and gena polished. Frons not concave. Pronotum polished, epomia present. Mesoscutum with close adpressed hairs. Scutellum punctured, apex with rough sculpture. Propodeum with irregular sculpture, the median longitudinal and lateral longitudinal carinae proximally obliterated. Apical transverse carina strong, medially developed into a keel, lying near to apex of propodeum. The minute propodeal spiracles circular. Dorsal rim of metanotum with a triangular projection, lying opposite the front end of lateral longitudinal carina. Mesopleurum polished, prepectal carina present. Front wing without areolet. Nervulus lying slightly distally of basal vein. Nervellus intercepted low, the discoidella running almost to wing margin. Coxae and legs whitish to light brown. First tergite with rough sculpture, spiracles at 0.40 of the length, end of first sternite at 0.30 of the length of the segment. Front half of second tergite with longitudinal striation and coriaceous sculpture. Apical half with weak striation and a median yellow brown spot. Following tergites more polished. Third and fourth tergite with yellow brown area. Apical part of gaster depressed.

Characteristics of the female: Front wing about 4.5 mm. Otherwise as the male. First tergite with close longgitudinal striation. Ovipositor not protruding beyond tip of gaster.

Distribution. — China, Shaowu Hsien, 1200—1500 m altitude (coll. Townes).

### **Hemiphanes hortense** species nova

Characteristics of the holotype (♂, Netherlands, Asperen (Prov. Zuid-Holland), 8.vi.1973, leg. and coll. C. J. Zwakhals): Front wing 2.8 mm. Head fuscous. Mandible yellowish brown, the lower tooth slightly the longer. Clypeus flat, rather protruding, the margin truncate. Clypeus and face, frons, vertex and gena coriaceous. Hind aspect of head deeply concave (seen from dorsal side V-shaped), occipital carina absent, lower part of genal carina present. Postannellus as long as second flagellar segment, slender. No tyloids present. Epomia absent. Notauli strong to about middle of mesoscutum. Mesoscutum, scutellum, and propodeum coriaceous. Propodeum with only apical transverse carina and pleural carina present. Mesopleurum coriaceous, prepectal carina weak but reaching the margin. Nervellus intercepted about in the middle, discoidella very weak. Legs including middle and hind coxae, yellowish brown, long and very slender, especially the hind tibia. First ter-

gite with conspicuous longitudinal sculpture. Second tergite with weak longitudinal sculpture. Gaster fuscous.

Material examined. — The holotype only.

**Hemiphanes inusitatum** species nova

Characteristics of the holotype (♂, Italy, Prov. Bolzano, Sarntal, 1250 m, 1.vi.1977, leg. and coll. C. J. Zwakhals): Front wing 3.7 mm. Mandible (teeth reddish), clypeus and face yellow. Clypeus not protruding, short, about 3.6 times as wide as long. Hind aspect of head not concave. Occipital carina present and closed. Postannellus stout, 3 times as long as apical width. No tyloids present. Antenna light brown. Epomia absent. Mesoscutum coriaceous, notauli absent. Propodeum coriaceous, no carinae present except for stubs of median longitudinal carinae. Lower part of mesopleurum coriaceous, upper part polished. Prepectal carina almost obsolete. Front and middle coxae white, hind coxae fuscous. Legs yellowish brown. First tergite 1.8 times as long as apical width, coriaceous. Gaster fuscous, second tergite with brownish apical band.

Material examined. — The holotype only.

The specific name is from the Latin "inusitatus", meaning "uncommon" or "unusual".

**Hemiphanes montanum** species nova

Characteristics of the holotype (♀, Austria, T., Niederthai Gubener Hütte, 2000 m, 1.ix.1979, leg. and coll. Haeselbarth): Front wing 4.7 mm. Mandible yellowish, teeth brown, of the same length. Clypeus yellow, the apical part depressed and with a deep median semicircular indentation, the side parts of which stand out flap-like. Malar space as wide as base of mandible. Head entirely coriaceous, excepting the clypeus. Flagellum yellowish, postannellus slender, 7.0 times as long as apical width. Epomia absent. Mesoscutum coriaceous, notauli present towards margin, shallow. Scutellum and propodeum coriaceous. Pleural carina present. Median longitudinal carina present only towards base of propodeum. Mesopleurum coriaceous and weakly striated. Prepectal carina strong, reaching the margin. Nervulus distad of basal vein. Nervellus not intercepted. Discoidella absent. All coxae fuscous. Second trochanter of all legs pale in colour. Front and middle legs brownish, hind femur fuscous. Front femur stout, middle and hind femur more slender. Left middle leg missing beyond femur. In the specimen the right hind leg missing beyond coxa; also tarsi of left hind leg missing beyond basitarsus. First tergite coriaceous, rather wide apically, about 1.6 times as long as apical width. A conspicuous pit at base of petiole between the median dorsal carinae. Following tergites coriaceous, with a yellow brown band medially from apical margin of tergite two. Ovipositor not projecting beyond tip of gaster.

Material examined. — The holotype only.

Genus **Oxytorus** Förster

*Oxytorus* Förster, 1868: 199.
*Oxytorus;* Townes, 1971: 185.
*Oxytorus;* Van Rossem, 1980: 88.

Type-species: *Oxytorus armatus* Thomson, 1883.

**Oxytorus luridator** (Gravenhorst)

*Ichneumon luridator* Gravenhorst, 1820: 379.
*Oxytorus luridator;* Van Rossem, 1980: 90.
*Atractodes properator* Haliday, 1838: 120.
*Oxytorus luridator;* Fitton, 1976: 332.

Characteristics of the lectotype of *Atractodes properator* Haliday. Labels: a printed label "England?"; a label "Haliday, 20.2.82"; a label "named by Claude Morley *Atractodes properator* Hal, Type, vi.193"; a circular label with red margin "Type CM"; a small label illegible; lectotype label Fitton, 1975. National Museum of Ireland, Dublin. Female. The specimen represents *Oxytorus luridator* (Gravenhorst).

**Oxytorus luridator** (Grav.)
forma **nigricoxa** Kiss von Zilah

*Callidiotes luridator* (Grav.) forma *nigricoxa* Kiss von Zilah, 1924: 118.

The two syntypes (Transylvania, Borosjenö, leg. Diöszeghy) are labelled as males, but both are females. They show fuscous coxae which is in fact a male character. The specimens are kept in the Természettudományi Múzeum, Budapest. I thank the curator Dr J. Papp for sending them to me.

Note. — In the description of *O. luridator* (Van Rossem l.c.) there is a wrong description of the mesopleural sculpture: "transverse" ridges should be "longitudinal" ridges.


Figs. 1, 2. Base of male entenna. 1, *Apoclima signaticorne* Förster, left antenna (right one broken); 2, *A. haeselbarthi* spec. nov., right antenna. Enlargement, ca 80 X.

## Genus **Apoclima** Förster

*Apoclima* Förster, 1871: 97—98.
*Apoclima;* Townes, 1971: 191—192.
*Apoclima;* Van Rossem, 1980: 97—98.

In Dr E. Haeselbarth's material I found an *Apoclima* male which I compared with the holotype of Förster's *Apoclima signaticorne*. The latter has a weak projection on segment three of the flagellum that merely delineates the notch of the segment (fig. 1). In Haeselbarth's specimen, which undoubtedly is another species, the projection is strong and toothlike (fig. 2).

### Key to *Apoclima* males

1. Third flagellar segment notched on apical half, the base of fourth flagellar segment somewhat notched (the tyloids). The third flagellar segment with a weak projection below the tyloid at the apex of which two bristles (fig. 1)..... *A. signaticorne* Förster
— Third flagellar segment notched on apical half (the tyloid), the base of fourth flagellar segment scarcely notched. The third flagellar segment with a strong tooth below the tyloid at the apex of which two minute hairs (fig. 2)..... *A. haeselbarthi* spec. nov.

### **Apoclima haeselbarthi** species nova

Characteristics of the holotype of *Apoclima haeselbarthi* (♂, Germany, Bayern, Oberammergau, Laber, 1400—1600 m, 5.ix.1980, leg. and coll. Haeselbarth (München)): Front wing 3.5 mm. Palpi brown. Lower margin of mandible turned inwards. Clypeus convex, coriaceous as malar space, face and vertex. Malar space and gena wide. Occipital carina widely interrupted medially. Occiput not so strongly curved inwards as in *A. signaticorne*. Antenna brown, including scape and pedicel tips missing in specimen. Pedicel large. Third flagellar segment notched on apical half (the tyloid). Base of fourth flagellar segment very weakly notched. The third flagellar segment with a strong tooth below the tyloid, at the apex with two minute hairs. Epomia present. Mesoscutum coriaceous, with notauli vaguely meeting in centre. Scutellum with weak carina running towards apex. Propodeum with irregular sculpture, apical transverse present, other carinae not strongly developed. Mesopleurum polished. Prepectal carina rather underdeveloped, not reaching margin. Front wing without areolet, with two bullae. Portion of cubitus between intercubitus and second recurrent vein 0.3 of the length of recurrent vein. Nervellus inclivous. Discoidella present. Legs brownish. Claws of front legs and left hind leg missing beyond femur in the specimen. Femora stout. All coxae fuscous and with long erect hairs. First tergite coriaceous, about 1.1 times as long as apical width, glymma present, median dorsal carina strong to about 0.75 of length. Dorsolateral carina strong, the spiracles protruding. The dorsal profile of first tergite strongly convex in the middle. Apex of first sternite in front of the middle. Second tergite for the greater part coriaceous. The entire gaster fuscous, except for vague brownish apical margin of tergite two. All tergites, except the first, with conspicuous suberect hairs.

Female unknown.

Material examined. — The holotype only.

I name this species after Erasmus Haeselbarth (München) who contributed his extensive Oxytorine material.

### **Apoclima signaticorne** Förster

*Apoclima signaticorne* Förster, 1871: 97—98.
*Apoclima signaticorne;* Van Rossem, 1980: 97—98.

Characteristics of the male. Length front wing 3.2 mm. The third flagellar segment notched on apical half, the base of fourth flagellar segment somewhat notched (the tyloids). The third flagellar segment with a weak projection below the tyloid, at the apex of which there are two bristles (fig. 1). Pedicel large. Postannellus 3.7 times as long as wide. Postocciput concave, occipital carina interrupted. First tergite wide and short. Apex of sternite and spiracles in front of the middle. Glymma present. Median dorsal carina not reaching the spiracles.

Characteristics of the female. Length of front wing 3.4 mm. Pedicel large. Flagellum slender, postanellus 4.0 times as long as wide. Postocciput rather concave. Occipital carina widely interrupted. Portion of cubitus between intercubitus and second recurrent vein 0.36 of the length of recurrent vein. Nervellus vertical, intercepted below the middle, front part of discoidella present. First tergite 1.4 times as long as apical width, coriaceous. Glymma weak. Median dorsal carina not reaching the spiracles, the latter at 0.32 of the length. Basal half of second tergite coriaceous. Ovipositor about the length of hind tibia beyond tip of gaster, apex somewhat upcurved, no dorsal notch present, the tip acuminate.

Distribution. — A very rare species. In total four specimens are registered; the male holotype is from Aachen (coll. Förster), a female from Blankenburg (Thüringen) (coll. Schmiedeknecht) and a male and female from Wiesen (Spessart) (Germany) (both coll. Haeselbarth).

## Genus **Cylloceris** Schiødte

*Cylloceria* Schiødte, 1838: 140.
*Cylloceria;* Townes, 1971: 192.
*Cylloceria;* Van Rossem, 1980: 98—107.

One undescribed species (*Cylloceria invicta*) is inserted. The lectotype of Gravenhorst's *Tryphon sylvestris* was brought to light. It proved to be the same as *Cylloceria striolata* (Hellén). The type specimen of *Lissonota occupator* Gravenhorst, 1829, is lost.

Key to females
(The female of *C. suerinensis* (Brauns) is unknown)

1. Frons with rough sculpture. Nervellus intercepted below the middle, upper part inclivous, lower part reclivous. Dorsolateral carina of the first tergite running to the spiracles. Second to fourth tergite orange, polished. Basal half of second tergite with some rough longitudinal wrinkling laterally. Ovipositor about the length of hind tibia ..... *C. langei* (Brauns)
— Frons polished or with fine sculpture or with regular longitudinal striation. Combination of characters not as above ..... 2
2. The last joint of flagellum conspicuously swollen. Second tergite with fine longitudinal striation. Ovipositor 0.34 of length of front wing ..... *C. borealis* (Roman)
— The last joint of flagellum not swollen ... 3
3. Mandible and clypeus yellow. Head and mesoscutum polished, without punctures. Hind femur fuscous. Nervellus intercepted deeply below the middle. Ovipositor about 0.46 of length of front wing ..... ..... *C. alpigena* (Strobl)
— Clypeus not yellow. Hind femur orange or yellow ..... 4
4. All coxae and femora orange ..... 5
— Alle coxae fuscous ..... 6
5. Mesopleurum polished, widely and finely punctured. Some striation may be present in the lower hind corner below the speculum and some below the subtegular ridge. Frons polished or with indistinct coriaceous sculpture. Ovipositor 0.50—0.67 of length of front wing ..... ..... *C. caligata* (Gravenhorst)
— Mesopleurum with close longitudinal striation. Frons with regular longitudinal striation. Ovipositor 0.85 of length of front wing..... *C. invicta* spec. nov.
6. Apical half of second tergite and all following tergites orange . *C. fusciventris* (Hellén)
— Gaster fuscous ..... 7
7. Postannellus long, 9.6 times as long as apically wide. Ovipositor 0.9—1.0 as long as the front wing..... 8
— Postannellus shorter, 7.0—8.8 times as long as apically wide. Ovipositor 0.6—1.1 of the length of front wing..... 9
8. First and second tergite with very rough sculpture. Basal margin of third and fourth tergite with a rough band of sculpture.

Mesopleurum polished. Apical margins of tergites black. Postanellus long, 9.0 times as long as apically wide. Ovipositor 0.9 of length of front wing ..... *C. imperspicua* spec. nov.

— First tergite with regular and rather fine sculpture. Second tergite finely striated. Third tergite also showing striation. Mesopleurum polished. Postanellus 9.6 times as long as apically wide. Ovipositor 0.9—1.0 of the length of front wing ..... *C. sylvestris* (Grav.)

9. Postannellus 8.0—8.8 times as long as apically wide. Second tergite with fine sculpture, the base finely striated. Nervellus intercepted slightly below, or in the middle. Ovipositor 0.9—1.1 of the length of front wing..... *C. sylvestris* (Grav.)

— Postannellus 7.0 times as long as apically wide. Second tergite coriaceous. Nervellus intercepted slightly over the middle. Ovipositor about 0.6 of the length of front wing..... *C. melancholica* (Gravenhorst)

Key to males

(Males of *C. invicta* spec. nov., *C. alpigena* (Strobl) and *C. imperspicua* spec. nov. are unknown).

1. Frons with rough sculpture. Second to fourth tergite orange, polished..... *C. langei* (Brauns)

— Frons polished or with fine sculpture .... 2

2. All coxaeand all femora including front and middle tibiae orange ..... *C. caligata* (Gravenhorst)

— All coxae brown or black ..... 3

3. Flagellar segments four and five weakly notched. Third and following tergites polished ..... *C. suerinensis* (Brauns)

— Flagellar segments three and four notched ..... 4

4. Gaster from tergite two reddish to orange in colour. Second tergite coriaceous and with longitudinal wrinkling. The following tergites for the greater part polished ..... *C. fusciventris* (Hellén)

— Gaster fuscous ..... 5

5. Third segment of flagellum apically with a deep semicircular notch. The base of the notch is emphasized tooth-like. The basal half of segment four with a weak notch. Notauli meeting..... *C. borealis* (Roman)

— Third segment of flagellum apically with a semicircular notch, the base not emphasized tooth-like. The basal part of segment four with a weak notch ..... 6

6. Nervellus intercepted slightly below the middle. Second and third tergite with some longitudinal sculpture. Gena polished, widely punctured..... *C. sylvestris* (Gravenhorst)

— Nervellus intercepted over the middle. Second, third and fourth tergites without longitudinal wrinkling. The base of the second and third tergites with weak coriaceous sculpture. The apical margins of tergite two to five with brownish to orange colour. Gena polished, punctures absent..... *C. melancholica* (Gravenhorst)

**Cylloceria borealis** (Roman)

*Lampronota borealis* Roman, 1925, Arkiv för Zoologi 17 A (4): 20—21.

Characteristics of the lectotype of *C. borealis*. Female. Front wing 6.4 mm long. Palpi brown. Mandible and clypeus brown, the latter polished and 2.2 times as wide as long. Malar space wide, 0.33 of width face. Face, frons and vertex finely sculptured. The last joint of flagellum conspicuously swollen, a character not shown in other *Cylloceria* species. Postannellus 7.1 times as long as apically wide. Pronotum finely sculptured with some wrinkling. Mesoscutum with indistinct sculpture. Notaulus strong. Upper part of scutellum polished. Propodeum with rough sculpture, the longitudinal carinae strong. Mesopleurum for the greater part polished. Prepectus with sculpture. All coxae brown, other parts of legs orange-yellow to brown in colour. Claws strong. First tergite with rough, somewhat striated sculpture. The first abdominal segment robust, with a broad apical edge. Second tergite with fine longitudinal striation. Base of third tergite with longitudinal wrinkling, the further part polished. The apical tergites polished. Ovipositor 0.34 of length of front wing.

Characteristics of the male. Front wing 6.4 mm long. Palpi yellow. The sculpture of the head corresponding to that of the female. Third segment of the flagellum apically with a deep semicircular notch, emphasized tooth-like at base of notch. Basal part of segment four also with a weak notch. Pronotum with irregular sculpture. Mesoscutum almost polished, notauli strong, meeting. Propodeum roughly sculptured, the longitudinal carinae strong. Mesopleurum polished. Prepectal carina bending towards the margin. Coxae brown, other parts of

legs yellow in colour. Claws strong. First tergite with rough sculpture. Second and third tergite with longitudinal wrinkling. The broad apical margin of the third tergite polished. The apical tergites polished.

Material examined. — Sweden: female holotype and male paratype, Ångermanland, leg. C. Stål (coll. Roman, Naturhistoriska Riksmuseet, Stockholm). Lectotype label of Townes.

Distribution. — According to Roman (l.c.), the species is found in northern Sweden, Finland and the U.S.S.R., Siberia (Jenissei region) and Kamchatskaya. Three specimens, all females, were received on loan from the Leningrad Museum: 5 km N. Pusjkina, Leningrad, lesopoloça (forest area near Leningrad), leg. D. R. Kasparyan, 14.viii.1980; Romanovka (east of Baykal Lake), bliz Jamburga, 30.v.1905, leg. Barovskij; R. Nelgeche, berch. Verchojan, okr. 11—12.viii.1927, leg. Tkatsjenko.

### **Cylloceria caligata** (Gravenhorst, 1829)

*Phytodietus caligatus* Gravenhorst, 1829: 936.
*Lampronota crenicornis* Curtis, 1832: 407.
*Cylloceria crenicornis;* Fitton, 1976: 323.
Characteristics of the female lectotype of *Lampronota crenicornis*. Labels: a separate label: Haliday 20-2-82; lectotype label of Fitton (National Museum of Ireland, Dublin). The specimen has the characteristic orange coloured coxae.
*Chalinoceras mancus* Ruthe, 1855: 82.
*Cylloceria manca;* Fitton, 1978: 76.

Labels: Germany: Spandau (BMNH). The lectotype is a specimen of Cylloceria caligata. This was also suggested by Fitton.

Material examined. — Five specimens, all females, were received on loan from the Leningrad Museum: females, Sumuch ? Sumucha), 28.vii.1896, leg. K. Kokujeva (Western Siberia); Kurjat, 18.vi.1886, merig, leg. K. Jarosjevskago; Kurjat, 18.viii.1888, Na Zet poyl, leg. K. Jarosjevskago; Kurjat, 18.vi.1889, merig A. offic., leg. K. Jarosjevskago. 1 ♂, Bologoye, Valdajsk, v.vii.1907, leg. Zajtseez (400 km south of Leningrad).

Distribution. — The species occurs through-out the Palaearctic Region.

### **Cylloceria invicta** species nova

Characteristics of the holotype. Female. Front wing 8.8 mm long. Palpi brown. Mandible brown, medially with a light brown spot. Clypeus brown. Other parts of head black. Face longitudinally striated. Malar space with irregular sculpture, 0.34 of width face. Frons with regular, longitudinal striation. Occiput punctured. Gena more polished, but punctured towards genal carina. Antennal scape closely punctured. Postannellus 7.8 times as long as apically wide. Pronotum closely striated. Mesoscutum finely punctured, backwards and laterally indistinct. Notaulus strong, particularly towards base. Propodeum with regular and rough sculpture, the longitudinal carinae strong. Mesopleurum with close, longitudinal striation. (The mesopleurum in *C. caligata* is polished and punctured, which is a distinguishing character). Prepectal carina indistinct. Front coxae brown. Middle and hind coxae and other parts of legs orange, except for trochanters, hind tibia and tarsus. Nervellus intercepted over the middle. First tergite with regular and rather subtle sculpture. Spiracles at 0.38 of the length of the segment. Median dorsal carina developed to the spiracle. Second and third tergite finely coriaceous. Ovipositor 0.85 of length of front wing.

Material examined. — Female holotype from the Zoological Institute at Leningrad: U.S.S.R., Olenek, Yakutia, 67—689, viii.1874, leg. A. Czekanowski. It also bears a number: 74478.

"Invictus" is the Latin for "irrefutable", "immovable".

### **Cylloceria imperspicua** species nova

Characteristics of the holotype of *C. imperspicua*. Female. Front wing 8.22 mm long. Palpi brown. Basal half of mandible coriaceous and with strong punctures, apical part polished, teeth robust. Clypeus with vague coriaceous sculpture, 2.0 times as wide as long. Malar space wide, 0.37 of width of face. Face towards malar space polished. Medially, below antennal sockets a triangular protuberance with vertically wrinkled sculpture. Postannellus extremely long, 9.0 times as long as apically wide. Frons strongly concave. Vertex with fine coriaceous sculpture. Gena wide, polished. Pronotum medially wrinkled. Mesoscutum with strong notauli, these not meeting. The median lobe in the backward part with rough wrinkled sculpture. The basal part of the median lobe punctured and the lateral lobes indistinctly punctured. Propodeum with rough sculpture, the longitudinal carinae present. Mesopleurum widely punctured and for the greater part polished. Prepectal carina strong, meeting the margin. A robust subtegular ridge present. Nervellus intercepted over the middle. Coxae fuscous and polished. Front and middle tibia and femur and the hind femur

orange in colour. The front and middle tarsus brown, the hind tibia and tarsus black. The first abdominal segment robust, the apical edge 0.85 of the length of the segment. The first and second tergite showing rough and irregular sculpture. Third and fourth tergite basally with a rough band of sculpture, backward more coriaceous. Gaster entirely black. Ovipositor 0.91 of the length of front wing.

Material examined. — Sweden: ♀, holotype, Dalarna, Idre (Fjätervålen), 24.vii—1.viii.1982, Malaise trap, leg. & coll. Van Rossem.

"Imperspicuus" is the Latin for "inscrutable".

**Cylloceria sylvestris** (Gravenhorst)

*Tryphon sylvestris* Gravenhorst, 1829: 138.
*Cylloceria sylvestris;* Pfankuch, 1906: 87.
*Lampronota melancholica* (Grav.) var. *striolata* Hellén, 1915: 48.
*Lampronota striolata* Hellén, 1937: 12.
*Cylloceria striolata;* Jussila, 1965: 101.
*Cylloceria striolata;* Van Rossem, 1980: 130—104.

Through the kindness of Dr M. Kak (Muzeum Przyrodnicze, Wrocław) I got the opportunity to study the type material of *Tryphon sylvestris* Gravenhorst. It appears that the type material in question consists of two male specimens. The one I labelled as the lectotype is identical with *Cylloceria striolata* (Hellén).

Dr Kak wrote that he was not quite sure that the specimen which I labelled as the type of *Tryphon sylvestris* is a Gravenhorst specimen. However, the other specimen represents *Cylloceria caligata*, which species was also described by Gravenhorst (l.c., p. 138).

Characteristics of the lectotype of *Tryphon sylvestris* (♂, a white tag, 69; a green tag; a white tag handwritten conf (confer?) *melancholica*): Front wing 7.1 mm long. Mandible brown. Clypeus: the apical part polished, near basal margin somewhat sculptured. The apical margin truncate. Face closely punctured, medially somewhat convex. Frons polished. Vertex and gena finely punctured (implantations of hairs). Apex of third flagellar segment with a semicircular notch, base of fourth segment also with a notch. Pronotum with rather coarse semicircular striation, epomia present. The median lobe of mesoscutum convex, closely punctured, the lateral lobes with fine punctures. Propodeum roughly sculptured, with all longitudinal carinae present. Mesopleurum with fine punctures, the prepectal carina to the margin. Below the subtegular ridge some longitudinal striation. Nervellus intercepted below the middle. All coxae and trochanters fuscous. All femora, front and middle tibiae yellow to orange. Hind tibia and tarsus conspicuously fuscous. First tergite roughly sculptured and somewhat longitudinally wrinkled. Second tergite coriaceous and with some longitudinal striation. The third tergite with indistinct coriaceous sculpture.

From Dr R. Jussila (Paattinen, Finland) I received a female and male of *Cylloceria striolata* (Hellén) from Finnish Lapland. In a collection Oxytorinae sent by Dr D. P. Kasparyan from the Zoological Institute at Leningrad there were four dubious specimens of the same species. Although these specimens show rather striking variability, I decided to place the four Russian

Table 1. *Cylloceria sylvestris* (Gravenhorst). For explanation, see text.

| specimen | length front wing | length ovipositor/ length front wing | ratio length postannellus/ apical width | ratio width malar space/ width face | nervellus |
|---|---|---|---|---|---|
| Reservoir Vudjavr 20.viii.1930 | 8.93 | 0.99 | 9.6 | 0.40 | below middle |
| Jujasnor chibinsja 8.viii.1937 | 8.17 | 0.91 | 9.6 | 0.35 | below middle |
| *C. striolata*, Suomi, Utsjoki, 10.vii.1961 | 7.86 | 0.88 | 8.8 | 0.36 | below middle |
| Koslovo, 16.vii.1975 | 7.55 | 0.94 | 8.4 | 0.34 | in the middle |
| Burunduk, kos. r. Adsva, Arkh. 29.vii.1909 | 7.06 | 1.10 | 8.0 | 0.35 | in the middle |

specimens tentatively with *C. sylvestris*. For comparison table 1 gives: the length of the front wing in mm; ratio of the length of the ovipositor to the length of the front wing; ratio of the length of postannellus to its apical width; ratio of the width of malar space to the width of face; interception of the nervellus.

Characteristics of the female. Front wing 7.1—8.9 mm long. Palpi brown. Malar space wide, 0.34—0.40 of width face, somewhat coriaceous. Face laterally widely punctured, medially somewhat convex. Postanellus long, 8.0—9.6 as long as apically wide. Second and third flagellar segments long. Frons, vertex and gena polished and with fine punctures (implantations of hairs). Pronotum with coarse sculpture, irregularly striated. The basal part of median lobe of the mesoscutum closely punctured. The lateral lobes indistinctly punctured. Propodeum roughly sculptured, the carination indistinct or absent. Mesopleurum polished, but in the last two specimens of the table, finely striated. The prepectal carina reaching to the margin. Coxae and trochanters fuscous. Other parts of legs yellowish to orange to brown (hind tibia). Hind tarsus fuscous. Nervellus intercepted below the middle or in the middle. First tergite with regular and rather fine sculpture, slightly striated. Second tergite with regular and fine striation, the apical margin polished. Third tergite with some fine striation and coriaceous sculpture. The fourth tergite sometimes also showing indistinct striation and some coriaceous sculpture. Ovipositor 0.9—1.1 of the length of the front wing.

Material examined. — Finland: ♂♀, Suomi Inl. Utsjoki, 10 & 14.vii. 1961 (coll. R. Jussila). U.S.S.R.: 4 ♀, Reservoir Vudjavr, Chibin. g. Kolsk (mountain), leg. Tsevurova, 30.viii.1930; Jujasnor chibinsja, gory Kolsk, leg. Fridolin, 8.viii.1937; Burunduk, kos. r. Adzva, Arkh. g. leg. Kuluk, 29.vii.1909; Kozlovo, 50 km s. Kalgi (? Kalga), Tsit. (=? Chitinskaya), obl. (= oblast = province), leg. Kasparyan, 16.vii.1975 (all Zoological Institute, Leningrad, curator D. P. Kasparyan). Poland: ♂, lectotype, "Warmbrunn" (coll. Gravenhorst, Wrocław).

### **Cylloceria melancholica** (Gravenhorst, 1820)

*Ichneumon melancholicus* Gravenhorst, 1820: 372.
*Lampronota fracticornis* Haliday, 1838: 121.
*Cylloceria fracticornis;* Fitton, 1976: 334.
Characteristics of the female lectotype of *Lampronota fracticornis*. Labels: "British"; a separate label: Haliday 20-2-82; lectotype label of Fitton (Nat. Mus. Ireland, Dublin). In my key the specimen runs to *C. melancholica*.
*Chalinoceras longicornis* Ratzeburg, 1852: 130. Sensu Viereck, 1914. The type is lost.

### **Cylloceria melancholica** forma **denticornis** (Haliday, 1838)

*Lampronota denticornis* Haliday, 1838: 121.
? *Cylloceria accusator* (Fabricius) sensu Fitton, 1976: 32 (8): 334.
The Fabrician type material does not belong to the Oxytorinae (Van Rossem, 1980).
*Cylloceria melancholica* f. *marginator* Schiødte, 1839: 24 (sensu Van Rossem, 1980).

Characteristics of the female lectotype of *Lampronota denticornis*. Labels: "British"; a separate label: 20-2-82; lectotype label of Fitton, 1975 (Nat. Mus. Ireland, Dublin). The second to sixth tergite have an orange to yellowish hind margin and a brownish to light brown colour.

Material examined of *Cylloceria melancholica* (Gravenhorst). — U.S.S.R.: several ♀, Guzeril, Kavkazck (Caucasus), Zapov (National Park), ysjtsj, Zjelobnoi, leg. D. R. Kasparyan, 22.vi.1976; 2 sp., Tebertsinsky, Zapov (Nat. Park), g. M. Chatipara, chv les (forest), leg. D. R. Kasparyan, 14.vii.1976; Berbiguno, 26.v.1891, Lisuv. ber., leg. K. Kokujeva. Identification dubious, ovipositor too short, Sejdozero, 20 km south east of Revdy, Murmansk district, leg. D. R. Kasparyan, 25.vii.1974 (label Aubert; *Cylloceria*). All specimens from the Zoological Institute at Leningrad.

Distribution. — *Cylloceria melancholica* (Gravenhorst) is widely spread in the Western Palaearctic Region.

## Genus **Proclitus Förster**

*Cryptus (Clepticus)* Haliday in Curtis, 1838: 112—121.
*Proclitus* Förster, 1868: 172.
*Proclitus;* Förster, 1871: 113.
*Plectiscus (Proclitus);* Thomson, 1888: 1306—1307.
*Proclitus;* Townes, 1971: 194.
*Proclitus;* Aubert, 1977: 142.
*Proclitus;* Van Rossem, 1983[a]: 153—165.

### Key to the males

The males of *P. comes* (Haliday in Curtis), *P. fulvicornis* Förster and *P. rudis* Förster are unknown. I have not seen the male of *P. fulvipectus* Förster. These four species are not included in the key.

The distinction of the males of *P. praetor* (Haliday in Curtis), *P. ardentis* species nova, *P. attentus* Förster and *P. albidipes* Förster is almost impossible; nevertheless I have included them in the key. I based the distinction on the

ratio of the length of the first abdominal segment to the apical width. I have used only those units which are clearly separated. This implies that other data can overlap.

1. Anterior tentorial pits impressed and with a carina between the eye margin and the lateral corner of the clypeus. Clypeus flat, the apical margin arcuate, 2.5 times as wide as long ..... *P. paganus* (Haliday in Curtis)
— Anterior tentorial pits not impressed and without carina between eye and clypeus .. 2
2. Face wide, about 0.45 of frontal width (including the eyes) and with a row of conspicuous long, erect setae along the inner margin of eye. Clypeus exceptionally wide, almost 3 times as wide as long, the apical margin arcuate. Lateral corner of clypeus reaching beyond line of inner margin of eye. Clypeus with widely placed long setae ..... *P. subsulcatus* Förster
— Not this combination of characters ..... 3
3. First tergite coriaceous. Lateral carinae of scutellum running to apex of scutellum, not meeting ..... *P. zonatus* (Gravenhorst)
— First tergite not coriaceous. Lateral carinae of scutellum not running to apex, only present at proximal corners of scutellum .... 4
4. First abdominal segment 4.0—4.7 times as long as the apical width. Clypeus for the greater part yellow ..... ..... *P. praetor* (Haliday in Curtis)
— First abdominal segment less than 4.0 times as long as the apical width. Clypeus fuscous ..... 5
5. First abdominal segment 3.5—3.7 times as long as the apical width ..... ..... *P. ardentis* spec. nov.
— First abdominal segment 3.1—3.3 times as long as the apical width *P. attentus* Förster

Remark. — There is a male paralectotype of *Proclitus edwardsi* with the same labels, but I doubt whether this male agrees with the female. The specimen does not show the impressed anterior tentorial pits and neither the shape of the clypeus agrees.

Key to the females
(Females of *P. subsulcatus* Förster and *P. albidipes* Förster are unknown)

1. Ovipositor long, 0.60—1.05 of length front wing ..... 2
— Ovipositor shorter, less than 0.60 of length front wing ..... 4
2. Ovipositor exceptionally long, 0.80—1.05 of length front wing. First abdominal segment 2.5—3.0 times as long as the apical width ..... *P. comes* (Haliday in Curtis)
— Ovipositor not exceptionally long, 0.60—0.70 of length front wing. First abdominal segment 2.7—4.5 times as long as the apical width ..... 3
3. First abdominal segment 3.5—4.5 times as long as the apical width. Ovipositor 0.59—0.69 of length front wing. Clypeus for the greater part yellow ..... ..... *P. praetor* (Haliday in Curtis)
— First abdominal segment 2.7—3.0 times as long as apical width. Ovipositor 0.63—0.65 of length front wing. Clypeus fuscous ..... *P. ardentis* spec. nov.
4. Anterior tentorial pits impressed and with a carina between eye margin and lateral corner of clypeus ..... 5
— Anterior tentorial pits not impressed and with a weak or no carina between eye margin and clypeus ..... 7
5. Ovipositor 0.27—0.31 of length of front wing. Clypeus flat, 2.4 times as wide as long, the apical margin weakly arcuate. Margin of tergite two yellowish brown, tergite three yellowish brown or entirely fuscous ..... *P. paganus* (Haliday in Curtis)
— Ovipositor 0.37—0.48 of length of front wing ..... 6
6. Ovipositor 0.37—0.47 of length of front wing. Median dorsal carina of first tergite present. Margin of tergite two and tergite three entirely more yellow in colour ..... ..... *P. fulvicornis* Förster
— Ovipositor 0.48 of length of front wing. Clypeus medially strongly convex, the apical margin arcuate. Median dorsal carina absent. Abdominal tergites from margin of tergite two to apex orange in colour ..... ..... *P. edwardsi* Roman
7. Ovipositor very short, 0.26 of length front wing. Malar space with a groove. Lateral carinae of scutellum running to apex of scutellum, not meeting. Apex of scutellum striated or with somewhat rough sculpture. First, and in some specimens also the second tergite coriaceous ..... ..... *P. zonatus* (Gravenhorst)
— Ovipositor longer, 0.36—0.48 of length front wing. Lateral carinae of scutellum only at proximal corners of scutellum ..... 8
8. Anterior tentorial pits conspicuous, open. A carina and laterally of the carina a groove

between eye margin and lateral corner of clypeus ..... *P. fulvipectus* Förster

— Anterior tentorial pits not conspicuous. There is a groove between eye margin and clypeus, but no carina present ..... 9

9. Ovipositor 0.42—0.48 of length front wing. First abdominal segment 2.7—3.0 times as long as the apical width. Radius originating at 0.54 of lower margin of stigma..... ..... *P. attentus* Förster

— Ovipositor 0.39 of length of front wing. First abdominal segment short, 2.0 times as long as the apical width[1]). Radius originating at 0.50 of lower margin of stigma..... ..... *P. rudis* Förster

**Proclitus ardentis** species nova

Characteristics of the holotype of *Proclitus ardentis*. Female. Front wing 4.97 mm long. Clypeus somewhat convex, fuscous, its apical margin protruding, with rather long setae. Malar space narrow, about as wide as the mandibular base, with a groove between eye margin and clypeus. Clypeal fovea somewhat impressed, but not forming a distinct carina between eye margin and clypeus. Face and other parts of head fuscous. Antennal sockets slightly elevated. Upper part of face between antennal sockets with a circular impression. Flagellum slender. Postannellus 5.6 times as long as the apical width. Pronotum polished, epomia almost obliterated. Mesoscutum polished, notaulus only present as a dent on the mesoscutal margin. Propodeum almost entirely polished, carinae present but rather weak. Mesopleurum polished, prepectal carina almost obliterated. Front and middle legs, inluding the coxae, yellow. Hind coxae yellow, hind femur, tibia and tarsus brownish. First abdominal segment 2.9 times as long as the apical width. Postpetiole with some longitudinal striation, median dorsal carina weakly present. Second tergite polished, thyridia present and rather large, the apical tergal margin yellow. Third tergite polished and almost wholly yellow. Remaining tergites fuscous, polished and with adpressed long setae. Ovipositor 0.65 of the length of front wing.

Characteristics of a male paratype of *P. ardentis*. Front wing 4.62 mm long. Clypeus somewhat convex, fuscous, its apical margin protruding, setae not conspicuous. Malar space narrow. All parts of head fuscous. Frons between antennal sockets impressed. Pronotum fuscous, polished. Epomia absent. Other parts of thorax polished and fuscous. Prepectal carina present, but weak. Front and middle legs, including coxae yellow. Hind coxae yellow. Apex of hind femur, tibia and hind tarsus brown. First abdominal segment 3.5 times as long as the apical width. Median dorsal carina present on postpetiole. All other tergites polished. Apical margin of tergite two yellow. Tergites three, four and five for the greater part yellowish brown. All tergites, except the first, with adpressed long setae.

The trivial name "ardentis" is from the Latin for "sparkling".

Material examined. — Austria: ♀, holotype, Oberösterreich, Riedl im Haselgraben, 12.ix.1985; 2 ♂, paratypes, same locality and date as holotype; 1 ♀, paratype, Oberösterreich, Felsleiten bei Eidenberg, 10.ix.1985; ♀, paratype, Oberösterreich, Brunnwald bei Bad Leonfelden, 21.viii.1985; ♂, paratype, Oberösterreich, Schauerschlag, bei Zwettl R., 15.ix.1985 (the entire series leg. & coll. Martin Schwarz, Zwettl, Österreich).

Distribution. — Only four localities in Austria are kwown.

**Proclitus edwardsi** Roman

*Proclitus edwardsi* Roman, 1923: 73—74.

Characteristics of the lectotype of *Proclitus edwardsi*. Female. Front wing 4.71 mm long. Palpi whitish. Mandible yellow. Malar space 0.35 of width face. Clypeus medially strongly convex, the apical margin arcuate. Anterior tentorial pits strongly impressed and with a carina between eye margin and lateral corner of clypeus. Face, frons, vertex and gena polished, fuscous. Pronotum fuscous, polished, epomia present, short. Mesoscutum polished, notaulus short. Scutellum polished, the margin only present at the front corner. Scutellar fossa deep. Propodeum polished, apical transverse carina strong. Median longitudinal carina developed as stubs on apical transverse carina. Mesopleurum polished, prepectal carina not reaching to the margin. Legs, including coxae yellow. Coxae polished. Front femur stout, about 3.0 times as long as wide. Postpectal carina absent. First tergite fuscous, polished, median dorsal carina absent. The spiracle in the middle. The first segment is 2.2 times as long as apically wide. All other tergites polished, from the apical margin

[1]) Based on the holotype only.

of tergite two orange in colour. The ovipositor 0.48 of the length of the front wing.

The species is a parasite of *Brachypeza radiata* Jenkins.

Material examined. — England: lectotype, labels: B.M. Type Hym. 3.b.1623; Shefford Beds. viii.1918, leg. F. W. Edwards, ex *Brachypeza radiata* Jenk. in *Pleurotus*; *Proclitus edwardsi* Roman, ♀, label: *Proclitus Edwardsi* Rn n.sp. type. Lectotype label Fitton, 1977.

## Genus **Pantisarthrus** Förster

*Pantisarthrus* Förster, 1871: 109—110.
*Pantisarthrus;* Townes, 1971: 193—194.
*Pantisarthrus;* Van Rossem, 1980: 110—113.

I found an undescribed species in Haeselbarth's collection. It is described below.

### Key to the species

1. First tergite exceptionally long, 2.7—3.0 times as long as apical width, with rough and irregular longitudinal sculpture. Profile of tergite trapezium shaped. Claws of front leg conspicuously stronger than of middle and hind leg. Ovipositor 0.16 of length hind tibia ..... *P. gracilis* spec. nov.
— First tergite not more than 2.5 times as long as apical width. Sculpture of first tergite coriaceous. In some males surpassing 2.5 times but in these the first tergite coriaceous ..... 2
2. Second tergite and following polished but with some, not very obvious robust, irregularly placed punctures. Mesoscutum strongly convex, prescutellar groove conspicuously deep. A not very distinct species, of which only the holotype is extant ..... ..... *P. rudepunctatus* Strobl
— Second tergite and following polished, without punctures ..... 3
3. Section gh of radiella (fig. 3) in hind wing absent. First tergite 2.0—2.6 times as long as apical width ..... *P. dispar* Van Rossem
— Section gh of radiella present. First tergite 1.4—2.3 times as long as apical width .... 4
4. Section gh of radiella equal to or slightly shorter than section dg. First tergite 1.8—2.3 times as long as apical width ..... ..... *P. inaequalis* Förster
— Section gh of radiella longer than section dg. First tergite 1.4—2.5 times as long as apical width ..... *P. luridus* Förster

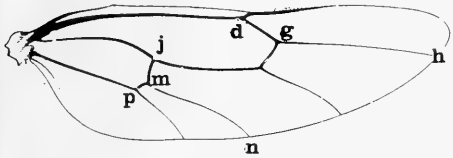


Fig. 3. Hind wing of an ichneumonid. dgh = radiella; jmp = nervellus; mn = discoidella. After Townes (1969).

### **Pantisarthrus gracilis** species nova

Characteristics of the holotype. Female. Front wing 3.5 mm. Palpi yellow. The mandible not turned inwards, the lower tooth much smaller than upper. Clypeus convex, yellowish brown in colour, the margin truncate. Clypeus with erect, long hairs. Occiput slightly concave and sloping beyond ocelli. Pronotum polished, with epomia. Mesoscutum polished, notaulus present towards centre of mesoscutum, but shallow. Prescutellar fovea wide and deep. Propodeum with strong apical transverse carina with an obtuse tooth between median longitudinal carinae (also a character of other *Pantisarthrus* species). Mesopleurum polished, prepectal carina present, not reaching to the margin. Portion of cubitus between intercubitus and second recurrent vein 0.5 times as long as recurrent vein. In the hind wing gh shorter than dg. Discoidella absent. Legs, including the coxae, yellowish. Dorsal part of hind tibia brown. Claws of front leg stronger than those of middle and hind legs. Hind femur conspicuously club-shaped. First tergite exceptionally long, 2.7 times as long as the apical width. The tergite has rough longitudinal sculpture and a trapezium shaped profile. All other tergites fuscous and highly polished. Second tergite with a yellow apical band. Ovipositor 0.16 of the length of hind tibia.

Male unknown.

Material examined. — Italy: ♀, holotype, Prov. Bolzano, Kaltern Leuchtenburg, 500 m, 22.ix.1978; ♀, paratype, Prov. Bolzano, Kaltern Leuchtenburg, 500 m, 22.ix.1978 (both leg. and coll. Haeselbarth, München).

### **Pantisarthrus inaequalis** Förster

*Pantisarthrus inaequalis* Förster, 1871: 110.
*Pantisarthrus ochropus* Förster, 1871: 110.
*Pantisarthrus pseudochropus* Strobl, 1903: 137.
*Aniseres subalpinus* Strobl, 1903: 138.
*Pantisarthrus inaequalis;* Van Rossem, 1980: 110—111.

Characteristics of male and female. Length front wing 3.0—3.6 mm. Tyloids absent. Malar space wide, with a groove. Face, frons and vertex polished. Occipital carina present. Mesoscutum convex, polished, notaulus absent. Scutellar carina almost reaching to apex. Section gh of radiella equal to or shorter than section dg. First tergite 1.8—2.3 times as long as wide, coriaceous. Median dorsal carina present.

Common and widely distributed.

### **Pantisarthrus luridus** Förster

*Pantisarthrus luridus* Förster, 1871: 110.
*Pantisarthrus luridus;* Van Rossem, 1980: 111—112.

Characteristics of male and female. Length front wing 3.0—3.6 mm. Section dg of radiella about 0.6 of section gh. First tergite 1.4—2.0 times as long as wide.

Common and widely distributed.

### **Pantisarthrus rudepunctatus** Strobl

*Pantisarthrus rudepunctatus* Strobl, 1903: 137—138.
*Pantisarthrus rudepunctatus;* Van Rossem, 1980: 112.

Characteristics of the female. Length front wing 3.0 mm. Section dg of radiella 0.5 of section gh. First tergite 2.4 times as long as wide, coriaceous. Other tergites, according to Strobl, with robust, irregularly placed punctures. I did not find these to be very conspicuous.

Distribution. — Only the holotype of Styrian Alp (Austria) is extant.

### **Pantisarthrus dispar** Van Rossem

*Pantisarthrus dispar* Van Rossem, 1980: 112—113.

Characteristics of male and female. Length of front wing 2.8—3.3 mm. Section gh of radiella absent. First tergite 2.0—2.6 times as long as wide.

Common and widely distributed.

## Genus **Plectiscidea** Viereck

*Plectiscus* auctores, before 1914.
*Plectiscidea* Viereck, 1914: 118.
*Plectiscus;* Förster, 1871: 84—90.
*Plectiscus;* Strobl, 1903: 125—130.
*Plectiscidea;* Townes, 1971: 196—197.
*Plectiscidea;* Aubert, 1975: 3—5; 7—8.

Förster (1871) published keys to his *Plectiscus* females and males and at the same time introduced 51 new species in his key to the females. The description of these is extraordinarily concise and based upon characters which do not lead to identification. Apparently Förster confused the conception of a species with mere individual differences, describing specimens rather than species.

The Förster type material is in the Zoologische Staatssammlung at München and in excellent condition. Aubert (1975) first revised this collection and recognized 14 species.

A subgenus, *Fugatrix*, is introduced to incorporate one species, *Plectiscus communis* Förster in the genus *Plectiscidea*. This species was placed in *Dialipsis* by Townes (1971). I think that the character used by Townes to separate *Dialipsis* and *Plectiscidea*, that is the ratio between the length of the petiolar area and the length of combined areola and basal area, does not exclude other *Plectiscidea* species from *Dialipsis*. Neither the shape of the postannellus separates these two genera. It seems to me that only the exceptionally large clypeal fovea is a true character of *Dialipsis*. Townes considers this character to be only an aberrant one. Consequently the other species belong to the subgenus *Plectiscidea*.

On the whole 36 species are dealt with; of these five are new: *Plectiscidea indomita*, *P. foersteri*, *P. substantiva*, *P. blandita* and *P. ventosa*. *Plectiscidea nemorensis* is a nomen novum for *Ephalmator subsimilis* Van Rossem.

## Morphology

It is difficult to find proper morphological characters for comparison and for the separation of Förster's types. I used the following eight criteria:

(1) ratio of width malar space to the width of face (enlargement 100×);
(2) ratio of length of postannellus to its apical width (enlargement 100×);
(3) presence or absence of notaulus;
(4) development of the lateral scutellar carina;
(5) ratio of length of first abdominal segment to its apical width (enlargement 100×);
(6) ratio of length of first abdominal segment to the length of the front wing (enlargement 40×);
(7) position of the spiracles of the first abdominal segment in proportion to the length of the segment (enlargement 100×);

(8) length of ovipositor in proportion to the length of the front wing (enlargement 40×).

These criteria offer a rather meagre foundation. Perhaps scanning electron microphotography would reveal better characters, but I had no access to such an instrument.

A word must be said about the males. Förster described 26 species, founded solely on the males. I regard these as species inquirendae as it is impossible at present to find the matching females.

Note to the key

An extensive series of *Plectiscidea collaris* collected in Austria by Martin Schwarz gave me a better understanding of the variability of this species. I, therefore, doubt if my key between 17 and 18 is reliable.

The following observations should also be noted:

*Plectiscidea monticola* is distinguished by the short first abdominal segment.

*Plectiscidea agitator*, of which only the holotype is available, could be identical with *P. collaris*.

*Plectiscidea conjuncta* can be distinguished from *P. collaris* by the ratio of the length of the first abdominal segment to the length of the front wing (0.14—0.16 in *P. conjuncta* and 0.17—0.19 in *P. collaris*). In *P. conjuncta* the spiracles of the first abdominal segment lie at 0.31—0.37 of the length of the segment. In *P. collaris* at 0.37—0.42 of the length of the segment.

Of *P. conjuncta* only the holotype and three other specimens were available. Two of these are type specimens of *P. flavicoxis* of which the status is doubtful.

Key to *Plectiscidea* females

1. Length of ovipositor 0.72—0.85 of length of front wing. Petiolar area of propodeum 1.5—2.0 times as long as combined areola and basal area. Postanellus 3.6—4.5 times as long as the apical width. First abdominal segment 1.8—2.5 times as long as the apical width. First tergite coriaceous. Front wing 2.3—3.6 mm long .. *Fugatrix* subgen. nov.
— Length of ovipositor less than 0.70 of length of front wing. (Subgenus *Plectiscidea*) ..... 2
2. Ovipositor relatively short, 0.09—0.30 of length of front wing ..... 3
— Ovipositor longer than 0.30 of length of front wing ..... 15
3. Ovipositor 0.09 of length of front wing. Postannellus long, 6.0 times the apical width and with a conspicuous character, viz., a medial notch, thus giving the impression of two short inflated segments. Antenna, legs, propodeum and gaster with long hairs. Abdominal segment 2.3 times as long as the apical width. The first tergite coriaceous ..... *P. nemorensis* nom. nov.
— Ovipositor more than 0.10 of length of front wing ..... 4
4. Ovipositor 0.14—0.18 of length of front wing. Postannellus 4.0—4.8 times as long as the apical width. The first abdominal segment 1.4—1.8 times as long as the apical width ..... *P. bistriata* (Thomson)
— Ovipositor longer than 0.18 of length of front wing ..... 5
5. Postannellus 4.0—4.8 times as long as the apical width ..... 6
— Postannellus 5.0—6.5 times as long as the apical width ..... 8
6. The length of the first abdominal segment 1.3 times as long as the apical width due to the conspicuous breadth of the tergite. Ovipositor 0.27 of the length of the front wing. Postannellus 4.2 times as long as the apical width ..... *P. subteres* (Thomson)
— The length of the first abdominal segment 2.0—2.4 times as long as apical width .... 7
7. Ovipositor 0.20—0.22 of the length of front wing. Postannellus 4.0—4.6 (4.8) times as long as apical width. The length of the first abdominal segment 2.0—2.3 times as long as apical width ..... *P. indomita* spec. nov.
— Ovipositor 0.25—0.27 of the length of front wing. Postannellus 4.3—4.6 times as long as the apical width. The length of the first abdominal segment 2.2—2.4 times as long as the apical width ..... *P. moerens* (Förster)
8. Postannellus 5.0—5.6 times as long as the apical width ..... 9
— Postannellus 6.0—6.5 times as long as the apical width ..... 12
9. First tergite with longitudinal striation and some not very conspicuous coriaceous sculpture between. The spiracles rather protruding. The first abdominal segment 2.1 times the apical width. Postannellus 5.0 times as long as the apical width. Malar space 0.41 of width face. Ovipositor 0.21 of the length of front wing . *P. tener* (Förster)
— First tergite with coriaceous sculpture .. 10

10. Ovipositor 0.19—0.22 of length of front wing. Postannellus 5.0—5.5 times as long as the apical width. First abdominal segment 1.8—2.0 times as long as the apical width ... ..... *P. parvula* (Förster)
— Ovipositor 0.24—0.30 of length of front wing. Postannellus 5.0—5.6 times as long as the apical width ..... 11
11. Ovipositor 0.24—0.27 of length of front wing. Postannellus 5.5—5.6 times as long as the apical width. First abdominal segment 2.0—2.3 times as long as apical width ..... ..... *P. tenuicornis* (Förster)
— Ovipositor 0.28—0.30 of length of front wing. Postannellus 5.0—5.5 times long as the apical width. First abdominal segment 1.9—2.3 times as long as apical width ..... ..... *P. cinctula* (Förster)
12. Ovipositor 0.22—0.23 of length of front wing. Postannellus 6.0 times as long as the apical width. The first abdominal segment 2.3—2.6 times as long as apical width ..... ..... *P. amicalis* (Förster)
— Ovipositor 0.25—0.30 of length of front wing..... 13
13. First abdominal segment 2.4—2.7 times as long as apical width. Ovipositor 0.25—0.31 of length of front wing. Postannellus 6.5 times as long as apical width ..... ..... *P. helvola* (Förster)
— First abdominal segment 2.0—2.3 times as long as apical width ..... 14
14. Ovipositor 0.25—0.30 of length of front wing. Postannellus 6.0 times as long as the apical width. Length of first abdominal segment 2.1—2.3 times the apical width..... ..... *P. vagator* (Förster)
— Ovipositor 0.27—0.30 of length of front wing. Postannellus 6.0—6.5 times as long as the apical width. Length of first abdominal segment 2.0 times the apical width..... ..... *P. melanocera* (Förster)
15. Notaulus indicated by a groove on the mesoscutal margin ..... 16
— Notaulus not present or evanescent..... 25
16. First abdominal segment conspicuously long, 3.1—3.5 times the apical width. Postannellus (4.8)—5.2 times as long as the apical width. Ovipositor 0.33—0.36 of length of front wing .... *P. canaliculata* (Förster)
— Length of first abdominal segment less than 3.0 times the apical width ..... 17
17. Postannellus 5.0—6.3 times as long as the apical width ..... 18
— Postannellus less than 5.0 times as long as the apical width ..... 22
18. Ovipositor 0.55 of the length of front wing. Postannellus long, 6.0 times the apical width. Length of first abdominal segment 2.7 times the apical width. Front wing 4.8 mm long ..... *P. erythropyga* (Förster)
— Ovipositor shorter, 0.35—0.52 of the length of front wing..... 19
19. First abdominal segment short, 2.0 times the apical width. Ovipositor 0.44 of length of front wing. Postannellus 5.0 times as long as the apical width. Front wing 3.7 mm long ..... *P. monticola* (Förster)
— Length of first abdominal segment 2.3—2.9 times the apical width ..... 20
20. Postannellus 6.0 times as long as the apical width. Ovipositor 0.40 of the length of front wing. First abdominal segment 2.3 times as long as the apical width. Front wing 4.5 mm long .... *P. agitator* (Förster)
— Postannellus 5.0—6.3 times as long as the apical width. Ovipositor 0.35—0.52 of length of front wing..... 21
21. The first abdominal segment measures 0.14—0.16 of the length of the front wing. Ovipositor 0.36—0.38 of length of front wing. Postannellus 5.2—5.3 times as long as the apical width. First abdominal segment 2.2—2.4 times as long as the apical width ... ..... *P. conjuncta* (Förster)
— The first abdominal segment measures 0.17—0.19 of the length of the front wing. Ovipositor 0.35—0.52 of length of front wing. Postannellus 5.0—6.3 times as long as the apical width. First abdominal segment 2.3—2.9 times as long as the apical width ... ..... *P. collaris* (Gravenhorst)
22. Postannellus 3.7 times as long as the apical width. Ovipositor 0.44 of length of front wing. First abdominal segment 2.4 times as long as the apical width. Front wing 4.7 mm long ..... *P. foersteri* spec. nov.
— Postannellus 4.2—4.6 times as long as the apical width ..... 23
23. Ovipositor 0.38 of length of front wing. Postannellus 4.3 times as long as apically wide. First abdominal segment 2.3 times as long as the apical width. Front wing 3.7 mm ..... *P. nava* (Förster)
— Ovipositor 0.41—0.48 of length of front wing. Postannellus 4.0—4.6 times as long as the apical width ..... 24
24. Malar space 0.29—0.35 of width face. Ovipositor 0.43—0.48 of length of front wing. Postannellus 4.0—4.5 times as long as the

apical width. First abdominal segment 2.4—2.7 times as long as the apical width. Front wing 4.2—5.2 mm long ..... *P. substantiva* spec. nov.

— Malar space wide, 0.41—0.42 of width face. Ovipositor 0.41—0.43 of length of front wing. Postannellus 4.2—4.6 times as long as apical width. First abdominal segment 2.3—2.6 times as long as the apical width. Front wing 3.7—4.5 mm long ..... *P. crassicornis* (Förster)

25. Postannellus extremely long, 7.0 times the apical width. Ovipositor 0.33—0.35 of length of front wing. First abdominal segment 2.7 times as long as apical width ..... *P. posticata* (Förster)

— Postannellus shorter, less than 5.8 × the apical width[1] ..... 26

26. Ovipositor 0.40—0.47 of length of front wing. Postannellus 5.0—5.7 times as long as the apical width. Length of first abdominal segment 1.8—2.8 times the apical width 27

— Ovipositor shorter, 0.33—0.38 of length of front wing. Postannellus 4.3—5.4 times as long as the apical width. Length of first abdominal segment 1.6—2.6 times the apical width ..... 33

27. Ovipositor 0.40 of length of front wing. Postannellus 5.3 times as long as the apical width. Malar space 0.40 of width face. Length of first abdominal segment 2.7 times the apical width, the spiracles situated at 0.37 of the length of the segment ..... *P. connexa* (Förster)

— Ovipositor more than 0.40 of length of front wing ..... 28

28. Length of first abdominal segment 1.8 times the apical width, the spiracles situated at 0.32 of the length of the segment. Postannellus 5.7 times as long as the apical width. Ovipositor 0.42 of length of front wing ..... *P. mesoxantha* (Förster)

— Length of first abdominal segment more than 1.8 times the apical width ..... 29

29. The spiracles of the first abdominal segment situated between 0.40—0.50 of the length of the segment ..... 30

— The spiracles of the first abdominal segment situated between 0.34—0.37 of the length of the segment ..... 32

30. The spiracles of the first abdominal segment situated in the middle of the segment (0.50). The length of the first abdominal segment 2.0 times the apical width. Postannellus 5.0 times as long as the apical width. Malar space 0.37 of width face ..... *P. mendica* (Förster)

— The spiracles of the first abdominal segment situated at 0.40—0.43 of the length of the segment ..... 31

31. The spiracles of the first abdominal segment situated at 0.40 of the length of the segment. The length of the first abdominal segment 2.3 times the apical width. Postannellus 5.5 times as long as the apical width. Malar space 0.38 of width face ..... *P. fraterna* (Förster)

— The spiracles of the first abdominal segment situated at 0.43 of the length of the segment. The length of the first abdominal segment 2.1 times the apical width. Postannellus 5.0 times as long as the apical width. Malar space 0.35 of width face ..... *P. deterior* (Förster)

32. Malar space 0.42 of width face. The first abdominal segment 2.5 times as long as the apical width, the spiracles situated at 0.34 of the length of the segment ..... *P. blandita* spec. nov.

— Malar space 0.33—0.35 of width face. The first abdominal segment 2.1—2.3 times as long as the apical width, the spiracles situated at 0.34—0.37 of the length of the segment. Postannellus 5.0—5.3 times as long as the apical width.[1]) Ovipositor 0.42—0.47 of the length of the front wing. Front wing 3.5—4.5 mm long .. *P. terebrator* (Förster)

33. Postannellus 4.3—4.6 times as long as the apical width. Ovipositor 0.32—0.37 of length of front wing. Length of first abdominal segment 1.6—1.8 times the apical width ..... *P. ventosa* spec. nov.

— Postannellus 5.0—5.4 times as long as the apical width ..... 34

34. Postannellus 5.4 times as long as the apical width. Ovipositor 0.36 of length of front wing. Malar space 0.31 of width face. Scutellar carina slightly beyond the scutellar corner and turning inwards, but not meeting. Length of first abdominal segment 2.2 times the apical width. Front wing long, 5.2 mm ..... *P. subangulata* (Förster)

— Postannellus 5.0—5.2 times as long as the apical width. Malar space 0.31—0.38 of width face. Front wing 3.5—4.3 mm long ..... 35

[1]) In *P. terebrator* the postannellus can reach to 6.3—6.6 times the apical width.

35. Postannellus 5.0 times as long as the apical width. Malar space 0.37 of width face. Ovipositor 0.36 of length of front wing. Scutellar carina slightly beyond scutellar corner. The spiracles of the first abdominal segment situated at 0.43 of the length of the segment. First abdominal segment 2.5 times as long as the apical width. Front wing 4.0 mm long ..... *P. eurystigma* (Thomson)
— Postannellus 5.0 times as long as the apical width. Malar space 0.33 of width of face. Ovipositor 0.37—0.38 of length of front wing. Scutellar carina slightly beyond corner and curving inwards, not meeting. The spiracles of the first abdominal segment situated at 0.32—0.34 of the length of the segment. First abdominal segment 2.0—2.6 times as long as the apical width. Front wing 3.6—4.3 mm long ..... ..... *P. humeralis* (Förster)

### Subgenus **Plectiscidea** Viereck

*Plectiscidea* Viereck, 1914: 118. Type: *Plectiscus collaris* Gravenhorst. Original designation.

Front wing 2.7—6.0 mm long. Postannellus 4.0—7.0 times as long as apically wide. Petiolar area of propodeum around 1.2 times as long as combined areola and basal area. First abdominal segment 1.3—3.5 times as long as apical width. Ovipositor 0.09—0.55 of length of front wing.

### **Plectiscidea nemorensis** nomen novum

*Ephalmator subsimilis* Van Rossem, 1980: 122 (nec Förster, 1871). Paratype examined in 1985. See also Van Rossem (1982: 169).

The male was originally described with *Ephalmator subsimilis*. It is not taken into consideration here.

Characteristics of the female. Front wing 3.0—4.1 mm long. Malar space 0.38—0.40 of width face. Anterior tentorial pits in the Dutch specimen rather impressed. Postannellus 5.6—6.0 times as long as apical width. The postannellus with a weak medial notch giving the appearance that the postannellus consists of two segments. Notauli not present or fading. Propodeum coriaceous, median longitudinal carina weak, present as stubs from the apical transverse carina. The latter strong. Legs, including coxae, with long hairs. First abdominal segment 2.0—2.3 times as long as apical width. The first tergite coriaceous, median dorsal carina absent, the spiracles at 0.37—0.43 of the length. Second tergite with an apical yellow band. Third tergite for the greater part yellow. The ovipositor exceptionally short, 0.09—0.10 of the length of the front wing. The main characters are shown on table 2.

Material examined. — Austria: ♀, T. Pertisau, 1550 m, 12.vii.1977 (paratype of *Ephalmator subsimilis*) (leg. & coll. Haeselbarth). Netherlands: ♀, Naardermeer, Malaise trap, (Loc. ix), 6.viii.1974, leg. Bunnik & Van Wijngaarden (coll. K. W. R. Zwart, Wageningen).

Remark. — The name "subsimilis" is preoccupied (Förster, 1871, Verh. naturh. Ver. preuss. Rheinl. 28: 86). The new name is from the Latin for "from the holy wood"; the locality "Naardermeer" is a nature reserve.

Table 2. *Plectiscidea nemorensis* nom. nov.: *frw* — the length of the front wing in mm; *ovip/frw* — ratio of ovipositor length to length of the front wing; *psta l/w* —ratio of length of postannellus to its apical width; *malsp /f* — ratio of width of malar space to the width of face; *abds l/w* — ratio of length of first abdominal segment to its apical width; *spir/abds* — the position of the spiracles of the first abdominal segment in relation to the lenght of the segment; *not* — notaulus (if not filled in, no attention is given to the notaulus); *pr* — notaulus present; *weak or prw* — notaulus weakly present; *not pr* — notaulus absent; *pet. area/areo + bas* — ratio of length of petiolar area to length of combined areola and basal area (used only for the subgenus *Fugatrix*); *abds/frw* — ratio of length of first abdominal segment to length of front wing (used only for *P. conjuncta* and *P. collaris*); *not filled in* — not determined.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| Paratype *Ephalmator subsimilis* | 4.1 | 0.10 | 5.6 | 0.40 | 2.0 | 0.37 | weak |
| Naardermeer 6.viii.1974 | 3.0 | 0.09 | 6.0 | 0.38 | 2.3 | 0.43 | not pr |

### Plectiscidea bistriata (Thomson)

*Plectiscus bistriatus* Thomson, 1888: 1288. Lectotype designation by Van Rossem. There is a male in the type series (Fitton, 1982).

Characteristics of the lectotype. Female. Front wing 3.5 mm. Clypeus small, square, convex, somewhat protruding, the apical margin truncate. Face polished, slightly produced forward below the antennal sockets. Postannellus 4.0 times as long as the apical width. Occipital carina closed. Mesoscutum polished, notauli weakly present. Scutellum with carina to apex. Propodeum almost completely polished, with erect rather long hairs. Mesopleurum polished, prepectal carina present but widely away from the margin. Legs and coxae brownish. First abdominal segment 1.5 times as long as apical width. Postpetiole finely coriaceous. Apical half of abdomen compressed. Ovipositor 0.18 of the length of the front wing. Compare table 3.

The two main characters of this species are the short ovipositor: 0.14—0.18 of the length of the front wing and the rather short and wide first abdominal segment (1.4—1.8 times the apical width).

The male was described by Thomson (1888).

Distribution. — The species is widely spread in the western Palaearctic region: Austria, Germany, the Netherlands and Sweden.

Material examined. — All ♀. Austria: Kärnten, Bodental 1100 m, 30.vi.1981 (leg. & coll. Zwakhals); Sonnenwendgebirge, 1300—1500 m, Hint. Swjoch 21.vi.1959; St. Haus Gföhlalm, 1300 m, 27.vi.1972. Germany: Oberbayern, Gauting, 5.vi.1972; ibidem, 17.v.1976; Hedemünden C, 12.v.1966; Dransfeld, 12.vi.1966 (all leg. & coll. Haeselbarth). Netherlands: Naardermeer (Malaise trap), 11.vi.1974, leg. Bunnik & Van Wijngaarden (coll. Zwart, Wageningen). Sweden: lectotype, Herrevadskloster (Skåne), vi.1882 (coll. Thomson, Entomology Museum, Lund).

### Plectiscidea subteres (Thomson)

*Plectiscus subteres* Thomson, 1888: 1300. Holotype label of R. Hinz (1962).

Characteristics of the holotype. Female. Front wing 4.2 mm. Clypeus polished, outer margin truncate, medially protruding, with erect hairs, width 0.61 of width face. Face, frons, vertex and temple polished. Occipital carina complete. Postannellus 4.2 times as long as the apical width. Pronotum polished, epomia strong. Mesoscutum polished, notauli present but obliterated posteriorly. Scutellum with the carina partly present. Most of the propodeum with irregular sculpture, carinae rather strongly developed. Mesopleurum polished, prepectal carina present but well away from the margin. Coxae and legs yellowish brown, legs slender. Length of the abdominal first segment 1.3 times the apical width. The apical margin wide. First tergite coriaceous, median dorsal carina to 0.42 of the length of the tergite. The spiracle situated at 0.37 of the length of the segment. The end of the first sternite is at 0.28 of the length of the segment. The second tergite is coriaceous, the apical margin is polished and light brown in colour. The ovipositor is 0.27 of the length of the front wing. Compare table 4.

Male unknown.

Table 3. *Plectiscidea bistriata* (Thomson). For explanation of abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | abds l/w | not |
|---|---|---|---|---|---|
| lectotype *P. bistriata* | 3.5 | 0.18 | 4.0 | 1.5 | |
| Kärnten, 30.vi.81 | | 0.13 | 4.8 | 1.5 | |
| Sonnenw. geb., 21.vi. | | 0.16 | 4.8 | 1.5 | |
| Haus, 27.vi.72 | | 0.17 | 4.0 | 1.5 | |
| Gauting, 5.vi.72 | | 0.15 | 4.0 | 1.4 | |
| Gauting, 17.v.76 | | 0.17 | 4.4 | 1.5 | |
| Hedemünden, 12.v.66 | | 0.16 | 4.4 | 1.7 | |
| Dransfeld, 12.vi.66 | | 0.17 | 4.3 | 1.7 | |
| Naardermeer, 11.vi.74 | | 0.14 | 4.8 | 1.8 | |

Table 4. *Plectiscidea subteres* (Thomson). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | abds l/w | not |
|---|---|---|---|---|---|
| holotype *P. subteres* | 4.0 | 0.27 | 4.2 | 1.3 | |

Material examined. — Germany: (?), ♀, holotype, f. 22.v.1886, leg. and coll. Thomson (Entomological Museum, Lund).

### **Plectiscidea indomita** species nova

Characteristics of the holotype of *P. indomita*. Female. Front wing 3.8 mm long. Mandible yellow, teeth about the same length. Clypeus rather convex, somewhat protruding. Malar space rather wide, 0.43 of width of face. Postannellus 4.0 times as long as the apical width. Epomia present. Notaulus present, short. Lateral carina of scutellum running somewhat behind the corner and slightly curving inwards. Propodeum dorsally with coriaceous sculpture, laterally with irregular fine sculpture. Prepectal carina present. First abdominal segment 2.0 times as long as the apical width. The spiracles situated at 0.40 of the length of the segment. The first tergite medially rather convex, with coriaceous sculpture. The second tergite with vague coriaceous sculpture. The other tergites polished. Ovipositor 0.22 of the length of the front wing. Compare table 5.

Male unknown.

Material examined. — Austria: paratype, T. Lechtaler A., Bichlbachle, 1350 m, 14.viii.1974. Germany: ♀, holotype, Hohenschwangau, Säulingweg, 1120—1300 m 16.vii.1974; 2 ♀, paratypes, Weszling, Hochstadt, 19.v.1974 (all leg. & coll. Haeselbarth); ♀, paralectotype of *Plectiscus sodalis* Förster, Lousberg, 19.v (coll. Förster, München). Italy: BS, Valvestino Malga Tombea, 1800 m, 14.vi.1976 (leg. & coll. Haeselbarth).

Distribution. — Widely spread in the western Palaearctic Region.

"Indomitus" is the Latin for "invincible", "indomitable".

### **Plectiscidea moerens** (Förster)

*Plectiscus moerens* Förster, 1871: 87. Holotype labelled by Van Rossem.

*Plectiscus xanthoneuris* Förster, 1871: 87. Holotype labelled by Van Rossem. **New synonym.**

*Plectiscus flavizonus* Förster, 1871: 88. Holotype labelled by Van Rossem. **New synonym.**

*Plectiscus eversorius* Förster, 1871: 88. Holotype labelled by Van Rossem. **New synonym**

Characteristics of the holotype of *P. moerens*. Female. Front wing 3.4 mm long. Postannellus 4.3 times as long as apical width. Epomia present, short. Notaulus short. Lateral carina of the scutellum somewhat behind the corner. Propodeum polished, with rather long hairs. Prepectal carina present. First abdominal segment 2.4 times as long as apical width. Spiracles situated at 0.33 of the length of the segment. First tergite coriaceous, with rather long lateral hairs. Second tergite polished. Ovipositor 0.27 of the length of the front wing. Compare table 6.

The species is characterized by the ratio of length and width of the postannellus, 4.3—4.6 times as long as the apical width, the length of the ovipositor, 0.25—0.27 of the length of the front wing and the ratio of length and width of the first abdominal segment, 2.2—2.4 times as long as the apical width. The second tergite almost polished in most specimens.

Male unknown.

Table 5. *Plectiscidea indomita* spec. nov. For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|
| holotype *P. indomita* | 3.8 | 0.22 | 4.0 | 2.0 | 0.40 | pr |
| Lecht, A., 14.viii. | 3.5 | 0.22 | 4.3 | 2.0 | 0.37 | pr |
| Weszling, 19.v.74 | 3.5 | 0.20 | 4.8 | 2.3 | 0.36 | prw |
| Weszling, 19.v.74 | 3.9 | 0.20 | 4.6 | 2.2 | 0.38 | prw |
| Lousberg, 19.v. | 3.5 | 0.22 | 4.3 | 2.2 | 0.40 | pr |

Table 6. *Plectiscidea moerens* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| holotype | 3.4 | 0.27 | 4.3 | | 2.4 | 0.33 | |
| *P. xanthoneuris* | 3.1 | 0.25 | 4.6 | | 2.3 | | |
| *P. flavizona* | 3.3 | 0.26 | 4.3 | | 2.3 | | |
| *P. eversoria* | 4.0 | 0.25 | 4.3 | | 2.7 | 0.40 | |
| paralectotype *P. subcurvata* | 3.6 | 0.26 | 4.3 | | 2.1 | 0.38 | |

Material examined. — Germany: ♀, holotype of *P. moerens*, Aachen; ♀, holotype of *P. xanthoneuris*, Aachen; ♀, holotype of *P. flavizona*, Aachen; ♀, holotype of *P. eversoria*, Aachen; ♀, paralectotype of *P. subcurvata*, Aachen (all coll. Förster, München); ♀, Bayern, Starnberg, Kerschlach, 18.v.1975; ♀, Oberbayern, Glonn, 13.vi.1968; ♀, Obb. Karwendel (illegible), 20.vii.1958; 2 ♀, Hedemünden (E), 10.vii.1967; 2 ♀, Dransfeld (A), 15.v.1966. Italy: ♀, Schabs, Südtirol, 750 m, 30.vii.1966 (all leg. & coll. Haeselbarth); ♀, Sarntal (Bolzano), 1250 m, 9.vi.1977 (leg. & coll. Zwakhals). Netherlands: ♀, Naardermeer, Malaise trap, 15.x.1974, leg. Bunnik & Van Wijngaarden (coll. Zwart, Wageningen).

Distribution. — Widely spread in Western and Central Europe.

### Plectiscidea tener (Förster)

*Plectiscus tener* Förster, 1871: 86. Report on type by Aubert (1975).

Characteristics of the holotype of *Plectiscus tener*. Female. Front wing 2.8 mm long. Postannellus 5.0 times as long as apical width. Epomia present, but short. Propodeum polished, the apical transverse carina well developed. Prepectal carina present, short, reaching lower corner of pronotum. Left wings missing. First abdominal segment 2.1 times as long as apical width. The first tergite showing the most important feature of the species, namely the longitudinal striation with some vague coriaceous sculpture in the hind part. The spiracles rather protruding. The other tergites polished. Ovipositor 0.21 of the length of the front wing.

I found only one other specimen; it more or less agrees with the type specimen. It has the longitudinal sculpture of the first tergite. Compare table 7.

Male unknown.

Material examined. — Germany: ♀, holotype, Aachen (coll. Förster, München); ♀, Wiershausen (Niedersachsen) (Cb), 14.viii.1966 (leg. & coll. Haeselbarth).

### Plectiscidea parvula (Förster)

*Plectiscus parvulus* Förster, 1871: 86. Holotype labelled by Van Rossem.

*Plectiscus coxator* Förster, 1871: 86. Holotype labelled by Van Rossem. **New synonym.**

*Plectiscus nuptialis* Förster, 1871: 87. Report on type by Aubert (1975). **New synonym.**

Characteristics of the holotype of *Plectiscus parvulus*. Female. Front wing 2.7 mm long. Postannellus 5.5 times as long as apical width. Malar space 0.41 of width face. Epomia short. Prepectal carina not reaching the margin. Scutellum damaged by pin. Middle femur extremely slender, 13 times as long as apical width. First abdominal segment 1.8 times as long as apical width. The first tergite coriaceous. Ovipositor 0.19 of the length of the front wing. Compare table 8.

