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A Revision of the African Species of *Centroptilum* Eaton (Baetidae, Ephemeroptera)

by

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GILLIES, M. T.: A Revision of the African Species of *Centroptilum* Eaton (Baetidae, Ephemeroptera).

Aquatic Insects, Vol. 12 (1990), No. 2, pp. 97-128.

Of the 20 Afrotropical species hitherto placed in the genus *Centroptilum* Eaton, the nymphs of 7 have been described, all of them from South Africa. The nymphs of a further 5 species from East Africa and 3 from West Africa are described here, 6 of them being new. In the light of the recent redefinition of the Palaearctic species of the genus, all the African species except one are transferred to the new genus *Afroptilum*, comprising the two subgenera *Afroptilum* s.s. and *Afroptiloides*. The genus is recorded from North Africa, Africa South of the Sahara, Madagascar and possibly the Oriental Region. The genus *Demoulinia* is created for the single aberrant species, *Centroptilum crassi*, from South Africa. The new genera are defined and the characteristics of the Cloeonine Baetidae are discussed.

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INTRODUCTION

Eaton (1869) created the genus *Centroptilum* for species of Baetidae with single marginal intercalaries in the fore wings and small hind wings. Jacob (1973) was the first to point out that *Centroptilum* Eaton in Europe was diphyletic. Edmunds, Jensen and Berner (1976), in their treatment of the Nearctic fauna, accepted *Centroptilum* as a valid genus while expressing doubts about its distinctness from *Cloeon* Leach. Keffermuller and Sowa (1984) and Sowa (1986) resolved the problem for the Palaearctic species of the former genus by separating those with single gill lamellae from those with double gills into the respective genera *Centroptilum* s.str. and *Pseudocentroptilum* Bogoescu.

This left a large number of African species still in *Centroptilum*. Soldán and Thomas (1985), in describing a new species from Algeria, expressed doubts as to the correctness of this generic placing. I have shared these doubts about other African species for many years. As a result of a study of the nymphs and associated adults of 8 species from tropical Africa I now present evidence to show that they are phylogenetically distinct from *Centroptilum* s.str. The new genus, *Afroptilum* is created to accommodate them.

Afroptilum gen. nov.

Differs from *Centroptilum* Eaton as follows:

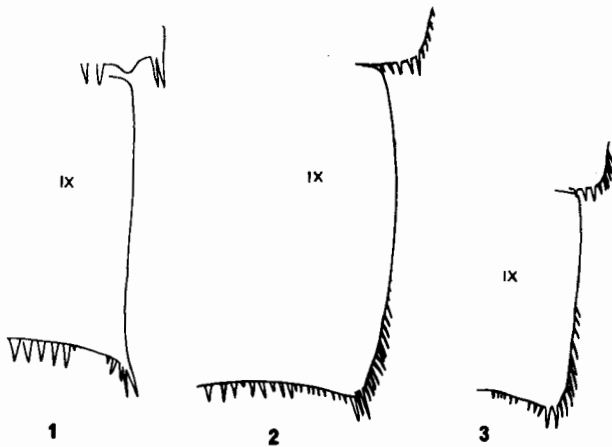
Adult; hind wing may be absent in one or both sexes, the spur single or double.

Second (long) segment of genital forceps often as in *Baetis*, i.e. tapered towards apex, third segment usually elongate, not globular.

Nymph: canines of mandibles broad, not tapered, often fused; glossae of labium narrower, sometimes much narrower, than paraglossae and overlapping bases of paraglossae. Tarsal claws with double row of teeth, sometimes reduced to a single row or, rarely, with teeth entirely absent. Gill lamellae asymmetrical, usually rounded at tip. Sides of abdominal terga VIII and IX without spines (Fig. 1).

Type species. *Afroptilum sudafricanum* (Lestage).

In contrast to *Afroptilum*, the adult of *Centroptilum* s.str., has the hind wing with a single spur only, the second forceps segment broadens towards the apex and the terminal segment is usually globular. In the nymph, the canines of the mandibles are slender and well separated, the gills are symmetrical and usually pointed and abdominal terga VIII and IX have a line of spines along the posterior one-third or half of the lateral margins (Figs. 2-3). The degree of development of these spines was described by Macan (1949) and used by him (1961) in his key to the British Baetidae. They were figured for *Centroptilum luteolum* Müller and related European species by Belfiore (1983). Gillies (1980) made use of lateral abdominal spines for separating the nymphs of West African *Cloeon*.



Figs. 1-3. Lateral margin of abdominal segments of nymphs. 1. *Afroptilum tarsale*. 2. *Centroptilum luteolum*. 3. *Centroptilum walshi* McD.

It is important to emphasise that the term "lateral abdominal spines" or "small spines on the sides of abdominal segments" (Macan, 1961) specifically excludes the spine or spines at the posterior angle of the margin of the segment. The latter are present on all segments in many Baetidae, *Afroptilum* among them. In their description of *Centroptilum dimorphicum*, Soldán and Thomas (1985) refer to the

presence of "lateral spines on abdominal segments" in *C. flavum* Crass and also in *C. dimorphicum*. Yet it is clear from Crass's figure, as well as from the detailed illustrations of the latter species, that what is referred to is the spine at the posterior angle and the adjacent spines along the *posterior* (not the *lateral*) margins.

Two subgenera of *Afroptilum* are recognised here, defined on nymphal characters, as follows:

Afroptilum s.str. Nymph of the swimming type, body without dorsal spines; tibiae without a dorsal line of fine setae; tails 3, with dense whorls of fine hairs, terminal filament equal to 1/4 or more length of lateral filaments.

Afroptiloides subgen. nov. Nymph of the sprawling type, body dorso-ventrally compressed, often with a medial line of dorsal spines; all tibiae with a dorsal line of fine setae; tails 2, bare or with scanty whorls of fine hairs.

Type species. *Afroptilum (Afroptiloides) varium* (Crass).

Afroptiloides comprises a small number of 2-tailed species that have been collected in stony streams. Since the adult of only one of them, *A. varium* (Crass) has been described, there has been some doubt as to their generic position and they have been variously placed in *Centroptilum*, *Acentrella* and *Pseudocloeon*. The adult of a second species from West Africa is described below, and it is now possible to clarify the position of these distinctive nymphs.

In contrast to *Afroptiloides*, *Afroptilum* s.str. includes a large number of species with a wide range of character states. Four main lineages can be recognised (Table 1). The most ancestral is the *A. sudafricanum* line, characterised by the double-spurred hind wing in the adult and the third segment of the labial palp being in the form of a cap. 10 named species are known. In addition, *Centroptilum* sp., Demoulin (1973) from Madagascar probably belongs here.

Table 1. List of currently recognised species of *Afroptilum*.

