

New species of Baetidae (Ephemeroptera) from the Upper River Sigi, Usambara, Tanzania

M. T. GILLIES†

Whitfeld, Hamsey, Lewes, Sussex BN8 5TD, UK

(Accepted 5 July 1999)

Additional species of mayflies are described from the relatively well-studied fauna of the Upper River Sigi in the East Usambara Mountains of Tanzania. They comprise *Cheleocloeon sigiense* sp. n. and *Centroptiloides ornatus* sp. n. A species of *Afroptiloides*, of which only the adult is known, is figured but not named. The composition of the assemblage of genera known as the *Bugilliesia* complex is critically examined.

KEYWORDS: Baetidae, *Cheleocloeon*, *Centroptiloides*, *Bugilliesia* complex, Africa, systematics.

Introduction

Two periods of intermittent study, separated by 25–30 years, made it possible to compile a catalogue of the mayfly fauna of a tropical African river, the Upper Sigi River in the East Usambara Mountains of Tanzania (Gillies, 1998). The list included 45 species from the upper 19 km of the river. Formal descriptions of 33 of these have been published in the past. I take the opportunity here to add descriptions of two more to the list of named species. Adults of both were bred out from the larvae.

Descriptions

Cheleocloeon sigiense n. sp.

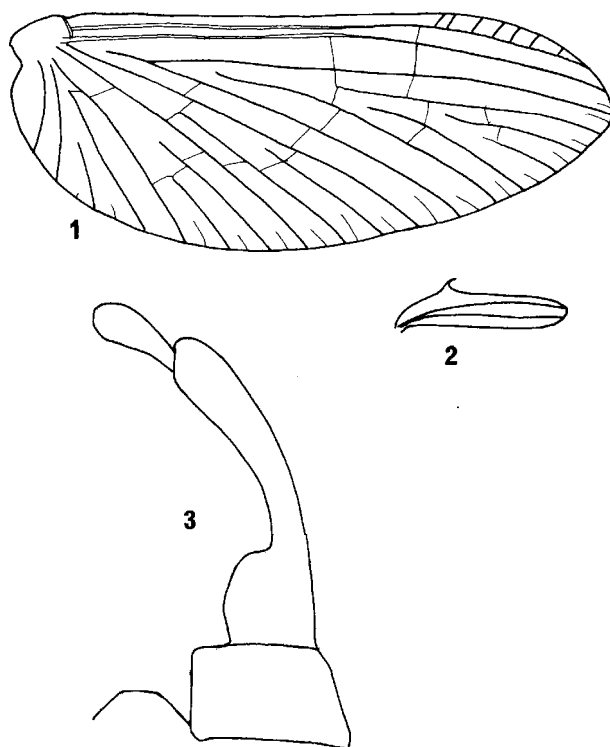
(figures 1–11)

Dabulamanzia sp. n., Gillies, 1998: 53.

Male imago (*in life*). Eyes chocolate brown; thorax pitch brown, fore femora tan, rest of legs clear; abdominal terga I–V greyish white, lateral margins and terga VI–X brown, a median dark red spot on I, II and V–VIII.

(*In spirit*). Turbinate eyes well separated, reddish brown; thorax dark brown, fore femora pale brown, rest of legs white; stigma of fore wing with four or five slanting cross-veins, hind wing (figure 2) narrow and blunt-tipped, with two veins and recurved spur; abdominal terga white, VI–X tinged with brown, venter white,

† Deceased.



FIGS 1-3. *Cheleocloeon sigiense* sp. nov.: (1) fore wing, female; (2) hind wing, male; (3) male foreceps.

sternum IX and forceps limbs (figure 3) pale brown; cerci white. Body 4 mm, fore wing 5 mm, cerci 8 mm.