Table 7. *Plectiscidea tener* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| holotype | 2.8 | 0.21 | 5.0 | | 2.1 | | weak |
| Wiershausen, 14.viii.1966 | 3.5 | 0.22 | 5.2 | | 2.5 | | weak |

Table 8. *Plectiscidea parvula* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| holotype *P. parvula* | 2.7 | 0.19 | 5.5 | 0.41 | 1.8 | | pr |
| holotype *P. coxator* | 2.8 | 0.22 | 5.0 | 0.41 | 1.9 | | pr |
| holotype *P. nuptialis* | 2.9 | 0.22 | 5.0 | 0.38 | 1.9 | | |
| Hohenschwangau, 16.vii.74 | 4.2 | 0.22 | 5.0 | 0.41 | 1.9 | | |
| Hedemünden, 12.v.66 | 3.1 | 0.21 | 5.0 | | 1.8 | | |

Also the holotype of *P. nuptialis* shows the extremely slender middle femur.

Male unknown.

Material examined. — Germany: ♀, holotype of *P. parvula*, Lousberg, 15.ix; ♀, holotype of *P. coxator*, Köln; ♀, holotype of *P. nuptialis*, Aachen (all coll. Förster, München); ♀, Bayern, Hohenschwangau, Wildsulz, 1420—1560 m, 16.vii.1974; ♀, Hedemünden C, 12.v.1966 (specimen badly damaged) (both specimens leg. & coll. Haeselbarth). Austria: 2 ♀, Pass Thurn, Salzburg, 1200 m, 8.ix.1968; ♀, Fliess, Tirol, 4.ix.1971 (all three coll. Haeselbarth).

Distribution. — This is a species from Western Europe and the Alpine Region.

**Plectiscidea tenuicornis** (Förster)

*Plectiscus tenuicornis* Förster, 1871: 86. Holotype labelled by Van Rossem.

*Plectiscus tenuicornis* Thomson, 1888: 1303.

*Plectiscus brachyurus* Förster, 1871: 87. Holotype labelled by Van Rossem. **New synonym.**

Characteristics of the holotype of *P. tenuicornis*. Female. Frontwing 2.7 mm long. Postannellus 5.5 times as long as apical width. Notaulus weak. First tergite coriaceous. First abdominal segment 2.1 times as long as apical width. Ovipositor 0.27 of length of front wing. Compare table 9.

Characteristics of the holotype of *P. brachy-*

Table 9. *Plectiscidea tenuicornis* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| holotype *P. tenuicornis* | 2.7 | 0.27 | 5.5 | | 2.1 | | weak |
| holotype *P. brachyura* | 2.8 | 0.26 | 5.5 | | 2.0 | | weak |
| Zell Pfarre, 14.vii.79 | 4.2 | 0.24 | 5.6 | | 1.8 | | |
| Fliess, Tirol, 11.viii | 3.0 | 0.24 | 5.5 | | 2.2 | | |
| Wiershausen, 14.viii | 3.5 | 0.24 | 5.2 | | 2.3 | | |
| Obb. Weszling, 25.viii | 4.3 | 0.24 | 5.3 | | 2.3 | | |
| Naardermeer, 4.vi.74 | 3.8 | 0.25 | 5.6 | | 2.0 | | |
| Norge, Lom — Lia, 26.vi.81 | 3.8 | 0.27 | 5.6 | | 2.2 | | |
| Sweden, Värmland, Transtrand, 21.vii.81 | 4.0 | 0.25 | 5.3 | | 2.0 | | |

*urus*. Female. Front wing 2.8 mm long. Postannellus 5.5 times as long as apical width. Notauli weak, with a short carina on the inner margin. First tergite coriaceous. First abdominal segment 2.0 times as long as apical width. Ovipositor 0.26 of length of front wing.

The species is characterized by the length of the ovipositor (0.24—0.27 of the length of the front wing). The postannellus is 5.5—5.6 times as long as the apical width.

The male was described by Thomson (1888).

Material examined. — Austria: ♀, Kärnten, Zell Pfarre, 1200 m, 14.vii.1979; ♀, Kärnten, Himmelberg, 1000 m, 15.viii.1980 (both coll. Zwakhals); ♀, Fliess (Tirol), 1550 m, 11.viii.1971 (coll. Haeselbarth). Germany; ♀, holotype of *P. tenuicornis*, Lousberg, 25.x.; ♀, holotype of *P. brachyurus*, Aachen (both leg. & coll. Förster, Münden); 2 ♀, Hann. München, 13.viii.1965; ♀, Hedemünden, 12.v.1966; ♀, Lippoldshausen, B, 20.v.1967; ♀, Hessen, Witzenhausen, 14.v.1966; ♀, Niedersachsen, Wiershausen, 19.viii.1966; 2 ♀, Bayern, Herrsching, Kerschlacher Forst, 19.v.1974; ♀, Oberbayern, Weszling, 2.viii.1973. Italy: ♀, Campenjoch, Südtirol, 1350 m, A, 3.ix.1967 (all leg. & coll. Haeselbarth). Netherlands: ♀, Naardermeer, Malaise trap, 4.vi.1974, leg. Bunnik & Van Wijngaarden; ♀, Malaise trap, 8.x.1974, leg. Bunnik & Van Wijngaarden (both specimens coll. Zwart, Wageningen). Norway: ♀, Oppland, Lom-Lia, 26.vi.—20.vii.1978 (leg. & coll. Van Rossem). Sweden: ♀, Örebro Län, Klysna "Norrberga", 8.vii.—2.viii.1979; ♀, Värmland, Transtrand, Storbacken, 1st station, 21—31.vii.1981, margin of forest, close vegetation (leg. & coll. Van Rossem).

Distribution. — The species is widely spread in the Western Palaearctic Region.

### Plectiscidea cinctula (Förster)

*Plectiscus cinctulus* Förster, 1871: 89. Holotype labelled by Van Rossem.

*Plectiscus determinatus* Förster, 1871: 88. Lectotype designation by Van Rossem. **New synonym.**

*Plectiscus curticauda* Thomson, 1888: 1302. Lectotype designation by Aubert (1977). The specimen has an Aubert label "gleiche Art wie hier unten als *tenuicornis* Frst." **New synonym.**

Characteristics of the holotype of *P. cinctulus*. Female. Front wing 3.8 mm long. Apical part of clypeus yellow. Postannellus 5.0 times as long as apical width. Notaulus weak, only visible on the margin. Scutellar carina running beyond the corner, not meeting at apex. Propodeum with vague coriaceous sculpture. Prepectal carina not reaching the margin. First abdominal segment 2.3 times as long as apical width. First tergite coriaceous. Ovipositor 0.29 of length of front wing.

Characteristics of the lectotype of *P. curticauda* (Thomson). Female. Front wing 4.3 mm long. Postannellus 5.1 times as long as apical width. Epomia short. Notaulus rather strong, but short. Lateral carina of scutellum not running behind the corner. Propodeum with irregular sculpture, the apical transverse carina with weak apophyses. The first abdominal segment 2.5 times as long as apical width. The spiracles lying at 0.35 of the length of the segment. The first tergite coriaceous. About 0.60 of the second tergite with coriaceous sculpture. Ovipositor 0.27 of the length of the front wing.

Male unknown.

Remark. — The lectotype and paralectotype of *P. determinata* are placed provisionally under *P. cinctula*. In both specimens the ratio of the length and width of the postannellus does not agree with the holotype of *P. cinctula*. Compare table 10.

Material examined. — Austria: ♀, T. Lechtaler Alpen, Bleispitze, 1900—2200 m, 14.viii.1974 (leg. & coll. Haeselbarth). Germany: ♀, holotype of *P. cinctula*, Aachen (coll. Förster, München); ♀, lectotype of *P. curticauda* (Thomson), ? Kaltenkirchen, 23.viii.1886 (coll. Thomson, Lund); 3 ♀, Hedemünden, C, 12.v.1966; ♀, Oberbayern, Deisenhofen, 26.vii.1958; 2 ♀, Bayern, Hohenschwangau, Säulingweg, 1120—1300 m, 16.vii.1974 and Wildsulz, 1420—1560 m, 16.vii.1974 (all leg. & coll. Haeselbarth). Sweden: 2 ♀, Fjätervålen — Idre, Dalarna, 2.viii—12.viii; 24.vii—1.viii.1982 (leg. & coll. Van Rossem); ♀, Dalarna, Transtrand, Hemfjällstangen, vii.1976 (leg. & coll. Van Rossem).

Distribution. — A widely spread species which may tend to mountainous regions.

### Plectiscidea amicalis (Förster)

*Plectiscus amicalis* Förster, 1871: 87. Lectotype designation by Van Rossem.

*Plectiscus sodalis* Förster, 1871: 88. Lectotype designation by Van Rossem. **New synonym.**

Characteristics of the lectotype of *P. amicalis*. Female. Front wing 4.0 mm long. Postannellus 6.0 times as long as apical width. Notaulus weakly indicated on the margin. Mesopleurum polished, prepectal carina not reaching the margin. The first abdominal segment 2.6 times as long as the apical width. First tergite in part coriaceous. Second tergite with vague coriaceous sculpture. Gaster with rather conspicuous hairs.

Table 10. *Plectiscidea cinctula* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| holotype *P. cinctula* | 3.8 | 0.29 | 5.0 | | 2.3 | | weak |
| lectotype *P. determinata* | 3.6 | 0.28 | 5.6 | | 2.36 | 0.4 | |
| paralectotype *P. determinata* | 3.3 | 0.27 | 4.8 | | 2.18 | 0.33 | |
| lectotype *P. curticauda* | 4.3 | 0.27 | 5.1 | | 2.5 | 0.35 | |
| Lechtaler, A., 14.viii | 3.5 | 0.30 | 5.2 | | 1.9 | | |
| Hedemünden, 12.v.66 | 3.0 | 0.30 | 5.5 | | 1.8 | | |
| Hedemünden, 12.v.66 | 3.8 | 0.31 | 5.2 | | 2.3 | | |
| Hohenschwangau, 16.vii (wings damaged) | | 0.29 | 5.2 | | 1.7 | | |
| Sverige, Fjätervålen, 2—12.viii | 3.4 | 0.28 | 5.2 | | 2.2 | | |

Ovipositor 0.22 of the length of the front wing. Compare table 11.

Male. Thomson (1888) described the male of *P. sodalis*. I did not see the specimen.

Material examined. — Germany: ♀, lectotype of *P. amicalis*, no locality; ♀, lectotype of *P. sodalis*, Lousberg, 26.x (coll. Förster, München); ♀, Bayern, Weszling, Hochstadt, 19.v.1974 (leg. & coll. Haeselbarth). Italy: ♀, Bz, Valvestino, Monte Tombea, 1500—1700 m, 14.vi.1976 (identification dubious); ♀, Bz, Valvestino, Cima Tombea, 1900 m, 14.vi.1976 (identification dubious) (both specimens leg. & coll. Haeselbarth). Sweden: ♀, paralectotype of *P. curticauda* (Thomson), Kfe (=Kävlinge, Skåne) (coll. Thomson, Lund).

Distribution. — There are few localities available of this species in Germany and Sweden. The Italian localities are dubious.

### Plectiscidea helvola (Förster)

*Plectiscus helvolus* Förster, 1871: 86. Report on type by Aubert (1975).

Table 11. *Plectiscidea amicalis* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| lectotype *P. amicalis* | 4.0 | 0.22 | 6.0 | | 2.6 | | |
| lectotype *P. sodalis* | 4.0 | 0.23 | 6.0 | | 2.0 | | |
| paralectotype *P. curticauda* (Th.) | 4.3 | 0.22 | 6.0 | | 2.3 | no areolet | |
| Weszling, Hochstadt | 2.8 | 0.23 | 6.0 | | 2.5 | | |
| Hedemünden, 12.v.66 | 3.4 | 0.24 | 6.0 | | 2.2 | | |
| Valvestino, 1900 m | 3.5 | 0.21 | 6.5 | | 2.3 | | |
| Valvestino, 1500—1700 m | 3.6 | 0.20 | 6.5 | | 1.8 | | |
| Valvestino, 1500—17.00 m | | 0.22 | 6.0 | | 2.4 | | |

Table 12. *Plectiscidea helvola* (Förster. For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| holotype *P. helvola* | 3.2 | 0.25 | 6.5 | | 2.4 | | weak |
| holotype *P. subsimilis* | 3.3 | 0.31 | 6.5 | | 2.5 | | |
| holotype *P. petiolata* | 3.8 | 0.28 | 6.5 | | 2.6 | | |
| paralectotype *P. amicalis* | 3.7 | 0.28 | 6.5 | | 2.7 | | |
| Kärnten, Himmelberg, 11.viii.1980 | 3.5 | 0.25 | 6.5 | | 2.4 | | |

*Plectiscus subsimilis* Förster, 1871: 86. **New synonym.** Placed as synonym of *P. melanocera* by Aubert (1975).

*Plectiscus petiolatus* Förster, 1871: 87. Holotype labelled by Van Rossem. **New synonym.**

Characteristics of the holotype of *P. helvola*. Female. Front wing 3.2 mm long. Postannellus 6.5 times as long as apical width. Epomia present. Notaulus almost absent. Scutellar carina running to the apex. Propodeal carinae weak. Prepectal carina present, but short. First abdominal segment 2.4 times as long as apical width. First tergite with vague coriaceous sculpture. Ovipositor 0.25 of the length of the front wing. Compare table 12.

Male unknown.

Remark. — The species closely resembles *P. melanocera*, but it differs in the length of the first abdominal segment, 2.4—2.7 times the apical width (2.0 times in *P. melanocera*).

Material examined. — Austria: ♀, Kärnten, Himmelberg, 1000 m, 11.viii.1980 (leg. & coll. Zwakhals). Germany: ♀, holotype of *P. helvola*, Aachen; ♀, holotype of *P. subsimilis*, Lousberg, 4.viii; ♀, holotype of *P. petiolata*, Aachen; ♀, paralectotype of *P. amicalis*, Aachen (all coll. Förster, München).

### Plectiscidea vagator (Förster)

*Plectiscus vagator* Förster, 1871: 87. Holotype labelled by Van Rossem.

*Plectiscus ambulator* Förster, 1871: 87. Holotype labelled by Van Rossem. **New synonym.**

Characteristics of the lectotype of *P. vagator*. Female. Front wing 3.8 mm long. Postannellus 6.0 times as long as apical width. Epomia present. Notaulus present, a short groove on the margin of the mesoscutum. Scutellar carina running to the apex. Propodeum with some coriaceous sculpture, the carinae rather weak. Prepectal carina present. First abdominal segment 2.1 times as long as apical width. First tergite coriaceous. Ovipositor 0.25 of the length of the front wing. Compare table 13.

The species is characterized by the length of the postannellus, 6.0 times as long as apical width (6.5 times in *P. melanocera* and *P. helvola*). The length of the ovipositor in the lectotype of *P. vagator* (0.25 of the length of the front wing) does not quite agree with the other specimens which I placed in *P. vagator* (0.27—0.30 of the length of the front wing).

Male unknown.

Material examined. — Switzerland: ♀, lectotype of *P. vagator*, Pontresina. Germany: ♀, holotype of *P. ambulator*, Aachen (both specimens coll. Förster, München); ♀, Oberbayern, Glonn, 14.vii.1968. Italy: ♀, Südtirol, 2100 m, B, 24.vii.1966 (both specimens leg. & coll. Haeselbarth).

### Plectiscidea melanocera (Förster)

*Plectiscus melanocerus* Förster, 1871: 87. Report on type by Aubert (1975).

*Plectiscus proximus* Förster, 1871: 88. Holotype labelled by Van Rossem. **New synonym.**

Characteristics of the holotype of *P. melanocera*. Female. Front wing 3.0 mm long. Lower tooth of mandible slightly shorter than upper tooth. Postannellus 6.5 times as long as apical width. Notaulus weakly present. Length of first abdominal segment 2.0 times the apical width. First tergite coriaceous. The other tergites pol-

ished, but the second tergite with vague coriaceous sculpture. Ovipositor 0.27 of the length of the front wing. Compare table 14.

The species is characterized by the long postannellus, 6.5 times the apical width; the length of the ovipositor, 0.27—0.30 of the length of the front wing and the short first abdominal segment, 2.0 times the apical width.

Male unknown.

Material examined. — Germany: ♀, holotype of *P. melanocera*, Lousberg, 13.ix; ♀, lectotype of *P. proxima*, Lousberg, 11.ix (coll. Förster, München); 2 ♀, Hedemünden, C, 12.v.1966 (leg. & coll. Haeselbarth). Netherlands: ♀, Naardermeer, Malaise trap, 20.viii.1974; ♀, Naardermeer, Malaise trap, 3.ix.1974; ♀, Naardermeer, Malaise trap, 8.x.1974 (all leg. Bunnik & Van Wijngaarden) (coll. Zwart, Wageningen).

Distribution. — Widely spread in the western Palaearctic Region.

### Plectiscidea canaliculata (Förster)

*Plectiscus canaliculatus* Förster, 1871: 86. Lectotype designation by Aubert. Report on type by Aubert (1975).

*Plectiscus subtilis* Förster, 1871: 86. Lectotype designation by Townes. Placed as synonym with *P. canaliculata* by Aubert (1975).

*Plectiscus distinctus* Förster, 1871: 88. Lectotype designation by Aubert. Placed as synonym with *P. canaliculata* by Aubert (1975).

*Plectiscus subcurvatus* Förster, 1871: 89. Lectotype designation by Van Rossem. **New synonym.**

Characteristics of the lectotype of *P. canaliculata*. Female. Front wing 3.1 mm long. Malar space 0.33 of width face. Postannellus 5.2 times as long as apical width. Epomia present but short. Notaulus strong on the mesoscutal margin. Lateral carina of scutellum at the corner. Propodeum with some vague coriaceous sculpture and widely placed rather long hairs. Prepectal carina present, short, not beyond ventral corner of pronotum. First abdominal segment long, 3.1 times as long as apical width. First tergite coriaceous and with a vague median dorsal carina. Ovipositor 0.36 of the length of the front wing. Compare table 15.

Male unknown.

Remark. — The species is characterized by the long first abdominal segment, 3.1—3.5 times as long as apical width. I am well aware that the lectotype of *P. subcurvata* does not quite agree with *P. canaliculata*. The postannellus is rather short. The ovipositor reaches 0.32 of the length of the front wing and the first abdominal segment measures 3.5 times the apical width.

Material examined. — Germany: ♀, lectotype of *P. canaliculata* Lousberg, 15.ix; ♀, lectotype of *P. subtilus*, Aachen; ♀, no locality (pencil label "subtilis"); ♀, lectotype of *P. distincta*, Aachen, 5.vii; ♀, lectotype of *P. subcurvata*, Lousberg, 5.v (all coll. Förster, München). Austria: ♀, Kärnten, Bodental, 1100 m, 13.vii.1981 (leg. & coll. Zwakhals). Germany: ♀, Bayern, Hohenschwangau, 830—1050 m, 16.vii.1974 (leg. & coll. Haeselbarth).

Distribution. — Widely spread in the western Palaearctic Region.

### Plectiscidea erythropyga (Förster)

*Plectiscus erythropygus* Förster, 1871: 88. Lectotype designation by Aubert (1975).

Characteristics of the lectotype of *P. erythropyga*. Female. Front wing 4.8 mm long. Mandibular teeth of the same length. Clypeus for the greater part yellow. Malar space impressed. Postannellus 6.0 times as long as apical width. Epomia strong, almost reaching the mesoscutal margin. Notaulus strong, reaching to about 0.3 of the distance to the center of mesoscutum. Upper part of propodeum more or less polished, apical transverse carina strong. Mesopleurum polished, prepectal carina not reaching the margin. Hind coxa punctured by implantations of hairs. First abdominal segment 2.7 times as long as apical width. The first tergite with longitudinal striated sculpture, also somewhat coriaceous. In the basal half of the second tergite vague coriaceous sculpture, the apical margin yellowish brown. Third tergite with a narrower yellowish margin. The apical part of the gaster dirty yellowish. Length of ovipositor 0.55 of the length of front wing. Compare table 16.

Male unknown.

Material examined. — Germany: ♀, lectotype of *P. erythropyga*, Lousberg, 15.x. (coll. Förster, München).

### Plectiscidea monticola (Förster)

*Plectiscus monticola* Förster, 1871: 89. Lectotype designation by Aubert. Report on type by Aubert (1975).

Table 13. *Plectiscidea vagator* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| lectotype *P. vagator* | 3.8 | 0.25 | 6.0 | | 2.1 | | pr |
| holotype *P. ambulator* | 4.0 | 0.30 | 6.0 | | 2.3 | | pr |
| Glonn, 14.vii.68 | 3.7 | 0.27 | 6.0 | | 2.3 | | weak |
| Südtirol, 2100 m, 24.vii.66 | 3.5 | 0.29 | 6.0 | | 2.1 | | pr |

Characteristics of the lectotype of *P. monticola*. Female. Front wing 3.7 mm long. Mandibular teeth of the same length. Malar space 0.35 of width of face. Postannellus 5.0 times as long as apical width. Epomia strong, reaching to the mesoscutal margin. Notaulus present, running to about 0.30 of the distance to the centre of the mesoscutum. Scutellar margin reaching beyond the scutellar corner, turning inwards but not meeting. Propodeum with coriaceous sculpture, carinae strong. Mesopleurum polished, prepectal carina strong, not reaching to the margin. Coxae brown, hind coxa coriaceous. First abdominal segment 2.0 times as long as apical width. First tergite coriaceous, medially rather convex. The second tergite coriaceous, with an apical yellow band, merging into a spot on tergite three. Ovipositor 0.44 of the length of the front wing. Compare table 17.

Material examined. — Switzerland: ♀, lectotype of *P. monticola*, Splügen (coll. Förster, München); ♀, Gr. S-charl Clemgiatal, 2000—2100 m, 12.viii.1973 (leg. & coll. Haeselbarth). Germany: ♀, Oberbayern, Umg. Deisenhofen, 26.vii.1958 (leg. & coll. Haeselbarth). Sweden: ♀, coll. Holmgren, no locality, paralectotype of *P. curticauda* (Thomson) (coll. Thomson, Lund).

Distribution. — The species seems to be a mountainous and perhaps a boreal species.

### **Plectiscidea agitator** (Förster)

*Plectiscus agitator* Förster, 1871: 89. Holotype labelled by Van Rossem. An Aubert label: *Plectiscidea subangulatus* Först. (= *mesoxanthus* = *agitator* Först.).

Characteristics of the holotype. Female. Front wing 4.5 mm long. Malar space 0.35 of

Table 14. *Plectiscidea melanocera* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| holotype *P. melanocera* | 3.0 | 0.27 | 6.5 | | 2.0 | | |
| lectotype *P. proxima* | 3.0 | 0.25 | 6.5 | | 2.0 | | |
| Hedemünden, 12.v.66 | 4.0 | 0.30 | 6.4 | | 2.0 | | |
| Hedemünden, 12.v.66 | 3.5 | 0.30 | 6.5 | | 2.0 | | |
| Naardermeer, 20.viii.74 | 3.1 | 0.28 | 6.0 | | 1.9 | | |
| Naardermeer, 3.ix.74 | 3.4 | 0.33 | 6.5 | | 2.0 | | |
| Naardermeer, 8.x.74 | 4.0 | 0.29 | 6.4 | | 2.0 | | |

Table 15. *Plectiscidea canaliculata* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| lectotype *P. canaliculata* | 3.1 | 0.36 | 5.2 | 0.33 | 3.1 | | pr |
| lectotype *P. subtilis* | 3.2 | 0.36 | 5.2 | | 3.1 | | pr |
| *P. subtilis* specimen, no loc. | 3.2 | 0.33 | 5.2 | | 3.1 | | |
| lectotype *P. distincta* | 3.1 | 0.35 | 5.2 | | 3.1 | | |
| lectotype *P. subcurvata* | 3.4 | 0.32 | 4.8 | | 3.5 | | pr |

width of face. Lower tooth of mandible slightly shorter than upper tooth. Postannellus 6.0 times as long as apical width. Epomia present. Notaulus present, but rather weakly impressed. Scutellar margin not reaching further than the scutellar corner. Propodeal carinae well developed. Prepectal carina strong. Right hind leg missing beyond femur. Left hind leg missing beyond trochanter. First abdominal segment 2.3 times as long as the apical width. First tergite with some longitudinal sculpture. Second tergite almost polished, with a yellow apical margin. Ovipositor 0.40 of the length of the front wing.

Male unknown.

Material examined. — Germany: ♀, holotype of *P. agitator*, Lousberg, 1.vii (coll. Förster, München).

### Plectiscidea conjuncta (Förster)

*Plectiscus conjunctus* Förster, 1871: 87. Report on type by Aubert (1975).

*?Plectiscus flavicoxis* Förster, 1871: 87. Placed in the synonymy of *P. conjuncta* by Aubert (1975).

Characteristics of the holotype of *P. conjuncta*. Female. Front wing 3.9 mm long. Clypeus yellow. Malar space 0.38 of width of face. Postannellus 5.2 times as long as apical width. Tips of both antennae broken off. Epomia to the pronotal margin (an exception). Notaulus present. Scutellar carina running beyond the corner, curving inwards, but not meeting. Propodeum polished. Prepectal carina present. First abdominal segment 2.4 times as long as apical width and it measures 0.16 of the length of the front wing. Spiracles situated at 0.34 of the length of the segment. First tergite coriaceous. Second tergite with vague coriaceous sculpture. Ovipositor 0.38 of the length of the front wing. Compare table 18.

Male unknown.

Remark. — The status of the lectotype of *P. flavicoxis* is disputable. The notaulus is obliterated by the glue fixing the head of the specimen. Nevertheless the first abdominal segment measures 0.15 of the length of the front wing. I have placed *P. flavicoxis* tentatively as a synonym of *P. conjuncta*. In the paralectotype of *P. flavicoxis* the abdominal segment measures 0.14 of the length of the front wing and consequently agrees with *P. conjuncta*.

Male unknown.

Material examined. — Germany: ♀, holotype of *P. conjuncta*, Lousberg, 25.x; ♀, lectotype of *P. flavicoxis*, Lousberg, 25.x; ♀, paralectotype of *P. flavicoxis*, Lousberg, 31.x (all coll. Förster, München). Italia: ♀, Funes (Prov. Bolzano), 20.vii—9.viii.1968, Selva Nera 1400—2000 m (leg. & coll. Van Rossem).

Table 16. *Plectiscidea erythropyga* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| lectotype *P. erythropyga* | 4.8 | 0.55 | 6.0 | | 2.7 | | pr |

Table 17. *Plectiscidea monticola* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| lectotype *P. monticola* | 3.7 | 0.44 | 5.0 | 0.35 | 2.0 | | pr |
| paralectotype *P. curticauda* | 4.4 | 0.42 | 5.0 | 0.44 | 2.1 | | weak |
| Deisenhofen, 26.vii.1958 | 5.2 | 0.42 | 5.6 | 0.41 | 2.1 | | pr |
| Clemgiatal, 12.viii.73 | 3.5 | 0.41 | 5.2 | 0.37 | 2.2 | | pr |

**Plectiscidea collaris** (Gravenhorst)

*Plectiscus collaris* Gravenhorst, 1829: 987. No Gravenhorst label present. Lectotype designation by Aubert.

*Plectiscus collaris*; Förster, 1871: 85 & 89.

*Plectiscus collaris*; Thomson, 1888: 1300. Material not examined.

*Plectiscus binodulus* Förster, 1871: 89. Holotype labelled by Van Rossem. **New synonym.**

Characteristics of the lectotype of *Plectiscus collaris*. Female. Front wing 4.8 mm long. Palpi yellow. Lower mandibular tooth somewhat shorter than upper tooth. Clypeus protruding, the apical margin curved inwards. Width of clypeus about half the width of face. Malar space wide, 0.38 of width of face. All parts of head polished. Postannellus 5.0 times as long as apical width. Epomia present. Notaulus strong at the margin, but short. Scutellum with the carina to the apex, not meeting. Mesopleurum polished, prepectal carina not reaching the margin. Coxae and legs yellow. Hind coxa slightly coriaceous. Length of first abdominal segment 2.6 times the apical width and it measures 0.18 of the length of the front wing. The first tergite coriaceous. The second tergite for the greater part polished with some vague coriaceous sculpture. The other tergites polished. Ovipositor 0.38 of the length of the front wing.

Characteristics of the holotype of *Plectiscus binodulus*. Female. Front wing 5.2 mm long. Palpi and mandible whitish. Lower tooth of mandible somewhat shorter than upper tooth. Clypeus protruding, the outer margin curved inwards weakly. Malar space 0.35 of width of face. Postannellus 5.2 times as long as apical width. Notaulus strong, but short. Margin of scutellum not present. Mesopleurum polished, prepectal caina wide away from margin. Length of first abdominal segment 2.4 times the apical width and measuring 0.19 of the length of the front wing. Coriaceous sculpture of the first tergite present but weak. Second tergite polished but with vague coriaceous sculpture. The other tergites polished. Ovipositor 0.35 of the length of the front wing. Compare table 19.

Male. Thomson (1888) and Strobl (1903) distinguished the male.

Material examined. — No locality, ♀, lectotype of *P. collaris* (Muzeum Przyrodnicze, Wroclaw). Germany: ♀, label *P. collaris*, Aachen; ♀, holotype of *P. binodula*, Lousberg, 26.x (both specimens coll. Förster, München); 2 ♀, Bayern, Herrsching, Wid-

Table 18. *Plectiscidea conjuncta* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not | abds /frw |
|---|---|---|---|---|---|---|---|---|
| holotype *P. conjuncta* | 3.9 | 0.38 | 5.2 | 0.38 | 2.4 | 0.34 | pr | 0.16 |
| lectotype *P. flavicoxis* | 3.5 | 0.38 | 5.2 | 0.35 | 2.2 | 0.31 | | 0.15 |
| paralectotype *P. flavicoxis* | 3.7 | 0.36 | 5.2 | 0.38 | 2.2 | 0.37 | weak | 0.14 |

Table 19. *Plectiscidea collaris* (Gravenhorst). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | abds l/w | spir/ abds | abds /frw |
|---|---|---|---|---|---|---|
| lectotype *P. collaris* | 4.8 | 0.38 | 5.0 | 2.6 | | 0.18 |
| Aachen, coll. Förster | 4.9 | 0.37 | 5.2 | 2.6 | | |
| holotype *P. binodula* | 5.2 | 0.35 | 5.2 | 2.4 | | 0.18 |
| Ede, 3.x.64 | | 0.40 | 6.0 | 2.8 | 0.37 | 0.19 |
| Sarntal, 1250 m, 24.vi.1976 | | 0.34 | 5.7 | 2.6 | | |
| + Amesberg, 30.viii.85 | | 0.45 | 5.7 | 2.3 | 0.42 | 0.18 |
| + Brunnwald, 21.viii.85 | | 0.52 | 6.0 | 2.6 | | 0.19 |
| + Brunnwald, 21.viii.85 | | 0.48 | 6.3 | 2.8 | 0.39 | 0.19 |
| + Schönau, 4.viii.85 | | 0.45 | 6.0 | 2.4 | 0.41 | 0.18 |
| + Penzenmühle, 19.ix.85 | 4.97 | 0.46 | 6.0 | 2.3 | | 0.18 |
| + Dreiegg, 24.ix.85 | | 0.46 | 5.6 | 2.6 | | 0.18 |
| + Riedl, 12.ix.85 | | 0.47 | 5.0 | 2.9 | | 0.19 |
| + Riedl, 12.ix.85 | | 0.45 | 4.8 | 2.3 | 0.40 | 0.17 |

+ = Austria

dersberg, sumpfiges Tal, 22.vi.1974 (leg. & coll. Haeselbarth). Italia: ♀, Bolzano, Sarntal, 24.vi.1976 (leg. & coll. Zwakhals). Netherlands: ♀, Ede, Planken Wambuis, 3.x.1964 (leg. & coll. Van Rossem).

Distribution. — *Plectiscidea collaris* is the type species of *Plectiscidea* but it seems to be uncommon. It is nevertheless widely spread.

### **Plectiscidea foersteri** species nova

Characteristics of the holotype. Labels: 23 gl., Aachen (coll. Förster, München). Female. Front wing 4.7 mm long. Lower tooth of mandible much shorter than upper tooth. Clypeus yellow. Malar space 0.33 of width of face. Right antenna missing. Postannellus 3.7 times as long as apical width. Pronotum reddish brown in colour. Epomia present. Notaulus developed to about 0.5 of the distance to the mesoscutal center, with a short carina on the inner side at the mesoscutal margin. Scutellum with the lateral carina only at the basal corner. Propodeum with vague coriaceous sculpture, the carinae well developed. Prepectal carina strong. Left hind leg missing beyond coxa. First abdominal segment 2.4 times as long as apical width. First tergite coriaceous. Second tergite with vague coriaceous sculpture, the apical half yellow. The other tergites and sternites yellow. Ovipositor 0.44 of the length of the front wing.

Male unknown.

The species is named after Arnold Förster (1810—1884).

Material examined. — Germany: ♀, holotype of *P. foersteri*. Aachen. (coll. Förster, München). The specimen belongs to the material placed by Förster under the name *Plectiscus collaris*.

### **Plectiscidea nava** (Förster)

*Proclitus navus* Förster, 1871: 117. Holotype labelled by Van Rossem. Label of Aubert: *Plectiscidea flavizonus* Först. (= *Proclitus navus* Först.).
*Plectiscidea* (nec *Proclitus*) *navus*; Aubert, 1977: 146.

Characteristics of the holotype of *Proclitus navus*. Female. Front wing 3.9 mm. Malar space 0.41 of width of face. Width of clypeus 0.52 of width of face. Postannellus 4.3 times as long as the apical width. Flagellum of the left antenna lacking. Flagellum of the right antenna lacking beyond the third flagellar segment. Epomia present. Mesoscutum polished, with notaulus strong towards the mesoscutal margin, further on obsolete. Propodeum with coriaceous sculp-

Table 20. *Plectiscidea nava* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| holotype *P. nava* | 3.9 | 0.38 | 4.3 | | 2.3 | | pr |
| Bodental, 1100 m 1.viii.81 | 4.7 | 0.39 | 4.0 | | 2.2 | | pr |
| Spertental, Tirol 5.vii.71 | 3.5 | 0.37 | 4.3 | | 2.0 | | pr |
| Clemgiatal, 1900—2000 m, 12.viii.73 | 3.5 | 0.35 | 4.0 | | 2.0 | | pr. |

ture. Mesopleurum polished, prepectal carina not reaching the margin. First abdominal segment 2.3 times as long as the apical width. The first tergite with coriaceous sculpture. The second tergite for the greater part coriaceous. The other tergites polished. Ovipositor 0.38 of the length of the front wing. Compare table 20.

Male unknown.

Material examined. — Germany: ♀, holotype of *P. navus*, Aachen (coll. Förster, München). Austria: ♀, Kärnten, Bodental, 1100 m, 1.vii.1981 (leg. & coll. Zwakhals); ♀, Tirol, Spertental, 1100 m, 5.vii.1971 (leg. & coll. Haeselbarth) Switzerland: ♀, Gr. S-charl, Clemgiatal, 1900—2000 m, 12.viii.1973 (leg. & coll. Haeselbarth).

Distribution. — Besides the type specimen from Aachen, there are some alpine localities at high altitudes.

### **Plectiscidea substantiva** species nova

Characteristics of the holotype of *P. substantiva* (♀, Nd Spessart, Lochmühle 1971, 17—22.ix, Malaise trap, leg. G. van Rossem): Front wing 4.5 mm long. Palpi and mandible yellow. Lower mandibular tooth shorter than upper tooth. Malar space wide, 0.35 of width of face. Anterior tentorial pits conspicuous. All parts of head polished. Mandible, clypeus and face with rather long hairs. Postannellus 4.2 times as long as the apical width. Epomia present. Notaulus strong on the mesoscutal margin and with a short carina on the inner side. Mesoscutum polished, on front part and along the lateral margin with suberect long hairs. First and second pleural area and metapleural area with conspicuous and close suberect hairs. Mesopleurum polished, hairs on lower part, prepectal carina strong, not reaching the margin. Front and middle coxae whitish, hind coxae brown. Claws strong. First tergite coriaceous and with fine longitudinal striation, laterally with hairs. The first abdominal segment 2.6 times as long as apical width. The second tergite with vague coriaceous sculpture and with a yellow apical band. The other tergites polished and yellow. Ovipo-

Table 21. *Plectiscidea substantiva* spec. nov. For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| holotype | 4.5 | 0.47 | 4.2 | 0.35 | 2.6 | | pr |
| Lochmühle, 17—22.ix.71 | 4.8 | 0.43 | 4.5 | 0.33 | 2.7 | | pr |
| Lochmühle, 17—22.ix.71 | 4.8 | 0.45 | 4.5 | 0.29 | 2.5 | | pr |
| Lousberg, 6.x, coll. Förster | 4.6 | 0.48 | 4.5 | 0.35 | 2.5 | | pr |
| Obbay. Jettenhausen, 12.vii.68 | 4.2 | 0.43 | 4.0 | 0.33 | 2.4 | | pr |
| Austria, Bodental, 1100 m, 3.vii.81 | 5.2 | 0.48 | 4.5 | 0.31 | 2.5 | | pr |
| Neth., Ede 2—3.xi.66 | 4.8 | 0.48 | 4.5 | 0.33 | 2.7 | | pr |

Table 22. *Plectiscidea crassicornis* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| holotype *P. crassicornis* | 4.5 | 0.41 | 4.2 | 0.42 | 2.6 | 0.37 | pr |
| Südtirol, 1900 m, 24.vii.66 | 4.5 | 0.41 | 4.2 | 0.41 | 2.3 | | |
| Switzl. St. Surains, 1500 m, 30.vii.73 | 3.7 | 0.43 | 4.6 | 0.41 | 2.3 | | |

sitor 0.47 of the length of the front wing. Compare table 21.

Male unknown.

Remark. The anterior tentorial pit of the holotype is strongly impressed. In the paratypes this is less conspicuous.

The specific name "substantivus" is the Latin for "separately".

Material examined. — Germany: ♀, holotype of *P. substantiva*, Nd Spessart, Lochmühle, Malaise trap, 17—22.ix.1971; 2 ♀, paratypes, Nd Spessart, Lochmühle, Malaise trap, 17—22.ix.1971 (leg. & coll. Van Rossem); ♀, paratype, third specimen of *P. collaris* sensu Förster, Lousberg, 6.x (coll. Förster, München); ♀, paratype, Oberbayern, Jettenhausen, 12.vii.1968 (leg. & coll. Haeselbarth). Austria: ♀, Kärnten, Bodental, 1100 m, 3.vii.1981 ((leg. & coll. Zwakhals). Netherlands: ♀, paratype, Ede (garden), 2—3.xi.1963 (leg. & coll. Van Rossem).

Distribution. — The species is widely spread in the Western Palaearctic Region.

### Plectiscidea crassicornis (Förster)

*Plectiscus crassicornis* Förster, 1871: 89. Report on type by Aubert (1975).

Characteristics of the holotype of *P. crassicornis*. Female. Front wing 4.5 mm long. Malar space wide, 0.42 of width of face. Postannellus 4.2 times as long as apical width. Epomia present, short. Notaulus present and rather strong. Scutellar carina not running behind the scutellar corner. Propodeum with strong carinae and weak apophyses. Prepectal carina present. Legs and coxae yellowish brown, strong. Femora stout. Front femur 3.0 times as long as wide. First abdominal segment 2.6 times as long as apical width. First tergite coriaceous and with a conspicuous lateral row of hairs. The spiracles situated at 0.37 of the length of the segment. The gaster bright yellow of colour in the apical half of the second tergite and further. Ovipositor conspicuously long, 0.41 of the length of the front wing. The type specimen is robust for a *Plectiscidea* species. Compare table 22.

Male. Thomson (1888) described the male.

Material examined. — Germany: ♀, holotype of *P. crassicornis*, Lousberg, 15.ix (coll. Förster, München). Italia: ♀, Südtirol (Bolzano district), 1900 m, C, 24.vii.1966. Switzerland: ♀, Gr. Sent Surains u. Val Gronda, 1500 m, 30.vii.1973 (both specimens leg. & coll. Haeselbarth).

Distribution. — Besides the type specimen from Lousberg (Aachen), there are two specimens from high altitudes in the Alps.

### Plectiscidea posticata (Förster)

*Plectiscus posticatus* Förster, 1871: 87. Report on type by Aubert (1975).

*Plectiscus pungens* Förster, 1871: 87. Placed as synonym of *P. posticata* by Aubert (1975).

Table 23. *Plectiscidea posticata* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| holotype *P. posticata* | 3.6 | 0.33 | 7.0 | 0.30 | 2.7 | | weak |
| holotype *P. pungens* | 3.6 | 0.35 | 7.0 | | 2.7 | | weak |

Table 24. *Plectiscidea connexa* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| holotype *P. connexa* | 4.2 | 0.40 | 5.3 | 0.40 | 2.7 | 0.37 | not pr |
| Austria, Haus, 1200 m 9.vi.72 | 4.2 | 0.46 | 5.0 | 0.37 | 3.0 | 0.40 | weak |

Characteristics of the holotype of *P. posticata*. Female. Front wing 3.6 mm long. Left antenna missing. Malar space 0.30 of width of face. Postannellus 7.0 times as long as apical width. Epomia present. Notaulus weak. Lateral carina of scutellum running somewhat past the scutellar corner. Propodeum polished. Prepectal carina present. First abdominal segment 2.7 times as long as apical width. First tergite coriaceous. The gaster compressed behind the second segment. Ovipositor 0.33 of the length of the front wing.

Male unknown.

Remark. — The chief characters of the female of this species are the following. Front wing 3.6 mm long. The postannellus is conspicuously long, 7.0 times the apical width. Notaulus evanescent. The ovipositor 0.33—0.35 of the length of the front wing. Compare table 23.

Material examined. — Germany: ♀, holotype of *P. posticata*, Aachen; ♀, holotype of *P. pungens*, Lousberg, 3.x (coll. Förster, München).

### Plectiscidea connexa (Förster)

*Plectiscus connexus* Förster, 1871: 89. Holotype labelled by Van Rossem.

Characteristics of the holotype of *P. connexa*. Female. Front wing 4.2 mm long. Malar space 0.40 of width of face. Postannellus 5.3 times as long as apical width. Epomia short. Notaulus not present. Lateral carina of scutellum running to apex of scutellum. Prepectal carina with a sinuosity caused by the indentation of the sternaulus. First abdominal segment 2.7 times as long as apical width. First tergite coriaceous. The spiracles situated at 0.37 of the length of the segment. Second tergite almost polished, with a yellow band merging into a yellow zone of tergite three. Ovipositor 0.40 of the length of the front wing. Compare table 24.

Male unknown.

Material examined. — Germany: ♀, holotype of *P. connexa*, Aachen (coll. Förster, München). Austria: ♀, St., Haus, Heidelbeere, 1200 m, 9.vi.1972 (leg. & coll. Haeselbarth).

### Plectiscidea mesoxantha (Förster)

*Plectiscus mesoxanthus* Förster, 1871: 88. Holotype labelled by Van Rossem.

Characteristics of the holotype of *P. mesoxantha*. Female. Front wing 4.6 mm long. Malar space 0.38 of width of face. Postannellus 5.7 times as long as apical width. Epomia strong, but short. Notaulus almost absent. Propodeal carinae strong. Prepectal carina with a sinuosity from the rather strong impression of the sternaulus. First abdominal segment 1.8 times as long as apical width. The apical margin of the postpetiole is wide. The spiracles situated at 0.30 of the length of the segment. The first tergite coriaceous with some longitudinal sculpture. The second tergite almost polished, with a yellow lateral and apical margin. The third tergite yellow. Ovipositor 0.42 of the length of the front wing. The right front wing missing, the other wings in bad shape. Compare table 25.

Male unknown.

Remark. The holotype of *P. mesoxantha* is a conspicuously stout specimen of *Plectiscidea*.

Material examined. — Germany: ♀, holotype of

Table 25. *Plectiscidea mesoxantha* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| holotype *P. mesoxantha* | 4.6 | 0.42 | 5.7 | 0.38 | 1.8 | 0.32 | not pr |

Table 26. *Plectiscidea mendica* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| holotype *P. mendica* | 4.2 | 0.43 | 5.0 | 0.37 | 2.0 | 0.50 | not pr |

*P. mesoxantha*, Veen (near Wesel) (coll. Förster, München).

### Plectiscidea mendica (Förster)

*Plectiscus mendicus* Förster, 1871: 88. Holotype labelled by Van Rossem.

Characteristics of the holotype of *P. mendica*. Female. Front wing 4.2 mm long. Malar space 0.37 of width of face. Postannellus 5.0 times as long as apical width. Epomia present. Notaulus hardly impressed. Lateral carina of the scutellum running somewhat beyond the corner and slightly curved inwards. First abdominal segment 2.0 times as long as apical width. First tergite coriaceous. The spiracles situated at 0.50 of the length of the segment, a character deserving attention. Ovipositor 0.43 of the length of the front wing. Compare table 26.

Male unknown.

Material examined. — Germany: ♀, holotype of *P. mendica*, Aachen (coll. Förster, München).

### Plectiscidea fraterna (Förster)

*Plectiscus fraternus* Förster, 1871: 87. Holotype labelled by Van Rossem.

Characteristics of the holotype of *P. fraterna*. Female. Front wing 3.1 mm long. Malar space 0.38 of width of face. Postannellus 5.5 times as long as apical width. Flagellum of both antennae missing, except for right postannellus. Epomia present. Notaulus absent. Lateral carina of scutellum curved inwards behind the corner, not meeting. Prepectal carina present. First abdominal segment 2.3 times as long as apical width. The spiracles situated at 0.40 of the length of the segment. First tergite coriaceous. Second tergite with vague coriaceous sculpture. Ovipositor 0.46 of the length of the front wing. Compare table 27.

Male unknown.

Material examined. — Germany: ♀, holotype of *P. fraterna*, Aachen (coll. Förster, München).

### Plectiscidea deterior (Förster)

*Plectiscus deterior* Förster, 1871: 88. Lectotype designation by Van Rossem. Report on type by Aubert (1975).

Characteristics of the lectotype of *P. deterior*. Female. Front wing 4.2 mm long. Malar space 0.35 of width of face. Postannellus 5.0 times as long as apical width. Notaulus evanescent. Lateral scutellar carina running somewhat behind the scutellar corner. First abdominal segment 2.1 times as long as apical width. The spiracles situated at 0.43 of the length of the segment. First tergite coriaceous. Sculpture of the second tergite for the greater part coriaceous. Ovipositor 0.46 of the length of the front wing. Compare table 28.

Male unknown.

Material examined. — Germany: ♀, lectotype of *P. deterior*, Aachen (coll. Förster, München). Austria: ♀, Fliess, Tirol, Heidelbeeren, 1600 m, 4.ix.1971 (leg. & coll. Haeselbarth).

### Plectiscidea blandita species nova

One paralectotype of *P. hostilis* does not agree with *P. humeralis* (of which *P. hostilis* is a synonym). The ovipositor is too long (0.44 of the length of the front wing). The specimen comes close to *P. terebrator*, but the malar space (0.43 of the width of face) does not agree with that of *P. terebrator*. The length of the first

Table 27. *Plectiscidea fraterna* (Förster). For abbreviatios, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| holotype *P. fraterna* | 3.1 | 0.46 | 5.5 | 0.38 | 2.3 | 0.40 | not pr |

Table 28. *Plectiscidea deterior* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| lectotype *P. deterior* | 4.2 | 0.46 | 5.0 | 0.35 | 2.1 | 0.43 | not pr |
| Tirol, Fliess, 1600 m, 4.ix.71 | | 0.45 | 5.2 | 0.35 | 2.1 | 0.40 | |

abdominal segment reaches 2.5 times the apical width. I consider this specimen to represent a different species.

Characteristics of the holotype of *P. blandita*. Labels: Aachen, 26.x. Paralectotype of *P. hostilis* Förster. Female. Front wing 4.0 mm long. Malar space 0.42 of width of face. Postannellus 5.0 times as long as apical width. Epomia short. Pronotum yellowish in colour. Notaulus not present. Lateral carina of scutellum curved inwards behind the scutellar corner. Prepectal carina present. Left hind leg missing behind the coxa. First abdominal segment 2.5 times as long as apical width. The spiracles situated at 0.34 of the length of the segment. First tergite coriaceous. The second tergite polished with some vague coriaceous sculpture near the base, the apical margin yellowish. The third tergite yellowish. Ovipositor 0.44 of the length of the front wing. Compare table 29.

Male unknown.

Material examined. — Germany: ♀, holotype of *P. blandita*, Aachen, 26.x (coll. Förster, München).

The specific name "blandita" is the Latin for "enchanting".

### Plectiscidea terebrator (Förster)

*Plectiscus terebrator* Förster, 1871: 87. Lectotype designation by Aubert (1975).

*Plectiscus habilis* Förster, 1871: 88. Holotype labelled by Van Rossem. **New synonym.**

*Plectiscus praepositus* Förster, 1871: 89. Lectotype designation by Van Rossem. **New synonym.**

Characteristics of the lectotype of *P. terebrator*. Female. Front wing 3.5 mm long. Malar space 0.33 of width of face. Postannellus 5.2 times as long as apical width. Epomia present. Notaulus absent. Prepectal carina present. First abdominal segment 2.2 times as long as apical width. First tergite coriaceous. Spiracles situated at 0.34 of the length of the segment. Second tergite weakly coriaceous. Ovipositor 0.46 of the length of the front wing. Compare table 30.

Male unknown.

Remarks. — Of the lectotype of *P. praeposita* the face and mouthparts are obscured by glue.

I have placed the single paralectotype of *P. proxima* under *P. terebrator* as I cannot identify it properly. A part of the first, second and third abdominal segments are damaged by Dermestids.

Material examined. — Germany: ♀, lectotype of *P. terebrator*, Aachen; ♀, holotype of *P. habilis*, Aachen; ♀, lectotype of *P. praeposita*, Lousberg, 15.ix; ♀, paralectotype of *P. praeposita*, Lousberg, 15.ix; ♀, paralectotype of *P. subangulata* (Förster), Lousberg, 26.x; ♀, paralectotype of *P. proxima* (Förster), Aachen (all coll. Förster, München); ♀, Lippoldshausen, B, 21.viii.1966 (coll. Haeselbarth). Austria: ♀, Fliess, Tirol, Heidelbeeren, 1600 m, 4.ix.1971 (leg. & coll. Haeselbarth). Sweden: ♀, Dalarna, Transtrand, Hemfjällstangen, vii.1976 (leg. & coll. Van Rossem).

Distribution. — Recorded from Germany (Aachen region) and Lippoldshausen, also from Austria and Sweden.

Table 29. *Plectiscidea blandita* spec. nov. For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| holotype *P. blandita* | 4.0 | 0.44 | 5.0 | 0.42 | 2.5 | 0.34 | not pr |

Table 30. *Plectiscidea terebrator* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| lectotype *P. terebrator* | 3.5 | 0.46 | 5.2 | 0.33 | 2.2 | 0.34 | not pr |
| holotype *P. habilis* | 4.3 | 0.47 | 5.3 | 0.33 | 2.3 | 0.35 | |
| lectotype *P. praepostia* | 4.2 | 0.47 | 5.0 | + | 2.1 | 0.35 | |
| paralectotype *P. praeposita* | 4.0 | 0.47 | 5.0 | 0.35 | 2.3 | 0.37 | |
| parelectotype *P. subangulata* | 4.5 | 0.45 | 5.3 | 0.33 | 2.2 | 0.37 | weak |
| paralectotype++ *P. proxima* | 3.5 | 0.42 | 5.2 | 0.33 | 1.9 | 0.20 | not pr |

\+ damaged
++ species inquirenda

**Plectiscidea ventosa** species nova

Characteristics of the holotype of *P. ventosa* (Holland, Naardermeer, Malaise trap, 20.viii.1974, Bunnik & Van Wijngaarden): Female. Front wing 3.7 mm long. Mandible yellow, lower tooth shorter than upper tooth. Clypeus rather small, with erect hairs, width 0.58 of width of face. Face, frons, vertex and temple polished. Occipital carina complete. Postannellus 4.3 times as long as the apical width. Mesoscutum highly polished. Notaulus absent. Hairs scarce, only along the margin and on the front part of the lateral lobes. Scutellar carina running to the apex, but not closed. First lateral and pleural areas and metapleurum coriaceous. Mesopleurum highly polished. Prepecteal carina present, well away from the margin. Legs slender, yellowish brown. First abdominal segment 1.7 times as long as the apical width. The first tergite coriaceous, fuscous. The end of the first sternite at 0.64 of the length of the tergite. Front half of the second tergite coriaceous, the apical half polished. Other tergites polished, brownish in colour. Ovipositor 0.33 of the length of the front wing. Compare table 31.

Male unknown.

Material examined. — Netherlands: ♀, holotype of *P. ventosa*, Naardermeer, Malaise trap, 20.viii.1974, leg. Bunnik & van Wijngaarden. Two paratypes from the same locality and data (all coll. K. W. R. Zwart, Wageningen). Sweden; ♀, syntype of *Plectiscidea curticauda* (Thomson), Halland (coll. Thomson, Entomological Museum, Lund).

Distribution. — The type material originated from a marshy area in the Netherlands. There is one specimen from Sweden.

Table 31. *Plectiscidea ventosa* spec. nov. For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| holtotype *P. ventosa* | 3.7 | 0.33 | 4.3 | | 1.7 | | not pr |
| paratype *P. ventosa* | 3.7 | 0.33 | 4.6 | | 1.6 | | not pr |
| paratype *P. ventosa* | 3.7 | 0.32 | 4.3 | | 1.8 | | not pr |
| paralectotype *P. curticauda* | 4.2 | 0.37 | 4.28 | | 1.8 | | |

Table 32. *Plectiscidea subangulata* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| lectotype *P. subangulata* | 5.2 | 0.35 | 5.4 | | 2.2 | | not pr |

The specific name "ventosus" is from the Latin meaning "tempestuous".

### Plectiscidea subangulata (Förster)

*Plectiscus subangulatus* Förster 1871: 88. Report on type by Aubert (1975).

Characteristics of the lectotype of *P. subangulata*. Female. Front wing 5.2 mm long. Malar space narrow, 0.31 of width of face. Postannellus 5.4 times as long as apical width. Notaulus absent. Scutellar carina running slightly behind the scutellar corner, curving inwards, not meeting. The length of the first abdominal segment is 2.2 times the apical width. Ovipositor 0.36 of the length of the front wing. Compare table 32.

Male unknown.

Material examined. — Germany: ♀, lectotype of *P. subangulata*, Lousberg, 14.ix (coll. Förster, München).

### Plectiscidea eurystigma (Förster)

*Plectiscus eurystigmus* Thomson, 1888: 1301. Lectotype designation by Townes, Momoi and Townes. Examination of type reported by Fitton (1982).

Characteristics of the lectotype of *P. eurystigma*. Female. Front wing 4.0 mm long. Malar space 0.37 of width of face. Postannellus 5.0 times as long as the apical width. Notaulus absent. Scutellar carina running slightly behind the scutellar corner, not curving inwards. The length of the first abdominal segment is 2.5 times the apical width. Spiracles situated at 0.43 of the length of the segment. Ovipositor 0.36 of the length of the front wing. Compare table 33.

Male unknown.

Material examined. — Sweden: ♀, lectotype of *P. eurystigma*, Esp (= Äsparöd) (Skåne) (coll. Thomson, Entomological Museum, Lund).

### Plectiscidea humeralis (Förster)

*Plectiscus humeralis* Förster, 1871: 86. Report on type by Aubert (1975).

*Plectiscus fulvus* Förster, 1871: 86. Report on type by Aubert (1975). **New synonym.**

*Plectiscus hostilis* Förster, 1871: 88. Placed as synonym of *P. humeralis* by Aubert (1975).

Characteristics of the holotype of *P. humeralis*. Female. Front wing 3.6 mm long. Malar space 0.33 of width of face. Postannellus 5.0 times as long as apical width. Epomia present, short. Notaulus not present. Scutellar carina running somewhat behind the scutellar corner. Propodeum polished. Prepectal carina present. First abdominal segment 2.3 times as long as apical width. Spiracles situated at 0.34 of the length of the segment. First tergite coriaceous. Ovipositor 0.38 of the length of the front wing.

Characteristics of the female. Front wing 3.6—4.3 mm long. Malar space 0.31—0.33 of width of face. Width of clypeus 0.50—0.53 of width of face. Clypeus protruding. Mandibular teeth about the same length. Postannellus 5.0 times as long as the apical width. Epomia present, but weak. Notaulus absent. Scutellar carina running somewhat behind the scutellar corner. Propodeum polished. Mesopleurum polished, prepectal carina present. The first abdominal segment 2.0—2.6 times as long as apical width. Spiracles lying at 0.32—0.34 of the length of the segment. First tergite coriaceous. Ovipositor 0.37—0.38 of the length of the front wing. Compare table 34.

Male unknown.

Table 33. *Plectiscidea eurystigma* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| lectotype *P. eurystigma* | 4.0 | 0.36 | 5.0 | 0.37 | 2.5 | 0.43 | not pr |

Table 34. *Plectiscidea humeralis* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | spir/ abds | not |
|---|---|---|---|---|---|---|---|
| holotype *P. humeralis* | 3.6 | 0.38 | 5.0 | 0.33 | 2.3 | 0.34 | not pr |

Material examined. — Germany: ♀, holotype of *P. humeralis*, Lousberg, 30.viii; ♀, holotype of *P. fulva*, Aachen; ♀, lectotype of *P. hostilis*, Lousberg, 9.x (all coll. Förster, München); ♀, Oberbayern, Glonn, Heidelbeeren, 18.viii.1970 (2 specimens, leg. & coll. Haeselbarth). Austria: ♀, Fliess, Tirol, 1550 m, 11.viii.1971 (leg. & coll. Haeselbarth). Netherlands: ♀, Naardermeer, Malaise trap, 8.x.1974, leg. Bunnik & Van Wijngaarden (coll. K. W. R. Zwart, Wageningen).

Distribution. — Three type-specimens are from the Aachen region. One specimen is Alpine. One specimen comes from a marshy area in the Netherlands.

### Subgenus **Fugatrix** novum

Type species *Plectiscidea communis* (Förster).

Front wing 2.3—3.6 mm long. Postannellus 3.6—4.5 times as long as apical width. Petiolar area of propodeum 1.5—2.0 times as long as combined areola and basal area. First abdominal segment 1.9—2.8 times as long as apical width. Ovipositor 0.72—0.85 of the length of the front wing.

"Fugatrix" is Latin for "she who dispels".

#### **Plectiscidea (Fugatrix) communis** (Förster)

*Plectiscus communis* Förster, 1871: 86. Report on type by Aubert (1975).
*Plectiscus nigritus* Förster, 1871: 86. Lectotype designation by Van Rossem. Report on type by Aubert (1975).
*Plectiscus gilvus* Förster, 1871: 86. Lectotype designation by Van Rossem. Report on type by Aubert (1975).
*Plectiscus infirmus* Förster, 1871: 86. Lectotype designation by Van Rossem. Report on type by Aubert (1975).

Characteristics of the lectotype of *P. communis*. Female. Front wing 3.6 mm long. Postannellus 3.6 times as long as the apical width. Petiolar area 1.6 times as long as combined areola and basal area. First abdominal segment 1.8 times as long as the apical width. Ovipositor 0.72 of the length of the front wing. Compare table 35.

Male. Förster (1871) observed the male. Also Thomson (1888) and Strobl (1903) were aware of it. I did not study the males of *Plectiscidea* for want of males of most species.

Material examined. — Germany: ♀, lectotype of *P. communis*, Lousberg, 11.ix; ♀, lectotype of *P. nigrita*, Lousberg, 25.x; ♀, lectotype of *P. gilva*, no locality; ♀, lectotype of *P. infirma*, Lousberg, 25.x; 3 ♀, Lousberg, 25.vi; 25.x; 31.x.1862; 4 ♀, Lousberg, 25.x.1864 (all coll. Förster, München). Austria: ♀, T. Achenkirch, 1100 m, 13.viii.1974; ♀, same locality, 1200—1500 m, 23.vii.1974 (leg. & coll. Haeselbarth); ♀, Kärnten, Bodental, 1100 m, 27.vi.1981 (leg. & coll. Zwakhals). Germany: 2 ♀, Bayern, Ammergebirge, Nickelswald, 1100—1300 m, 28.vii.1974; 2 ♀, Weszling, Hochstadt, 19.v.1974; 2 ♀, Hohenschwangau, Säulingweg, 1120—1300 m, 16.vii.1974; 2 ♀, Oberbayern, Umg. Gauting, 24.v.1959 & 22.vi.1972; ♀, Umg. Andechs, 18.v.1959; ♀, Lippoldshausen, B, 8.viii.1966; ♀, Oberjettenberg b. Reichenhall, 26.v.1969; ♀, Harthausen b. München, 20.viii.1969; 2 ♀, Hedemünden, C, 12.v.1966 (all leg. & coll. Haeselbarth). Ireland: ♀, Co Tyrone, Moy (H8356), 17—24.ix.1984, Malaise trap (leg. & coll. M. Boston). Italia: ♀, Bolzano, Feldthurns, 1200 m, 11.ix.1978; ♀, Bs, Valvestino, Monte Tombea, 1500—1700 m, 14.vi.1976; ♀, Vr, Malcesine, 500—1300 m, 18.vi.1976; 2 ♀, Campenjoch, Südtirol, 1550 m, E, 23.vii.1966.

Distribution. — The species is widely spread in the Western Palaearctic Region.

### Genus **Gnathochorisis** Förster

*Gnathochorisis* Förster, 1868: 152.
*Gnathochorisis*; Förster, 1871: 111.
*Gnathochorisis*; Aubert, 1969: 41.
*Laepserus* Förster, 1868: 205.
*Laepserus*; Perkins, 1962: 434.
*Laepserus*; Aubert, 1969: 41.
*Laepserus*; Van Rossem, 1980: 114.
*Blapticus* Thomson, 1888: 1288.
*Blapticus*; Strobl, 1902: 113.
*Acroblapticus* Schmiedeknecht, 1911: 2173.
*Blapticus* Förster, 1869 is a subjective synonym of *Symplecis* Van Rossem, 1980: 114, 123.

Dr. Klaus Horstmann (Würzburg) kindly drew my attention to the priority that the name *Gnathochorisis* takes over *Laepserus*, as Aubert

Table 35. *Plectiscidea (Fugatrix) communis* (Förster). For abbreviations, see table 2.

| | frw | ovip/ frw | psta l/w | malsp /f | abds l/w | pet.area /areo+bas |
|---|---|---|---|---|---|---|
| lectotype *P. communis* | 3.6 | 0.72 | 3.6 | | 1.8 | 1.6 |
| lectotype *P. nigrita* | 3.4 | 0.80 | 3.6 | | 2.2 | 1.5 |
| second specimen *P. nigrita* | 2.8 | 0.84 | | | 2.1 | 2.0 |
| lectotype *P. gilva* | 3.0 | 0.85 | | | 2.5 | 1.6 |
| second specimen *P. gilva* | 2.6 | 0.89 | | | 2.5 | 2.0 |
| Ammergeb., Nickelswald 1100—1300 m | | 0.80 | | | 2.5 | 1.6 |
| Hohenschwangau, 1120—1300 m, 16.vii | | 0.82 | | | 2.2 | 1.8 |
| Italia, Feldthurns, 1200 m, 11.ix.78 | | 0.85 | | | 2.8 | 1.6 |

(1969), being the first reviser, gave precedence to *Gnathochorisis*.

I cannot redeem my first view that *Gnathochorisis (Blapticus* sensu Thomson) *crassulus* (Thomson, 1888) is a colour-form of *Gnathochorisis dentifer* (Thomson, 1888). With hesitation I arrive at the opinion that the taxa in question represent two species although the morphological differences are not convincing. The differences in colouring seem to be constant between the males, though not between the females of the two species.

Key to the males

Without recapitulation of the entire key to *Gnathochorisis (Laepserus* Van Rossem, 1980), the males of these two species can be separated as follows.

1. Face, lower third part of frons and lower frontal orbits yellow. Pronotum, lower half of mesopleurum and mesosternum yellow. Width of face 1.0—1.4 times the width of face in *G. dentifer*. The first abdominal segment 2.1—2.3 times as long as the apical width *Gnathochorisis crassulus* (Thomson)
— Face yellow. Frons fuscous. Lower frontal orbits yellow. Pronotum, mesopleurum and mesosternum fuscous. Width of face 0.71—0.95 times the width of face in *G. crassulus*. The first abdominal segment 2.0—2.4 times as long as the apical width ..... *Gnathochorisis dentifer* (Thomson)

Key to the females

1. Face fuscous. Clypeus and lower gena ivory to yellow (a fuscous lower gena may occur). Lower frontal orbits yellow or fuscous. Dorsal corner of pronotum and tegulae yellow. Width of face 1.0—1.3 times the width of face in *Gn. dentifer*. The first abdominal segment 2.1—2.6 times as long as the apical width ..... *G. crassulus* (Thomson)
— Face fuscous. Clypeus ivory to yellow. Lower gena fuscous. Lower frontal orbit fuscous. Dorsal corner of pronotum and tegulae yellow. Width of face 0.70—0.90 times the width of face in *G. crassulus*. The first abdominal segment 2.2—2.7 times as long as the apical width ..... *G. dentifer* (Thomson)

Material examined. — *Gnathochorisis crassulus* (Thomson). No locality label: 3 ♂/♀, (ex coll. Schmiedeknecht) (Laboratorium voor Entomologie, Wageningen). Austria: 1 ♀, Kärnten, Bodental, 1100 m, 30.vi.1981 (coll. Zwakhals). Germany: 1 ♀, Bechtaler Wald (near Stegen-Wittental, Baden-Württemberg), 14.ix.1984 (leg. & coll. H. Hilpert, Forstliche Versuchsanstalt, Freiburg im Breisgau). Italy: 1 ♀, Funes (Prov. Bolzano), 20.vii.—9.viii.1968, Selva Ne-

ra, 1400—2000 m (coll. Van Rossem). Netherlands: 6 ♀, Asperen (Prov. Zd. Holl.), 3.ix.1972; 1.vi, 30.vii, 9.viii, 7.ix, 10.ix.1973; 1 ♀, Nunspeet, 10.vii.1975; 4 ♀, Ede, 22.v, 26.v, 6.vi, 12.vi.1971 (Dutch specimens coll. Zwakhals). Sweden: 2 ♀, Järnavik (Blekinge) 12—20.vii.1972; Örebro Län, Klysna-Norrberga, 8.vii—2.viii.1979 (coll. Van Rossem).

Distribution. — Widely spread in the Western Palaearctic Region.

*Gnathochorisis dentifer* (Thomson). Austria: 2 ♂, Tirol, Aschbach, 1400 m, 6.vii.1976 and 1 ♀, 18.viii.1975; 3 ♀, Kärnten, Himmelberg, 1100 m, 14.vii.1979, 11.viii and 15.viii.1980; 1 ♂, Kärnten, Bodental, 1100 m, 13.vii.1981 (all coll. Zwakhals). Germany: 4 ♀, Bechtaler Wald (Stegen-Wittental), 5.x & 2—9.xi.1984; 29.v.1985; no locality: 7.ix.1984 (leg. & coll. H. Hilpert). Netherlands: 1 ♂ 3 ♀, Asperen (Prov. Zd Holl.), 3.vi, 15.vi, 1.ix.1972; 4 ♂, Ede, 22.v, 26.v, 3.vi, 6.vi.1971 (coll. Zwakhals).

Distribution. — Widely spread in the Western Palaearctic Region.

Checklist of *Gnathochorisis* species

1. *Gnathochorisis flavipes* Förster, 1871: 113.
   *Gnathochorisis terebrata* Strand, 1918: 159. The holotype has the following labels: Ignalina (Litauen), viii.1916, leg. W. Horn; *G. terebrata* m. ♀ Strand det. Typus (Institut für Pflanzenschutsforschung Kleinmachow, Eberswalde). The type agrees with *G. flavipes*.
   *Gnathochorisis terebrata*; Oehlke, 1963: 409.
   *Laepserus flavipes*; Van Rossem, 1980: 115.
2. *Gnathochorisis dentifer* (Thomson, 1888: 1288) (comb.n.).
   *Laepserus dentifer*; Van Rossem, 1980: 118.
3. *Gnathochorisis crassulus* (Thomson, 1888: 1289) (comb.n.).
   *Laepserus dentifer* f. *crassulus*; Van Rossem, 1980: 119.
4. *Gnathochorisis xanthocephalus* (Strobl, 1903: 113) (comb.n.).
   *Laepserus xanthocephalus*; Van Rossem, 1980: 120.
5. *Gnathochorisis restrictus* (Van Rossem, 1980: 121) (comb.n.).
   *Laepserus restrictus*; Van Rossem, 1980: 121.

Revision of the genus **Eusterinx** Förster

*Eusterinx* Förster, 1868: 172.
*Eusterinx;* Förster, 1871: 107—109.
*Eusterinx;* Aubert, 1968: 39.
*Eusterinx;* Townes, 1971: 202—204.
*Eusterinx;* Van Rossem, 1980: 131—132.
*Eusterinx;* Van Rossem, 1982: 154—169.

Since my revision of the type material of *Eusterinx* in 1982 I have come to the conclusion that the diverging characters of the species allow the introduction of six subgenera, viz., *Eusterinx* Förster, 1868; *Catomicrus* Thomson, 1888; *Ischyracis* Förster, 1868; *Divinatrix* subgenus novum; *Dallatorrea* Ashmead, 1902; and *Holomeristus* Förster, 1868. A tentative key to the subgenera follows here.

1. Tyloids absent ..... 2
— Tyloids present ..... 3
2. Apophyses absent. Front wing not longer than 3.0 mm. Eyes not hairy ..... Subgenus *Eusterinx* Förster
— Apophyses weakly developed or well developed. Front wing in most specimens longer than 3.0 mm. Eyes often hairy ..... Subgenus *Catomicrus* Thomson
3. Front wing without areolet ..... 4
— Front wing with areolet ..... 5
4. Strong apophyses present. Front wing without areolet and in most specimens longer than 3.0 mm. Sixth flagellar segment with a tyloid, a concave polished area ..... Subgenus *Ischyracis* Förster
— Apophyses absent. Front wing without areolet and in most specimens not longer than 3.0 mm. There is a tyloid on sixth flagellar segment or the sixth and seventh flagellar segments are flattened ..... Subgenus *Eusterinx* Förster
5. Second and third tergites in the female and tergites two, three, four and five in the male divided by a conspicuous transverse suture. The two parts of the tergites have a different sculpture .. Subgenus *Divinatrix* novum
— Tergites of female and male without suture ..... 6
6. Eyes crassate. Apophyses exceptionally strong. Ovipositor straight, 0.12—0.14 of length of front wing. (I have seen only two females of this subgenus) ..... Subgenus *Dallatorrea* Ashmead
— Eyes normal. Apophyses not developed. Ovipositor somewhat upcurved, 0.19—0.25 of length of front wing (straight in *E. aquilonigena*). Tyloids on flagellar segments six and seven, a longitudinal carina; or on segments six to eleven, laterally somewhat concave and polished and with a carina ..... Subgenus *Holomeristus* Förster

Key to the females
(The females of *E. minima* and *E. tartarea* are unknown)

1. Eyes convergent towards clypeus ..... 2
— Eyes not convergent towards clypeus .... 7
2. Apophyses of propodeum absent ..... 3
— Apophyses of propodeum present..... 4
3. Second and third tergite with different sculpture of proximal and distal half. These areas separated by a groove. Ovipositor 0.15 of length of front wing ..... .... *E.* (*Divinatrix*) *inaequalis* Van Rossem
— Second and third tergite without groove. Ovipositor 0.22 of length of front wing .... ..... *E.* (*Catomicrus*) *pusilla* (Zetterstedt)
4. Eyes conspicuously hairy, converging towards clypeus. Notauli meeting, with a weak carina from pronotal margin. Scutellum striated. Apophyses somewhat developed. Mesopleurum polished. Front wing with areolet not closed. Hind femur 6.3 times as long as wide. First to fourth tergite coriaceous. Ovipositor 0.28 of length of front wing..... .... *E.* (*Catomicrus*) *disparilis* Van Rossem
— Eyes without hairs or with inconspicuous setae. Strong apophyses present..... 5
5. First and second tergite with striation. Third tergite with weaker striation. Strong apophyses present. Ovipositor 0.20 of length of front wing..... ..... *E.* (*Ischyracis*) *bispinosa* (Strobl)
— First to fourth tergite coriaceous ..... 6
6. Eyes exceptionally large and convex, inner margins strongly converging towards clypeus, leaving a very narrow face. Notauli strong, meeting, restricting the median lobe. The apical region of the median lobe with strong longitudinal sculpture. Propodeum with all carinae and robust, flattened apophyses. Mesopleurum polished, with some longitudinal sculpture medially. Legs long and slender, including coxae orange in colour. Hind coxae for the greater part with rough sculpture. First abdominal segment very slender, with long petiole. Postpetiole apically with some striation. First to fouth tergite coriaceous. Ovipositor 0.12 of length front wing..... ..... *E.* (*Dallatorrea*) *armata* Ashmead
— Eyes not excessively large and convex, converging to clypeus. Mesoscutum without special characters. Propodeum with all carinae and robust, flattened apophyses. Mesopleurum polished, with some longitudinal sculpture medially. Legs slender, brownish. Hind coxa with rough sculpture. First abdominal segment slender, with long petiole. First to fourth tergite coriaceous. Ovipositor 0.10—0.14 of length of front wing..... ..... *E.* (*Dallatorrea*) *circaea* Van Rossem
7. Front wing without areolet. Eyes without hairs. Head square, vertex deep. Tip of mandible twisted and with a sharp upper and lower tooth. Second tergite slightly striated or with some rough longitudinal sculpture or second tergite coriaceous or polished. Some specimens have conspicuous thyridia. Length of front wing 1.7—3.0 mm ..... Subgenus *Eusterinx*
— Front wing with areolet ..... 8
8. Malar space very narrow, 0.18 of width face. Postannellus slender 4.5 times as long as the apical width. Notauli not meeting on mesoscutum. Propodeum without apophyses. Second tergite proximally with some longitudinal striation, apical half polished. Ovipositor 0.14—0.19 of length of front wing..... *E.* (*Holomeristus*) *aquilonigena* Van Rossem
— Malar space wide, 0.25—0.40 of width of face ..... 9
9. Malar space 0.23—0.25 of width of face. Postannellus 3.0—5.0 times as long as the apical width. Notauli meeting on center of mesoscutum. Propodeum without apophyses. Second tergite coriaceous and with longitudinal striation. Ovipositor upcurved, about 0.20—0.26 of length of front wing ... .... *E.* (*Holomeristus*) *tenuicincta* (Förster)
— Malar space wide, 0.40 of width of face. Postannellus 3.3 times as long as the apical width. The apical transverse carina somewhat lamelliform and with weak apophyses. Second tergite coriaceous. Ovipositor somewhat upcurved, 0.23—0.25 of length of front wing ..... *E.* (*Holomeristus*) *refractaria* Van Rossem

Key to the males

(Males of the Subgenus *Eusterinx* are tentatively included; males of *E.* (*Catomicrus*) *disparilis* and *E.* (*Dallatorrea*) *circaea* are unknown)

1. Front wing without areolet..... 2
— Front wing with areolet ..... 9
2. Propodeum with strong apophyses. First, second and third tergites striated. Sixth flagellar segment with a tyloid, which is a concave polished area ..... ..... *E.* (*Ischyracis*) *bispinosa* (Strobl)
— Propodeum without apophyses ..... 3
3. Second tergite with conspicuous thyridia.

