

ON TWO SPECIES OF MAYFLIES FROM THE WISSEL LAKES, CENTRAL NEW GUINEA (EPHEMEROPTERA)

by

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Our knowledge of the mayflies of New Guinea consists merely of some scattered data in the literature. However, on account of its numerous rivers and lakes the island is very suitable for the development of a rich mayfly fauna. The species hitherto described appear to have been invariably caught in or near the coastal area (cf. LIEFTINCK, 1949, localities on map on p. 310, and the neighbourhood of Port Moresby for *Bactis sogeriensis* HARKER, 1954, p. 264); it is therefore interesting to deal with specimens originating from the Wissel Lakes in the mountains of the central part of the island. The Wissel Lakes, discovered as late as December 31, 1936 (oral communication of Lieutenant Commander F. J. WISSEL), were explored by a naturalist in 1939, during an expedition of the Koninklijk Nederlands Aardrijkskundig Genootschap (Royal Dutch Geographical Society) ¹⁾. Dr. H. BOSCHMA, zoologist of the expedition, collected a number of mayflies on Lake Paniai, the northernmost of the three lakes. Afterwards the Wissel Lakes were visited by Dr. L. D. BRONGERSMA, and later on again by the same naturalist accompanied by Dr. M. BOESEMAN and Dr. L. B. HOLTHUIS, during the zoological explorations in Dutch New Guinea sponsored by the Rijksmuseum van Natuurlijke Historie at Leiden, in 1954-1955. At my request Dr. HOLTHUIS collected a sample of Ephemeroptera at the eastern shore of Lake Paniai, which he kindly entrusted to me for examination. The material proved to consist of two new species belonging to the families Brachycercidae (olim Caenidae) and Baetidae.

The material has been studied in a solution of alcohol 70 %, glycerine, and distilled water in equal proportions. The specimens are preserved in alcohol 70 % to which is added a small amount of glycerine; in this fluid the specimens, particularly the joints of the legs, remain quite soft and movable.

1) The first entomological collections from this little known region were made at Lake Paniai in September, 1938, in behalf of the Buitenzorg Museum (Java), by Mr. J. P. K. VAN ECHOUDE, at one time Governor of Netherlands New Guinea. These were mostly heterocerous Lepidoptera. — Ed.

Tasmanocoenis novaeguineae nov. spec. (figs. 1-2).

Male imago.

Head short and wide. Head and thorax uniformly yellowish brown, though head somewhat more brownish. Antennae yellowish brown, basal joint comparatively thick. Compound eyes black, prominent. Median ocellus relatively large, prominent, black; lateral ocelli idem, not very prominent, contiguous with the inner margin of the compound eyes:

Central dorsal area of thorax much paler than other parts. Scutellum comparatively large, prominent. The body as a whole gives a somewhat translucent impression.

Abdomen pale yellowish brown, at the dorsal surface of each segment showing a pale brown-grey pattern, except on the last tergite; ventral surface of abdomen very pale yellow to yellowish white. The last segments may be somewhat darker than the other. Tergites with rather sharp lateral edges, somewhat roofing over the ventral parts of the abdomen. Stigmata hardly visible. Cerci and filum terminale silver-white with dark brown markings at both ends of each segment.

Legs very pale yellowish brown to nearly colourless. Anterior legs with femur somewhat less than half as long as tibia; tibia and tarsus about equal in length. First tarsal segment about twice as long as second and third, which are nearly equal in length; last tarsal segment somewhat less than half the length of the third. Tarsal joints dark brown at both ends. Claws bluntly rounded. Median and posterior legs much shorter; tarsal joints without brown markings. Tarsal formula of hind legs 4, 3, 1 = 2, 5.

Wings (fig. 1) vitreous, rather narrow at the base, veins light grey except subcosta and radius, which are dark grey brown. Area subcostalis very pale yellowish white. Base of wings ciliate.

Genitalia (fig. 2) yellowish brown. Genostyles¹⁾ comparatively short, straight, yellowish white, with short, stiff, silvery hairs. End of genostyles with some spines (generally three), pointing inward. Penis very short and wide, not lobed.