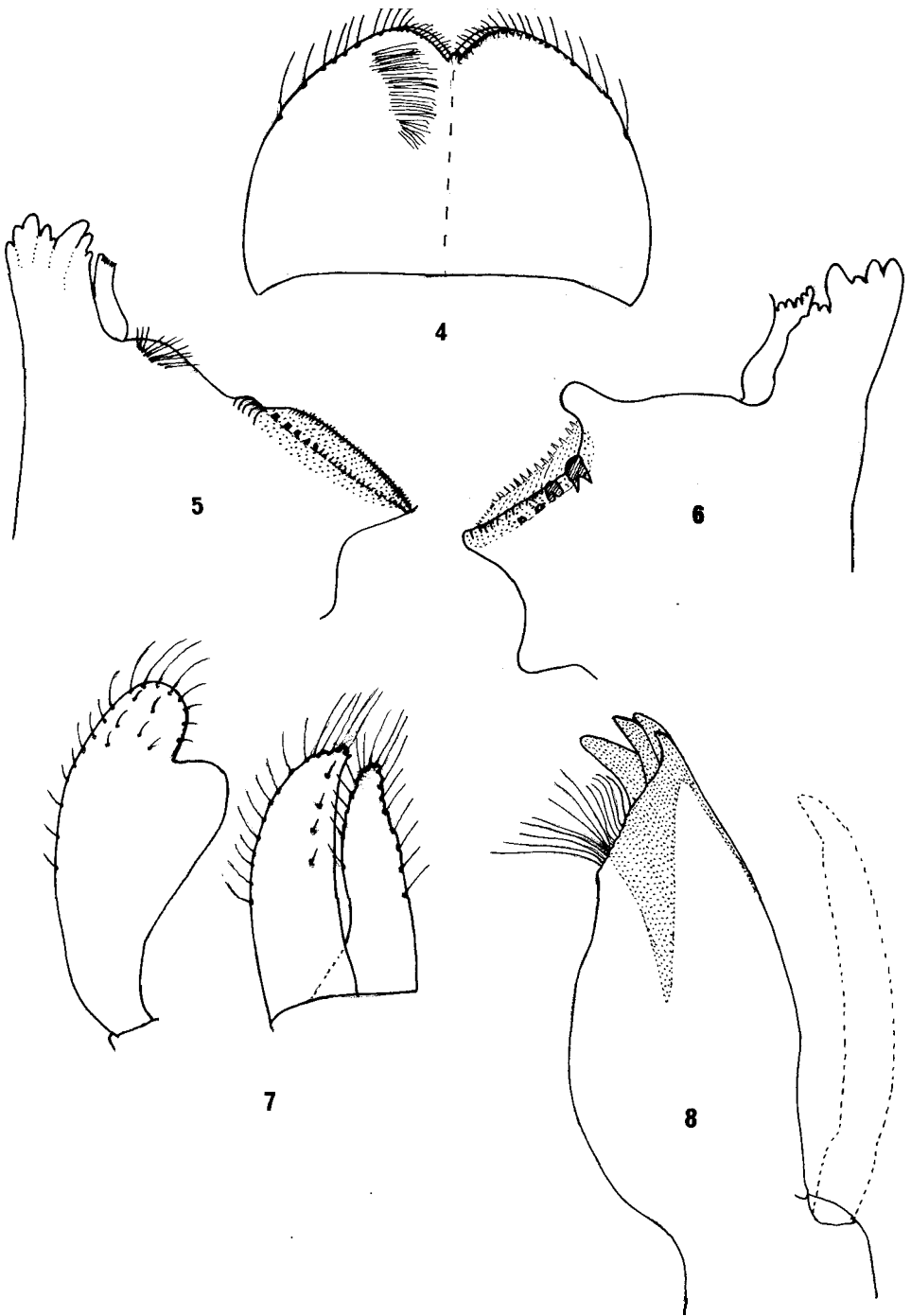
Female imago (in life). A generally dark brown insect, abdomen with brownish yellow and red markings above, cerci white.

(In spirit). Body pale brown, paler on venter; terga III and VI and along margins darker brown; fore femora pale brown, rest of legs white. Fore wing (figure 1) as in male, hind wing apparently absent. Body 5 mm, wing 5 mm.

