

Ceratopogonidae from the wings of Dragonflies

by

J. W. S. MACFIE.

Since DE MEIJERE (1923) published his description of a midge, *Ceratopogon aeshnosuga*, found in Sumatra on the wing of a dragonfly, a number of additional specimens have been taken in the same region, and a collection of them, formed by Mr. M. A. LIEFTINCK,¹⁾ was recently forwarded to the British Museum (Natural History), London. Thanks to the kindness of Dr. F. W. EDWARDS, it has been my privilege to examine, and to report on this collection.

Ceratopogonidae are apparently not uncommon on the wings of dragonflies in Java, Sumatra, New Guinea, and the Moluccas. The parasitic index, however, is not high, for Mr. LIEFTINCK notes that on about 8,000 dragonflies from New Guinea he found only the ten specimens included in the collection, and some ten or twelve others discarded because they were much damaged. They occur also in other parts of the world. I am indebted to Dr. EDWARDS for permission to include in this report the description of a West African species sent to him by Mr. J. BEQUAERT from Liberia, which is of peculiar interest because of its close resemblance to one of the species collected in New Guinea; and it is not improbable that they occur also in England, for Michelsmore (1929) in his Introduction to The Diptera of Wicken Fen records "the capture by Wicken Lode in August, 1926, of a specimen of the large dragonfly, *Aeschna grandis* L., carrying on its wings a number of minute black flies" which may have been Ceratopogonids.

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It seems probable, indeed, that they may be found to have a wide distribution, now that attention has been drawn to them.

The midges suck the juices from the veins of the wings, but it is not known to what degree they cause injury to their hosts. Mr. LIEFTINCK notes that when a dragonfly is hovering within a short distance, the little midges can be observed with the naked eye as dark spots on the veins of the wings. They lie flattened out against the wing surface, with the legs outspread, and the empodium expanded (see Fig. 2). In some species at any rate it must be mainly by means of the empodium that the insect retains its hold, for there are no claws. The appearance of a specimen from Sumatra, probably *C. aescnosuga* DE MEIJ., in the British Museum collection suggests that there may be some secretion from the empodium to aid attachment, but whether this is so or not, the structure of the empodium itself in this species is peculiarly adapted for clinging to a flat surface.

Altogether thirty specimens, all females, are dealt with in this report, namely, nine from Java, ten from New Guinea, four from Karimon Djawa Island in the Java Sea, four from Buru Island in the Moluccas, and four from Liberia in West Africa. All of them had been preserved in spirit, and a few had already been mounted for examination by Mr. LIEFTINCK, so that details of distinctive colour-markings may be lacking. The unit used in the descriptions is approximately 3.7μ . Exact measurements when given, and unless otherwise stated, refer to selected specimens, and are therefore individual and not averages. The term "tarsal ratio", abbreviated to T. R., is used to express the ratio of the lengths of the first and second tarsal segments of the hind legs. For many of the text-figures I am indebted to Mr. LIEFTINCK, and I take this opportunity of thanking him for his courtesy in permitting me to make use of them.

Pterobosca gen. n.

With the general characters of *Forcipomyia*, but with the six terminal segments of the antenna of the female elongate, and the empodium large and broad, modified for clinging;

without scales, with the T.R. 3 or more than 3. The females of all the species at present known suck juices from the wing-veins of dragonflies. The males are not known.

Key to the species here described.

1. Legs without claws 2
 Legs with claws 4
2. Large species: palp without pit *aeschnosuga* (DE MEIJ.)
 Smaller species: palp with pit 3
3. T.R. about 3.7, one spermatheca . *adhesipes* sp.n.
 T.R. about 3.2, two spermathecae . *mollipes* sp.n.
4. Second radial cell large, fourth tarsal segment about
 equal to fifth. . . *odonatiphila* sp.n.
 Second radical cell obliterated, fourth tarsal segment
 about half length of fifth . . *ariel* sp.n.

***Pterobosca aeschnosuga* (DE MEIJ.)**

A dark brown species of moderate size, with T.R. about 3, fourth tarsal segment obliquely truncated, legs without claws, and empodium very large and complex.

♀ Length of wing, 1.6 to 1.8 mm.; greatest breadth of wing, 0.6 to 0.7 mm.

Head dark brown. Eyes bare, the facets separated above by a narrow line. Proboscis short. Palpi (Fig. 1, A) dark brown, short and fusiform, broadest about the basal portion of the third segment, and tapering thence both apically and basally; third segment bearing sensory hairs on its inner surface, but without a sensory pit; the lengths of the last three segments in one specimen 17, 8, and 9 units respectively. Antennae (Fig. 1, B) dark brown: segments 3—9 disc-shaped, armed with rather short, slightly curved spines, all broader than long but successively narrowing a little, measuring in one specimen from 8 by 12.5 to 6 by 10.5 units; segments 10—15 more elongate, segments 10—14 sub-equal, in the same specimen about 22 by 12 units; the last segment longer, about 35 by 12 units, tapering distally, and ending in a nipple-like process. The combined lengths of segments 10—15 three to four times as long as those of segments 3—9.

Thorax dark brown, well clothed with shortish, dark hairs. Scutellum and postscutellum dark brown, the former bearing numerous bristles and hairs.