Subgenus <i>Afroptilum</i>		
(1)	(2)	(3)
<i>sudafricanum</i> group	<i>tarsale</i> group	<i>sudanense</i> group
<i>biarcuatum</i> (Kopelke)	<i>badium</i> (Kopelke)	<i>griseum</i> sp. nov.
<i>bicorne</i> (Ulmer)	<i>falcatum</i> (Crass)	<i>guineense</i> sp. nov.
<i>boettgeri</i> (Kopelke)	<i>flavum</i> (Crass)	<i>nitidum</i> (Ulmer)
<i>decipiens</i> sp. nov.	<i>indusii</i> (Crass)	<i>notabile</i> (Kimmins)
<i>dicentrum</i> (Demoulin)	<i>loweae</i> (Kimmins)	<i>sudanense</i> (Ulmer)
<i>erepens</i> sp. nov.	<i>medium</i> (Crass)	
<i>montanum</i> (Kimmins)	<i>tarsale</i> sp. nov.	(4)
<i>parvum</i> (Crass)	<i>vitreum</i> (Navas)	<i>dimorphicum</i> group
<i>spinulosum</i> (Demoulin)		<i>dimorphicum</i> (Sold. & Thom.)
<i>sudafricanum</i> (Lestage)		<i>excisum</i> (Crass)
Subgenus <i>Afroptiloides</i>		
<i>bicaudatum</i> sp. nov.		
<i>varium</i> (Crass)		

The second line is represented by the *A. tarsale* group which, on the basis of unnamed material that I have seen from tropical Africa, probably contains a very large number of species. It is characterised by reduction in size of the hind wing and loss of the second spur. The labial palp is variable.

In the *A. sudanense* lineage the hind wing is also reduced. The forceps have become modified from the basic baetid pattern to a remarkable extent. The third segment has been lost and both forceps limbs have swung towards the mid line so that the basal segments are almost in contact with each other. This modification is comparable to that seen in *Rhithroclaeon* Gillies. But in contrast to that genus, the nymphs of the species of the *sudanense* group that are known do not depart to a significant extent from other groups of *Afroptilum*. On these grounds, I do not feel that the character state of the terminalia alone justifies their removal to a separate genus or subgenus. It may be noted that this group of *Afroptilum* has features of the genitalia in common with the unicolourous genus *Mutelocloeon* Gillies and Elouard. In this genus, however, the nymph has departed significantly from the basic *Afroptilum* pattern.

In the fourth lineage, represented by *A. dimorphicum*, Soldán and Thomas (1985) from Algeria, the reduction of the hind wing has gone further with its complete loss in the female. From their detailed description of the nymph it is clear that it should be treated as a species of *Afroptilum*. *A. excisum* (Barnard) from South Africa also belongs here. I have seen a similar reared female from West Africa, while in another species from West Africa the loss of the hind wing extends to both sexes, J. Wuillot (unpublished data).

DESCRIPTIONS OF SPECIES

An account follows of the nymphs and associated adults of 6 new species of *Afroptilum* from tropical Africa, together with descriptions of the nymphs of 2 species previously known only as adults. Unless otherwise stated, all specimens were collected by the author and the paratypes held in his private collection.

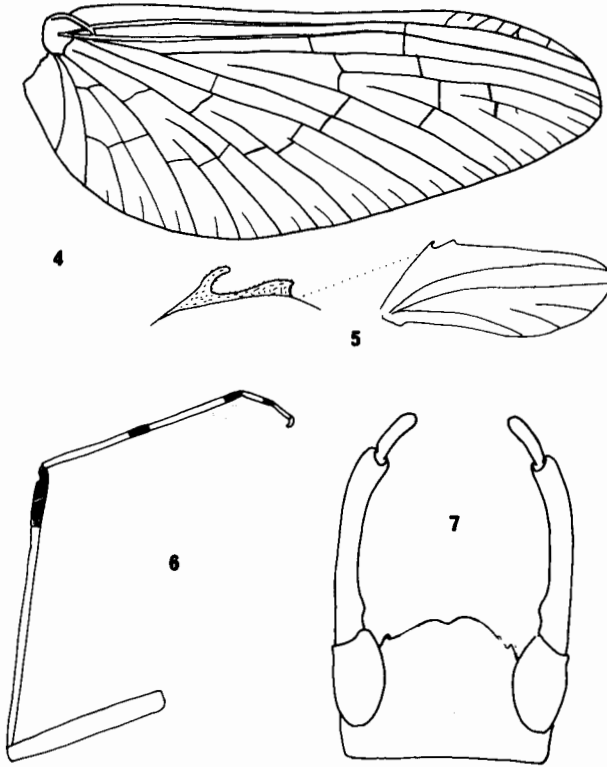
(1) *A. sudafricanum* group.

A large and strikingly marked baetid occurs in the River Sigi basin in Tanzania, which for many years I regarded as a species of *Centroptiloides*. The recent discovery of its nymph shows it to be a species of *Afroptilum*, a description of which follows.

Afroptilum decipiens sp. nov. (Figs. 4-19)

Male imago (in life). Turbinate eyes coffee-coloured, antennal pedicel, scape and base of filament tinged with pink, rest of filament dusky; thorax pale yellowish-brown; wings hyaline; fore femora and tibiae orange except for distal 1/5 of tibia

which is almost black, tarsi banded apically with black; mid and hind legs yellow; abdomen generally yellowish, central portion of terga I-VIII burnt umber, posterior margins strongly marked with dark brown, venter and forceps yellow, tails white with faint orange annulations.