Female imago.

Same as ♂, abdomen, and cerci and filum terminale excepted. Pattern on the dorsal surface of abdomen more evident than in ♂. The caudal filaments are silver-white, densely covered with comparatively long, stiff, silvery hairs; at the base of these filaments the colour darkens to pale yellowish brown. Legs without dark markings at tarsal joints.

Nymph unknown.

Measurements: length body ♂	3 mm
length body ♀	3-3.3 mm
length wing ♂, ♀	3-3.2 mm
length caudal filaments ♂, ♀	8-10 mm

Eggs yellow, in clusters protruding from the abdomen of females.

1) Term according to VERRIER (1956).

Material:

Holotype ♂, Central Dutch New Guinea, Wissel Lakes, eastern shore of Lake Paniai, Enarotali, on the outside of the pasanggrahan (= resthouse), 1750 m, February 20, 1955, 8.30 a.m., leg. Dr. L. B. HOLTHUIS.

Allotype ♀, same data.

Paratypes 4 males and 14 females, same data. One of the male paratypes, although similar to the other males, is considerably smaller; it shows the following measurements, wing 2.5 mm, body 2.5 mm, caudal filaments 10 mm. Because of the rather scanty material at my disposal (20 specimens in all) I only may presume that perhaps the amount of variation in size is fairly large.

The material here discussed is preserved in the Rijksmuseum van Natuurlijke Historie, Leiden; most specimens, however, are rather damaged.

The marked sexual dimorphism in the caudal filaments is very interesting as similar cases in the family Brachycercidae are not yet known. The difference also exists, perhaps, in *Caenis demoulini* VAN BRUGGEN (1954), for the caudal filaments of the female (the male is still unknown) are much like those of *Tasmanocoenis novaeguineae*. Another remarkable feature are the spines at the end of the genostyles, a peculiarity hitherto not observed in any other species of *Tasmanocoenis*. The present characters, in combination with the remarkable structure of the hind tarsus (vide key), show that the new species is not closely allied to the species already described.

Taking into consideration the data contained in the recent paper of DEMOULIN (1955), the genus *Tasmanocoenis* comprises three not very closely allied species that are distributed in Tasmania (*tillyardi*, *tonnoiri*), in the continent of Australia (*tillyardi*) and in New Guinea (*novaeguineae*). Of one species (*tonnoiri*) we know the male imago only, of another the male imago, the female subimago, and the nymph are known (*tillyardi*); while of the third we know the male and the female imago (*novaeguineae*).

The genus *Tasmanocoenis* seems to replace *Caenis* and *Caenodes* in the Papuan fauna on the Sahul Shelf (cf. DE BEAUFORT, 1951, pp. 177-184); the biology of the three closely allied genera does not seem to differ in any matter of importance.