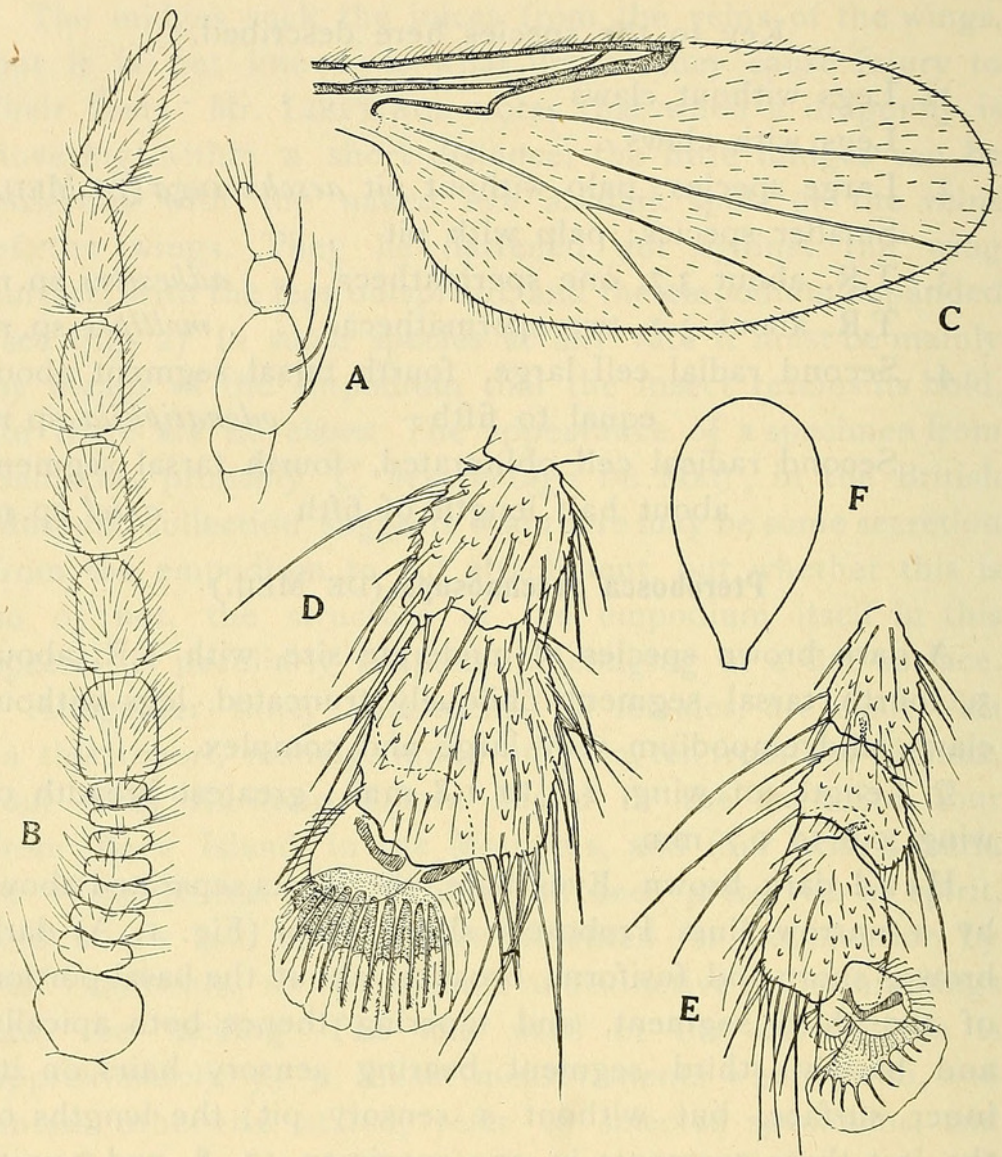


Fig. 1. *Pterobosca aescnosuga* (DE MEIJ.): A - palp; B - antenna; C - wing; D and E - terminal segments of legs; F - spermatheca. (Figs. A—E drawn by Mr. LIEFTINCK).

Wings (Fig. 1, C) unadorned, densely clothed with macrotrichia which are especially numerous along the anterior border; without scales. Fringe long, as in *Forcipomyia*. Alula without a fringe. Intercalary fork indistinct. Anal angle large, and anal vein straight. Costa extending slightly beyond the middle of the wing, deficient for a short space near the base, and with the usual bare area devoid of macrot-

richia just beyond its end. First radial cell almost obliterated; second narrow, lenticular. Cross-vein very oblique. Median vein dividing just beyond the cross-vein, but the fork not clearly visible as the proximal ends of both branches are deficient. Fork of Cu. at about the level of the basal part of the second radial cell. Halteres with brown knobs.

Legs (Fig. 1, D and E) uniformly dark brown; well clothed with rather short hairs; without scales. T.R. about 3. Fourth tarsal segment small, obliquely truncated. Claws absent. Empodium very large, broader than long, with a complicated structure.

Abdomen often greatly distended, darkish brown, densely clothed with short hairs, without scales. Spermathecae (Fig. 1, F) two, highly chitinated, pyriform, sub-equal, total length about 70—85 μ and greatest breadth about 45—50 μ .

Java: Kawah Kamodjang, above Garoet, about 1750 metres altitude, 19-IV-1930, 6 ♀♀ (M. A. LIEFTINCK), on wings of *Procordulia artemis* LIEFT.; Lake Pangkalan, above Garoet, c. 1450 m. alt., 21-IV-1930, 1 ♀ (M. A. LIEFTINCK), on wing of *Orthetrum pruinosum* BURM. (Libellulid); Buitenzorg, Botanic Garden, 250 m. alt., 11-V-1930, 1 ♀ (M. A. LIEFTINCK), on wing of *Zygonyx ida* SELYS (Libellulid); and Mt. Salak, crater lake, c. 1300 m. alt., 6-IV-1931, 1 ♀ (M. A. LIEFTINCK), on wing of *Procordulia artemis* LIEFT.

This species is probably the same as *Ceratopogon aeschnosuga* DE MEIJ., a species described from a single female taken in Sumatra on the wing of an Aeschnid, *Anax magnus* RAMB. The original description of *C. aeschnosuga* is brief, and is now insufficient to distinguish it from allied species. I accordingly wrote to Prof. DE MEIJERE asking if he could furnish further details, and I am indebted to him for a courteous reply regretting his inability to do this owing to the fact that the unique specimen had been destroyed. Prof. DE MEIJERE informs me that the specimen was lost before his examination was completed, and that in consequence his description had had to be based on annotations on the dried insect. This misfortune may explain away certain apparent discrepancies between *C. aeschnosuga* and the insect described above, for example

those in the descriptions of the antennae, for which at first it seemed difficult to account. The species is therefore redescribed here from specimens collected in Java by Mr. LIEFTINCK so as to facilitate a comparison with other, allied species. Mr. LIEFTINCK states that the species is apparently common on the lower and upper sides of the wings of the Corduliid dragonfly *Procordulia artemis* LIEFT., and records that once he observed a pair *in coitu* on the wing of this dragonfly. The male, which was much smaller than the female, unfortunately escaped.