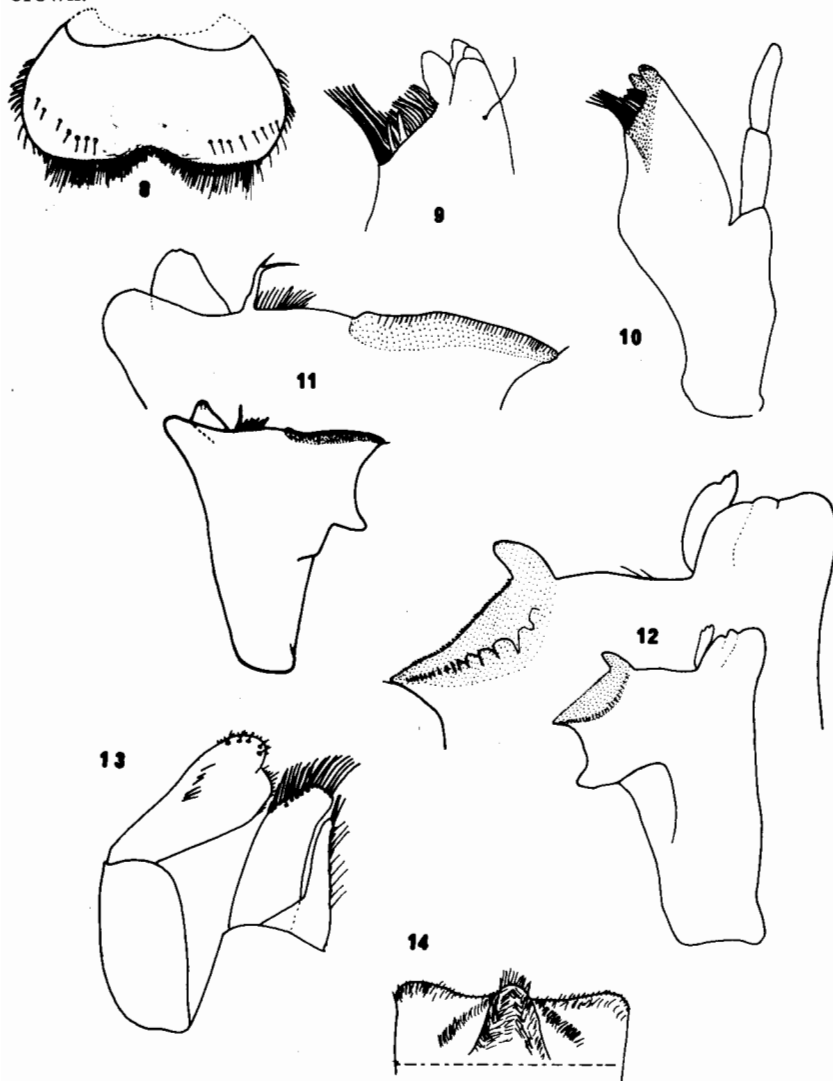


Figs. 4-7. *Afroptilum decipiens* ♂. 4. Fore wing. 5. Hind wing (spur at higher magnification). 6. Fore leg. 7. Forceps.

(In spirit). Turbinate eyes purple, low and elliptical in outline, well separated. Thorax fawn; fore femur and most of tibia cream, apex of tibia and tarsus 1 pitch-brown, tarsus 2-4 banded apically with the same colour (Fig. 6); mid and hind femora cream, tarsus 2-4 touched with brown at apices. Fore wing (Fig. 4) hyaline except for a milky wash in the stigma, anterior crossveins brown and thickened, stigma with 4-6 crossveins; hind wing (Fig. 5) with double spur, the outer spur short and broad, with 3 veins and 2 disconnected intercalaries. Abdominal terga I-VII translucent cream, VIII-X cream, a broad median dark brown streak present on II and III and, rather more faintly, on V-VII, posterior margins of I-VI very narrowly dark brown; sterna and forceps white; long forceps segment truncated and with a small sub-basal swelling on inner margin, terminal segment long (Fig.

7); a small callus present on forceps base, just medial to insertion of forceps; tails white.

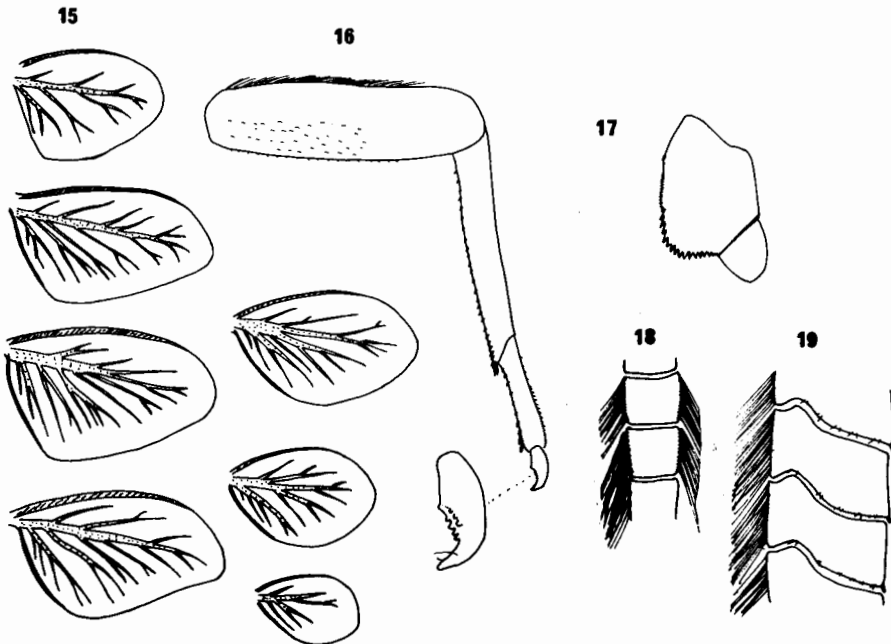
Female imago (in spirit). A generally dark brown insect. Fore legs uniformly dark brown, mid and hind femora fawn, tarsi dusky; wings hyaline except for pale brown tinting of costal and subcostal area, crossveins in anterior part of wing field thickened and dark brown. Abdominal terga dark brown, hind margins of I-VII narrowly darker still; sterna I-VII cream, VIII-X reddish-brown. Tails dark brown.



Figs. 8-14. *Afropitulum decipiens*. 8. Labrum. 9. Tip of maxilla. 10. Maxilla. 11. Right mandible (two specimens). 12. Left mandible (two specimens). 13. Labium. 14. Lingula of hypopharynx.

Male subimago (in life). Wings blue-grey, abdomen greenish above; fore femur and most of tibia orange-yellow, apex and tarsus 1-4 very dark grey, tarsus 5 colourless.

Nymph. Body somewhat flattened. Mouthparts (Figs. 8-14); labrum with narrow, forwardly directed plate; canines of left mandible fused, prostheca of the scraping type, hair fringe at base of prostheca absent in some specimens; right mandible with canines divided and without apparent teeth (possibly due to wearing down), prostheca a stout bifid seta, hair fringe well developed; apical teeth of maxilla blunt and broad, basal 6-7 setae of hair fringe much longer than the rest, usually with 1 or 2 spine-like setae, their shape and position differing from specimen to specimen; in the specimen figured there is also a sensory hair behind the apical teeth (absent in other specimens examined); palp short, with 2 segments; glossa of labium much smaller than paraglossa, palp with apical segment cap-like; lingula of hypopharynx narrow. Legs (Fig. 16); femora with a fringe of short, fine hairs along anterior border, the upper surface bearing scattered, very short spine-like setae; claws short with 2 rows of 3-4 blunt teeth and an apical hair. Gills (Fig. 15) present on segments I-VII, asymmetrical, rounded at apex and strongly thickened along anterior and inner margins. Paraproct (Fig. 17). Terminal filament about half as long as cerci, strongly haired; the joints between individual segments of the latter (except at base and towards the tip) show a deep sinuosity near the lateral margin (Fig. 19).



Figs. 15-19. *Afroptilum decipiens*. 15. Gill lamellae I-VII. 16. Fore leg, claw at higher magnification. 17. Paraproct. 18. Terminal filament (detail). 19. Cerci (detail).

♂ body 9-9.5 mm, ♀ 10 mm; ♂ wing 9.5 mm, ♀ 10 mm; ♂ tails 20-25 mm, ♀ 18-20 mm; mature nymph 10 mm.