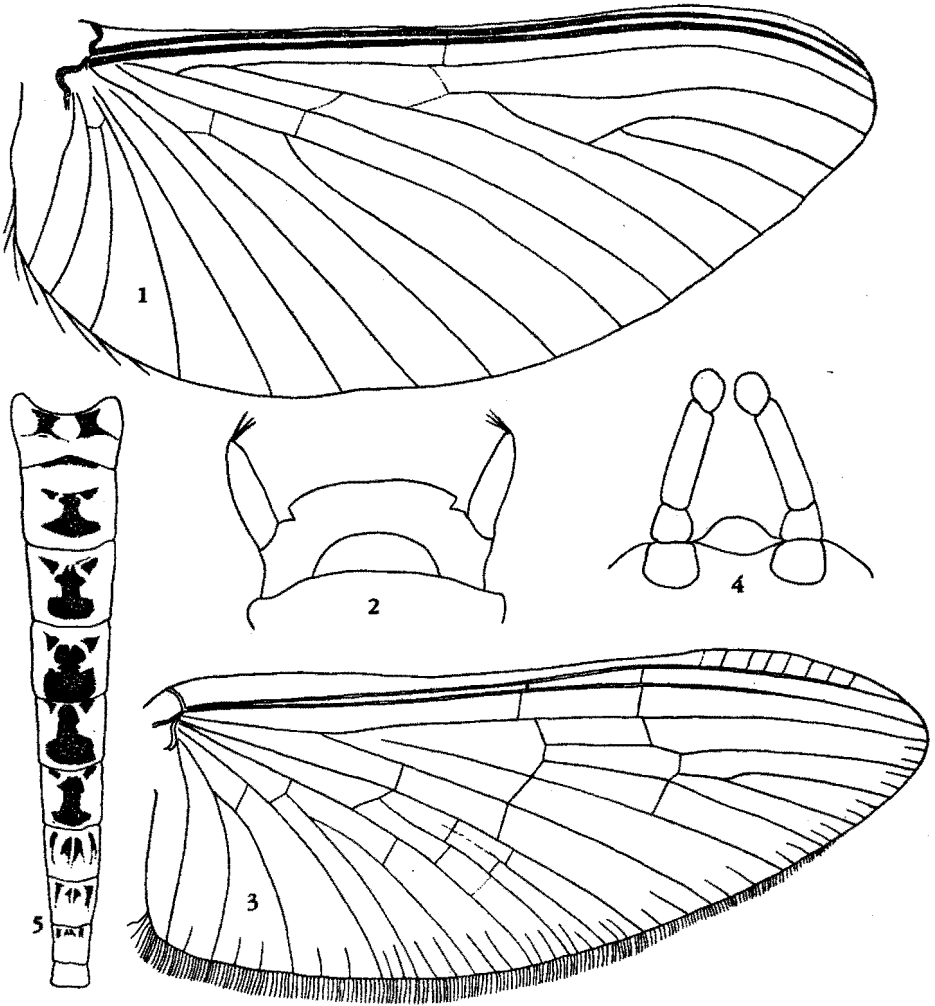
We can distinguish the known species with the aid of the following key for the identification of the males:

1. Genostyles comparatively short, straight, with spines. Tarsal formula of hind legs 4, 3, 1 = 2, 5 (New Guinea) . . . *novaeguineae* nov. spec.
Genostyles comparatively long, curved like horns, without spines . . . 2
2. Penis rather long, lobed. Tarsal formula of hind legs 1, 5, 2, 3 = 4 (Tasmania, Australia) *tillyardi* LESTAGE
(= *Caenis scotti* TILLYARD nec ULMER)
- Penis short, not lobed. Tarsal formula of hind legs 5, 1, 2, 3, 4 (Tasmania) *tonnoiri* LESTAGE

Cloeon papuanum nov. spec. (figs. 3-5).

Male imago.

Head short and wide. Antennae pale whitish yellow, comparatively long (ge-



Figs. 1-2. *Tasmanocoemis novaeguineae* nov. spec. Wing of female (1), and genitalia of male (2). — Figs. 3-5. *Cloeon papuanum* nov. spec. Wing of male (3), genitalia of male (4), and pattern on dorsal surface of abdomen of female (5).

nerally over 1 mm). Compound eyes black, turban eyes pale buckthorn brown (RIDGWAY, 1912, Plate XV). Turban eyes widely separated; distance in between approximately one third of diameter of surface of turban eyes. Ocelli black, not prominent.

Thorax pale yellowish brown; central dorsal area with three parallel narrow white longitudinal bands. Lateral surfaces sometimes paler, with some pleurites darker, to light brown. Scutellum rather prominent.

Abdomen colourless, translucent; last four segments pale yellowish brown and much less transparent, rarely coloured as basal abdominal segments. Stigmata in small blackish spots. Cerci pale whitish yellow; joints with small, stiff hairs, arranged in a definite pattern. Each hair starts from a slight transversal elevation; the hairs are pointing backward. Joints of cerci sometimes annulated brown.

Legs very pale yellowish brown, generally somewhat darkening towards the end. Anterior legs with femur and tibia about equal in length, tarsus slightly shorter than tibia. Tarsal joint 1 very short, wider than long, joints 2 and 3 about equal in length, joint 5 somewhat longer than 4; formula 2 = 3, 5, 4, 1. Median and hind legs shorter than fore legs, with rather short tarsus. Segments 1 and 2 of median and hind tarsus fused; fused basal segments of hind tarsus somewhat less than twice as long as the third. Tarsal formula of median and hind legs 1 + 2 = 5, 3, 4.