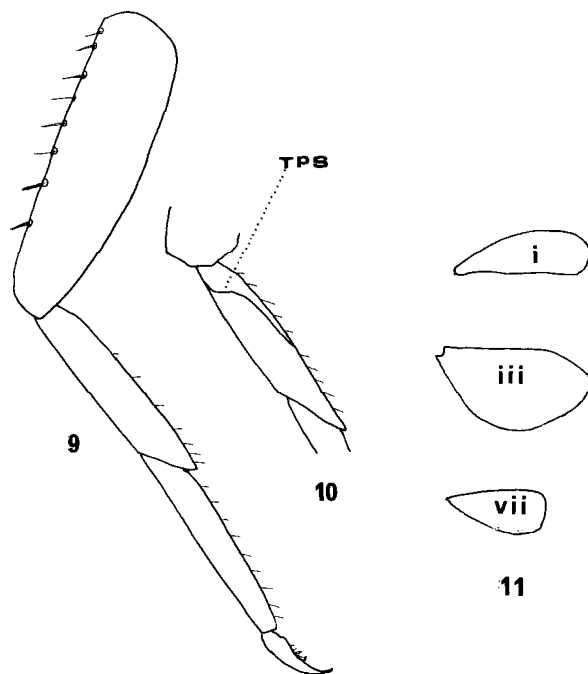
Larva. In life a small dark species. Mouthparts (figures 4-8): incisors of mandibles fused, right prostheca a broad scraper, apically fimbriate, well-developed setal tuft at base, left prostheca without setal tuft, left molar surface terminating medially in two or three large, blunt teeth; apical teeth of galea-lacinia stout, tapered, maxillary palp slender, apparently shorter than galea-lacinia (damaged in available specimens); glossa of labium broad with sub-parallel sides, apical medial process of second segment of palp well developed, rounded; upper surface of labrum without setae except along margin.

Legs (figures 9, 10). Femora narrow, posterior margin with scattered narrow, spine-like setae; a distinct tibio-patellar seam present on mid and hind tibiae; tarsal claws with three or four coarse teeth in a single row.

Abdomen. Gills (figure 11) present on I-VII, obovate, small and narrow on I, serrated on antero-apical margin. Spines on posterior tergal margins small and more or less regular. Paraprocts with five or six stout spines. Cerci and terminal filament subequal, setose except for last two or three segments.



FIGS 4-8. *Cheleocloeon sigiense* sp. nov., mouthparts: (4) labrum, ventral side on left; (5) right mandible; (6) left mandible; (7) labium, dissected; (8) maxilla.



FIGS 9–11. *Cheleocloeon sigiense* sp. nov.: (9) fore leg, tarsal claw enlarged; (10) hind leg, showing tibiopatellar suture (TPS); (11) abdominal gills i, iii, vii.

Material

Tanzania: R. Sigi, Amani, 23 February 1991, holotype male with associated nymph skin on slide (in Natural History Museum, London); *ibid.*, paratypes, 23 February 1991, 1 male, 1 female, with associated larval skins on slides; *ibid.*, 1 July 1962, 2 males, 7 February 1963, at light, 1 male.

The adult of *C. sigiense* differs from *C. yolandae* Wuillot and *C. carinatum* Wuillot by the presence of a hind wing in the male. The larva differs from all other members of the genus by the reduced apical medial process of the labial palp.

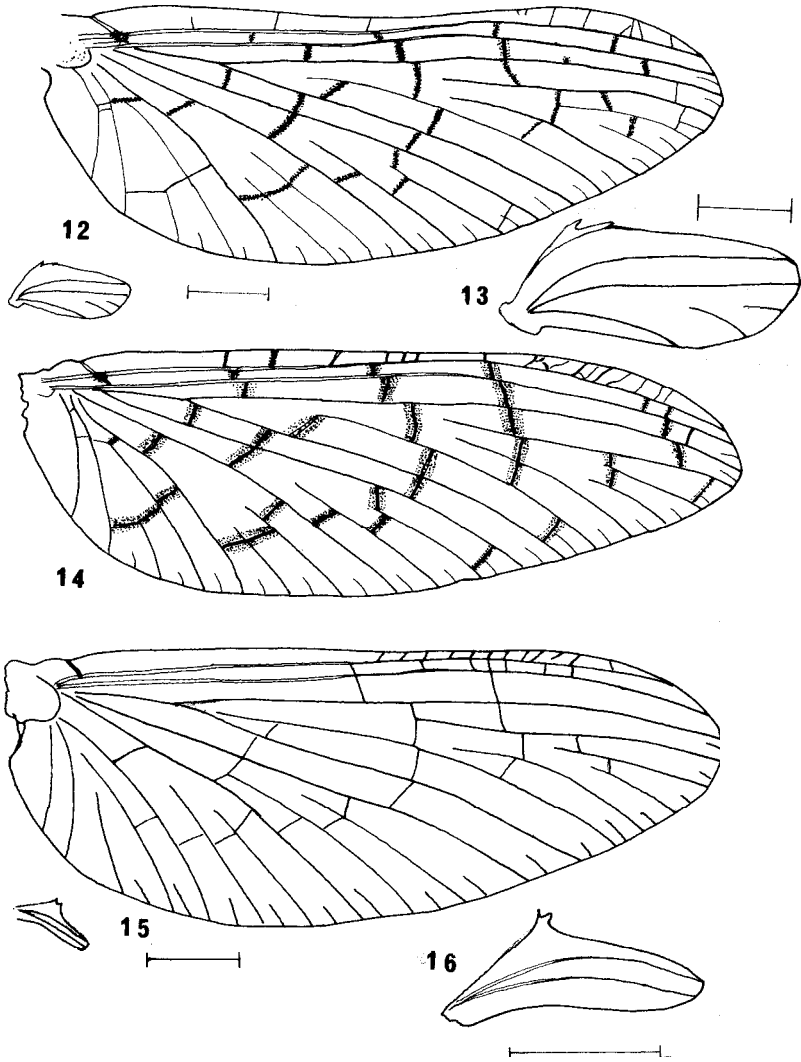
Centroptiloides ornatus sp. n.