***Pterobosca adhesipes* sp. n.**

Allied to *P. aeschnosuga* (DE MEIJ.), but smaller, the third segment of the palp furnished with a sensory pit, the T.R. greater (3.6 to 4.1), and differing also as indicated below.

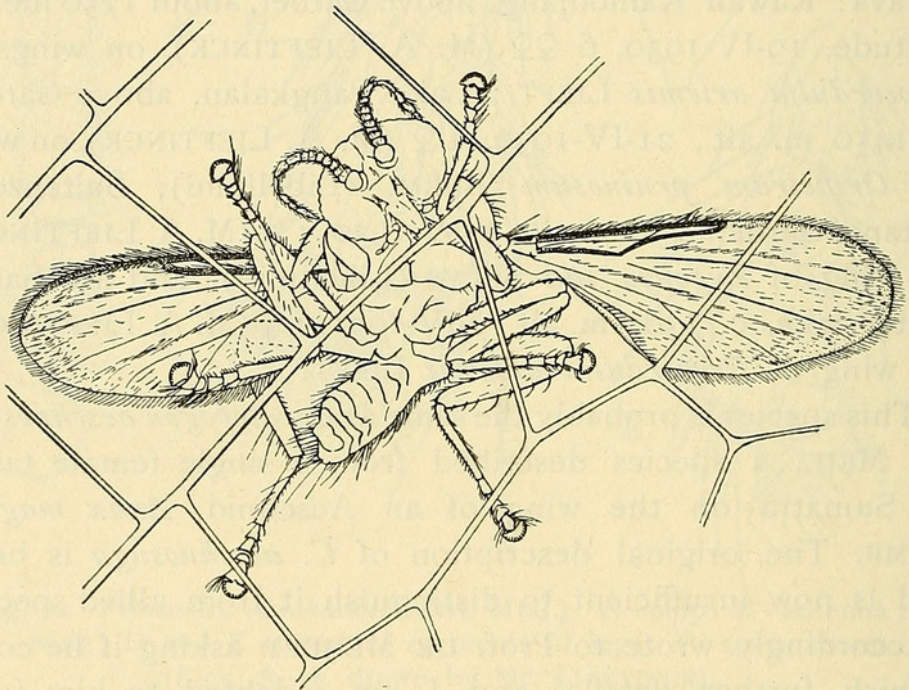


Fig. 2. *Pterobosca adhesipes* sp. n. attached to underside of hind wing of a Libellulid dragonfly, *Agrionoptera insignis allogenae* TILL.
(Drawn by Mr. LIEFTINCK).

♀ - Length of wing, 0.8 to 1.3 mm., average 1.0 mm.; greatest breadth of wing, 0.3 to 0.5 mm., average 0.37 mm.

Palp (Fig. 3, A) with third segment smaller, and furnished with a shallow sensory pit; the lengths of the last three segments averaging 9, 6, and 7 units respectively. Antennae

(Fig. 3, B) with segments 3—9 rather less flattened, armed with long spines with curved ends, measuring on the average from about 6 by 10 to 4.6 by 7.6 units; segments 10—14 sub-equal, rather variable, but averaging about 10 by 7.6 units; the last segment averaging 19 by 7 units, and ending