Tyloids absent ..... 4
— Second tergite without, or with indistinct thyridia ..... 6
4. Medial part of clypeal margin somewhat risen, with a pair of very weak tubercles. Postannellus 2.8 times as long as apically wide. Three flagellar segments after the postannellus about 0.71 of length of postannellus. Second tergite finely striated. Thyridia conspicuous ..... *E.* (*Eusterinx*) *jugorum* (Strobl)
— Medial part of clypeus not risen and without tubercles. Flagellar segments after the postannellus short ..... 5
5. Postannellus 2.0 times as long as apically wide. Flagellar segments after the postannellus short less than 0.71 of length postannellus. Setae of flagellar segments erect. Thyridia in basal corners of second tergite conspicuous, yellow in colour. Second tergite basally with some coriaceous sculpture. Following tergites polished. (There is no male in Förster's material, it is inserted tentatively) .. *E.* (*Eusterinx*) *obscurella* Förster
— Postannellus 3.0 times as long as apically wide. Flagellar segments after the postannellus less than 0.71 of length postannellus. Setae of flagellar segments erect. Thyridia of second tergite less conspicuous. Second tergite with longitudinal striation, the distal margin and the following tergites polished ..... *E.* (*Eusterinx*) *subdola* Förster
6. Flagellum without tyloids ..... 7
— Flagellum with tyloids ..... 8
7. Eyes hairy. Hind femur notably slender, 7.4 times as long as wide. Second tergite striated and with coriaceous sculpture. Propodeum with indistinct apophyses. Length of front wing about 3.8 mm ..... *E.* (*Catomicrus*) *pusilla* (Zetterstedt)
— Eyes not hairy. Second tergite polished, or with indistinct coriaceous sculpture. Propodeum without apophyses. Length of front wing about 1.9 mm ..... *E.* (*Eusterinx*) *pseudoligomera* Gregor
8. Antenna with tyloid on sixth flagellar segment. Second tergite polished or proximally somewhat coriaceous. In some specimens the second tergite weakly striated ..... *E.* (*Eusterinx*) *oligomera* Förster
— Antenna with tyloids on flagellar segments six and seven (the second tyloid difficult to see). An indication of a tyloid on segment eight. The flagellum more robust than in *E.* (*Eusterinx*) *oligomera* ..... *E.* (*Eusterinx*) *argutula* Förster
9. Apophyses of propodeum present. In *E. refractaria* the apical transverse carina somewhat lamelliform, thus developing weak apophyses ..... 10
— Apophyses of propodeum absent ..... 11
10. Apophyses rather strong. Antenna without tyloids. Hind femur stout, 3.8 times as long as wide. First and second tergites entirely coriaceous. Third tergite proximally coriaceous ..... *E.* (*Catomicrus*) *tartarea* Van Rossem
— Apophyses weak, caused by the somewhat lamelliform shape of the apical transverse carina. Flagellar segments six and seven with a tyloid, a longitudinal carina. Hind femur stout. First, second and proximad half of third tergite coriaceous. Tergites two, three and four with narrow apical margin yellow. ..... *E.* (*Holomeristus*) *refractaria* Van Rossem
11. Second and third tergites with a transverse groove (groove weak on fourth tergite). The proximal and distal regions of these tergites with a difference in sculpture ..... *E.* (*Divinatrix*) *inaequalis* Van Rossem
— Second and third tergites not so ..... 12
12. Tyloids on flagellar segments six to eleven. The flagellar segments flattened, without setae. Second tergite for the greater part with longitudinal striation. The thyridia visible. The third tergite with some striation ..... *E.* (*Holomeristus*) *aquilonigena* Van Rossem[1])
— Tyloids on flagellar segments six to eight or six to nine. The flagellar segments flattened and with a carina. Thyridia not visible .. 13
13. Second tergite and front part of third tergite with longitudinal sculpture. Thyridia not visible. Tyloids on flagellar segments six to eight. Clypeus impressed ..... *E.* (*Holomeristus*) *tenuicincta* Förster
— Second and third tergites coriaceous. Tyloids on flagellar segments six to nine. Clypeus not impressed ..... *E.* (*Holomeristus*) *minima* Strobl

## Subgenus **Eusterinx** Förster

*Eusterinx* Förster, 1868: 172.
Type-species: *Eusterinx oligomera* Förster.

[1]) The separation of *E. aquilonigena* and *E. tenuicincta* is difficult without females from the same locality.

Front wing 1.7—3.0 mm long. Males with one tyloid on sixth flagellar segment, and either two or none on flagellar segments six and seven. Head square, vertex deep. Ratio gena-width : eye-width = 7 : 4 (7 : 6) or 1 : 1. Mesoscutum strongly convex, notauli varying from very weak to strong. Propodeum with all carinae. In some specimens the costula is absent. Front wing without areolet. Nervellus reclivous. First gastral segment slender, spiracles at about 0.5 of length. In *E. obscurella* and *E. subdola* the thyridia are conspicuous, in other species weak or absent. Second tergite in most species polished, occasionally somewhat coriaceous, seldom striated. The ovipositor relatively long, 0.15—0.22 of length front wing, rather wide or somewhat club-shaped and with long erect hairs on sheath.

The subgenus includes five closely related species. Males of different species are distinguishable. The separation of the females of *E. oligomera*, *E. argutula* and *E. pseudoligomera* remains impossible. The following characters are not reliable: length of postannellus; the ratio of gena-width to eye-width; and the ratio of ovipositor length to length of hind tibia.

The males are inserted into the general key to *Eusterinx* males. The following key to the females is tentative.

Key to the females
(The female of *E. jugorum* (Strobl) is unknown)

1. Second tergite with conspicuous thyridia in proximal corners ..... 2
— Second tergite without or with weak thyridia ..... 3
2. Ratio gena-width : eye-width = 7 : 5 or 7 : 6. Postannellus 3.0 times as long as wide. Second tergite polished or with some coriaceous sculpture ..... *E. (Eusterinx) obscurella* Förster
— Ratio gena-width : eye-width = 1 : 1. Postannellus 4.5 times as long as wide. Second tergite with longitudinal striation or weakly striated and somewhat coriaceous ..... *E. (Eusterinx) subdola* Förster
3. Notauli weakly indicated directly behind mesoscutal margin. Second tergite polished, thyridia weak ..... *E. (Eusterinx) pseudoligomera* Gregor
— Notauli stronger, running towards centre of mesoscutum. Second tergite polished. Thyridia absent in *E. argutula* ..... *E. (Eusterinx) oligomera* Förster and *E. (Eusterinx) argutula* Förster

**Eusterinx (Eusterinx) jugorum** (Strobl)

*Hemiteles pseudominutus* var. *jugorum* Strobl, 1900: 243—244.

Characteristics of the holotype (label partly illegible, 12/8, Styriae Alp Strobl, holotype label of Horstmann, 1971): Male. Front wing 2.44 mm long. Medial part of clypeal margin somewhat risen, with a pair of very weak tubercles (a character not found in other species of the subgenus). Face finely coriaceous. Malar space wide. Postannellus 2.8 times as long as apically wide. Tyloids absent. Three segments coming after the postannellus about 0.71 of the length of postannellus. Frons, vertex and gena polished. Gena wide. Pronotum indistinctly coriaceous. Mesoscutum polished, notauli strong, meeting and medially extended by a short furrow. Propodeum laterally coriaceous. Mesopleurum polished, prepectal carina not reaching to the margin. Coxae and all other parts of the legs conspicuously brown. Hind coxae coriaceous. Gaster fuscous. First tergite coriaceous, spiracles protruding. Second tergite finely striated. Thyridia conspicuous. The apical margin of the second tergite yellowish. Third tergite indistinctly coriaceous. The apical tergites polished.

The holotype from the "Kalbling" (2000 m) (Austria) is the only extant specimen.

Remark. — A female syntype (Horstmann, 1971) of *Hemiteles pseudominutus* Strobl, 1900, has no original label. The specimen belongs to *Eusterinx* (*Eusterinx*).

As the identification of the females of this subgenus is still uncertain, the specimen was labelled: *Eusterinx* (*Eusterinx*) species.

Postannellus 3.0 times as long as apically wide. Spiracles of first gastral segment at 0.41 of the length of the segment. Second and following tergites polished. Ovipositor 0.18 of the length of front wing.

According to Horstmann "jugorum" is derived from the Latin word "jugum" which means "pass, narrow passage in mountains".

**Eusterinx (Eusterinx) oligomera** Förster

*Eusterinx oligomera* Förster, 1871: 109.
*Eusterinx oligomera;* Townes, 1971: 202.

*Eusterinx oligomera;* Van Rossem, 1982: 163—164.

Characteristics of the female: Front wing 1.7 mm long. Clypeus flat, 2.0 times as wide as long. Malar space wide, 0.3 of width of face, somewhat coriaceous. Face coriaceous, slightly convex with widely placed long hairs. Eyes small, broadly elliptic. Ratio gena-width : eye-width = 7 : 4. Head square, frons and vertex about 0.5 deeper than wide. Frons vaguely coriaceous. Vertex polished. Postannellus 3.3 times as long as wide. Mesoscutum polished, notauli present. Propodeum coriaceous, with all carinae. Nervulus distad of basal vein. Areolet absent. Nervellus reclivous. Lower part of mesopleurum coriaceous. Middle and hind legs, including tarsi, with long, subadpressed hairs. First tergite coriaceous, spiracles at 0.4 of length. Apex of first sternite at 0.56 of length. Ovipositor club shaped, 0.12 of length front wing.

Characteristics of the male: Front wing 1.7 mm long. A lateral tyloid on sixth flagellar segment, somewhat flattened and polished. Pronotum polished, epomia weak. Mesoscutum polished, notauli present. Propodeum weakly coriaceous, with all carinae, except costula. Legs with close, long hairs. Second gastral segment variable in sculpture, from polished to somewhat coriaceous. Striated sculpture may occur.

Distribution. — Apart from the Förster specimens from the Aachen region, the species occurs at rather striking altitudes (1200—1300 m) in Austria and Italy (Dolomites).

### Eusterinx (Eusterinx) argutula Förster

*Eusterinx argutula* Förster, 1871: 108
*Eusterinx argutula;* Van Rossem, 1982: 164—165.

Characteristics of the female: Front wing 2.5—3.0 mm long. Ratio gena-width : eye-width = 1 : 1 (or 8 : 7). Mesoscutum rather strongly convex, polished, notauli present but faint. All tergites polished. Thyridia obsolete.

There is no female in the Förster type material.

Characteristics of the male: Front wing 2.6 mm long. Anterior tentorial pits large. Malar space wide. Face, frons, vertex and gena polished, vertex deep. Postannellus 3.5 times as long as wide. Sixth flagellar segment flattened on one side, seventh segment slightly flattened and here the microscopical longitudinal ridges (glumes) absent. An indication of a tyloid on segment eight. The flagellum more robust than in *E. oligomera*. Mesoscutum convex, polished, notauli present but weak. Second tergite vaguely coriaceous, other tergites polished.

Distribution. — The Aachen Region (Förster collection). Italy: Dolomites (1300 m); Judikari Alpen (1720 m) (Haeselbarth collection).

### Eusterinx (Eusterinx) pseudoligomera Gregor

*Eusterinx pseudoligomera* Gregor, 1941: 8.
*Eusterinx pseudoligomera;* Van Rossem, 1982: 168—169.

The males of this species can be tentatively distinguished from males of other species by lack of antennal tyloids and by the vagueness of the thyridia; but females cannot be distinguished from those of other species, except by their association in the field with males.

Characteristics of the female: Front wing 1.9 mm long. Ratio gena-width : eye-width = 1 : 1. Malar space wide. Pronotum coriaceous. Mesoscutum polished, notauli obsolete. Propodeum with all carinae. Mesopleurum coriaceous. First tergite coriaceous, median dorsal carinae present. End of first sternite at 0.69 of length of segment. Second tergite polished, with weak thyridia. Ovipositor 0.21 of length of front wing.

Characteristics of the male: Front wing 1.9 mm long. Ratio gena-width : eye-width = 1 : 1. Antenna without tyloids. Notaulus short. Upper half of mesopleurum polished, lower half somewhat coriaceous. Spiracles of first gastral segment at 0.5 of length of segment. End of first sternite at 0.7 of length of segment. First tergite coriaceous, the others polished. Gaster rather depressed.

Distribution. — Czechoslovakia, the Gregor type material is from Moravia, Ubušín. Austria, Reiter Alp, 1600 m; St. Haus, 1200 m. Germany, Lippoldshausen.

### Eusterinx (Eusterinx) subdola Förster

*Eusterinx subdola* Förster, 1871: 108.
*Eusterinx subdola;* Aubert, 1968: 39.
*Eusterinx subdola;* Van Rossem, 1982: 165.
*Hemiteles pseudominutus* Strobl, 1900: 243.

There is no female of this species in the Förster collection. Recognition of the female remains uncertain.

Characteristics of the supposed female by

comparison with the male: Front wing 2.6 mm long. Postannellus 4.5 times as long as wide. Ratio gena-width : eye-width = 1 : 1. Second tergite with longitudinal striation. Ovipositor 0.2 of length of front wing.

Characteristics of the male: Front wing 3.0 mm long. No tyloids present. Postannellus 3.0 times as long as wide. Femora rather stout, hind femur 4.3 times as long as wide. Second tergite with large thyridia and longitudinal sculpture. Other tergites polished, with apical margins yellow and rather long adpressed hairs.

Characteristics of the lectotype of *Hemiteles pseudominutus* Strobl. Lectotype label of Horstmann, 1971. Male. Front wing 2.6 mm long. Postannellus 2.8 times as long as wide. Second tergite with longitudinal sculpture. Hind femur 4.0 times as long as wide.

Distribution. — The type locality is Lousberg (Aachen). I saw specimens from Austria, Tirol, 1400 m. Czechoslovakia, near Prague. Germany, Oberbayern. Italy, Bolzano Region. Netherlands, Asperen. Sweden, Skåne; Lappland.

**Eusterinx (Eusterinx) obscurella** Förster

*Eusterinx obscurella* Förster, 1871: 108.
*Eusterinx obscurella;* Aubert, 1968: 39.
*Eusterinx obscurella;* Van Rossem, 1982: 167—168.

Characteristics of the type female from the type locality Aachen: Front wing 2.5 mm long. Postannellus 3.0 times as long as apically wide. Ratio gena-width : eye-width = 7 : 6. Thyridia on second tergite conspicuous, more outlined by their colour. Ovipositor 0.15—0.22 of the length of front wing.

Characteristics of the male. The male was not described by Förster. The following description is based on males tentatively considered to be of this species. They are from Monte Bondone Cornetto, 1900—2100 m, Dolomites, Italy. Front wing about 1.9 mm long. No tyloids present. Ratio gena-width : eye-width = 6 : 4. Eyes comparatively small, roundish. Pedicel proportionally large, slightly shorter than postannellus. Apex of scutellum with rough sculpture. First tergite with longitudinal striation. Large thyridia in proximal corners of second tergite, yellow in colour, some coriaceous sculpture between them. Rest of tergite and other tergites polished.

Distribution. — The type locality is Aachen. Italy: Trento, M. Bondone Cornetto, 1900—2100 m (coll. Haeselbarth).

Subgenus **Catomicrus** Thomson

*Catomicrus* Thomson, 1888: 1291.

Type-species: *Tryphon pusillus* Zetterstedt (*Catomicrus trichops* Thomson).

Characteristics: Front wing 2.8—3.5 mm long. Males without tyloids. Eyes converging to clypeus in females, in males not converging. Eyes hairy in some species. Notauli strong and meeting in some species. Apophyses of propodeum weakly or strongly developed. Front wing with or without closed areolet. Ovipositor 0.22—0.28 of length of front wing.

I have placed two species in this subgenus. The single female of *E. disparilis* is inserted tentatively.

**Eusterinx (Catomicrus) pusilla** (Zetterstedt)

*Tryphon pusillus* Zetterstedt, 1838: 385. Male holotype.
*Catomicrus trichops* Thomson, 1888: 1291.
*Eusterinx trichops*; Townes, 1971: 203.
*Eusterinx pusilla*; Van Rossem, 1982: 159—160.

Characteristics of the female: Front wing 2.8 mm. Malar space absent, eye margin almost touching clypeal margin. Face narrow, polished, eyes strongly converging to clypeus. Frons, vertex and gena polished. Antenna rather short, towards distal end gradually somewhat widening. Epomia distinct. Mesoscutum polished, notauli present, with short carina on pronotal margin. Propodeum coriaceous, with all carinae. No apophyses present. Mesopleurum somewhat coriaceous, prepectal carina not reaching the margin. Front wing with areolet not closed. Legs slender. Hind femur notably slender, 6.6 times as long as wide, with close subadpressed hairs. First, second and third tergite coriaceous. Apical margins of tergites two, three and four yellow. Ovipositor 0.22 of length of front wing.

Characteristics of the male: Front wing 3.8 mm. Malar space 0.27 of width of face. Eyes hairy and with inner margins parallel. Face, frons, vertex and gena polished. Face with erect hairs. Epomia distinct. Notauli strong, with a carina along inner edge. Propodeum without

distinct dorsal face. Apical transverse carina lying towards distal edge of propodeum, with weak apophyses. Prepectal carina present. Hind femur slender, 7.4 times as long as wide. First tergite coriaceous, medially convex, median dorsal carinae weak. Second tergite coriaceous and with weak striation. Third tergite proximally coriaceous.

Distribution. – Sweden.

**Eusterinx (Catomicrus) tartarea** Van Rossem
*Eusterinx tartarea* Van Rossem, 1982: 159.

Characteristics of the male: Front wing 3.8 mm. Clypeus 1.3 times as wide as long, polished, somewhat convex. Face polished. Malar space wide, 0.3 of width of face, with a groove. Frons, vertex and gena polished, with rather long subadpressed hairs. Antenna without tyloids. Epomia present. Notauli rather strong, with a short carina. Apex of scutellum striated. Propodeum with all carinae and conspicuous apophyses. Prepectal carina to the middle of pronotal margin. Front wing with areolet. Hind coxae with rough coriaceous sculpture. Hind femur stout. First tergite coriaceous, median dorsal carinae absent. Lateral dorsal carina indicated. Second tergite for the greater part coriaceous, third tergite proximally coriaceous. Second tergite with a carina from spiracle to proximal margin. All tergites with rather long adpressed hairs.

Female unknown.

Distribution. — Only the male holotype from Italy, St. Peter, Ahrntal, 1350 m, Südtirol, is extant (coll. Haeselbarth).

**Eusterinx (Catomicrus) disparilis** Van Rossem
*Eusterinx disparilis* Van Rossem, 1982: 159.

Characteristics of the female: Front wing 3.5 mm. Malar space 0.3 of width of face. Face polished, with widely placed setae. Eyes hairy, converging to clypeus. Frons, vertex and gena polished. Mesoscutum with adpressed hairs, notauli meeting, with weak carina from margin. Scutellum striated. Propodeum coriaceous. Apophyses somewhat developed. Front wing with areolet not closed. Legs slender, hind femur 6.3 times as long as wide. First to fourth tergite coriaceous. Apical margin of second to fourth tergite yellowish. Ovipositor 0.28 of length of front wing.

Male unknown.

Distribution. — Only the holotype from Sweden, Messaure (Lapland) is extant.

Subgenus **Ischyracis** Förster
*Ischyracis* Förster, 1868: 175
Type-species: *Catomicrus alpigenus* Strobl.
*Ischyracis*; Perkins, 1962: 431—432.
*Ischyracis*; Townes, 1971: 203.

Front wing 3.1—3.6 mm long, without areolet. In the female the eyes converging to the clypeus, in the males not so. Sixth flagellar segment of the male with a tyloid, a concave polished area. Strong apophyses present.

I have placed only one species in this subgenus, viz. *E. alpigena* (Strobl) = *Eusterinx bispinosa* (Strobl), which species was designated by Perkins as the type species of *Ischyracis*.

**Eusterinx (Ischyracis) bispinosa** (Strobl)
*Hemiteles bispinosus* Strobl, 1900: 234—235.
*Ischyracis bispinosus*; Aubert, 1970: 279.
*Eusterinx bispinosa*; Horstman, 1974: 53.
*Catomicrus alpigenus*; Strobl, 1903: 116—117.
*Eusterinx alpigena*; Van Rossem, 1980: 131—132.

Characteristics of the female: Front wing 3.1—3.6 mm long. Eyes convergent to clypeus, not touching clypeal margin. Eyes not hairy. Malar space present. The clypeal fovea situated in a conspicuous depression between eye and clypeus. Face and frons polished. Strong notauli meeting in the middle. Front wing without areolet. Propodeum with strong apophyses. Hind coxa black, coriaceous. Hind femur 5.0 times as long as wide. Gaster fuscous. First tergite with strong striation, second and third tergite with weaker striation. Ovipositor 0.2 of length of front wing.

Characteristics of the male: Front wing 3.2—3.6 mm long. Eyes not convergent. Sixth flagellar segment with a tyloid, a concave polished area. Notauli meeting in the middle. Propodeum with strong apophyses. Front wing without areolet. Hind femur robust, 4.4 times as long as wide, with conspicuous adpressed hairs. Median sternal groove (mesolcus) deep. Gaster fuscous. Spiracles of first segment at 0.5 of length. First tergite with rong striation, weaker on second and third tergite. Tergites two to four coriaceous.

Distribution. — Austria, Admont; Natterriegel. Germany, Thüringen, Blankenburg (Schmiedeknecht); Lippoldshausen (Haeselbarth). Netherlands, Asperen (Prov. Zuid-Holland) (Zwakhals).

**Divinatrix** subgenus novum

Front wing 3.0—3.20 mm long, with areolet. Eyes strongly convergent to clypeus in the female; slightly converging in the male. Mesoscutum with deeply impressed notaulices. Apophyses absent. Second and third tergites in the female and tergites two to five in the male divided by a conspicuous transverse suture. The two parts of the tergites with a different sculpture. Ovipositor 0.15 of length of front wing.

There is only one species in this subgenus, *E. inaequalis*, which is the type-species. "Divinatrix" is the Latin for "prophetess".

**Eusterinx (Divinatrix) inaequalis** Van Rossem

*Eusterinx inaequalis* Van Rossem, 1980: 132.

Characteristics of the female: Front wing 3.2 mm long. Clypeus somewhat protruding, about as wide as long. Large eyes strongly convergent to clypeus, touching clypeal margin. Face and frons polished. Scape and pedicel yellow. Pronotum coriaceous. Mesoscutum with strong, deeply impressed notauli, meeting in the middle, with conspicuous transverse ridges. Pronotal margin turning inwards towards notauli. Mesoscutum with adpressed hairs. Prepectal carina reaching pronotal margin somewhat below wing base. Propodeum completely areolated. Front wing with areolet. Front and middle coxae yellow, hind coxa coriaceous, brown; hind femur 6.4 times as long as wide. The most conspicuous character is the sculpture of the second and third tergite. Proximal 0.75 part of second tergite coriaceous and striate, distal part polished. About 0.5 part of third tergite striated, distal part polished. The two halves separated by a conspicuous suture, almost giving the impression of two tergites. A weak indication of the suture on tergite four. Ovipositor 0.15 of length of front wing.

Characteristics of the male: Front wing 3.0 mm long. Eyes slightly converging, not touching clypeal margin. Malar space present. The tergites two, three, four and five with the same conspicuous character as the female's second and third tergites.

Distribution. — Italy, Riva S. Garda (Haeselbarth). Netherlands: Asperen (Prov. Zuid-Holland) (Zwakhals). U.S.A.: Spring Br. Pa., 25.viii.1945 (leg. H. K. Townes).

Subgenus **Dallatorrea** Ashmead

*Dallatorrea* Ashmead, 1902: 205.
*Dallatorrea*; Townes, 1971: 203.
Type-species: *Dallatorrea armata* Ashmead.

Front wing 5.2—6.0 mm long, with areolet. Eyes crassate, converging, or strongly converging to clypeus. Antenna short. Mesoscutum with close adpressed hairs. Notauli strong. Apophyses very robust, flattened. Ovipositor 0.11—0.14 of length of front wing.

There are two species in this subgenus. I have examined only females.

**Eusterinx (Dallatorrea) armata** (Ashmead)

*Dallatorrea armata* Ashmead, 1902: 205.
*Eusterinx armata*; Townes, 1971: 203.

Characteristics of the female: Front wing 5.2 mm. Mandible turned in, upper tooth long and sharp, lower tooth minute. Clypeus protruding, its width about 2.0 times the lower width of face. Malar space absent. Eyes very large and strongly convex, with inconspicuous setae. Inner margins of eyes strongly converging to clypeus. Width frons at ocelli more than 3.5 times the width of face at clypeus. Face, frons and gena polished. Antenna short. Occipital carina closed. Epomia strong. Pronotum polished. Mesoscutum with close adpressed hairs. Notauli robust, meeting in centre of mesoscutum, bounding a convex median lobe. The distal zone of median lobe with strong, longitudinal wrinkles. Propodeum completely areolated with strong carinae. Apophyses very conspicuous, robust and flattened. Mesopleurum polished, with some longitudinal wrinkles medially. Front wing with areolet. Nervulus proximal of basal vein. Nervellus vertical, discoidella absent. Legs long and slender, including the coxae yellowish to orange in colour. Hind coxae with rough sculpture, about 3.0 times the size of middle coxae. Hind femur strongly developed. Fringe at apex of hind tibia minute. Petiole long. First tergite coriaceous, with some longitudinal striation on post-petiole. Spiracles about in the middle. Second, third and fourth tergite proxi-

mally coriaceous. Ovipositor 0.12 of length of front wing. The ovipositor with a long and slender tip.

Material examined. — 1♀, Corvallis (Oregon, U.S.A.), 11 July 1978, from collection Townes.

### **Eusterinx (Dallatorrea) circaea** Van Rossem

*Eusterinx circaea* Van Rossem, 1982: 157—158.

Characteristics of the female: Front wing 5.2—6.0 mm long. Mandible yellowish, the tip twisted. Upper tooth with sharp point, the lower tooth inside and less than 0.3 of length of upper tooth. Clypeus convex, strongly protruding, about as wide as long. Clypeus not distinctly separated from face by a groove. Malar space wide, about 0.5 of width clypeus, with a groove between eye and clypeus. Eye margins converging to clypeus. Face and frons polished. Ocelli robust. OOL : POL = 6 : 4. Vertex narrow, occiput steeply sloping behind ocelli. Occipital carina closed. Antenna slender, but short. Epomia present. Mesoscutum polished, with close adpressed hairs. Notauli strong, with a sharp notch on margin. Scutellum and postscutellum rugulose. Propodeum laterally with conspicuous hairs. Median longitudinal carinae around area superomedia strongly developed. Apophyses very robust, flattened. Mesopleurum polished, ventrolateral margin rugulose and with longitudinal striation. Front coxae yellow, polished. Middle coxae with long hairs, ventrally rugulose. Hind coxae fuscous, with long hairs, rugulose, dorsally with a polished concavity towards trochanter. Front and middle legs slender, hind femur robust, with rugulose sculpture. Hind tibia and tarsus slender. Claws of all legs small. Front wing with areolet. First gastral segment with slender petiole, spiracles at 0.5 of length. End of first sternite at 0.7 of length. First tergite coriaceous, with longitudinal striation. Second to fourth tergite coriaceous, apical margins polished, yellow. Ovipositor 0.11—0.14 of length of front wing.

Male unknown.

Distribution. — The female holotype is from Hochstadt, Oberbayern (Germany) (coll. Haeselbarth). One female was collected in Italy, Prov. Bolzano, Sarntal, 1250 m, 28.vi.1976, leg. and coll. C. J. Zwakhals.

## Subgenus **Holomeristus** Förster

*Holomeristus* Förster, 1868: 171.

Type-species: *Holomeristus tenuicinctus* Förster.

Front wing 2.6—4.0 mm long, with areolet. Malar space wide. Males with tyloids on sixth to eleventh flagellar segments, flattened and slightly concave areas with a longitudinal carina on one side or only a longitudinal carina. Eyes not convergent to clypeus. Notauli present. Propodeum completely areolated. (*E.* (*Holomeristus*) *refractaria* has weakly developed apophyses). Front wing with areolet. Thyridia weak. Ovipositor somewhat upcurved, 0.14—0.26 of length of front wing.

The subgenus includes four species.

### **Eusterinx (Holomeristus) tenuicincta** (Förster)

*Holomeristus tenuicinctus* Förster, 1871: 80—81.
*Holomeristus tenuicinctus*; Aubert, 1970: 274.
*Eusterinx tenuicincta*; Townes, 1971: 202.
*Eusterinx tenuicincta*; Van Rossem, 1982: 160—161.

Characteristics of the female: Front wing 3.5 mm long. Eyes not convergent to clypeus. Clypeus yellow, impressed, 1.8—2.1 times as wide as long.Mandible twisted, with a single tooth. Malar space 0.23—0.25 of width face. Gena wide. Scape and other parts of antenna yellow. Postannellus 3.0—5.0 as long as the apical width. Last joint of antenna large and inflated. Pronotum polished, epomia long. Mesoscutum fuscous, polished, with conspicuous notauli coming together in centre of mesoscutum and with a short carina on their front side, meeting the epomia. Propodeum with all carinae, apical transverse carina somewhat lamelliform, but not developing apophyses. Mesopleurum polished, prepectal carina extending to subtegular ridge. Sternaulus not developed but indicated by weak ridges to edge of mesopleurum. Legs, including coxae yellowish with brownish hind femur, tip of hind tibia and hind tarsus. Areolet present. First tergite fuscous and with longitudinal striation. Second tergite fuscous and striated, with polished yellow apical margin. Thyridia vague. Third tergite in some specimens with narrow front margin striated, the greater part brownish and polished, with yellow apical margin. Other tergites fuscous and polished. Ovipositor 0.20—0.26 of length of front wing, upcurved. Its sheaths slender.

Characteristics of the male: Front wing 3.1—3.6 mm long. Mandible twisted, narrow, with a sharp point. The clypeus impressed, yellowish brown, with a marginal fringe of setae. Malar space 0.22 of width of face. All parts of head fuscous and polished. Gena wide. Postannellus

3.7 times as long as the apical width. Antenna yellow, with vague tyloids on flagellar segments 6, 7 and 8. Pronotum fuscous, epomia long. Mesoscutum fuscous, polished. Notauli conspicuous, meeting in center with a short carina on front side. Propodeum with all carinae. Mesopleurum polished, prepectal carina to subtegular ridge. Sternaulus absent, indicated by weak ridges. Legs yellowish. Front and middle legs very slender. Areolet present, in some specimens not closed. First abdominal segment fuscous, slender, about 3.25 times as long as the apical width. First tergite with longitudinal striation. Second tergite with longitudinal striation, fuscous, with polished apical margin brown. Third tergite with longitudinal striation proximally, the remaining part polished.

Distribution. — The Palaearctic Region, including Japan. The Nearctic Region, including Alaska.

Remark. — Mr. Andreas Zumdick (Kiel) bred the species from *Polyporus squamosus* Fr. collected in the Stifter Wald (near Kiel, Germany) between July and September 1983. The mushrooms were infested with Diptera larvae: Mycetophilidae, Limoniidae and Muscidae.

**Eusterinx (Holomeristus) refractaria**
Van Rossem

*Eusterinx refractaria* Van Rossem, 1982: 158.

Characteristics of the female: Front wing 3.9 mm long. Eyes not convergent to clypeus. Clypeus rather convex, polished, 2.0 times as wide as long. Face polished, with widely-placed fine punctures. Malar space wide, 0.4 of width face, with a distinct furrow. Frons, vertex and gena polished. Postannellus 3.3 times as long as wide. Pronotum with distinct epomia. Mesoscutum with close adpressed hairs. Notauli strong, with a short carina from margin. Propodeum with all carinae, the apical transverse carina somewhat lamelliform and thus developing short apophyses. Mesopleurum polished, prepectal carina to about the middle of pronotal margin. Front wing with areolet. Nervellus vertical, not intercepted. Front and middle coxae yellow; hind coxae brown, coriaceous; hind femur stout; claws of all legs strong. End of first sternite at 0.6 of length of segment. First tergite without dorsolateral and median dorsal carinae. Second tergite and proximal part of third tergite coriaceous. Following tergites polished. All tergites with apical margin yellow. Ovipositor somewhat upcurved, 0.23—0.25 of length of front wing.

Characteristics of the male: Tyloids, longitudinal carinae, on flagellar segments six and seven. Hind femur stout. First, second and proximal part of third tergite coriaceous. Tergites two, three and four with narrow apical margin yellow.

Distribution. — The holotype is from Kytin (Bohemia), Czechoslovakia. Italy, Bolzano, Feldthurns, 1200 m. Sweden, Skåne, Rostanga.

**Eusterinx (Holomeristus) minima** (Strobl)

*Holomeristus minimus* Strobl, 1903: 119.
*Eusterinx minima*; Van Rossem, 1982: 161—162.

Of this species only the Strobl holotype male is extant. It has the tyloids on the flagellar segments six to nine. The sculpture of the second and third tergites is coriaceous. In *E. tenuicincta* these tergites have longitudinal striation. The sculpture of the tergites is rather variable in *Eusterinx* and does not offer definite characters to separate the species.

Characteristics of the holotype: Front wing 2.6 mm long. Clypeus slightly protruding and somewhat convex, 1.5 times as wide as long. Face, frons and vertex polished. Antenna with tyloids on flagellar segments 6—9. Notauli strong, meeting in middle of mesoscutum. Legs very slender, with long hairs. Prepectal carina to about 0.5 of pronotal margin. First, second and third tergite coriaceous.

Female unknown.

Distribution. — The holotype was collected in Austria, Styrian Alp (Alpenwiesen des Natterriegel). It is kept in the Strobl collection at Admont (Austria).

**Eusterinx (Holomeristus) aquilonigena**
Van Rossem

*Eusterinx aquilonigena* Van Rossem, 1982: 156—157.

Characteristics of the female: Front wing 3.0 mm long. Mandible twisted, with a sharp upper tooth. Lower tooth 0.5 of length of upper tooth. Clypeus 1.5 times as wide as long, the apical margin with a close row of bristles. Malar space very narrow, 0.18 of width of face. Face polished, with a row of erect hairs along inner margins of eyes and with two rows medially. Frons, vertex and gena polished. Gena with two rows of subadpressed hairs. Scape subcylindrical.

Epomia weak. Notauli with a fine carina on their front side. The notauli not meeting in center. Propodeum with all carinae. Prepectal carina not reaching the margin. Front wing with areolet. Legs slender, including coxae, yellow. First tergite coriaceous, medially convex. Second tergite coriaceous and with longitudinal striation on front part, apical half polished. Thyridia lying near basal margin behind end of ventrolateral carina of first tergite. Other tergites polished. Ovipositor 0.14—0.19 of length of front wing.

Characteristics of the male: Front wing 3.1 mm long. Tyloids on flagellar segments 6—11, a flattened zone without setae. Second tergite more rough than in female, for the greater part with longitudinal striation. Third tergite in front part with some longitudinal striation.

Distribution. — Sweden. Skåne.

## Genus **Helictes** Haliday

*Helictes* Haliday, 1838: 115.
*Myriarthrus* Förster, 1869: 172.
*Myriarthrus*; Förster, 1871: 102.
*Idioxenus* Förster, 1868: 171.
*Idioxenus*; Förster, 1871: 94.
*Megastylus*; Holmgren, 1855: 129.
*Megastylus* (*Helictes*); Thomson, 1888: 1312.
*Helictes*; Strobl, 1903: 139.
*Helictes*; Townes, 1971: 204.
*Helictes*; Aubert, 1977: 148.

*Ichneumon erythrostoma* Gmelin, 1790, was designated as the type-species of *Helictes* Haliday by Westwood in 1840. Gmelin's material is lost. It is therefore best to follow Gravenhorst, 1829, with respect to this species and to designate Gravenhorst's male as the neotype.

For no good reason Förster rejected the name *Helictes* and introduced the genus *Myriarthrus* with *Plectiscus erythrostoma* Gravenhorst as the type. Förster did not see the Gravenhorst type material. His other species in *Myriarthrus* belong to *Megastylus* Schiødte. Moreover Förster described the genus *Idioxenus* with *Megastylus mediator* Schiødte, 1838, as the type-species. The Schiødte type specimen is a true *Megastylus* (Townes, 1971; van Rossem, 1974). The lectotype of Förster's *Idioxenus mediator* is a male specimen of *Helictes erythrostoma* (Gmelin) (sensu Gravenhorst).[1]) The other species placed by Förster in *Indioxenus* also belong to *Helictes*.

Redescriptions of the Western Palaearctic species of *Helictes* Haliday, 1838, are given below, with a key to the males. Two new species are proposed: *Helictes fabularis* and *H. incongruens*. The identity of the males could only be based on a single character namely the position of the tyloids on the flagellar segments. I have been unable to recognize the females. Only with *Helictes erythrostoma* I have females and a male from the same locality and date.

### Key to *Helictes* males
(Postannellus counted as first segment)

1. Segment five of flagellum with a tyloid ... 2
— Segment five of flagellum without a tyloid 3
2. Tyloids on flagellar segments 5—6—7. Tergite two with vague microsculpture ..... *H. erythrostoma* (Gmelin)
— Tyloids on flagellar segments 5—6—7—8. Tergite two with microsculpture ..... *H. conspicuus* (Förster)
3. Tyloid on flagellar segment six ..... *H. fabularis* spec. nov.
— Tyloids on flagellar segments 6—7—8 or 6—7—8—9 ..... 4
4. Tyloids on flagellar segments 6—7—8. Tergite two polished or with indistinct microsculpture ..... *H. borealis* (Holmgren)
— Tyloids on flagellar segments 6—7—8—9. Tergite two polished ..... *H. incongruens* spec. nov.

### **Helictes erythrostoma** (Gmelin)

*Ichneumon erythrostoma* Gmelin, 1790: 2721. Type destroyed.
*Plectiscus erythrostoma*; Gravenhorst, 1829: 718.
*Cryptus* (*Helictes*) *fulvicornis* Haliday, 1838: 115. Lectotype Fitton, 1976: 333.
*Idioxenus mediator* (Schiødte, 1838) sensu Förster, 1871: 95.
*Idioxenus inaequalis* Förster, 1871: 95.

The type material of *Ichneumon erythrostoma* Gmelin has been destroyed. This species is named according to the revision by Gravenhorst, 1829, whose specimen is regarded as the neotype. No original Gravenhorst label is present. There are two existing labels; that of Aubert which says *Helictes erythrostoma* Gmel.

[1]) If Förster, 1871, designates as type-species for *Idioxenus* gen. nov. a species that he cites in some such manner as *Megastylus mediator* Schiødte, 1838, the type-species of *Idioxenus* is that which was before Förster, and not that named by Schiødte, and its name is to be cited as *Idioxenus mediator* Förster, 1871. (Int. Code, 1985, Art. 70c).

male (= *conspicuus* = *inaequalis*) and the neotype label of the present author.

Characteristics of the neotype of *Helictes erythrostoma*: Male. Front wing 3.5 mm long. Tyloids of flagellar segments 5—6—7. Tergite two almost polished. The specimen is in bad condition and glued on a square of mica. Right antenna missing beyond postannellus; left antenna missing beyond segment eight. Right middle leg and left hind leg missing.

Characteristics of the lectotype of *Cryptus* (*Helictes*) *fulvicornis* Haliday. Labels: lectotype label of Fitton, 1975. Ireland. Female (National Museum of Ireland, Dublin). I have seen the lectotype. It is a reddish brown specimen.

There is a male specimen of *Idioxenus mediator* sensu Förster labelled as follows: a Förster label "Aachen, male, 27 gl."; a box label "*mediator*" Schiødte"; a label of Aubert "*Helictes erythrostoma* Grav. (= *mediator* auct. nec. Schiødte)".

Characteristics of Förster's specimen of *Helictes mediator*: Male. Front wing 3.6 mm long. Tyloids on flagellar segments 5—6—7. Tergite two with fine microsculpture.

The lectotype of *Idioxenus inaequalis* is labelled as follows. A Förster label "Lousb. 15.6."; a box label "*inaequalis* Frst." and the lectotype label of the present author.

Characteristics of the lectotype of *Helictes inaequalis*: Male. Front wing 3.2 mm long. Tyloids on flagellar segments 5—6—7. Tergite two almost polished. There are two paralectotypes, both from Lousberg.

Description of the male of *H. erythrostoma* (Gmelin): Front wing 2.9—3.6 mm long. Palpi yellow. Clypeus convex. Face with fine microsculpture and suberect, rather close hairs. Frons polished, only upper part with some hairs. Vertex, occiput and temple with suberect hairs. Tyloids on flagellar segments 5—6—7. Pronotum with microsculpture, epomia present. Mesoscutum with microsculpture and adpressed hairs, notauli present, reaching margin. Scutellum without margin. Propodeum with microsculpture, pleural carina present and strong. Apical carina present or absent. Mesopleurum polished with hairs on lower part. Prepectal carina not reaching margin. Tegulae white to yellowish. Front and middle coxae brownish, hind coxae fuscous and with microsculpture. Tergites one and two with microsculpture (tergite three sometimes), following tergites more polished.

Characteristics of the female: Description based on Haeselbarth's specimen from Lippoldshausen, 20.v.1967, from the same locality (A) as a male. Front wing 3.6 mm. Palpi whitish. Face with microsculpture and adpressed hairs. Frons polished. Vertex and occiput with very fine microsculpture and widely placed adpressed hairs. Temple polished, without hairs. Antenna yellowish brown, slender. Postannellus long and slender, 8 times as long as apical width. Pronotum with fine microsculpture, epomia present. Mesoscutum with microsculpture, notauli almost obliterated. Scutellum with microsculpture, without margin. Propodeum with strong microsculpture. Median longitudinal carina strong down to apical transverse carina. Pleural carina present. Mesopleurum with microsculpture and adpressed hairs on front half up to apex of prepectal carina. Prepectal carina not reaching margin. Tegulae whitish. Legs, including coxae, light brown. Middle and hind coxae with close sculpture. Tergites one, two and three with microsculpture. Ovipositor not extending beyond subgenital plate.

Material examined. — ♂, no locality label, neotype, coll. Gravenhorst (Wrocław). Austria: ♂, Kärnten, Himmelberg, 1000 m, 14.vii.1979 (coll. Zwakhals); 2 ♂, Pass Thurn, Salzburg, 1200 m, 8.ix.1968 (coll. Haeselbarth). Germany: 2 ♂, Lippoldshausen, A, 20.v.1967; B, 20.v.1967; 3 ♀, Lippoldshausen, A, 20.v.1967; B, 20.v.1967; E, 21.v.1967; ♂, Lippoldshausen, B, 5.vi.1966; 2 ♂, Hedemünden, D, 10.vii.1967; ♂, Erding, 4.vii.1971; ♂, Wiershausen, A. 22.v.1966; ♂, Ober Bayern, Umg. Gauting, 22.vi.1972; ♂, Bayern, Weszling, Hochstadt, 22.vi.1974; ♂, Fl. Triesenberg, 1450 m, 1.ix.1969 (all German specimens leg. & coll. Haeselbarth). Italy: ♂, Bolzano, Sarntal, 1250 m, 30.vi.1976 (coll. Zwakhals); ♂, St Peter, Ahrntal, Südtirol, 1300 m, G, 25.viii.1967; 5 ♂, St. Peter, Ahrntal, Südtirol, 1800 m, Jb, 26.viii.1967; 5 ♂, ibid., 1950 m, Ja (all coll. Haeselbarth). Netherlands: ♂, Terschelling, Hoorn, 23.v.1967, Alnus wood; ♂, Ameland, Hollum, de Blieke, pond "Tonny", 5—26.vii.1969 (both coll. van Rossem); 5 ♂, Ede (Prov. Geldl.), 28.ix., 10.x, 14.x, 21.x, 24.x.1970 (coll. Zwakhals); ♂, Asperen (Prov. Zuid-Holland), 30.viii.1968; ♂, Asperen, 17.v; 4 ♂, 20.v, 2 ♂, 27.v, 2 ♂, 30.v, ♂, 2.vii, ♂, 25.vii, ♂, 29.vii, 2 ♂, 6.viii, ♂, 18.x.1972; 3♂, Asperen, 10.v, 24.v.1973; ♂, Arkel, 26.vii.1970; 2 ♂, 15.vi.1980 (all. coll. Zwakhals); ♂, Giessenburg, 1.viii.1968 (coll. Zwakhals). Suisse: ♂, Gr., Scharl, God Tamangur, 2150 m, 12.viii.1973 (coll. Haeselbarth).

Distribution. — The species is widely spread in the western Palaearctic Region.

### Helictes conspicuus (Förster)

*Idioxenus conspicuus* Förster, 1871: 95.
*Idioxenus inquilinus* Förster, 1871: 95.
*Idioxenus intricator* Förster, 1871: 95.
*Idioxenus tetraglyptus* Förster, 1871: 95.
*Helictes nigricoxus* Strobl, 1903: 139.

The holotype of *Idioxenus conspicuus* is laballed as follows: a Förster label "Aachen ♂"; a box label "*conspicuus* Frst." and the holotype label of the present author.

Characteristics of the holotype of *Helictes conspicuus*: Male. Front wing 3.4 mm long. Face with microsculpture and adpressed hairs. Vertex, occiput and temple with adpressed hairs. Tyloids on flagellar segments 5—6—7—8. Pronotum with epomia and microsculpture. Mesoscutum with microsculpture and notauli present. Propodeum with microsculpture down to position of apical transverse carina, the latter being obliterated. A part of mesopleurum almost polished. Prepectal carina not reaching margin. Upper part of hind coxae with somewhat more rough sculpture. Second tergite with fine microsculpture.

The lectotype of *Idioxenus inquilinus* is labelled with a Förster label "♂, 30 gl. 5—8 ausgebuchtet". Lectotype label of Aubert, 1977.

Characteristics of the lectotype of *Helictes inquilinus*: Male. Front wing 4.0 mm long. Face with microsculpture. Tyloids on flagellar segments 5—6—7—8. Mesoscutum, first and second tergite with microsculpture.

There are two paralectotypes from Lousberg (the type locality), probably a specimen of *H. erythrostoma* and also one female from Lousberg.

The holotype of *Idioxenus intricator* is labelled with a Förster label, "♂, 28 gl., Lousberg 12.10." and a holotype label of the present author.

Characteristics of the holotype of *Helictes intricator*: Male. Front wing 4.0 mm long. Face with microsculpture. Tyloids on flagellar segments 5—6—7—8. Mesoscutum, first and second tergite with microsculpture.

The lectotype of *Idioxenus tetraglyptus* is labelled with a Förster label, "♂, 25 gl., Lousberg, 9.6." and a lectotype label of the present author.

Characteristics of the lectotype of *Helictes tetraglyptus*: Male. Front wing 3.2 mm long. Face with microsculpture. Tyloids on flagellar segments 5—6—7—8. Mesoscutum with microsculpture. First and second tergite with vague microsculpture.

There are three paralectotypes (2 ♂ 1 ♀), all from Lousberg. There are also specimens (8 ♂ 14 ♀), labelled by Förster *Idioxenus tetraglyptus*, but these are not type specimens.

The lectotype of *Helictes nigricoxus* Strobl, 1903, is labelled: "Admont 18 August" and bears the lectotype label of Aubert, 1977, who identified this specimen as *Helictes erythrostoma* Grav., male. I have not seen this specimen, but following the original description of Strobl, viz. "das fünfte bis achte Geiszelglied start ausgerandet" I am inclined to place it under *Helictes conspicuus*. Strobl also noted: "nach Frst. Tab. gelangt man auf *inquilinus*".

Material examined. — The localities mentioned above are not recapitulated. Germany: ♂, holotype of *Idioxenus conspicuus*, Aachen (coll. Förster, München); 2 ♂, Wiershausen (Niedersachsen), A, 22.v.1966; 4 ♂, Lippoldshausen, A & B, 20.v.1967; 2 ♂, Ziegenhagen (Hessen), Ac, 13.viii.1966; Aa, 15.viii.1966; ♂, Münden (Hann.), 13.viii.1965; ♂, Glonn (Ober Bayern), 14.vii.1968; ♂, Weszling (Ober Bayern), 12.viii.1972; 2 ♂, Weszling, Hochstadt (Bayern), 22.vi.1974; ♂, Starnberg, Kerschlach (Bayern), 27.vii.1974; ♂, Sachsenkam, Kirchseefilz (Ob. Bayern), 19.vii.1972 (all leg. & coll. Haeselbarth). Italy: ♂, TN, M. Baldo Bocca Navene, 1400 m, 9.vii.1972; ♂, Algund (Südtirol), 1800 m, A, 24.vii.1966; male, Idrosee (Brescia), Vesta, 500 m, 15.vi.1958; ♂, Campi, Riva s. Garda, 1400 m, E, 7.ix.1967 (all leg. & coll. Haeselbarth); 2 ♂, Sarntal (Bolzano), 1250 m, 26.vi.1976 & 30.vi (both leg. & coll. Zwakhals). Netherlands: 10 ♂, Ede (Prov. Geldl.), 28.ix.1970, 14.x, 17.x, 24.x, 1.xi, 15.xi; 12.vi.1971; ♂, Overveen (Prov. Noord-Holland), 9.vi.1974; 4 ♂, Asperen (Prov. Zuid-Holland) i.v.1967; 18.v.1970; 24.v.1972; 27.v.1972; ♂, Arkel (Prov. Zuid-Holland), 10.viii.1967; ♂, Schelluinen, 23.viii.1967; ♂, Hoornaar, 11.vii.1967. All material leg. and coll. Zwakhals. Poland: ♂, Polanowice (10 km N. of Wrocław), 15.vii.1967, leg. W. J. Pulawski (coll. van Rossem). Switzerland: ♂, Tarasp Lai Nair (Gr.), 11.viii.1973 (coll. Haeselbarth); ♂, Bern, Delémont, 21.v.1975, leg. R. T. Simon Thomas (coll. van Rossem). Sweden: ♂, Lapland m., 30.viii. Bhn (Boheman) (in type series of *Megastylus borealis* Holmgr., Riksmuseet, Stockholm).

Distribution. — The species is widely spread in the western Palaearctic Region.

### Helictes borealis (Holmgren)

*Megastylus borealis* Holmgren, 1855: 129.
*Idioxenus coxalis* Förster, 1871: 95.
*Idioxenus propinquus* Förster, 1871: 95.
*Idioxenus invalidus* Förster, 1871: 95.

*Idioxenus variator* Förster, 1871: 95.
*Megastylus* (*Helictes*) *pilicornis* Thomson, 1888: 1312.

The lectotype of *Megastylus borealis* Holmgren (Riksmuseet, Stockholm) is labelled: "Lp (= Lapland) m, 5.viii. Bhn (= Boheman)". Lectotype label of the present author.

Characteristics of the lectotype of *Helictes borealis*: Male. Front wing 3.7 mm long. Palpi and mandible yellow. Clypeus convex, yellow. Face coriaceous, with long, subadpressed hairs. Malar space wide, 0.26 of width of face. Eyes with setae. Tyloids on flagellar segments 6—7—8. Frons and vertex polished. Gena with long hairs. Occipital carina closed. Pronotum with vague sculpture, epomia present. Mesoscutum with adpressed setae. Notauli present. Propodeum polished, carinae absent except for stubs of longitudinal carinea. Mesopleurum polished, prepectal carina not reaching te margin. Coxae and legs yellow. Middle and hind coxae with long hairs. Hind femur slender, hind tibia slender and very long, Nervellus vertical, discoidella absent. First gastral segment rather slender, tergite almost polished. Following tergites polished. Second tergite proximally and distally yellow. Third tergite proximally yellow.

The two males labelled: "Lapland m., 4.viii. Bhn" and "Lapland in. Bhn", respectively, I labelled as paralectotypes.

The lectotype of *Idioxenus coxalis* was labelled by Aubert and has a Förster label "Aachen".

The neotype of *Idioxenus coxalis* has a Förster label "Aachen, ♂ und ♀, 29 gl" a cabinet label *coxalis* Frst. and a lectotype label of Aubert, 1977. There are two specimens mounted on the pin. I consider the right-hand specimen, a male, to be the neotype.

Characteristics of the neotype of *Helictes coxalis*: Male. Front wing 3.4 mm long. Palpi yellow. Clypeus convex, yellowish brown. Malar space wide, 0.33 of width of face. Clypeus and face with rather long, close, suberect hairs. Face with microsculpture. Scape ventrally yellow, with long hairs. Tyloids on flagellar segments 6—7—8. Frons vertex and gena polished. Lower gena with long hairs. Pronotum polished, epomia present. Mesoscutum strongly convex, with fine microsculpture. Notauli present, but not reaching the margin. Scutellum with lateral carina only at proximal corners and with long hairs. Propodeum polished, laterally with hairs, pleural carina present. Mesopleurum polished, with prepectal carina present but weak, not reaching the margin. Tegulae white. Legs including coxae yellow. All tergites polished.

The holotype of *Idioxenus propinquus* is labelled with a Förster label "Aachen, ♂".

Characteristics of the holotype of *Helictes propinquus*: Male. Front wing 4.3 mm long. Tyloids on flagellar segments 6—7—8. Second tergite almost polished, some vague microsculpture present.

The lectotype of *Idioxenus invalidus* has two Förster labels: "Aachen, ♂, 30 gl"; "6—8..." (illegible) and the lectotype label of the present author.

Characteristics of the lectotype of *Helictes invalidus*: Male. Front wing 3.4. mm long. Tyloids on flagellar segments 6—7—8. second tergite polished.

There are two males mounted on the pin. I consider the right-hand specimen to be the type. The other specimen also represents *H. coxalis*. There are also three female paralectotypes; one of these is the holotype of *Megastylus* (*Helictes*) *pilicornis* Thomson, holotype label of M. G. Fitton, 1980.

The lectotype of *Idioxenus variator* has a Förster label "Lousberg, 17.10. ♂, 29 gl" and the lectotype-label of the present author.

Characteristics of the lectotype of *Helictes variator*: Male. Front wing 4.2 mm long. Tyloids of flagellar segments 6—7—8. Second tergite almost polished, some vague microsculpture is present.

Ther are two other Förster males, one labelled "Aachen". The other without a label.

Material examined. — I studied 147 ♂ from the following localities. Austria: St. Schladming, 1250 m, Heidelbeere; Flintsbach, Inn.B, 550 m; Walchsee, Tirol, 800 m; T. Pertisau, 1550 m; Fl.3, Schwestern Grat, 2000 m; Reiter Alm, 1600 m, Heidelbeere (all coll. Haeselbarth); Kärnten, Himmelberg, 1000 m (coll. Zwakhals). Germany: Bayern. Wiershausen; Jettenhausen; Ammergeb. Jausen, 1400—1600 m, Nickelswald 1100—1300 m; Starnberg, Kerschlach; Leutstetten; Glonn; Niederaudorf, 1000 m; Herrsching Widdersberg Mischwald; Gauting (all coll. Haeselbarth); Ellmau 1050 m; Garmisch 700—1400 m; illegible 750 m (coll. Bauer, Zool.Staatss. München). Hann. Münden; Geierlambach, Heidelbeere; Lippoldshausen; Nd. Sachsen, Bramwald; Holledau, Heidelbeere; Fl.Triesenberg, 1450 m; Hedemünden; Meensen; Dransfeld (all coll. Haeselbarth); illegible leg. Pfankuch (Zool.Staatss. München); Augsburg (Zool.Staatss. München); Goslar a. H. Haldenstieg, Grauhöferholz; Harz, Harzburg, Radautal; Allgäu,

Riezlern, 1150 m (coll. Bauer, Zool. Staatss. München). Italy: St. Peter, Ahrntal, Südtirol, 1350—1600 m; Martelltal, Südtirol, 2100 m; Tremalzo, Judikar Voralpen, 1730-1900 m; Karthaus Südtirol, 1200 m; Merano, 700 m; Feldthurns (Bolzano) 1200 m; Partschins, Südtirol, 850 m; Tirol, Südtirol, 2250 m; Malcesine (VR) 500—1300 m, Bosco ceduo; Campi, Riva s. Garda, 240—1200 m (22 specimens) (all coll. Haeselbarth); Bolzano, 800 m; Sarntal (Bolzano) 1250 m (coll. Zwakhals). Netherlands: Ede (Prov. Gelderl.) (coll. Zwakhals and coll. van Rossem); Heilo and Bergen (Prov. Nd Hol.); Asperen and Arkel Prov. Zd Hol.) (14 specimens); Halsteren (Prov. Nd Brab.) (coll. Zwakhals). Norge: Opland, Lom-Lia (4 specimens) (coll. van Rossem). Sweden: Dalarna, Boda Kyrkby, Silverberg; Fjätervålen Idre; Transtrand, Hemfjäll Stangen (coll. van Rossem); Höör (Skåne) (coll. Zwakhals). Switzerland: Wallis, Fiesch, 1200 m (coll. Zwakhals).

Localities of type material are not repeated.

Collecting dates between May and November.

Distribution. — The species is widely spread in the western Palaearctic Region.

### **Helictes incongruens** species nova

The holotype of *Helictes incongruens* species nova has the following labels: "Judikar Voralpen, C. Tombea 1800 m, 18.vi.1958" (leg. & coll. Haeselbarth). "*Helictes* sp." det. Townes, 1964, and the holotype label of the present author.

Characteristics of the holotype of *Helictes incongruens*: Male. Front wing 3.6 mm long. Palpi whitish. Clypeus convex, polished, fuscous, front margin light brown, width 0.59 of width face. Lower part of face polished, towards antennal sockets somewhat rough, with suberect hairs. Frons, vertex an occiput polished. Vertex and occiput with widely placed hairs. Tyloids on flagellar segments 6—7—8—9. Pronotum polished, epomia present. Mesoscutum almost polished. Lateral carina of scutellum only present beyond the corner and not meeting at apex. Mesopleurum polished, prepectal carina not reaching the margin. Legs long and slender. Tegulae white. Propodeum polished, only pleural carina present. All tergites polished.

Material examined. — Italy: ♂, Brescia, Judikar Voralpen, C. Tombea, 1800 m, 18.vi.1958, holotype. Paratypes: ♂, Judikar Voralpen, C. Tombea, 1800 m, 18.vi.1958. Austria: ♂, Steiermark, Schladming, 1250 m, 11.vi.1972, Heidelbeere. Germany: ♂, Reither Alm, 1600 m, Heidelbeere. Preceding specimens leg. and coll. E. Haeselbarth, München. Sweden: ♂, Lapland in., 8.viii., Bhn (= Boheman) (specimen in type series of *Megastylus borealis* Holmgren; Riksmuseum Stockholm).

Distribution. — The species gives the impression of being a boreal and alpine element.

The name "incongruens" is the Latin for "disagreeing".

### **Helictes fabularis** species nova

In the type series of *Megastylus borealis* Holmgren there is a male which differs conspicuously from the other syntypes by having a single tyloid. I consider this specimen to represent an undescribed species.

The holotype of *Helictes fabularis* has the following labels: "Lp (= Lapland) in., Bhn" (= Boheman) (Riksmuseum, Stockholm).

Characteristics of the holotype of *Helictes fabularis*: Male. Front wing 4.7 mm long. Palpi and mandible yellow. Clypeus convex, polished, front margin protruding. Face wide, polished to slightly coriaceous, with widely placed setae. Malar space wide, 0.45 of width of face. Frons and gena slightly coriaceous. Gena and occiput with long, subadpressed hairs. Occipital carina closed. The single tyloid on the sixth flagellar segment. Postannellus long. Scape large, broadly ovate. Pronotum polished, with strong epomia and a rather characteristic downward slope of the hind margin dorsally. Mesoscutum with indistinct microsculpture and vaguely outlined notauli (damaged by pin). Propodeum polished, with erect setae. Only the pleural carina present. Mesopleurum polished, prepectal carina not reaching the margin. Legs, including the coxae yellowish. Hind coxa relatively slender. Hind femur and tibia exceptionally slender. Nervellus indistinctly intercepted, discoidella absent. First gastral segment slender, polished and with the spiracles at 0.5 of the length. The first sternite ending in the apical half. The other tergites fuscous, polished, with short suberect hairs.

Material examined. — The holotype only (Sweden, Lapland). In a collection of the Museo de Ciencias Naturales (Santa Cruz de Tenerife) (Dr G. Ortega) I found specimens from Gran Canaria, Gomera and Palma (Islas Canarias).

The name "fabularis" is the Latin for "mythical".

### **Phosphoriana** nomen novum

*Phosphorus* Voet, ? 1769: 84.

*Phosphorus* Thomson, 1857: 27 (= *Voetia* Strand, 1943).

*Phosphorus* Van Rossem, 1980: 129—131.

The name *Phosporus*, which I re-introduced in 1980, is preoccupied. I propose to use *Phosphoriana* as the replacement name, gender feminine. The type-species of *Phosphoriana* is *Entypoma rugosissimum* Strobl, 1903, the type-species of *Phosphorus* Van Rossem by monotypy.

**Phosporiana rugosissima** (Strobl)

*Entypoma rugosissimum* Strobl, 1903: 114.
*Phosphorus rugosissimus*; Van Rossem, 1980: 129—131.

Hitherto the male of this species was unknown. I found two males in the collection of Haeselbarth. A description follows here.

Characteristics of the male: Length front wing 4.6 mm. Palpi white. Mandible yellow, lower tooth slightly shorter. Clypeus with apical half flattened and yellow, about 1.7 times as wide as long. Face below the antennae protuberant, with a conspicuous groove between the antennal sockets. Below each antennal socket a triangulate ivory spot, the base proximal to the socket. Malar space as wide as apex of postannellus. OOL : POL =2 : 1[1]). Frons, vertex and gena polished. Face with some vague and shallow punctures. Gena narrow, about 0.35 of width eye. Antenna long and slender, postannellus 7.0 times as long as the apical width. No tyloids present. The pronotum striking, having two elevations, ivory in colour, with a sharp groove between, directly behind the postocciput. The mesoscutum strongly inclined upwards from the pronotum, the median lobe conspicuously separated from the lateral lobes by wide but shallow notauli. Towards the centre of the mesoscutum the median lobe with a V-shaped depression. The propodeum with some transverse, irregular sculpture. Pleural, lateral longitudinal and median longitudinal carinae present. Mesopleurum polished prepectal carina strong. All coxae and most of the front and middle legs whithish yellow. Hind femur and tibia more yellow. All femora rather stout. Hind tibia long and slender. First tergite long and slender, 3.5 times as long as the apical width, with longitudinal sculpture, which is continued on tergites two and three. All tergites with a broad apical ivory band.

Material examined. — Germany: 2 ♂, Bayern, Neuburg Donau, Finkenstein, 6.vii.1982, leg. and coll. Haeselbarth.

Characteristics of the female: Length front wing 5.0 mm. Postannellus slender, 7.0—9.0 times as long as wide. The pronotum with the same characteristics as in the male. Mesoscutum steeply rising, polished, with conspicuous notauli. Propodeum with pleural, lateral longitudinal and apical transverse carina. Prepectal carina strong. Colour of the legs the same as in the male. Hind femur robust, 4.3 times as long as wide. Front wing with areolet. Nervellus intercepted below the middle, discoidella present. First tergite long and slender, about 3.0 times as long as wide apically, with rough sculpture, spiracles at 0.76 of length. Apical margins of all tergites ivory-yellow. Ovipositor 0.25 of length front wing.

Distribution. — A rare species. The holotype of Strobl is from Johnsbachgraben (Austria). There are three specimens from Germany in the collection of E. Haeselbarth (München).

Genus **Proeliator** Van Rossem

*Proeliator* Van Rossem, 1982: 152—154.

Dr. H. Townes brought to my notice an undescribed species in the type series of *P. proprius* Van Rossem. A description follows here.

Key to the *Proeliator* females
(The males of *P. invictus* and *P. captiosus* are unknown)

1. Length of ovipositor 0.14—0.17 of length of front wing ..... *Proeliator invictus* spec. nov.
— Length of ovipositor 0.23—0.30 of length of front wing ..... 2
2. Lower tooth of mandible very small, giving the impression of a single-toothed mandible. Last tarsal joint of hind leg robust, claws strong. Alaska ..... *Proeliator captiosus* Van Rossem
— Lower tooth of mandible shorter than upper tooth, but visible. Last tarsal joint of hind leg not particularly robust. Europe .... *Proeliator proprius* Van Rossem

[1]) OOL = ocular-ocellar line.
POL = distance between lateral ocelli

**Proeliator invictus** species nova

Characteristics of the holotype of *P. invictus*. Female. Front wing 3.4 mm long. Lower tooth of mandible about half the length of upper tooth. Clypeus elliptical, upper margin convex. for the rest clypeus impressed. Entire head polished. Pedicel large. Antenna yellowish brown. Pronotum polished, with epomia. Mesoscutum polished, with adpressed rather close hairs. Notauli weak, only indicated on the margin. Propodeum with rather close erect hairs. Apical transverse, median longitudinal, and pleural carinae present. Mesopleurum polished, prepectal carina to the margin. Front wing with areolet. Discoidella absent. Front and middle legs, including coxae yellow. Hind legs more brownish, hind femur with conspicuous long hairs. First tergite coriaceous, 2.0 times as long as apical width. Dorsolateral and median dorsal carina strong. Median dorsal carina to apical margin. Following tergites polished. The fourth tergite and following with transverse rows of widely placed suberect setae. Ovipositor 0.14 of length front wing. Sheath with widely placed long hairs.

Ovipositor of paratype is 0.17 of length of front wing.

Male unknown.

Material examined. — Sweden, ♀, holotype, Messaure, 7.ix.1972, leg. Karl Muller; ♀, paratype, Messaure, 12.ix.1971, leg. Karl Muller (both coll. Townes, Gainesville (Florida).

The name "invictus" is the Latin for "indisputable, irrefutable".

**Proeliator proprius** Van Rossem

*Proeliator proprius* Van Rossem, 1982: 152—153.

Characteristics of the female: Front wing 3.5 mm. The lower tooth of mandible visible, shorter than upper tooth. Head polished, square. Occipital carina closed. Scapus subcylindrical, pedicel large. Pronotum polished, epomia present. Mesoscutum convex, polished, with widely placed subadpressed hairs. Notauli weak. Propodeum with a strong apical transverse carina and pleural carina, other carinae weak to obsolete. Propodeum with long, erect hairs. Front wing with areolet. Nervellus vertical, discoidella absent. Front and middle coxae whitish, hind coxae brown. Legs yellow, with rather long hairs, especially the hind tibia, the hind femur and the tarsi. The first tergite rather variable in shape, 1.8—2.5 times als long as the apical width. Median dorsal carina in most specimens short. The first tergite coriaceous. Second tergite in part coriaceous. Following tergites polished. Ovipositor 0.23—0.30 of length of front wing. Sheath with widely placed hairs.

Characteristics of the male: Tyloids of flagellar segments 6—8.

Distribution. — Germany: Spessart. Sweden: Messaure (Lapland).

**Proeliator captiosus** Van Rossem

*Proeliator captiosus* Van Rossem, 1982: 153—154.

Characteristics of the female: Front wing 3.3 mm. Lower tooth of mandible very small, giving the impression of a single toothed mandible. Occipital carina closed. Pedicel large. Postannellus 4.0 times as long as wide. Epomia present. Front wing with areolet. Nervulus somewhat inclivous. Nervellus somewhat reclivous. Last tarsal joint of hind leg robust, claws strong. First tergite coriaceous, median dorsal carinae not present. Following tergites brown, polished. Ovipositor 0.26 of length front wing. Sheath with widely placed long hairs.

Male unknown.

Distribution. — U.S.A.: Mt McKinley, Alaska (coll. Townes)

Genus **Megastylus** Schiødte

*Megastylus* Schiødte, 1838: 139.
*Megastylus*; Townes, 1971: 205.
*Megastylus*; Van Rossem, 1974: 273—285.
*Megastylus*; Van Rossem, 1983b: 121—132.

Type-species: *Megastylus cruentator* Schiødte, 1838.

**Megastylus cruentator** Schiødte

*Megastylus cruentator* Schiødte, 1838: 139.
*Megastylus cruentator*; Van Rossem, 1974: 276—278.
*Megastylus cruentator*; Van Rossem, 1983b: 123 & 126.
*Cryptus* (*Helictes*) *cruentatus* Haliday, 1838: 115.
*Megastylus cruentator*; Fitton, 1976: 333.

Characteristics of the lectotype of *Cryptus cruentatus* Haliday. Labels: a label "named by Claude Morley *Helictes cruentatus* Hal. Type (unlabelled) vi.1913; a circular label with red margin Type CM; lectotype label of Fitton, 1975. Nat. Mus. Ireland, Dublin). Female. The

specimen represents *Megastylus cruentator* Schiødte.

### Megastylus orbitator Schiødte

*Megastylus orbitator* Schiødte, 1839: 139 (type lost).
*Megastylus orbitator*; Van Rossem, 1983b: 127—129 (neotype)
*Misoleptus maderensis* Wollaston, 1859: 21 (*Misoleptus* is a lapsus for *Mesoleptus*)
?*Megastylus maderensis*; Fitton, 1976: 356.

Characteristics of the holotype. Labels: Madeira Wollaston (printed); a blue label: *Misoleptus maderensis* W.; B. M. Type Hym. 36. 1999; holotype label Fitton 1974. Male. Front wing 2.4 mm long. The specimen is quite small and stuck to the mounting slip in such a way that ventral examination is impossible. Nevertheless I hold it to be close to *M. orbitator*.

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## INDEX

*(Synonyms in italics)*

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# ECOLOGY, LIFE HISTORY AND DISTRIBUTION OF *PALINGENIA LONGICAUDA* (OLIVIER) (EPHEMEROPTERA)

by

BORIS K. RUSSEV

*Institute of Zoology, Bulgarian Academy of Sciences, Sofia*

*Dedicated to the memory of the Dutch naturalist Jan Swammerdam, who initiated the studies on the life history of* Palingenia longicauda *with great love and dedication in 1667*

Abstract

The ecology and life history of *Palingenia longicauda* (Olivier) have been studied in the Bulgarian section of the river Danube, both for the aquatic larval stages and the flying adult stage. The significance of this species for the fisheries is outlined. The distribution in Europe, the retreat from Western Europe and finally the complete disappearance from the Danube river system are described.

## Introduction

The first record of mayflies, as well as an explanation of their name was given by Aristoteles (384—322 B.C.) in his Historia Animalium (see Illies, 1968; Francissen & Mol, 1984). Swammerdam (1752: 100) was correct in assuming that Aristoteles, later cited by Plinius and Elianus, had studied the same insect, calling it *Hemerobius*, *Ephemerus* and *Diaria*, respectively.

Clutius (1634) wrote about the abundance of *Hemerobius* in Dutch rivers some 350 years ago. He drew somewhat distorted pictures of the larva (in dorsal and ventral view), of the exuviae and of the adult.

Swammerdam (1675) was the first, who reported on the life history of the larva and of the adult, which he called "Haft" of "Oeveraas", and presented pictures and descriptions of both. They were later included in the Dutch edition of the "Bible of Nature" (Bijbel der Nature) by Swammerdam (1737) — the first book of this kind and of primary importance for that time. In 1752 it was translated into German, and in 1758 into English. Marsili (1726: 25) in his six volumes with geographical, historical, astronomical and hydrographical data on Hungary and the Balkans, reported on the mass flight of this mayfly species over the Tissa river.

At present the nomenclature of this species is as follows:
*Ephemera longicauda* Olivier, 1791
*Ephemera flos-aquae* Illiger, 1802
*Semblis marginata* Panzer, 1804
*Ephemera swammerdiana* Latreille, 1805
*Ephemera swammerdamiana* Shaw, 1806
*Palingenia longicauda* (Burmeister, 1839)

## Material and methods

I started my study on the life history and distribution of larvae of *Palingenia longicauda* along the Bulgarian Danubian stretch in September, 1952. For my qualitative and quantitative surveys I used the so-called fisherman's probe or gunter, utilized by sportsmen for collecting mayfly larvae as bait. This is a metal cylinder, measuring 16—18 by 32—34 cm, fixed on a wooden handle of 6—8 m long. In total 1033 larvae and nymphs were collected from 22 localities along the Bulgarian bank of the Danube (table 1).

The transversal distribution of larvae of *Palingenia longicauda* was established during several years of zoobenthal studies along and across the river between km 845 and 375. These studies were carried out aboard of the hydrographical ship "Ossum", property of the Bulgarian Danube Shipping and Monitoring Au-

Table 1. Larvae and nymphs of *Palingenia longicauda* on the clay bottom immediately by the right Danubian bank.

| Date | Locality (river km) | Total No of individuals | Average body length (cm) | Average length of caudal filaments (cm) | Average body width (cm) | Average body weight (mg) | Average number (ind/m²) | Average biomass (g/m²) |
|---|---|---|---|---|---|---|---|---|
| 1.10.52 | 498 | 20 | 3.7 | 0.8 | 0.7 | 254 | 1100 | 279 |
| 12.09.53 | 497 | 4 | 4.4 | 1.1 | 0.7 | 331 | Qualitative sample | |
| 6.07.54 | 475 | 15 | 4.0 | 1.1 | 0.6 | 297 | 248 | 74 |
| 23.09.54 | 436 | 204 | 3.4 | 0.8 | 0.5 | 174 | 1625 | 286 |
| 28.09.54 | 789 | 17 | 4.3 | 0.9 | 0.6 | 403 | 846 | 341 |
| 29.09.54 | 745 | 9 | 4.5 | 1.1 | 0.7 | 388 | Qualitative sample | |
| 30.09.54 | 715 | 31 | 4.2 | 0.6 | 0.6 | 350 | 1755 | 615 |
| 1.10.54 | 678 | 6 | 4.0 | 1.1 | 0.6 | 301 | 298 | 90 |
| 16.10.54 | 555 | 19 | 3.8 | 0.5 | 0.6 | 242 | 473 | 115 |
| 22.10.54 | 475 | 100 | 3.8 | 0.7 | 0.6 | 192 | 1244 | 239 |
| 24.10.54 | 527 | 27 | 4.0 | 0.6 | 0.7 | 282 | 697 | 190 |
| 18.03.55 | 475 | 106 | 4.3 | 0.9 | 0.6 | 250 | 1294 | 330 |
| 18.03.55 | 436 | 12 | 4.2 | 1.1 | 0.6 | 279 | 176 | 49 |
| 14.06.55 | 475 | 57 | 3.0 | 1.3 | 0.6 | 330 | 1045 | 345 |
| 19.06.55 | 516 | 38 | 3.3 | 0.7 | 0.5 | 179 | 1631 | 293 |
| 13.09.55 | 544 | 14 | 3.4 | 0.8 | 0.5 | 224 | 550 | 123 |
| 14.09.55 | 666 | 16 | 3.5 | 0.8 | 0.5 | 216 | Qualitative sample | |
| 20.09.55 | 383 | 56 | 4.4 | 1.1 | 0.6 | 384 | 1485 | 593 |
| 20.09.55 | 376 | 3 | 4.3 | 1.1 | 0.6 | 343 | Qualitative sample | |
| 21.09.55 | 436 | 38 | 3.8 | 1.1 | 0.6 | 296 | 614 | 183 |
| 9.01.58 | 517 | 234 | 3.3 | 1.1 | 0.6 | 414 | 1045 | 433 |
| 17.10.59 | 715 | 7 | 3.3 | 1.1 | | | | |
| | | 1033 | | | | Average: | 949 | 269 |

thority, Russe. The precise data (within 1—2 m) of the position of the ship at each site were obtained by trigonometric methods; also data on the amount of water as well as the current velocity at the surface and every second meter down to the bottom were provided by the authorities. Zoobenthos was collected by means of a Petersen's bottom sampler (1/10 m²).

From 1956 to 1973 the Bulgarian stretch of the Danube was surveyed at 1036 sites; *Palingenia* was collected at 37 of these (table 2). Sixty-five observations were carried out on the metamorphosis of the nymph, the moulting of the subimago and the flight of the adults at various localities of the Bulgarian Danube (table 3). The stomach content of 387 sterlets (*Acipenser ruthenus* (L.)) obtained from fish markets all the way from Vidin to Silistra, as well as during the actual fishing with fishing rods and nets, was studied between 1953 and 1958 in order to find out the significance of the zoobenthos and particularly of *Palingenia longicauda* for the nutrition of this and other fish species. The laboratory and statistical analyses were done according to Russev (1963).

## Ecology and life history of aquatic stages

Our studies showed that a fertilized female of *Palingenia longicauda* produced 8—9000 eggs (Unger, 1927, estimated some 7000 eggs per female). The eggs were carried downstream for kilometres due to the high current velocity of the river (over 1 m/s), the average water depth of 7—8 m, and the fact that they are sinking slowly.

Quantitative studies along and across the river (Russev, 1978) revealed to a certain extend the fate of the young larvae after they had reached favourable or less favourable substrates (table 2). No larvae were ever found in sandy substrate, only two on sand-and-clay, and one on both gravel-and-sand and mud-and-sand. They were more frequent in gravel and gravel-with-corophium-mud or cinder (13 times, 7.0% of the samples in this biotope), and in clay (19 times, 40.6% of the samples in this biotope). The frequency of occurrence in the entire stretch studied amounted 3.6% (Russev, 1967), thus indicating the significance of the clay substrate for larval development. As the clay is located near the

banks the distance from the banks can be considered a key, although indirect, ecological factor, affecting the distribution (Russev, 1977).