Material: TANZANIA: Holotype male imago, Chemka, Amani, 20.x.61 [deposited in British Museum (Nat. Hist.)]. Paratypes, same site, 13 male, 8 female imagines, 12.x.61, 20.x.61, 11.xii.61, 27.i.62, 28.i.62, vii.62, 8.x.62. 2 male, 1 female subimagines, associated nymph skins, Dodwe stream, Amani, 27.ii.85, 1.iii.85, 3.iii.85. Same site, 2 male, 5 female subimagines, 1 female imago, associated nymph skins (pooled), 5.iii.85. R. Kwamkuyu, Amani, 6 female imagines from cobweb.

Etymology. From the latin, *decipiens*, deceiving.

A. decipiens differs from all other species of *Afroptilum* with double-spurred hind wings by its large size and the distinctive markings of the male imago. On the other hand, it closely resembles *Centroptiloides spinulosus* Demoulin from South Africa, the nymph of which has not been described. The large double-spurred hind wing and moderate size led Demoulin to treat it as a species of *Centroptiloides*. *A. decipiens* differs from *C. spinulosus* in the lack of yellow tinting of costal and subcostal areas of the wings, the abdominal markings and the colour of the hind tarsus. The terminalia of the two species are very similar, but the spines that give *spinulosus* its name are on the Xth sternum, whereas the somewhat similar structures in *decipiens* are on the forceps base. Despite the resemblance of the adult of *A. decipiens* to *Centroptiloides*, the nymph is typical of *Afroptilum*, particularly in the mouthparts and in the absence of broad lobes on the lamellae of the gills.

The nymphs of *A. decipiens* appear to be adapted to life in mountain torrents. At Amani they were particularly abundant at a point in a stream where the water cascaded over an inclined slab of rock. Large numbers of nymphs could be collected by dragging a net across this smooth rockface in not more than 2-3 cm of water. They shared this exposed site with smaller numbers of a species of *Centroptiloides*. The subimaginal stage lasts about 24 h. Adult males were only encountered in light-trap catches, but females were occasionally caught in spiders' webs spun across the stream. In life, the males hold their conspicuously marked fore legs straight out in front of them, close together like a lance at the ready.

In certain rivers in the mountains of north-east Tanzania a baetid nymph occurs which has the curious habit of leaving the main body of water and crawling over the adjacent rocks at points where they are kept wet with spray. The nymphs have flattened bodies and a greatly reduced terminal filament, but despite these unusual features the adults associated with them appear to be typical of the genus *Afroptilum*. The only male obtained is unfortunately in a poor state of preservation and the associated nymph skin is lost. But I have notes made at the time of capture which, in conjunction with two reared females, enable the species to be characterised with a fair degree of precision. A description of this taxon follows.

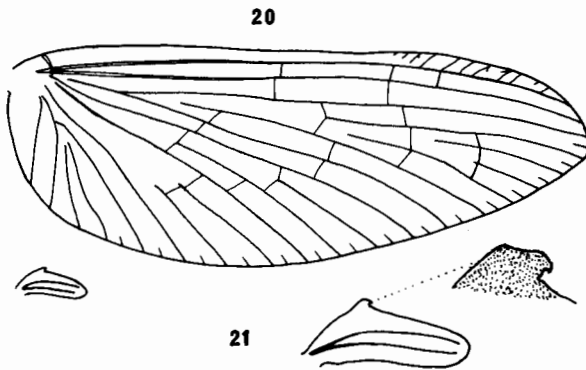
Afroptilum erepens sp. nov. (Figs. 20-35)

Male imago (in life). Turbinate eyes low, chocolate-brown. Mesonotum pitch-brown; fore femur dark sandy-brown with subapical dark red blotch, tibia clear except at apex which is broadly black, tarsus grey, each segment slightly darker at apex; mid and hind femora yellowish. Wings hyaline. Abdomen dark sandy-brown with very dark reddish lateral patches on III, VI and VII and the same colour along posterior margins of most segments. Tails grey. Forceps strikingly black in contrast to adjacent sterna; third segment very slender and elongate.

(In spirit, after desiccation). Thorax dark brown; mid and hind legs amber. Posterior margins of all abdominal terga narrowly dark brown, those on III and IV each with a small median spur on posterior margin; II, III and VI with dark brown antero-lateral patches, IV and V with dark lateral stripes.

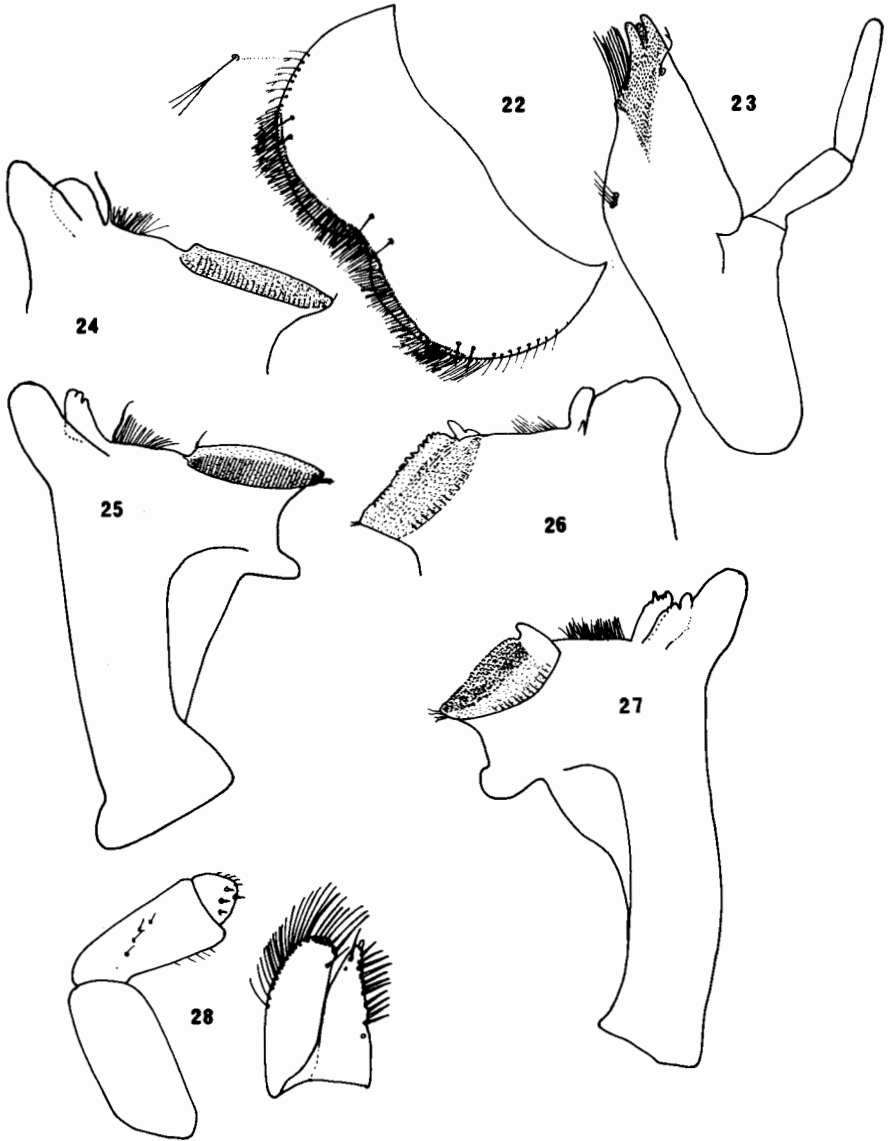
Female imago (in life). Body generally dark brown. Fore femur and tibia dark chestnut-brown, remainder of legs pale.