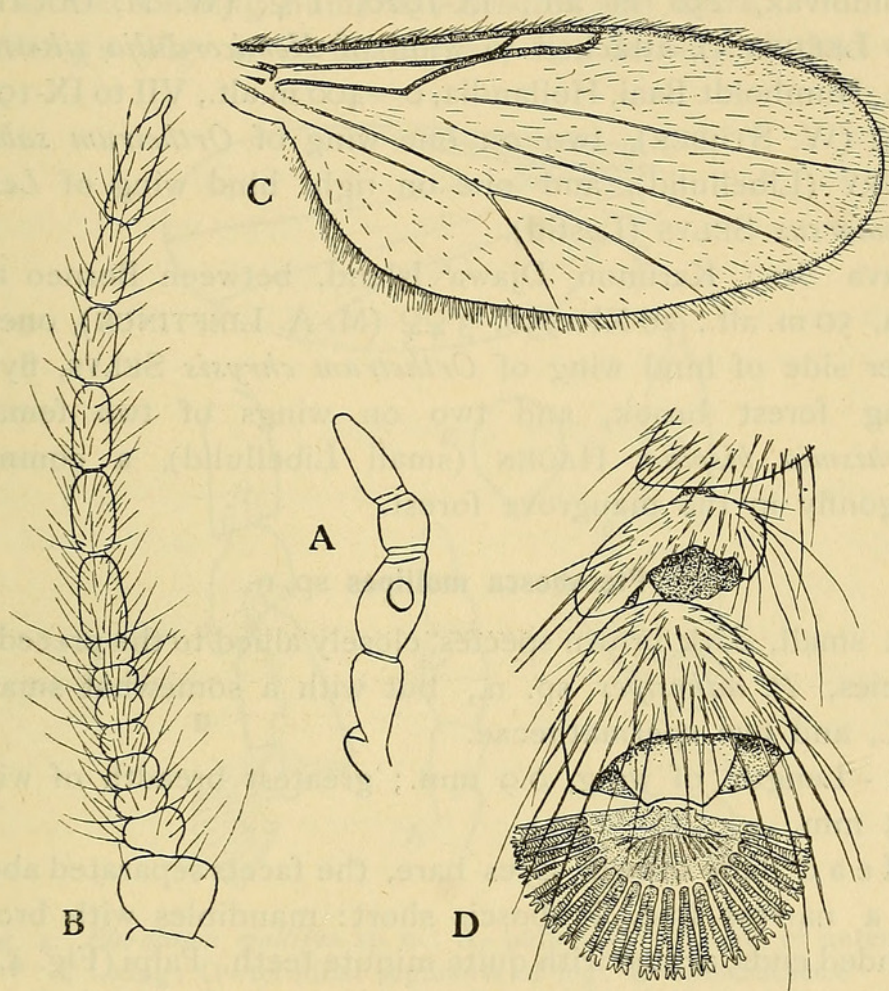


Fig. 3. *Pterobosca adhesipes* sp. n.: A - palp; B - antenna; C - wing; D - terminal segments of leg (pulvilli and basal structures of foot omitted). (Figs. B—D drawn by Mr. LIEFTINCK).

in a nipple-shaped process. The combined lengths of segments 10—15 two to two and a half (average 2.3) times as long as those of segments 3—9. Wings (Fig. 3, C) less densely clothed with macrotrichia, intercalary fork distinct, with the second radial cell rather larger. Legs (Fig. 3, D) sometimes with infuscation on each side of the knee joints. T.R. 3.6 to 4.1, average 3.77. Fourth tarsal segment smaller. Claws absent. Epodium somewhat similar, as figured. Spermatheca

single, well chitinated, oval, total length about 45—55 μ and greatest breadth about 33—38 μ .

New Guinea: Meervlakte, VIII-1926, 1 ♀ (W. M. DOCTERS VAN LEEUWEN), attached to ventral side of right hind wing of *Agrionoptera insignis allogenae* TILLYARD (Libellulid); Hoofdbivak, 250 m. alt., IX-1926, 1 ♀, (W. M. DOCTERS VAN LEEUWEN), attached to wing of *Hemicordulia silvarum* RIS; Humboldt Baai, Hollandia, 0—400 m. alt., VII to IX-1930, 3 ♀♀ (W. STÜBER), two on one wing of *Orthetrum sabina* DRURY (Libellulid), and one on right hind wing of *Lestes praemorsus* SELYS (Lestid).

Java Sea: Karimon Djawa Island, between Borneo and Java, 50 m. alt., 26-XI-1930, 3 ♀♀ (M. A. LIEFTINCK), one on lower side of hind wing of *Orthetrum chrysis* SELYS, flying along forest brook, and two on wings of two females *Raphismia bispina* HAGEN (small Libellulid), a common dragonfly in the mangrove forest.

***Pterobosca mollipes* sp. n.**

A small, dark brown species, closely allied to the preceding species, *P. adhesipes* sp. n., but with a somewhat smaller T.R., and two spermathecae.

♀ - Length of wing, 0.9 mm.; greatest breadth of wing, 0.35 mm.

Head dark brown. Eyes bare, the facets separated above by a narrow line. Proboscis short: mandibles with broad, rounded ends, armed with quite minute teeth. Palpi (Fig. 4, A) brown, short and fusiform: third segment only slightly longer than broad, furnished with a shallow sensory pit; fifth conical; the lengths of the last three segments in one specimen 7.5, 5, and 4 units respectively. Antennae (Fig. 4, B) darkish brown: segments 3—9 disc-shaped, armed with long spines curved at their ends, all broader than long but successively narrowing a little, measuring in one specimen from 5 by 10 to 5 by 8 units; segments 10—15 more elongate but shorter than in *P. aeshnosuga*, segments 10—14 sub-equal, measuring in the same specimen about 9 by 7 units; the last segment longer, about 19 by 7 units, tapering distally, ending in a nipple-shaped process. The combined lengths of segments

10—15 (64 units) fully twice as long as those of segments 3—9 (30 units).

Thorax dark brown, slightly paler just anterior to the scutellum, and with traces in this area of paler antero-posterior sub-lateral stripes. Scutellum and postcutellum dark brown; the former bearing numerous bristles and hairs.

Wings (Fig. 4, C) unadorned, less densely clothed with

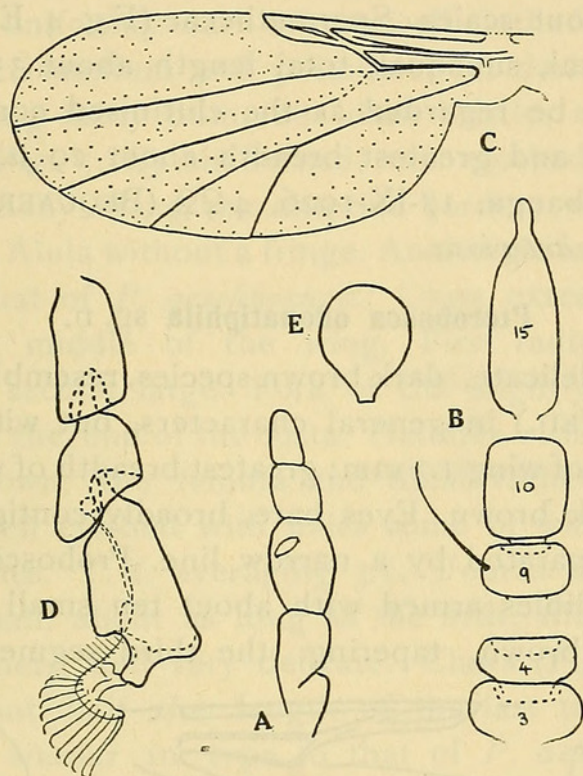


Fig. 4. *Pterobosca mollipes* sp. n.: A - palp; B - segments of antenna; C - wing; D - terminal segments of leg; E - spermatheca.

macrotrichia than those of *P. aeschnosuga*. Macrotrichia most abundant, and so forming a dark line, along the anterior border. The areas on each side of the veins devoid of macrotrichia. Tip rounded; anal angle broad. Fringe long. Alula without a fringe, or with one or two hairs only. Intercalary fork distinct. Anal vein straight. Costa extending slightly beyond the middle of the wing, interrupted near the base as usual, and with the usual bare area just beyond its termination. First radial cell obliterated; second relatively long, slit-like, not so large as in *P. adhesipes*. Cross-vein oblique. Median forking just beyond the cross-vein. Fork of

Cu. slightly proximal to the level of the end of the costa. Halteres with brown knobs.