The larvae were predominantly found up to 100 m from the Bulgarian bank (70% of the localities), seven localities (23%) were between 100 and 252 m and two (7%) between 789 and 880 m off the Bulgarian bank. This shows the inability of the larvae to maintain their positions at distances of more than 250 m from the banks, which should be attributed to the higher current velocity and the inadequate sand substrate in the middle of the stream. No larvae were found at flow rates over 0.76 m/s (measured 0.5 m above the bottom) and on sandy substrate.

Depth is hardly of influence on larval distribution. Larvae were found at depths of up to 10.6 m. During periods of rapid fall of the water level (e.g. on 29 September, 1954) they left their holes in the clay, while many of them died while they tried to follow the retreating water.

The studies on the horizontal and vertical distribution of larvae of *Palingenia longicauda* at km 166.5 of the Tissa river led to the conclusion (Csoknya & Halasy, 1974), that "... the most uniform distribution of the zoobenthos is found 5 m from the bank towards the river bed, in the entire depth of the mud samples (60 cm). In the region lying closer to the bank (3 m) the young larvae (0.5—20.5 mm) are distributed fairly uniformly in the mud samples. Between 3 and 7 m from the bank, however, they occurred in the uppermost 20 cm layer. The largest larvae (40.5—60.5 mm) are more frequent 4—5 m from the bank, and predominantly in the mud layers (30—50 cm). Intermediate larvae (20.5—40.5 mm) exhibit a uniform distribution in the region examined".

During our studies on *Palingenia longicauda* we measured the following hydrological and hydrochemical parameters: average current velocity ranging from 0.56 to 2.10 m/s; turbidity 13—1046 g/m$^3$; floating deposits 37—8391 kg/s; transparency 0.9—23 cm; temperature up to 28.2 °C; dissolved oxygen 5.55—9.65 ml/l; oxygen saturation 68—123%; oxydability 2.41—9.40 mg/l $O_2$; biological oxygen demand for five days ($BOD_5$) 5.74—0.35 ml $O_2$/l; total hardness 7.67—13.7 dH°; pH 7.5—8.2; alkalinity 2.00—3.06 mg equiv./l; $HCO_3$ 124.0—186.9 mg/l; Cl' 11.8—17.5 mg/l; general mineralization 239—439 mg/l (Russev, 1968).

According to Swammerdam (1752), Unger (1927) and Schoenemund (1929) the larvae of

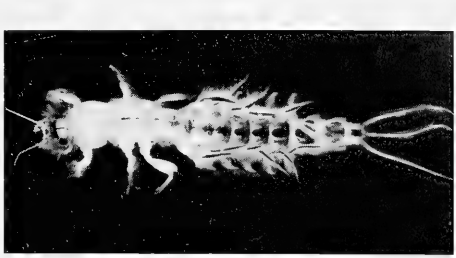


Fig. 1. Larva of *Palingenia longicauda* (Photo A. Valkanov).

*Palingenia longicauda* feed on the organic matter, which is taken up by the stomach from the clay that is consumed. Strenger (1973) noticed that the mouth organs of *Palingenia* are well adapted for scratching the detritus.

Only eggs that have reached adequate clay substrate, develop normally. Under laboratory conditions at water temperatures of 20—25 °C Unger (1927) found out that the embryonal development up to the hatching of the larvae lasted for 4—6 weeks. He assumed that larval development took three years, and because of continuous growth, the larvae passed through some twenty moultings. Already Swammerdam (1752) made the observation of three different size classes of larvae shortly before the metamorphosis, from which he concluded that their longevity was three years. We tried to distinguish the respective stages by biometrics and analysis of variance between larvae of various ages, but we obtained no positive results. This was obviously due to individual and nutritional peculiarities of larvae of various ages leading to merging sizes and weights within the various age groups. Only in July, shortly after the emergence of the adults but before the hatching of the young larvae, two age groups could be distinguished, which confirmed the three-year life-cycle. In other cases we have observed just one age group after emergence. The probability of absence of a certain age group at a particular site is very high, since new eggs do not reach all localities each year.

The larvae live in U-shaped holes dug in the clay. They make these holes using their well-adapted legs. Particularly the forelegs provided with denticles on the lateral sides, as well as the mandibulae with their strong lateral chitine denticles, are very suitable for digging (fig. 1). According to Swammerdam (1752) these holes are "... lange, und rechte, zuweilen aber auch krumme und schiefe hohle Röhren in Thone,

Table 2. Distribution of *Palingenia longicauda* larvae across the Danube off the Bulgarian river bank (samples collected from a ship by the Petersen Bottom Sampler. 1/10 $m^2$).

| Date | km | Distance off the bank | Depth (m) | Substrate | Water temp. | Vbot. (m/s) | ind./ $m^2$ | Weight/ $m^2$ | Aver-age weight (mg/ind) | Aver-age length (mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| 3.04.61 | 516 | 15 | 4.80 | clay | 11.2 | 0.76 | 46 | 1141 | 25 | 9.9 |
| 4.04.61 | 552 | 880 | 7.20 | clay | 11.2 | 0.76 | 110 | 4565 | 41 | 13.7 |
| 19.04.61 | 381 | 52 | 2.90 | clay | 16.8 | 0.73 | 27 | 1214 | 45 | 16.3 |
| 13.04.64 | 704 | 15 | 5.20 | clay and mud | 11.0 | 0.60 | 27 | 5400 | 200 | 24.5 |
| 14.04.64 | 693 | 252 | 3.40 | clay and mud | 11.4 | 0.60 | 5 | 1800 | 360 | 29.2 |
| | | | | | Average: | | 43 | 2824 | 134 | 18.7 |
| 6.04.61 | 661 | 15 | 6.40 | gravel, coroph. mud | 11.6 | | 18 | 475 | 26 | 12.3 |
| 17.04.64 | 563 | 75 | 3.70 | gravel, clay | 12.2 | 0.74 | 3 | 458 | 153 | |
| 15.04.58 | 747 | 300 | 9.80 | gravel | 9.0 | | | body parts | | |
| 15.04.58 | 747 | 150 | 7.00 | gravel | 8.9 | | | body parts | | |
| | | | | | Average: | | 11 | 467 | 90 | 12.3 |
| 2.06.59 | 381 | 52 | 8.00 | clay | 20.2 | 0.76 | 18 | 667 | 37 | 16 |
| 14.06.60 | 381 | 45 | 4.20 | clay | 22.0 | | 9 | 27 | 3 | |
| 10.07.68 | 599 | 2 | | clay | 26.7 | | 2 | 27 | 14 | 9 |
| 3.06.59 | 432 | 50 | 6.00 | clay and sand | 21.7 | | 9 | 849 | 94 | 19 |
| 13.07.64 | 588 | 15 | 1.00 | clay | 23.7 | | | Qualitative sample | | |
| | | | | | Average: | | 10 | 228 | 19 | 12.5 |
| 14.07.64 | 552 | 123 | 5.00 | gravel, sand | 23.8 | 0.51 | 9 | 164 | 18 | 9.2 |
| 26.06.60 | 665 | 40 | 10.60 | coroph. mud gravel | 21.8 | | 9 | 849 | 94 | 19 |
| 27.09.56 | 381 | 25 | 6.50 | clay | 16.7 | | 27 | 1408 | 52 | 15.3 |
| 19.10.58 | 536 | 15 | 5.20 | clay | 13.2 | | 27 | 183 | 7 | 9 |
| 19.10.58 | 523 | 15 | 4.70 | clay | 12.9 | | 27 | 183 | 7 | 10 |
| 2.09.60 | 381 | 783 | 2.90 | clay | 23.2 | 0.57 | 119 | 1488 | 13 | 11 |
| 2.09.60 | 381 | 41 | 2.80 | clay | 23.2 | 0.64 | 18 | 180 | 10 | 11 |
| 15.10.64 | 693 | 458 | 3.10 | clay | 15.4 | 0.88 | 37 | 2356 | 64 | 17.3 |
| 23.10.64 | 381 | 57 | 3.30 | clay | 15.0 | | 237 | 3588 | 15 | 10.91 |
| 7.10.56 | 678 | 100 | 5.00 | clay and sand | 17.0 | | 5 | 676 | 135 | 27 |
| 14.09.57 | 747 | 15 | 3.20 | clay and gravel | 20.9 | | 3 | 137 | 46 | 18 |
| | | | | | Average: | | 56 | 1133 | 39 | 14.5 |
| 27.09.56 | 381 | 38 | 8.32 | gravel | 16.5 | | 9 | 430 | 48 | 26 |
| 14.09.57 | 747 | 73 | 2.72 | gravel | 20.8 | 0.54 | 9 | 55 | 6 | 17 |
| 10.10.58 | 747 | 101 | 2.90 | gravel | 17.2 | 0.43 | 3 | 92 | 31 | 12.8 |
| 22.10.58 | 432 | 40 | 2.50 | gravel | 12.6 | | 18 | 174 | 10 | 10 |
| 9.10.59 | 678 | 15 | 5.60 | gravel and cinder | 16.5 | | 5 | 265 | 53 | |
| 15.10.58 | 678 | 15 | 5.60 | gravel and cinder | 15.9 | | 9 | 128 | 14 | 8.5 |
| | | | | | Average: | | 9 | 191 | 27 | 14.9 |

*(Table 2, continued)*

| Date | km | Distance off the bank | Depth (m) | Substrate | Water temp. | Vbot. (m/s) | ind./ $m^2$ | Weight/ $m^2$ | Average weight (mg/ind) | Average length (mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| 9.10.56 | 747 | 73 | 2.72 | coroph. mud, gravel | 15.3 | | 18 | 59 | 3 | |
| 10.10.58 | 747 | 15 | 3.20 | coroph. mud, gravel | 17.2 | | 18 | 694 | 39 | 18 |
| 12.10.58 | 834 | 107 | 2.50 | coroph. mud, gravel | 17.3 | 0.43 | 5 | 206 | 41 | 17 |
| 19.10.64 | 552 | 121 | 3.50 | coroph. mud, gravel | 15.4 | 0.34 | 9 | 182 | 20 | 8.7 |
| 18.09.65 | 747 | 105 | 4.90 | coroph. mud, gravel | 19.0 | 0.62 | Qualitative sample | | | |
| 13.10.64 | 747 | 689 | 2.70 | mud. fine sand | 15.4 | 0.30 | 9 | 274 | 30 | 10 |
| | | | | | Average: | | 12 | 283 | 27 | 13.4 |

die sich nach Grösse und aus dem Anwachsen ihrer Leiber immer weiter und grösser machen".

Using a fisherman's probe on July 14, 1956, between two islands at km 475 of the Danube river, we dug out a well-preserved U-hole, which was 25 cm long, 10 mm in diameter at the arch and 8 mm at the straight sections. It may have housed a metamorphosing nymph that had emerged the previous day, when we observed a mass flight of *Palingenia*. Usually the larval holes were 10—15 cm long and 6—8 mm wide. The larvae maintain a constant water and oxygen inflow, as well as excrement and $CO_2$ outflow by regular wave-like movements of the body and the tracheal gills. The larvae stay in their holes during daytime, while at night they move around searching for food or a better site (Bačescu, 1943). We were unable to capture one single larva during our multiple attempts with Bačescu's catching device.

During very low water level in fall, we have observed small areas of the clay bottom densely covered with holes of *Palingenia*, e.g. 2000—4500 holes/$m^2$ (12 September, 1952 at km 497), 1200 holes/$m^2$ (28 September, 1954 at km 789) and 6700 holes/$m^2$ (14 September, 1955 at km 666) (fig. 2). This means densities of up to 3350 larvae per $m^2$.

Our studies revealed that the right bank of the following stretches were particularly rich biotopes for *Palingenia*: km 380—383, km 435—437, km 470—478, km 515—540, km 556—558, km 714—716 and km 830—836. The average larval density amounted to 949 specimens/$m^2$, and the average biomass to 269 gram/$m^2$ (table 1). The average larval density in the Kilian branch of the Danube, as observed by Markovskii (1955), was 360 specimens/$m^2$, and the average biomass 5.16 g/$m^2$. He also recorded a presence in the biocenosis of 100%, and a density index of 22.7. Csoknya & Ferencz (1972) found an average larval density at the first and 2nd km of the Maroš river of 89.7 specimens/$m^2$, and of 17.5 specimens/$m^2$ between km 170—171.5 in the Tissa river.

Larvae of *Palingenia longicauda* were the dominant and most typical representative of the argylorheophilous biocenosis in the Danube river off the Bulgarian bank.

## Ecology and life history of flying stages

We have observed the flight of *Palingenia longicauda* between June, 1955 and June, 1968 along nearly the full Bulgarian stretch of the Danube (km 845—375), as well as at the river mouths of the Iskar (Danube km 640) and the Yantra (Danube km 537) (table 3).

Ethology and metamorphosis of nymphs and subimago. — The nymphs, after leaving their

Table 3. Observation on the flight of *Palingenia longicauda* over the Danube between the 845th and 375th km.

| Date | Locality (river km) | Time of beginning | Time of mass flight | End of flight | Abundance estimates | Air temp. | Water temp. | Direction and strength of wind | Clouds | Source |
|---|---|---|---|---|---|---|---|---|---|---|
| 20.06.49 | 556 | | | | mass | | | | | Vl. Beshkov |
| 15.06.55 | 475 | 16 | 17 | 18.15 | medium | 21.5° | 20° | 0.00 | 2/0 | ours |
| 15.06.55 | 527 | | | | mass | | | | | fishermen |
| 17.06.55 | 517 | 14.30 | — | 16 | single | 25.5° | 21.7° | SSW[1-2] | 5/0 | ours |
| 07.06.56 | 536 | | — | | single | | 20.0° | | | fishermen |
| 10.06.56 | 434 | | — | | single | | 21.2° | | | fishermen |
| 11.06.56 | 381 | | — | | single | | 21.4° | | | fishermen |
| 12.06.56 | 381 | | — | | single | | 22.2° | | | fishermen |
| 14.06.56 | 475-495 | 13.30 | — | 19.30 | medium | | 22.8° | | 80 | fishermen |
| 15.06.56 | 517 | 15.30 | 17.15 | 19.30 | abundant | 25.5° | 24.5° | | 55 | fishermen |
| 16.06.56 | 517 | 17 | 17.30 | 19.45 | medium | 21° | 23.9° | | 74 | fishermen |
| 13.06.57 | 834 | 15 | | | single | | 21.1° | | | N. Mladenov |
| 14.06.57 | 747 | 15 | 16 | 19 | mass | | 21.2° | | | N. Mladenov |
| 15.06.57 | 747 | 15 | 16 | 19 | mass | | 21.6° | | | N. Mladenov |
| 05.06.58 | 396-385 | 17 | — | | single | 23° | 21° | | | ours |
| | 377-376 | | — | | single | | | | | ours |
| 06.06.58 | 396 | 15 | — | | single | 16.3° | 22.4° | | | ours |
| 06.06.58 | 415 | 17.30 | — | 19.30 | single | 19° | 23° | NW[2-3] | 10/4 | ours |
| 08.06.58 | 597-554 | 17.30 | — | 18.30 | medium | 17.2° | 21.1° | | | N. Mladenov |
| 08.06.58 | 527-544 | | | | mass | 19.4° | 21.4° | 0.00 | 0/0 | crews |
| 09.06.58 | 523-548 | 16.25 | 17.30 | 19.30 | peak | 23.5° | 21.4° | 0.00 | 0/0 | ours |
| 10.06.58 | 536-544 | | | | mass | 20.3° | 21.4° | 0.00 | 0/0 | fishermen |
| 11.06.58 | 519-536 | 16.20 | 18.30 | 20 | medium | 25.1° | 22.3° | E[3] | 8/0 | ours |
| 12.06.58 | 536 | 16.20 | 18.30 | 20 | mass | 25° | 23° | 0.00 | 3/0 | ours |
| 04.06.59 | 536 | 15.30 | | | single | 14.4° | 19.6° | NE[3] | | ours |
| 05.06.59 | 536 | 15.30 | 17 | 18.30 | mass | 13.4° | 18.7° | | | ours |
| 06.06.59 | 536 | 15.30 | — | 18.30 | single | 16.2° | 18.6° | | 10/10 | ours |
| 07.06.59 | 544 | 17 | — | | single | 18.6° | 19° | | | ours |
| 08.06.59 | 536 | 17 | — | 19 | single | 19.6° | 19.8° | E[3-4] | | ours |
| 09.06.59 | 536 | 17 | — | 18.30 | single | 19.6° | 21.2° | E[1-2] | 6/4 | ours |
| 11.06.59 | 600 | | — | | single | 18.4° | 20.4° | | | ours |
| 31.05.60 | 536 | | | | single | 18.1° | 18.4° | | | fishermen |
| 04.06.60 | 536 | 16.20 | — | 19 | single | 25° | 20.5° | W[2] | 3/2 58 | ours |
| 05.06.60 | 536 | 16.10 | — | 17.30 | single | 22° | 21.5° | 0.00 | 8/0 | ours |
| 07.06.60 | 715 | 16 | — | — | single | 18.6° | 20.5° | E[3] | | ours |
| 09.06.60 | 715 | 16.30 | 17 | 19 | mass | 19.6° | 21.1° | | | ours |
| 10.06.60 | 715 | 16.30 | 17 | 19 | mass | 20.3° | 22° | | | ours |
| 11.06.60 | 715 | — | — | — | — | 16.4° | 18.8° | W[4] | 10/10 | ours |
| 24.06.60 | 616-620 | 18 | — | 19 | single | 17.5° | 20° | | | ours |
| 27.06.60 | 714 | 18.30 | | | single | 25° | 22.4° | 0.00 | 7/0 | ours |
| 01.06.61 | 585 | | | | | | | | | N. Mladenov |
| 05.06.61 | 455 | 17 | — | 18 | single | | | | | N. Mladenov |
| 05.06.61 | 516-544 | 15.30 | | 18 | single | | | | 75 | ours |
| 06.06.61 | 423-434 | | | | single | | | | | N. Mladenov |

*(Table 3, continued)*

| Date | Locality (river km) | Time of beginning | Time of mass flight | End of flight | Abundance estimates | Air temp. | Water temp. | Direction and strength of wind | Clouds | Source |
|---|---|---|---|---|---|---|---|---|---|---|
| 07.06.61 | 454 | 16.30 | 17.30 | 18 | medium | | | | | N. Mladenov |
| 07.06.61 | 520-536 | 16 | 18 | 19 | medium | 23.5° | 20.5° | E[3] | 68 | ours |
| 08.06.61 | 536 | 16.30 | 17.30 | 19 | medium | 21- | 20.5° | | 98 | ours |
| 09.06.61 | 527-541 | 16.45 | | 18.15 | single | 22.5° | 20.5° | SW[2] | 82 | ours |
| 17.06.61 | 834 | 17.30 | | | single | | | | | N. Mladenov |
| 20.06.61 | 600 | | | | single | | | | | N. Mladenov |
| 07.06.63 | 743 | 17.30 | — | 19 | single | | 20.8° | | | ours |
| 08.06.63 | 747 | 12 | 17 | 19.30 | medium | | 21° | | | ours |
| 09.06.63 | 568-554 | 16 | 17 | 19 | abundant | | | | | ours |
| 15.06.65 | 565-589 | 17.20 | 18.20 | | mass | | | wind clouds | | W. Naidenov |
| 16.06.65 | 678 | 17 | | | single | | | | | N. Mladenov |
| 16.06.65 | 555 | 17 | 18.30 | 19.30 | medium | | | | | W. Naidenov |
| 18-20.06.65 | 834 | | | | single | | | | | N. Mladenov |
| 01.06.66 | 742-744 | 16 | — | 18 | single | | | | | N. Mladenov |
| 01.06.66 | 670 | | 16 | | mass | | | | | fishermen |
| 2-5.06.66 | 743-495 | | | | single | cold | | wind | 10/10 | N. Mladenov |
| 06.06.66 | 478-473 | 16.25 | 17.30 | | few | | | | | N. Mladenov |
| 07.06.66 | 434 | 17.30 | | | single | | | | | N. Mladenov |
| 10.06.66 | 470 | 18.30 | | | single | | | | | N. Mladenov |
| 28.05.68 | 576 | | | | medium | | | | | N. Mladenov |
| 29.05.68 | 570 | | | | mass | | | | | N. Mladenov |

U-shaped holes, emerge at the water surface. Within a few seconds the head and thoracal skin cracks and the winged insect flies out (fig. 3). The larval exuviae are carried away by the stream. The females always complete metamorphosis at the water surface, while male subimagos were usually observed flying directly out of the water. The metamorphosis of the male nymph presumably takes place while it is moving to the water surface. The flying male subimagos reach the river bank, where they attach to trees, grass, bottom, buildings etc. Within seconds they moult again, and the imago leaves the subimaginal skin. This is a critical moment in its life, since the entire muscle system participates in the moulting, which is accompanied by a tremour of the body. At the beginning the insect is somewhat stiff. The moulting then goes through the following fases, (a) the wings are brought together at an angle of less than 40°, (b) the legs are bent under the thorax, while the latter is raised above the level of the abdomen, (c) the head is bent downwards, (d) meanwhile, beginning from the final abdominal segment and the caudal filaments, the moulting takes place and the wings and thorax are gradually released. Wing moulting is much slower than that of the thorax, and the white skin can be observed while

Fig. 2. Holes of *Palingenia longicauda* larvae in a clay bank of the Danube river at km 715 (Photo B. Russev).

it is removed from the base to the apex of the wing. During the moulting of the legs, the insect loses its equilibrium and falls sidewards. After releasing wings and legs, the imago makes intensive movements for the complete release of the caudal filaments and the entire body from the exuviae (figs. 4—10). Unsuccessful moultings were seen very frequently.

Ethology of imagos. — The newly emerged male imago is more active and flies much faster than the subimago. Its caudal filaments are about three times as long (ca. 65 mm), the forelegs are longer and its yellowish-brown coloration is much brighter. Males usually fly towards the middle of the stream searching for females, whereafter they either return to the bank or fly further upstream. In the latter case they make the 45° turn until they take the downstream direction again. The movements and body position of males searching for females is most typical. The two caudal filaments are stretched sidewards at an angle of 45° towards the body, thus forming an angle of 90° between themselves. The forelegs are stretched forewards resembling horns. The caudal filaments often touch the water surface, when the male flies low over the water surface. When a female emerges, a cluster of up to ten competing males may approach it. Males seem to emerge one hour before the females, while they also frequent the banks. This may lead to the wrong conclusion that males are more numerous than females. As was already observed by Swammerdam (1752), Cornelius (1848) and Csongor & Moczar (1954) females do not have a subimago stage. This may be the reason why they moult somewhat later. The females may be easily distinguished by their larger body, large white wings, smaller eyes, and three times shorter caudal filaments. They fly higher and faster than males. Although we have observed matings in flight, gradually losing height, most matings

were seen on the water surface. Drenkelfort (1910, cited after Brinck, 1957), however, considered mating at the surface exceptional. During copulation the position of the male is under the female, while he holds her head with the forelegs. Couples may fly in any direction. According to Brodskii (1973), in his work on the swarming behaviour of mayflies, species of the family Palingeniidae show the very abundant third swarming type; the male's mating flight includes rapid horizontal flight parallel to the water surface.

Mass flights. — During mass flights the abundance of males and females gradually increases, and may reach more than 120 individuals/$m^3$. The river turns brown and even darker strips and spots may be detected. A typical buzz of hundreds of thousands of wings can be heard and a fish odour be smelled. Most specimens fly between one and three m above the surface. After the mating the males fall at the water and are carried away by the stream. The fertilized females continue their short life until they have layed their eyes. Mass flights seldom last more than half an hour.

After mass flights the banks are covered with subimaginal skins and look white (figs. 11—13). The water surface is still covered with skins, and exhausted males still moving their wings.

Compensation flights. — After the mating the females fly upstream with c. 18 km/h (Russev, 1959). Males that were unable to mate also do so, but usually at a lower speed of 14 km/h (figs. 14, 15). Females may sometimes touch the water, and fly off again without getting drowned. We have observed, under experimental conditions, that females oviposit immediately after a dropping by wave-like movements. The total number of eggs laid numbers appr. 8—9000, which all get dispersed in the water.

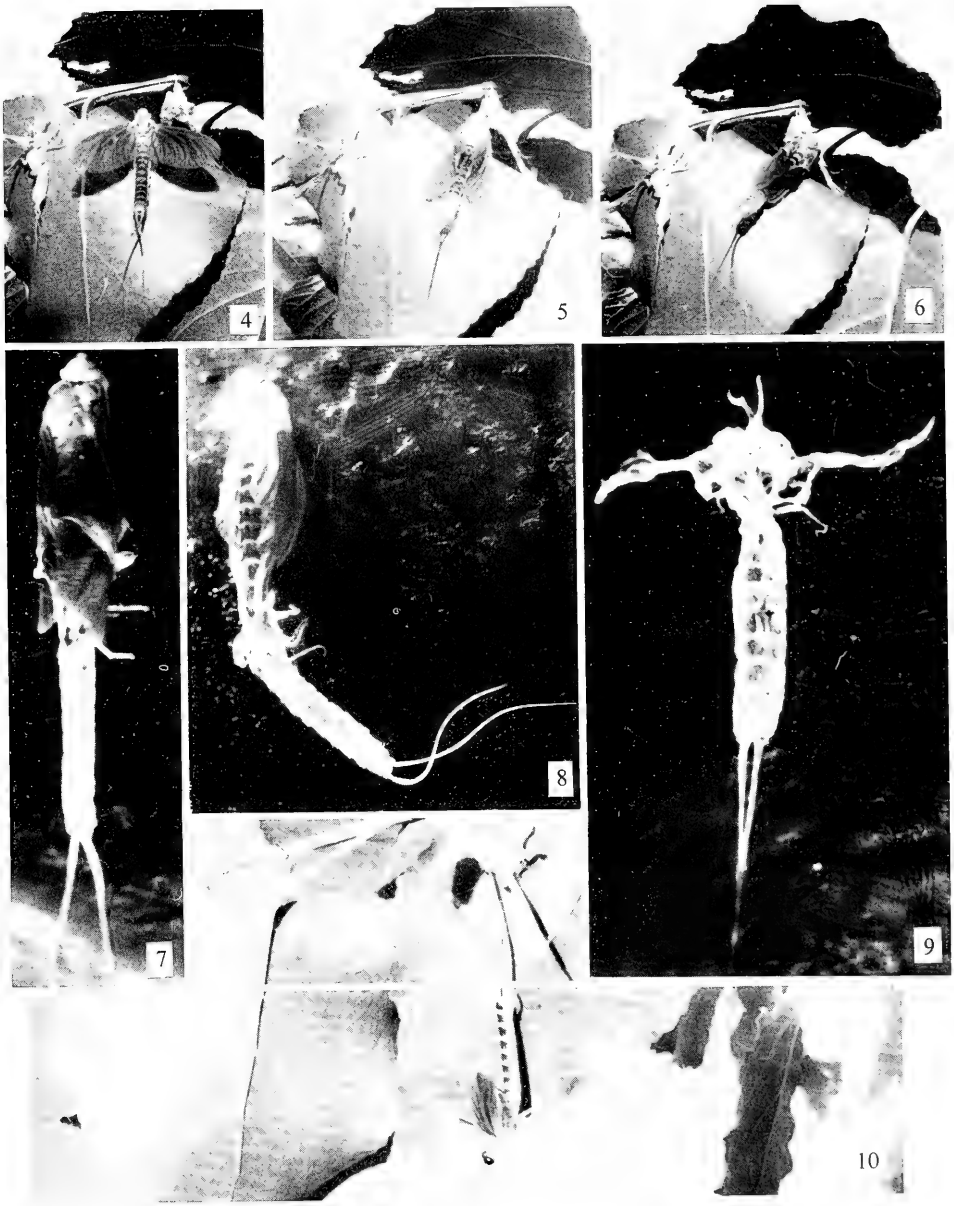
We have called the upstream flight of the fertilized females the "egg-laying-preceding compensation flight" (Russev, 1959). This adaptive behaviour may compensate the downstream movements of the nymphs during metamorphosis, as well as the carriage of the eggs by the water current before they reach the bottom. Eggs are very small (360/300 to 380/330 µm, see figs. 16—20) and may be carried ca. three km (Russev, 1973). This is corresponding to the "colonization cycle" concept of Müller (1954), and confirmed by other studies (Müller, 1973, 1982; Keller, 1975, and others).

Fig. 3. Mass metamorphosis of nymphs of *Palingenia longicauda* on the water surface of the Danube river (Photo B. Russev).

Ecological factors. — The ecological factors that influence emergence and development of the adult stages are not fully clear. The compensation flight is strongly influenced by strong winds. This was clearly observed in June 1960 at km 715. After mass flights on the 9th and 10th, there was not a single mayfly on the 11th with poor weather and strong western wind. The flights resumed after June the 20th under more favourable weather conditions (table 3). Another example dates from June 1958 at km 536. *Palingenia longicauda* was most abundant on the 8th, 9th, 10th and 12th during calm, sunny and warm weather, whereas the flight was of medium intensity on 11th, with a wind of 3 Beaufort.

During a gentle breeze (3 Beaufort or less), fertilized females can still perform their compensation flight, as already described by Russev (1973, figs. 3—5). It seems that wind direction does not influence these flights, as could be concluded from observations where the stream followed a west-east (fig. 5), or northwest-southeast direction (at km 716 and 556), or any other direction. Orientation seems to be guided by the oculi, or, as was noted earlier by Russev (1959), by brief touches of the water surface, where the insects may be able to detect the current direction. Further studies are, however, needed to find out the exact orientation mechanism. The larger weight and wings, as well as the shorter caudal filaments of the females may be considered as morphological adaptations for carrying eggs, as well as for the compensation flight.

Influence of light intensity on swarming, as was proposed by Pongracz (1933, cited after Csongor & Moczàr, 1954), should be investigated further, and the same is true for Csongor & Moc-




Figs. 4—10. Stages of moulting of the subimago of *Palingenia longicauda* (Photos B. Russev).

Figs. 11—13. Subimaginal exuviae of *Palingenia longicauda* on the bank of the Danube river (Photos B. Russev).

Figs. 14—15. Upstream compensation flight of *Palingenia longicauda*. Danube river. (Photo B. Russev).

sàr's statement that "the coincidence of high atmospheric pressure, high water and air temperature, with changing moon phase furthers mass emergence". According to our observations in the period 1955—1958 mass flights in the Danube coincided with the last quarter of the moon (13 June, 20 June and 9 June, respectively), but we do not consider this clear proof.

We also tried whether summarized water temperatures affected the timing of swarming. The average water temperature at the town of Svishtov was calculated for the period 15 June 1955 to 9 June 1960, but no correlation was found between annual averages and the timing of the flights.

Flight period. — Mass flights of *Palingenia longicauda* off the Bulgarian bank in the Danube were observed between 8 and 15 June; the entire flight period lasted from 5 to 20 June. Only very few observations are available outside this period. A medium to mass flight was observed on 28 and 29 May, 1968 at km 576 and km 570 by eng. N. Mladenov (personal communication) (table 3). These observations confirm the period of records of mass flights by Swammerdam (13 June 1671), Triebke (1840) (middle of June), Cornelius (1848) (12—20 June), Dzięd̨zielewicz (1867) (10—25 June), Selys Longchamps (1888) (10—25 June), Moczary (1900) (10—20 June) and Unger (1927) (5 June—early July), but is somewhat different from Beretzk et al. (1957) (end of June—early July, and sometimes even somewhat later). Swammerdam (1752) and Cornelius (1848) considered warm winters, hot springs (particularly May), and limited precipitation favourable for early timing of flights. The abundance of the flights varies from year to year.

Table 4. Literature data on the use of *Palingenia longicauda* as food of various fish.

| | Unger (1927) Hungarian Danube | Dimitriu (1937) Romanian Danube | Ferencz (1956) Tissa River | Jancovič (1958) Yougoslavian Danube | Kolarov (1959). Russev (1963) Bulgarian Danube | Gheracopol & Selin (1968) Romanian Danube | Gheracopol et al. (1970) Romanian Danube |
|---|---|---|---|---|---|---|---|
| Acipenser gueldenstaedti Brand | | | | | x | | |
| Acipenser ruthenus (L.) | x | x | x | x | xx | x | |
| Acipenser stellatus Pall. | | | x | | x | | |
| Ameirus nebulosus Le Sucur | | | x | | | | |
| Barbus barbus L. | x | | x | | x | | |
| Cyprinus carpio L. | | | x | | x | | |
| Esox lucius L. | | | x | | x | | |
| Gymnocephalus cernuus (L.) | x | | | | | | |
| Gymnocephalus schraetzer (L.) | x | | | | | | |
| Huso huso (L.) | | | | | x | | |
| Silurus glanis L. | | | x | | | | |
| Stizostedion lucioperca (L.) | | | x | | x | | |
| Zingel streber (Siebold) | x | | | | | | |
| Zingel zingel (L.) | x | | | | | | x |

In some years, e.g. 1961, no mass flight was seen at all (table 3).

Flights in Bulgaria were observed between 15.30—19.30 h (sunset on 12 June is at 19.45 h), usually with the following sequence. Metamorphosis of nymphs and male subadults occurred between 15.30—17.00 h; female adults emerged between 16.00—17.00 h; mass flights were between 17.30 and 18.00 h, and compensation flights started after 18.00—18.30 h. Flights started earlier or later only very seldom.

Imago and subimago usually live not longer than two hours, provided that they have mated. Cornelius (1848) noted an adult longevity of 1.5 hours, or up to 13 hours if males had not mated.

## SIGNIFICANCE OF *PALINGENIA LONGICAUDA* FOR FISH NUTRITION

*Palingenia* has extensively been used as fishing bait. It has various local names, e.g. "oeveraas" and "haft" in The Netherlands, "Spork-Oese", "Sprock", "Spaargoos","Spaargaänse" in Germany (Westfalen), "Tiszavirag", "Theissblüte" in Hungary, "Vetritze", "Rusalii" in Romania, and "gandatsi" (for the larvae), "rusalki" and "karchani" (for the adults) in Bulgaria. Szent-Ivany & Ujhazy (1973) reported on New Guinean and Hungarian folk songs devoted to mayflies. Two Hungarian folksongs are about the "Flower of the Tissa" (*Palingenia longicauda*).

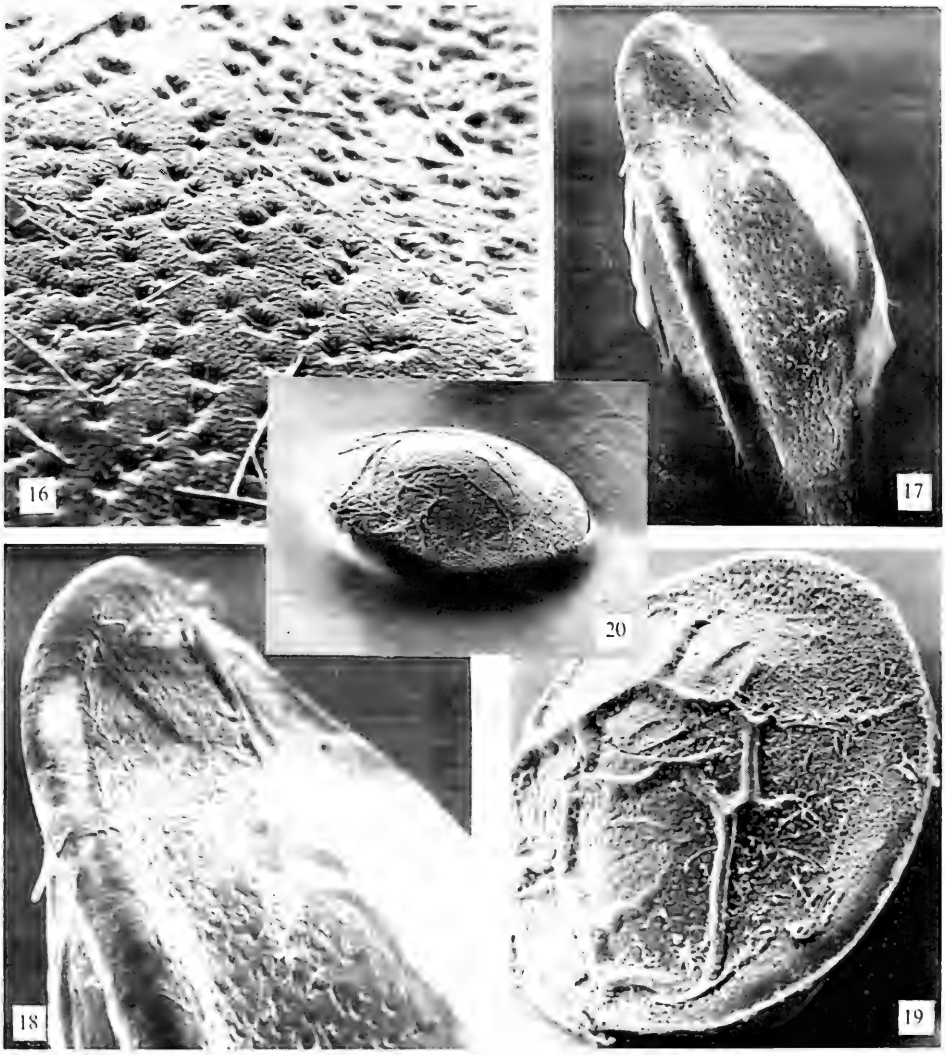
Several authors have reported on the use of larvae of *Palingenia* as baits for fishing sterlet (*Acipenser ruthenus* (L.)), and barbel (*Barbus barbus* L.), *Lota lota* L., *Silurus glanis* L., *Aspro cingel* L., *Chalcalburnus chalcoides danubicus* Antipa and *Cyprinus carpio* L. (Swammerdam, 1752; Antipa, 1909: 248; Băcescu, 1943; Csongor & Moczàr, 1954; Russev, 1956). Bulgarian fishermen were using larvae of *Palingenia* as baits from May to September, and sometimens during winter at low water level, for fishing *Lota lota* and also sterlet. Larvae were collected using the fisherman's probe (gunter). Larvae can be kept alive for several days in cool, moisty sand.

The significance of *Palingenia longicauda* for fish nutrion in the Balkans has extensively been studied (table 4).

Several studies revealed that *Palingenia* dominates in the diet of fishes. In a study of Gheracopol & Selin (1968) and Gheracopol et al. (1969) in the Danube river 69.4% of the diet of the starlet consisted of this mayfly species. An average of 30—40% of the food weight of fishes was found in many other studies (e.g. Russev, 1963). Also see fig. 21.

## FACTORS LIMITING THE DISTRIBUTION

Swammerdam (1752) already described the negative influence of climatological factors on the distribution of *Palingenia*: "Diejenigen




Figs. 16—20. Eggs of *Palingenia longicauda* at various magnifications. — 16, 1450 ×; 17, 285 ×; 18, 730 ×; 19, 285 ×; 20, 140 × (Photos N. Hinton).

Dinge, die das Aas an seiner Veränderung hindern, es tödten, seinen Anwachs aufhalten und verursachen, dass es das eine Jahr in geringerer Anzahl und später als im andern hervorkommt sind folgende: Ein harter langer Winter, viel Schnee und Regen, als welche die Röhrgen, darinnen sie leben, zu und wegspülen, und mit Sand bedecken; dessgleichen auch die grossen Dürre, als die sich nöthiget ihre Häusgen zu verlassen, und andere anzubauen und auszubohren". Nowadays we would add the bank slides, the harmful effects of the deposits on the holes during periods of high water level, the high wind and rain during the time of mass flights, when compensation

flights are impossible and the chance of being carried downstream are increased. Negative effects by fishes were already discussed, but also birds and spiders are heavy predators of this species. Mass flights of *Palingenia* were seen to be attacked by birds as spoonbill (*Platalea leucorodia* L.), sparrowhawk (*Accipiter nisus* L.), kittiwake (*Rissa tridactyla*), as well as wild ducks, swallows, sparrows, larks, wagtails, crows, kites and terns (Gorove, 1819; Csongor & Mocsàr, 1954, personal observations).

On 11 June, 1958, on the pier of Krivina Port, as well as in many other cases, I have observed male subadults being trapped in spider webs, and immediately attacked by the spider.

However, anthropogenetic factors have exerted the strongest negative influence on this species. These factors include the construction of canals, dams, reservoirs, hydrodynamic power plants, commercial irrigation pumps etc. Also increasing pollution was detrimentous to the species. Some indirect evidence of this will be discussed in the following chapter.

## Distribution in Europe

In several parts of western Europe *Palingenia* was abundant up to the end of the 19th century. Lestage (1937) and Tshernova (1949) already expressed their concern about the process of its extinction in the rivers of western Europe. They also listed the publications with distributional records. In southern and southeastern Europe it occurred in large numbers as late as the 1960's, but its seems that it is now extinct from most localities in Europe.

The following is a survey of all records available, arranged per country. It should be understood that not all records are fully reliable. Records given by Schäffern (1757) and Cremer (1938) probably all belong to *Ephoron virgo* (Oliv.), what may be concluded from the flight period reported. Also records for France and Belgium are doubtful.

The Netherlands: Clutius (1634), Swammerdam (1675, 1737, 1752), Selys Longchamps (1888), Albarda (1888) and Lauterborn (1918, p. 40) — the rivers of Rhine, Meuse, Waal, Lek, IJssel and some of their tributaries.

Hungary: Marsili (1726, p. 125), Gorove (1819), Mocsáry, S. (1875), Mocsáry, A. (1900), Unger (1927), Pongracz (1933 after Csongor-Mòcsàr, 1954), Csongor and Mòcsàr (1954), Beretzk et al. (1957), Csoknya and Ferencz (1972) — the river of Tissa, Mocsàry, S. (1875) — the following tributaries of the Tissa — Maros, Temes, Fehir-Koros; the Danube; the rivers of Zala and Silo; Dudich et al. (1959, p. 235) — the Danube river.

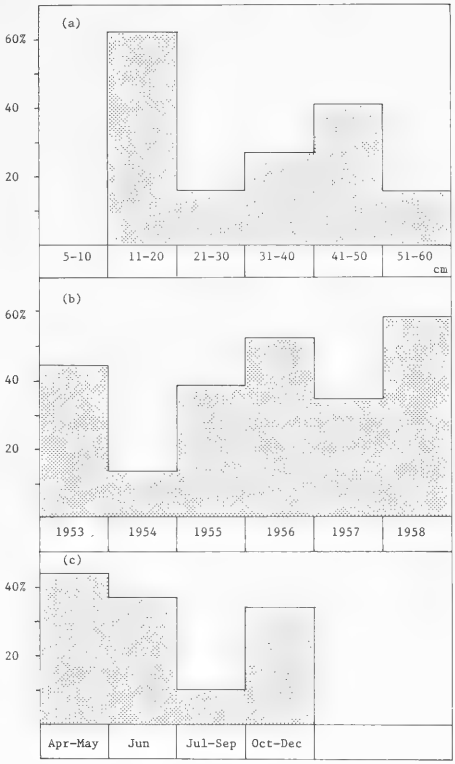



Fig. 21. *Palingenia longicauda* in the diet of sterlet, in terms of percentages of total weight (a) in various size classes of the sterlet, (b) in different years, (c) in different seasons.

France: Latreille (1805, p. 98) — the Meuse; Hagen (1888); Lestage (1922) — near Cette.

Czechoslovakia: Mocsàry, S. (1875) — the rivers of Raba, Rebtze, Bodrog and Ronva, Ortvay (1902) — the Danube at Bratislava and the March; Zavřel (1905) — the Morava at Hodonin; Zavřel (1934, cited after Landa, 1969) — the lower course of the March and Šamal (1935) — the Morava at Hodonin; Brtek and Rothschein (1964, p. 30) obtained larvae from Komarno; Rothschein (1959) — the Bodrog and its tributaries Uh, Laboree and Latorica (Eastern Slovakia); Soldan (1978) — the rivers of Bodrog, Strena, Tissa, Trakany.

Germany: Triepke (1840) — the Oder and some of its tributaries; Cornelius (1848) — the Lippe — a right tributary of the Rhein; Hagen (1859) — Prussia.

The USSR: Dziedzielewicz (1867, p. 161) — the Dnester (upstream from Strvionzh at Sambor town); Kinel, Krasucki, Noskiewicz (1927) — the Dnester; Mikulskii (1936, p. 64) — the Dnester (Strvionzh, Seret and from Lvov downstream); Motaš and Bačescu (1973, p. 29) — 18 km to the east from Kishinev; Tchernova (1949), Markovskii (1955) and Olivari (1961) — the Kilian branch of the Danube.

Romania: Mocsàry, S. (1875) — the Danube at Orsova (The Iron Gates); Motaš (1936) — the Danubian island of Ada-Kale (on the bottom of the present day Iron Gates reservoir); Băcescu (1943) — the Danube, the Prut, the Mureš and the Olt; Bogoescu (1958, p. 58) — the Danube delta, Calaraši and Olteanu at the Danube; Bušnita, Enačeanu and Brezeanu (1961, p. 207) — the Ardjes (a left tributary of the Danube); Bušnita, Brezeanu and Prunescu-Arion (1961, p. 320) — the Olt and the Danube at the Jiul rivermouth; Brezeanu and Prunescu-Arion (1962, p. 167) — the Snt. George branch of the Danube; Enačeanu and Brezeanu (1966, p. 182) — between the 488th and the 235th km of the Danube river; Prunescu-Arion, Elian and Baltac (1965, p. 164) — Măcin branch of the Danube near Braila town; Enačeanu (1967, p. 298 and 416) — the Danube and the flooded lowlands; Bogoescu and Tabacaru (1969) — the Danube delta.

Belgium: Lestage (1923) — "The only known specimen from Belgium was collected some 50 years ago in the vicinity of Diest near Demer".

Poland: Ulmer (1927, p. 240) — the Visla river and some of its tributaries.

Bulgaria: Buresh (1936) — the Iskar river at Svoge; Russev (1956 and 1966) — the Bulgarian stretch of the Danube and channel of the Maritza river.

Yugoslavia: Ikonomov (1958) — the Vardar river, 15 km to the south of Skopje City; Russev (1968) — the Danube.

The data on the distribution of *Palingenia longicauda* in Europe over the last 350 years, reveal that three, not precisely defined, periods can be distinguished. One has to bear in mind, that for many parts of the range insufficient studies are available. The periods are:

1. 1634—1900. *Palingenia longicauda* occurs widely in the lower and middle courses of large and medium-sized rivers,

2. 1901—1927. Its becomes extinct in Western Europe, and is strongly diminishing is Central Europe,

3. 1928—1978. It is still present in the lower course of the Danube river, as well as in the rivers Tissa, Bodrog, Maros-Muresul, Uh, Laboree and Lazorica (all within the water catchment of the Tissa, a left tributary of the Danube), and it was also present in the river Vardar and in a canal near the Maritsa river.

*Palingenia* used to find favourable conditions in the oligo-$\beta$-mesosaprobic water of the Bulgarian Danubian stretch. The gradual deterioration, caused by pollution, led to the rapid extinction of this species. The most abundant flight ever seen was observed in 1958, and before 1968 mass flights were still recorded. Later on the flights became more and more scarce, and over more limited parts of the river. After 1974 no fisherman, crewman of anybody else ever noticed the flight of this popular and large mayfly along the Bulgarian Danubian stretch. Not one single male was seen, nor one single nymph found in clay bottoms of formerly typical localities during a special investigation carried out along the entire Bulgarian bank of the Danube. For this reason, we assume that it has become extinct from this part of the river, as happened in the upper parts of the same river earlier.

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# NEW SPECIES OF THE FIG WASP GENUS *DIAZIELLA* (HYMENOPTERA, CHALCIDOIDEA, SYCOECINAE)

by

A. J. GARDINER and S. G. COMPTON

*Department of Zoology and Entomology, Rhodes University, Grahamstown, South Africa*

Abstract

Eight new species of *Diaziella* are described from Borneo: *alleni*, *laticeps*, *latipennis*, *longiceps*, *pallidiceps*, *retakensis*, *tumidigena*, and *wiebesi*. A key to the known species of the genus is added.

## Introduction

The Sycoecinae are a well defined but enigmatic group of fig wasps. Although generally placed in the Torymidae, Bouček (in Bouček et. al., 1981) has suggested that they may have closer affinities with the Agaonidae. *Diaziella* Grandi is the only genus of the subfamily described from outside Africa, although representatives of a further, undescribed, genus have been collected in Australia (Wiebes, pers. comm.). Grandi (1928) based *Diaziella* on two new species from Sumatra (*D. bicolor* and *D. macroptera*). Wiebes (1974) subsequently added a further two species (*D. philippinensis* and *D. falcata*), both from the Philippines. With the exception of *D. falcata*, the species are known only from the female sex.

Material collected at light by B. Allen on the island of Borneo has been found to contain females of a further eight speecies. This paper describes these new species of *Diaziella* and provides a key to the known representatives of the genus.

Certain features are of particular value for distinguishing between the species, these are:

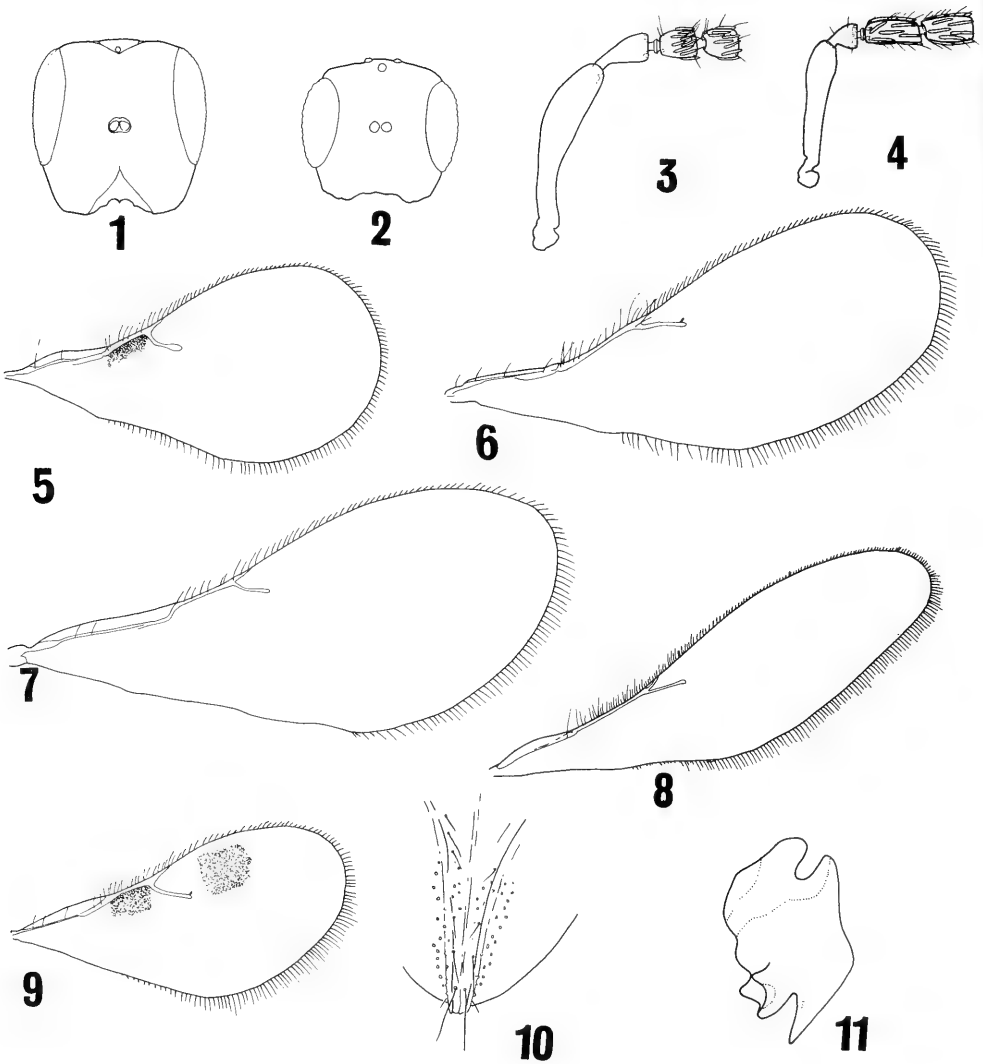
1. The epistomal margin of the clypeus, which is variable in shape and form.
2. The fore wings, which vary considerably in shape.
3. The mandibles. These have one or more cusps on the subapical tooth.
4. The hypopygium, which protrudes beyond the gaster to a varying extent.

## Methods

Specimens were stored in 70% ethanol. For detailed examination, examples of each species were slide mounted using a modified version of Prinsloo's (1980) technique for the preparation of permanent slide mounts.

### Key to the known species of *Diaziella* (females)

1. Head yellow in colour; epistomal margin with three slight protuberances, one in the centre and one on either side of the central protuberance (the protuberances being broadly separated) (fig. 12) ..... *pallidiceps* spec. nov.
— Head brown or black in colour, epistomal margin if having incisions or protuberances then not as above (for example figs. 1, 2, 19) ..... 2
2. Epistomal margin with the central region forming an inverted w, the top of the w leveling off slightly and then rising to the cheek margin (fig. 1). First funicle segment of the antenna with irregular sensilla; remaining funicle segments with two slightly irregular transverse rows of sensilla. Submarginal to marginal ratio 1.8 : 1 or greater (fig. 7) ..... *philippinensis*
— Epistomal margin not as described above (for example figs. 2, 43, 45). Funicle segments of antenna with one row of transverse sensilla, or at most with the first and second




Figs. 1, 7. *Diaziella philippinensis* Wiebes, female. 1, head; 7, fore wing. Figs. 2, 8. *Diaziella macroptera* Grandi, female (redrawn from Wiebes, 1974). 2, head; 8, fore wing. Figs. 3, 5. *Diaziella latipennis* spec. nov., female. 3, first five antennal segments; 5, fore wing. Fig. 6. *Diaziella alleni* spec. nov., fore wing. Figs. 9, 11. *Diaziella bicolor* Grandi, female (redrawn from Grandi, 1928). 9, fore wing; 11, mandible. Fig. 10. *Diaziella falcata* wiebes, female, hypopygium (redrawn from Wiebes, 1974).

funicle segments having two or three rows. Submarginal to marginal ratio less than 1.8 : 1 (figs. 5, 6, 9) ..... 3

3. Antenna: Pedicel longer than the first funicle segment (fig. 3); first funicle segment with one irregular transverse row of large sensilla (fig. 3) ..... 4

— Antenna: Pedicel shorter than first funicle segment (fig. 4); first funicle segment with more than one row of sensilla, which may form definite or integrated rows, but clearly not one row (fig. 4) ..... 10

4. Basal portion of stigmal vein almost perpendicular to the wing margin (fig. 5). Wing club shaped, its length less than two and a half times the width (fig. 5) ..... 5

— Basal portion of stigmal vein at an acute angle to the wing margin (fig. 6). Wing more elongate, its length more than two and a half times the width (fig. 6) ..... 8

5. Fore wing with few microtrichia, almost glabrous. Hypopygium just projecting beyond the end of the abdomen (fig. 10) ... *falcata*

— Fore wing with many microtrichia (fig. 17). Hypopygium clearly protruding beyond the end of the abdomen (fig. 66) ..... 6

6. Two dark patches on the fore wing, one below the stigmal vein and adjacent to the marginal vein the other above the stigmal vein (fig. 9). Mandible with subapical tooth tricuspid (fig. 11) ..... *bicolor*

— One dark patch on the fore wing, below the stigmal vein and adjacent to the marginal vein (fig. 5). Mandible with subapical tooth monocuspid or bicuspid (figs. 44, 46) .... 7

7. Head with the vertex raised towards the ocelli (fig. 45); epistomal margin with small cone-like central protuberance (fig. 45). Mandible bidentate tricuspidate and three times as long as wide (fig. 46). Antennal insertion clearly above ventral margin of the eye (fig. 45) ..... *latipennis* spec. nov.

— Head with vertex truncate (fig. 43), epistomal margin more indented, with a central (but not cone like) protuberance. The sides of the protuberance smooth and leading up to a fairly sharp central point (fig. 43). Mandible bidentate bicuspidate, with a slight protuberance on the inner margin of the subapical tooth; four times as long as wide (fig. 44). Antennal insertion just above ventral margin of the eye (fig. 43) ..... ..... *laticeps* spec. nov.

8. Fore wing almost four times as long as wide (fig. 8). Epistomal margin indented and with two slight projections on either side of a small central incision (fig. 2) *macroptera*

— Fore wing less than three and a half times as long as wide (fig. 67). Epistomal margin either slightly protruding with a central incision (fig. 53) or indented but without a central incision (fig. 61) ..... 9

9. Epistomal margin slightly protruding and with a central u-shaped incision (fig. 53) head more rounded in shape). Mandible bidentate tricuspidate; length approximately two and a half times the width (fig. 54) .... ..... *alleni* spec. nov.

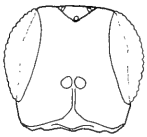
— Epistomal margin indented and with a very slight central protuberance (fig. 61) (head more square in shape). Mandible bidentate bicuspidate (the subapical tooth may have a small protuberance on the inner margin); length almost four times the width (fig. 62) ..... *wiebesi* spec. nov.

10. Antennal insertion clearly closer to the epistomal margin than to the vertex (fig. 35). Head clearly longer than broad (1.13 : 1) (fig. 35). Epistomal margin with a central incision (fig. 35). Mandible bidentate tricuspidate, length approximately four times the width (fig. 36) ..... *longiceps* spec. nov.

— Antennal insertion slightly or distinctly closer to the vertex than to the epistomal margin (figs. 19, 27). Head as long as broad or slightly longer than broad (max 1.04 : 1) (Figs. 19, 27). Epistomal margin with a central truncate protuberance (figs. 19, 27). Mandible bidentate bicuspidate, length more than six times the width (figs. 20, 28) 11

11. Mandible extremely long and narrow, the length more than nine times the width (fig. 28). Antennal insertion clearly closer to the vertex than to the epistomal margin (fig. 27). Epistomal margin with a broad truncate protuberance (width approximately one third the width of the head) (fig. 27); cheeks diverging towards the ventral margin (fig. 27) ..... *tumidigena* spec. nov.

— Mandible length six to seven times longer than wide (fig. 20). Antennal insertion slightly closer to the vertex than to the epistomal margin (fig. 19). Epistomal margin with a smaller truncate protuberance (width approximately one seventh the width of the head) (fig. 19); cheeks parallel or converging towards the ventral margin (fig. 19) ..... ..... *retakensis* spec. nov.



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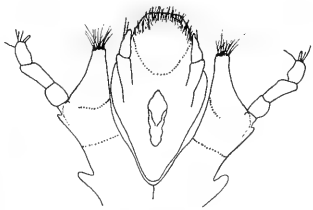

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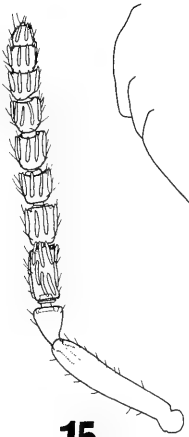

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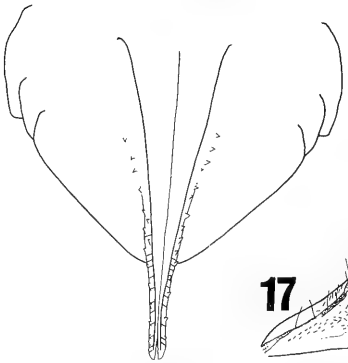

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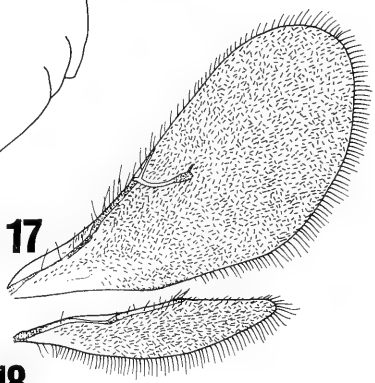

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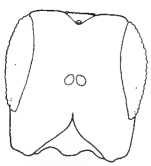

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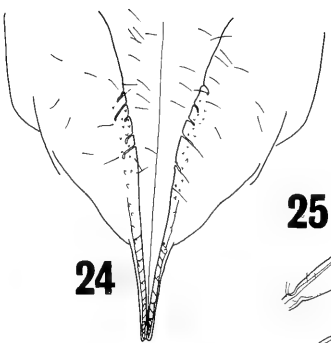

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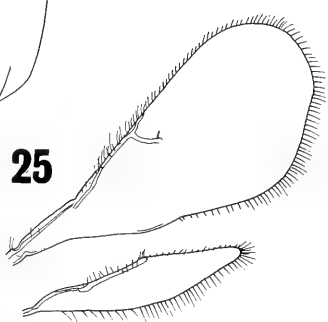

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**Diaziella pallidiceps** Gardiner spec. nov.
(figs. 12—18)

Female. — Head (fig. 12) yellow in colour; almost quadrate, slightly wider than long (1.15 : 1); length of the compound eye approximately 2.5 times the length of the cheek (2.6 : 1); eyes protruding laterally; epistomal margin with three slight protuberances one in the centre and one on either side of the central protuberance. Antenna (fig. 15) eleven segmented: antennal insertion closer to the epistomal margin than to the vertex; scape almost four times as long as wide (3.75 : 1) and three times the length of the pedicel (3 : 1); pedicel shorter than the first funicle segment; funicle, first segment longer than the others (29 : 24 : 23 : 23 : 24), first funicle segment with two transverse rows of long sensilla; remaining segments including the three segmented club, with one row of sensilla each. Mandible (fig. 13) bidentate, subapical tooth longer than the apical tooth; mandible about four times longer than wide (3.9:1). Maxillary palp (fig. 14) three segmented (6 : 8 : 9); labial palp (fig. 14) two segmented (1:1).

Thorax. Fore wing (fig. 17) 1.33 mm long; length approximately 2.5 times the width (2.55 : 1); marginal vein twice the length of the stigmal (2.04 : 1); stigmal vein arising at almost 90° to the wing margin; submarginal 1.5 times the length of the marginal (1.58 : 1); membrane with dense microtrichia. Hind wing (fig. 18) 0.83 mm long; length about 4.5 times the width (4.6 : 1). Fore leg: tibia with one dorsal-apical tooth, one ventro-apical tooth and one spur; tibia to tarsal ratio 0.83 : 1; tarsal segments in ratio 23 : 12 : 8 : 24. Mid leg: tibia with one ventro-apical spur. Hind leg: tibia with two spurs (one much smaller than the other); tibia with a row of dorsal cones (usually three), tarsal segments in ratio 36 : 35 : 30 : 12 : 26.

Gaster. Hypopygium (fig. 16) length 0.51 mm, with many spines and extending well beyond end of abdomen. Pygostyle with four long setae.

Total length 2.21 mm.

Type material. — Holotype ♀ (slide mounted), Brunei, Mt. Retak, iv.1981, leg. B. Allen, at light. Paratypes: 6 ♀, same data as holotype (coll. dates 23—28.iv.1981). Holotype to be deposited in BM (NH) London, some paratypes in RMNH Leiden.

**Diaziella retakensis** Gardiner spec. nov.
(figs. 19—26)

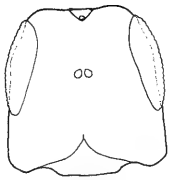
Female. — Head (fig. 19) dark brown to black in colour; almost quadrate, slightly longer than wide (1.05 : 1) or as long as wide; length of the compound eye almost twice that of the cheek (1.73 : 1); eyes slightly protruding laterally; epistomal margin with a truncate protuberance the width of which is an approximately one seventh the width of the head (epistomal margin below the ventral margin of the cheek). Antenna (fig. 23) eleven segmented; antennal insertion slightly closer to the vertex than to the epistomal margin (distance ratio 4 : 5); scape four times as long as wide (3.9 : 1) and about three times the length of the pedicel (2.81 : 1); pedicel shorter than the first funicle segment; funicle, first segment longer than the remaining four (30 : 22 : 23 : 22 : 23), first funicle segment with two rows of long sensilla; remaining segments including the three segmented club with one row of sensilla. Mandible (fig. 20) bidentate, bicuspidate, subapical tooth more robust than the apical but both of approximately the same length; mandible more than 6.5 times as long as wide (.6.77 : 1). Maxillary palp (fig. 21) three segmented (5 : 9 : 9); labial palp (fig. 22) two segmented (1 : 1).

Thorax. Fore wing (fig. 25) 1.33 mm long; length approximately 2.5 times the width (2.48 : 1); marginal vein twice the length of the stigmal (2 : 1); stigmal vein arising at almost 90° to the wing margin; submarginal one and a half times the length of the marginal (1.5 : 1); membrane with dense microtrichia. Hind wing (fig. 26) 0.82 mm long; length 4.5 times the width (4.56 : 1). Fore leg: tibia with two dorso-apical teeth, one ventro-apical tooth and one ventro-apical spur; tibia to tarsal ratio 1 : 1; tarsal segments in ratio 14 : 7 : 4 : 14. Hind leg: tibia with two ventro-apical spurs (one much smaller than the other); tibia with a row of dorsal cones (usually six) tarsal segments in ratio 32 : 37 : 27 : 20 : 27.

Gaster. Hypopygium (fig. 24) 0.51 mm long, with many spines and clearly extending beyond end of abdomen. Pygostyle with four long setae.

Total length 1.98 mm.

Figs. 12—18. *Diaziella pallidiceps* spec. nov., female. 12, head; 13, mandible, ventral aspect; 14, labiomaxillary complex; 15, antenna; 16, hypopygium; 17, fore wing; 18, hind wing. Figs. 19—26. *Diaziella retakensis* spec. nov., female. 19, head; 20, mandible, ventral aspect; 21, maxillary palp; 22, labial palp; 23, first five antennal segments; 24, hypopygium; 25, fore wing; 26, hind wing.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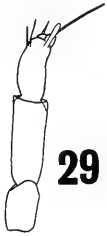
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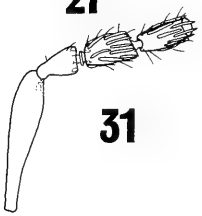
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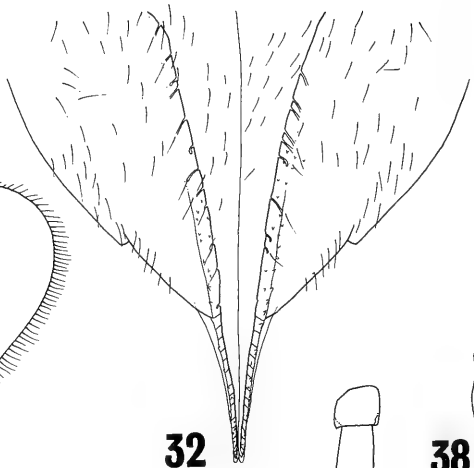
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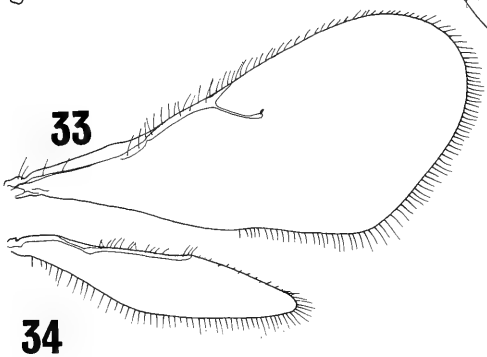
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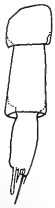
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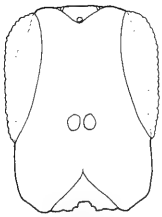
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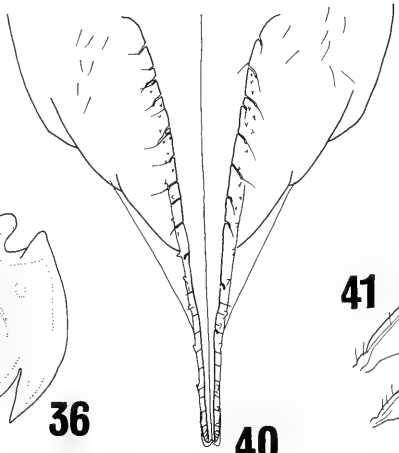
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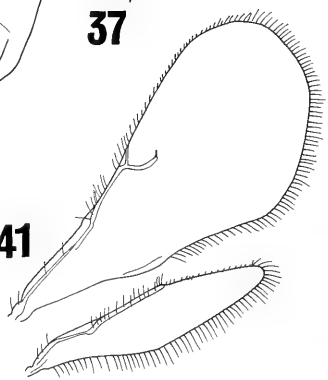
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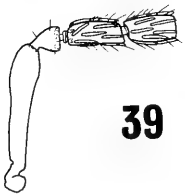
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Type material. — Holotype ♀ (slide mounted), Brunei, Mt. Retak, iv.1981, leg. B. Allen, at light. Paratypes: 9 ♀, same data as holotype (coll. dates 23—28.iv.1981). Holotype to be deposited in BM (NH) London, some paratypes in RMNH Leiden.

**Diaziella tumidigena** Gardiner spec. nov.
(figs. 27—34)

Female. — Head (fig. 27) dark brown to black in colour; bell shaped, slightly longer than wide (1.04 : 1); length of the eye slightly more than 1.5 times the length of the cheek (1.63 : 1); eyes not protruding beyond lateral margin of the cheek; cheek diverging towards the epistomal margin; epistomal margin with an almost truncate protuberance the width of which is approximately one third the width of the head (the epistomal margin protuberance may protrude beyond the ventral margin of the cheek). Antenna (fig. 31) eleven segmented; antennal insertion clearly closer to the vertex than to the epistomal margin (distance ratio 0.58 : 1); scape over four times as long as wide (4.37 : 1) and about three times as long as the pedicel (3.07 : 1); pedicel shorter than the first funicle segment; funicle, first segment longer than the remaining four and with two rows of long sensilla, second segment longer than the remaining three and with two irregular rows of long sensilla (37 : 31 : 28 : 28 : 28); remaining segments including the three segmented club with one row of sensilla. Mandible (fig. 28) bidentate, bicuspidate, subapical tooth more robust than the apical but both of approximately the same length; extremely long and narrow almost eleven times as long as wide (10.87 : 1). Maxillary palp (fig. 29) three segmented (9 : 12 : 11); labial palp (fig. 30) two segmented (9 : 7).

Thorax. Fore wing (fig. 33) 1.9 mm long; length almost 2.5 times the width (2.44 : 1); marginal vein twice the length of the stigmal (2.19 : 1); submarginal 1.5 times the length of the marginal (1.49 : 1); membrane with dense microtrichia. Hind wing (fig. 34) 1.17 mm long; length slightly more than four times the width (4.33 : 1). Fore leg: tibia with two dorso-apical teeth, one ventro apical tooth and one spur; tibia to tarsal ratio 0.96 : 1; tarsal segments in ratio 34 : 23 : 13 : 37. Hind leg: tibia with two ventro-apical spurs (one much smaller than the other); tibia with a row of dorsal cones (usually six) tarsal segments in ratio 50 : 56 : 36 : 25 : 36.

Gaster. Hypopygium (fig. 32) 0.62 mm long, with many spines, its projecting portion extremely long. Pygostyle with four long setae.

Total length 2.64 mm.

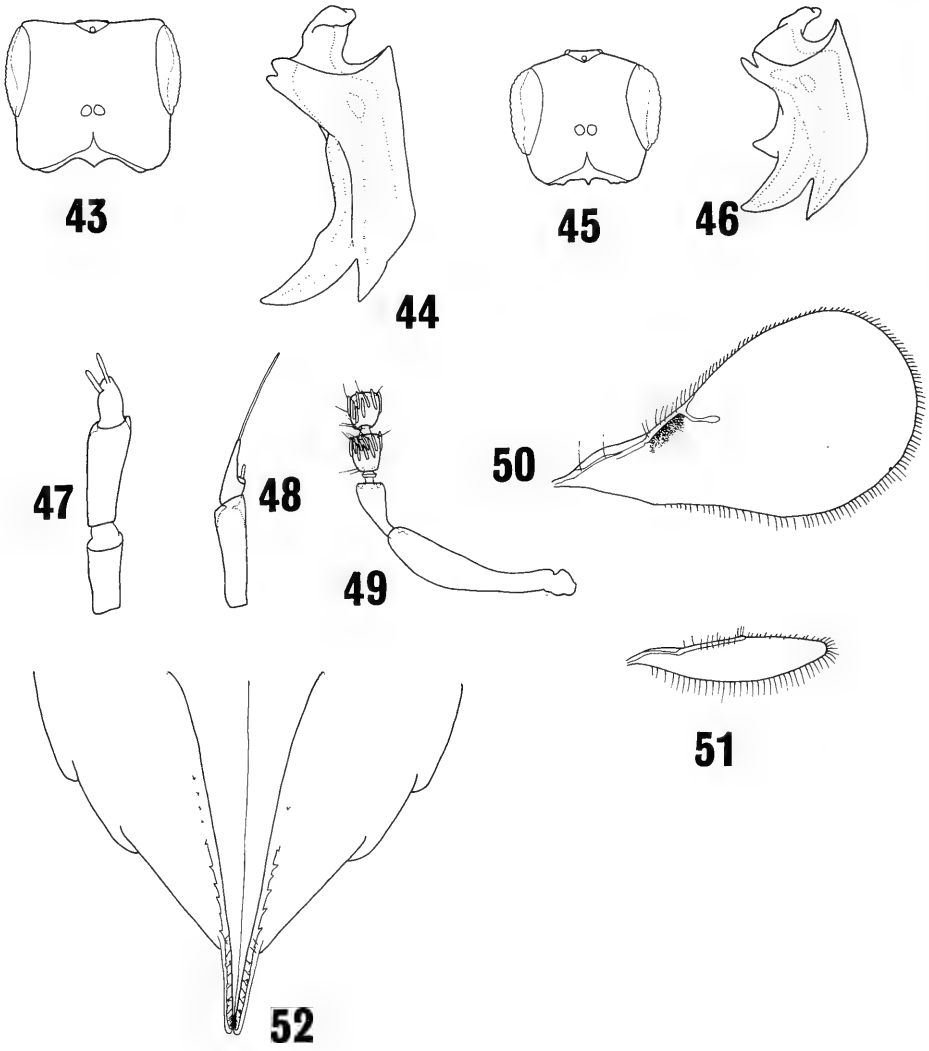
Type material. — Holotype ♀ (slide mounted), Sarawak, Mt. Pargon, 1850 m, 29.iv.1981, leg. B. Allen, at light. Paratypes: 2 ♀, same data as holotype. Additional material: 1 ♀, Brunei, Mt. Retak, iv.1981, leg. B. Allen, at light. Holotype to be deposited in BM (NH) London, a paratype in RMNH Leiden.

**Diaziella longiceps** Gardiner spec. nov.
(figs. 35—42)

Female. — Head (fig. 35) dark brown in colour; distinctly longer than wide (1.15 : 1); length of eye between 1.5—2 times the length of the cheek (1.74 : 1); eyes protruding laterally; epistomal margin having a central incision with stepped sides. Antenna (fig. 39) eleven segmented; antennal insertion closer to the epistomal margin than to the vertex; antennal insertion well above the ventral margin of the eye; scape 3.5 times as long as wide (3.5 : 1) and almost three times the length of the pedicel (2.8 : 1); pedicel shorter than the first funicle segment; funicle, first segment longer than the remaining four and with three irregular rows of long sensilla, second segment longer than any of the remaining three and with two irregular rows of long sensilla (40 : 34 : 31 : 30 : 31); remaining segments including the three segmented club with one row of sensilla each. Mandible (fig. 36) bidentate, tricuspidate, all cusps large with upper cusp of subapical tooth slightly larger than apical tooth; almost 3.5 times longer than wide (3.3 : 1). Maxillary palp (fig. 37) three segmented (5 : 7 : 7); labial palp (fig. 38) two segmented (9 : 7).

Thorax. Fore wing (fig. 41) 1.71 mm long; length between 2—2.5 times as long as wide (2.31 : 1); marginal vein almost twice the length of the stigmal (1.88 : 1); stigmal vein arising at almost 90° to the wing margin; submarginal 1.5 times the length of the marginal (1.5 : 1); mem-

Figs. 27—34. *Diaziella tumidigena* spec. nov., female. 27, head; 28, mandible, ventral aspect; 29, maxillary palp; 30, labial palp; 31, first five antennal segments; 32, hypopygium; 33, fore wing; 34, hind wing. Figs. 35—42. *Diaziella longiceps* spec. nov., female. 35, head; 36, mandible, ventral aspect; 37, maxillary palp; 38, labial palp; 39, first five antennal segments; 40, hypopygium; 41, fore wing; 42, hind wing.