(figures 12–14, 17, 19–25, 27–29)

Centroptiloides sp. n., Gillies, 1998: 53.

Male imago (in life). Turbinate eyes black. Thorax generally sandy-brown, mesonotum mustard; fore femur reddish brown, tibia chocolate, this becoming more intense apically; tarsus 1 black, 2–4 clear except for apical 1/4 which is dark grey, tarsus 5 grey; mid and hind legs cream, femora diffusely tinged with red. Fore wing (figure 12), costal and subcostal areas yellowish brown, rest of wing field hyaline, all cross-veins black, the pigment spreading out on to adjacent wing membrane. Abdomen conspicuously marked in chocolate on a cream background, lateral margins of II–IX diffusely maroon; forceps dark grey, tails greyish brown with red annulations.

(In spirit). Turbinate eyes ovoid, contiguous, purplish black. Thorax generally pale buff, metanotum orange-yellow. Fore femur yellowish, tibia (figure 17) medium brown turning to umber at apex, tarsus I umber, tarsi II–IV clear, dark brown at apices giving a ringed effect, tarsus V dark brown. Wings (figures 12, 13). Abdomen,

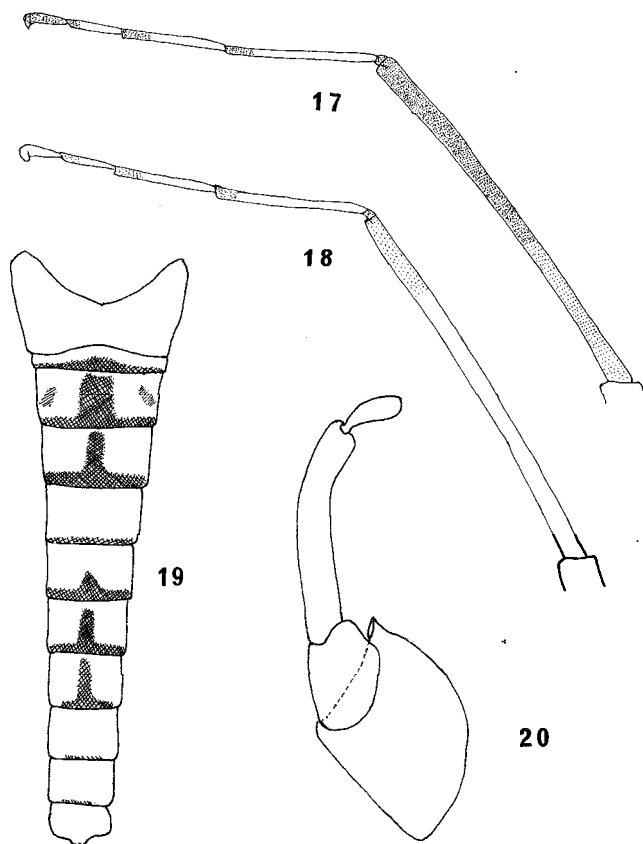


FIGS 12–16. (12–14) *Centroptiloides ornatus* sp. nov.: (12) fore and hind wings, male, Tanzania, bar = 1 mm; (13) hind wing enlarged, bar = 0.5 mm; (14) fore wing, female, Ethiopia. (15, 16) *Afroptiloides* sp.: (15) fore wing, female, bar = 1 mm; (16) hind wing, female, enlarged, bar = 0.5 mm.

tergal markings (figure 19), venter entirely pale except for dark grey colour of long forceps segment (figure 20). Cerci pale grey.