Legs (Fig. 4, D) uniformly darkish brown, well clothed with shortish hairs, without scales. T.R. about 3.2. Fourth tarsal segment small, but longer than in *P. adhesipes*, obliquely truncated. Claws absent. Empodium large, complex, similar to that of *P. aescnosuga* in general form, but not so large.

Abdomen darkish brown, less hairy than that of *P. aescnosuga*; without scales. Spermathecae (Fig. 4, E) two, highly chitinised, oval, subequal, total length about $35\ \mu$ (of which $3-4\ \mu$ may be regarded as the chitinised commencement of the duct), and greatest breadth about $29\ \mu$.

Liberia: Gbanga, 17-IX-1926, 4 ♀♀ (BEQUAERT), on wings of *Trithemis arteriosa*.

***Pterobosca odonatiphila* sp. n.**

A rather delicate, dark brown species, resembling *P. aescnosuga* (DE MEIJ.) in general characters, but with claws.

♀ - Length of wing 1.1 mm; greatest breadth of wing 0.4 mm.

Head dark brown. Eyes bare, broadly contiguous above, the facets separated by a narrow line. Proboscis short, pale brown; mandibles armed with about ten small teeth. Palpi (Fig. 5, A), brown, tapering, the third segment furnished

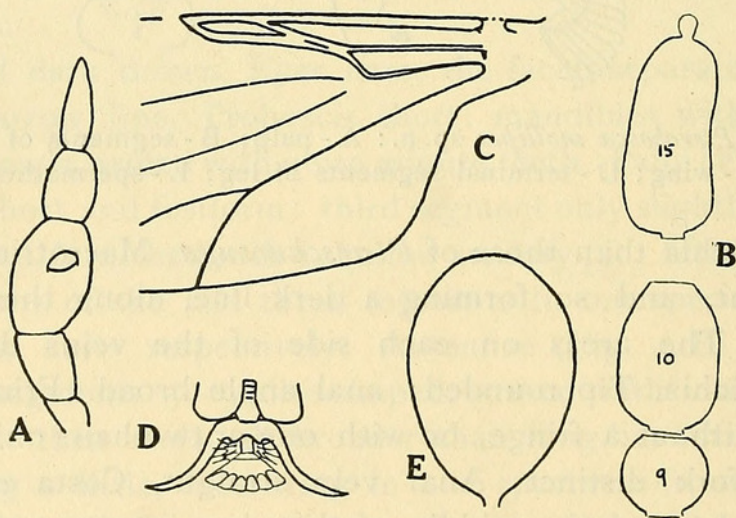


Fig. 5. *Pterobosca odonatiphila* sp. n.: A - palp; B - segments of antenna; C - part of wing; D - claws and empodium; E - spermatheca.

with a shallow sensory pit, and the fifth narrow and conical; the lengths of the last three segments in one specimen 10,

6, and 8 units respectively. Antennae (Fig. 5, B) brown: segments 3—9 not much flattened, sub-spherical, armed with long pointed spines with curved ends, measuring in one specimen from 8 by 9 to 6 by 8 units; segments 10—15 elongate, 10—14 sub-equal, about 12 or 13 by 9 or 10 units, the last segment about 19 by 8 units, ending in a rounded, nipple-like process. The combined lengths of segments 10—15 averaging 1.7 times those of segments 3—9.

Thorax uniformly dark brown, well clothed with shortish dark hairs. Scutellum and postscutellum dark brown; the former bearing fairly numerous dark bristles and hairs.

Wings (Fig. 5, C) unadorned, well clothed with macrotrichia especially along the anterior border; without scales. Fringe long. Alula without a fringe. Anal angle large. Venation similar to that of *P. aeschnosuga*. Costa extending slightly beyond the middle of the wing. First radial cell almost obliterated; second large. Fork of Cu. slightly proximal to the level of the end of the costa. Halteres with brown knobs.

Legs brown, the femora and tibiae rather darker than the tarsi; well clothed with hairs some of which are long; without scales. T.R. averaging 3.1. Fourth tarsal segment not very small, about as long as the fifth; fifth paler brown than the others, and very delicate. Claws (Fig. 5, D) well curved, about half the length of the last tarsal segment. Empodium similar in type to that of *P. aeschnosuga*, but smaller and more delicate.

Abdomen dark brown, cerci paler brown; well clothed with shortish dark hairs; without scales. Spermathecae (Fig. 5, E) two, well chitinated, oval, sub-equal, averaging $79\ \mu$ by $57\ \mu$; the duct narrow, and chitinated for only a short distance, about 3—4 μ .

New Guinea: Humboldt Baai, Hollandia, 0—400 m. alt. (W. STÜBER), VII-1930, 1 ♀, on wing of *Gynacantha kirbyi* KRÜGER (Aeschnid), and VIII to IX-1930, 3 ♀♀, on left hind wing of *Gynacantha moscaryi* FOERSTER (Aeschnid).

***Pterobosca ariel* sp. n.**

Allied to the preceding species *P. odonatiphila* sp. n.; differing as indicated below.

♀ - Antennae (Fig. 6, A) darker brown: segments 3—9 more disc-shaped, measuring from 5 by 9 to 4 by 7.5 units; segments 10—14 successively a little longer, from 7 by 8 to 9 by 6 units; the last segment about 19 units long, tapering distally, and ending in a nipple-like process. The combined lengths of segments 10—15 (60 units) approximately 2.2 times as long as those of segments 3—9 (27 units). Wings (Fig. 6, B) with the second radial cell almost obliterated.