Figs. 43, 44. *Diaziella laticeps* spec. nov., female. 43, head; 44, mandible, ventral aspect. Figs. 45—52. *Diaziella latipennis* spec. nov., female. 45, head; 46, mandible, ventral aspect; 47, maxillary palp; 48, labial palp; 49, first five antennal segments; 50, fore wing; 51, hind wing; 52, hypopygium.

brane with dense microtrichia.. Hind wing (fig. 42) 1.07 mm long; length almost 4.5 times the width (4.4 : 1). Fore leg: tibia with two dorso-apical teeth, one ventro-apical tooth and one spur; tibia to tarsal ratio 0.89 : 1; tarsal segments in ratio 33 : 14 : 11 : 31. Hind leg: tibia with two ventro-apical spurs (one much smaller than the other); tibia with a row of dorsal cones (usually six) tarsal segments in ratio 44 : 47 : 36 : 22 : 30.

Gaster. Hypopygium (fig. 40) 0.66 mm long, with many spines and extending well beyond the end of the abdomen. Pygostyle with four long setae.

Total length 2.44 mm.

Type material. — Holotype ♀ (slide mounted), Brunei, Mt. Retak, iv.1981, leg. B. Allen, at light. Paratypes: 5 ♀, same data as holotype (coll. dates 23—28.iv. 1981). Additional material: 3 ♀, Sarawak, Mt. Pargon, 1850 m, 29.iv.1981, leg. B. Allen, at light. Holotype to be deposited in BM (NH) London, some paratypes in RMNH Leiden.

**Diaziella laticeps** Gardiner spec. nov.
(figs. 43, 44)

Female. — Head (fig. 43) brown in colour; almost quadrate, slightly wider than long (1.18 : 1); length of the eye slightly more than 1.5 times the length of the cheek (1.7 : 1); eyes protruding slightly beyond lateral margin of the head; epistomal margin indented with a central protuberance and with the clypeus sloping back towards the posterior of the head. Antenna (as in *D. latipennis*, fig. 49) eleven segmented; antennal insertion closer to the epistomal margin than to the vertex and slightly above the ventral margin of the eye; scape four times as long as wide (4.17 : 1) and about 2.5 times the length of the pedicel (2.63 : 1); pedicel longer than the first funicle segment; funicle, first segment longer than the remaining four and with one irregular row of long sensilla (30 : 25 : 22 : 22 : 24); remaining segments including the three segmented club with one row of sensilla. Mandible (fig. 44) bidentate, bicuspidate, subapical tooth longer than the apical and with a slight protuberance on its inner margin; about 4.5 times as long as wide (4.6 : 1). Maxillary palp three segmented (4 : 5 : 2); labial palp two segmented (1 : 1) (Maxillary and labial palps similar in appearance to *D. latipennis* spec. nov., figs. 47 and 48 respectively).

Thorax. Fore wing (as in *D. latipennis* spec. nov. fig. 50) 2.14 mm long; length twice the width (2 : 1); marginal vein 1.5 times the length of the stigmal (1.5 : 1); stigmal vein arising at almost 90° to the wing margin; submarginal 1.5 times the length of the marginal (1.5 : 1); membrane with dense microtrichia and a dark marking below the stigmal vein (adjacent to the marginal vein). Hind wing (as in *D. latipennis* spec. nov., fig. 51) 1.38 mm long; length almost five times the width (4.78 : 1). Fore leg: tibia with two dorso-apical teeth, one ventro-apical tooth and one spur; tibia to tarsal ratio 1:1; tarsal segments in ratio 33 : 21 : 13 : 40. Hind leg: tibia with two ventro-apical spurs (one much smaller than the other); tibia with a row of dorsal cones (usually six) tarsal segments in ratio 68 : 62 : 43 : 25 : 41.

Gaster. Hypopygium (as in *D. latipennis* spec. nov., fig. 52) 0.63 mm long with many spines and extending well beyond the end of the abdomen. Pygostyle with four long setae.

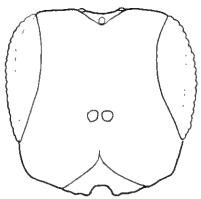
Total length 2.93 mm. Apart from the characteristic head and mandibles *D. laticeps* spec. nov. is very similar to *D. latipennis* spec. nov.

Type material. — Holotype ♀ (slide mounted), Sarawak, Mt. Pargon, 1850 m, 29.iv.1981, leg. B. Allen, at light. Paratypes: 12 ♀, same data as holotype. Additional material: 2 ♀, Brunei, Mt. Retak, 23—28.iv.1981, leg. B. Allen, at light and 2 ♀, Brunei, Temburong River, 300 m, 26.iv.1981, leg. B. Allen, at light. Holotype to be deposited in BM(NH) London, some paratypes in RMNH Leiden.

**Diaziella latipennis** Gardiner spec. nov.
(figs. 45—52)

Female. — Head (fig. 45) dark brown in colour; vertex raised towards the ocelli; wider than long (1.27 : 1); longitudinal diameter of the eye not quite 2.5 times the length of the cheek (2.37 : 1); eyes protruding laterally; epistomal margin slightly indented and with a small central cone like protuberance. Antenna (fig. 49) eleven segmented; antennal insertion closer to the epistomal margin than to the vertex and well above the ventral margin of the eye; scape almost 4.5 times as long as wide (4.41 : 1) and almost three times longer than the length of the pedicel (2.89 : 1); pedicel longer than the first funicle segment; funicle, first segment longer than any of the remaining four and with one slightly irregular row of long sensilla (30 : 24 : 24 : 25 : 25); remaining segments including the three segmented club with one row of sensilla. Mandible (fig. 46) bidentate, tricuspidate (subapical tooth with two large cusps), three times as long as wide (3 : 1). Maxillary palp (fig. 47) three segmented (5 : 6 : 4); labial palp (fig. 48) two segmented (1 : 1).

Thorax. Fore wing (fig. 50) 2.3 mm long; length twice the width (2 : 1); marginal vein almost 1.5 times the length of the stigmal (1.43 : 1); stigmal vein arising at almost 90° to the wing margin submarginal vein 1.5 the length of the marginal (1.58 : 1); membrane with dense microtrichia and a dark marking below the stigmal vein (adjacent to the marginal vein). Hind wing (fig. 51) 1.3 mm long; length between 4.5 to five times longer than wide (4.64 : 1). Fore leg: tibia with two dorso-apical teeth, one ventro-apical tooth and one spur; tibia to tarsal ratio 1 : 1; tarsal segments in ratio 35 : 20 : 12 : 42. Hind leg: tibia with two ventro-apical spurs (one much



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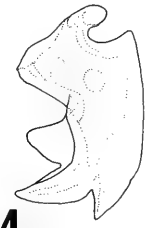

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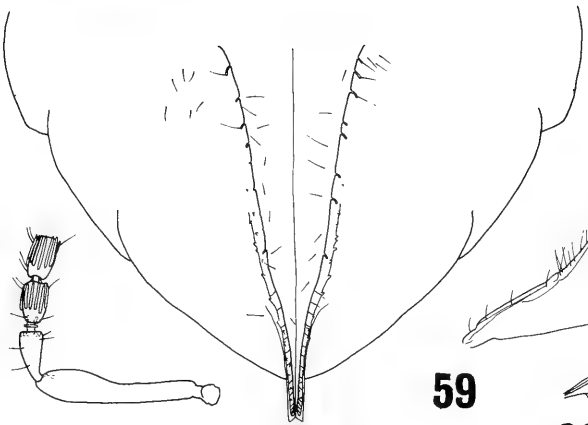

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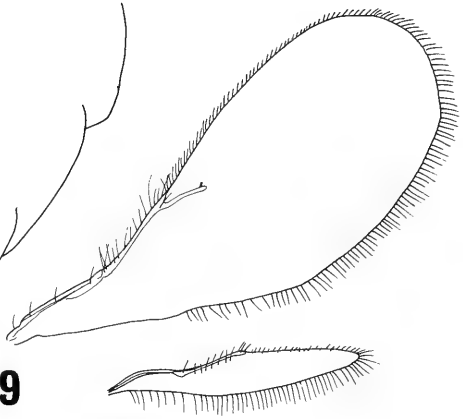

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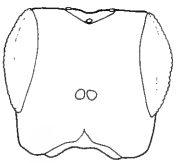

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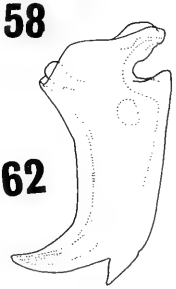

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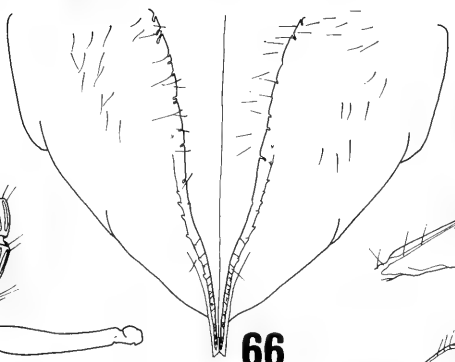

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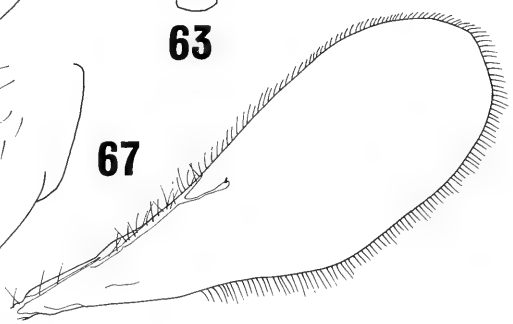

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smaller than the other); tibia with a row of dorsal cones (usually four) tarsal segments in ratio 6 : 5 : 4 : 2 : 3.

Gaster. Hypopygium (fig. 52) 0.59 mm long, with many spines and clearly projecting beyond the end of the abdomen. Pygostyle with four long setae.

Total length 2.73 mm.

Type material. — Holotype ♀ slide mounted), Brunei, Mt. Retak, iv.1981, leg. B. Allen, at light. Paratype: 1 ♀, same data as holotype (coll. dates 23—28.iv.1981). Additional material: 2 ♀, Sarawak, Mt. Pargon, 1850 m, 29.iv.1981, leg. B. Allen, at light. Holotype to be deposited in BM (NH) London.

**Diaziella alleni** Gardiner spec. nov.
(figs. 53—60)

Female. — Head (fig. 53) brown in colour; almost quadrate; slightly wider than long (1.08 : 1); length of the eye twice the length of the cheek (2.12 : 1); eyes protruding beyond the lateral margins of the head; epistomal margin initially protruding and then forming a large central u shaped incision. Antenna (fig. 57) eleven segmented; antennal insertion closer to the epistomal margin than to the vertex; scape 4.5 times as long as wide (4.65 : 1) and just over 2.5 times the length of the pedicel (2.72 : 1); pedicel longer than the first funicle segment; the funicle segments approximately the same size (10 : 9 : 9 : 9 : 9); all the funicle and club segments with one row of long sensilla. Mandible (fig. 54) very robust; bidentate tricuspidate, upper cusp of subapical tooth larger than the apical tooth and lower cusp of subapical tooth approximately the same length as the apical tooth, length 2.5 times the width (2.58 : 1). Maxillary palp (fig. 55) three segmented (5 : 5 : 6); labial palp (fig. 56) two segmented (7 : 6).

Thorax. Fore wing (fig. 59) 1.84 mm long; length 2.5 times the width (2.57 : 1); marginal vein slightly more than 1.5 times the length of the stigmal (1.68 : 1); stigmal vein arising at an acute angle to the wing margin; submarginal vein slightly longer than the marginal (1.22 : 1); membrane with dense microtrichia. Hind wing (fig. 60) 0.93 mm long; narrow almost 6.5 times longer than wide (6.43 : 1). Fore leg: tibia with two dorso-apical teeth, one ventro-apical tooth and one spur; tibia to tarsal ratio 0.95:1; tarsal segments in ratio 27 : 16 : 11 : 28. Hind leg: tibia with two ventro-apical spurs (one much smaller than the other); tibia with a row of dorsal cones (usually six) tarsal segments in ratio 55 : 47 : 32 : 22 : 33.

Gaster. Hypopygium (fig. 58) 0.49 mm long, with many spines and clearly extending beyond end of abdomen. Pygostyle with four long setae.

Total length 2.15 mm.

Type material. — Holotype ♀ (slide mounted), Brunei, Mt. Retak, iv.1981, leg. B. Allen, at light. Paratypes: 7 ♀, same data as holotype (coll. dates 23—28.iv.1981). Additional material: 2 ♀, Sarawak, Mt. Pargon, 1850 m, 29.iv.1981, leg. B. Allen, at light. Holotype to be deposited in BM (NH) London, some paratypes in RMNH Leiden.

**Diaziella wiebesi** Gardiner spec. nov.
(figs. 61—68)

Female. — Head (fig. 61) dark brown to black in colour; almost quadrate, wider than long (1.25 : 1); length of the eye slightly more than twice the length of the cheek (2.26 : 1); eyes protruding beyond the lateral margin of the head; epistomal margin indented and with a slight central prominence. Antenna (fig. 65) eleven segmented; antennal insertion closer to the epistomal margin than to the vertex; scape almost five times longer than wide (4.93 : 1) and 2.5 times the length of the pedicel (2.55 : 1); pedicel longer than the first funicle segment; first funicle segment slightly longer than the remaining four (19 : 16 : 16 : 16 : 17); all funicle segments and the three segmented club with one row of long sensilla. Mandible (fig. 62) bidentate, bicuspidate, subapical tooth clearly longer than the apical (a small protuberance may be present on the inner margin of the subapical tooth); length four times the width (4.09 : 1). Maxillary palp (fig. 63) three segmented (11 : 17 : 14); labial palp (fig. 64) two segmented (16 : 11).

Thorax. Fore wing (fig. 67) 1.98 mm long; length almost three times the width (2.87 : 1); marginal vein between 1.5—2 times the length

Figs. 53—60. *Diaziella alleni* spec. nov., female. 53, head; 54, mandible, ventral aspect; 55, maxillary palp; 56, labial palp; 57, first five antennal segments; 58, hypopygium; 59, fore wing; 60, hind wing. Figs. 61—68. *Diaziella wiebesi* spec. nov., female. 61, head; 62, mandible, ventral aspect; 63, maxillary palp; 64, labial palp; 65, first five antennal segments; 66, hypopygium; 67, fore wing; 68, hind wing.

of the stigmal (1.72 : 1); stigmal vein arising at an acute angle to the wing margin; submarginal slightly longer than the marginal (1.29 : 1); membrane with dense microtrichia. Hind wing (fig. 68) 0.93 mm long; narrow the length about seven times the width (6.89 : 1). Fore leg: tibia with two dorso-apical teeth, one ventro-apical toothh and one spur; tibia to tarsal ratio 1 : 1.07; tarsal segments in ratio 23 : 12 : 7 : 22. Hind leg: tibia with two ventro-apical spurs (one much smaller than the other); tibia with a row of dorsal cones (usually six); tarsal segments in ratio 48 : 44 : 30 : 19 : 27.

Gaster. Hypopygium (fig. 66) 0.45 mm long, with many spines and clearly extending beyond the end of the abdomen. Pygostyle with four long setae.

Total length 2.08 mm.

Type material. — Holotype ♀ (slide mounted), Brunei, Mt. Retak, iv.1981, leg. B. Allen, at light. Paratypes: 61 ♀, same data as holotype (coll. dates 23—28.iv.1981). Additional material: 2 ♀, Sarawak, Mt. Pargon, 1850 m, 29.iv.1981, leg. B. Allen, at light. Holotype to be deposited in BM (NH) London, some paratypes in RMNH Leiden.

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# EXTERNAL MORPHOLOGY OF ADULT SYRPHIDAE (DIPTERA)

by

M. C. D. SPEIGHT

*Research Branch, Forest and Wildlife Service, Sidmonton Place, Bray, Co. Wicklow*

## Contents



## Introduction

Dipteran morphology has been surprisingly little studied. Recent reviews of the available information are provided by McAlpine (1981) and in the sections on Diptera in the volumes by Bitsch et al. (1973), Bitsch & Matsuda (1979) and Matsuda (1965, 1970, 1976). From these texts conflicting theories as to the homologies of sclerites found in different Diptera are all too evident. And with the theories has grown up a jungle of conflicting terminologies. Faced by the apparent inability of morphologists to agree on the morphological terms which can be applied to many of the taxonomically important parts of adult flies, and also finding need to refer to parts which to morphologists seemingly had no individual morphological identity, taxonomists have frequently been forced to coin quasi-morphological terms of their own. Workers on Syrphidae have been particularly plagued by this problem since morphologists have concentrated their efforts principally upon Nematocera and Calypterates, leaving Syrphid taxonomists to decide for themselves which of the sclerites found in Syrphidae could be identified with those named in other Diptera. The resulting terminological chaos reaches an extreme in accounts of European Syrphidae, where writers in different languages have developed partly independant terminologies but have also "borrowed" terms (sometimes in translation and sometimes not) from each other, adding to this mélange a sprinkling of polysyllabic latinisms when all else failed. At this juncture, it is doubtful that all Europeans working on Syrphidae would adopt in its entirety any proposed set of terms.

The present text does not attempt to select a definitive set! Certain principles have been employed here as follows:

i) where the homology of a sclerite is generally agreed among morphologists and the sclerite is normally referred to in its entirety when used by taxonomists the latin (or greek) morphological term for the sclerite is used e.g. cercus;

ii) where a sclerite has an agreed homology, morphologically, but is not normally referred to in its entirety in taxonomic texts, the terms used by taxonomists for each individual part of the sclerite are used if they

are rendered in latin or greek and do not imply an *incorrect* homology for the sclerite e.g. post-alar callus;

iii) where the homology of a sclerite is disputed but there is in existence for the sclerite a latin or greek term which does *not* imply a particular homology that term is used e.g. basale;

iv) where the homology of a sclerite is disputed and no suitable latin or greek term is available for that sclerite, a neutral term derived from some other language is used e.g. barrette.

The literature search conducted as part of the present work revealed only one complete published account of the external morphology of an adult Syrphid — the unillustrated text by Nayar (1965), on *Episyrphus balteatus*. Crampton (1942) considers the morphology of various Syrphids, but does not illustrate all the parts of any one species.

The present account is based on the morphology of the type species of the type genus of the family, *Syrphus ribesii* L., augmented by comparison with European representatives of the other two main subdivisions of the family, the Eristalinae (exemplified by *Eristalis tenax* L.) and the Microdontinae (exemplified by *Microdon mutabilis* (L.)). Other species are mentioned in discussion of particular parts of the fly, so that some idea can be presented of the range of morphological variation found among Palaearctic Syrphidae. Illustrations are all based on male specimens, except where specifically stated otherwise. In his massive work defining taxonomic subdivisions of the Syrphidae Hull (1949) illustrates a wide range of Syrphidae from different parts of the world, amply demonstrating the extremes of form exhibited by the family. His similar volume on fossil Syrphidae (Hull, 1945) gives an impression of the morphology of some of the family's antecedents. Studies of individual morphological regions or features of particular hoverfly species, or groups of species, have been undertaken by various authors. For instance, recently a favoured topic for consideration has been the male abdomen and the modifications undergone by its terminal segments. Such texts are mentioned in the relevant sections of the present account.

## THE HEAD

Detailed morphological studies of the head capsule of *Eristalis* species have been conducted by Gouin (1949) and Schiemenz (1957). Nayar (1964) considered *Episyrphus balteatus* and Crampton (1942) figured the head of a N. American *Rhingia* species.

The major feature of the Syrphid head are the compound eyes and the mouthparts, which occupy, respectively, the lateral and ventral surfaces of the head capsule. The front of the head, from mouth-edge to ocellar triangle, is rather featureless, its main variation being in the extent to which it projects either ventrally to accommodate the mouthparts or dorsally to produce an antennal tubercle. The occipital region starts abruptly immediately behind the eyes, almost without exception forming a sharp angle with the sides of the head.

As Snodgrass (1960) has pointed out there is a great difference between joints between sclerites (Sutures) and intrascleritic invaginations of the exoskeleton (Sulci) that form sites for muscle attachment, but these two phenomena can be indistinguishable externally. In Syrphids the head capsule exhibits on its surface various grooves marking the location of internal apodemes and most authors referred to these grooves as "sutures", thus not differentiating them from features representing joint lines. In order to make the necessary distinction, these cephalic grooves are here called sulci, following Snodgrass's (l.c.) terminology.

### Compound eyes

In Syrphids the two compound eyes are large, occupying most of the top and sides of the head and making up two thirds or more of the width of the head capsule. There is a certain amount of sexual dimorphism, the male eyes meeting in the mid-line between antennal insertions and ocellar triangle (the holoptic condition) in a majority of the genera, but always remaining separate (the dichoptic condition) in the females (figs. 1, 2). In addition, facets in the upper part of the male eyes may be distinctly larger than those below (e.g. in *Scaeva*) while in the female they are of very similar dimensions throughout. Short, straight hairs, inserted between the facets, characterise some genera. These hairs may be generally distributed over most of the surface (as in many *Cheilosia* species) or arranged in stripes of different density (as in *Eristalis tenax*) or colour (as in *Paragus* species). In some genera the facets themselves iridesce in bands or spots of different colours (as in *Eristalodes*, *Orthonevra* and *Eristalinus*) which fade after death. Some authors, e.g. Gouin (1949), have recognised

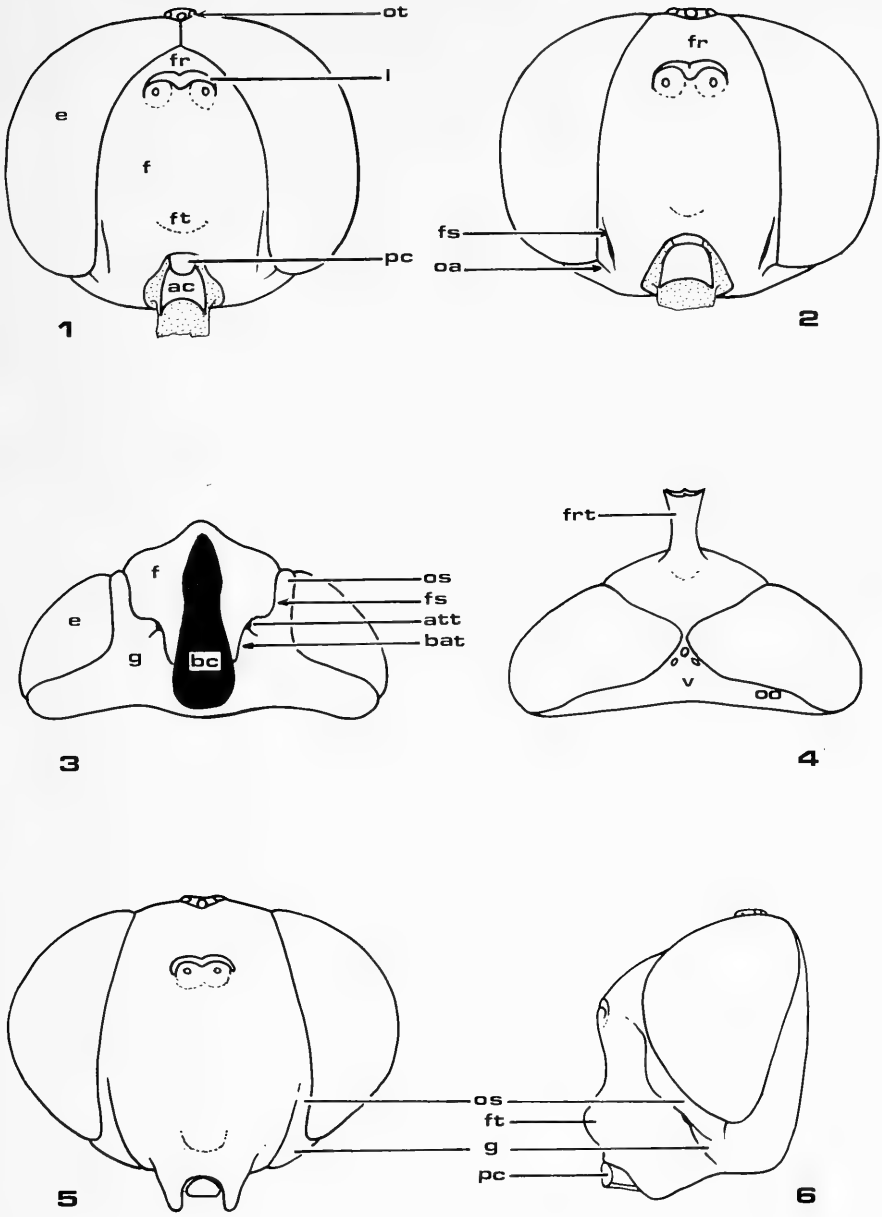



Fig. 1, *Syrphus ribesii*, male, head, anterior view. Figs. 2, 3, *S. ribesii*, female, head, anterior view (2) and ventral view (3). Fig. 4, *Ceriana* sp., male, head, dorsal view. Fig. 5, *Eristalis tenax*, female, head, anterior view. Fig. 6, *Cheilosia grossa*, male, head, lateral view of left side.

an externally visible ocular sclerite forming a rim to the eyes, but no external evidence of this plate has been encountered by the present author.

### Head capsule: frontal, genal and vertical regions

Sulci precisely delimiting the frons are absent in Syrphidae, leaving the anterior ocellus, the compound eyes and the anterior tentorial pits as the only reference points by which to define the extent of the frontal region of the head capsule. Judged in this way, the "frons" is generally regarded as extending from the ocelli to the anterior rim of the buccal cavity. The clypeus, which should intrude between frons and mouth-parts is taken either to have disappeared, or to have been incorporated without trace into the lower areas of the frons, or (as in most recent literature) to have been mostly incorporated into the buccal cavity. Most authors have failed to refer to the area from the antennae to the edge of the buccal cavity as the frons, restricting this term to the area between antennae and ocellar triangle (the term ocellar triangle refers, as used here, to the often raised triangular area containing and demarkated by the ocelli). The lower frons is then referred to as either the face (as in McAlpine, 1981) or the fronto-clypeus. In some instances the areea immediately above the edge of the buccal cavity is termed the post-clypeus, on the assumption that only the more basal of the two clypeal plates has been absorbed into the frons. Since there are median sclerites in the front part of the buccal cavity (see section on mouthparts) serving the functions which sclerites of the clypeal origin might be expected to serve and since the more basal of these is hinged to the upper edge of the buccal cavity, it seems unreasonable to regard them as secondary sclerites and thus require the true clypeus to have been incorporated without trace into the frons. Following this logic the entire area between anterior ocellus and the upper mouth edge is here regarded morphologically as the frons.

However, there is taxonomically a need to distinguish between the frontal area above the antennae and the frontal area beneath them, so following popular usage the latter area is referred to here as the *face* (this does not entirely accord with the definition of the face used in McAlpine, 1981, where the face is taken to terminate below the level of anterior tentorial pits) and the former as the "frons".

A dorsal-ventral sulcus continuing upwards on each side of the lower frons, from the invagination of each anterior tentorial pit, and more or less parallel with the anterior eye margin, is developed to a greater or lesser extent in many Syrphid genera. This facial sulcus is almost universally well-developed in *Cheilosia* spp (fig. 6), where it reaches the level of the antennal insertions. In this way, the part of the face between the facial sulcus and the eye margin is cut off from the rest of the face and also frequently looks very different, due to differences in colour and pilosity between it and the rest of the face. Some authors have sought to name these orbital strips as separate regions of the head capsule, labelling them genae or parafrontalia, etc. Here they are simply termed the *orbital strips* (figs. 3, 5, 6).

At its ventral end the tentorial sulcus does not terminate precisely at the anterior tentorial pit (usually detectable externally as a widening and deepening of the sulcus) and may bifurcate, one arm (buccal arm) continuing to the edge of the buccal cavity, the other arm (ocular arm) swinging round towards the antero-ventral angle of the eye, where it slopes at the eye margin. Either or both of these arms may be incomplete. In *Syrphus* (figs. 1, 2) both arms are incomplete, but in genera where the ocular arm is complete externally and the buccal arm is not in evidence (e.g. in *Cheilosia*, fig. 6) the orbital strips are delimited precisely at their lower ends. In *Eristalis* (figs. 3, 5), where the ocular arm is indistinct but the buccal arm continuous strongly to the edge of the buccal cavity, the buccal arms divide the face into a median and lateral regions. Schiemenz (l.c.) regards these lateral regions as the genae and in those Syrphidae in which *both* lower arms of the anterior tentorial sulcus are complete this use of the term would follow precisely the definition of the genae given by Snodgrass (1960). Where one or other, or both, lower arms of the anterior tentorial sulcus are missing the frontal and genal regions of the head capsule cannot, by definition, be precisely delimited.

The antennal insertions are found on the frons. Immediately above them a pair of arcuate raised areas is usually differentiated (absent in *Microdon*) in Syrphidae. These are jointly known as the *frontal lunule*. That part of the top of the head capsule between the para-sagittal sulci (fig. 7) and containing the ocellar triangle with its three ocelli is most conveniently referred to as the *vertex*. Crampton (l.c.) has discussed the difficulties inherent in using this term in Diptera. Here the vertex is taken to merge imperceptibly

with the occipital region of the head capsule at the angle where the posterior face of the head dips down. Gouin (l.c.) and Schiemenz (l.c.) used the terms vertex to include the median part of the occipital region referred to here as the *post-vertex*. Other authors have used the terms "vertex" and "vertical triangle" as synonyms of the term "ocellar triangle" as employed here. It should be noted that in the males of the syrphid species with holoptic eyes the vertex is frequently represented only by the area of the ocellar triangle, such that the terms vertex and ocellar triangle become interchangeable, giving rise to some confusion. In both sexes of most species the ocelli are disposed in a roughly equilateral triangle. But in some genera e.g. *Eumerus*, species occur in which the anterior ocellus is placed further forward, some distance from the two lateral ocelli.

Dorsally, behind the eyes and lateral to the vertex, the head capsule often projects to some extent, before curving ventrally into the occipital region. Whether or not there is a para-sagittal sulcus in evidence on each side of the ocellar triangle, thus precisely segregating the vertex from these post-ocular strips, they may conveniently be termed the *post-ocular orbits*, as in Coe (1953). The post-ocular orbits continue without interruption down the side of the head to merge with the genal region.

Between the antennae and the upper mouth edge a median protruberance is present in many Syrphid genera. Although this bump has no discrete identity morphologically, it is important taxonomically and is usually referred to either as the *facial tubercle* or facial prominence (figs. 1, 6). The area surrounding the antennal insertions may also be drawn out to form a tubercle, which in European Syrphids reaches its extreme of development in *Ceriana* (fig. 4). This has been referred to as the frontal prominence or *frontal tubercle*.

The surface of the frons is not infrequently thrown into a series of furrows or ridges (referred to as *regulae*) well illustrated by species of *Chryogaster* and *Orthonevra*. Other genera exhibit highly polished concave or flattened median fields contrasting markedly with the surrounding surface, e.g. *Neoascia* and *Neocnemodon*, or areas of procumbent, iridescent microhairs (dusting) alternating with bare, shining patches, as in many Syrphinae.

### Head capsule: posterior surface

In Syrphidae, the posterior surface of the head (*post cranium* of McAlpine, l.c.) is concave, making a sharp angle with the sides of the head. In the case of *Eumerus* and *Merodon* this angle is extremely sharp, producing a distinct postcranial carina (fig. 8). This angle makes a very convenient marker for defining the outer edge of the three major post-cephalic regions, referred to here as the *occipital region*, the *post-genal region* and the *hypostomal region*. Tentorial sulci, radiating out from the centre, delimit these regions one from another.

More or less in the centre of the back of the head is found the *occipital foramen*, or foramen magnum. This is largely surrounded by the *post-occipital sclerite*, which merges below with a mid-ventral plate delimited laterally by the well-marked *hypostomal sulci*. This mid-ventral plate makes up the hypostomal region of the head and is supposedly derived largely from lobes of the postgenae that have fused in the mid-line (Snodgrass, l.c.) giving it one of its names, the *hypostomal bridge*. In *Syrphus* and its allies (fig. 7) a dorso-ventral, median, hypostomal suture probably indicates the fusion line. The posterior tentorial pits occur in the hypostomal sulci and the two lateral plates demarkated ventrally by the hypostomal sulci make up the *post-genal region* (referred to simply as a part of the genae by Gouin and Schemenz) of the head. A more dorsal pair of rather incomplete sulci, referred to as the *transverse sulci*, help to delimit the upper boundary of the postgenal region. The *occipital region* is then that part dorsal to the transverse sulci. Yet another pair of sulci, the *parasagittal sulci*, divide the occipital region into three fields. The two lateral fields of the occipital region have usually been called the *tempora* but the dorsal, median, field has been subject to various appellations. Here it is termed the *post-vertex*. In *Merodon* and related genera the post-vertex is almost obliterated (fig. 8), the para-sagittal sulci swinging into the mid-line at the post-cranial carina.

Very prominent towards the centre of the postgenal fields of Eristaline syrphids are large, raised, dorso-ventral bands of sensillae — these bands of sensillae are often very restricted in their extent in Syrphinae. In all Syrphids the occipital foramen is so constructed just above mid-way as to be almost converted into two separate holes, due to the development of prominent transverse *cervical condyles* for articulation with the cervical sclerites (figs. 7, 8).

### Antennae

Syrphid antennae comprise three principal

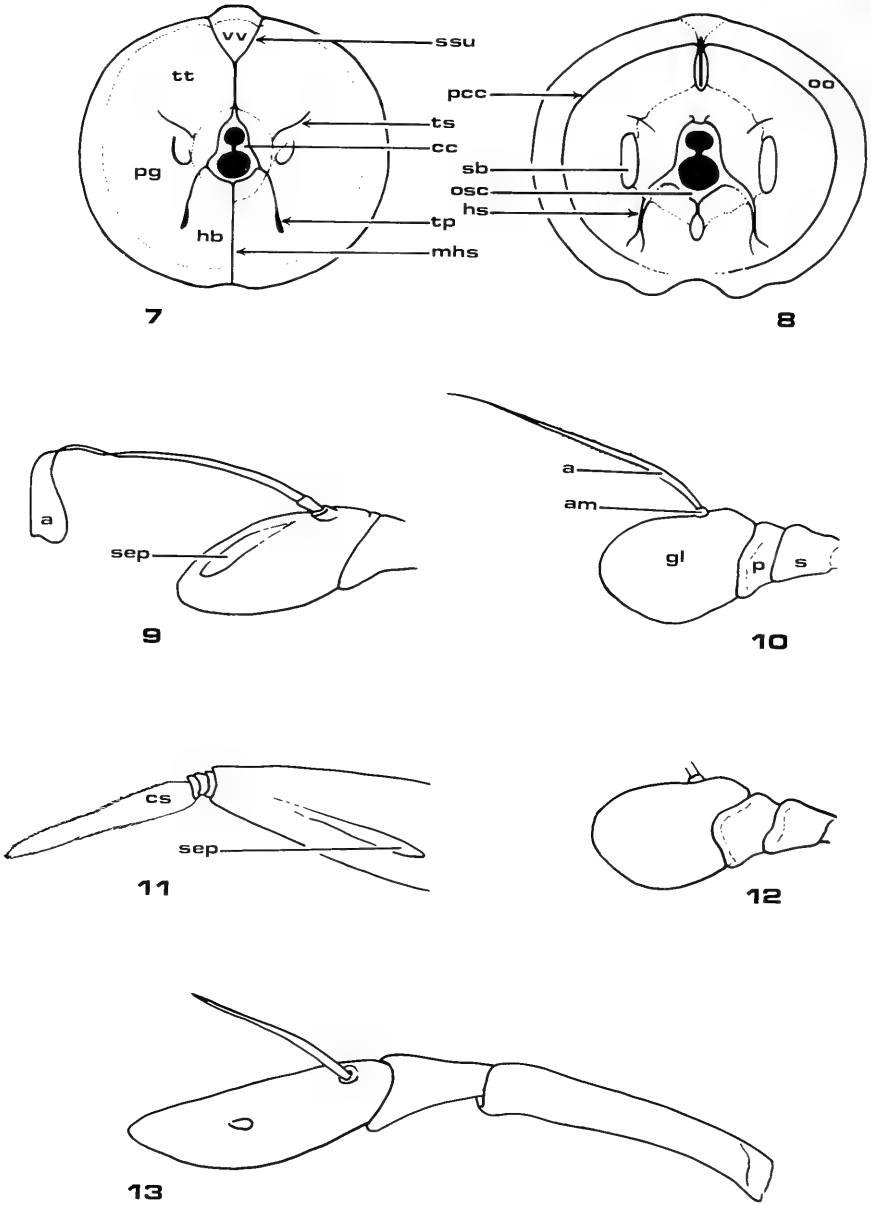



Fig. 7, *Syrphus ribesii*, male, head, posterior view. Fig. 8, *Merodon equestris*, male, head, posterior view. Fig. 9, *Platynochaetus setosus*, third antennal segment and arista, lateral view, outer side. Fig. 10, *Syrphus ribesii*, antenna, lateral view, outer side. Fig. 11, *Callicera aenea*, end of third antennal segment and arista, lateral view, inner side. Fig. 12, *Syrphus ribesii*, antenna, lateral view, inner side. Fig. 13, *Microdon mutabilis*, antenna, lateral view, outer side.

segments and a more or less annulate *arista* borne on the third segment. The third segment represents the first flagellar segment. The arista represents the rest of the flagellar segments, one or more of which may be distinct (figs. 9—13). These aristal segments have been termed aristomeres (McAlpine, l.c.). Inserted between the eyes on the frons, the antennae occur at a point where there is a distinct change in the angle of slope of the frons. Not infrequently the frons projects at this point, producing in extreme cases a frontal tubercle (fig. 4).

The antennal segments vary in their proportions between genera, but segment 3 is normally the largest. Sensory pits are frequently discernible on either the inner or the outer face of segment 3. *Cheilosia* species often possess large numbers of small pits, while in many other genera there is at least one large pit (figs. 9, 11, 13). The dorsal margins of segments 1 and 2 carry bristles in various genera.

The arista may be terminal or sub-dorsal, hairless, pilose or plumose. In most genera it is bristle-like, but it may be bulbous or strap-like. In *Platynochaetus* it is spatulate (fig. 9). Crampton (1942) discusses the merits of applying the term "ceratostylate" to certain forms of the antennae with a terminal "arista" and the condition found in *Ceriana* would certainly be better termed cerato-stylate rather than aristate were the term ceratostyle to come into common use.

To accord with general usage, the terms *scape* and *pedicel* should be applied to the first and second antennal segments, respectively.

## Mouthparts

The modifications exhibited by the mouthparts of Syrphidae, occasioned by these flies' specialised nectar and pollen-feeding habits, have given rise to various published accounts of their structure. The most detailed study is that of Schiemenz (1957), who deals with both external and internal anatomy of the mouthparts of *Eristalis arbustorum*. Crampton (l.c.), Gilbert (1981), Gouin (l.c.), Holloway (1976) and Nayar (1964) provide additional information. Gilbert's (l.c.) account considers the functional implications of variations in structure exhibited by a range of European species and also incorporates a comprehensive bibliography.

Although morphologically part of the head-capsule the clypeal sclerites have apparently come to lie within the buccal cavity in Syrphidae, so they are considered in this section of the present text together with the head appendages which make up the mouth-parts proper (alternative theories concerning the fate of the clypeus are mentioned under the section dealing with the frons).

Syrphid mouthparts comprise sclerites derived from the clypeus, located dorsally towards the base of the mouthparts complex; a modified *labrum* lying dorsally and distal to the clypeal sclerites; a lateral pair of *maxillary stylets* plus palps; a ventral *hypopharynx* and a partly membraneous and partly sclerotised labial complex lying beneath the hypopharynx. The labial complex provides a sheathing trough (the "labial gutter") for the other mouthparts that lie distal to the clypeal sclerites. The entire apparatus, normally called the proboscis, is hinged to the head capsule at the upper mouth edge, via the basal clypeal sclerite, and hinged again at the junction between the distal clypeal sclerite and the labrum. Because of this hinging arrangement, when the proboscis is retracted into the head it folds away such that the clypeal sclerites form a floor to the head capsule in the anterior part of the buccal cavity and the labrum rests up against them with its tip pointing forwards and surrounded by the fleshy lobes at the end of the labial complex. The main labial sclerite, the *premental sclerite*, is then the plate seen bulging from the buccal cavity when the head is viewed from beneath.

There is no obvious sexual dimorphism in the structure of syrphid mouthparts. There is no external indication of mandibular sclerites in any of the genera examined during preparation of the present text.

Apart from in *Microdon*, two clypeal sclerites are present in Syrphidae: A *postclypeus*, articulating on its proximal margin with the anterior edge of the buccal cavity, and a more distal *anteclypeus*. The proximal edge of the anteclypeus articulates with the anterior edge of the postclypeus. The distal margin of the anteclypeus is deeply concave, its lateral arms passing forwards to articulate with the base of the labrum but visible externally only as narrow sclerotised strips (fig. 14). A solitary clypeal sclerite is present in *Microdon*, bearing a close resemblance to the anteclypeus of other Syrphidae (fig. 15).

The labrum is a heavily sclerotised, highly polished plate, in external appearance reminiscent of an upturned canoe. In genera such as *Rhingia*, with mouthparts adapted to nectar extraction from flowers with a deep corolla, the labrum is greatly elongate (fig. 16).

Roofed by the labrum, the food-channel is floored by the hypopharynx, a sclerotised, stylet-

like, concave sclerite, which projects forwards as far as the tip of the labrum. The pair of maxillary sclerites, with their unsegmented *palps*, lie in the membrane lateral to the sclerites of the food channel. Each maxillary sclerite is continuous internally with a sclerotised rod interpreted as the *stipes*, which passes back into the head capsule. In most genera the maxillary sclerites sweep down from their lateral position towards the mid-line, sheathing the hypopharynx ventro-laterally. The maxillary palps, conversely, sweep upwards, hugging the outer surface of the labrum so that distally they come to lie side by side along its dorsal surface. In some general, e.g. *Merodon*, the maxillary palps are quite strongly sclerotised, but in the most cases they are membraneous.

The identity of the maxillary sclerites, here termed the *maxillae*, remains an unresolved problem: See Matsuda (1965). Currently, they are most often regarded as the lacinia (e.g. in McAlpine, 1981). *Microdon* is exceptional among Syrphidae in possessing short, flange-like maxillary sclerites, orientated transversely rather than longitudinally. Also, the maxillary palps are rudimentary in *Microdon* (fig. 15).

The most complex and varied structure of the syrphid mouthparts is the labium and its appendages. Matsuda (1965) summarises the information available on the origin of dipteran labial structures. Essentially, of the two vertical labial sclerites the more basal, the postmentum, is absent. The other, the prementum, has become partly desclerotised but gave rise to the large external, ventral plate of the Syrphid labial complex (figs. 14—16) termed here the *premental sclerite*. The membraneous lobes lying distal to the premental sclerite, collectively known as the *labellum*, are apparently derived from the original labial palps. The terminal lobes of the original prementum (glossae and paraglosae, together known as the ligula) have been lost. The partly membraneous prementum containing the premental sclerite has become weakly resclerotised on its upper surface, producing a secondary sclerite (see fig. 16) known as the *hypoglossa* (usually hidden from sight when the mouthparts are examined in side view).

Within the labellum, the original two-segmented form of the labial palps has been modified but is evidenced from the position of largely internal strengthing rods, the *furca* and *epifuraca* (see Schiemenz, l.c.). In different Syrphids the labellar lobes exhibit a range of variation from the voluminous, convoluted, membraneous flaps exhibited by *Syrphus* (fig. 14) to narrow, tongue-like strips with strongly sclerotised tips such as are found in *Rhingia* (fig. 16).

In the literature reference is frequently made to regions of the proboscis called the *rostrum* and *haustellum*. The rostrum is the largely membraneous basal section of the proboscis, as far as the base of the labrum and labium. The haustellum is then the most distal portion containing the mouthparts proper and including the labellum.

## The cervical region

In Diptera, the cervical region or cervix, is largely impacted onto the front face of the thorax. Its structures comprise three pairs of *cervical sclerites* (or cervicalia) and the *cervical organ* complex (figs. 17—19, 21). The main feature of the cervical region is the pair of *lateral cervical sclerites*. These flank the cervical cavity, along their outer edges articulating internally with prothoracic elements. Ventrally, the lateral cervical sclerites meet in the mid-line over the membraneous pocket containing the cervical organ. Dorsally, arms from the lateral cervical sclerites twist forwards, flanking the lower edge of the cervical canal and articulating at their tips with the cervical condyles on the back of the head. Resting alongside the tips of the lateral cervical sclerites is the pair of small, dorsal or *anterior cervical sclerites*.

In the cervical membrane along the lower edge of the main body of the lateral cervical sclerites is found the pair of *posterior cervical sclerites*. In Syrphidae these are rather variable in appearance and in degree of sclerotisation. At their outer ends the posterior cervical sclerites appear to fuse with the prothoracic episterna. Their inner ends bear sclerotised outgrowths, as in *Syrphus* (fig. 21).

According to Matsuda (1970), in Diptera the lateral cervical sclerites are derived from pleural elements of the prothorax but the other cervical sclerites are secondary sclerotisations. The lateral cervical sclerites would most logically articulate laterally with propleural elements, and since the antepronotum and proepisternum are indistinguishably fused somewhere in the region of the point of articulation of the lateral cervical sclerites, the position of that articulation has been used by some authors as an indication of the dorsal extent of the proepisterna. However, Matsuda (l.c.) has reduced the value of this argument by suggesting that in *Tabanus* the lateral cervical sclerites probably articulate with elements of the antepronotum.

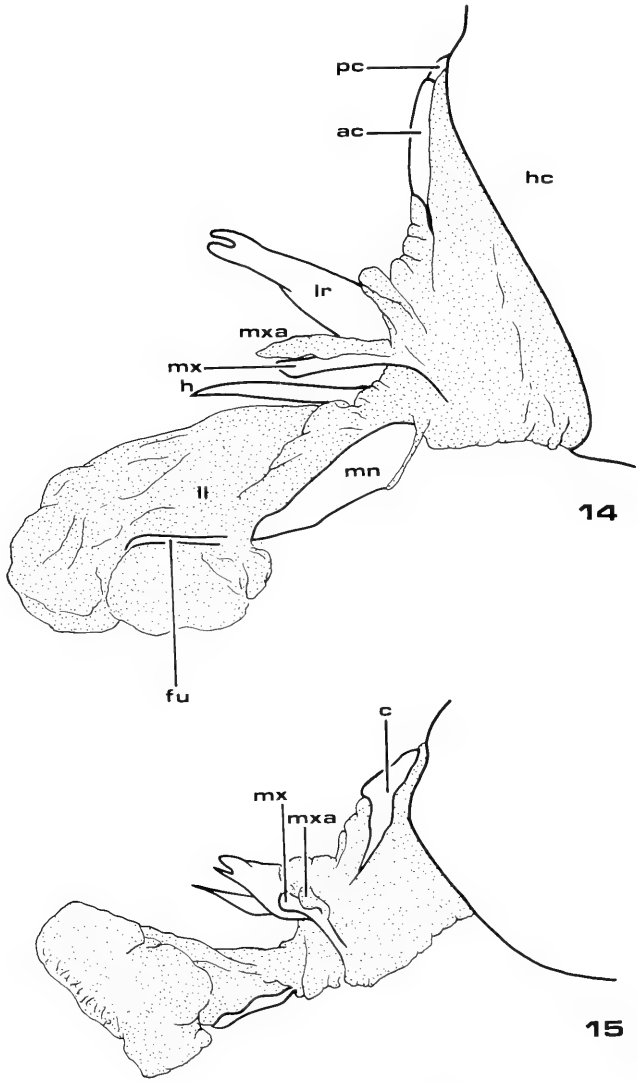



Fig. 14, *Syrphus ribesii*, mouthparts, lateral view. Fig. 15, *Microdon mutabilis*, mouthparts, lateral view.

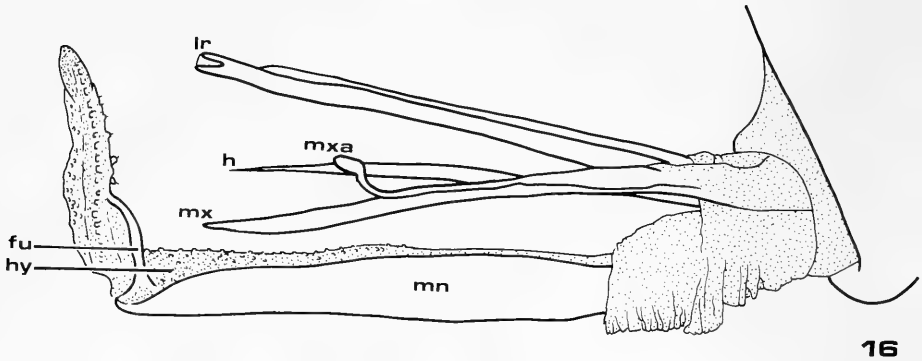



Fig. 16, *Rhingia campestris*, mouthparts, lateral view.

The cervical organ complex has received scant attention in Diptera, being entirely ignored in reviews of Dipteran morphology such as those conducted by Matsuda (1970), Bitsch & Matsuda (1973) and McAlpine (1981). The only published review of its structure in Diptera is that incorporated into Speight (1969). Among Syrphidae, the cervical organ is rather varied in its detailed structure, but is essentially a sensilla-bearing plate, termed the *sella*, lying across the mid-line in a membraneous pocket beneath the postero-median wings of the lateral cervical sclerites. The sensilla are directed upwards and slightly outwards so that their tips touch the underside of the postero-median wings of the lateral cervical sclerites. The sella extends posteriorly in the mid-line as a sclerotised bar in the surface of the cervical membrane, where it articulates with, or is fused to, a median sclerite which some authors have identified as the presterum of the prothorax. Matsuda (l.c.), however, argues that this latter plate is more likely a secondary sclerotisation of the cervical region and should be regarded as a cervical sclerite. Here, because of its evident involvement in the functions of the cervical organ and its debateable origin, this plate is simply called the *postsella*. In many genera, (e.g. *Syrphus*), at some point along its length the sella expands laterally into a trapezoid, bearing at its lateral extremities a pair of sclerotised tubercles (fig. 21).

## THE THORAX

Even a small amount of original research on muscle origins would proably produce dramatic results in deciding correct designations for thoracic sclerites, since the number of Dipteran species whose thoracic musculature has been comprehensively investigated can almost be counted on the fingers of one hand. The only syrphid whose thoracic musculature has been reported on is *Eristalinus megacephalus* Rossi (as *Lathyrophthalmus obscuritarsis*), in Maki (1948). The degree of confusion existing at present can be adduced from a comparison between the terminologies employed for the Dipteran thoracic sclerites by Crampton (1942) and Matsuda (1970): hardly a single part of the thorax is given the same name in the two texts. In the present account an attempt has been made to follow the terminology employed by Matsuda (l.c.), with certain modifications based on McAlpine (1981). Unfortunately, Matsuda's text is based largely on a comparison between certain Tipulids, *Tabanus* and a Nycteribiid, augmented by occasional observations on *Drosophila*, and syrphid thoracic morphology presents features departing significantly from what has been observed in these other flies.

### Prothorax

The most anterior of the three thoracic segments, the prothorax, is in Diptera an insignificant and incompletely delimited component of the front end of the thorax, overhung by part of the mesonotum. The prothoracic tergum, the pronotum, occurs externally as three sclerites, the *antepronotum* and the paired *postpronotal sclerites*. In Syrphidae, the antepronotum is dorsally reduced to a narrow semi-circular plate, deeply notched in the mid-line, arching round the

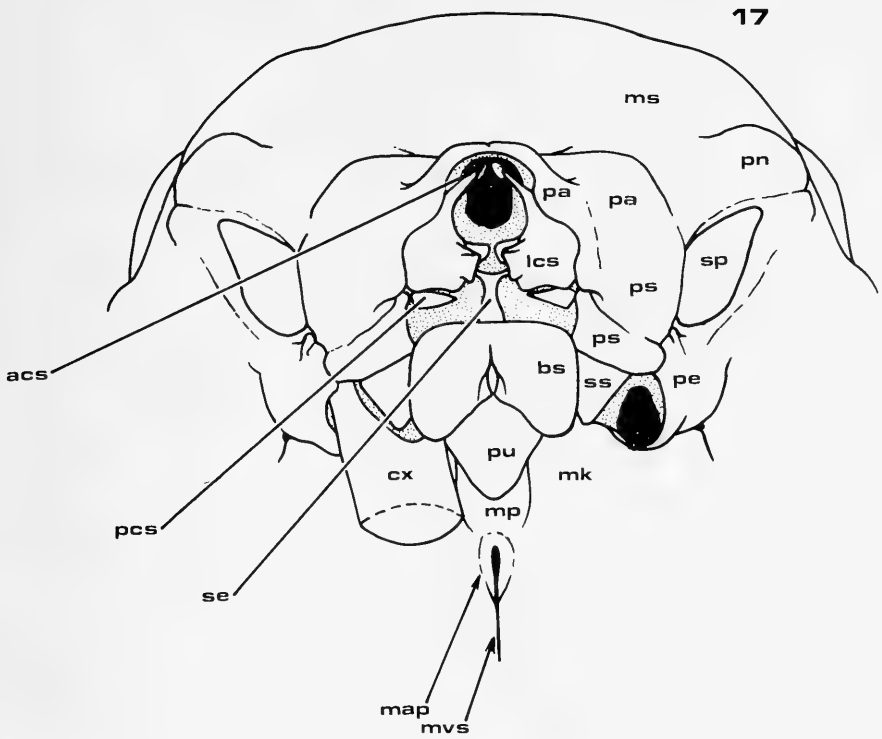



Fig. 17, *Eristalis tenax*, prothoracic region, anteroventral view.

upper edge of the cervical membrane. Laterally it widens out, passing ventrally to fuse indistinguishably with the prothoracic episterna. Posteriorly, in the mid-line, the antepronotum dips down into the deep, pit-like *antecostal suture* (fig. 20), from which the first thoracic phragma is invaginated. More laterally, the posterior edge of the antepronotum abuts onto the postpronotum, a junction marked by a complete suture in most Syrphidae, e.g. *Syrphus* (fig. 18).

The postpronotum is represented externally by the pair of sclerites forming at least the major part of the prominent humeral calli of taxonomists. Unless the antecostal suture occurs between antepronotum and postpronotum in Syrphidae, rather than between post-pronotum and meso-notal acrotergite as is generally supposed, the lateral elements of the postpronota are not externally connected with each other in these flies. Instead, the postpronotal sclerites appear to dip into the antecostal suture at its outer ends. In the absence of information to the contrary, the suture curving up, over the humeral calli posteriorly, from the antero-dorsal edge of the prothoracic spiracle, is here taken to delimit the junction between postpronotum and mesonotal elements. This suture curves round towards the antecostal suture but then usually fades out, so that postponotum and mesonotum are incompletely demarkated from each other.

The propleura comprise a *proepisterum* and a *proepimeron*. The proepisternum (propleuron of taxonomists) is fused anterodorsally with the antepronotum and anteroventrally with the posterior cervical sclerites. Some authors (e.g. Thompson, 1972) have recognised anepisternum and katepisternum in the proepisternum, but on what basis is unclear. The position of the anterior edge of the proepimeron can be detected by the line of the propleural suture, which divides proepisternum from proepimeron and runs from the rim of the fore coxal cavity to the prothoracic

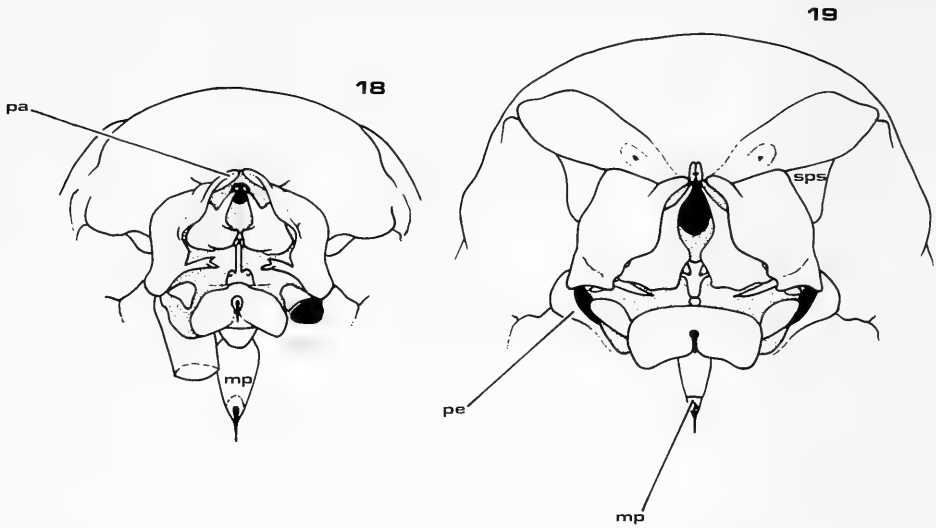



Fig. 18, *Syrphus ribesii*, prothoracic region, anteroventral view. Fig. 19, *Microdon mutabilis*, prothoracic region, anteroventral view.

spiracle. In *Microdon* (fig. 19) the posterior edge of the proepimeron appears to be marked by a suture for part of its length, but it is otherwise not differentitated from mesopleural elements.

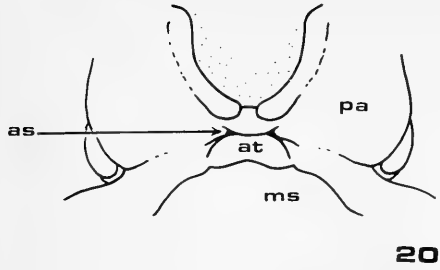
Anteroventrally, a projection of the proepisternum articulates with or fuses to the posterior cervical sclerites. This projection is to a variable extent marked off from the main body of the proepisternum by a suture and may or may not represent the remains of a propleural precoxale — it is given no separate designation in this account. Another sclerite which could be interpreted as either the propleural precoxale or a trochantin lies free in the cervical membrane along the anterior rim of the coxal cavity, between proepisternum and probasisternum. This sclerite is often poorly sclerotised and may be absent. Here it is regarded as of secondary origin and labelled simply as a secondary sclerite (figs. 17—19).

The sternum of the prothorax is represented externally by a *basisternum* and a *furcasternum*. The "presternum" of some authors is discussed in that section of the present account dealing with the cervical region. The basisternum (prosternum of taxonomists) is a large median plate interposed between the cavities of the fore coxae, carrying a pronounced median sulcus, from which is invaginated the basisternal carina. In Syrphidae the probasisternum is clearly differentiated along all its margins. It does not seem to join with propleural elements to form a precoxal bridge in any members of this fly family. On its anterior margin the probasisternum is in the mid-line contiguous with the sella or postsella of the cervical organ.

The profurcasternum is in syrphids a median, ventral, triangular sclerite (figs. 17—19), joined anteriorly to the probasisternum, from which it is delimited by a complex suture. It meets the mesothoracic presternum posteriorly, anterior to the point at which the latter plate disappears into the mid-ventral thoracic suture. In its anterior angles the profurcasternum bears the furcal pits from which the furcal arms are invaginated.

### Mesothorax: mesonotum

In Diptera the mesothorax is greatly expanded and makes up the main bulk of the thoracic surface. This expansion is presumed to be due to the need to accommodate the flight musculature associated with the fore wings, which are attached on this thoracic segment between pleural and tergal elements. Coincident with the expansion of the musculature has been differentiation of a complex endoskeleton, the *mesosternal apophy-*

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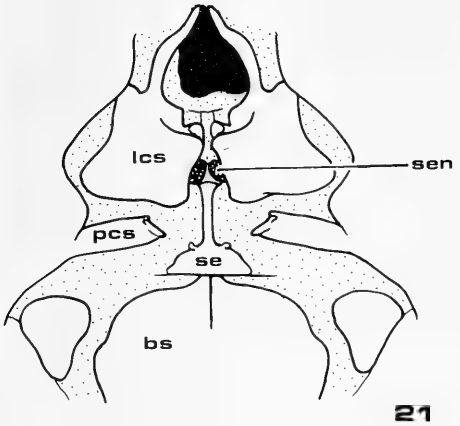


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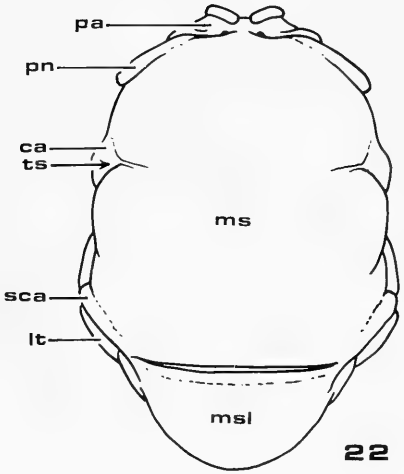


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Fig. 20, *M. mutabilis*, prothoracic region, anterodorsal view. Figs. 21, 22, *Syrphus ribesii*, cervical region, anteroventral view (21) and thorax, dorsal view (22).

*sis*, for muscle attachment. In most Diptera — including Syrphidae — almost the entire mesothoracic sternal region is invaginated into the thorax as the mesosternal apophysis.

Viewed from above, the Syrphid thorax is nearly all of mesonotal origin (fig. 22). The mesothoracic notum, or mesonotum, is made up of five sclerites. The most anterior of these is the *acrotergite*, possibly visible on the antero-dorsal face of the thorax in *Microdon* (fig. 20), but otherwise seemingly not discernible in Syrphidae. The acrotergite is followed by the *prescutum*, which is reduced to a pair of lateral, unconnected strips, running along the edge of the mesonotum from just above the prothoracic spiracle to as far as the transverse sulcus of the mesoscutum. These *prescutal strips* are usually just visible when the thorax is examined from the side (fig. 23), but are so reduced in *Microdon* as to be unrecognisable without first partially desclerotising the specimen. Even then they cannot be seen in side view, being concealed beneath the lateral edge of the mesoscutum.

The *mesoscutum*, generally known among taxonomists as the mesonotum, is the main mesonotal sclerite. Although its anterior and posterior sutures are incomplete, it is well differentiated laterally and includes the morphological features known taxonomically as the "notopleural area" (or "presutural area") and the "post-alar calli". The confusing term notopleural area (and associated terms notopleural depression and notopleural callus) is not used here, since the part of the thorax to which it refers is in origin mesonotal, not mesopleural. The alternative term of *presutural area* (and associated terms *presutural depression* and *presutural calli*) is used in its place. The mesoscutum carries a shallow trans-

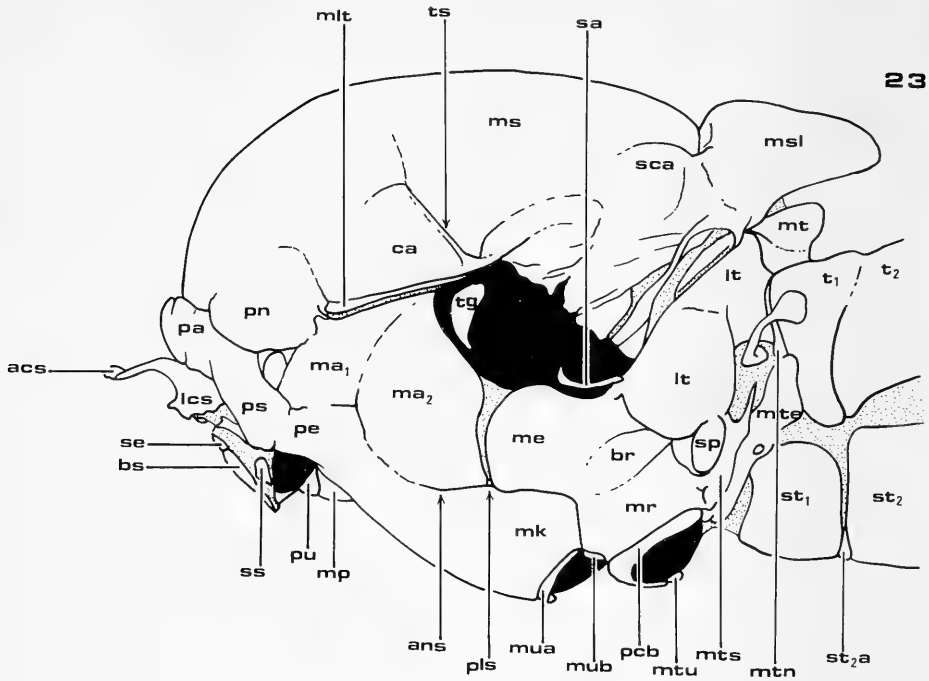



Fig. 23, *S. ribesii*, thorax, lateral view, left side.

verse gulley, just anterior to the wing base. A similar feature occurs in many different Diptera and has been given various names: transverse suture, lateral parapsidal suture, scutal suture, transcutal suture. Since, according to Matsuda (1.c.), this feature is intra-scutal and thus does not mark a joint between sclerites, it should ideally be termed a sulcus, following Snodgrass (1960). Diptera may carry up to three distinct transverse sulci on the mesoscutum, but Syrphidae luckily only exhibit one, so whatever its homologies (see McAlpine, 1981), it can conveniently be called "the *transverse sulcus*," which is the term used for it here. At the outer ends of the transverse sulcus of the mesoscutum, *Microdon* possesses a pair of shelf-like, semi-circular, sclerotised outgrowths of the mesoscutum, which do not seem to have an equivalent in other Syrphids. The prescutal strips are beneath these mesoscutal flanges.

Posteriorly, the suture marking the mesoscutal junction with the succeeding mesonotal sclerite, the scutellum, has been lost. The very deep and well-marked trans-scutellar sulcus is located *within* the mass of the original mesoscutellum: (see Matsuda, (1.c.), so that some indeterminate portion of the hind part of the "mesonotum" of taxonomists is scutellar in origin. In syrphids the hind part of the mesoscutum differentiated by the transscutellar sulcus protrudes from the posterior end of the dorsal thoracic surface as a well-defined semi-circular lobe, generally called the scutellum by taxonomists. Here, this feature is called the *scutellar lobe*. In some genera its outer (postero-dorsal) edge is tuberculate or crenulate. Ventral to the scutellar lobe is the median plate of the most posterior of the mesonotal elements, the *mesopostnotum* (also known as the mediotergite, or subscutellum or postscutellum), flanked by its two lateral sclerites (figs. 23, 24). These are the *lateral post-nota* of the mesonotum, also known as the laterotergites (or pleurotergites). Some authorities, e.g. Colless & McAlpine (1970), currently regard these postnotal sclerites as derived from the acrotergite originally interposed between mesonotal and metanotal elements, rather than from the mesonotum.

The *median postnotum* is normally a convex

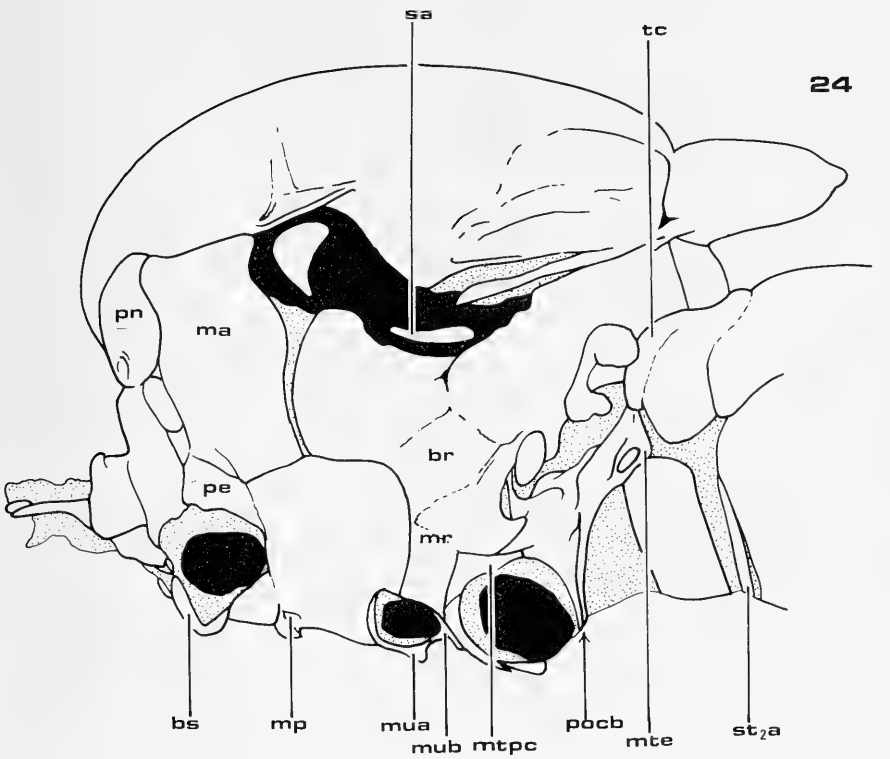



Fig. 24, *Microdon mutabilis*, thorax, lateral view, left side.

plate in *Syrphus* and its relatives (fig. 23), pushing out into a distinct lobe. But in *Microdon* (fig. 24) it is unusually flat. The lateral post-nota form shallow calli just dorsal to the metathoracic spiracles, but continue towards the mid-line beyond these calli to a point where an unobtrusive suture marks their junction with the median postnotum. Antero-dorsally, the lateral postnota border the posterior part of the wing-base complex of axillary sclerites. Postero-ventrally, the lateral post-nota border the similar, but physically much smaller, complex of sclerites round the base of the haltere. The massive second thoracic phragma attaches directly to the hind margin of the median postnotum and passes down internally to form the sclerotised hind wall of the functional thorax. The second phragma stops just short of the floor of the thorax, immediately above the membraneous strip between hind coxae and first abdominal sternite that acts as a thoracic/abdominal flexion joint. Certain small, detached sclerites located in the axillary complex are believed to be derived from the mesonotum. These include the *tegula*, *humeral plate*, *4th axillary sclerite*, and *subalare*. They are dealt with in that portion of the present text concerned with the wings.

### Mesothorax: mesopleura

The pleural sclerites of the second thoracic segment exhibits in Diptera a bewildering array of bumps, hollows and grooves, some of which represent primary subdivisions of the pleura and most of which have been employed as taxonomic characters at some time or another. In Syrphidae, most of the side of the thorax is mesopleural in origin. The largest recognisable entity is the *mesepisternum*. The anterior margin of this sclerite is marked by the posterior edge of the prothoracic spiracle, from which an incomplete suture extends towards the fore coxae, the me-

sepisternum being fused with propleural elements ventrally. In the mid-line ventrally, the mesepisterna meet along the line of the mid-ventral suture, which terminates anteriorly in the mesofurcal pit. Posteriorly, the upper part of the edge of the mesepisternum is marked by the vertical membraneous strip of the pleural suture. The pleural suture continuous downwards as a well-marked groove, taking a zig-zag course toward the mid-coxae. The lowest (third) section of the suture is unusually complete in Syrphidae, being especially well-marked in *Microdon* (fig. 24). Dorsally, the margin of the mesepisternum is indicated by the suture delimiting mesonotal elements and by the membraneous area round the wing-base containing the axillary sclerites (some of which are mesepisternal in origin).

Within the mesepisternum, various subdivisions may be recognised. From the ventral end of the upper (first) section of the pleural suture the incomplete anapleural suture proceeds forwards, dividing the mesepisternum into a dorsal *anepisternum* (the "mesopleuron" of taxonomists) and a ventral *katepisternum* (see McAlpine, 1981, for reasons why the ventral area of the mesepisternum delimited by the anapleural suture should be regarded as *kat*-episternum rather than *pre*-episternum). The katepisternum is the "sternopleuron" of taxonomists. The anepisternum may be further differentiated into an antero-dorsal flat area (the "anterior depressed portion of the mesopleura" of Coe, 1953, and the "anterior flat portion of mesopleuron" of Vockeroth, 1969), and a shallow more posterior callus (fig. 23). These fields of the anepisternum are frequently mentioned independently in taxonomic texts but do not seem to have been named, other than by Speight (1980), where they were referred to as mesopleurite 1 and mesopleurite 2. They would be better called *anepisternite 1* and *anepisternite 2*, and these terms have been used to denote them here.

The *mesothoracic epimeron* is clearly delimited anteriorly by the pleural suture. Posteriorly its edge is marked by the suture between it and the lateral postnotum of the mesonotum. Ventrally, it is fused with a plate regarded as the mesothoracic meron, to produce a composite sclerite known as the *meropleurite*. In Syrphidae the mesepimeron and the meropleurite are hardly differentiated from each other by sutures. The upper part of the mesepimeron corresponds more or less with the "pteropleuron" of taxonomists. It is flat above but exhibits a transverse callus below, just above where its junction with the meropleurite is probably located. The flat part is regarded by McAlpine (1981) as the mesepimeral anepimeron and the callus as the mesepimeral katepimeron. The callus is of taxonomic significance and by taxonomists has been called the *barrette*, a term used for it here. The meropleurite corresponds roughly with the "hypopleuron" of taxonomists, though the term hypopleuron has been applied in such a way that it also includes metapleural elements.

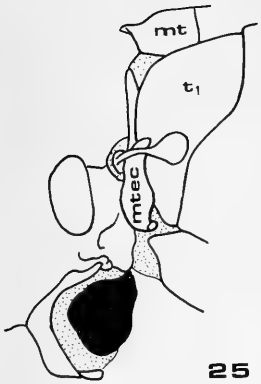
### Mesothorax: mesosternum

Mesosternal elements are surprisingly well represented externally in Syrphidae — in Schizophora the mesosternum is, almost in its entirety, invaginated into the thorax. In the three syrphids illustrated here (figs. 26—28) the mesosternal *presternum* is clearly differentiated from the preceding prothoracic furcasternum and invaginated posteriorly into the mesofurcal pit at the beginning of the mid-ventral thoracic suture. Laterally, the meso-presternum meets mesepisternal elements, from which it is less clearly separated. The two wings of the anterior *mesosternal furcasternum* each occur externally as a narrow strip along the anterior rim of the mesocoxal cavities, dipping down into the midline to reappear posteriorly as the ventral *coxal condyles*, articulating with the median mesocoxite (figs. 26—28). The *posterior mesosternal furcasterna* make a hind rim to the mid coxae. These external furcasternal elements are continuous internally with the massive mesofurca, without indications of sutures interposed, thus reducing the probability that they might be better interpreted as some vestige of a mesopleural trochantin.

### Metathorax

The metathorax is proably the least studied region of the external anatomy of Diptera and apart from the remarkable paper of Young (1921) has been largely ignored in the literature.

Whatever elements may have once been present in the *metanotum*, it is represented in Syrphidae solely by a narrow hoop-like sclerite evanescent medially in some genera, hugging the antero-dorsal face of the abdomen but invaginated along its anterior edge into the suture marking externally the position of the second thoracic phragma (figs. 41—43). Due to its location it is often only visible at its dorso-lateral corners, when the abdomen is viewed from above. In side view it can be quite concealed on the front of the abdomen, by a forward bulge of abdominal tergite 1, as in *Microdon* (fig. 24). In

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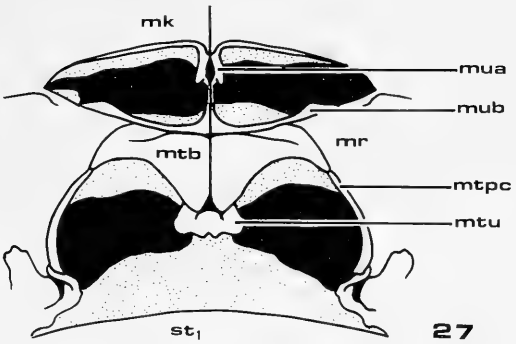


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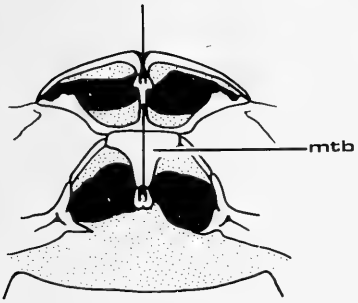


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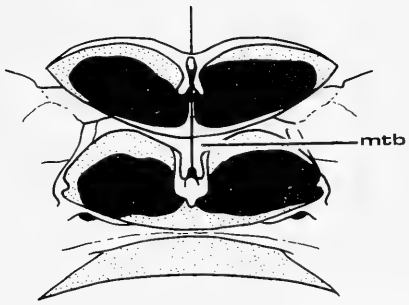


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Fig. 25, *Eristalis tenax*, thorax, region surrounding the haltere, lateral view, left side. Fig. 26, *Syrphus ribesii*, meso and methathoracic sterna, ventral view. Fig. 27, *Eristalis tenax*, meso and meta thoracic sterna, ventral view. Fig. 28, *Microdon mutabilis*, meso and methatoracic sterna, ventral view.