Female imago (in spirit). Thorax pale buff: fore femur, tibia and tarsus I dark brown, femur paler at base, tarsus 2–5 pale. Wings (figure 14) as male but pigmented spots larger. Abdomen, terga II–VII with postero-median margins dark brown, the dark areas narrower on posterior segments, terga II–III, V–IX with dark median streak; venter pale.

Subimago. Wing membrane dark brown with extensive pale windows giving a dappled effect. Abdominal terga II–VII broadly dark-banded posteriorly and with a broad, dark, lateral stripe; sterna pale, unmarked.



FIGS 17–20. (17) *Centroptiloides ornatus* sp. nov., fore tibia and tarsus, male imago; (18) *Centroptiloides bifasciatus* (Esb. Pet.), the same; (19) *Centroptiloides ornatus* sp. nov., abdominal dorsum, male imago; (20) male forceps.

Body: male 9–9.5 mm, female 9.5 mm. Wing: male 9 mm, female 10 mm.

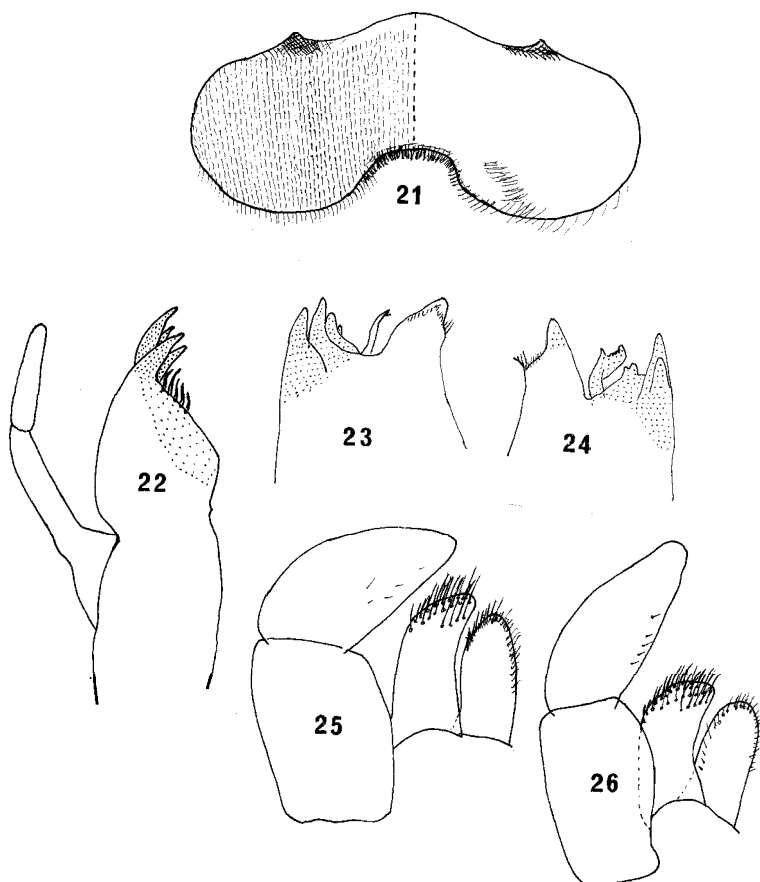
Larva. Body pale brown, without obvious markings. Mouthparts (figures 21–25). Labrum deeply excavated in midline, upper surface with a uniform covering of short setae; canines of mandibles sharply pointed, molar surface reduced to a single broad tooth, right prosthema a stout bifid process; maxillary palp two-segmented, apical teeth of galea-lacinia stout, sharp, subapical setae stout; labial palp very broad, with two segments, distal segment strongly flexed.

Fore leg (figures 27, 28) short and broad, setation confined to short, stout hairs along anterior margins of tibia and tarsus and finer hairs along basal half of posterior margin of femur, tarsal claw stout with a double row of six or seven blunt teeth; tibio-patellar seam absent from fore leg, present on mid and hind legs.