(In spirit). Body orange-brown throughout. Posterior margins of abdominal terga I-III or IV narrowly dark brown. Femora orange, tibia pale, tarsi tinged with orange; in mid and hind legs ratios of femur : tibia : tarsus, 6 : 9 : 2.6, tarsal segments, 9 : 4 : 4 : 9. Wings hyaline, venation strongly developed (Fig. 20), stigma with 7-10 cross-veins, marginal intercalaries present from second space posterior to vein R₁; hind wing narrow and rounded, with 2 veins, spur very short and beak-like and with a rudimentary second spur anterior to this (Fig. 21). Tails dark.



Figs. 20-21. *Afroptilum erepens*. 20. Fore wing. 21. Hind wing (with detail of spur).

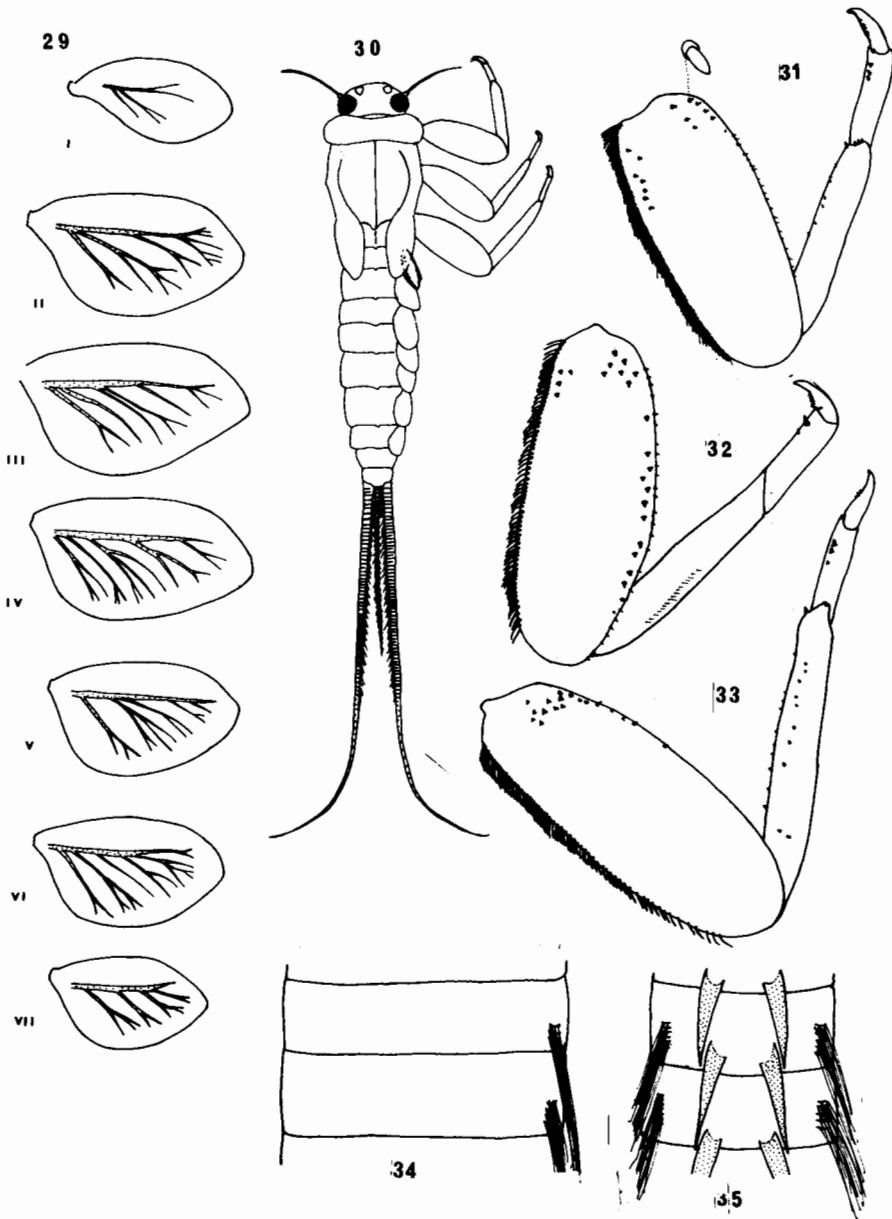
Nymph (Fig. 30). Body pale brown with darker brown markings on mesonotum and abdominal terga; femora with a broad linear streak in front of posterior margin, on fore femur this is broadened over most of anterior surface. Antennae short, about 1.2X width of head. Mouthparts (figs. 22-28). Labrum with dense anterior fringe; apical teeth of maxilla stout and blunt, palp with 2 segments; canines of left mandible partly fused, right prosthema a single stout bristle; apical segment of labium cap-like. Pronotum with rounded lateral projections extending



Figs. 22-28. *Afroptilum erepens*. 22. Labrum. 23. Maxilla. 24, 25. Right mandible (two specimens). 26, 27. Left mandible (two specimens). 28. Labium.

out on either side beyond the mesonotum. Femora (figs. 31-33) broad with a covering of dense bristles along the posterior margin; claws short, strongly curved with a double row of coarse teeth and, in some specimens, with a delicate seta arising from the distal end of the claw. Abdominal terga I-VII or VIII with a small, backwards-directed spur at mid point of hind margin, largest on the anterior

segments; sterna VII-IX with small antero-lateral patches of minute scales, their points directed forwards. Gills (fig. 29) present on I-VII, broad, rounded but with the front margin more or less straight and sparsely ornamented with very fine



Figs. 29-35. *Afroptilum erepens*. 29. Gill lamellae I-VII. 30. Mature nymph. 31-33. Fore, mid, hind legs. 34. Detail of cercus (medial side to right). 35. Ventral surface of terminal filament.

hairs; tracheae markedly asymmetrical. Tails sparsely haired (fig. 34); terminal filament much reduced, scarcely half the width of the cerci at the base and rather less than half the length; on its ventral surface there are a pair of stout, sub-median, posteriorly-directed spines on each segment (fig. 35).

♀ body 6-7 mm; ♂ wing 7 mm, ♀ 7-8 mm.