*Syrphus* (fig. 41) the metanotum bears a distinct transverse groove which could represent the suture between two of the original metanotal sclerites. Equally, this groove might be a secondary feature. No attempt has been made to identify subdivisions of the metanotum. Laterally, the metanotum fuses with metapleural elements, the junction being in some instances, e.g. *Syrphus*, distinctly marked.

The metapleura comprise an *episternum,* an *epimeron* and a *precoxale*. The met-episternum is imperfectly demarkated from both mesothoracic meropleurite anteriorly and metathoracic epimeron posteriorly and can only be detected clearly immediately posterior and ventral to the metathoracic spiracle. In some genera the metepisternum appears to contact the lateral postnotum of the mesonotum behind the metathoracic spiracle (see *Eristalis*, fig. 25), but in others membrane of the haltere axillary complex intervenes (see *Microdon*, fig. 24). Ventrally, the metepisternum may, in combination with the metepimeron, form a postmetacocal bridge (fig. 28).

The metepimeron, as interpreted here, exhibits some unlikely characteristics. That it is incompletely delimited from the metepisternum has already been mentioned. Postero-ventrally, the metepisternum is bordered by membrane interposed between it and abdominal sternite 1. In forms lacking a postcoxal bridge this membrane is continuous with that of the meta-coxal cavities. In some syrphids, the metepimeron bulges postero-dorsally into a distinct callus on the front margin of the first abdominal tergite (fig. 25),

from which it is separated by reflexed membrane. This metepimeral callus is frequently visible from above as an angular projection on the outer, anterior corner of tergite 1, and is especially visible in *Neoascia* (fig. 44) where it is developed into a massive spine — illustrated in Stackelberg (1965) as apparently part of abdominal sternite 1. The metepimeron frequently encloses the first abdominal spiracle at its lower edge (figs. 23—25). In *Microdon* and *Ceriana* this callus is lacking, but the first abdominal spiracle is still enclosed by the metepimeron in European species of these genera. In *Eristalis*, the first abdominal spiracle occurs partly in the metepimeron and partly in the adjacent abdominal membrane. Zumpt & Heinz (1949) regarded the metepimeral callus of *E. tenax* as either a secondary sclerite or a part of abdominal tergite 1.

The metacoxal precoxale is a narrow sclerotised strip clearly differentitated round the lateral rim of the metacoxal cavity. At its posterior end it reaches the lateral condyle of the metacoxa. Anteriorly, it joins with the metabasisternum in most hoverflies, to form a composite sclerite making a precoxal bridge round the metacoxae. It retains its identity independent of the metabasisternum in *Melanostoma* and *Sericomyia*.

The principal metasternal sclerite is the metabasisternum, a mid-ventral plate located between and anterior to the hind coxae. It is deeply grooved in the mid-line and frequently fused with the metaprecoxale laterally, as described above. The premetacoxal bridge thus developed is frequently called the "metasternum". Its particular make-up requires that it be given some morphological appelation such as metabasisterno-precoxite — not a term likely to be met with general approval! For want of a more appropriate alternative this composite structure is referred to here as the *premetacoxite*. With the postmetacoxal bridge, the premetacoxal bridge forms in some syrphids, e.g. *Sphegina*, a pronounced conical bump protruding postero-ventrally from the underside of the thorax.

The other external sclerite of the metasternum is the vestigial furcasternum, projecting from within the thorax to form the *ventral meta-coxal condyles*, to either side of the mid-line just posterior to the tip of the metabasisternum.

## WINGS

In Diptera only the fore wings (hereafter referred to as "the wings") remain as organs of flight, the hind wings being modified into gyroscopic organs known as the halteres. As described in preceding pages, the wings and the halteres are located on the side of the thorax between tergal and pleural elements. Externally, the junction between wing and thorax is marked by a cluster of axillary sclerites and associated membrane, which may be referred to as the axillary complex. The haltere base has a corresponding axillary complex.

The wing itself is a largely transparent sheet of membrane, traversed by a series of sclerotised bars, the wing-veins, radiating from the wing-base. In syrphids there are six major wing veins. Those radiating into the middle area of the wing branch one or more times before reaching the wing margin. Occasional cross-members are also present, termed cross-veins. The wing-membrane is in some genera banded or blotched with brownish pigment and may be all or in part covered by microtrichia. The most posterior fields of the wing-membrane are largely separated from the main body of the wing, going to form the *alula* and, folded beneath the wing-base, the *calypters* (fig. 31).

Attempts have been made by morphologists and taxonomists alike to homologise the main fields of the wing-membrane and the main wing-veins, throughout the various Orders of insects. The wing-vein notations resulting have been largely incompatible, but nonetheless many authors have adopted hybrid wing-vein terminologies based partly on one theory and partly on another. Wootton (1979) provides an able review of the present chaos, which affects syrphid wing-venation notation along with that of other Diptera. Goffe (1947) attempted to derive a stable system for naming syrphid wing-veins, but unfortunately the notation he proposed is a confusing hybrid. Alternative notations, differing from one another to a greater or lesser extent, can be found in Coe (1953), Colles & McAlpine (1970), McAlpine (1981), Matsuda (1970), and Seguy (1959, 1961), etc. In the present account, Colless & McAlpine (1970) are followed, with modifications suggested by Wootton (1979).

The nomenclature of the three most anterior longitudinal wing-veins, named here the *Costa*, *Subcosta* and *Radius*, is reasonably stable in Diptera. However, the next vein, the *Radial Sector*, has anomalously usually been labelled as though its branches were branches of the Radial. That convention is not adopted here, following Wootton's recommendation. The following three veins, here named the *Median*, the *Anterior Cubitus* and the *Posterior Cubitus* have been much

confused, the appropriate designations for distal branches which could be derived from either the Median or the Anterior Cubitus (or represent cross-veins — see below) remaining today almost a matter of personal opinion. The vein regarded here at the Posterior Cubitus has been omitted from illustrations of syrphid wing-venation by some authors, e.g. Oldroyd (1970). The *First Anal* vein as recognised here is labelled as such in most recent literature, but Wootton (1979) suggests the cubito-anal area of the wing may well have been misinterpreted by dipterists, and the true anal veins may well be confined to the alula in Diptera. Elucidation of that problem awaits further work, as Wootton (1.c.) himself says, so the more traditional approach to the identity of the First Anal has been adopted in the present text.

The more basal cross-veins of the syrphid wing have generally received the same designations, but there are differences of opinion as to which of the more distal cross-veins are actually transverseley deflected branches of longitudinal veins. Thus the vein labelled here as an anterior branch (M.1) of the Median, has been called the "upper marginal cross-vein" and the vein labelled *marginal cross-vein* has often been regarded as a branch of the Anterior Cubitus.

The areas of membrane entirely enclosed by wing-veins comprise the "cells" of the wing. One approach to naming wing-cells is to number them from the anterior margin of the wing backwards. An alternative approach is to designate them according to their position on the general wing-surface, a system which gives rise to costal cells, basal cells, marginal cells, etc. This system, as laid out in Oldroyd (1970) is employed in the present account (fig. 29). Neither system is very satisfactory because of the problems of homology of wing-cells in fly families — like the Syrphidae — in which few wing-cells are present.

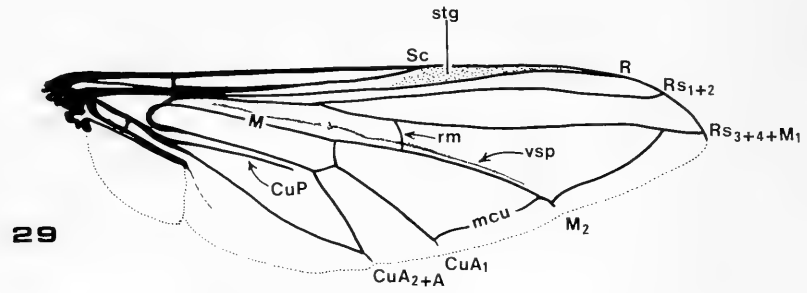
A venational characteristic of Syrphidae, mentioned almost universally in the literature, is the *vena spuria*. This secondary strengthening of the wing membrane lies between the Radial Sector and Median veins and is more or less parallel with the latter. Almost invariably it crosses the *radio-median cross-vein* into the *posterior cell,* but most of its length is found in the *first basal cell* where it may proceed almost as far as that cell's inner end. Although popularly regarded as one of the most characteristic features of the Syrphidae, the vena spuria is entirely absent in some species, for example, *Syritta flaviventris*.

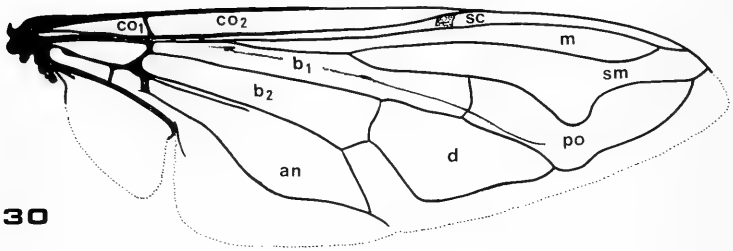
According to Wootton (1.c.), in Diptera the area of the wing posterior to the 1st Anal vein and including the *alula* is homologous with the *claval field* recognised in other insects. The *jugal field* is then represented by the *calypters*. The cleft between the alula and the main body of the wing is generally termed the *axillary incision*. The alula is a simple membraneous flap, its only venation a vein-stub at its postero-basal corner. The calypters hinge onto the base of the wing via the 3rd and 4th axillary sclerites (fig. 31). The upper calypter is folded over the lower when the wing is at rest, but when the wing is stretched out, as in the illustration (fig. 31), their relation to the rest of the wing membrane can be better appreciated. The rim of each calypter is somewhat sclerotised and bears a thick fringe of long hairs.

The axillary complex of the Syrphid wing-base has not been thoroughly investigated in the compilation of this account. Suffice it to say that there are four principal *axillary sclerites* in Diptera. The 1st and 2nd have been tentatively identified in fig. 31, following Matsuda (1970). The 3rd and 4th are easier to distinguish. Axillary sclerites 1—3 represent detached basal parts of the wing-veins (Matsuda, 1.c.), while the 4th is supposedly mesonotal in origin. On the front margin of the wing, two basal sclerites may be distinguished, the *humeral plate*, and the *tegula*. These are apparently homologous with the sclerites of the same name found in other Orders and are seemingly of mesonotal origin. A detailed account of the Dipteran wing-base complex is given by McAlpine (1981).

A final important feature of the axillary complex is the *subalare*. Although located beneath the wing-base, according to Matsuda (1.c.) this sclerite is of mesonotal origin. In Syrphidae it carries the *plumule*, a feature unique to the family. The plumule is a membraneous, finger-like appendage, thickly covered in long, fine, wavy hairs. It projects backwards from the posterior tip of the subalare and thus lies closely opposed to the underside of the lower calypter. It is an easily seen feature in all syrphids except *Neoascia* and Microdontinae, where it is rudimentary and represented only as a rather hairy tip to the subalare, and in *Ceriana/Sphiximorpha*, where it is not recognisable. In *Myathropa* it reaches an opposite extreme of development, the entire outer rim of the subalare giving off small, plumulate appendages.

According to Bonhag (1949) and Mickoleit (1962), who worked on *Tabanus* and *Tipula*, respectively, the haltere base possesses clustered



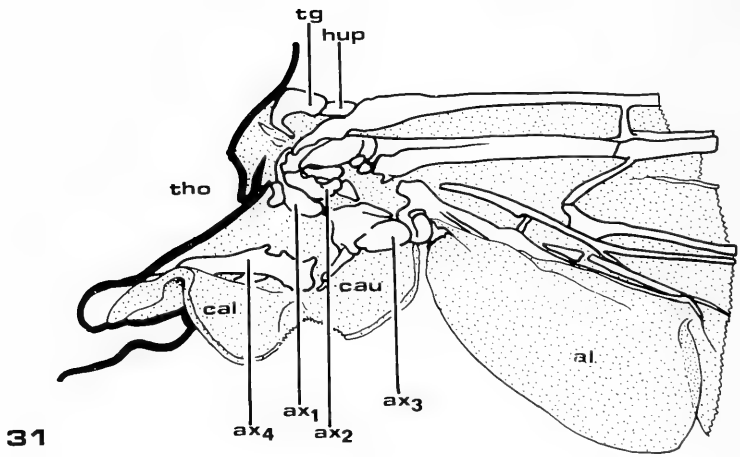




Fig. 29, *Syrphus ribesii*, right wing. Fig. 30, *Eristalis tenax*, right wing. Fig. 31, *Syrphus ribesii*, axillary region of right wing.

around it miniaturised versions of the axillary complex sclerites found round the base of the fore wings, but the haltere base sclerites do not seem to have been examined in any species of Syrphidae and they have not been investigated for the purposes of the present account. The haltere itself is a roughly dumbell-shaped structure broadening rather abruptly at the distal end of its stalk into the head or knob and more gradually at its base.

## LEGS

The legs of syrphids comprise the following elements; *coxa*, *trochanter*, *femur*, *tibia*, five tarsal segments (or tarsomeres) and *pretarsus*, typified by the fore leg of *Syrphus* shown in fig. 34. The fore and hind coxae are single sclerites, fully mobile and articulated basally to the thorax, apically to the trochanter. The mid coxa, however, is made up of three separate sclerites or coxites (fig. 36). The *anterior mesocoxite* is fused to the thorax, but the *posterior* and *median mesocoxites* are mobile. The median mesocoxite articulates with the mesothoracic furcasternum via the coxal condyle and also with the other two mesocoxites. The posterior mesocoxite articulates with the anterior mesocoxite as well as with the median mesocoxite.

Almost universally in Syrphidae — *Microdon* representing the exception — there is a long, blade-like process projecting outwards from the antero-lateral end of the outer side of the posterior mesocoxite. This blade-like process, termed here the *trochanteral process of the posterior mesocoxite* (figs. 35, 36) fits into a shallow hollow on the surface of the mesotrochanter, when the leg is in certain positions.

In all three pairs of legs the segments from the trochanter outwards (inclusively) are all individual sclerites, essentially tubular and articulated to each other. Only the pretarsus is more complex. This, the terminal leg-joint, is attached within the concave end of the most distal (the fifth) tarsal segment. The pretarsus includes a central process terminating in a bristle-like or peg-like *empodium*, flanked by a pair of membraneous pads known as the *pulvillae*, which are themselves attached to the central process via small sclerotised plates called the *auxilliae* (fig. 37). The lower surface of each pulvillus is in syrphids densely covered in short hairs. Above the pulvillae are found a pair of simple *claws*, which attach to a median apical projection of the 5th tarsal segment known as the *unguifer process*.

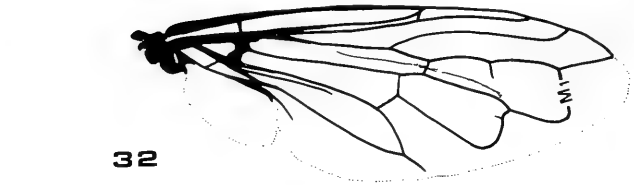
The first tarsal segment is usually referred to as the *basitarsus* or (confusingly) as the metatarsus. The undersides of the tarsal segments, in particular, carry arrangements of short, blunt bristles used in cleaning the body surface and the hind basitarsi have a ventral brush of close-packed bristly hairs used for this same purpose.

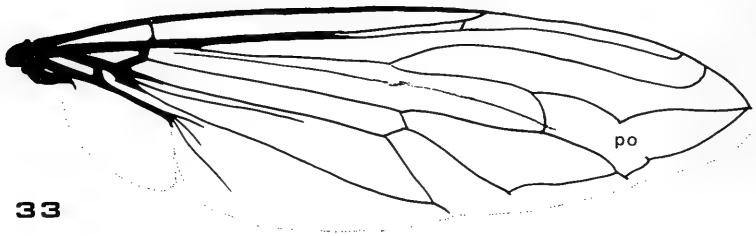
Although the number of leg segments remains the same throughout the family, in a significant number of genera one or more of the leg segments are modified in form, the modifications in nearly all cases being more pronounced in the males than in the females. In some genera, such as *Platycheirus*, in which the male fore tarsal segments are flattened and expanded laterally, the vast majority of species exhibit the same general type of modification. In others only single species may be affected — thus *Sphegina platychira* males possess flattened tarsal segments reminiscent of those of species of *Platycheirus*, but the tarsi of other *Sphegina* species are unmodified. Almost any part of the leg may be affected by such modifications in Syrphidae, though usually segments of either fore or hind legs are involved. Rarely, as in *Neocnemodon latitarsis*, all three pairs of legs have some segments modified. In the male of *N. latitarsis* the fore basitarsi exhibit a large pit on one surface, the mid-tibiae are expanded into a leaf-like flange for about half their length and the trochanters of both hind and mid legs carry pronounced tines (fig. 39), as do the hind coxae. A frequent modification of the hind legs is for the hind femora to become bulbous and carry some arrangement of pegs and or tubercles and for the hind tibiae to become angular and ridged (fig. 40).

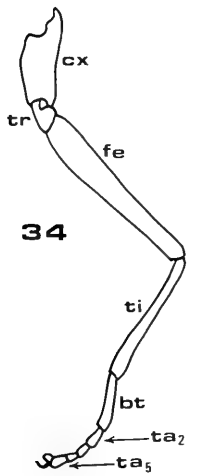
## THE ABDOMEN

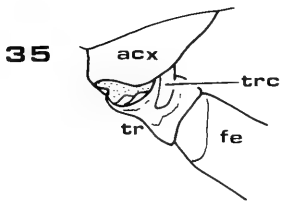
There is great sexual dimorphism in the form of the terminal segments (and occasionally in the form of some of the more anterior segments as well) of the syrphid abdomen, requiring that the male and female abdomen be given detailed consideration separately. In the male the abdomen is divided into two distinct sub-regions, a largely unmodified "preabdomen" and a highly modified "postabdomen". Equivalent terms are not used in relation to the female abdomen. Certain features of the abdomen common to both sexes may be considered at this juncture.

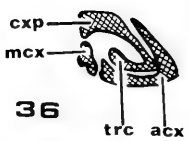
As viewed from above, the overall shape of the syrphid abdomen exhibits considerable variation. It may be conical, parallelsided, ovate or petiolate. These shape differences are due largely to



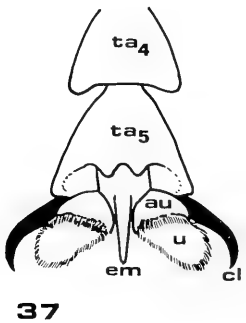




Fig. 32, *Microdon mutabilis*, right wing. Fig. 33 *Ceriana* sp., right wing. Figs. 34—36, *Syrphus ribesii*, left fore leg, anterior view (34), male, base of left mid leg, antero-lateral view (35) and diagrammatic representation of mid coxa to show inter-relation between the three meso-coxites. Fig. 37, *Microdon mutabilis*, pretarsus and last two tarsomeres of left hind leg, ventral view.

intergeneric differences in the *shapes* of the visible abdominal tergites, rather than to differences in the number or identity of the sclerites in view. The number of visible tergites is four or five in the male and generally five or six in the female.

The first abdominal tergite (t.1) is largely fused with the second (t.2) in Syrphidae, though the junction between the two sclerites is usually evident. The anterior margin of t.1 is frequently complex, since in most syrphids the flexion line between thorax and abdomen passes through it, as in *Eristalis* and *Syrphus* (fig. 41). In such cases there is a median area of t.1 which reaches forwards to the metanotum, flanked by narrower lateral areas of t.1 which do not reach the metanotum and are partly separated from the median area of t.1 by an incomplete, transverse membraneous cleft. *Paragus* (fig. 42) is an exception. In this genus the anterior margin of t.1 is straight and membrane intervenes between it and the metanotum across its entire width, leaving the abdomen noticeable more capable of flexion than in most other genera. A prominent feature of certain genera, such as *Ceriana*, is a pair of antero-laterial calli on t.1, giving the impression that an extra sclerite is present on the front margin of the tergite (fig. 43).

Tergite 2 is a large sclerite with the joint between it and tergite 3 (t.3) usually clearly marked. The actual anterior margin of t.3 is concealed beneath the hind margin of t.2, the two tergites being joined to each other by folded membrane. This type of junction is common to succeeding tergites except (e.g. in *Microdon*) where two tergites are fused to each other: tergites 2 and 3 are fused in *Paragus*; tergites 3 and 4 are fused in *Microdon*. In *Triglyphus* tergite 3 is greatly expanded, occluding t.4 and t.5 from view.

With the exception of the first, the abdominal spiracles are always found in the membraneous strip between tergites and sternites. The first abdominal spiracle is more often than not enclosed within the metathoracic epimeron which is (as described earlier) in part functionally a component of the abdomen, together with the metanotum. In *Microdon* it was only found possible to locate the 1st abdominal spiracle during the course of this study.

The abdominal sternites are generally rather poorly sclerotised rectangular sclerites with rounded corners, lying free in the membrane of the underside of the abdomen. The 1st abdominal sternite may be largely desclerotised and much reduced. The second abdominal sternite (st. 2) is divided in two by a transverse membraneous strip. The sclerotised anterior part of st. 2 then appears in some genera, e.g. *Microdon*, as a separate, narrow plate lying along the entire anterior edge of the main sclerite (fig. 48). In *Eristalis* and *Syrphus* (fig. 47) this anterior plate of sternite 2 is a lunulate piece confined to the middle half of the width of st. 2. In *Sphegina clunipes* (fig. 45) the two sclerotised parts of sternite 2 are separated from each other by an appreciable distance, though the intervening membraneous section of the sternite evidently connects them to each other.

### Male abdomen

In Diptera the male abdomen is regarded as comprising eleven segments (numbered from the thorax to the abdomen tip). In the Cyclorrhapa in general there is extensive modification of segments 6—10 in the male due to their incorporation into the copulatory apparatus. Segment 11 is rudimentary, represented only by the cerci (which flank the anus). The term "preabdomen" is used to denote the unmodified portion of the male abdomen and "postabdomen" to refer to the modified portion. Zumpf & Heinz (1949) have argued that the postabdomen commences with segment 5 in *Eristalis*, since it structure is also greatly modified by involvement in the copulatory apparatus. Thompson (1972) points out that defined in this fashion the preabdomen comprises but four segments throughout the Milesiinae, but is found in its more usual 5-segmented form throughout the Syrphinae. The sclerites of the male postabdomen have become markedly asymmetrical, associated with a twisting or torsion of the segments on the long axis of the abdomen and a progressive recurvature of them such that when at rest the terminal segments now face the front of the fly.

The sclerites representing the abdominal segments distal to segment 8 are in male Syrphidae highly modified to form a genital capsule or *hypopygium*, incorporating a complex intromittent organ and accessory structures, together with the anus and its flanking cerci. The hypopygium is concealed beneath the terminal tergites of the preabdomen when at rest, in a hollow termed by Cole (1972) the genital pouch.

### Male preabdomen

In species of genera such as *Melanostoma* and *Neoascia* there are distinct though minor differences in abdominal shape between males and females, produced by differences in the propor-

tions of tergites 1—4 (fig. 44). More subtle differences in the overall appearance of male and female abdomen occur in other genera, produced in the same way. Quite precise differences between male and female occur in the form taken by abdominal sternites in some genera, notably *Speghina*, *Neocnemodon* and *Eumerus*, where particular sternites of the male preabdomen exhibit structural modifications. The modifications may be in the form of sclerotised outgrowths along the mid-line, as in *Neocnemodon latitarsis* (fig. 46) or paired lobes developed on the distal margin of some sternite, as in *Eumerus*.

## Male postabdomen

Literature accounts of the degree of torsion exhibited by the abdomen of male Syrphidae are confusing, since in most instances it is stated that syrphids possess a *hypopygium inversum* or *h. retroversum*, but more recently it has been claimed they show the *h. circumversum* condition. The most explicit discussion of these conflicting views is found in Griffiths (1972: 56) as follows: Failure to appreciate the conceptual difference between rotation and deflexion has led to some confusion in the literature on Syrphidae, which I illustrate from the work of Zumpt and Heinz (1949). Zumpt and Heinz state that in *Eristalis*, "we are dealing with a *hypopygium inversum*, thus apparently contradicting the view (which I hold correct) that all Cyclorrhapha possess a *hypopygium circumversion*. However, if Zumpt and Heinz's arguments are followed closely, it will become apparent that they have confused rotational movement and deflexion. The hypopygium of *Eristalis* is "inverse" in the sense that it is so strongly deflexed that it points anteriorly and its "dorsal" side has become ventral."

To indicate the complex derivation of the orientation of the hypopygium found in Syrphidae, which his torsion theory demands, Griffiths (1.c.) suggests the term *hypopygium circumversum et reflexum* be used to describe the condition of the syrphid postabdomen. Lehrer (1971a) reached conclusions different again from those of Griffiths, dubbing the condition of the syrphid male postabdomen as a *hypopygium inversotransversum*.

Whether the post-abdomen has twisted through 360° or 180°, the twisting has occurred anterior to the hypopygium. It is presumed to have occurred *between* segments, such that if a twist of 180° occurred between a given pair of segments, the *tergite* of the distal segment of the pair would subsequently face outwards from the same surface as the *sternite* of the more proximal segment, and vice versa.

Griffiths' (1.c.) contention that a 360° torsion has occurred requires, in his view, a 180° twisting between segments 7 and 8 and a further 180° twisting between segment 8 and the hypopygium. The more traditional approach of Zumpt & Heinz (1949) contends that a 90° twist has occurred between segments 5 and 6 and a second 90° twist between segment 8 and the hypopygium. Lehrer (1.c.) suggests there has been 180° of torsion between abdominal segments 5 and 6, a further 90° of torsion between segment 8 and the hypopygium and a reflexion of the hypopygium from the longitudinal axis along which the segments up to and including segment 8 are aligned. He also points out that the hypopygium has in the latter process been pushed to one side.

In the present text, Griffiths' (1.c.) hyptothesis of 360° torsion in the syrphid male postabdomen is regarded as unproven and the views of Zumpt & Heinz (1.c.) and of Lehrer (1.c.) are regarded as each in part correct. It is presumed that 90° of torsion has occurred between segments 5 and 6 and a further 90° between segment 8 and the hypopygium, leaving segments 6—8 on their sides and the hypopygium inverted. Subsequent *reflexion* of the postabdomen, progressively more complete from segment 7 onwards, has then led to the present state of the abdomen. The superfluity of complex — and different — latinisms, each deemed to define precisely the *same* features of the male syrphid postabdomen, suggests that the practice of deriving such terms is a redundant exercise and no such term is employed here. Detailed discussion of torsion of the male abdomen in Diptera may be found in Griffiths (1972) and McAlpine (1981).

Abdominal segments 5—8 in Milesiinae and 6—8 in Syrphinae are much modified by the torsion process, going to form the "stalk" at the end of which is born the hypopygium. In both subfamilies tergites 6—8 remain reasonably large, externally visible sclerites, but the other plates involved are reduced to poorly sclerotised transverse strips concealed on or at the base of the "stalk". Zumpt & Heinz (1949) provide a clear illustration of these sclerites, suggesting that at the base of the stalk on the right side of the abdomen an extra, secondary, spiracle-bearing sclerite has been developed. This they term the "intersegmental sclerite". Lehrer (1971a) demonstrates that this "intersegmental sclerite" is part of tergite 5, joined narrowly to the other

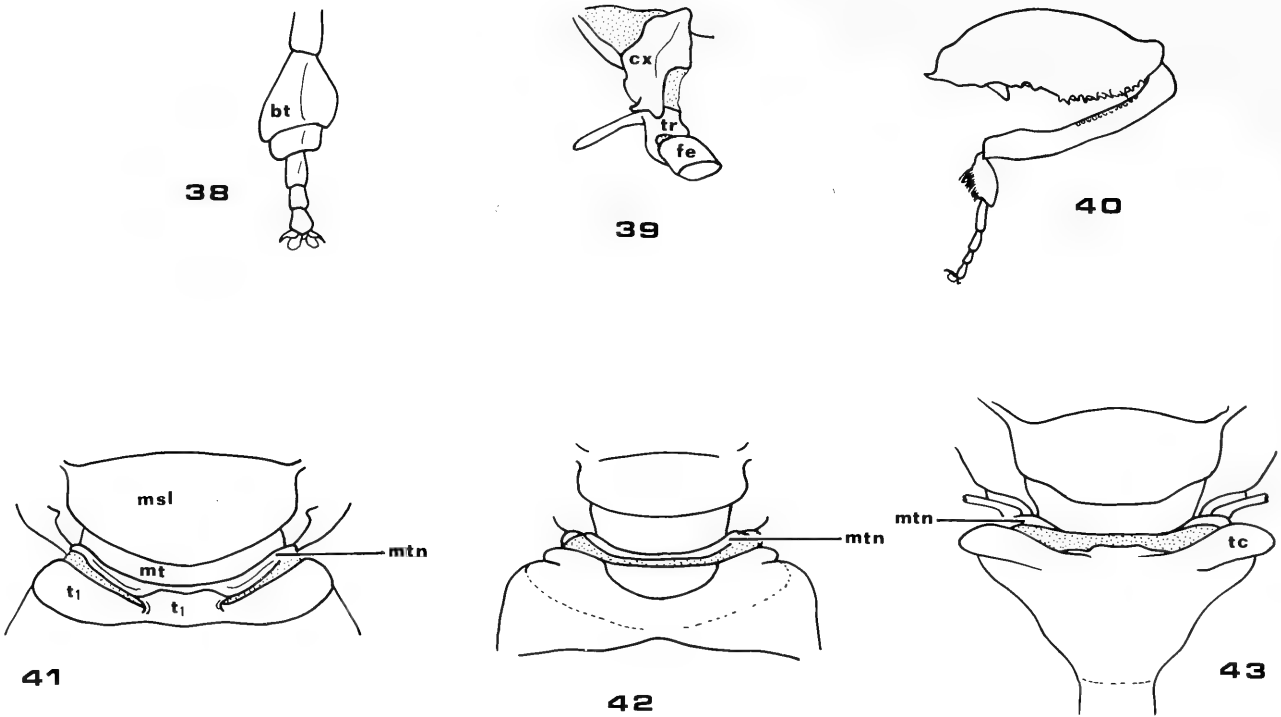



Fig. 38, *Platycheirus manicatus*, male, tarsomeres of left fore leg, dorsal view. Fig. 39, *Neocnemodon latitarsis*, male, base of left hind leg, lateral view of outer side. Fig. 40, *Syritta flaviventris*, left hind leg, lateral view of inner side. Fig. 41, *Syrphus ribesii*, junction between thorax and abdomen, dorsal view. Fig. 42, *Paragus bicolor*, junction between thorax and abdomen, dorsal view. Fig. 43, *Ceriana* sp., junction between thorax and abdomen, dorsal view.

elements recognised by Zumpt & Heinz (l.c.). Lehrer refers to these two elements of t.5 as hemitergites.

### Male postabdomen: components of the hypopygium

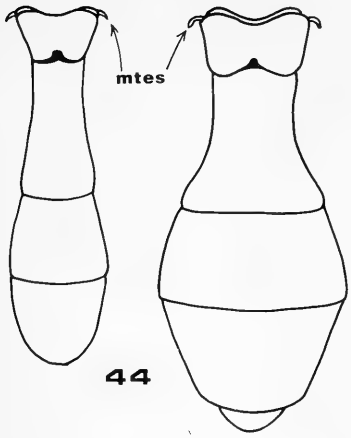
Unfortunately, a favourite "sport" of syrphid morphologists and taxonomists has been to develop their own individual theories on the homologies of the component sclerites and structures of the hypopygium, and to accompany each theory with its own set of names for the sclerites involved. For instance, the main external plate of the hypopygium bears on its outer end a pair of appendages, to be seen on either side of, and just distal to, the cerci. These appendages have variously been called dististyli, gonopods, gonostyli, ninth coxites, paralobi, styli and surstyli. Matsuda (1976) points out that attempts to homologise sclerites of the male ano-genital complex of one family of Diptera with those either of the genitalia of other Diptera or of the original segments of the abdomen of Insecta in general are almost inevitably doomed to failure, because (a) they do not arise ontogenetically from homologous primordia in different families, and (b) secondary structures with no antecedents elsewhere are found repeatedly. It would thus appear that to attempt to name all parts of the syrphid hypopygium in such a way as to suggest precise homologies for the individual sclerites is by and large pointless. The names employed in this text for parts of the hypopygium are chosen from among existing terms which do *not* suggest particular origins for sclerites. This approach is the converse of that employed by McAlpine (1981).

When at rest tucked into the end of the preabdomen (figs. 47, 48) the most obvious feature of the hypopygium is the convex rim of a scoop-shaped sclerite (behind which the other structures are hidden from view) bearing the closely opposed cerci in a membraneous cleft on its distal edge, which is oriented to point towards the head-end of the fly. This scoop-shaped sclerite is referred to here as the *basale*, which is joined round its basal rim to the distal rim of tergite 8. At the distal end of the basale, more or less flanking the cerci, are attached a pair of appendages here termed the *styli*. The styli are articulated to the basale rather than fused with it, and on the inner wall of the basale are continuous with a weakly sclerotised plate here called the *minis*. They may be simple, thumb-shaped pieces, as in *Eristalis* (fig. 51), or more complex structures with more than one lobe.

The main structure concealed within the basale when the hypopygium is at rest is the *theca*. The theca is essentially a sclerotised tube containing the aedeagus, but it usually carries sclerotised terminal lobes of some complexity which vary considerably in their form from species to species and genus to genus. The theca articulates to the inner edge of the basal rim of the basale. The terminal lobes of the theca are the *lingula* and the paired *superior lobes*. In its simplest form the lingula is a digitate or pointed projection, as in *Syrphus* (fig. 49). It may also be absent, as in *Eristalis* (fig. 51). The paired superior lobes may be either articulated to or fused with the main body of the theca. In many Syrphinae they articulate to cuticular outgrowths of the theca known as the *lateral arms* (fig. 49). In *Microdon* the theca is largely membraneous and carries no structure that could be homologised with either lingula or superior lobes (fig. 50).

Three principal elements have been identified in the syrphid aedeagus. The most distal of these is the *tubus*, most often a weakly sclerotised, trumpet-shaped sclerite, which protrudes beyond the end of the theca (fig. 49). The tubus may be entirely lacking (e.g. in *Eristalis*, fig. 51). The tubus passes down into the *pyxis*, a roughly ring-shaped sclerite which sits in the mouth of the theca, with which its outer edge articulates. The pyxis may itself carry a pair of sclerotised, rather hook-like outgrowths known as the *harpes*, which often project from within the theca (fig. 51). Beneath the pyxis and articulated to it is the aedeagal apodeme, the tip of which is external and may be visible within the theca (fig. 49). *Microdon* again differs significantly from other hoverflies in possessing a pair of simple, whip-like sclerotised tubes as the sole aedeagal structures protruding from and contained within the theca. Metcalf (1921) recognised a structure deep within the hypopygium of *Microdon* as homologous with the pyxis of other syrphids.

This rather basic account of the principal components of the syrphid hypopygium falls far short of providing a reasonable indication of the range of variation they exhibit in different hoverflies. But in this one family of flies these structures exhibit a quite remarkable range of forms and the male genitalia of many syrphid species have been illustrated elsewhere recently: see Dusek & Laska (1964, 1967), Gaunitz (1960, 1966, 1969), Glumac (1960), Goeldlin (1976), Hippa (1968, 1978), Metcalf (1921), Thompson (1972), and Vockeroth (1969).

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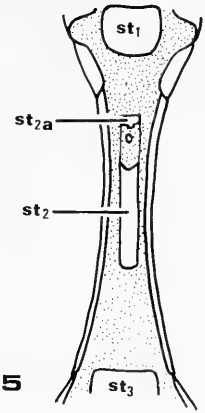


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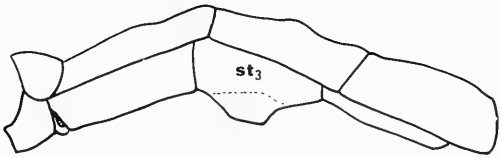


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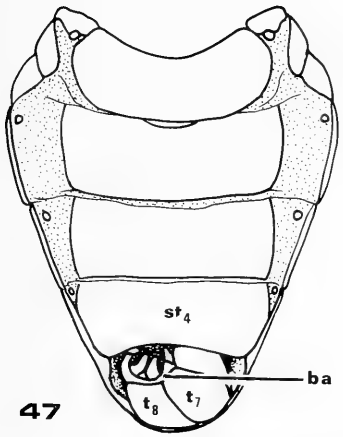


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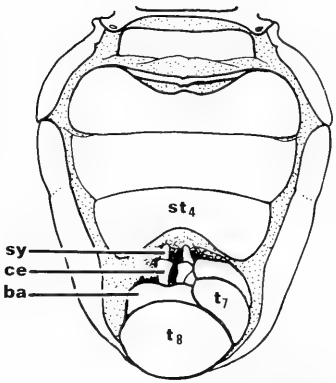


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Fig. 44, *Neoascia podagrica*, male (left) and female (right), abdomen, dorsal view. Fig. 45, *Sphegina clunipes*, female, base of abdomen, ventral view. Fig. 46, *Neocnemodon latitarsis*, male, basal abdominal segments, lateral view, left side. Fig. 47, *Eristalis tenax*, male abdomen, ventral view. Fig. 48, *Microdon mutabilis*, male abdomen, ventral view.

Female abdomen

Matsuda (1976) interprets the abdomen of female syrphids as comprising discernible elements of nine segments, plus the cerci. An alternative interpretation is provided by Lehrer (1971b), who follows Herting (1957) in identifying elements of ten segments plus the cerci. Matsuda (l.c.) points out that the nine segments he recognises cannot be assumed to be homologous in all dipteran families, because of the possibility that the particular segment which has been lost is not the same in all instances.

Both Lehrer (l.c.) and Matsuda (l.c.) agree in numbering the first eight visible abdominal segments of female syrphids from 1 to 8, sequentially, with each segment represented by a tergite and sternite. The first 7 segments each carry a spiracle. The spiracles lie in the membrane between tergite and sternite towards the anterior end of each segment, except in the case of the 1st abdominal spiracle, which is more frequently found entirely or partly enclosed within the posterior part of the metathoracic epimeron.

Beyond the eighth segment the situation becomes confused. Dorsally, Matsuda recognises a tergite 9 flanked by the cerci. Matsuda's tergite 9 is Lehrer's tergite 10 and the epiproct or proctiger of some other authors. For Lehrer, tergite 9 is identified with a pair of tiny lateral sclerites that are unconnected externally. These rudimentary plates are not mentioned by Matsuda.

Ventrally, Matsuda identifies in his text "the definitive 9th sternum or the postgenital plate as seen in *Eristalis*". He thus interprets this "postgenital plate" as sternite 9.

In the range of Syrphidae examined for purposes of the present account, the number of sclerites noted distal to the eighth tergite and sternite is not consistent. For instance, in *Syrphus* no dorsal sclerites distal to tergite 8 are found, although at least one additional dorsal sclerite distal to tergite 8 occurs in many other genera. Similarly, although in *Eristalis* a narrow sclerotised strip (st. 9 of Lehrer) occurs distal to sternite 8 and basal to the genital opening, this sclerotised strip is not present in other genera examined. Further, there are indications that secondary sclerotisation of membranous areas has on occasion occurred, as in *Eumerus* (fig. 55, *ss*).

What terminology to use for sclerites in the female abdomen posterior to tergite and sternite 8 is problematic. Lehrer's (l.c.) argument that the so-called "tergite 9" of Matsuda and McAlpine is in reality tergite 10 is persuasive. And if the designation tergite 9 is retained for this plate, what are the small lateral sclerites regarded as tergite 9 by Lehrer? Authors other than Lehrer have conveniently ignored any mention of these lateral sclerites. Neither of the terms epiproct and proctiger can be used for the "tergite 9" of Matsuda and McAlpine because both have particular morphological connotations. Further, the morphological definition of these terms varies with author, as a comparison of the definitions in McAlpine and Tuxen (1970) demonstrates. Probably the most neutral of the available terms that have been applied to this sclerite in Diptera is the supra-anal plate, so that is what it has been termed here (see fig. 53 onwards, *sap*).

The pair of lateral sclerites regarded by Lehrer (l.c.) as derived from tergite 9 are not given any particular designation here. They are indicated in fig. 57 (fig. 57, *ls*). Lehrer was able to detect these sclerities in *Ceriana*, *Volucella* and *Xylota*, as well as in *Eristalis*.

Considering the ventral abdominal sclerites distal to sternite 8, *Eristalis* appears to be exceptional in exhibiting the sclerotised strip regarded by Lehrer (l.c.) as sternite 9. In the other species examined (including *Volucella bombylans* and *V. pellucens*) during preparation of this account the most that is visible in this position is a median, membranous flap which serves as an egg guide. Seeing the uncertain homology of this feature it is referred to here not as sternite 9 but as the ventral egg-guide (figs. 56 *on*, *vg*).

A pair of lateral sclerotised or membraneous egg guides may also be present. They have been identified by Lehrer as elements of tergite 9. Since they are linked by a sclerotised bar passing along the upper margin of the genital opening, these lateral egg guides may be of sternal origin. The lateral egg guides are well exemplified by *Volucella* (fig. 58, *lg*). In *Eristalis* and *Sericomyia* the ventral egg-guide is well-developed but the lateral ones are lacking, while in *Syrphus* no egg-guides are differentiated (figs. 56—62).

The terminal ventral sclerite of the abdomen is the sternite 9 or post-genital plate of Crampton (1942), Matsuda (1976) and McAlpine (1981), which is sternite 10 of Lehrer (1971b). This plate appears to be universally present. Since its homology is questionable it is referred to here as the sub-anal plate (fig. 56 onwards, *sup*). The anus is located between the sub-anal plate and the supra-anal plate and is flanked by the cerci, which are generally recognised as being derived from the original eleventh abdominal

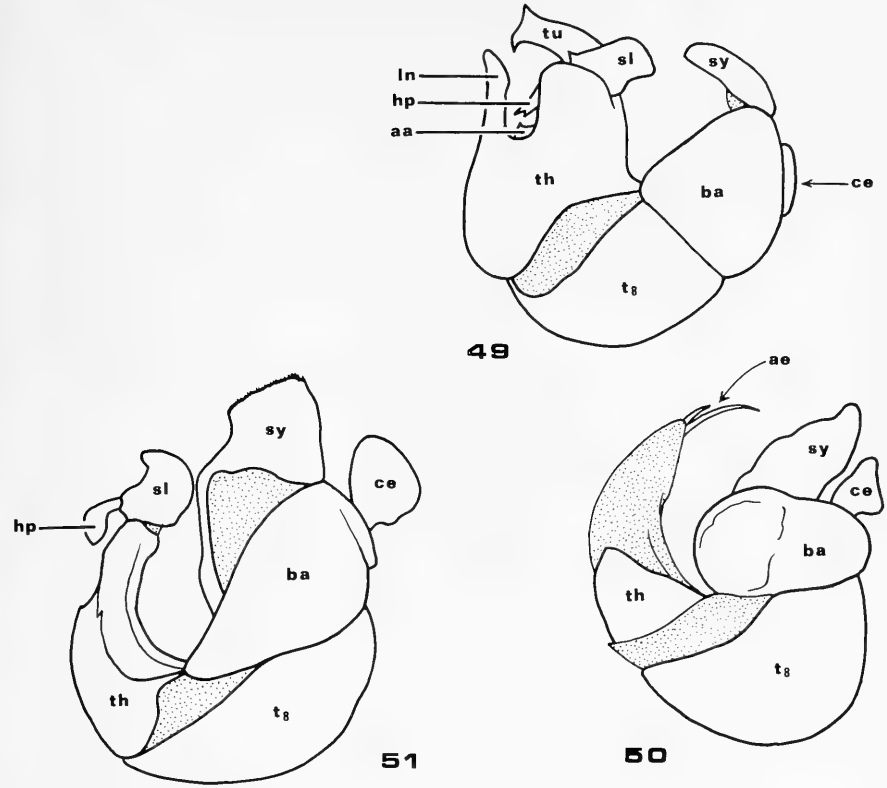



Fig. 49, *Syrphus ribesii*, male, hypopigium, lateral view. Fig. 50, *Microdon mutabilis*, male, hypopygium, lateral view. Fig. 51, *Eristalis tenax*, male hypopygium, lateral view.

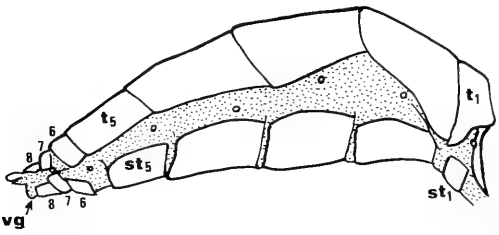
segment. In *Syrphus*, where the supra-anal plate is lacking, the cerci come to occupy a mid-dorsal position (fig. 60).

In many syrphids the abdominal segments posterior to segment 5 are hardly visible when at rest, being then retracted telescopically into segment 5, but they do not really form a distinct subregion of the abdomen as in the male. These terminal segments may be modified to form an ovipositor as long as or even longer than the first five abdominal segments together, the elongation being achieved primarily by widening the bands of intersegmental membrane, as in *Eristalis* and *Sericomyia* (figs. 53, 54). In *Eumerus* a similar result is achieved by elongation of the largely membraneous segment 8. Also in *Eumerus*, secondary sclerotisation of the attenuated bands of intersegmental membrane has produced a "false segment" between segments 6 and 7 and another "false segment" between segments 8 and 9. In the latter case a complete ring of sclerotised membrane has formed (fig. 55, *ss*).

## The relationship between the Syrphidae and genera allied to *Microdon*

Repeated references are made during course of this account to differences existing between the morphology of *Microdon* and the morphology of other syrphids. Various of these differences e.g. in *Microdon's* mouthparts, have not been alluded to in other texts. *Microdon* and allied genera have until recently usually been regarded as constituting a separate subfamily, the Microdontinae, within the Syrphidae.

Thompson (1969) reviewed the genera con-

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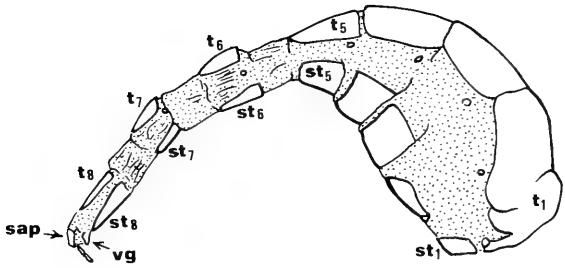


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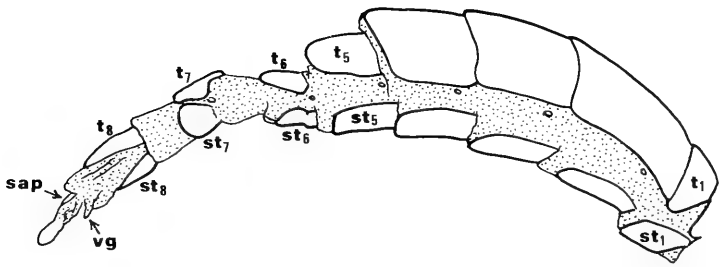


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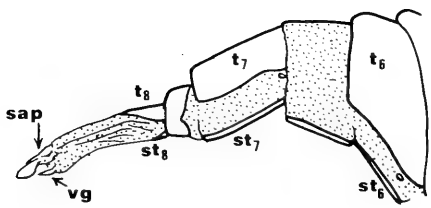


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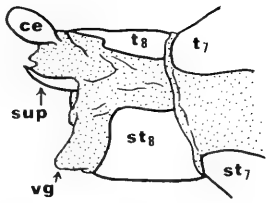
Fig. 52, *Syrphus ribesii*, female, abdomen, lateral view, right side. Fig. 53, *Eristalis tenax*, female, abdomen, lateral view, right side. Fig. 54, *Sericomyia silentis*, female, abdomen, lateral view, right side. Fig. 55, *Eumerus strigatus*, female, distal abdominal segments, lateral view, right side.

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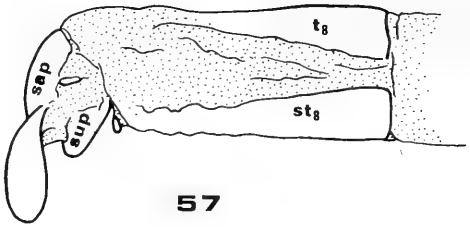


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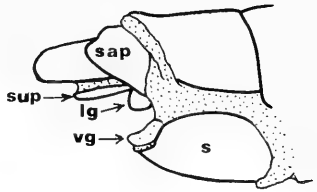


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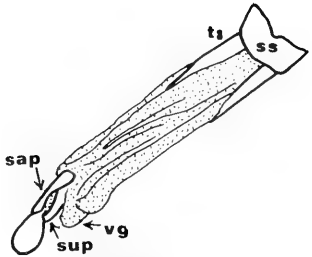


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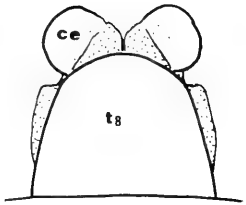


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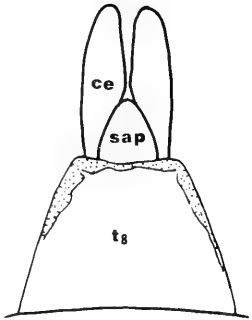


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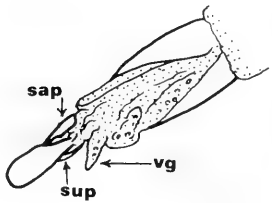


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Fig. 56, *Syrphus ribesii*, female, terminalia, lateral view, right side. Fig. 57, *Eristalis tenax*, female, terminalia, lateral view, right side. Fig. 58, *Volucella bombylans*, female, terminalia, lateral view, right side. Fig. 59, *Eumerus strigatus*, terminalia, lateral view, right side. Fig. 60, *Syrphus ribesii*, female, terminalia, dorsal view. Fig. 61, *Microdon mutabilis*, terminalia, dorsal view. Fig. 62, *Sericomyia silentis*, terminalia, lateral view, right side.

signed to the Microdontinae and provided a definition of the subfamily, based upon both adult and larval characteristics. He concluded that "the Microdontines should be considered the first divergence in the phylogeny of the family (Syrphidae)". He further remarked that the "strongly plesiomorphic nature of the subfamily suggests that the microdons might best be considered as a separate family". In a later paper Thompson (1972) separated the Microdontidae from the Syrphidae. The additional data provided in the present account would tend to support Thompson's action, but does only relate to the European genus *Microdon*. If the other microdontine genera differ from the rest of the syrphids in these same ways, there would seem little justification for retaining the Microdontinae within the Syrphidae.

The incongruity attendent upon retention of the Microdontinae within the Syrphidae is highlighted by bringing into consideration the degree of morphological difference found between other dipteran groups currently recognised as separate families. However, Thompson's recognition of the family Microdontidae has not been adopted by other authors. For that reason *Microdon* has been included in this account of syrphid morphology, despite the present author's doubt that the genus belongs in the family Syrphidae.

### ABBREVIATIONS USED IN FIGURES

a: arista of antenna
A: first anal vein of wing
aa: aedeagal apodeme of aedeagus of male genitalia
ac: anteclypeus
ae: aedeagus of Microdon male genitalia
acs: anterior cervical sclerite
acx: anterior mesocoxite of middle leg
al: alula of wing
am: aristomere
an: anal cell of wing
ans: anapleural suture of mesothoracic pleura
as: antecostal suture
at: acrotergite of mesothoracic notum
att: anterior tentorial pit
au: auxillia of pretarsus of leg
$ax_1$, etc.: axillary sclerite 1, etc.
$b_1$, $b_2$: first and second basal cells of wings
ba: basale of hypopygium of male genitalia
bat: buccal arm of anterior tentorial sulcus
bc: buccal cavity
br: barrette: probably the katepimeron of the mesothoracic pleura
bs: prothoracic basisternum
bt: basitarsus of leg
C: costal vein of wing
ca: presutural callus of mesonotum of thorax
cal: lower calypter of wing
cau: upper calypter of wing
cc: cervical condyle of postoccipital sclerite
ce: cercus of terminal segment of abdomen
cl: claw of pretarsus of leg
cls: clypeal sclerite in *Microdon*
$co_1$, $co_2$: first and second costal cells of wing
cs: ceratostyle
CuA: anterior cubitus vein of wing
CuP: posterior cubitus vein of wing
cx: coxa
cxp: posterior mesocoxite of middle leg
d: discal cell of wing
e: compound eye
em: empodium of pretarsus of leg
f: face
fe: femur of leg
fr: frons
frt: frontal tubercle
fs: facial sulcus
ft: facial tubercle
fu: furca of labellum of labium
g: gena
gl: first segment of flagellum of antenna
h: hypopharynx
ha: haltere
hb: hypostomal bridge
hc: head capsule
hr: harpes of aedeagus of male genitalia
hs: hypostomal sulcus
hu: humeral cross-vein of wing
hup: humeral plate of wing-base
hy: hypoglossa of labium
l: lunule
la: lateral arm of theca of hypopygium of male genitalia
lcs: lateral cervical sclerite
ll: labellum
ln: lingula of theca of hypopygium of male genitalia
lr: labrum
lt: lateral postnotal sclerite of mesonotum

M: median vein of wing
$M_{1—4}$: branches of median vein of wing
m: marginal cell of wing
$ma_1$, $ma_2$: anepisternites of mesothoracic pleura
map; mesofurcal pit
mcu: median-cubital cross-vein of wing
mcx: median mesocoxite of middle leg
me: mesepimeral sclerite of mesothoracic pleura
mhs: median hypostomal suture
mk: katepisternum of mesothoracic pleura
mlt: mesonotal prescutum
mn: premental sclerite of the labium
mp: mesosternal presternum
mr: meropleurite of mesothoracic pleura
ms: mesoscutum of mesonotum
msl: scutellar lobe of mesonotum
mt: median postnotal sclerite of mesonotum
mtb: basisternum of metathoracic sternum
mte: epimeron of metathoracic pleura
mtec: metepimeral callus of metathoracic pleura
mtes: epimeral spine of the metathoracic pleura
mtn: metathoracic notum
mtpc: precoxale of metathoracic pleura
mts: episternum of metathoracic pleura
mtu: furcasternum of metathoracic sternum
mua: anterior mesosternal furcasternum
mub: posterior mesosternal furcasternum
mvs: mid-ventral thoracic suture
mx: maxillary stylet
mxa: maxillary palp
oa: ocular arm of anterior tentorial sulcus
oo: post-ocular orbits
os: orbital strip of face
osc: post-occipital sclerite
ot: ocellar triangle
p: pedicel of antenna
pa: antepronotum of pronotum of thorax
pc: postclypeus
pcb: premetaxocal bridge
pcc: postcranial carina
pcs: posterior cervial sclerite
pe: proepimeron of propleura
pg: postgena
pls: pleural suture of mesopleura
pn: postpronotal sclerite of pronotum of thorax
po: posterior cell of wing
pocb: post-metaxocal bridge
ps: proepisternum of propleura
pu: prothoracic furcasternum
R: radial vein of wing
rm: radial-median cross-vein of wing
$Rs_{1—4}$: branches of the radial-sector vein of the wing
s: scape of antenna
sa: subalare
sb: band of sensilla on postgena
Sc: subcostal vein of wing
sc: subcostal cell of wing
sca: postalar callus of mesonotum of thorax
scr: subcostal-radial cross-vein of wing
se: sella of cervical organ
sen: sensilla of cervical organ
sep: sensory pit of 3rd antennal segment
sl: superior lobe of theca of male genitalia
sm: submarginal cell of wing
sp: spiracle
sps: spiracular sclerite of Microdon thorax
ss: secondary sclerite
ssu: parasagittal sulcus of head capsule
$st_1$, $st_2$, etc.: sternum of first abdominal segment, second abdominal segment, etc.
st2a: anterior sclerite of abdominal sternite 2
stg: stigma of wing
sy: stylus of basale of hypopygium of male genitalia
$t_1$, $t_2$, etc.: tergite of first abdominal segment, second abdominal segment, etc.
$ta_2$, $ta_5$: tarsal segments of leg
tc: callus of 2nd tergite of abdomen
tg: tegula
th: theca of hypopygium of male genitalia
tho: thorax
ti: tibia of leg
tp: posterior tentorial pit of head capsule
tr: trochanter of leg
trc: trochanteral process of posterior mesocoxite of middle leg
ts: transverse sulcus
tt: tempota of head capsule

tu: tubus of aedeagus of male genitalia
u: pulvillus of pretarsus of leg
v: vertex of head capsule
vs: vena spuria of wing
vv: postvertex of head capsule

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# TAXONOMY AND BIOGEOGRAPHY OF ORIENTAL PRASIINI. 3. THE *FATILOQUA* AND *PARVULA* GROUPS OF THE GENUS *LEMBEJA* DISTANT, 1892 (HOMOPTERA, TIBICINIDAE)

by

M. R. DE JONG

*Institute of Taxonomic Zoology (Zoölogisch Museum), University of Amsterdam, The Netherlands*

Abstract

Tentative concepts for two species-groups of the genus *Lembeja* Distant, 1892, the *fatiloqua* and the *parvula* group, are presented. The widely distributed *fatiloqua* group incorporates ten species, viz., *Lembeja fatiloqua* (Stål, 1870) from Mindanao (Philippines) and North Borneo, *L. consanguinea* n.sp. from North Sulawesi, *L. maculosa* (Distant, 1883), *L. fruhstorferi* Distant, 1897, *L. lieftincki* n.sp., *L. sanguinolenta* Distant, 1909, and *L. tincta* (Distant, 1909) from South Sulawesi, *L. roehli* Schmidt, 1925 from Sumba, *L. sumbawensis* n.sp. from Sumbawa, and *L. paradoxa* (Karsch, 1890) from SE New Guinea, Torres Strait Islands and Cape York Peninsula. The *parvula* group is confined to Sulawesi with two species, viz., *L. parvula* n.sp. from South Sulawesi and *L. wallacei* n.sp. from North Sulawesi. Characters and character states are discussed in connection with the supposed monophyletic status of the species-groups. All species but *L. paradoxa* are (re)described and structures of taxonomic importance as well as the whole insects are depicted. A key to males and females is presented.

## Introduction

In previous publications (De Jong, 1985, 1986) on the Oriental Prasiini, the genus *Prasia* Stål, 1863, and the *foliata* group of the genus *Lembeja* Distant, 1892, have been defined and the species incorporated have been (re)described. The present studies of the *fatiloqua* and *parvula* groups of the genus *Lembeja* are further contributions to a revision of the oriental Prasiini (see also De Jong & Duffels, 1981; De Jong, 1982). For a review on the history of the genus the reader is referred to De Jong (1986).

## Concepts of the *fatiloqua* and the *parvula* groups (with notes on their relationships and distribution)

### Monophyly of the *fatiloqua* group

The *fatiloqua* group is characterized by a moderately to strongly developed, longitudinal medial dent in the male tergite 1, which is considered a synapomorphous character for the species of the group.

Another highly characteristic feature of the group is the capability of the males to inflate their abdomen in a probably unique manner (see Moulds, 1975). The tergites 3—6, when telescoping from under their preceding tergites, show clearly the, sometimes broad, intersegmental membranes. This feature is also displayed by the African genus *Iruana* Distant, 1905 (Boulard, 1975, 1981, 1985). This genus was formerly attributed to the Prasiini (Metcalf, 1963), but is probably more related to other genera than to those constituting the Prasiini. The telescoping abdomen most probably developed independently in the two groups.

Species attributed to the *fatiloqua* group are *L. consanguinea* n.sp., *L. fatiloqua* (Stål, 1870), *L. fruhstorferi* Distant, 1897, *L. lieftincki* n.sp., *L. maculosa* (Distant, 1883), *L. paradoxa* (Karsch, 1890), *L. roehli* Schmidt, 1925, *L. sanguinolenta* Distant, 1909, *L. sumbawensis* n.sp. and *L. tincta* (Distant, 1909).

### Monophyly of the *parvula* group

The *parvula* group is characterized by the obliquely hindwards running edge of the pygofer between the lateral lobe and the caudodorsal beak, which is considered a synapomorphy for the species of the group.

Furthermore, the wings have five apical areas instead of the usual number of six. This character state is also displayed by an undescribed species from New Guinea, belonging to the Oriental Prasiini. Because this species is probably more related to one, or more, of the other species-groups or genera, than it is to the *parvula* group, this character state cannot be used as a strong synapomorphy for the species of the *parvula* group.

Finally, the male tergite 1 is only very slightly medially dented in the *parvula* group.

Species attributed to the *parvula* group are *L. parvula* n.sp. and *L. wallacei* n.sp.

### Relationships within the species-groups

Some character states suggest that the *fatiloqua* group can be divided into several subgroups. As there is no evidence yet whether the character states involved are to be interpreted as plesio- or apomorphic, a possible subdivision of the species-group is postponed until outgroup comparison provides more information on those characters. These characters are:

Pigmentation of tegmina. — The males of five species have unspotted (sub)hyaline tegmina, viz., *Lembeja fatiloqua*, *L. maculosa*, *L. roehli*, *L. sumbawensis* n.sp. and *L. tincta*. The males of four species have spotted tegmina: *L. consanguinea* n.sp., *L. lieftincki* n.sp., *L. paradoxa* and *L. sanguinolenta*. The remaining species, *L. fruhstorferi*, is known only from its female holotype. The female tegmina are spotted, except in *L. fatiloqua*, *L. roehli* and *L. sumbawensis* n.sp.

Apical lobes of the aedeagus. — All species with spotted tegmina in the males possess an aedeagus with long, rounded apical lobes, whereas those with unspotted male tegmina have an aedeagus with short, pointed to rounded, apical lobes or without lobes. However, one undescribed species with spotted tegmina, only known from poor material, is provided with an aedeagus with short and pointed lobes.

Uncus. — The males of three species, viz., *L. consanguinea* n.sp., *L. lieftincki* n.sp. and *L. sanguinolenta*, have an uncus that is enlarged medially above the claspers.

The small-sized species of the *parvula* group are very similar to one another.

### Relationships between the *fatiloqua* and the *parvula* groups

The male tergite 1 is medially slightly dented near its proximal border in the *parvula* group, and moderately to strongly dented in the *fatiloqua* group. On account of the more or less strongly developed medial dent the groups are tentatively regarded sister-groups.

### Distribution of the *fatiloqua* and *parvula* groups

The *fatiloqua* group is by far the most widespread group of the genus. It is distributed from Mindanao (Philippines), North Borneo, North and South Sulawesi, Nusa Tenggarah (Lesser Sunda Islands), SE New Guinea, Torres Strait Islands up to the Cape York Peninsula (North Queensland).

The *parvula* group is distributed in North and South Sulawesi.

Both groups show a distribution that seems hard to reconcile with their supposed monophyletic origins. Both the *fatiloqua* group and the *parvula* group show a peculiar disjunction in Sulawesi by their restricted occurrence in the most eastern part of the Minahassa Peninsula and in the most southern part of the island; no representatives of these groups are found in Central Sulawesi. The collections made by the brothers Sarasin in Central Sulawesi at the end of the 19th century, as well as recent collecting during Operation Drake in Morowali N.P. in 1980 and by Dr J. P. & Mrs M. J. Duffels, and Mr J. van Tol in Lore-Lindu N.P. in 1985, did not provide any material belonging to these two species-groups.

*L. paradoxa* of the *fatiloqua* group has a widely remote distribution in SE New Guinea, the Torres Strait Islands and the Cape York Peninsula of Australia; no other representatives of the group are found in New Guinea.

### DEPOSITORIES

The abbreviations given below have been used in the list of material and throughout the text.

| | |
|---|---|
| BIN | Koninklijk Belgisch Instituut voor Natuurwetenschappen, Brussel |
| BISH | Bernice P. Bishop Museum, Honolulu |
| BMNH | British Museum (Natural History), London |

| | |
|---|---|
| DEI | Deutsches Entomologisches Institut, Eberswalde |
| FSC | Florida State Collection, Gainesville |
| MCZ | Museum of Comparative Zoology, Harvard University, Cambridge |
| MW | Institut Zoologique, Warszawa |
| MZB | Museum Zoologicum Bogoriense, Bogor |
| NBM | Naturhistorisches Museum, Basel |
| NHMW | Naturhistorisches Museum, Wien |
| NMWC | Natural Museum Wales, Cardiff |
| NRS | Naturhistoriska Riksmuseet, Stockholm |
| RMNH | Rijksmuseum van Natuurlijke Historie, Leiden |
| SMD | Staatliches Museum für Tierkunde, Dresden |
| SMN | Staatliches Museum für Naturkunde, Stuttgart |
| TMB | Természettudomany Muzeum, Budapest |
| USNM | United States National Museum, Smithsonian Institution, Washington |
| ZIM | Zoologisches Institut und Zoologisches Museum, Hamburg |
| ZMA | Instituut voor Taxonomische Zoölogie, Zoölogisch Museum, Amsterdam |
| ZSM | Zoologische Staatssammlung, München. |

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## Taxonomy

A short characterization of each species-group will preceed the descriptions of the species, included in the group.

All methods of investigation follow De Jong (1985, 1986). The female genitalia will be described and discussed separately in a paper dealing with the female genitalia of the oriental Prasiini.

Key to the species of the *fatiloqua* and *parvula* groups

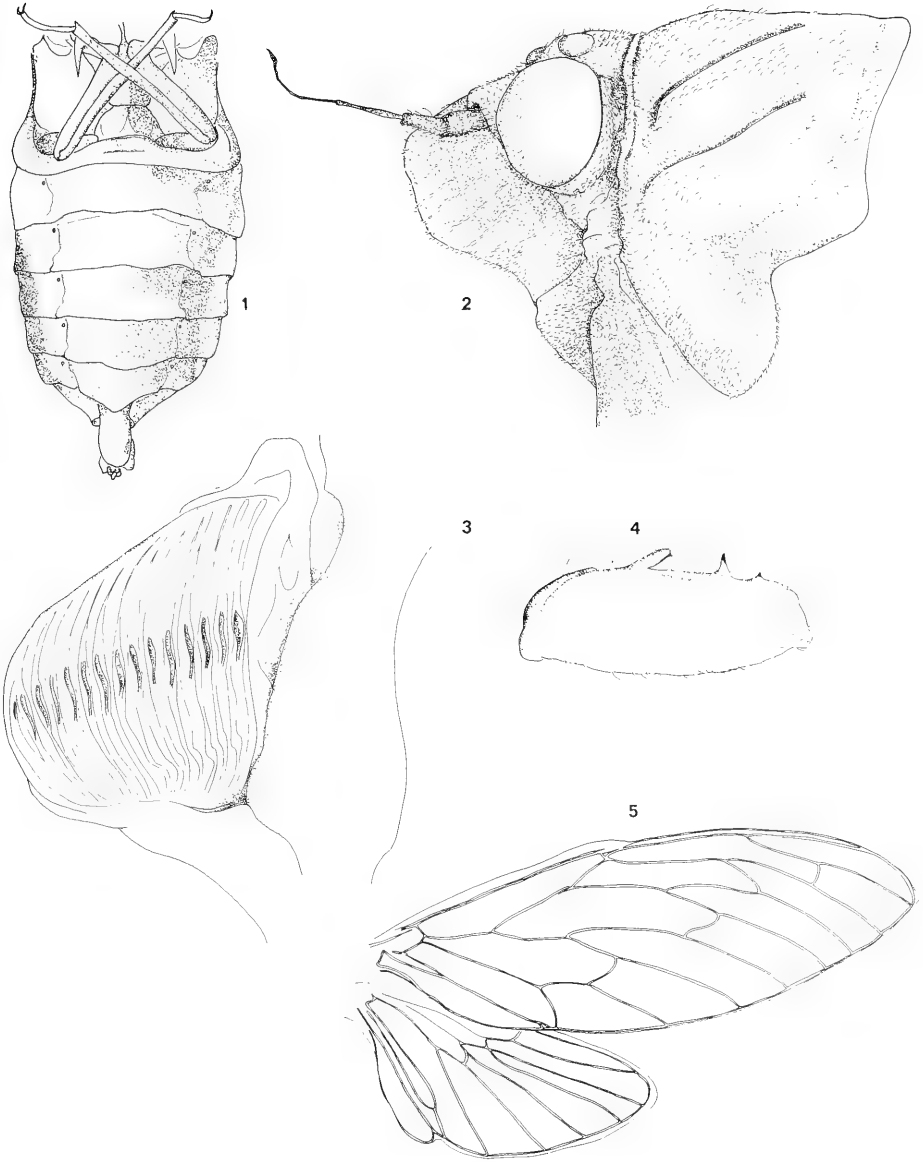
1. Wings with 6 apical areas. Medium-sized to large species (body length ♂: 17.9—21.8 mm, ♀: 14.9—24.5 mm). ♂: tergite 1 with a strong longitudinal medial dent ..... *fatiloqua* group 2
— Wings with 5 apical areas. Small-sized species (body length ♂: 12.5—16.2 mm, ♀: 11.8—13.7 mm). ♂ : tergite 1 with a weak, proximal medial dent *parvula* group 19
2. Tegmina (sub)hyaline, spotted ..... 3
— Tegmina (sub)hyaline, unspotted, sometimes greenish or yellowish opaque .... 12
3. Males ..... 4
— Females ..... 7
4. Abdomen with large mediodorsal spines on segments 4—7. Papua New Guinea, Torres Strait islands, Cape York Peninsula ..... *paradoxa*
— Abdomen without such large spines. Sulawesi ..... 5
5. Body green; aedeagus provided with dorsal aedeagal appendage. North Sulawesi ..... *consanguinea*
— Body brownish, reddish or ochreous; aedeagus without dorsal aedeagal appendage. South Sulawesi ..... 6
6. Medium-sized species (body length: 21.4—21.6 mm); tegmina, though spotted, reasonably hyaline. Median uncus part amply

enlarged in the shape of a tube-like structure. South Sulawesi ..... *lieftincki*
— Large species (body length: 24.6 mm); tegmina heavily pigmented with red. Median uncus part only slightly enlarged. South Sulawesi ..... *sanguinolenta*
7. Abdomen with three longitudinal fasciae: one distinct, dorsal medial fascia and two broad, lateral fasciae ..... 8
— Abdomen monochromous, or with faint fasciae ..... 9
8. Body dark ochreous; tegmen areas finely stippled; ovipositor sheath 0.4—0.41 × as long as abdomen. South Sulawesi ..... *lieftincki*
— Body virescent to orange-yellowish, with light pale ochreous; tegmen areas patchy stippled; ovipositor sheath 0.25 × as long as abdomen. South Sulawesi ..... *tincta*
9. Body and tegmina green; tegmen areas with a faint stippling. North Sulawesi ..... *consanguinea*
— Body and tegmina variably coloured; tegmen areas with a distinct stippling ..... 10
10. Pigmentation along tegmen veins distinct and dark-coloured. Papua New Guinea, Torres Strait Islands, Cape York Peninsula ..... *paradoxa*
— Pigmentation along tegmen veins weak. South Sulawesi ..... 11
11. Large species (body length: 25.9 mm); stippling in tegmen areas patchy. South Sulawesi ..... *fruhstorferi*
— Medium-sized species (body length: 17.3—19.1 mm); stippling in tegmen areas relatively fine. South Sulawesi ... *maculosa*
12. Males ..... 13
— Females ..... 17
13. Tegmina hyaline ..... 14
— Tegmina opaque; tymbal with 17—19 pairs of alternating ridges; genitalia as in figs. 18—21. Sumbawa ..... *sumbawensis*
14. Aedeagus long and slender (figs. 6—8, 23, 26, 28) ..... 15
— Aedeagus short and sturdy (figs. 12—14, 29—31) ..... 16
15. Body size: 17.9—21.8 mm; tymbal with 15 pairs of alternating ridges; genitalia as in figs. 6—9. Mindanao, North Borneo ..... *fatiloqua*
— Body size: 22.3—24.2 mm; tymbal usually with 14 pairs of alternating ridges; genitalia as in figs. 23, 25, 26, 28. South Sulawesi ..... *maculosa*
16. Body orange-yellowish and large (body length: 22.8—26.2 mm); aedeagus with hooked apex provided with two pointed flaps. South Sulawesi ..... *tincta*
— Body greenish-yellow and medium-sized (body length: 18.8—22.9 mm); aedeagus straight without apical flaps. Sumba ..... *roehli*
17. Tegmina hyaline. Mindanao, North Borneo, Sumba ..... 18
— Tegmina orange-greenish opaque. Sumbawa ..... *sumbawensis*
18. Large species (body length: 17.9—20.9 mm); ovipositor sheath 0.22—0.26 × as long as abdomen. Mindanao, North Borneo ..... *fatiloqua*
— Small species (body length: 14.9—16.1 mm); ovipositor sheath 0.32—0.33 × as long as abdomen. Sumba ..... *roehli*
19. ♂: body ochreous; tegmen areas unspotted, veins with some markings; genitalia as in figs. 61—64, 66. ♀: body brownish-ochreous; abdomen with three longitudinal fasciae: one dorsal medial fascia and two broad lateral fasciae. South Sulawesi ..... *parvula*
— ♂: body green; 8th apical and 4th ulnar areas of tegmen spotted; genitalia as in figs. 68—71, 73. ♀: body dark-brown, abdomen usually without fasciae. North Sulawesi ..... *wallacei*

The material studied contained several unidentified males and females belonging to the *fatiloqua* group. Three females with pigmented tegmina, viz., two from North Sulawesi (a small one from Edwards Camp in the Dumoga-Bone N.P. (RMNH), and a large one from Gunung Muajat, east of Kotamobagu (BMNH)), and a small one from South Sulawesi (Watampone (MZB)); two females with opaque tegmina, one from Flores (SMD) and one from Sumbawa (NRS); a large female with hyaline tegmina from Sangihe island (RMNH). Furthermore, two males (representing one species) with pigmented tegmina from North Sulawesi (Labuanika (ZMA)); two males with hyaline tegmina, one of which from South Sulawesi (Assumpati (BMNH)), and one from North Sulawesi (Tonsealama (MCZ)); three males with opaque tegmina, one from Lombok (Sapit (NHMW)), and two males (representing one species) from Sumbawa (SMD; BMNH).

### The *Lembeja fatiloqua* group

Head triangularly to obconically protruding in dorsal view. Antennal segment 1 long. Male




Figs. 1—5. The *L. fatiloqua* group: 1, male abdomen, ventral view, *Lembeja tincta*; 2, head and pronotum, lateral view, *L. lieftincki*; 3, left tymbal, lateral view, *L. fatiloqua*; 4, female femur, lateral view, *L. fatiloqua*; 5, right tegmen and wing, *L. fatiloqua*.

opercula small, not covering tymbal cavities. Tegmina (sub)hyaline or opaque, with or without spots along the veins and inside the tegmen cells. Abdomen in males moderately to strongly carinate along tergites 3—7. Tergites strongly folded laterally, forming a ridge on each side of the sternites. Intersegmental membranes sometimes clearly exposed. Tergite 1 bulbous, usually with two short lateroproximal flaps, and provided with a moderately to strongly developed, medial longitudinal dent. Sternite 1 triangular and small. Folded membranes and mirrors medium-sized, sometimes in an angle of 90° with one another. Tymbals with 12—20 long ridges, alternating usually with an equal number of short ridges. Abdomen in females slender, carinate dorsally; in lateral view convex from tergite 3—8. Ovipositor sheath extending beyond caudodorsal beak. Lateral lobes of pygofer usually short and concave on the outer surface. Claspers vary from short and curved to long and elongate; ventrally usually concave. Median uncus part usually slightly compressed, sometimes enlarged to a short to somewhat longer tube, just above the claspers. Aedeagus long and slender to short and more sturdy; apex rounded, or with two short to long lobes. Only one species (*L. consanguinea* n.sp.) provided with an unsclerotized, dorsal aedeagal appendage.