Gill lamellae on segments I–VII (figure 29) palette-shaped with well-developed basal lobe not forming a distinct basal flap. Posterior margins of abdominal terga with uniform, closely packed teeth. Paraprocts with 15–20 marginal spines. Median caudal filament about two-thirds length of cerci.

Material

Tanzania: holotype male imago, Chemka, Amani, Usambara Mts, 600m, at light, 27/28 January 1962, 2 males same provenance, 27/28 January 1962, 1 male,



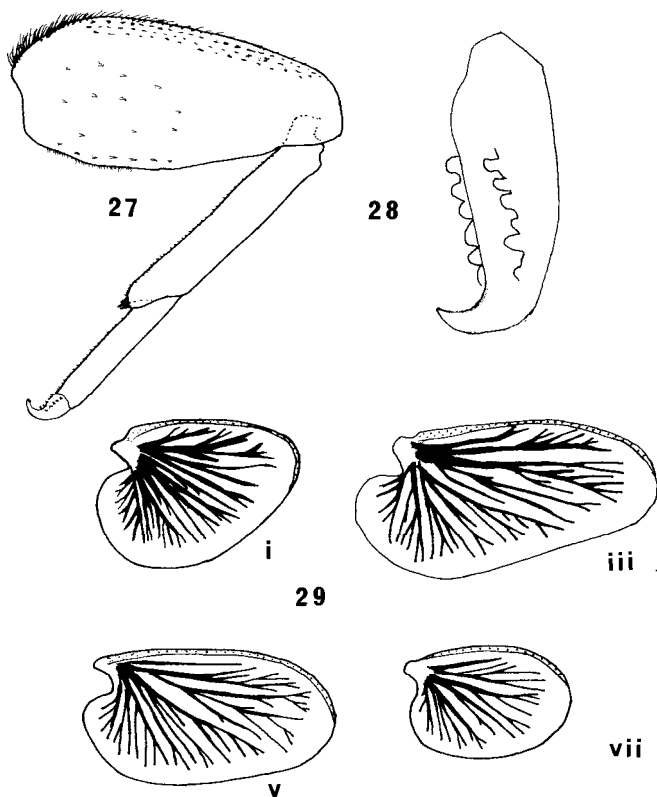
FIGS 21–26. *Centroptiloides ornatus* sp. nov.: (21) labrum, dorsal surface on left; (22) maxilla; (23) right mandible; (24) left mandible; (25) labium. *Centroptiloides bifasciatus* (Esb. Pet.); (26) labium.

31 March/1 April 1962, 1 male subimago with associated nymph skin, Dodwe stream, Amani, 900m, 3 March 1985, 6 nymphs, same provenance, 1 March 1985.

Ethiopia: N.H.M. 1961-546, 1 male imago, 1 female imago, 1 female subimago, Ghibe R., 260km from Addis Ababa, at light, 6 May 1961, S. Chojnacky.

According to Article 30 of the International Code of Zoological Nomenclature, 1961, the names of genera ending in *-oides* are masculine. In contrast to current practice the name of the type species of *Centroptiloides* Lestage should therefore be rendered as *C. bifasciatus* (Esben-Petersen). The species described here is accordingly given as *C. ornatus* nov.

Apart from its smaller size, the adult of *C. ornatus* differs from *C. bifasciatus* by the ornate markings on the abdominal terga, the pigmented spots on the cross-veins and the more intense markings on the fore legs (figures 17, 18). The larva differs in the broader distal segment of the labial palp and, at first sight, in the absence of a basal flap on the gill lamellae even in fully mature specimens. However, there is a problem here. This flap was figured by Crass (1947) for *C. bifasciatus* but not by Demoulin (1970), who explained that he only had immature larvae for study. However, Lugo-Ortiz and McCafferty (1998) recorded that the flap was sometimes present in



FIGS 27–29. *Centroptiloides ornatus* sp. nov.: (27) fore leg, larva; (28) tarsal claw; (29) abdominal gills i, iii, v, vii.

immature larvae and excluded it from their figure of gill 4 of a (presumably) mature specimen. Apparently mature larvae from South Africa that I have been able to examine all possess a basal flap on the gills of the anterior segments. In the present state of knowledge it would be unwise to regard this as a reliable taxonomic character.