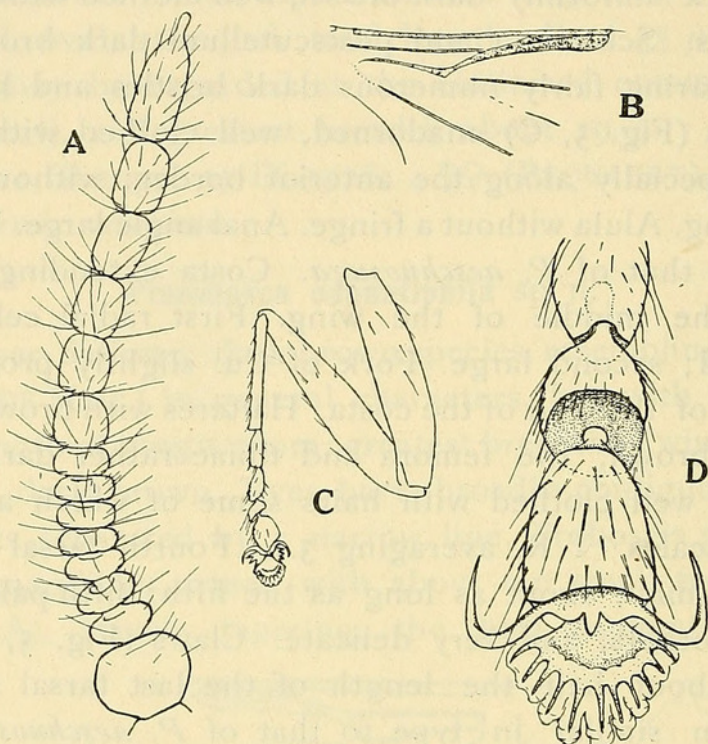


Fig. 6. *Pterobosca ariel* sp. n.: A - antenna; B - part of wing; C - middle leg; D - terminal segments of leg (pulvilli and basal structures of foot omitted). (Drawn by Mr. LIEFTINCK).

ated. Legs (Fig. 6, C) darker brown. T.R. similar, 3.1. Fourth tarsal segment smaller, obliquely truncated, only about half the length of the fifth. Claws similar, well curved. Empodium (Fig. 6, D) larger, and less delicate.

Moluccas: Buru Island, Lake Rana, 500 m. alt., V-1921, 1 ♀ (L. J. TOXOPEUS), on wing of *Orthetrum sabina* DRURY (Libellulid).

The collection contains a single incomplete specimen of this species, of which only the legs, one antenna, and portions of the head and one wing remain. When further material is available additional points of difference may be found,

but those given here are sufficient to show that the insect, although closely allied to *P. odonatiphila* sp. n., is clearly distinct from it.

***Lasiohelea* KIEFFER 1921.**

The genus *Lasiohelea* is intermediate between *Forcipomyia* and *Atrichopogon*, but it is not easy to find reliable characteristics by means of which it may be separated from the former. It would be best probably to regard *Lasiohelea* as a sub-genus of *Forcipomyia*, and as one stage beyond *Euforcipomyia* in the direction of *Atrichopogon*. As the genus *Forcipomyia* is already overcrowded and unwieldy, the name may, however, be retained conveniently to include those species in which the basal segments of the antenna of the female are short, often discoidal, the second radial cell relatively long and narrow, and the first tarsal segment of the hind legs considerably longer than the second.

Several species of *Lasiohelea* are vicious biters of man and other mammals, but hitherto none has been recorded as preying on dragonflies.

***Lasiohelea samoensis* EDW.**

A small, dark brown species, without scales; with the basal segments of the antenna of the female broader than long, and the T.R. about 3.1.

♀ - Length of wing, 0.9 mm.; greatest breadth of wing, 0.37 mm.

Head dark brown. Eyes hairy. Proboscis short; the mandibles with rather bluntly rounded ends armed with numerous minute teeth. Palpi (Fig. 7, A) darkish brown; third segment furnished with a small sensory pit; the lengths of the last three segments in one specimen 7, 3.5, and 7 units respectively. Antennae (Fig. 7, B) dark brown: segments 3—10 broader than long, measuring in one specimen from 5 by 9 to 4 by 7 units, armed with long, pointed spines with curved ends; segments 11—15 elongate, segments 11—14 measuring in the same specimen from 10 by 7 to 13 by 7 units; the last segment longer, about 20 by 6 units, ending in a nipple-like process. The combined

lengths of segments 11—15 (67 units) about 2.4 times as long as those of segments 3—10 (28 units).

T h o r a x uniformly dark brown; well clothed with dark hairs most of which are short. Scutellum und postscutellum dark brown, the former bearing numerous bristles and hairs.

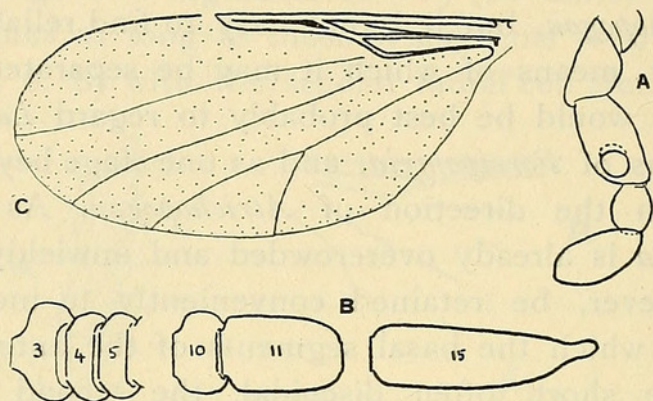


Fig. 7. *Lasiohelea samoensis* EDW.: A - palp;
B - segments of antenna; C - wing.