**Lembeja fatiloqua** (Stål, 1870)
(figs. 6—11, 74, 75; map 1)

*Prasia fatiloqua* Stål, 1870: 718; Distant, 1892: xiv, 146, Pl. 6 figs. 2, 2a—b; Breddin, 1901: 153; Distant, 1905: 279; Distant, 1906: 184; Distant, 1909: 394; Kato, 1932: 184; de Jong, 1985: 166; de Jong, 1986: 141.

*Lembeja fatiloqua*; Horvath, 1912: 609; Myers, 1928: 392, 460; Myers, 1929: 52, text fig. 24; Metcalf, 1963: 430; de Jong, 1982: 182; de Jong, 1986: 142.

The following reference was found to relate to another species: *Prasia fatiloqua*; Lallemand, 1935: 677 (Sumba specimens belong to *Lembeja roehli* Schmidt, 1925).

The male holotype of the species has been studied at the NRS, by kind permission of Dr P. Lindskog, in order to establish the identity of the species.

Description.

Body pale ochreous, sometimes greenish; abdomen sometimes slightly darker than remaining part of body. Head and pronotum together 0.92—1.07 × as long as meso- and metanotum together. Thorax and head together in males 0.63—0.82 ×, in females 0.88—1.08 × as long as abdomen. Greatest width of body in males at the level of abdominal segment 2 and 3, in females at lateral angles of pronotum collar.

Head. — Second antennal segment slightly darker than 1st. Eye small, in dorsal view 0.49—0.57 × as wide as width of vertex between eyes. Ocelli raised. Distance between lateral ocelli 1.0—1.31 × distance between lateral ocellus and eye. Length of head 1.33—1.49 × as long as width of vertex between eyes; width of head 1.98—2.13 × as wide as width of vertex between eyes. Transverse ridges in the same colour as underside of postclypeus. Rostrum with dark apex reaching middle trochanter.

Thorax. — Unicoloured. Fissures on pronotum not prominent. Pronotum collar 1.96—2.47 × as wide as length of head, 1.41—1.61 × as wide as width of head head including eyes. Mesonotum sometimes slightly darker than pronotum. Paramedian obconical spots recognizable; lateral ones usually consisting of some dark coloured spots.

Legs. — Same colour as underside of body. Basal spine of fore femur blunt, provided with a small subapical spine. Middle and apical spines acutely pointed.

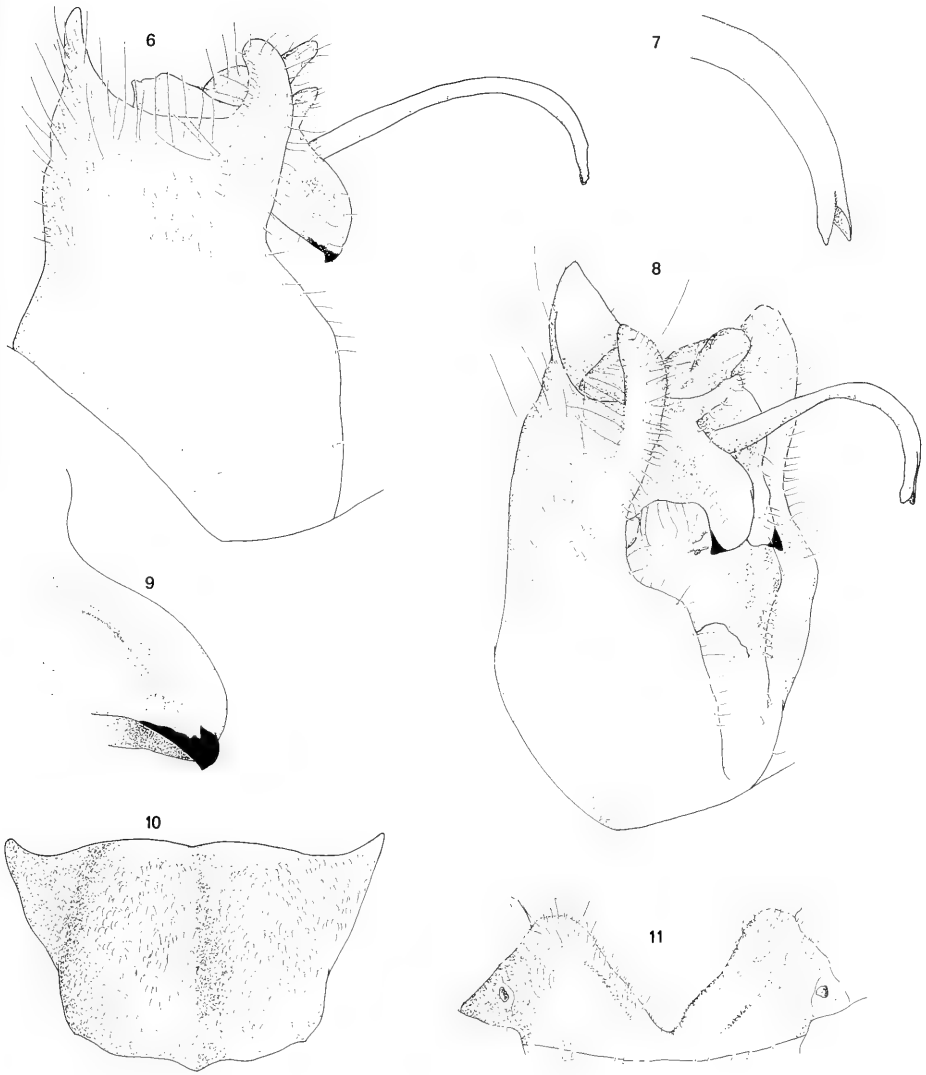
Tegmina and wings. — Tegmina and wings hyaline; venation whitish to virescent. In tegmina transverse vein of 2nd ulnar area extending into 3rd one. Corial fold recognizable. Node in $M_{3+4}$ present. $Cu_2$ and $A_1$ forming a small triangle at tegmen border. Third ulnar area 0.99—1.15 × as long as 1st one; 4th ulnar area 0.91—1.07 × as long as radial area. Third apical area 0.78—0.95 × as long as 4th one. $Cu_2$ and $A_1$ in wings fused at 81—98% from their origin.

Male: Operculum. — Small, more or less sickle-shaped; not reaching folded membrane. Long and pointed meracanthus broad at base.

Abdomen. — Dorsally slightly carinate. Pale ochreous to sometimes dark-brown. Tergite 1 with two latero-proximal flaps. Folded membrane almost parallel with underside of thorax. Mirrors medium-sized. Triangular structure between the folded membranes fairly large.

Tymbals. — Medium-sized, provided with 15 long and 15 intercalary short ridges.

Genitalia. — Lateral lobes small, convex inner surface somewhat swollen, not reaching beyond anal valves. Caudodorsal beak short, only very slightly pointed, reaching just beyond anal valves. Sturdy claspers short, curved and pointed apically. Median uncus part narrow. Aedeagus long and



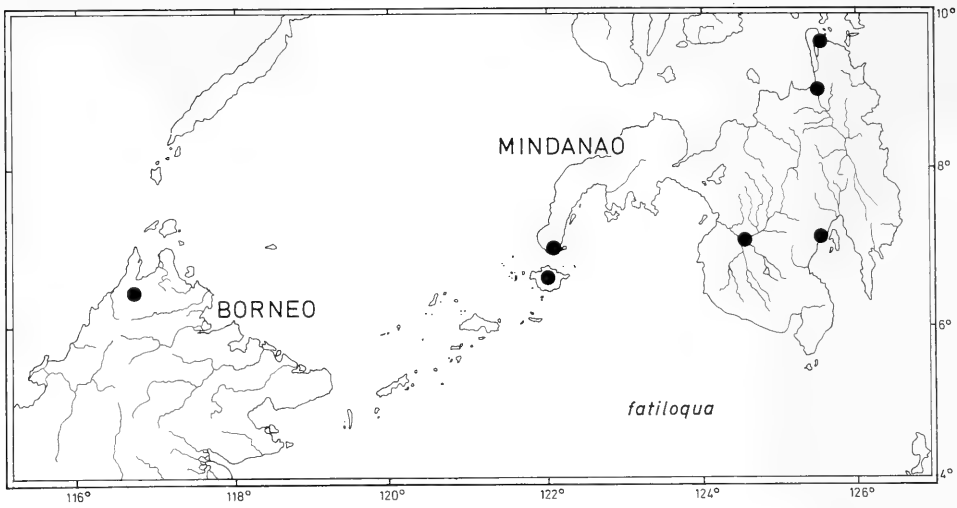

Figs. 6—11. *Lembeja fatiloqua*; 6—10, ♂; 11, ♀. 6, pygofer, lateral view, Basilan island; 7, apex of aedeagus, laterodorsal view, Basilan island; 8, pygofer, ventrolateral view, Basilan island; 9, clasper, lateral view, Basilan island; 10, tergite 1, dorsal view, Davao; 11, sternite 7, ventral view, Davao.

slender. Apex of aedeagus with two short, hardly pointed flaps in the shape of a serpent's tongue.

Female: Operculum. — Small, somewhat sickle-shaped.

Abdomen. — Unicoloured; ovipositor sheath 0.22—0.25 × as long as abdomen.

Measurements of the material studied: body length ♂: 17.9—21.8 mm, $\bar{x} = 19.7 \pm 1.2$ mm, ♀:




Map 1. Distribution of *L. fatiloqua*.

17.9—20.9 mm, $\bar{x} = 19.5 \pm 1.1$ mm; width of pronotum collar ♂: 5.0—6.1 mm, $\bar{x} = 5.6 \pm 0.3$ mm, ♀: 5.9—7.1 mm, $\bar{x} = 6.4 \pm 0.5$ mm; tegmen length ♂: 22.3—25.0 mm, $\bar{x} = 23.5 \pm 0.9$ mm, ♀: 23.7—27.8 mm, $\bar{x} = 25.8 \pm 1.7$ mm.

Distribution. — Mindanao, Island of Basilan and North Borneo (map 1).

Material examined. — Malaysia, Borneo: Kina Balu, ex. coll. Oberthur, 1 ♂ (BIN). Philippines: Basilan Isl., Baker, 2 ♂ (USNM). Mindanao: Butuan, *Prasia fatiloqua* Stål, J. G. Myers det., 1 ♂ (BMNH); Calian, Davao Prov., C. S. Clagg., 19.vi, Lembeja sp. det. J. P. Duffels, 2 ♂ (MCZ); Cotàbato, Taylor, 2 ♂ (USNM); Davao, Baker, 2 ♀ (USNM); same data but: Distant Coll. 1911—383, 1 ♂ (BMNH); Milbuk, S. del sur, 9—10.viii.1958, H. E. Milliron coll., 1 ♂ (BISH); same locality and collector but: 10.viii.1958, light trap, 1 ♀ (BISH); same locality and collector but: 3.2 km NW of, 4.viii.1958, light trap in jungle, 1 ♂ (BISH); Surigao, Baker, 1 ♀ (USNM); Zamboanga, Baker, 1 ♂ (USNM); without further specification, Semper, 1 ♀ (NRS). Philippines, without further specification: "Ins./Philipp." (print), "Semper" (print, italics), "Typus" (print, dark red label, black cadre), " *Prasia/fatiloqua*/Stål" (handwritten), ♂ holotype of *Prasia fatiloqua* (NRS); same data but: paratypus, 1 ♂ (NRS), J. J. Moursey, 1912—181, 730, 1 ♂ (BMNH).

**Lembeja roehli** Schmidt, 1925
(figs. 12—17; map 2)

*Lembeja roehli* Schmidt, 1925: 42, 43; Jacobi, 1941: 317; de Jong, 1982: 182, 183; de Jong, 1986: 141, 142.

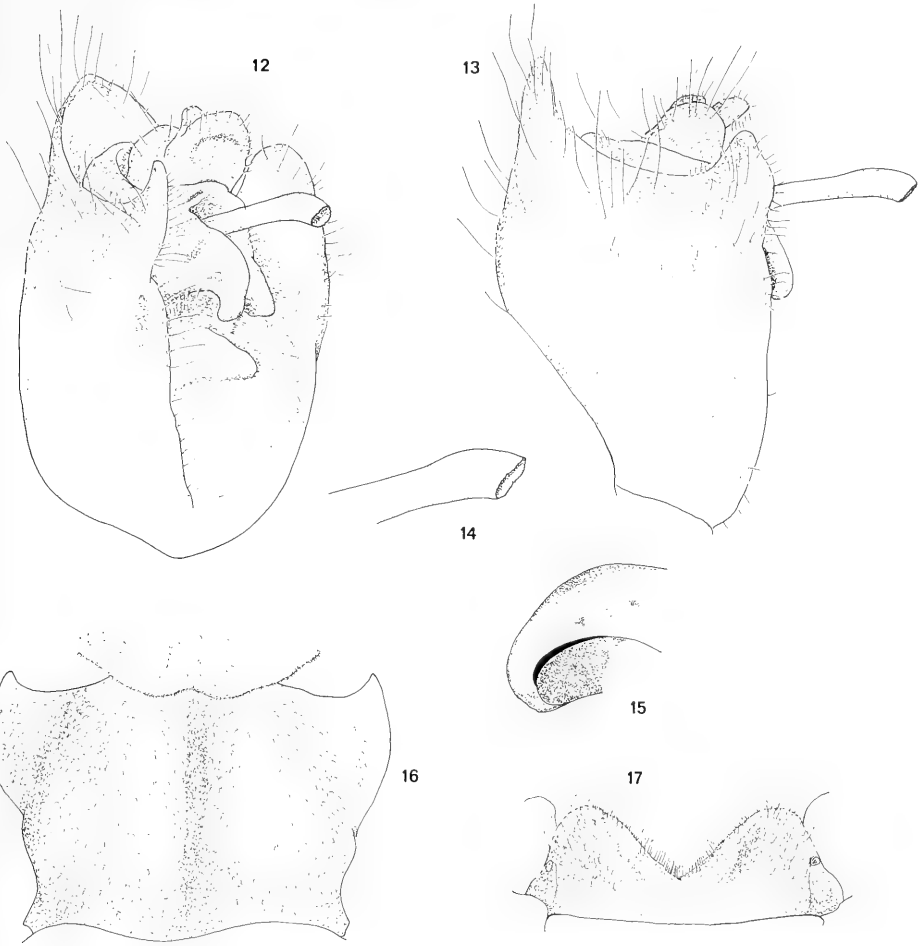
The species is described in comparison with *L. fatiloqua*.

Description.

Body size larger than in *L. fatiloqua*. Pale yellowish to greenish. Head and pronotum together 0.87—1.07 × as long as meso- and metanotum together. Thorax and head together in males (depending upon the inflation of the abdomen) 0.61—0.81 ×, in females 0.97—1.11 × as long as abdomen.

Head. — Antennae unicoloured. Eye relatively small, in dorsal view 0.39—0.48 × as wide as width of vertex between eyes. Distance between lateral ocelli 0.69—0.87 × distance between lateral ocullus and eye. Length of head 1.25—1.42 × as long as width of vertex between eyes; width of head 1.82—1.96 × as wide as width of vertex in between eyes. Rostrum with only slightly darker apex reaching coxae of middle legs.

Thorax. — Pronotum collar 1.58—1.73 × as wide as width of head including eyes, 2.14—2.5 × as wide as length of head. Mesonotum unicoloured.



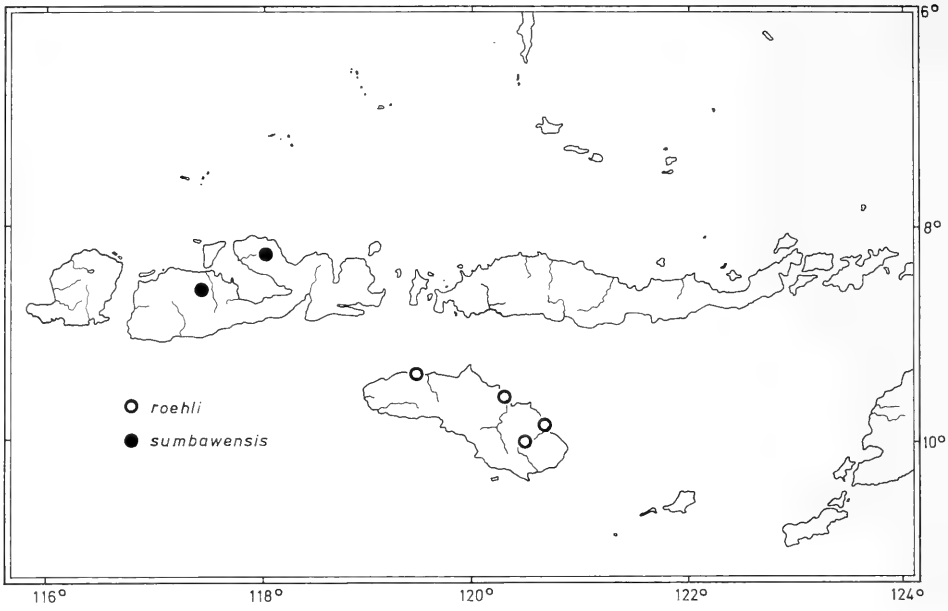

Figs. 12—17. *Lembeja roehli*; 12—16, ♂; 17, ♀. 12, 13, pygofer, 12, ventrolateral view, Waingapu, 13, lateral view, Waingapu; 14, apex of aedeagus, lateral view, holotype; 15, clasper, lateral view, Waingapu; 16, tergite 1, dorsal view, Waingapu; 17, sternite 7, ventral view, Melolo.

Tegmina and wings. — Tegmina hyaline; venation yellowish to whitish. Transverse vein of 2nd ulnar area hardly extending into 3rd one. Corial fold hardly recognizable. Small node in $M_{3+4}$ present. Third ulnar area 0.91—1.1 × as long as 1st one; 4th ulnar area 0.85—1.04 × as long as radial area. Third apical area 0.79—0.98 × as long as 4th one. Wings hyaline. Fusion of $Cu_2$ and $A_1$ at 81—88% from their origin.

Male: Operculum. —Small, round; just reaching folded membrane. Long and pointed meracanthus broad at base.

Abdomen. — Dorsally moderately carinate from segment 4—7. Usually pale ochreous. Tergite 1 broad. Mirrors relatively small. Abdomen, when inflated, showing clearly the intersegmental membranes; in normal position, underside curved upwards to the posterior in lateral view.

Tymbals. — Provided with 12 long and 12 short intercalary ridges.




Map 2. Distributions of *L. roehli* and *L. sumbawensis*.

Genitalia. — Lateral lobes very small; hardly swollen on convex inner surface, not reaching beyond anal valves. Caudodorsal beak much less pointed than in *L. fatiloqua*. Claspers smaller, but generally shaped as in *L. fatiloqua*; apically hardly pointed. Median uncus part narrow. Aedeagus short and sturdy. Somewhat swollen apex of aedeagus almost round.

Female: Operculum. — Small.

Abdomen. — Unicoloured; ovipositor sheath 0.32—0.33 × as long as abdomen.

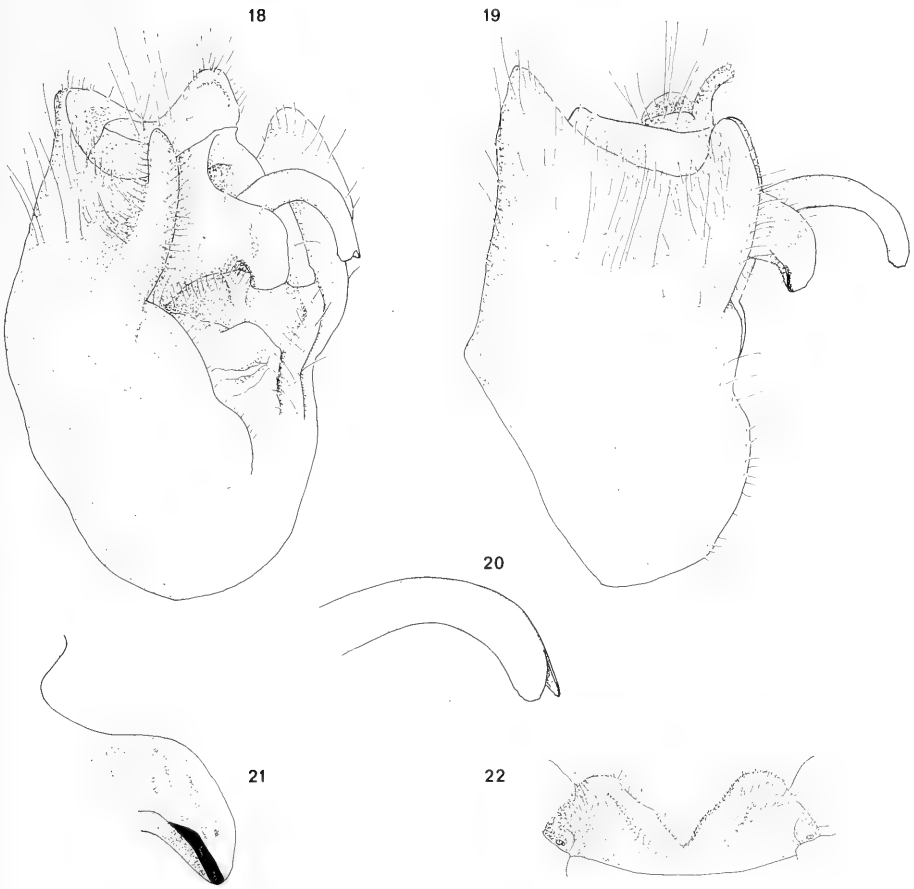
Measurements of the material studied: body length ♂ : 18.8—22.9 mm, $\bar{x} = 20.7 \pm 1.7$ mm, ♀: 14.9—16.1 mm; width of pronotum collar ♂: 5.3—6.1 mm, $\bar{x} = 5.6 \pm 0.3$ mm, ♀: 4.8—5.3 mm; tegmen length ♂: 24.1—25.3 mm, $\bar{x} = 24.7 \pm 0.5$ mm, ♀: 20.6—22.0 mm.

Distribution. — Sumba island (map 2).

Material examined. — Indonesia, Sumba: Grelak, "Sumba/Grelak" (print, black cadre), "Typus" (print, red label, black cadre), "*Lembeja*/ Roehli Schmidt/Edm. Schmidt/♂. determ. 1925" (partly print, partly handwritten) ♂ holotype of *Lembeja roehli* (MW); Kananggar, 700 m, E. Soemba, v.1925, Dammermann, 1 ♂ (MZB); Laluku, E. Sumba, 4.vii, Dr Bühler & Dr Sutter, *Baeturia exhausta* Guérin, det. V. Lallemand 1951, 1 ♂ (NBM); Laora, 100 m, N.W. Sumba, iv.1925, Dammermann, 3 ♂ (MZB); Melolo, E. Sumba, 29.v.1949, Dr Bühler & Dr Sutter, *Muda obtusa* Walk., det. H. Synave 1951, 1 ♀(NBM); Prai Jawang, E. Sumba, Rende Wai, 12.vi.1949, Dr Bühler & Dr Sutter, *Baeturia exhausta* Guérin, 1 ♀ (RMNH); Waingapu, i.1932, *Prasia fatiloqua* Stål, *Lembeja fatiloqua* Stål, 1 ♂ (NBM). Specimen without labels: 1 ♂ (ZBM).

Remarks.

The taxonomic position of *L. roehli* within the species-group is unclear. Though the species is much like *L. fatiloqua*, because of the coloration of the tegmina, some features suggest a close affinity to *L. paradoxa*, viz. the telescoping of the abdomen in the males, and the low number of ridges on the tymbal organ. The male genitalia, however, resemble those of *L. sumbawensis* n.sp., and, to a certain extent, those of *L. tincta*.




Figs. 18—22. *Lembeja sumbawensis*; 18—21, holotype; 22, ♀ paratype. 18, 19, pygofer, 18, ventrolateral view, 19, lateral view; 20, apex of aedeagus, lateral view; 21, clasper, lateral view; 22, sternite 7, ventral view.

**Lembeja sumbawensis** n.sp.
(figs. 18—22, map 2)

The description is made in comparison with *L. fatiloqua.*

Description.

Body green to ochreous. Head and pronotum together 0.94—1.07 × as long as meso- and metanotum together. Head and thorax together in males 0.76—0.79 ×, in females 1.03 × as long as abdomen.

Head. — Antennae unicoloured. Eye in dorsal view 0.46—0.56 × as wide as width of vertex in between eyes. Distance between lateral ocelli 0.78—1.29 × distance between lateral ocellus and eye. Length of head 1.24—1.41 × as long as width of vertex between eyes; width of head 1.92—2.11 × as wide as width of vertex between eyes. Rostrum with slightly darker apex.

Thorax. — Unicoloured. Fissures on pronotum somewhat deeper than in *L. fatiloqua.* Pronotum collar 2.34—2.89 × as wide as length of head, 1.57—1.65 × as wide as width of head. Obconical areas on mesonotum not discernable.

Legs. — Same colour as underside of body. Basal, pointed spine on fore femora relatively shorter than in *L. fatiloqua*; very broad at base.

Tegmina and wings. — Tegmina opaque, greenish to ochreous. Venation whitish to greenish. Transverse vein of 2nd ulnar area extending only shortly into 3rd ulnar area. Corial fold not recognizable. Third ulnar area 0.88—1.03 × as long as 1st one; 4th ulnar area 0.83—1.0 × as long as radial area. Third apical area 0.83—0.9 × as long as 4th one. Wings subhyaline, fusion of $Cu_2$ and $A_1$ at 75—85% from their origins.

Male: Operculum. — Small, as in *L. fatiloqua*. Meracanthus long and pointed.

Abdomen. — On the whole as in *L. fatiloqua*, but somewhat more carinate. Lateral flaps of tergite 1 less pointed.

Tymbal. — Provided with 17—19 long ridges, alternating with an equal number of short ridges.

Genitalia. — Lateral lobes very small, not extending beyond anal valves. Caudodorsal beak short and rounded. Claspers relatively small, hardly pointed. Aedeagus short and sturdy, slightly incised at apex.

Female: Operculum. — Very small, as in *L. fatiloqua*.

Abdomen. — Unicoloured; ovipositor sheath 0.22 × as long as abdomen.

Measurements of the types: body length ♂: 17.9—19.5 mm, ♀: 14.9 mm; width of pronotum collar ♂: 5.4—6.0 mm, ♀: 5.3 mm; tegmen length ♂: 22.8—23.0 mm, ♀: 22.7 mm.

Distribution. — Sumbawa island (map 2).

Types. — Indonesia, Sulawesi: Holotype: "Soembawa/Coll. Noualhier 1898" (print), "Distant Coll./1911—383" (print) 1 ♂ holotype of *Lembeja sumbawensis* (BMNH). Paratypes: Sumbawa, Tambora, W. Doherty 1903—31, 1 ♂ (BMNH). Sumbawa, without precize locality: ex coll. Fruhstorfer 1 ♂ (NHMW); same data but: *Lembeja foliata* (Walk) Jacobi det., coll. Breddin 1 ♂ (DEI); collectio Haglund, 266—84, 1 ♀ (NRS).

Etymology. — The species is named after Sumbawa island.

Remarks.

The species resembles, as far as its genitalia are concerned, *L. roehli* very much. Three other related species with opaque tegmina are recognized in material from the Lesser Sunda Islands, but description of these three species has not been undertaken, because the material is too poor.

**Lembeja maculosa** (Distant, 1883)
(figs. 23—28; map 3)

*Perissoneura maculosa* Distant, 1883: 190, pl. 25, figs. 3, 3a—b; Karsch, 1890: 190; Mac-Lachlan, 1891: 320; Jacobi, 1903: 13.

*Lembeja maculosa*; Distant, 1892: xiv, 147 (in partim); Distant, 1897: 371; Jacobi, 1903: 12, 13; Distant, 1905: 279; Distant, 1906: 184; Kato, 1932: 189; Metcalf, 1963: 428, 431; De Jong, 1986: 141, 142.

*Prasia maculosa*; Breddin, 1901: 27, 113, 153.

The following reference was found to pertain to *L. distanti* de Jong, 1986: Distant, 1892: xiv: 147 (in partim), pl. 7, 13a—b.

This species is described in comparison with *L. fatiloqua*. The males and females of *L. maculosa* are differently coloured.

Description.

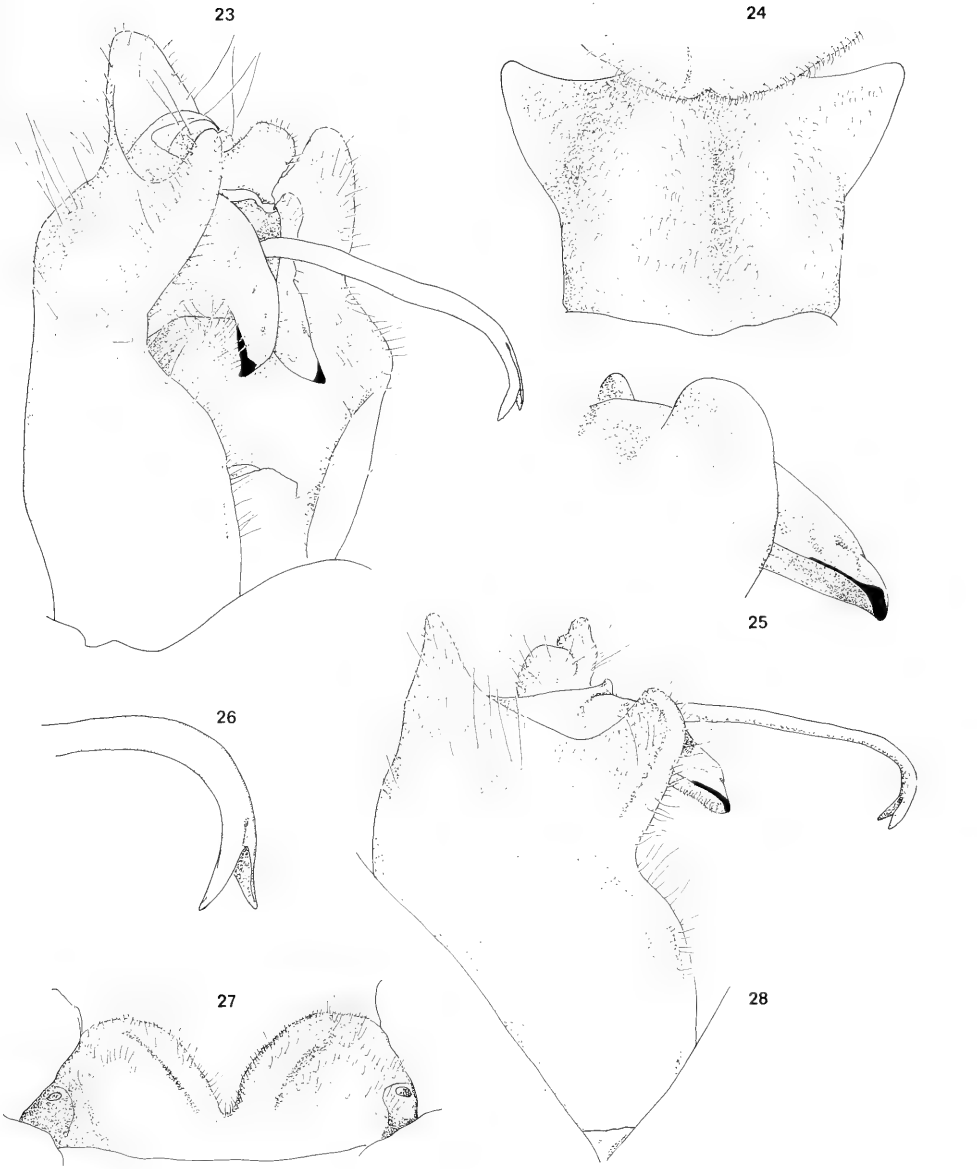
Body greenish- to yellowish-ochraceous in males, brownish-ochreous in females (holotype green). Males larger than in *L. fatiloqua*. Females with spotted tegmina, tegmina in males hyaline. Head and pronotum together 0.9—1.08 × as long as meso- and metanotum together. Head and thorax together in males 0.64—0.76 ×, in females 1.01—1.21 × as long as abdomen.

Head. — Antennae unicoloured. Eye in dorsal view 0.47—0.55 × as wide as width of vertex between eyes. Distance between lateral ocelli 0.72—1.0 × distance between ocellus and eye. Length of head 1.28—1.44 × as long as width of vertex between eyes; width of head 1.84—2.1 × as wide as width of vertex between eyes. Dark apex of rostrum reaching middle coxae.

Thorax. — Fissures on pronotum not very deep. Pronotum collar 2.17—2.57 × as wide as length of head, 1.5—1.73 × as wide as width of head. Females with some dark brown patches on areas between fissures and between fissures and pronotum collar; central fascia slightly darker coloured than remaining part of pronotum. Obconical areas on mesonotum hardly discernable. Female with median longitudinal dark brown stripe on cruciform elevation.

Legs. — In males with same colour as underside body; in females with darker patches. Basal spine on fore femora long and pointed. Sometimes a small 4th, apically situated spine present.

Tegmina and wings. — Tegmina hyaline in males, in females spotted regularly along and in veins and faintly spotted within tegmen cells. Transverse vein of 2nd ulnar area extending into 3rd ulnar area. Corial fold clearly distinct. Costa and veins whitish tinged in males, pale-ochreous in females. Third ulnar area 0.88—1.08 × as long as 1st one; 4th ulnar area 0.91—1.16 × as long as radial area. Third apical area 0.8—1.01 × as




Figs. 23—28. *Lembeja maculosa*; 23—26, 28, ♂ Patunuang; 27, ♀ Patunuang. 23, pygofer, ventrolateral view; 24, tergite 1, dorsal view; 25, clasper, lateral view; 26, apex of aedeagus, laterodorsal view; 27, sternite 7, ventral view; 28, pygofer, lateral view.

long as 4th one. Wings hyaline, extreme base and veins whitish in males, red in females. $Cu_2$ and $A_1$ fused at 70—89% from their origins.

Male: Operculum. — Small, hardly reaching folded membrane. Meracanthus long and slender.

Abdomen. — Yellow to light brown; carinate. In lateral view relatively larger than in *L. fatiloqua*. Mirrors relatively smaller than in *L. fatiloqua*. Tergite 1 with relatively broader flaps.

Tymbals. — Provided with usually 14 (sometimes 15) long ridges with an equal number of short ridges.

Genitalia. — Lateral lobes of pygofer broad, short and flat, concave on outer and convex on inner surface. Caudodorsal beak short, bluntly rounded. Claspers elongate, hardly curved and only slightly pointed. Median uncus part compressed and narrow. Aedeagus long and slender, its two apical short lobes acutely pointed.

Female: Operculum. — As in *L. fatiloqua*.

Abdomen. — Darker coloured than remaining part of body. Three, usually faint, longitudinal fasciae, a dorsal, medial narrow one and two broad lateral ones. Segment 9 with two fairly broad longitudinal, dark coloured lateral stripes, just uniting in front of caudodorsal beak. Ovipositor sheath 0.19—0.24 × as long as abdomen.

Measurements of the material studied: body length ♂: 22.3—24.2 mm, $\bar{x} = 23.2 \pm 0.8$ mm, ♀: 17.3—19.1 mm, $\bar{x} = 18.4 \pm 0.6$ mm; width of pronotum collar ♂: 5.4—6.7 mm, $\bar{x} = 6.3 \pm 0.4$ mm, ♀ = 6.1—6.7 mm, $\bar{x} = 6.4 \pm 0.4$ mm; tegmen length ♂: 24.9—27.9 mm, $\bar{x} = 26.6 \pm 0.8$ mm, ♀: 25.2—28.5 mm, $\bar{x} = 26.7 \pm 1.0$ mm.

Distribution. — South Sulawesi (map 3).

Material examined. — Indonesia, Sulawesi: Makassar (= Ujung Pandang), leg. Dres. Sarasin, coll. Breddin, 1 ♂ (DEI); same locality and collectors but: *Lembeja fatiloqua* (Stål), Jacobi det., 1 ♀ (DEI); same locality and collectors but: *fatiloqua* Stål, coll. A. Jacobi 1910—6, 1 ♂ (SMD); same locality but: F. Muir, Dec. 1908, 1 ♀ (BISH); Patunuang, S. Celebes, Jan. 1896, H. Fruhstorfer, 4 ♂ 3 ♀ (NHMW); same data but: 1909—21, Type, 1 ♀ (BMNH); same data but: *maculosa* Dist., Type, Distant coll. 1911—383, 1 ♀ (BMNH); same data but: coll. A. Jacobi, 1910—6, 1 ♂ (SMD); same data but: *Lembeja maculosa* Dist. ♀, 1 ♀ (TMB); same data but: *Prasia faticina* Dist, Cotypus!, *tincta* Dist. coll. A. Jacobi 1910—6, 1 ♂ (SMD); same data but: *Prasia* sp., Dist. coll. 1911—383, 7, 1 ♂ (BMNH); same data but: *Cystosoma, C. paradoxa* S. Celebes, Fruhst. 1900, 12029, 1 ♀ (SMN); same data but: *L. tincta* Dist, Prof. Dr A. Jacobi determ., H. Fruhstorfer vend. 30.ix.1897, 1 ♂ (ZIM); Samanga, S. Celebes, Nov. 1895, H. Fruhstorfer, *Lembeja maculosa* Dist. ♀, 1 ♀ (SMD). Sulawesi, without further indication: "*maculosa*/Dist./type" (handwritten), "*maculosa*/(Dist)" (yellow label, handwritten), "A.B. Meyer/Celebes 1871" (print, yellow label), "coll. A. Jacobi" (print), "363" (handwritten) ♀ holotype of *Perissoneura maculosa* (SMD).

Remarks.

*L. maculosa* is very similar to *L. fatiloqua* in respect to the male genitalia. Furthermore, the tymbal in both species is provided with almost the same number of alternating ridges. A feature of distinction is the sexual dimorphism in coloration of body and tegmina of *L. maculosa*, which is also found in *L. tincta*.

**Lembeja tincta** (Distant, 1909) n. comb.
(figs. 29—34, 76, 77; map 3)

*Prasia tincta* Distant, 1909: 393; Gaedike, 1971: 319; de Jong, 1982: 182; Duffels & v. d. Laan, 1985: 313; de Jong, 1985: 166; de Jong, 1986: 141.
*Lembeja tincta*; de Jong, 1986: 142.

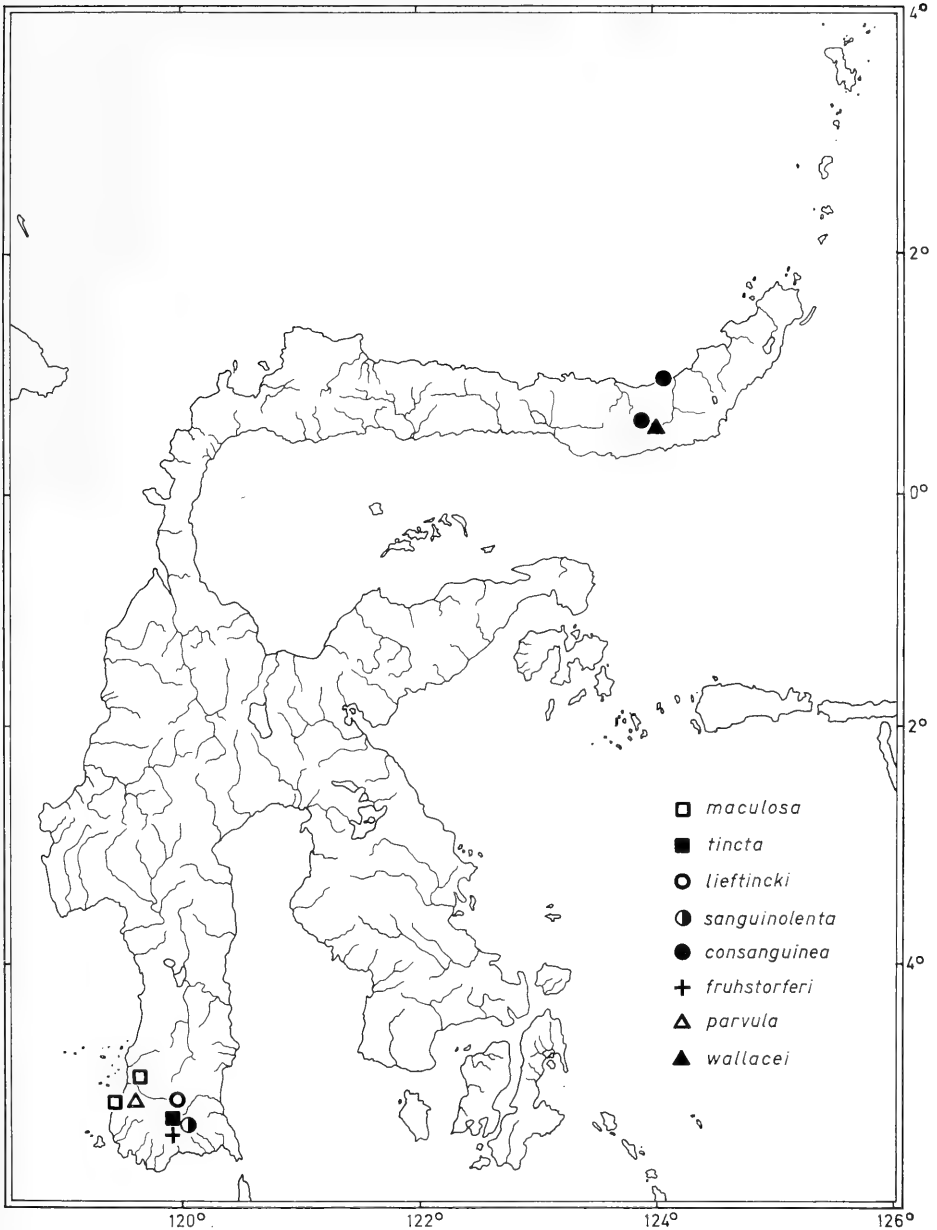
This species is described in comparison with *L. maculosa*. The different coloration of males and females reminds that of *L. maculosa*.

Description.

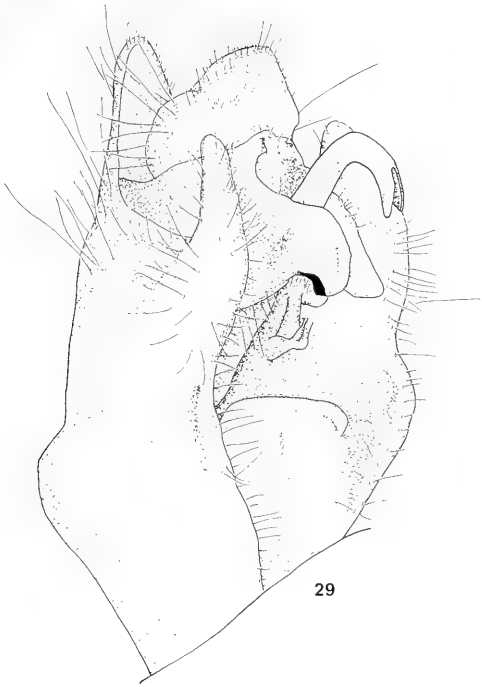
Body virescent to orange-yellowish in males, brownish-ochreous to orange-yellowish in female. Tegmina unspotted in males, spotted in female. Head and pronotum together 0.86—1.06 × as long as meso- and metanotum together. Head and thorax together in males 0.61—0.79 ×, in female 0.9 × as long as abdomen.

Head. — Antennae dark-coloured from 2nd segment to apex. Eye large, in dorsal view 0.54—0.64 × as wide as width of vertex between eyes. Area between lateral ocelli brownish in female only. Distance between lateral ocelli 0.74—1.0 × distance between lateral ocellus and eye. Length of head 1.26—1.43 × as long as width of vertex between eyes; width of head 2.09—2.27 × as wide as width of vertex between eyes. Transverse ridges in the ground-colour in male, somewhat darker than ground-colour, especially near base of rostrum, in female. Rostrum with black apex reaching middle trochanter.

Thorax. — Pronotum collar 2.47—2.84 × as




Map. 3. Distributions of *L. consanguinea*, *L. fruhstorferi*, *L. lieftincki*, *L. maculosa*, *L. sanguinolenta*, *L. tincta*, *L. parvula* and *L. wallacei*.





Figs. 29—30. *Lembeja tincta*, ♂ Lompobatang. 29, 30, pygofer, 29, ventrolateral view, 30, lateral view.

wide as length of head, 1.50—1.76 × as wide as width of head. Pronotum with fissures more prominent than in *L. maculosa*; uniformely virescent or orange-yellowish in males; dark brown spots between fissures and between fissures and pronotum collar, and dark-coloured central fascia and lateral corners of pronotum collar in female. Mesonotum with four light-coloured obconical areas in males; obconical areas in female indicated by a whitish edge, and darker coloured in front of cruciform elevation. Cruciform elevation in female with dark median longitudinal stripe, extending on metanotum.

Legs. — Same colour as underside of body in males; in females with dark patches, basally and apically, on tibiae and tarsi. Relatively slender basal spine usually blunt, sometimes with small subapical spine.

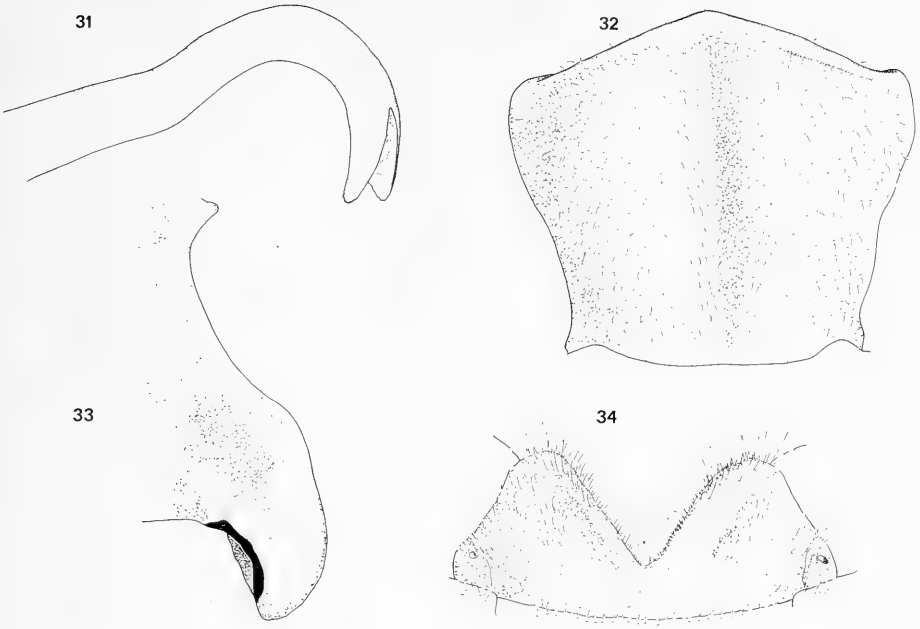
Tegmina and wings. — Tegmina hyaline, with a virescent tinge, especially in basal half, in males. Tegmina in female regularly spotted along and in veins, and more heavily spotted than inside tegmen cells of *L. maculosa*, extreme base and postcostal area vermillion-red, remainder of rudimentary vein indicated by two large red patches, one in the 3rd and one in the 4th ulnar area. Third ulnar area 0.84—1.06 × as long as 1st one; 4th ulnar area 0.78—0.93 × as long as radial area. Third apical area 0.74—0.89 × as long as 4th one. Wings hyaline, extreme base whitish in males, vermillion-red in female. Fusion of $Cu_2$ and $A_1$ at 67—86% from their origins.

Male: Operculum. — Very small, slightly sickle-shaped, hardly reaching folded membrane. Meracanthus long and slender.

Abdomen. — Virescent to orange-yellowish, carinate. Hind edges of tergites 3—6 vermillion-red. Trapezoid tergite 1 large; longitudinal medial dent not as prominent as in *L. maculosa*. Lateroproximal flaps hardly present. Folded membranes almost parallel with underside of thorax. Mirrors small.

Tymbals. — Seventeen (sometimes 18) long ridges, alternating with an equal number of short intercalary ridges.

Genitalia. — Lateral lobes of pygofer slender,




Figs. 31—34. *Lembeja tincta*, 31—33, ♂; 34, ♀. 31, apex of aedeagus, laterodorsal view, Bua Kraeng; 32, tergite 1, dorsal view, Lompobatang; 33, clasper, lateral view, Bua Kraeng; 34, sternite 7, ventral view, Bua Kraeng.

slightly swollen; not reaching beyond anal valves; hardly concave at the outer and convex on inner surface. Caudodorsal beak medium-sized, almost pointed. Claspers short, sturdy and curved. Aedeagus medium-sized, subapically strongly curved; apex with two short pointed flaps.

Female: Operculum. — Small, darker; edges sometimes lighter. Meracanthus long and slender.

Abdomen. — Three dark-coloured longitudinal fasciae situated as in *L. maculosa*, but more conspicuous. Coloration of segment 9 more conspicuous than in *L. maculosa*. Ovipositor sheath, with dark apex, 0.25 × as long as abdomen.

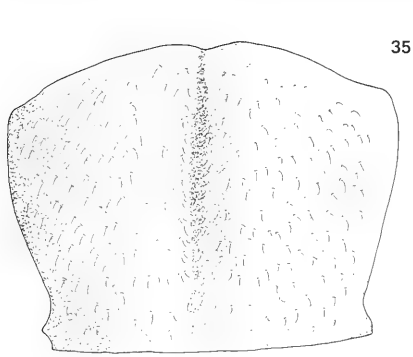
Measurements of the material studied: body length ♂: 22.8—26.2 mm, $\bar{x} = 24.7 \pm 0.9$ mm, ♀: 23.2 mm; width of pronotum collar ♂: 6.7—7.7 mm, $\bar{x} = 7.2 \pm 0.3$ mm, ♀: 7.1 mm; tegmen length ♂: 32.5—34.3 mm, $\bar{x} = 33.6 \pm 0.6$ mm, ♀: 33.7 mm.

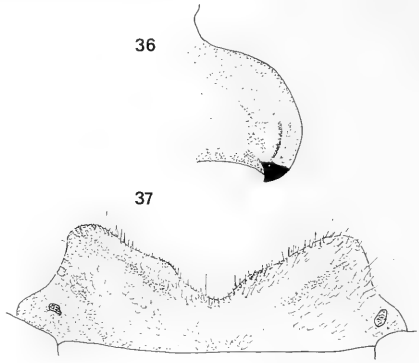
Distribution. — South Sulawesi (map 3).

Material examined. — Indonesia, Sulawesi: "S. Celebes/Bua-Kraeng/5000' Febr. 1896/H. Fruhstorfer" (print, black cadre), "1909—21" (print), "Type" (print, round label, red edged), "syn-type" (print, round label, blue edged), "*Prasia/tincta*/Dist./*Type*" (handwritten), "Brit. Mus." (print) ♂ holotype of *Prasia tincta* (BMNH); same locality and collector but: syntype, *Prasia tincta*, 2 ♂ paratypes of *Prasia tincta* (BMNH); same locality and collector, 1 ♂ 1 ♀ (BMNH) 1 ♂ (NHMW); same locality and collector but: syntypus, *Lembeja tincta* (Dist) Jacobi det., 1 ♂ (DEI); same locality and collector but: *Lembeja fruhstorferi* Dist., 1 ♂ (TMB); Lompa-Battau (= Lompobatang), 3000' Marz 1896, H. Fruhstorfer, vend. 30.ix.1897, Prof. Dr A. Jacobi determ., 1 ♂ (ZIM); same locality, 1600 m, vii.1936, L. J. Toxopeus, 5 ♂ (MZB).

Remarks.

*L. tincta* and *L. maculosa* are characterized by sexual dimorphism in the coloration of body and tegmina. The genitalia of *L. tincta* and especially the sturdy aedeagus, are more alike those found in the species of the Lesser Sunda Islands.




Figs. 35—37. *Lembeja paradoxa*; 35, 36, ♂ Port Moresby; 37, ♀ Port Moresby. 35, tergite 1, dorsal view; 36, clasper, lateral view; 37, sternite 7, ventral view.

**Lembeja paradoxa** (Karsch, 1890)
(figs. 35—37)

*Perissoneura paradoxa* Karsch, 1890: 191; Mac-Lachlan, 1891: 320.
Lembeja paradoxa; Distant, 1892: xiv, 148; Distant, 1897b: 382; Jacobi, 1903: 13; Distant, 1906: 182; Schmidt, 1925: 43; Kato, 1932: 189; Metcalf, 1963: 432; de Jong, 1982: 175—179, 182—184, figs. 1—8, 17—19, 22—23; de Jong, 1986: 141, 142.
*Prasia paradoxa*; Breddin, 1901: 153.
*Perissoneura acutipennis* Karsch, 1890: 192; Mac-Lachlan, 1891: 320.
*Prasia acutipennis*; Breddin, 1901: 153.
*Lembeja acutipennis*; Jacobi, 1903: 13; Distant, 1906: 184; Kirkaldy, 1907: 309; Schmidt, 1925: 43; Burns, 1957: 669; Metcalf, 1963: 429; de Jong, 1982: 175—177 (in synonymy of *Lembeja paradoxa*).
*Lembeja brunneosa* Distant, 1910: 418; Distant, 1913: 601; Ashton, 1914: 356; Burns, 1957: 669, 670 (equals *Lembeja australis* and *Prasia viticollis* (sic)); Metcalf, 1963: 430; Woodward, Evans and Eastop, 1970: 413; Moulds, 1975: 251—254, figs. 1—6; de Jong, 1982: 175—177 (in synonymy of *Lembeja paradoxa*).
*Lembeja australis* Ashton, 1912b: 77, pl. 7 fig. 3; Distant, 1913: 601 (in synonymy of *Lembeja brunneosa*); Metcalf, 1963: 430 ditto; de Jong, 1982: 175—177 ditto.

No new material has been studied since the redescription of *Lembeja paradoxa* (see de Jong, 1982). In addition to the redescription, I add here all relevant measurements and some additional figures in order to facilitate comparison with other species of the *fatiloqua* group.

Head and pronotum together 0.97—1.14 × as long as meso- and metanotum together. Head and thorax together in females 0.9—1.17 × as long as abdomen, in males very variable because of the telescoping abdomen, and therefore unreliable.

Eye in dorsal view 0.40—0.49 × as wide as width of vertex between eyes. Distance between lateral ocelli 0.52—1.05 × distance between lateral ocellus and eye. Length of head 1.23—1.35 × as long as width of vertex between eyes; width of head 1.81—1.98 × as wide as width of vertex between eyes.

Pronotum collar 2.13—2.53 × as wide as length of head, 1.42—1.68 × as wide as width of head.

Third ulnar area 1.19—1.65 × as long as 1st one; 4th ulnar area 0.95—1.10 × as long as radial area. Third apical area 0.89—1.16 × as long as 4th one. Fusion of $Cu_2$ and $A_1$ in wings at 71—91% from their origins.

Tymbal provided with 13—14 long ridges, alternating with an equal number of short intercalary ridges.

Ovipositor sheath 0.13—0.19 × as long as abdomen.

**Lembeja fruhstorferi** Distant, 1897
(map 3)

*Lembeja fruhstorferi* Distant, 1897 (part.): 371; Jacobi, 1903: 13; Distant, 1906: 184; Kato, 1932: 189; de Jong, 1986: 141, 142.
*Prasia fruhstorferi*; Breddin, 1901: 27, 153.

The following reference was found to pertain to *L. distanti* de Jong, 1986: Distant, 1897: 371.

A very short description, made in comparison

with *L. fatiloqua*, is given here, as the species is only known from its female holotype

Description of the female.

Body dull-brown. Head and pronotum together 0.96 × as long as meso- and metanotum together. Head and thorax together 0.92 × as long as abdomen.

Head. — Brownish ochreous. Eye in dorsal view 0.56 × as wide as width of vertex between eyes. Distance between lateral ocelli 0.87 × distance between lateral ocellus and eye. Length of head 1.41 × as long as width of vertex between eyes; width of head 2.12 × as wide as width of vertex. Postclypeus and its transverse ridges uniform.

Thorax. — Irregularly brown and ochreous. Pronotum with some irregular patches. Pronotum collar with two small medial light ochreous patches. Pronotum collar 2.54 × as wide as length of head, 1.7 × as wide as width of head. Mesonotum with irregular patches in obconical areas.

Legs. — Same colour as underside of body. Basal spine on fore femora blunt and short.

Tegmina and wings. — Tegmina subhyaline, spotted along and in veins and in tegmen cells. Costa and veins light brownish. Extreme base light brownish. Transverse vein of 2nd ulnar area extending into 3rd one. Corial fold brown, in 4th ulnar area accompanied by a large brown patch. Third ulnar area 1.12 × as long as 1st one; 4th ulnar area 0.84 × as long as radial area. Third apical area 0.88 × as long as 4th one. Wings hyaline, veins whitish tinged. $Cu_2$ and $A_1$ fused at 92% from their origins.

Operculum. — Very small. Small meracanthus broad at base, just a little longer than operculum.

Abdomen. — Brownish, underside a little paler. Hind margins of tergites 3—7 dull red. Ovipositor sheath 0.21 × as long as abdomen.

Measurements of the holotype: body length 24.5 mm; width of pronotum collar: 8.0 mm; tegmen length: 35.4 mm.

Distribution. — South Sulawesi (map 3).

Material examined. — Indonesia, Sulawesi: "S. Celebes/Bua-Kraeng/5000' Febr. 1896/H. Fruhstorfer" (print, black cadre), "*fruhstorferi*/ Dist." (handwritten), "Type" (print, round label, red edged), "Distant Coll./1911—383" (print) ♀ holotype of *Lembeja fruhstorferi* (BMNH).

Remarks.

See *L. sanguinolenta*.

**Lembeja sanguinolenta** Distant, 1909
(figs. 38—41, map 3)

*Lembeja sanguinolenta* Distant, 1909: 394; de Jong, 1982: 182; de Jong, 1986: 141, 142.

The description is based upon the only known specimen of the species, the male holotype.

Description of the male.

Body for its greater part dull red. Head and body pilose. Head and pronotum together 0.91 × as long as meso- and metanotum together. Head and thorax together 0.89 × as long as abdomen. Greatest width of the body across the 2nd and 3rd abdominal segment.

Head. — Red, transverse ridges in the same colour as underside. Eye large, in dorsal view 0.68 × as wide as width of vertex between eyes. Distance between lateral ocelli 0.92 × distance ocellus and eye. Length of head 1.65 × as long as width of vertex between eyes; width of head 2.35 × as wide as width of vertex between eyes. Rostrum with only slightly darker apex reaching intermediate coxae.

Thorax. — Median part of pronotum, including central fascia and pronotum collar, red. Rest of pronotum light ochreous with some brown patches. Pronotum collar 2.68 × as wide as length of head, 1.88 × as wide as width of head. Fissures fairly deep. Obconical areas on mesonotum patchy.

Legs. — Same colour as thorax. Basal spine of fore femur blunt.

Tegmina and wings. — Tegmina subhyaline, on the whole spotted with red. Costa and veins red. Transverse vein of 2nd ulnar area extending into 3rd. Corial fold in 3rd ulnar area somewhat darker, in 4th one indicated by a large red patch. Third ulnar area 1.02 × as long as 1st one; 4th ulnar area 0.84 × as long as radial one. Third apical area 0.97 × as long as 4th one. Wings subhyaline. Extreme base white with red. Fusion of $Cu_2$ and $A_1$ at 78% from their origins.

Operculum. — Hairy. Hardly reaching folded membrane. Large mecanthus broad at base, pointed apically.

Abdomen. — Reddish ochreous, tergite 3—7 with red hind edges. Tergite 1 with small lateroproximal flaps. Mirrors large.

Tymbals. — Provided with 20 long and 20 short intercalary ridges.

Genitalia. — Pygofer large. Flat lateral lobes medium-sized, not reaching beyond anal valves. Caudodorsal beak medium-sized, hardly pointed apically. Edge of pygofer just below each lateral

lobe somewhat protruding. Uncus narrow, a slight onset of a tube-like structure, just above claspers, discernable. Curved claspers relatively small. Apex of sturdy aedeagus with two long, more or less toothed, flaps.

Measurements of the holotype: body length: 24.6 mm; width of pronotum collar: 8.8 mm; tegmen length: 36.6 mm.

Distribution. — South Sulawesi (map 3).

Material examined. — Indonesia, Sulawesi: "S. Celebes/Bua-Kraeng/5000' Febr. 1896/H. Fruhstorfer" (print, black cadre), "*Lembeja/sanguinolenta*/Type Dist." (handwritten), "Type" (round label, red edged, print), "1909—21" (print) ♂ holotype of *Lembeja sanguinolenta* (BMNH).

Remarks.

*L. fruhstorferi* and *L. sanguinolenta* have about the same body-size, but some body ratios are very different.

**Lembeja lieftincki** n.sp.
(figs. 42—48, 78, 79; map 3)

The description is based upon two males and two females from South Sulawesi.

Description.

Body green to dark ochreous. Head and pronotum together 0.96—1.06 × as long as meso- and metanotum. Head and thorax together in males 0.78—0.79 ×, in females 0.84—0.95 × as long as abdomen.

Head. — Green to reddish-brown. Antennae usually darker coloured. Area between lateral ocelli sometimes darker coloured. Eye in dorsal view 0.55—0.58 × as wide as width of vertex between eyes. Distance between lateral ocelli 0.81—0.92 × distance between lateral ocellus and eye. Length of head 1.33—1.39 × as long as width of vertex between eyes; width of head 2.09—2.16 × as wide as width of vertex between eyes. Underside of head usually slightly darker.

Thorax. — Dark with black patches between fissures and between fissures and pronotum collar. Central fascia in females darker coloured than remaining part of pronotum. Pronotum collar 2.31—2.55 × as wide as length of head, 1.47—1.65 × as wide as width of head. Obconical areas distinctly recognizable. Cruciform elevation usually with median longitudinal dark stripe.

Legs. — Generally same colour as underside thorax but with some dark patches, especially basally and apically on tibiae and tarsi. Spines on fore femora dark.

Tegmina and wings. — Tegmina hyaline, spotted in and along veins in a regular pattern, and in tegmen cells, especially in apical area 8. Corial fold recognizable by heavy pigmentation, especially in 4th ulnar area. Basal area infuscated. Extreme base reddish. Venation green to red. Third ulnar area 0.97—1.0 × as long as 1st ulnar area; 4th ulnar area 1.0—1.08 × as long as radial area. Third apical area 0.85—0.96 × as long as 4th one. Wings hyaline. Fusion of the $Cu_2$ and $A_1$ veins at 72—84% from their origins.

Male: Operculum. — Small. Meracanthus long and pointed.

Abdomen. — Sometimes darker coloured. Mirrors large. Folded membranes nearly continuous with underside of thorax. Tergite 1 laterally slightly depressed near the small lateroproximal flaps.

Tymbals. — Provided with 19 long ridges, alternating with an equal number of short intercalary ridges.

Genitalia. — Lateral lobes of pygofer sturdy. Lateral surface of pygofer with a short ridge-like structure running downwards from each lateral lobe. Caudodorsal beak relatively long, apically rounded. Claspers short and curved, hardly pointed. Median uncus part enlarged to a tube-like structure. Apex of aedeagus with two recurved, long flaps; dorsally provided with a long subapical incision.

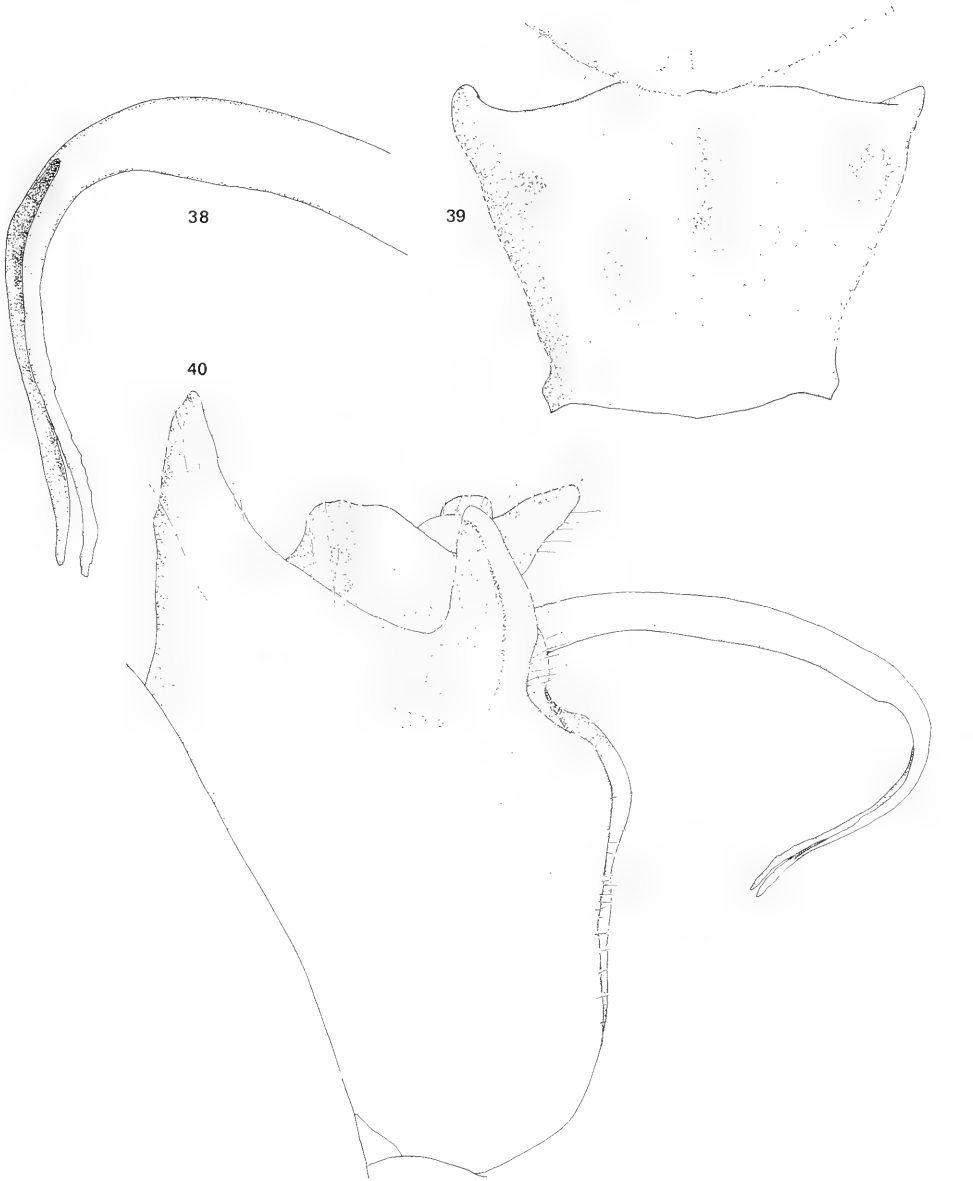
Female: Operculum. — Small, but relatively large compared to other species of the species-group.

Abdomen. — Provided with three dark-coloured, longitudinal fasciae as in *L. tincta*, but the two dark stripes on segment 9 narrower and not united in front of caudodorsal beak. Dark ovipositor sheath 0.40—0.41 × as long as abdomen.

Measurements of the types: body length ♂: 21.4—21.6 mm, ♀: 21.6—21.8 mm; width of pronotum collar ♂: 6.2—6.6 mm, ♀: 7.2 mm; tegmen length ♂: 27.5—28.0 mm, ♀: 29.0—30.0 mm.

Distribution. — South Sulawesi.

Types. — Indonesia, Sulawesi: Holotype: "S.W. Celebes, 1100 m/Mt. Lompobatang/area, Malino, 2,/8—10.vi.1982/M. A. Lieftinck" ♂ holotype of *Lembeja lieftincki* (RMNH). Para-




Figs. 38—40. *Lembeja sanguinolenta*, holotype. 38, apex of aedeagus; 39, tergite 1, dorsal view; 40, pygofer, lateral view.


Fig. 41. *Lembeja sanguinolenta*, pygofer, ventrolateral view, holotype.

types: same data as holotype, 2 ♂ 1 ♀ (RMNH); Macassar (= Ujung Pandang), Rippon coll., 1 ♂ (NMWC).

Etymology. — The species is named after its collector, the late Dr Lieftinck, odonatologist, in recognition of his major contributions to the biogeography of Indonesia and the Pacific region.

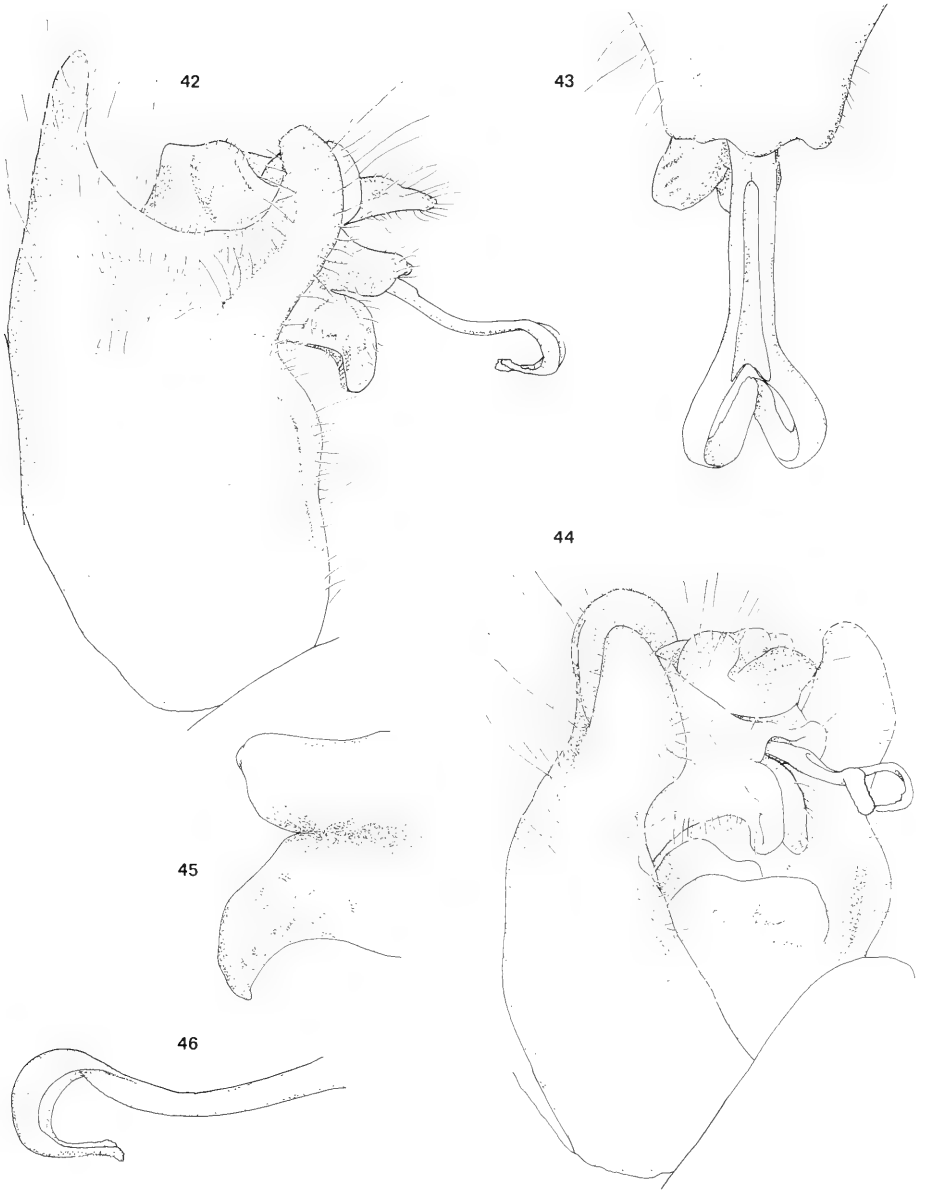
**Lembeja consanguinea** n.sp.
(figs 49—56; map 3)

This species is described after a large series of specimens, collected by various participants to the "Project Wallace" expedition.

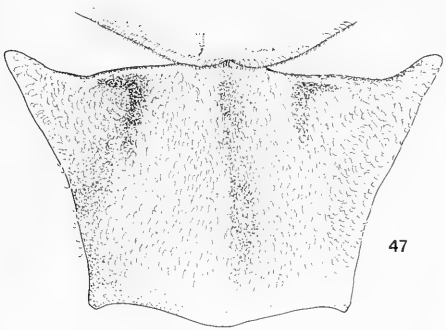
Description.

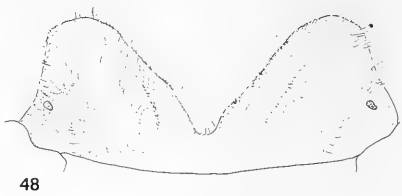
Body green. Tegmina greenish, tegmen areas usually faintly red mottled. Head and pronotum together 0.95—1.21 × as long as meso- and metanotum together. Head and thorax together in males 0.69—0.95 ×, in females 0.92—1.10 × as long as abdomen.

Head. — Eye in dorsal view 0.45—0.56 × as wide as width of vertex between eyes. Distance between lateral ocelli 0.71—1.04 × distance between lateral ocellus and eye. Length of head 1.26—1.56 × as long as width of vertex between eyes; width of head 1.84—2.12 × as wide as width of vertex between eyes. Transverse ridges in the




Figs. 42—46. *Lembeja lieftincki*, ♂ holotype. 42, pygofer, lateral view; 43, apex of aedeagus and mediane uncus part, dorsal view; 44, pygofer, ventrolateral view; 45, clasper and mediane uncus part, lateral view; 46, apex of aedeagus, lateral view.




Figs. 47—48. *Lembeja lieftincki*; 47, ♂ holotype; 48, ♀, paratype. 47, tergite 1, dorsal view; 48, sternite 7, ventral view.

same colour as underside postclypeus. Rostrum with black apex reaching middle trochanter.

Thorax. — Pronotum collar 2.02—2.58 × as wide as length of head, 1.41—1.62 × as wide as width of head. Obconical areas of mesonotum hardly or not discernable.

Legs. — Same colour as underside body. Basal spine on fore femora pointed.

Tegmina and wings. — Tegmina subhyaline, green; tegmen areas usually faintly mottled with red. Venation green to yellowish. Transverse vein of 2nd ulnar area extending well into 3rd one. Corial fold clearly recognizable. Third ulnar area 0.88—1.04 × as long as 1st one; 4th ulnar area 0.82—1.05 × as long as radial area. Third apical area 0.88—1.02 × as long as 4th one. Wings hyaline. Fusion of $Cu_2$ and $A_1$ at 79—90% from their origins.

Male: Operculum. — Very small. Meracanthus fairly broad, long and pointed.

Abdomen. — Green, reddish near hind edges of tergites. Tergite 1 laterally sometimes brownish. Mirrors fairly large.

Tymbals. — Seventeen long ridges alternating with an equal number of short intercalary ridges.

Genitalia. — Pygofer very large. Lateral lobes flat, apically dark. Caudodorsal beak short and rounded. Lateral surfaces of pygofer with a ridge-like structure running downwards from each lateral lobe. Claspers short, curved apically, slightly pointed. Two huge, broadly rounded parallel shields elevating distally of the claspers, connected distally by a medial, protruding flattened lip, forming a tube-like structure. Aedeagus long and very slender, with two long, apically rounded lobes; provided with unsclerotized dorsal aedeagal appendage.

Female: Operculum. — Small. Meracanthus long and pointed.

Abdomen. — Green. Ovipositor sheath 0.23—0.29 × as long as abdomen.

Measurements of the types: body length ♂: 18.9—22.1 mm, $\bar{x}$ = 20.9 ± 0.8 mm, ♀: 16.7—21.7 mm, $\bar{x}$ = 19.2 ± 1.1 mm; width of pronotum collar ♂: 5.7—6.6 mm, $\bar{x}$ = 6.1 ± 0.2 mm, ♀: 5.7—7.2 mm, $\bar{x}$: 6.4 ± 0.4 mm; tegmen length ♂: 24.6—28.4 mm, $\bar{x}$ = 26.6 ± 1.1 mm, ♀: 25.0—29.4 mm, $\bar{x}$ = 27.1 ± 1.1 mm.

Distribution. — North Sulawesi (map 3).