***Afroptiloides* sp.**
(figures 15, 16)

Afroptiloides sp. A, Gillies 1998: 53.

Imago. A relatively large species with short median spines on abdominal terga I–VII. Fore wing (figure 15) with four to six cross-veins in outer one-third of subcostal space. Hind wing (figure 16) with double costal spur, arising from a single promontory. Wing 8 mm.

This species is distinguished from the other known *Sigi* species, *A. variegatum* Gillies, by its much larger size and the presence of subcostal cross-veins in the fore wing. This latter character is also seen in certain species of *Centroptiloides*.

In the original description of *A. variegatum* I figured the costal spur as single. On re-examination it can be seen that the spur is shallowly split at the apex and should be described as bifid. The conspicuous splitting of the apex of the spur is shown in the case of the *Afroptiloides* sp. described here (figure 16).

This species is known from 1 male, 2 females from a light-trap beside the R. Sigi. The genus *Afroptiloides* Gillies has had a chequered history. Originally described as a subgenus of *Afroptilum* Gillies it was synonymized by Barber-James and McCafferty (1997) with *Acanthiops* Demoulin. This action was critically examined by Gillies (1999), as a result of which the reinstatement of *Afroptiloides* as a valid genus was advocated.

Without associated larval material it is impossible to determine the generic or phylogenetic relationships of this distinctive mayfly. Formal description of the species is therefore not undertaken at the present time.

Placement of *Cheleocloeon* in the *Bugilliesia* group of genera: a criticism

In their discussion of the systematics of *Cheleocloeon* (Lugo-Ortiz and McCafferty, 1997) the authors emphasized that the larvae of the genus were distinguished by the long poorly denticulate tarsal claws and the well-developed medial process of the second segment of the labial palps. This distinctive process [likened by Wuillot and Gillies (1993) to the outline of a crustacean claw] is clearly a shared apomorphy. It is long and pointed in *C. yolandae* Wuillot and *C. carinatum* Wuillot from Guinea, intermediate in *C. incisum* (Crass) from South Africa, and rather shorter and rounded in *C. dimorphicum* (Soldan and Thomas) and *C. sigiense* sp. n. from North Africa and Tanzania, respectively. The last-named species differs from the others in that the anterior margin of this process is straight not convex.

If the definition of the larva of *Cheleocloeon* can be established with reasonable confidence, the same cannot be said of the adult. The hind wing has been lost in a number of unrelated lineages of the Baetidae and, as pointed out by Lugo-Ortiz and McCafferty (1997), its absence in the female of all known species of *Cheleocloeon* is unremarkable.

However, the same authors (Lugo-Ortiz and McCafferty, 1996) have gone on to describe an association of baetid genera from Africa which they have designated the '*Bugilliesia* complex'. They define this grouping as distinguished by a conspicuous basomedial protuberance on segment 2 of the male forceps. It is certainly true that the forceps in the genera *Bugilliesia* Lugo-Ortiz and McCafferty, *Rhithrocloeon* Gillies, *Kivua* Lugo-Ortiz and McCafferty, and *Mutelocloeon* Gillies and Elouard have undergone reduction and sometimes bizarre modification. But in the other genera incorporated by Lugo-Ortiz and McCafferty in the complex, namely *Afrobaetodes* Demoulin, *Potamocloeon* Gillies and especially in *Cheleocloeon*, this protuberance is no more marked than in certain other baetid lineages. For example, Traver (1935) figured similar forceps in a number of Nearctic species of *Centropilum* Eaton, some of which were later shown by McCafferty and Waltz (1990) to belong to *Procloeon* Bengtsson.

Lugo-Ortiz and McCafferty (1996) remark that the complex is not definable in the larval stage. Indeed one may go further by pointing out that larval taxonomy provides evidence for the polyphyletic nature of the complex.

Foremost among the elements that indicate the diverse origins of the group is the tibiopatellar suture. The importance of this structure was shown by Kluge and Novikova (1992) and Kluge (1997) who drew attention to a plesiomorphic character shared by members of the *Afroptilum* group of genera. This character was the contrasting presence of a tibiopatellar suture in the mid and hind legs and its absence from the fore legs (figure 10). In most other Baetidae, including all the Baetinae, it is present on all three legs. This structure and the taxonomic importance attributed to it by Kluge (1997) is not referred to by Lugo-Ortiz and McCafferty (1996, 1997).