Wings (fig. 3) vitreous, completely colourless, veins pale whitish yellow. Marginal cross-veins 5-8, well spaced, never forked or otherwise divided. Apical cross-veins between subcosta and radius, between radius and sector radii, and between sector radii and the first branch of that vein, nearly always touching each other, sometimes last mentioned cross-vein placed somewhat farther towards the apex. Number of cross-veins in wings not very large. Hind margins of wings ciliate up to media or somewhat farther.

Genitalia (fig. 4) very pale yellowish brown, generally basal joints of genostyles darker. Penis short, bluntly rounded. Genostyles comparatively short and thick, with four segments. First and second segments rather short and wide, third more than twice as long as second. Last joint rounded, base broadly attached to next segment.

Female imago.

Slightly larger than ♂. Antennae slightly shorter than in ♂. Compound eyes black, with dark markings in between. Prothorax with dark pattern on dorsal surface. Abdomen opaque, pale brownish yellow, with brown markings on dorsal surface, fading towards the end of abdomen (fig. 5). Stigmata as in ♂. Wings generally with 7-8 marginal cross-veins.

Nymph unknown.

Measurements:	length body	♂	6-7	mm
	length body	♀	7-8	mm
	length wing	♂	7-8	mm
	length wing	♀	7-8	mm
	length cerci	♂	14-15	mm
	length cerci	♀	13-14	mm

Material:

Holotype ♂, Central Dutch New Guinea, Wissel Lakes, eastern shore of Lake Paniai, Enarotali, on the outside of the pasanggrahan (= resthouse), 1750 m, February 20, 1955, 8.30 a.m., leg. Dr. L. B. HOLTHUIS.

Allotype ♀, same data.

Paratypes 10 males and 4 females, same data.

Three females, collected by Dr. H. BOSCHMA on Lake Paniai, September 15 and 26, 1939, very probably belong to the same species. These specimens are somewhat smaller (perhaps in consequence of the dry state of preservation), and show the following measurements: length body ♀ 5.5 mm, length wing ♀ 7-8 mm. The pinned material (34 specimens altogether, 31 of which can be only identified as *Cloeon* spec.), however, is in bad condition.

The material is preserved in the Rijksmuseum van Natuurlijke Historie, Leiden; the specimens collected in 1955 are in a rather good condition.

The present species is characterized by the great length of body and wings. In fact it is the largest species of *Cloeon* in S.E. Asia and in the Australian region. Only *Cloeon tasmaniae* TILLYARD (1936) may reach the large size of the newly discovered species, which differs, however, from the Tasmanian species by the last joints of the genostyles, which do not have a narrow base, and by the relatively small and short penis. *C. apicatum* NAVAS (1932) from India has rather long wings (up to 7.5 mm) in the ♂, but the body is much shorter than in the species here discussed.

It is interesting to note that the hind margins of the wings are ciliated; generally this is a character of subimagines. As far as I know this is very rare if known at all in adults in the genus *Cloeon*.

It is rather difficult to determine the relationships of *Cloeon papuanum*. Many species of this commonly encountered genus are inadequately known or described; moreover, some species might belong to *Procloeon* BENTSSON (some perhaps even to *Pseudocloeon* KLAPALEK). When revising the generic characters, KIMMINS (1942, 1947, 1950), e.g., transferred some of the species to *Procloeon*. *Cloeon* and allied genera are badly in need of revision. As already suggested by GILLIES (1949, p. 173), it may be possible to distinguish several groups (perhaps subgenera) judging by the pigment in the wings. In my opinion the abdominal pattern of the females will eventually prove the most essential and suitable character for distinguishing between the numerous described species. The genitalia and the venation of the wings, sometimes useful characters in other genera of Ephemeroptera, have to be employed in *Cloeon* and allied genera with the utmost care. Particularly the venation of the wings occasionally shows a considerable amount of variation.