Types. — Indonesia, Sulawesi: Holotype: "stat. 3/Forest/margin" (print), "Toraut/Base Camp/29—30.i.1985/J. P. Duffels" (print), "Indonesia/Sulawesi Utara/Dumoga-Bone N.P./Project Wallace" (print) ♂ holotype of *Lembeja consanguinea* (ZMA). Paratypes: Base Camp Toraut, same labels as holotype, 1 ♂ 1 ♀ (MZB); same locality but: st. 7, lowland rainforest, MV light-trap, 1—2.ii.1985, J. P. Duffels & J. D. Holloway, 1 ♂ (ZMA); same locality but: st. 8, river bank, lowland rainforest, 2.ii.1985, J. P. Duffels, 1 ♂ (MZB); same locality but: st. 16, lowl. rainforest, light-trap site 1 + 2 understorey/canopy, 7—14.ii.1985, H. S. Barlow, 4 ♂ 10 ♀ (ZMA); same locality but: st. 24, lowl. rainforest, light-trap site 1, understorey, 17—26.ii.1985, H. S. Barlow, 4 ♂ 3 ♀ (MZB) 4 ♂ 2 ♀ (ZMA); same locality but: base camp, ii.1985, 1 ♀ (BMNH); same locality but: rothamsted light-trap site 1, 200 m, v.1985, H. Barlow, 4 ♀ (BMNH); same


Figs. 49—53. *Lembeja consanguinea*, ♂ paratypes Toraut. 49, pygofer, lateral view; 50, clasper and mediane uncus part, lateral view; 51, aedeagus with dorsal aedeagal appendage, laterodorsal view; 52, 53 apex of aedeagus, 52, lateral view, 53, dorsal view.

data as previous but: vi.1985, 3 ♂ 2 ♀ (BMNH); same locality but: 8—23.X.1985, J. B. Heppner, 1 ♂ 8 ♀ (FSC); same locality but: 19.x.1985, M. R. de Jong, 1 ♂ (ZMA); Edwards Camp 664 m, MV light-trap understorey/canopy, st. 27, 19.ii.1985. J. P. Duffels & J. D. Holloway, 1 ♂ 3 ♀ (ZMA); same locality but: st. 29, 24—25.ii.1985, 1 ♀ (ZMA); same locality but: iv.1985, J. H. Martin, 1 ♂ (BMNH); Goeroepahi, *Baeturia*, 6.ii.1917, W. Kaudern, 1 ♀ (RMNH); Hog's Back Camp 492 m, s.-side of ridge, st. 15, lowl. rainforest understorey/canopy, MV light-trap, 12—13.ii.1985, J. P. Duffels & J. D. Holloway, 1 ♂ (ZMA); Kosingsolan, P. P. A. headquarters, at light, René Dekker & Charlotte Vermeulen, 23.iii.1985, 1 ♀ (ZMA); Minahassa, *Prasia foliata* (Walk) Stål ♂?, det. MacGill., coll. D. MacGillavry, 1 ♂ (ZMA); Molosso Island, station 100, xi.1985, R. Bosman & J. v. Stalle, 2 ♀ (BIN); Page Camp 302 m, st. 9, lowl. rainforest, MV light-trap, 4—8.ii.1985, J. P. Duffels & J. D. Holloway, 2 ♂ (ZMA).

Etymology. — The name is derived from consanguinea (latin for "related"), for being closely related to *L. lieftincki*, by the typically shaped median uncus part.

Remarks.

I believe *L. consanguinea* and *L. lieftincki* to be very closely related. A strong synapomorphy might be found in the shape of the median uncus part.

### The *Lembeja parvula* group

Head triangularly to obconically protruding in dorsal view. Antennal segment 1 long. Male operculum small, not covering tymbal cavities. Tegmina hyaline; a regular pattern of spots in veins, sometimes also in tegmen cells; $Cu_2$ and $A_1$ forming a small triangle at tegmen border. Wings with 5 apical areas; $Cu_2$ and $A_1$ fused. Abdomen in males weakly carinate. Tergites strongly folded laterally, forming a ridge on each side of the sternites. Abdomen in males in lateral view more or less triangular shaped. Tergite 1, with two short and pointed lateroproximal flaps, only slightly swollen and faintly dinted near proximal border. Tymbal provided with 18—19 long ridges, alternating with an equal number of short intercalary ridges. Abdomen in females slender, dorsally carinate. Ovipositor sheath extending just beyond caudodorsal beak. Lateral lobes of pygofer short and fairly flat. Edge of pygofer between each lateral lobe and caudodorsal beak obliquely running hindwards (figs. 63, 67). Claspers relatively long, ventrally concave. Median uncus part narrow and compressed. Aedeagus short; sturdy apex with slightly incised dorsal projection.

**Lembeja parvula** n.sp.
(figs. 61—67; map 3)

This small species is described after one male and one female specimen.

Description.

Body yellowish-green in male, brownish-ochreous in female. Head and pronotum together 1.0—1.15 × as long as meso- and metanotum together. Head and thorax in male 0.72 ×, in female 0.98 × as long as abdomen.

Head. — Green in male; brownish with paler underside in female. Antennae darker than remaining part of head. Eye in dorsal view 0.42—0.49 × as wide as width of vertex between eyes. Distance between lateral ocelli 0.58—0.71 × distance between lateral ocellus and eye. Length of head 1.25—1.36 × as long as width of vertex between eyes; width of head 1.84—1.97 × as wide as width of vertex between eyes. Rostrum with black apex reaching middle trochanter.

Thorax. — Pronotum in male unicoloured, in female with dark-coloured central fascia, and provided with dark patches, especially between fissures and pronotum collar. Pronotum collar 2.16—2.24 × as wide as length of head, 1.49—1.52 × as wide as width of head. Mesonotum with the same colour as pronotum in male, in female dark-brown, though laterally somewhat lighter, and provided with a median, brown stripe on cruciforum elevation.

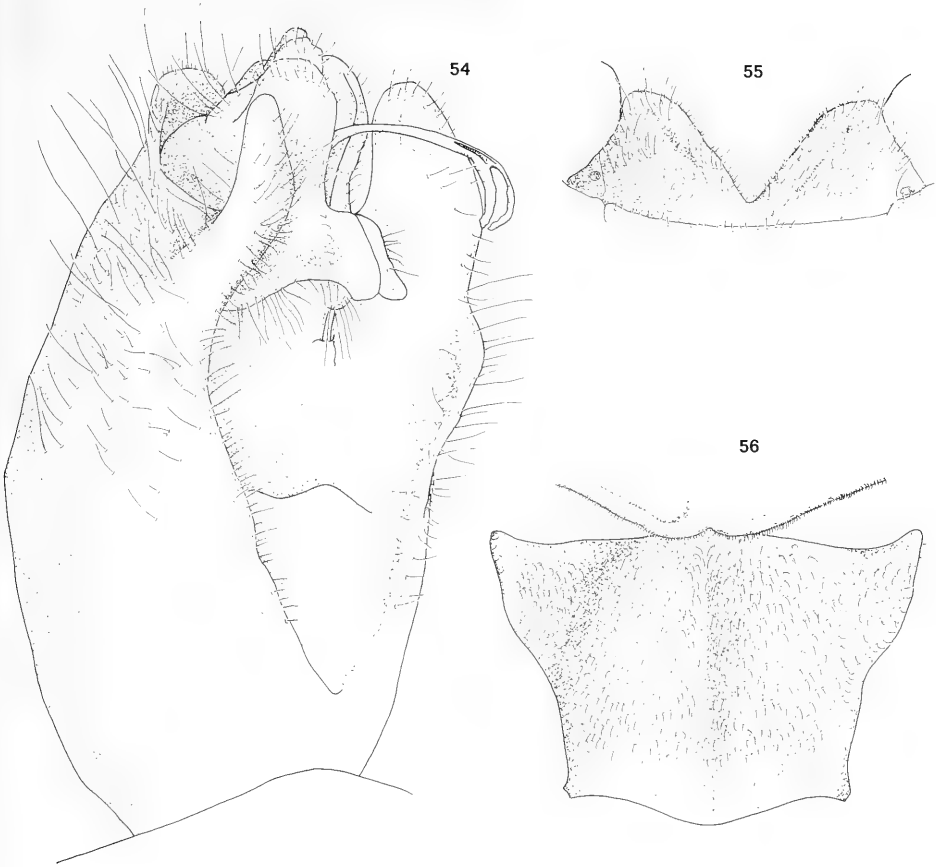
Legs. — Same colour as underside thorax in male; in female with dark-brown patches, basally and apically on femora, tibiae and tarsi. Armature of fore femora as in fig. 60.

Tegmina and wings. — Tegmina hyaline. Veins in apical half of tegmen in male with brown spots, venation yellowish-green. Tegmina in female with spotted veins, and with spots in tegmen cells in basal half of tegmen. Third ulnar area 0.96—1.12 × as long as 1st one; 4th ulnar area 0.8—0.81 × as long as radial area. Third apical area 0.81—0.86 × as long as 4th one. Wings hyaline. Fusion of $Cu_2$ and $A_1$ at 63—78% from their origins.

Male: Operculum. — Small. Meracanthus slender and pointed.

Abdomen. — Mirrors medium-sized.

Tymbal. — Provided with 19 long ridges alter-




Figs. 54—56. *Lembeja consanguinea*; 54, 56, ♂; 55, ♀ paratype Toraut. 54, pygofer, ventrolateral view, paratype Toraut; 55, sternite 7, ventral view; 56, tergite 1, dorsal view, holotype.

nating with an equal number of short intercalary ridges.

Genitalia. — Lateral lobes of pygofer fairly broad. Caudodorsal beak small. Claspers very long, apically only slightly recurved and weakly pointed. Median uncus part triangularly compressed. Dorsal projection of apex of aedeagus fairly long.

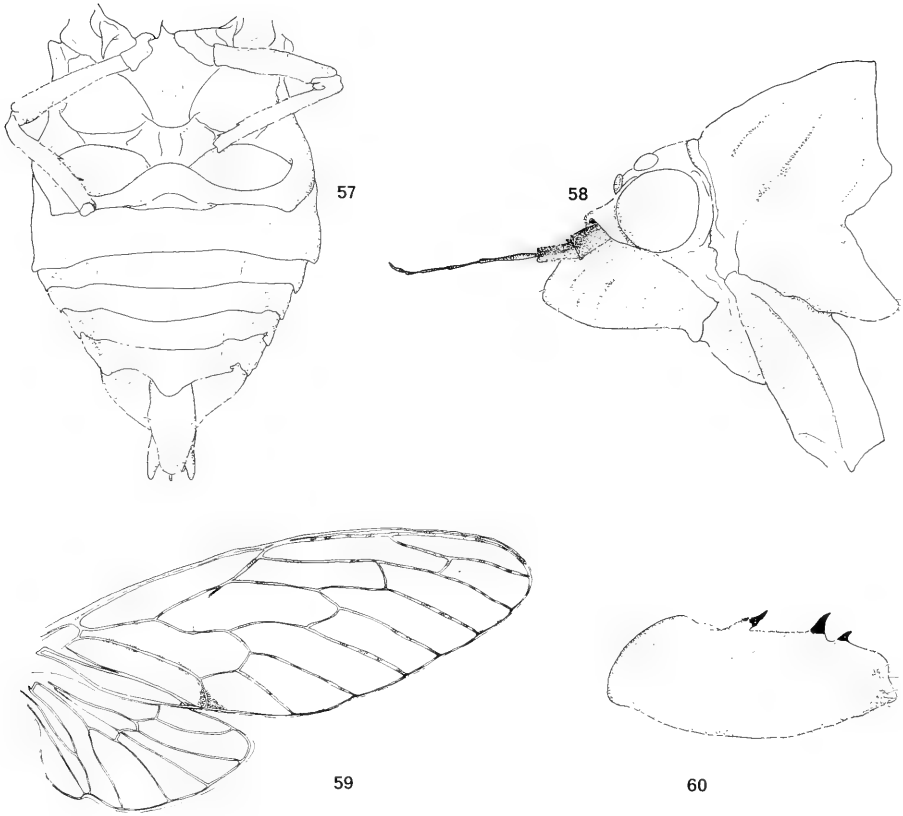
Female: Operculum. — Small, basal half dark coloured. Meracanthus short and pointed.

Abdomen. — Three longitudinal dark-brown fasciae, a dorsal, medial one, up to segment 8 and two lateral ones up to segment 7. Segment 9 with two broad laterodorsal, slightly darker fasciae, just not uniting in front of caudodorsal beak. Caudodorsal beak with dark-brown apex. Dark ovipositor sheath 0.2 × as long as abdomen.

Measurements of the types: body length ♂: 15.3 mm, ♀: 13.7 mm; width of pronotum collar ♂: 4.3 mm, ♀ 4.5 mm; tegmen length ♂: 20.3 mm. ♀: 19.6 mm.

Distribution. — South Sulawesi (map 3).

Types. — Indonesia, Sulawesi: Holotype; "Bantimoerang/552" (handwritten), "coll. A. Jacobi" (print), "Staatl. Museum für Tierkunde Dresden" (print) 1 ♂ holotype of *Lembeja parvula* (SMD). Paratype: same data as holotype but: *Lembeja* sp., 1 ♀ (SMD).




Figs. 57—60. The *L. parvula* group: 57, male abdomen, ventral view, *Lembeja wallacei*; 58, head and pronotum, lateral view, *L. parvula*; 59, right tegmen and wing, *L. wallacei*; 60, femur, lateral view, *L. parvula*.

Etymology. — The name is derived from parvula (latin for "small") as it is a small-sized species.

**Lembeja wallacei** n.sp.
(figs. 68—73, 80, 81; map 3)

The species is described in comparison with *L. parvula*, after a series of specimens collected by participants to the "Project Wallace" expedition.

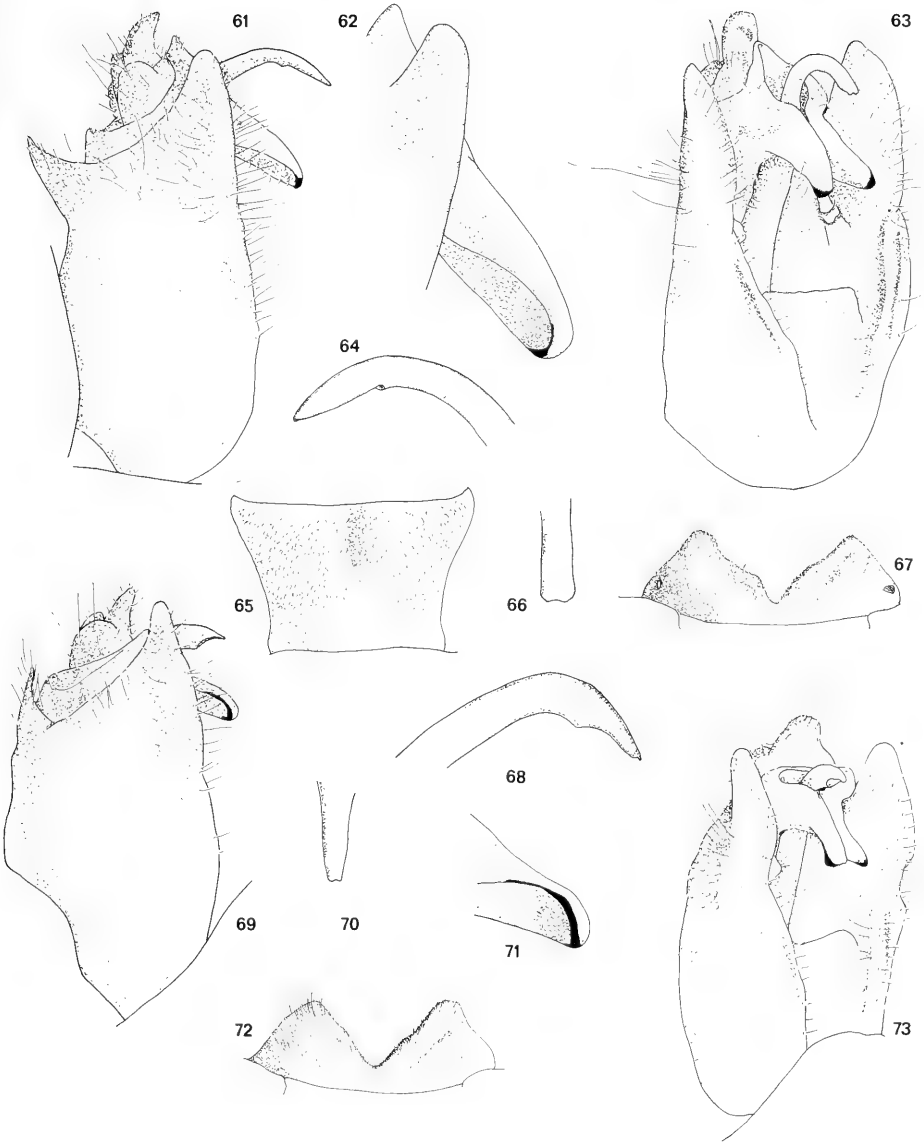
Description.

Body green in males, dark-brown in females. Head and pronotum together 1.08—1.24 × as long as meso- and metanotum together. Head and thorax together in males 0.75—0.93 ×, in females 0.91—1.02 × as long as abdomen.

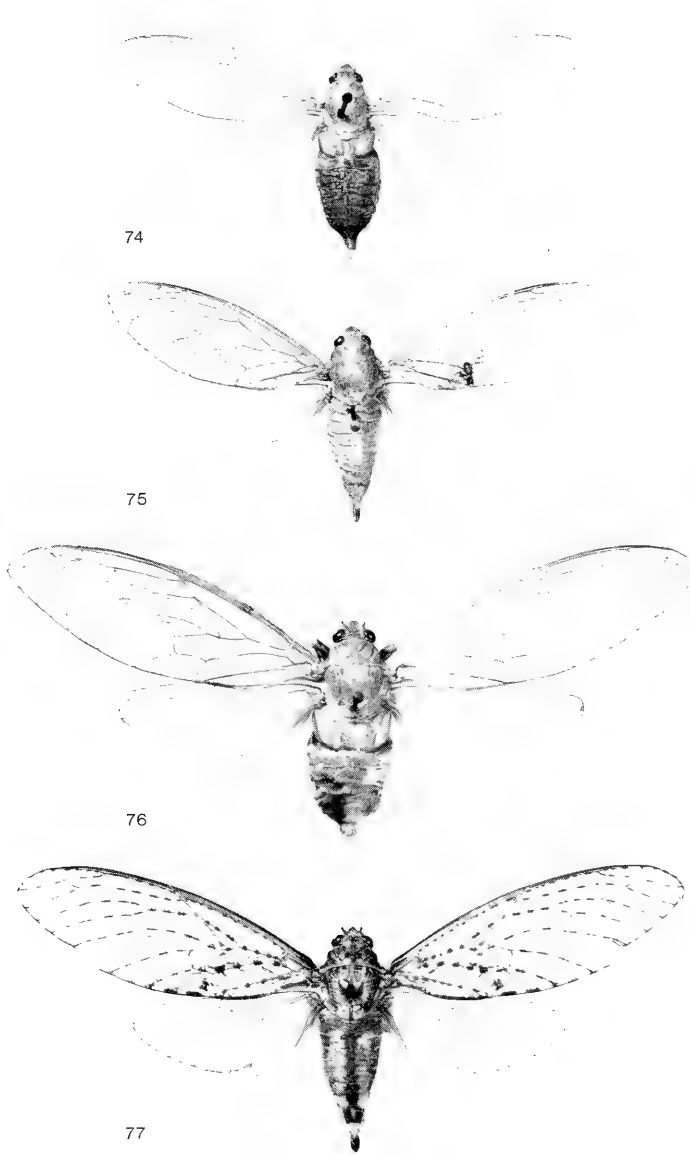
Head. — Uniformely green in males; in females dorsally irregularly covered with some light patches, postclypeus ventrally greenish. Antennae dark-brown. Eye in dorsal view 0.37—0.53 × as wide as width of vertex between eyes. Distance between lateral ocelli 0.76—1.0 × distance between lateral ocellus and eye. Length of head 1.23—1.38 × as long as width of vertex between eyes; width of head 1.75—2.05 × as wide as width of vertex between eyes. Rostrum as in *L. parvula*.

Thorax. — In males uniformely green, in females darker coloured than in *L. parvula*. Pronotum collar 2.03—2.25 × as wide as length of head, 1.35—1.58 × as wide as width of head.

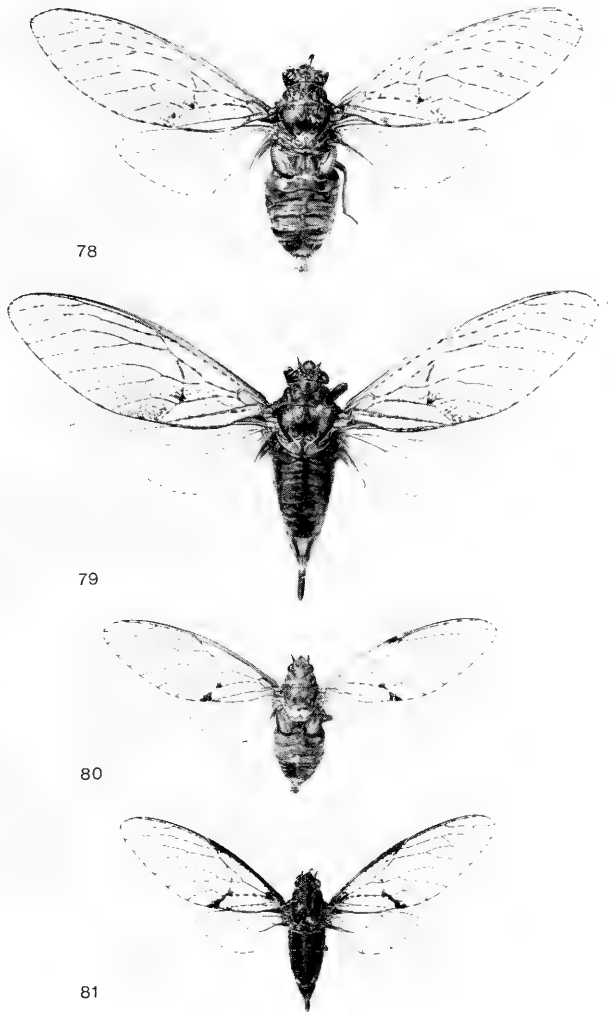
Legs. — Same colour as underside thorax in




Figs. 61—73. 61—67, *Lembeja parvula*; 61—66, ♂ holotype; 67, ♀ paratype. 61, pygofer, lateral view; 62, clasper, lateral view; pygofer, ventrolateral view; 64, apex of aedeagus, lateral view; 65, tergite 1, dorsal view; 66, apex of aedeagus, dorsal view; 67, sternite 7, ventral view. 68—73, *Lembeja wallacei*; 68, 70. ♂ paratype Page Camp, 69, 71, 73, ♂ holotype; 72, ♀ paratype Edwards Camp. 68, apex of aedeagus, lateral view; 69, pygofer, ventrolateral view; 70, apex of aedeagus, dorsal view; 71, clasper, lateral view; 72, sternite 7, ventral view; 73, pygofer, lateral view.




Figs. 74—77. General facies. 74, *Lembeja fatiloqua* ♂, Calian; 75, *Lembeja fatiloqua* ♀, Z. del Sur; 76, *Lembeja tincta* ♂, Bua Kraeng; 77, *Lembeja tincta* ♀, Bua Kraeng.




Figs. 78—81. General facies. 78, *Lembeja lieftincki* ♂, paratype; 79, *Lembeja lieftincki* ♀, paratype; 80, *Lembeja wallacei* ♂, holotype; 81, *Lembeja wallacei* ♀, paratype Edwards Camp.

males. In females fore legs with brown coxa, trochanter and femur, middle and hind legs with brown coxae, patches on femora, tibiae and tarsi.

Tegmina and wings. — Tegmina hyaline. In males veins conspicuously spotted; tegmen cells in basal half of tegmen provided with spots; venation yellowish green. Coloration in females more prominent than in *L. parvula*. Third ulnar area 0.88—0.98 × as long as 1st one; 4th ulnar area 0.85—0.93 × as long as radial one. Third apical area 0.80—0.97 × as long as 3rd one. Fusion of $Cu_2$ and $A_1$ in wings at 43—69% from their origins.

Male: Operculum. — As in *L. parvula*.

Abdomen. — As in *L. parvula*, but with faintly reddish hind edges of the tergites.

Tymbals. — Provided with 20 (sometimes 19) long ridges alternating with an equal number of short intercalary ridges.

Genitalia. — Dark lateral lobes of pygofer apically more slender than in *L. parvula*. Claspers somewhat more curved. Median uncus part flat. Apex of aedeagus more sturdy with short dorsal projection.

Female: Operculum. — Dark coloured. Shape as in *L. parvula*.

Abdomen. — Dark-brown. Segment 8 with a pale lateral spot on each side. Hind edges of tergites reddish. Dark ovipositor sheath 0.22—0.30 × as long as abdomen.

Measurements of the types: body length ♂: 12.5—16.2 mm, $\bar{x} = 14.0 \pm 1.1$ mm, ♀: 11.8—13.6 mm, $\bar{x} = 12.5 \pm 0.5$ mm; width of pronotum collar ♂: 3.8—4.5 mm, $\bar{x} = 4.2 \pm 0.2$ mm, ♀: 3.8—4.3 mm, $\bar{x} = 4.1 \pm 0.1$ mm; tegmen length ♂: 18.2—20.1 mm, $\bar{x} = 19.2 \pm 0.6$ mm, ♀: 17.0—19.2 mm, $\bar{x} = 18.1 \pm 0.7$ mm.

Distribution. — North Sulawesi (map 3).

Types. — Indonesia, Sulawesi: Holotype: "Stat. 11/Lowland/rainforest" (print), "Toraut/bank of Tumpah R./(recreation area)/8.ii.1985/J. P. Duffels" (print), "Indonesia/Sulawesi Utara/Dumoga-Bone N.P./Project Wallace" (print) 1 ♂ holotype of *Lembeja wallacei* (ZMA). Paratypes: Base camp Toraut, same data as holotype, 1 ♂ (MZB); same locality but: st. 16, lowl. rainforest, light-trap site 1 + 2, understorey/canopy, 7—13.ii.1985, H. S. Barlow, 1 ♀ (ZMA); same locality but: lowl. rainforest, 200—300 m, 2 ♂ (BMNH); same locality but: Toraut, M. R. Wilson, vi.1985, 2 ♂ (BMNH); same locality but: malaise-trap Toraut forest, M. R. Wilson, vi.1985, 1 ♂ (BMNH); same locality but: 13.ii.1985, 1 ♂ (BMNH); Edwards Camp, 664 m, st. 27, lowl. rainforest, MV light-trap, understorey/canopy, 20.ii.1985, J. P. Duffels & J. D. Holloway, 1 ♂ 1 ♀ (ZMA); same locality but: 22.v.1985, 1 ♀ (BMNH); same locality but: light-sheet, 23.vi.1985, M. R. Wilson, 1 ♀ (BMNH); Hog's Back Camp, 492 m, stat. 30A, lowl. rainforest, MV light-trap, canopy, 14.ii.1985, J. D. Holloway, 1 ♀ (MZB); Page Camp, 302 m, stat. 9, lowl. rainforest, MV light-trap, 4—8.ii.1985, J. P. Duffels & J. D. Holloway 4 ♂ 3♀ (ZMA).

Etymology. — The species is named after Alfred Russel Wallace, for numerous reasons.

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(*Author's address*: *Institute of Taxonomic Zoology, P.O. Box 20125, , 1000 HC Amsterdam, The Netherlands.*)

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# ON FOUR NEW PALAEARCTIC SPECIES OF THE GENUS *CECIDOMYIA* (DIPTERA, CECIDOMYIIDAE)

by

W. NIJVELDT

*Gruttoweide 122, Wageningen, The Netherlands*

Abstract

Larvae of the genus Cecidomyia live in resin of conifers, mainly pines. Twelve described species are recorded from North America, Europe and Asia. In this paper two new European and two new Asiatic species are described and figured: *C. harrisi, C. japonica, C. phagwariae* and *C. sarae*. A redescription of the type-species, *C. pini*, is given and a neotype is designated.

## Introduction

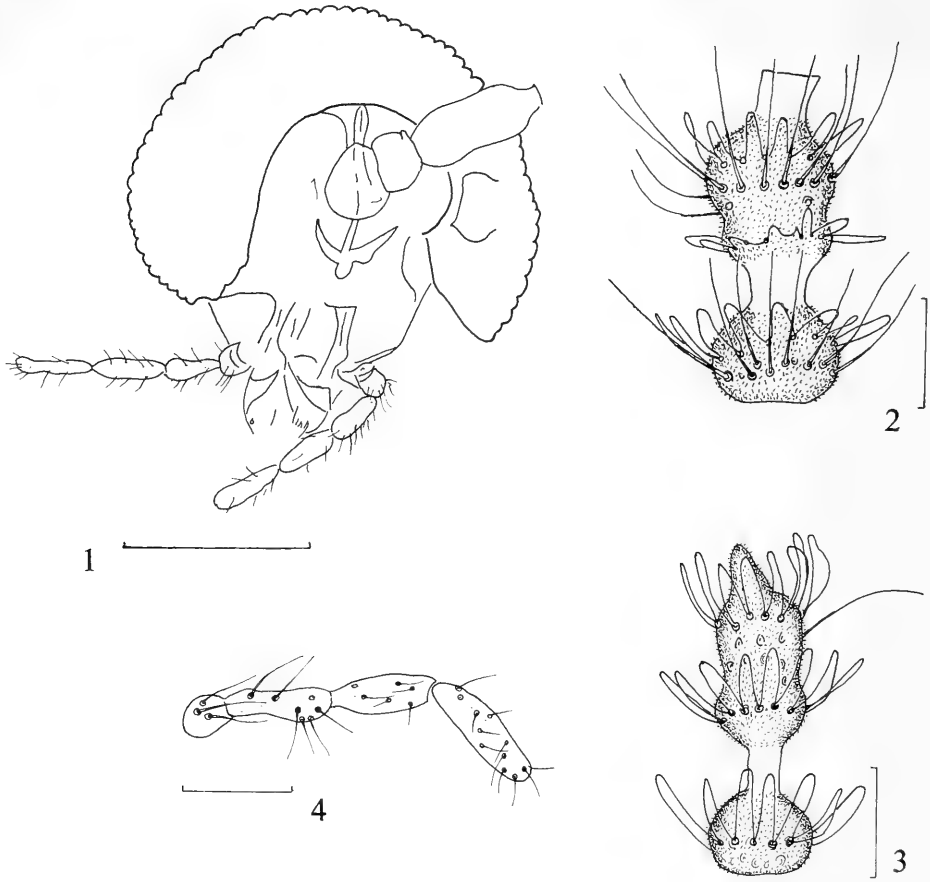
Larvae of the oldest gall midge genus *Cecidomyia* are known to live in resin of conifers, mainly pines. The first taxonomic revision of *Cecidomyia* was published by Gagné (1978 b). In his paper eleven species are recorded, eight from North America and Cuba, two from Europe and one, or possibly two, from the Himalayan region. The twelfth species, *C. bisetosa* Gagné, was discovered too late to be included in this revision (Gagné, 1978 a). *C. mesasiatica*, very briefly described from two males and one female by Mamajev (1971), was not included in Gagné's papers. This species was bred from resin on spruce in the Kirghizian Republic, USSR. I have been unable to obtain specimens for study, but the description indicates that *C. mesasiatica* closely resembles *C. magna* (Möhn). The genus *Cecidomyia* currently contains the following described species: *C. bisetosa* Gagné, *C. brevispatula* Gagné, *C. candidipes* Foote, *C. fortunactus* Gagné, *C. magna* (Möhn), *C. mesasiatica* Mamajev, *C. pini* (De Geer), *C. piniinopis* Osten Sacken, *C. reburrata* Gagné, *C. resinicola* (Osten Sacken), *C. resinicoloides* Williams and *C. tortilis* Gagné. However, examination of material bred from resin masses, taken from *Pinus sylvestris* L. in Europe, from *P. thunbergii* Parl. in Japan and from *P. roxburghii* Sarg. in Pakistan showed that four new species can be added. They will be described below.

The larvae of these species of *Cecidomyia* live completely submerged in the resin, keeping their protruding hind spiracles free from it. The European species are not known to cause economic damage but, according to Gagné (1978 b), the North American species promote breakage and secondary infection on twigs and branches of pines. *C. bisetosa* was the first species found to feed on cones, inducing malformations of the scales and preventing release of the seeds. The second record is that by Grijpma (1981). He found larvae of *C. pini* in resin exudations between the scales of green cones on *P. sylvestris* at Grubbenvorst, Province of Limburg, The Netherlands. However, it is not yet known if seed production and seed release were affected by the feeding of the larvae.

Referring to the literature mentioned here it may be concluded that *Cecidomyia* larvae feed directly on the plant tissue and not on the resin itself. It is more likely that the latter serves as a medium for protection, though several hymenopterous parasites were reared from them in the past years.

Pupation takes place in or outside the resin masses. According to Gagné (1978 b), Nearctic species that pupate apart from the resin have distinctive dorsal abdominal lobes (fig. 13), which may be helpful in leaving the mass. Contrary to this, *C. magna*, a European species, is recorded as pupating in the resin mass, unlike all the other species whose larvae have dorsal lobes (Möhn, 1955). However, in the winter of 1984-1985 I found a mature larva which had left the resin to pupate in a white cocoon attached to a branch of a spruce tree near Wageningen.

The following description of the European type-species is, as far as the adults are con-



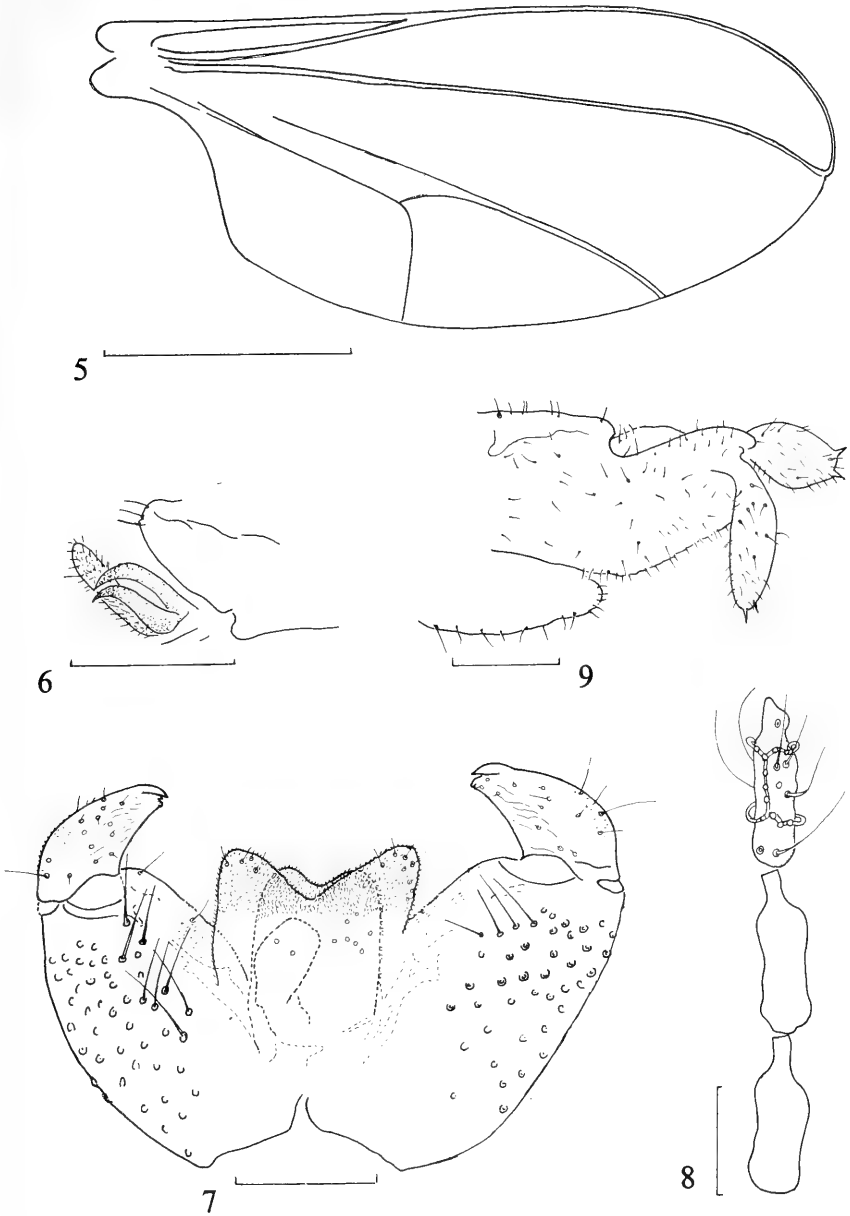

Figs. 1—4. *C. pini*, 1: head; 2: third male flagellomere; 3: distal male flagellomere; 4: palp segments. Scale line of fig. 1: 0.25 mm, of figs. 2—4: 0.1 mm. Figs. 1—4 after neotype.

cerned, based on material from Sweden, where the type-locality is situated.

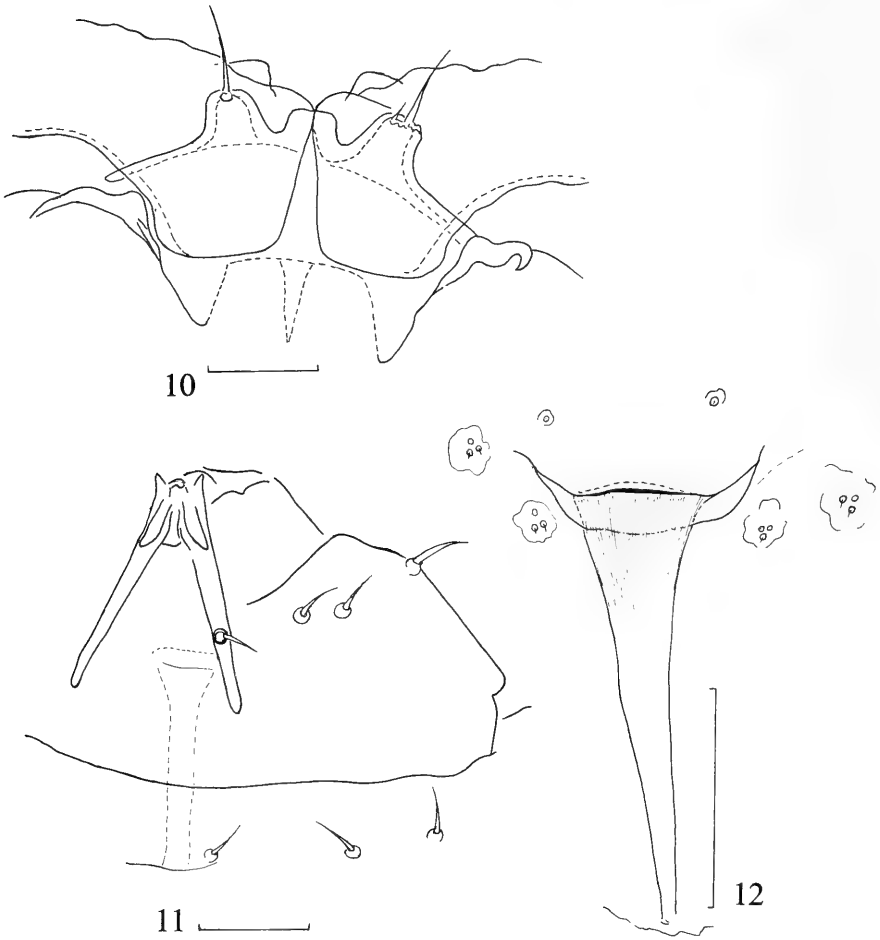
**Cecidomyia pini** (De Geer)
(figs. 1—14)

*Tipula pini* De Geer, 1776: 417 (Sweden).

The following subjective synonyms of *C. pini* are recorded by past authors: *C. pinimaritimae* (as *pini maritimae*) Dufour, 1838: 294 and *C. pilosa* Bremi, 1847: 31, 61. That synonymy was established when it was thought that only one species occurred in Europe. Gagné (1978 b) records that syntypes of *C. pinimaritimae* (two ♀ and two cocoons) were reared from *Pinus pinaster* Ait. (*P. maritima* Mill.), SW. France, and that it is not known if types exist or, if so, where, but that females and cocoons are not diagnostic. The type of *C. pilosa* Bremi is in poor condition, covered with fungal hyphae, sex undetermined, "Bre./Lindau" (nr. Zürich), in Entomologisches Institut, Eidgenössischen Technische Hochschule, Zürich, Switzerland. This information was provided to Gagné by W. Sauter of that Institute. Neither the type material nor the original descriptions of *C. pinimaritimae* and *C. pilosa* were adequate enough to use these names as subjective synonyms of *C. pini*



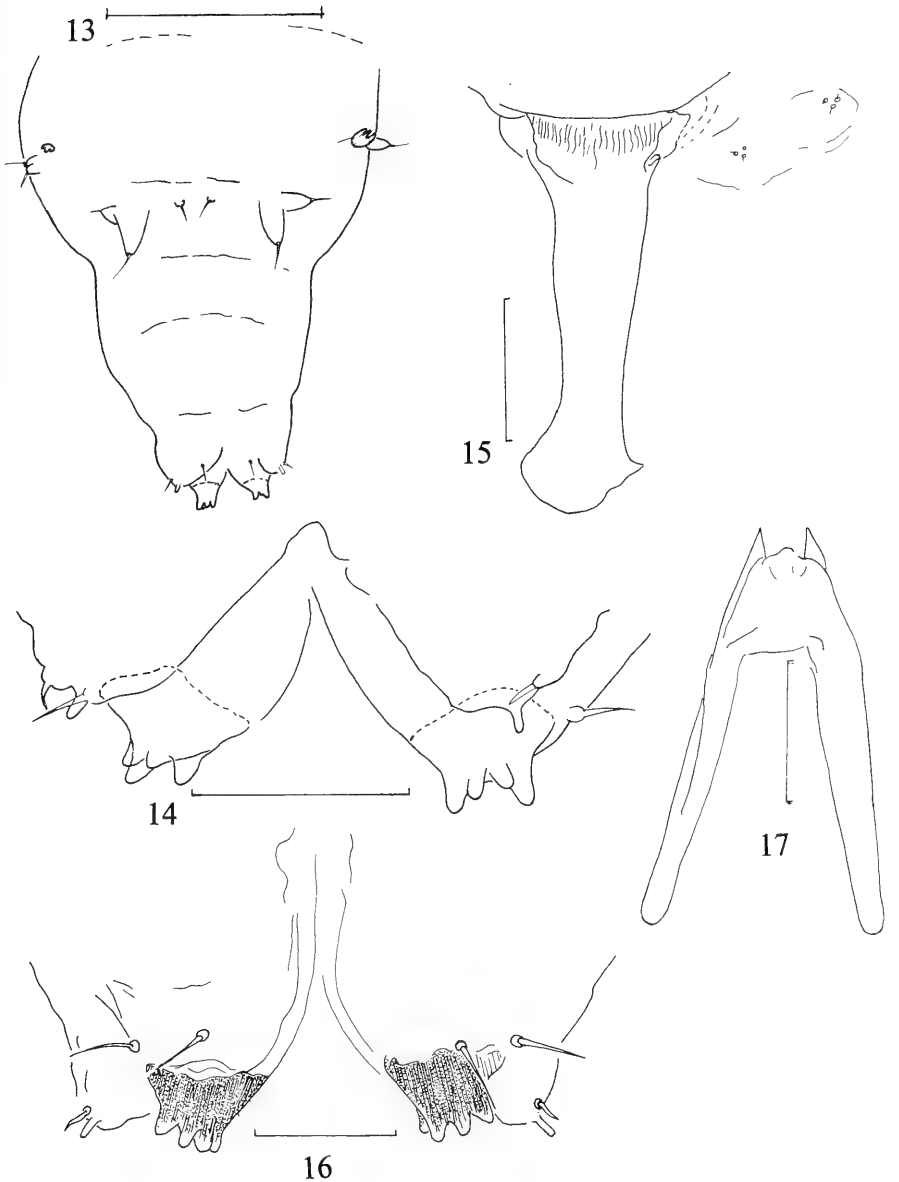

Figs. 5—9. *C. pini*, 5: wing; 6: tarsal claws; 7: male terminalia (dorsal); 8: distal female flagellomeres; 9: ovipositor (lateral). Scale line of fig. 5: 1 mm; fig. 6: 0.05 mm and figs. 7—9: 0.1 mm. Figs. 5—7 after neotype.




Figs. 10—12. *C. pini*, 10: pronotum (anterior); 11: head of last instar larva (dorsal); 12: sternal spatula. All scale lines 0.1 mm.

or as available names for my newly described European species.

Male. — Head without postvertical peak (fig. 1). Antenna with twelve flagellomeres, binodal, first and second not connate; three circumfila (fig. 2). Proximal node of third flagellomere: length about 0.76 times its diameter; distal node: length 1.18 times its diameter. Length of proximal stalk about 0.11 and of distal stalk 0.17 times the total length of third flagellomere. Proximal node with one whorl of looped circumfila and one whorl of long setae; length of circumfila about 0.25 and length of setae 0.53 times the length of third flagellomere. Distal node with two whorls of looped circumfila and one whorl of setae; length of inferior circumfila of this node about 0.21, of superior circumfila 0.25 and of setae 0.35 times the length of third flagellomere. Nodes covered with microtrichia, stalks bare, distal flagellomere tapering into a short stalk-like process (fig. 3). Maxillary palps with four segments, about 0.54 times the height of head (fig. 4). Wing length about 2.5 mm and twice as long as wide; R 5 curved distally, joining C posterad of wing apex; C broken at junc-




Figs. 13—14. *C. pini*, 13: larval abdominal segment with dorsal tubercles; 14: larval terminal segment. Figs. 15—17. *C. magna*, 15: sternal spatula; 16: larval terminal segment; 17: larval head capsule. All scale lines 0.1 mm.

ture with R 5, Rs weak; M 3 + 4 fold present; Cu forked; R 5 about 2.2 times as long as R 1 (fig. 5). Legs covered with brown scales; tarsal claws all simple, curved beyond midlength; empodia longer than claws (fig. 6). Abdomen elongate cylindrical. Gonocoxite and gonostylus fairly stout; gonocoxite about 1.8 times as long as gonostylus, covered with setae except on inner side. Gonostylus with apical tooth. Cerci triangular, broadly rounded distally; hypoproct shallowly emarginated. Aedeagus simple, short and rounded apically (fig. 7).

Female. — Antenna with twelve uninodal, stalked flagellomeres, first and second not connate. Flagellomeres cylindrical with two circumfila connected by two longitudinal strands and with two whorls of setae (fig. 8). Node of third flagellomere with a length of about 2.85 times its diameter, length of stalk 0.2 times the total length of third flagellomere. Length of proximal whorl of setae about 0.38 and of distal setae 0.47 times the length of third flagellomere. Nodes covered with microtrichia, stalks bare. Distal flagellomere tapering with rounded tip. Maxillary palps with four segments and about 0.45 times height of head. Wing length about 3.2 mm and 2.4 times as long as wide; R 5 about 2.3 times as long as R 1. Abdomen elongate, ovoid. Ovipositor short, retractile; cerci with two short apical sensoria and covered with setae (fig. 9).

Pupa. — Antennal horn ridged anteriorly; pronotum as in fig. 10.

Last instar larva. — Length about 5.5 mm. Head capsule with apodemes of about 122 µ (fig. 11). Sternal spatula light brown; total length about 108 µ; anterior end broadened, the cephalic margin somewhat convex (fig. 12). Pleural and dorsal abdominal papillae situated on tubercles, two lateral pairs of dorsal papillae each on a forked lobe (fig. 13). Length of setae of dorsal papillae from the left to the right: prothorax: about 17, 20, 14, 14, 20, 17 µ; mesothorax: 20, 22, 14, 14, 22, 20 µ; metathorax: 22, 24, 15, 15, 26, 21 µ; 1st abdominal segment: 27, 34, 20, 20, 34, 27 µ; 7th abdominal segment: 24, 27, 20, 19, 27, 24 µ. Terminal papillae: two on each side; one with tapered seta of about 17 µ and one with peg-like seta of about 14 µ. Terminal spiracles bilaterally symmetrical, four caudal prongs with a length of about 10 µ (fig. 14).

Original type material of *C. pini* must be considered non-existant (Prof. E. Sylvén, pers. comm.) and, in the interest of taxonomic stability, I here designate the following neotype of this species. Neotype: ♂, slide no. 5192, Sweden, Uppland near Stockholm, E. Sylvén, reared from resin on *Pinus sylvestris* L., 1979. This designation stabilizes the usage by Barnes (1951), Möhn (1955), Vockeroth (1960), Mamajev & Krivosheina (1965) and Gagné (1978 b). Paratypes: ♀, slides no. 5193-5196, with same data as holotype. All specimens in the Swedish Museum of Natural History, Stockholm.

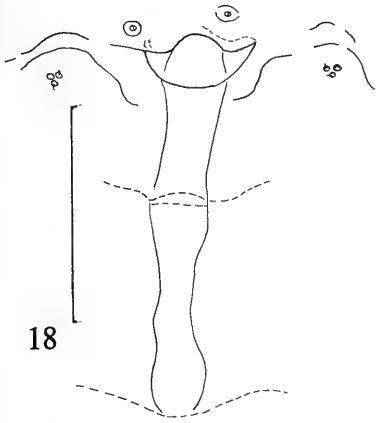
Other material (larvae, collected from resin on *P. sylvestris* in the Netherlands): slides no. 4537-4541, Grubbenvorst, October 1980, P. Grijpma, two year old cones; no. 4556—4566, Ede, 26.x.1980; no. 4573—4575, Ede, October 1980; no. 4576, Remmerden, 20.xi.1980; no. 4577—4579, Leuvenum, October 1980; no. 5146—5147, Wageningen, 6.xii.1984; no. 5158—5172, Grubbenvorst, 13.viii.1980, P. Grijpma, two year old cones. Pupal skin, slide no. 2225, from resinous cocoon on needle of *P. sylvestris*, Wageningen, 21.vii.1960. ♀, slide no. 3569, from resinous cocoon on needle of *P. sylvestris*, Remmerden, 1960. Specimens deposited in the collection of the Instituut voor Taxonomische Zoölogie (Zoölogisch Museum), Amsterdam.

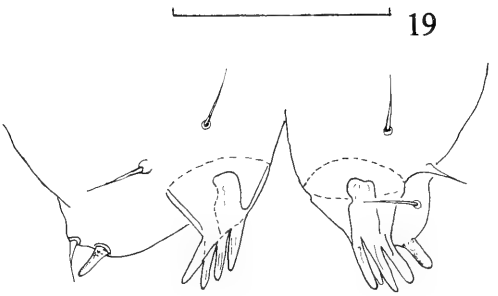
Pupation of *C. pini* takes place apart from the resin mass in a white resinous cocoon. The fact that larvae from *C. harrisi* and *C. sarae*, from which the adults are still unknown, have been found together with those of *C. pini* in the same resin masses makes the exact identity of the remaining adult specimens in this collection rather uncertain. Study of more material, reared from identified larvae, will be necessary to clarify this problem.

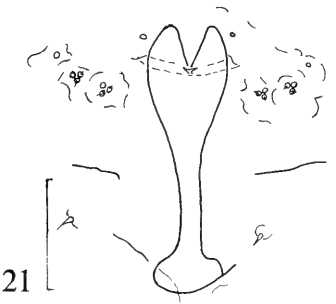
### **Cecidomyia magna** (Möhn)
(figs. 15—17)

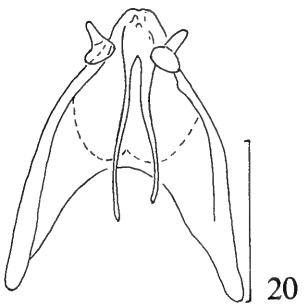
*Stelechodiplosis magna* Möhn, 1955: 127—151 (Germany).

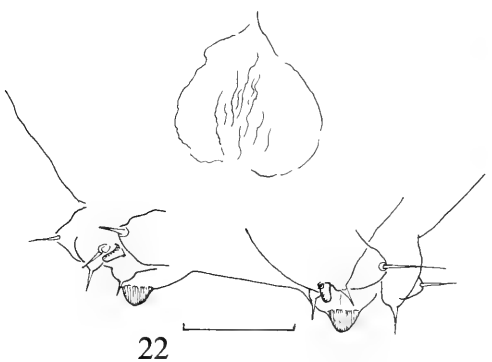
This second European species was originally described as *Stelechodiplosis magna* by Möhn (1955), but was included in *Cecidomyia* by Vockeroth (1960). It was found in Germany in the resin of spruce in which, according to Möhn (1955), it also pupates. However, in the winter of 1984—1985 I found a mature larva which had left the resin to pupate in a white cocoon like the other species whose larvae have two lateral pairs of dorsal papillae on prolonged lobes. The

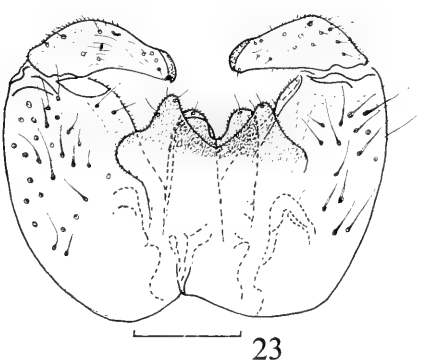



Figs. 18—20. *C. sarae*, 18: sternal spatula; 19: larval terminal segment; 20: larval head capsule. Figs. 21—22. *C. harrisi*, 21: sternal spatula; 22: larval terminal segment. Fig. 23. *C. japonica*, male terminalia (dorsal). Scale line of fig. 20: 0.05 mm and of figs. 18, 19, 21, 22 and 23: 0.1 mm.

cocoon was attached to a branch of a spruce tree near Wageningen, The Netherlands (Nijveldt, 1985). Möhn included illustrations of male terminalia, larval spatula and larval terminal segments in his description. Figs. 15 and 16 show some larval characters.

A recent record of *C. magna* in England is: Shropshire, Cantlop near Shrewsbury, 18.x.1984, in resin masses on *Picea abies* (spruce). CIE Coll. A. 16422, four larvae in the British Museum (Natural History) (Dr K. M. Harris, pers. comm.)

**Cecidomyia sarae** n. sp.
(figs. 18—20)

I found the larvae of this species in resinous wounds and in resin lumps, caused by *Retinia resinella* L. (Lepidoptera) on *Pinus sylvestris*.

Adult and pupa.—unknown.

Last instar larva. — Length about 4.5 mm. Apodemes of head capsule about 122 µ (fig. 17). Sternal spatula dark brown, slender with a total length of about 108 µ; anterior end not broadened, the cephalic margin convex (fig. 18). Pleural and dorsal abdominal papillae with short setae, situated on tubercles. No lateral pairs of dorsal papillae on prolonged lobes. Length of setae of dorsal papillae from the left to the right: prothorax: about 10, 14, 8, 8, 14, 10 µ; mesothorax: 12, 15, 10, 10, 15, 14 µ; metathorax: 17, 20, 8, 7, 19, 15 µ; 1st abdominal segment: 20, 19, 10, 10, 18, 21 µ; 7th abdominal segment: 17, 14, 7, 7, 14, 17 µ. Terminal papillae: two on each side; one with tapered seta of about 14 µ and one with peg-like seta of about 13 µ. Terminal spiracles longer mesally than laterally, four caudal prongs with a length of about 20 µ (fig. 19).

Holotype: one larva, in resin on branch of *P. sylvestris*, Ede (The Netherlands), 26.x.1980, W. Nijveldt, slide no. 4567. Paratypes: one larva with same data as holotype, slide no. 4568; one larva in resin lump on a twig of *P. sylvestris*, caused by the larva of *Retinia resinella*, Wageningen (The Netherlands), November 1960, W. Nijveldt, slide no. 2271. Specimens deposited in the collection of the Instituut voor Taxonomische Zoölogie (Zoölogisch Museum), Amsterdam.

I name this species after my wife Sara, in gratitude for her great help during my study of the Cecidomyiidae. *C. sarae* is also known from England, where it was found in 1980 by Dr K. M. Harris (Commonwealth Institute of Entomology, London) in resinous wounds on *P. sylvestris* in the Wisley Garden of the Royal Horticultural Society. It is not known whether the larvae leave the resin to pupate.

**Cecidomyia harrisi** n. sp.
(figs. 21—22)

I found the larvae in resin on *Pinus sylvestris*.

Adult and pupa. — unknown.

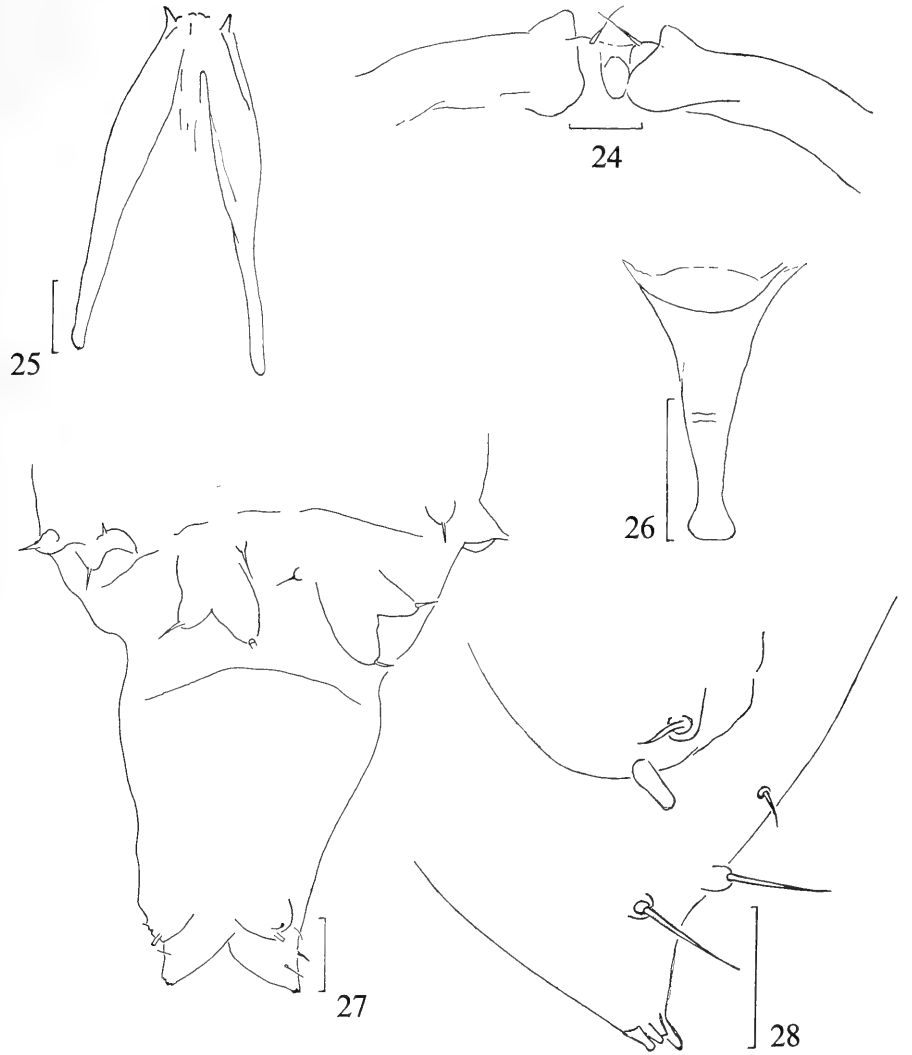
Last instar larva. — Length about 3.3 mm. Apodemes of head capsule about 68 µ (fig. 20). Sternal spatula large, light brown, with a total length of about 211 µ; anterior end broadened, the cephalic margin deeply cleft (fig. 21). Pleural and dorsal abdominal papillae with short setae, situated on small tubercles. Lateral pairs of dorsal papillae not on prolonged lobes. Length of setae of dorsal papillae from the left to the right: prothorax: about 4, 7, 7, 7, 7, 4 µ; mesothorax: 5, 7, 7, 7, 7, 5 µ; metathorax: 7, 7, 10, 10, 7, 7 µ; 1st abdominal segment: 7, 7, 10, 10, 7, 7 µ; 7th abdominal segment: 7, 9, 10, 10, 9, 7 µ. Terminal papillae: three on each side; two with tapered seta of about 14 µ and one with peg-like seta of about 14 µ. Terminal spiracles bilaterally symmetrical, no caudal prongs (fig. 22).

Holotype: one larva in resin on branch of *P. sylvestris*, Ede (The Netherlands), October 26.x.1980, W. Nijveldt, slide no. 4570. Paratypes: three larvae with same data as holotype, slides no. 4569, 4571 and 4572. Specimens deposited in the collection of the Instituut voor Taxonomische Zoölogie (Zoölogisch Museum), Amsterdam.

I name this species in honour of Dr K. M. Harris (Commonwealth Institute of Entomology, London), who collected this species in 1980 for the first time from resinous stem wounds on *P. sylvestris* in the Wisley Garden of the Royal Horticultural Society in England. *C. harrisi* closely resembles *C. fortunactus*, a species with mainly plesiomorphic characters, as discussed by Gagné (1978 b) in his analysis.

**Cecidomyia japonica** n. sp.
(figs. 23—28)

Dr J. Yukawa (University of Kagoshima, Japan) collected the larvae and reared the associated adults from resin on *Pinus thunbergii* Parl. in Japan.




Figs. 24—28. *C. japonica*, 24: pronotum (anterior); 25: larval head capsule; 26: sternal spatula; 27: larval abdominal segment with dorsal tubercles; 28: larval terminal segment. All scale lines 0.1 mm.

Male. — Head without postvertical peak. Proximal node of third flagellomere: length about 0.75 times its diameter; distal node: length about 1.7 times its diameter. Length of proximal stalk about 0.11 and of distal stalk 0.18 times the total length of third flagellomere. Proximal node with one whorl of looped circumfila and one whorl of long setae; length of circumfila about 0.21 and length of setae 0.62 times the length of third flagellomere. Distal node with two whorls of looped circumfila and one whorl of setae; length of inferior circumfila of this node about 0.18, of superior circumfila 0.25 and of setae 0.46 times the length of third

flagellomere. Distal flagellomere tapering into a long stalk-like process. Maxillary palps with four segments, about 0.44 times the height of head. Wing length about 2 mm and twice as long as wide; R 5 about 2.5 times as long as R 1. Legs covered with brown scales. Abdomen elongate cylindrical. Gonocoxite and gonostylus fairly stout; gonocoxite about 1.9 times as long as gonostylus, covered with setae except on inner side. Gonostylus with apical tooth. Cerci rounded apically; hypoproct narrower, incised, with rounded lobes. Aedeagus simple, short and broadly rounded apically (fig. 23).

Female. — Node of third flagellomere with a length of about 3.25 times its diameter, length of stalk 0.17 times the total length of third flagellomere. Length of proximal whorl of setae about 0.45 and of distal setae 0.5 times the length of third flagellomere. Distal flagellomere tapering with pointed tip. Maxillary palps with four segments and about 0.56 times height of head. Wing length about 3.1 mm and 2.4 times as long as wide; R 5 about 2.3 times as long as R 1. Abdomen elongate, ovoid.

Pupa. — Antennal horn pointed anteriorly (fig. 24).

Last instar larva. — Length about 4.3 mm. Apodemes of head capsule about 122 µ (fig. 25). Sternal spatula light brown with a total length of about 102 µ; anterior end broadened, the cephalic margin somewhat convex (fig. 26). Pleural and dorsal papillae situated on tubercles; two lateral pairs of dorsal papillae each on a forked lobe (fig. 27). Length of setae of dorsal papillae from the left to the right: prothorax: about 17, 20, 17, 17, 20, 17 µ; mesothorax: 24, 34, 14, 15, 34, 24 µ; metathorax: 24, 31, 20, 20, 31, 22 µ; 1st abdominal segment: 34, 41, 20, 20, —, 34 µ; 7th abdominal segment: 31, —, —, 20, 34, 31 µ. Terminal papillae: two on each side; one with tapered seta of about 12 µ and one with peg-like seta of about 14 µ. Terminal spiracles bilaterally symmetrical, four caudal prongs with a length of about 13.6 µ (fig. 28).

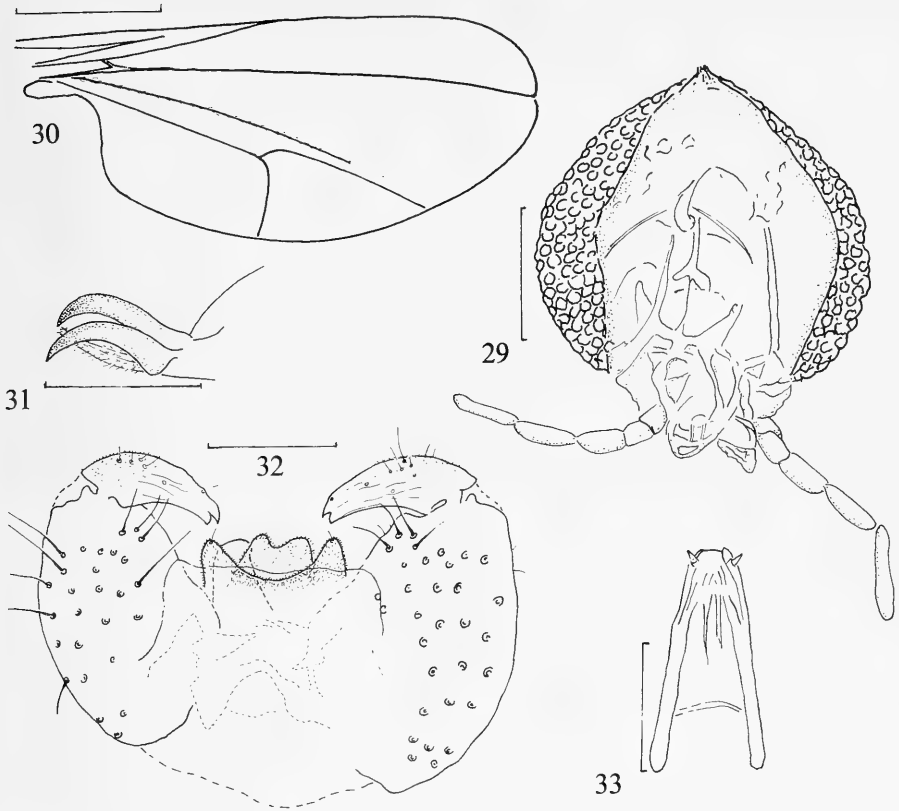
Holotype: ♂, slide no. 5203, Koga, Fukuoka-pref., Kyushu, Japan, 6.v.1965 em., on *Pinus thunbergii*, reared by Yukawa. Paratypes: ♀, slide no. 5204, 5205 with same data as holotype; ♂, slides no. 5197—5199, Mitoma, Fukuoka-pref. Kyushu, Japan, 4—17.vii.1966 em., on *P. thunbergii*, reared by Yukawa; ♀, slides no. 5200—5202 with same data; one larva, slide no. 5206, Hanami, Fukuoka pref., Kyushu, Japan, 22.vi.1967, on *P. thunbergii*, J. Yukawa; pupal skins, slides no. 5207 and 5208 with same data. All specimens in the collection of the University of Kagoshima, Japan.

I name this species *japonica* because it is the first *Cecidomyia* species found in Japan.

### **Cecidomyia phagwariae** n. sp.
(figs. 29—36)

Gagné (1978 b) recorded an undescribed *Cecidomyia* species, which is known from a male, a female, and three larvae in the U.S. National Museum (Natural History) in Washington. They are from *Pinus roxburghii* in Pakistan. He did not describe this species because the male genitalia are slightly distorted on the slide and it was not known whether the larvae leave the resin mass to pupate. However, through the courtesy of Dr K. M. Harris, I have studied another three males, four females and one larva of the same origin from the collection of the British Museum (Natural History) in London. Together with the slides of the U.S. National Museum of Natural History, kindly sent on loan by Dr R. J. Gagné, they form the basis of the following description.

Male. — Head with postvertical peak (fig. 29). Antenna with twelve flagellomeres, binodal, first and second not connate; three circumfila. Proximal node of third flagellomere: length about 0.81 times its diameter; distal node: length about 0.79 times its diamter. Length of proximal stalk about 0.16 and of distal stalk 0.25 times the total length of third flagellomere. Proximal node with one whorl of looped circumfila and one whorl of setae; length of circumfila about 0.33 and length of setae 0.41 times the length of third flagellomere. Distal node with two whorls of looped circumfila and one whorl of setae; length of inferior circumfila of this node about 0.27, of superior circumfila 0.29 and of setae 0.66 times the length of third flagellomere. Nodes covered with microtrichia, stalks bare. Distal flagellomere tapering into a stalk-like process. Maxillary palps with four segments, about 0.48 times the height of head. Wing length about 2.7 mm and 2.4 times as long as wide; R 5 curved distally, but not so strongly as in *C. pini* and *C. japonica*, joining C at wing apex; C broken at juncture with R 5, R s weak; M3+4 fold present; Cu forked; R 5 about twice as long as R 1 (fig. 30). Legs covered with brown scales; tarsal claws all simple, curved beyond midlength and about as long as empodia



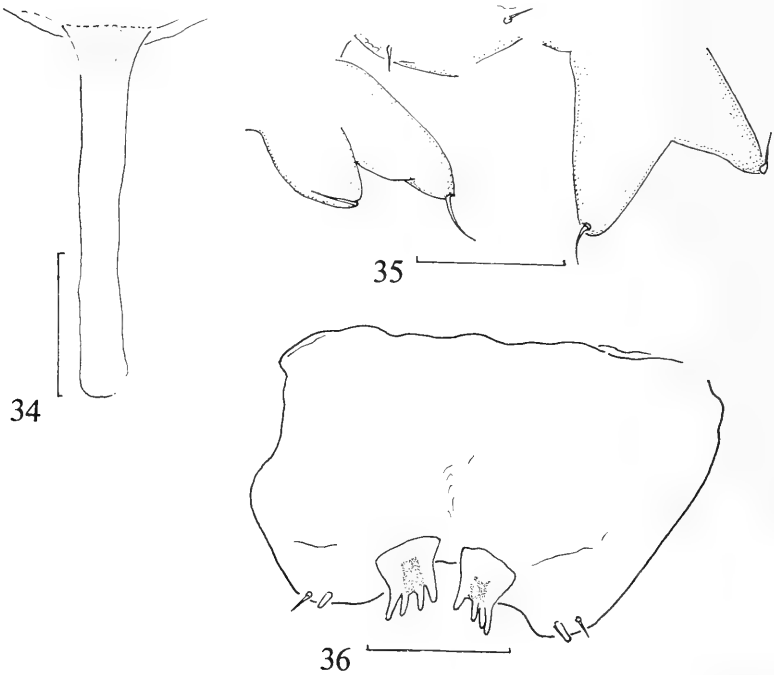

Figs. 29—33. *C. phagwariae*, 29: head; 30: wing; 31: tarsal claws; 32: male terminalia (dorsal); 33: larval head capsule. Scale line of fig. 29: 0.2 mm; 30: 1 mm, 31: 0.05 mm and figs. 32—33: 0.1 mm.

(fig. 31). Abdomen elongated cylindrical. Gonocoxite and gonostylus stout; gonocoxite about 1.6 times as long as gonostylus, covered with setae except on inner side. Gonostylus with apical tooth. Cerci broadly rounded distally; hypoproct shallowly emarginated. Aedeagus simple, longer than hypoproct and rounded apically (fig. 32).

Female. — Antenna with twelve uninodal flagellomeres, which are cylindrical with two circumfila connected by two longitudinal strands. Node of third flagellomere with a length of about 2.87 times its diameter, length of stalk 0.18 times the total length of third flagellomere. Length of proximal whorl of setae about 0.76 and of distal setae 0.39 times the length of third flagellomere. Nodes covered with microtrichia, stalks bare. Distal flagellomere tapering with pointed tip. Maxillary palps with four segments, about 0.52 times the height of head. Wing length about 3.6 mm and 2.5 times as long as wide; R 5 2.3 times as long as R 1. Abdomen elongate, ovoid. Ovipositor short, retractile; cerci with two short apical sensoria and covered with setae.

Pupa. — unknown.

Last instar larva. — Length about 6.3 mm. Apodemes of head capsule about 109 μ (fig. 33). Sternal spatula light brown with a total length of about 204 μ, anterior end broadened, the cephalic margin nearly straight (fig. 34). Pleural and dorsal abdominal papillae situated on tubercles, two lateral pairs of dorsal papillae each on a forked lobe (fig. 35). Length of




Figs. 34—36. *C. phagwariae*, 34: sternal spatula; 35: dorsal abominal tubercles; 36: larval terminal segment. Scale line of fig. 35: 0.2 mm, of figs. 34 and 36: 0.1 mm.

setae of dorsal papillae from the left to the right: prothorax: about 27, 34, —, 26, 34, 27 μ; mesothorax: 38, 41, 30, 30, 41, 38 μ; metathorax: 41, 48, 30, 27, 48, 41 μ; 1st abdominal segment: 57, 63, 31, 31, 63, 57 μ; 7th abdominal segment: 54, 54, 30, 27, 54, 54 μ. Terminal papillae: two on each side; one with tapered seta of about 14 μ and one with peg-like seta of about 14 μ. Terminal spiracles bilaterally symmetrical, four caudal prongs with a length of about 14 μ (fig. 36).

The following specimens are in the British Museum (Natural History): Holotype: ♂, slide no. 17.270, Phagwari, Pakistan, 3—12—70, on *P. roxburghii* Sarg., CIBC, 5B 12/70, 47B 964, BM, 1975 CIE coll. A 4502. Paratypes: ♀, slide no. 17.275,962 with same data as holotype; ♂, slide no. 17.272,960 and ♀ slide no. 17.274,961 with same data; ♀, slide no. 17.273,965, Lathrar, Pakistan, 4—12—70, on *P. roxburghii*, SB. 12/70—48 B; three larvae, slides no. 5209—5211. Lathrar, Pakistan, on *P. roxburghii*, 9.xii.1970, CIBC CIE A 4502. Specimens in the U.S. Museum of Natural History: Paratypes: ♂, slide 974, with same data as holotype; ♀, slide 973, Lathrar, on *P. roxburghii*, 9—12—70, CIBC (Pakistan Sta.) 71—2291, SB, 12/70—48B; one slide with three larvae with same data.

I name this species after its type locality in Pakistan.

KEY TO LAST INSTAR LARVAE (EXCEPT THOSE OF *C. MESASIATICA*).

1. Abdomen without dorsal lobes ..... 2
— Abdomen with dorsal lobes (figs. 13, 28, 37) ..... 3
2. Spatula large, light drown, cephalic margin deeply cleft (fig. 21); terminal spiracles bilaterally symmetrical, no caudal prongs (fig. 22); from *Pinus sylvestris* ..... *C. harrisi* Nijveldt
— Spatula shorter, dark brown, cephalic margin convex (fig. 18); terminal spiracles longer mesally than laterally, four rather long caudal prongs (fig. 19); from *P. sylvestris* ... ..... *C. sarae* Nijveldt

3. Spatula short, light brown, cephalic margin somewhat convex, shaft long and slender, tapering slowly (fig. 12); terminal spiracles bilaterally symmetrical, four caudal prongs of moderate length (fig. 14); from *P. sylvestris* ..... *C. pini* (De Geer)
— Spatula shorter than in *C. pini*, light brown, cephalic margin somewhat convex, shaft broader and tapering quickly (fig. 27); terminal spiracles bilaterally symmetrical, four caudal prongs of moderate length (fig. 29); from *P. thunbergii* .... *C. japonica* Nijveldt
4. Spatula long, light brown, cephalic margin nearly straight, shaft slender (fig. 36); terminal spiracles bilaterally symmetrical, four caudal prongs of moderate length (fig. 38); from *P. roxburghii* ..... ..... *C. phagwariae* Nijveldt
— Spatula long, black, cephalic margin straight, shaft broad (fig. 15); terminal spiracles bilaterally symmetrical, four caudal prongs of moderate length (fig. 16); from *Picea abies* ..... *C. magna* (Möhn).

## Acknowledgments

The author wishes to thank Dr K. M. Harris (London) and Dr R. J. Gagné (Washington) for their kind suggestions, for critical reading the manuscript and for lending material of *C. phagwariae*. Furthermore Prof. dr E. Sylvén (Stockholm) and Dr J. Yukawa (Kagoshima) for lending material of *C. pini* and *C. japonica*.

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