Material: TANZANIA: holotype female imago, associated nymph skin on slide, Amani, from trickle down rock-face beside R. Sigi, Chemka, 600 m, 24.xi.61. [deposited in British Museum (Nat. Hist.)]. Paratypes. 1 nymph, *ibid.*, 20.vi.54, nymph skin on slide, *ibid.*, 28.vi.54, 5 nymphs, *ibid.*, 3.iii.85. Female imago, Amani, Dodwe stream, 28.i.57. Female imago, associated nymph skin on slide, Upare, Gonja, 28.vii.55. Male imago, *ibid.*, 31.x.55. Nymph skin on slide (not associated), *ibid.*, 11.viii.55.

Etymology. From the latin, *erepens*, creeping out.

The adult of *A. erepens* differs from other species of *Afroptilum* in the form of the spur of the hind wing. *A. medium* Crass from Natal has a somewhat similar spur but in this species there are 3 hind wing veins. Although the dimensions of the segments of the legs have not been recorded for many African species, the tibiae in *A. erepens* would seem to be unusually long in relation to the femora and tarsi.

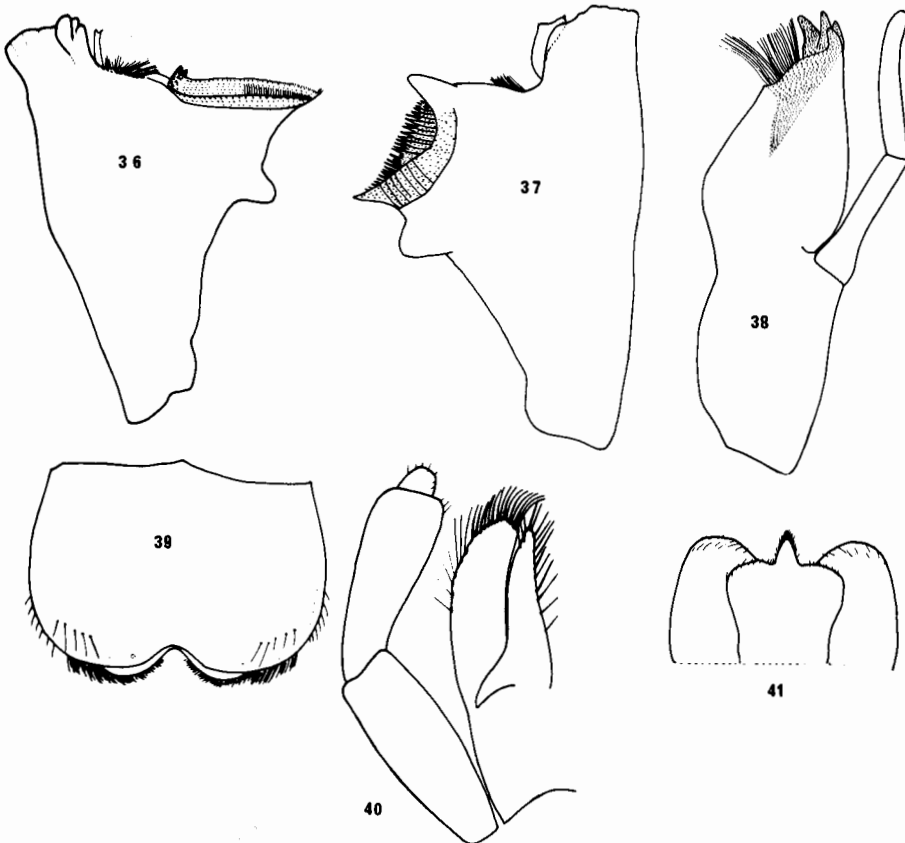
The nymph of *A. erepens* differs rather markedly from other described species in the exceptionally broad mesonotum and the specialised terminal filament. *Acanthiops marlieri* Demoulin and members of the subgenus *Afroptiloides* show somewhat similar flattening, but are distinguished by complete absence of the terminal filament. The mouthparts and gills of *A. erepens* are similar to other species of *Afroptilum*, likewise the adults. Thus it seems to represent a typical member of this genus, that nevertheless displays a number of derived characters in line with its unusual choice of habitat. Among these adaptations the most interesting are the spines on the underside of the terminal filament. From their backwards-pointing direction they would appear to act as a sort of ratchet to prevent the nymph slipping down when crawling or resting on vertical surfaces.

Nymphs of *A. erepens* seem to be at home both on semi-permanent vertical trickles and in the splash zone beside small waterfalls. One particular site at Amani has persisted over a period of at least 30 years. At this point, an overflow from the main falls on the river Sigi forms a sidearm that trickles constantly down a 4-5 m rock face. Spray from the falls helps to keep the whole face moist and a clinging carpet of moss coats the vertical surface. Occasional nymphs of *A. erepens* can be found attached to the moss, their bodies barely covered by water. If disturbed, they nimbly shift sideways into a less exposed position. If the attack is persisted with, they flip themselves backwards off the wall and into the pool at its base. No other Afrotropical mayfly is known to exploit this type of habitat, but Peters (1973) has recorded similar behaviour by *Moribaetis* on rock faces in Peru. The African species seems to occur at low densities, which is not surprising considering the specialised nature of the preferred habitat.

***Afroptilum montanum* (Kimmins) comb. n. (Figs. 36-44)**

Centroptilum montanum Kimmins, 1960, Bull. Brit. Mus. (Nat. Hist.) Entom. 9 : 345.

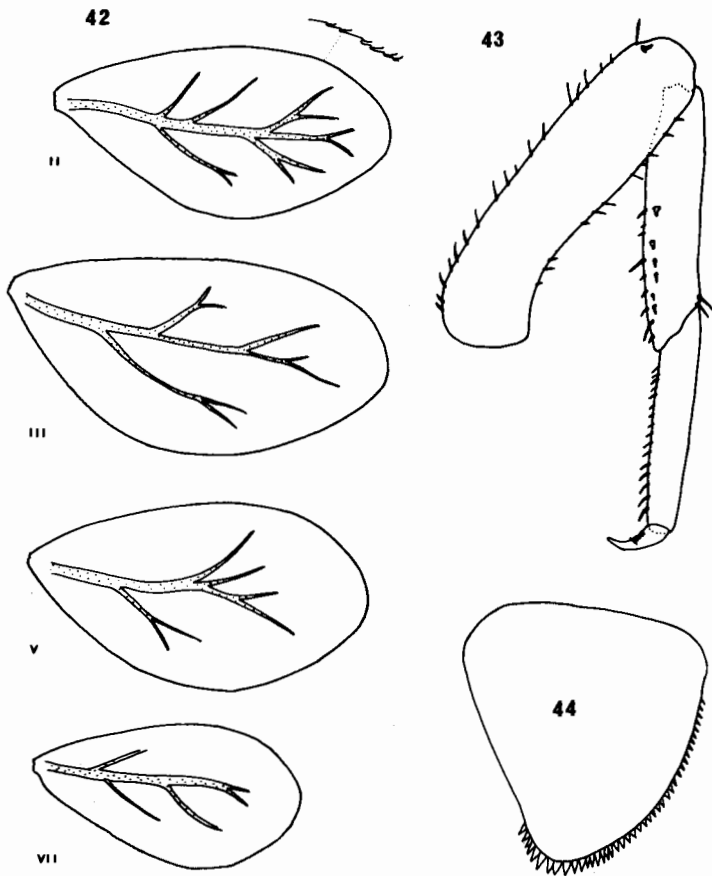
Described from the Ugandan side of Mount Elgon at an altitude of 3500 m, this species was subsequently recorded by Kopelke (1980) from a highland stream (1800 m) in eastern Zaire. I have been able to examine a collection of nymphs and adults of Baetidae made by Dr P. C. Barnard in the Rift Valley of Kenya in the vicinity of Lake Naivasha. By far the commonest species in his collections of both adults and nymphs was *A. montanum*. Identification of the nymphs was made possible by dissection of the hind wing buds in a mature specimen and demonstration of the double spur characteristic of this species. This coincidence of adults and nymphs in numbers, place and time is therefore taken as convincing evidence for the association of the two.