The present species differs from *Cloeon fluviatile* ULMER (1920a), the only other *Cloeon* species at present known to occur in New Guinea, by its large size, by the completely colourless wings, by the abdominal pattern in both sexes, and by the shape of the last joint of the genostyles in the ♂.

The following Asiatic species today included in *Cloeon* possess colourless wings: *C. navasi* nom. nov. ¹⁾, *C. pulchellum* BANKS (1913), *C. rubellum* NAVAS (1923), *C. siccum* GILLIES (1949), *C. taeniatum* NAVAS (1932), and *C. variegatum* CHOPRA (1924). None of the known Australian or Pacific forms have colourless wings. *C. papuanum* is by far the largest of the above listed species. Some other Asiatic and Australian species have wings with faint colour marks or coloured veins, viz., *C. erromangense* KIMMINS (1936), *C. julia* GILLIES (1949), *C. septimum* GILLIES (1949), and *C. tasmaniae* TILLYARD (1936). The new species also exceeds these forms in length of body, cerci, and wings.

Summarizing the knowledge of the mayflies of the island New Guinea, we can present the following checklist of the species:

Fam. Palingeniidae

1. *Plethogenesia papuana* (EATON, 1879, p. 398), cited by EATON (1883, p. 27), ULMER (1920b, p. 102), LESTAGE (1923, p. 110), ULMER again (1939, p. 461, doubtful specimen from Sumatra; p. 587), and by LIEFTINCK (1949, p. 311);

[*Plethogenesia* spec. (LIEFTINCK, 1949, p. 312; also LAM, 1928, and DOCTERS VAN LEEUWEN, 1926, cited by LIEFTINCK);]

2. *Tritogenesia bibisica* LESTAGE, 1923, p. III, cited by LIEFTINCK (1949, p. 309);

[*Tritogenesia* spec. (LIEFTINCK, 1949, p. 309);

Palingeniidae spec. (LIEFTINCK, 1949, p. 309);]

Fam. Leptophlebiidae

[Leptophlebiidae spec.; on account of a sample of nymphs in the Museum Zoologicum at Bogor, Java, collected by W. STÜBER in December, 1935, near Hollandia, Humboldt Bay. The label reads in the handwriting of Dr. G. ULMER: "Leptophlebiidae, verwandt mit *Thraululus*, Kiemen I bis VII gleich";]

Fam. Brachycercidae

3. *Tasmanocoenis novaeguineae* nov. spec.;

Fam. Baetidae

4. *Baetis sogeriensis* HARKER, 1954, p. 264;

5. *Cloeon fluviatile* ULMER, 1920a, p. 54, cited by ULMER (1920b, p. 125), LESTAGE (1928, p. 49; 1929, p. 99);

6. *Cloeon papuanum* nov. spec.;

1) *Cloeon navasi* nom. nov. for *Cloeon apicatum* NAVAS (1933, p. 17, nec 1932, p. 21). The species is also cited in WU (1935, p. 250).

Fam. Prosopistomatidae

[*Prosopistoma* spec. (oral communication of Dr. M. A. LIEFTINCK)].

The Palingeniidae are to be worked out by Dr. G. DEMOULIN (Brussels), and *Prosopistoma* by Dr. LIEFTINCK (Leiden).

The genera composing the mayfly fauna of New Guinea, six altogether, have the following distribution:

*Plethogenesia*¹⁾ and *Tritogenesia* are endemic;

Tasmanocoenis is known to occur in Tasmania, Australia, and New Guinea (vide supra);

Baetis and *Cloeon* (in the wide sense of today's opinions, both genera in need of a revision) are cosmopolitan;

Prosopistoma has been found hitherto in Continental Europe, Africa and Madagascar, Ceylon, Sumatra and Java, and New Guinea.

The major part of the species of mayflies in Australia belong to the family Leptophlebiidae; therefore it is not surprising to encounter the family in New Guinea.

The discovery of two new species in the mountains of the central part of New Guinea shows that interesting results may be expected from future explorations in the interior of the island.

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1) ULMER (1939) records one ♀ from Sumatra; however, considerable doubt is expressed by him about the identity of the species.

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