W i n g s (Fig. 7, C) unadorned; macrotrichia rather scanty, only two rows extending towards the base between M and Cu. Alula without a fringe. Anal angle large, and anal vein straight. Costa extending somewhat beyond the middle of the wing (7:12). First radial cell obliterated; second rather long, and almost obliterated. Median vein forking just beyond the oblique cross-vein; both branches deficient basally. Fork of Cu. at about the level of the middle of the second radial cell. Halteres with brown or yellowish knobs.

L e g s uniformly dark brown; well clothed with dark hairs, without scales. T.R. about 3.1. Fourth tarsal segment cylindrical, slightly longer than the fifth. Claws and empodium normal.

A b d o m e n dark brown. Spermatheca single, well chitinated, oval or pyriform, total length about 45μ (of which about 3μ may be regarded as the chitinated commencement of the duct), and greatest breadth about 34μ .

Moluccas: Buru Island, Lake Rana, 500 m.alt., V-1921, 2 ♀♀ (L. J. TOXOPEUS), one on wing of *Orthetrum signiferum* LIEFT. (Libellulid), and one on wing of *O. villosovittatum* BRAUER.

New Guinea: Mamberamo River, IX-1926, 1 ♀ (W. M. DOCTERS VAN LEEUWEN), attached to ventral side of front wing of *Notoneura salomonis* SELYS (Agrionid) This specimen probably belongs to this species, but it is too much damaged to be certain, only one antenna, one wing, one complete leg (hind), and a fragment of the thorax and another leg remaining. With regard to this specimen Dr. LIEFTINCK notes that the face was yellowish, the eyes coarsely hairy, the halteres yellow at the tip, and the total length 1.09 mm.

These specimens correspond closely with the description of *L. samoensis* EDW., a Samoan species of which only a single female is known, but apparently lack the "hair-like scales" on the tarsi. There are also fractional differences in the measurements of the terminal segments of the antennae. These differences are probably not of great significance as the materials for comparison are so scanty. The Samoan specimen was not taken on the wing of a dragonfly.

***Lasiohelea pennambula* sp. n.**

This species resembles the preceding one, *L. samoensis* EDW., very closely, only the following differences being noted: legs, palpi, and antennae brown, much paler than in the preceding species; eyes bare; T.R. about 3.5; and spermathecae two, well chitinated, pyriform, sub-equal, total length about $52\ \mu$ (of which $3-4\ \mu$ may be regarded as the chitinated commencement of the duct), and greatest breadth about $35\ \mu$.

Moluccas: Buru Island, Lake Rana, 500 m. alt., V-1921, 1 ♀ (L. J. TOXOPEUS), attached to wing of *Orthetrum signiferum* LIEFT. (Libellulid) together with a female of the preceding species.

Several species of *Forcipomyia* (including *Lasiohelea*) are now known to prey on other, larger insects, the females attacking them and sucking juices from their wings or bodies. Some of them may be truly parasitic, but others have been found also on flowers, or have been taken under conditions in no way suggesting parasitism. These species fall conveniently into two main groups, namely those in

T.R.	Species	Host	Locality
0.5	<i>F. ixodoides</i> (Fiebrig-Gertz 1928) <i>F. obesa</i> da Costa Lima 1928 <i>Williston's</i> sp. 1908	Phasmid sp. » »	Paraguay Rio Negro, S. America West Indies
	<i>F. alboclavata</i> (Kieff. 1919) <i>F. canaliculata</i> (Goetg. 1920) <i>F. crudelis</i> (Karsch 1886) <i>F. hirtipes</i> (de Meij. 1907) ? <i>F. australiensis</i> (Kieff. 1917) <i>F. crudelis</i> Knab 1914 <i>F. tropica</i> (Kieff. 1917) <i>F. erucicida</i> Knab 1914 <i>F. squamosa</i> Lutz 1914	Larvae of sphingid Moth <i>Deilephila galii</i> Larva of saw-fly Larvae of <i>Papilio clytia</i> & <i>Othreis fullonica</i> Caterpillars Larva of papaya sphinx <i>Erinnyis ello</i> Caterpillars of sphingid	Hungary Germany Ceylon, Samoa Mexico Florida Peru, Brazil
1.5	<i>F. propinqua</i> (Willist. 1896)	Larvae of geometrid Moth <i>Melanchroia geometroides</i>	N. America
2.5	<i>F. eques</i> (Joh. 1908) <i>F. fuscicornis</i> (Coq. 1905) <i>F. papilionivora</i> Edw. 1923 <i>Apelma auronitens</i> Kieff. 1910 <i>Trichohoelea tonnoiri</i> Goetg. 1920	Wings of lace-wing flies Sialid (<i>Chauliodes</i> sp.) Wings of lepidoptera (<i>Cidaria didymata</i> , <i>Pieris napi</i> , <i>Liparis monacha</i> , etc.)	N. America, Europe N. America Europe
2.7	<i>F. pectinunguis</i> (de Meij. 1923)	Wings of <i>Miltocrista cruciata</i> and <i>Simplicia marginata</i>	Sumatra
3 or more	<i>Lasiohelea samoensis</i> Edw. 1928 <i>L. pennambula</i> sp. n. <i>F. peregrina</i> (Joh. 1908)	Wings of dragonflies » » » Feeding on dead worm	New Guinea, Moluccas Moluccas N. America

which the second segment of the hind tarsus is twice as long as the first (T.R. 0.5), and those in which it is much shorter (T.R. 2 or more).

One species, that recorded by BAKER (1907) as attacking the larvae of the geometrid moth *Melanchroia geometroides* (WALKER) falls between these two groups. It was identified by Coquillett as *Ceratopogon eriophorus* WILLIST., but according to KNAB (1914) was almost certainly *F. propinqua* (WILLIST.). WILLISTON (1896) states clearly that in this species (and also in *C. eriophorus*) the first tarsal segment is one and a half times as long as the second, that is the T.R. 1.5. KNAB however considers *F. erucicida* and his *F. crudelis*, in both of which the T.R. is about 0.5, as closely related to *F. propinqua*, so that unless WILLISTON'S statement is incorrect the identification of BAKER'S species is still in doubt.