Figs. 36-41. *Afroptilum montanum*. 36. Right mandible. 37. Left mandible. 38. Maxilla. 39. Labrum. 40. Labium. 41. Lingula of hypopharynx.

Nymph. Body not flattened, medium brown without distinctive markings. Mouthparts (figs. 36-41). Labrum with projecting median flange; apical teeth of maxilla stout and blunt, palp with 2 segments; canines of mandible fused on both sides, blunt; median lobe of hypopharynx with a prominent, acute anterior process; terminal segment of labial palp small, cap-like. Legs (fig. 43) broad, outer half of tibia with a line of spine-like setae just inside posterior margin. Gills 6 in number (fig. 42), broad, rounded, tracheae more or less symmetrical. Paraproct (fig. 44) broad, on inner surface spines extending to near base. Terminal filament about half length of cerci.

Material: KENYA: 22 males, 4 females, 2 subimagines, Naivasha, beside rivers Gilgil, Malewa and Murindati, xii.82. 22 nymphs from same rivers, all collected P. C. Barnard [in British Museum (Natural History)].



Figs. 42-44. *Afroptilum montanum*. 42. Gill lamellae II, III, V, VII. 43. Fore leg. 44. Paraproct.

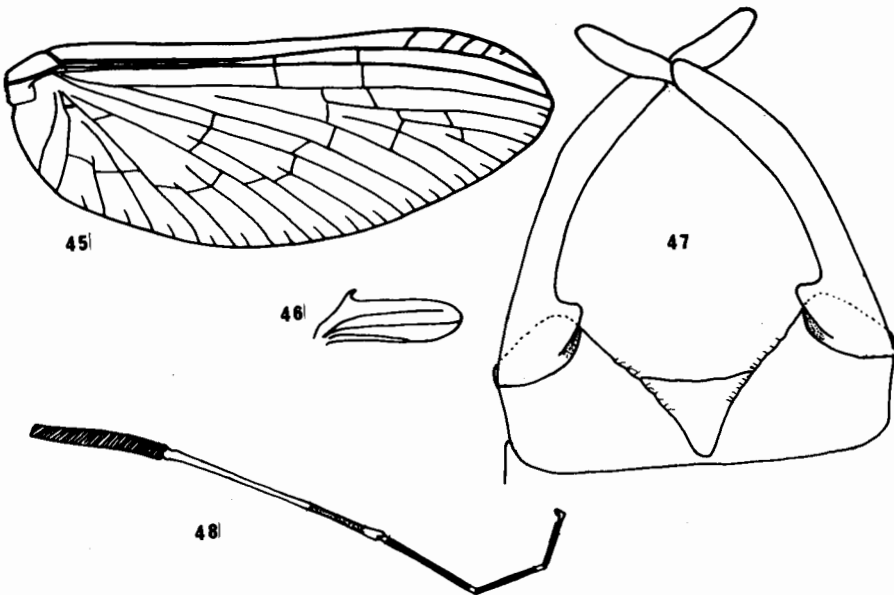
The nymphs of two other species with double-spurred hind wings have been described, *A. parvum* (Crass) and *A. sudafricanum* (Lestage). *A. montanum* differs from the former in the absence of gill I and the fused canines of the mandibles. It appears close to *sudafricanum* in the mouthparts and gills, but differs in the greater number of spines on the legs, particularly in possessing a group of large spine-like setae near the apex of the posterior border of the femora of all legs (fig. 43). All three species, however, share the derived character state of the cap-like terminal segment of the labial palp.

I have seen similar nymphs from Ethiopia, recorded by Harrison and Hynes (1988) as *Centroptilum sudafricanum*. The conspecificity or otherwise of these two species remains to be determined. It is clear they have a wide distribution in mountain streams in East Africa.

(2) *A. tarsale* group.

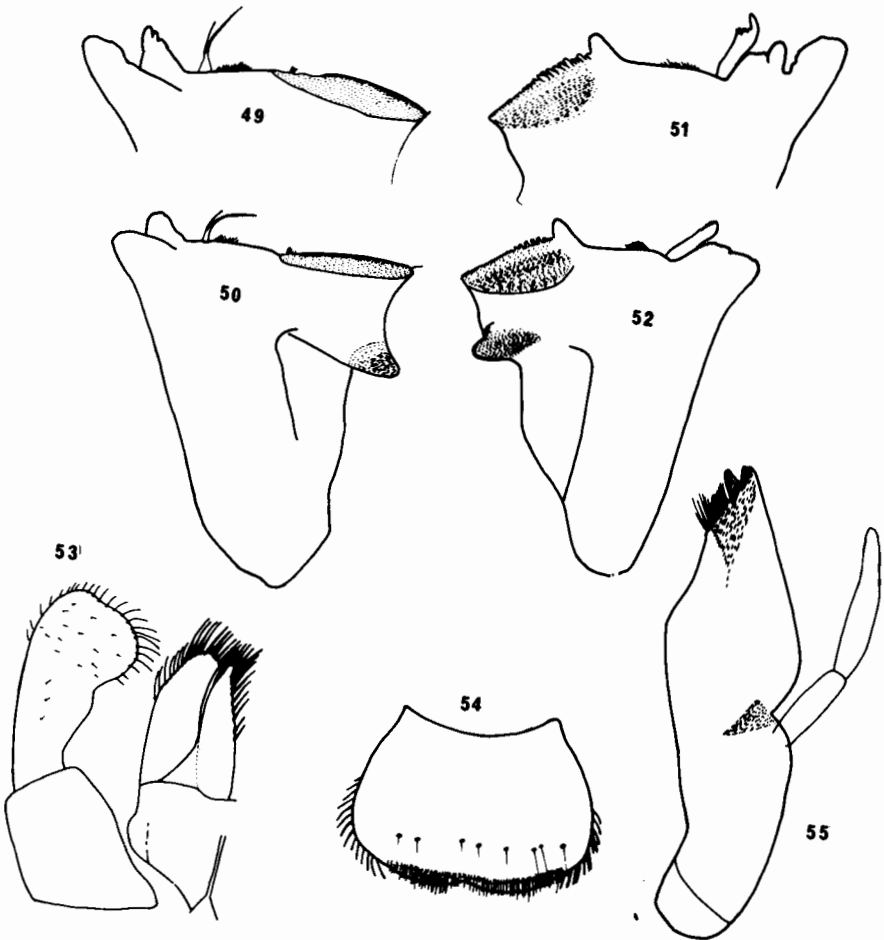
Afroptilum tarsale sp. nov. (Figs. 1, 45-58)

Male imago (in life). A dark brown species. Turbinate eyes and thorax chocolate-brown; fore femur dark reddish-brown, tibia very pale brown fading to clear at tip, tarsus broadly banded purplish-brown. Abdomen variable, either generally dark brown with tergum VII conspicuously yellow or with II-VI translucent cream overlaid with yellow and with dark hind margins. Forceps base dark brown, limbs clear. Tails white.