Nevertheless, from examination of material in my own collection it can be shown that among the genera included by these authors in their *Bugilliesia* complex are some with a tibial suture on the fore leg, for example *Afrobaetodes* and *Potamocloeon*, and some with a suture on the mid and hind legs only, including *Bugilliesia* and *Cheleocloeon* (cf. figure 10).

Further evidence of the polyphyletic nature of the complex is provided by the inclusion of the genus *Potamocloeon*. This genus shares with *Cloeon* Leach and *Procloeon* the presence of bilamellate gills on the anterior abdominal terga and of well-developed spines on the lateral margins of the terga, Gillies and Thorpe (1996). Together, they form a group adapted to slow-moving and sometimes still waters.

These findings suggest that the term *Bugilliesia* complex should be restricted to the rather small group of genera with major reduction of the genital forceps, namely *Bugilliesia*, *Rhithrocloeon*, *Kivua* and *Mutelocloeon*.

Acknowledgement

I am greatly indebted to Mrs Helen Barber-James for the loan of specimens of South African mayflies.

References

- BARBER-JAMES, H. M. and MCCAFFERTY, W. P., 1997, Review and a new species of the African genus *Acanthiops* (Ephemeroptera: Baetidae), *Annales de Limnologie*, **33**, 85–92.
- CRASS, R. S., 1947, The May-flies (Ephemeroptera) of Natal and the Eastern Cape, *Annals of the Natal Museum*, **11**, 37–110.
- DEMOULIN, G., 1970, Ephemeroptera des faunes éthiopienne et malgache, *South African Animal Life*, **14**, 24–170.
- GILLIES, M. T., 1998, The mayflies of the Upper River Sigi, north-east Tanzania, *Freshwater Forum*, **10**, 49–57.
- GILLIES, M. T., 1999, Reinstatement of *Afroptiloides* as a genus (Baetidae, Ephemeroptera), *Aquatic Insects* (in press).
- GILLIES, M. T. and THORPE, J. R., 1996, When is a spine not a spine? A new look at an old problem in the taxonomy of the Baetidae (Ephemeroptera), *The Entomologist*, **116**, 85–90.
- KLUGE, N. YA., 1997, Classification and phylogeny of the Baetidae (Ephemeroptera) with description of the new species from the Upper Cretaceous resins of Taimyr, in P. Landolt and M. Sartori (eds) *Ephemeroptera & Plecoptera, Biology-Ecology-Systematics* (Fribourg: Kluwer), pp. 527–535.
- KLUGE, N. YA. and NOVIKOVA, E. A., 1992, Revision of Palaearctic genera and subgenera of mayflies in the subfamily Cloeoninae (Ephemeroptera, Baetidae) with descriptions of new species from the USSR, *Entomological Review*, **71**, 29–54.
- LUGO-ORTIZ, C. R. and MCCAFFERTY, W. P., 1996, The *Bugilliesia* complex of African Baetidae (Ephemeroptera), *Transactions of the American Entomological Society*, **122**, 175–197.
- LUGO-ORTIZ, C. R. and MCCAFFERTY, W. P., 1997, Contribution to the systematics of the genus *Cheleocloeon* (Ephemeroptera: Baetidae), *Entomological News*, **108**, 283–289.
- LUGO-ORTIZ, C. R. and MCCAFFERTY, W. P., 1998, The *Centroptiloides* complex of Afrotropical small minnow mayflies (Ephemeroptera: Baetidae), *Annals of the Entomological Society of America*, **91**, 1–26.
- MCCAFFERTY, W. P. and WALTZ, R. D., 1990, Revisionary synopsis of the Baetidae (Ephemeroptera) of North and Middle America, *Transactions of the Entomological Society of America*, **116**, 769–799.
- TRAVER, J. R., 1935, in J.G. Needham, J. R. Traver and Y.-C. Hsu (eds) *The Biology of Mayflies* (Ithaca: Comstock), 759 pp.
- WUILLOT, J. and GILLIES, M. T., 1993, *Cheleocloeon*, a new genus of Baetidae (Ephemeroptera) from West Africa, *Aquatic Insects*, **26**, 213–217.