Species with T.R. 0.5. To this group belong three species found preying on phasmids, namely, *F. ixodoides* (FIEBRIG-GERTZ 1928), *F. obesa* DA COSTA LIMA 1928, and a species referred to by WILLISTON (1908); and six species found preying on larvae, namely, *F. alboclavata* (KIEFF. 1919) (*F. canaliculata* GOETG. 1920), *F. crudelis* (KARSCH 1886), *F. crudelis* KNAB 1914, *F. hirtipes* (DE MEIJ. 1907) (? *F. australiensis* KIEFF. 1907), and *F. squamosa* LUTZ 1914. These species do not immediately concern us because none of them has been found hitherto preying on dragonflies. The following points may however be mentioned.

As regards the species found on phasmids, it seems not improbable that the two South American species, *F. ixodoides* and *F. obesa*, may be the same. FIEBRIG-GERTZ' description of *F. ixodoides* contains few significant facts, and his figures are frankly crude. DA COSTA LIMA'S description of *F. obesa*, published four months later, is however well illustrated by photo-micrographs, but he relies for the differentiation of his species on points in the description or figures of *F. ixodoides* which are presumably erroneous, such as the statements that the antenna is composed of thirteen, and the palp of three segments. It is possible that WILLISTON'S species, found in the West Indies, was also the same, but

this probably can never now be determined as the specimen has been lost.

As regards the other species, *F. alboclavata* is very closely related to *F. crudelis* (KARSCH), and to *F. hirtipes*, according to EDWARDS (1923). *F. crudelis* KNAB, whose name is preoccupied, is probably a synonym of *F. tropica* KIEFF. 1917 according to the same author. *F. crudelis* (KARSCH) KIEFFER (1919) considered insufficiently described, and, having two radial cells, as doubtfully placed in *Forcipomyia*; and later (1925) he removed it to *Lasiohelea*, a questionable step (as the T.R. is about 0.5), and one about which he was apparently uncertain, for in the same year, in his fascicle for Faune de France, although he does not include this species in any of his keys, he still uses the old name for it on P. 4 in referring to its biology. And *F. squamosa* is apparently the only species of the group which bears scales.

Species with T.R. 2 or more. To this group belong *F. eques* (JOHAN. 1908), *F. fuscicornis* (COQ. 1905), *F. papilionivora* EDW. 1923 (*Apelma auronitens* KIEFF. 1910, and *Trichohoelea tonnoiri* GOETG. 1920), *F. pectinunguis* (DE MEIJ. 1923), and the two species of *Lasiohelea* mentioned in this report, *L. samoensis* EDW. 1928, and *L. pennambula* sp. n.

All these species suck juices from the wings of larger insects, *F. eques* having been taken on lace-wing flies, *F. fuscicornis* on a sialid (but ? on wings) *F. papilionivora* and *F. pectinunguis* on Lepidoptera, and the last two on dragonflies.

In three, namely *F. eques*, *F. fuscicornis*, and *F. papilionivora*, the T.R. is about 2.5. According to EDWARDS (1923) *F. fuscicornis* is practically the same as *F. papilionivora*, "In fact", he writes, "it is not impossible that the two may be conspecific, though it seems unsafe to identify a European with a North American form without actual comparison of material." *F. eques* also resembles very closely *F. papilionivora*. I have not had an opportunity of examining an American specimen of *F. eques*, but the species is found also in Europe, and thanks to the courtesy of Dr. EDWARDS I have been able to examine a British specimen, and to compare it with a co-type of *F. papilionivora*. The two species appear to be exceedingly near, the most notable differences

being apparently the paler colour of the scutellum and the greater length of the distal segments of the antenna in *F. papilionivora*, but even these are not very distinctive, for according to the descriptions of JOHANNSEN and EDWARDS respectively, the scutellum in *F. eques* is "fuscous" like the rest of the thorax "or but little lighter", and in *F. papilionivora* "dull yellow", and the terminal segments of the antenna in *F. eques* "from twice to thrice as long as wide", and in *F. papilionivora* "nearly three times as long as broad". It seems hardly possible to separate the females of these species. They might indeed be the same, in which case the name *F. fuscicornis* has priority, but clearer points for differentiation may be discovered when the males are known. In this connexion it should be mentioned that EDWARDS (1924) has suggested that *F. papilionivora* is the female of *Apelma auronitens*, and that KIEFFER (1925) gives *Trichohalea tonnoiri* as a synonym of the latter species.

In one species, *F. pectinunguis*, the T.R. is slightly more, about 2.7. This species may in fact be a *Lasiohelea*, and it may readily be recognised by its peculiar and characteristic claws. In the two remaining species, *L. samoensis* and *L. pennambula*, the T.R. is 3 or more than 3.

A passing reference should perhaps be made here to *F. peregrina* (JOHAN. 1908) which MALLOCH (1915) once found feeding on a dead worm, because in this species also, if indeed it is a *Forcipomyia* which is doubtful in view of the wing characters, the T.R. is about 3.

All these species belong to those divisions of *Forcipomyia* which approximate in some respects to *Atrichopogon*. It is of interest to note therefore that two species of *Atrichopogon* have been observed to prey on other insects, namely, *A. meloesugans* KIEFF. 1922 on the beetle *Meloe majalis* in Algiers (KIEFFER, 1922), and *A. rostratus* (WINN. 1852) on a closely related beetle, *Meloe proscarabeus*, in Denmark (EDWARDS, 1923) and that these are apparently the only other Ceratopogonids known to have this parasitic propensity, although of course many species prey on mosquitos and other small insects.



Macfie, J W S. 1932. "Ceratopogonidae from the wings of Dragonflies."
Tijdschrift voor entomologie 75, 265–283.

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