Figs. 45-48. *Afroptilum tarsale* ♂. 45. Fore wing. 46. Hind wing. 47. Forceps. 48. Fore leg.

(In spirit). Turbinate eyes pinkish-brown, oval, well separated; antennal base cream, mesonotum fawn, paler at sutures, metanotum darker. Fore femur dark reddish-brown, tibia faintly tinged with brown in distal 1/3 except at apex which is clear, tarsus dark brown with pale bands at base and apex of segments I-III (Fig. 48); mid and hind legs whitish, unmarked. Wings hyaline (Figs. 45, 46), stigma of fore wing with 2-6 cross-veins, normally 4-5, marginal intercalaries absent from first 2 spaces behind stigma, hind wing with 3 veins. Abdominal terga II-VI dark red with paired clear, antero-medial triangles increasing in size in successive segments, VII-X brownish, posterior margins of all terga with narrow dark-red bands; sterna cream; forceps base and swollen base of long segment brownish, forceps (Fig. 47); tails white.



Figs. 49-55. *Afrotiptum tarsale*. 49, 50. Right mandible (two specimens). 51, 52. Left mandible (two specimens). 53. Labium 54. Labrum 55. Maxilla.

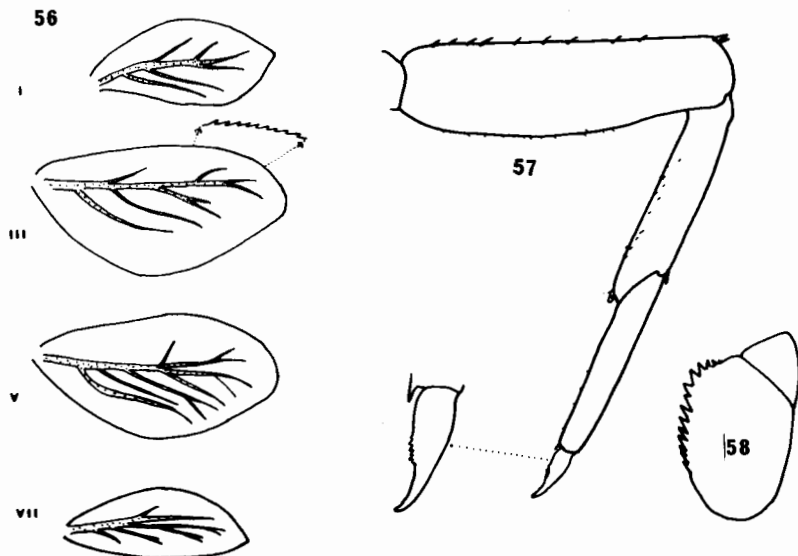
Female imago (in life). Body brown throughout, tails white, legs as in male.

(In spirit). Body generally pinkish-brown. Fore femur pinkish-brown, tibia clear, tarsi I-III purplish-brown, very narrowly clear at apices of I and II, tarsus IV clear; mid and hind legs cream. Wings as in male, venation strongly developed. Posterior margins of abdominal terga I-VIII very narrowly bordered with dark brown, not reaching to lateral margins. Tails white.

Nymph. Mouthparts (Figs. 49-55): canines of mandibles arching outwards, fused near their bases, in some specimens showing signs of wearing down of the grinding surfaces so that no teeth remain; prostheca of right mandible in the form of a pair of unequal, stout bristles arising from a common, swollen base. Apical teeth of maxilla reduced to 2-3 short, blunt processes, palp two-segmented. Glossa of labium strongly tapered towards apex, palp with rounded apical segment apparently fused with proximal segment. Legs (Fig. 57), claws short with a single row of teeth. Gills 7 (Fig. 56), obovate, mostly rounded but those on I and VII narrow and pointed. Paraproct (Fig. 58). Tails strongly haired, terminal filament about 5/6 length of cerci.

♂ body 5.5-6 mm, ♀ 5.5-7 mm; ♂ wing 5.5-6 mm, ♀ 6 mm.

Material: TANZANIA: holotype male imago, associated nymph skin on slide, Amani, Dodwe stream, 25.ii.85 [deposited in British Museum (Nat.Hist.)]. Paratypes, female imago, associated nymph skin on slide, *ibid.*, 25.ii.85. 3 males with associated nymph skins (1 on slide), *ibid.*, 26.ii.85. 1 male, associated nymph skin on slide, Amani, Ukungwi stream, 7.iii.85. 2 males, 1 with associated nymph skin, *ibid.*, 4.iii.85. 8 males, 3 females, Amani, 2.vi.51, 16.xii.51, 3.ii.52, 25.xii.52. 1 male, 1 female, 1 male subimago, 2 nymph skins, *ibid.*, 28.vi.52. 1 male, 1 female, *ibid.*, 26.ix.59. 2 nymph skins, River Sigi, Amani, 3.vii.54, no date (1951-1956).



Figs. 56-58. *Afroptilum tarsale*. 56. Gill lamellae I, III, V, VII. 57. Fore leg. 58. Paraproct.

The adults of *A. tarsale* are distinguished from all other described species by the conspicuous dark banding of the fore tarsus. In specimens that have been in spirit for 30 years these markings have often faded, in which case identification depends on the combination of the elongate terminal segment of the forceps and the rounded hind wing with a single recurved spur and 3 longitudinal veins. The nymph belongs to the group of species which have the canines of the mandibles arched outwards, somewhat in the form of a spur as Demoulin (1964) put it, and which includes *Centroptilum* sp. no. 2, Demoulin (1964), *Centroptilum* sp. no. 4, Demoulin (1970) and *Centroptilum* sp.A., (Kimmins, 1955, in *Baetis*). It is closest to sp. no. 4 from Natal but, in so far as this nymph has been described, differs from it in the narrow and tapered glossa of the labium.

A. tarsale appears to be one of the commoner baetids in the River Sigi basin, although they were seldom caught in light-traps beside the river. Mature nymphs are not uncommonly seen along the edges of rivers, which may reflect a tendency to move into shallow water before emergence. The duns have pale grey wings and emerge at and shortly before dusk. The final moult takes place during the course of the following day.

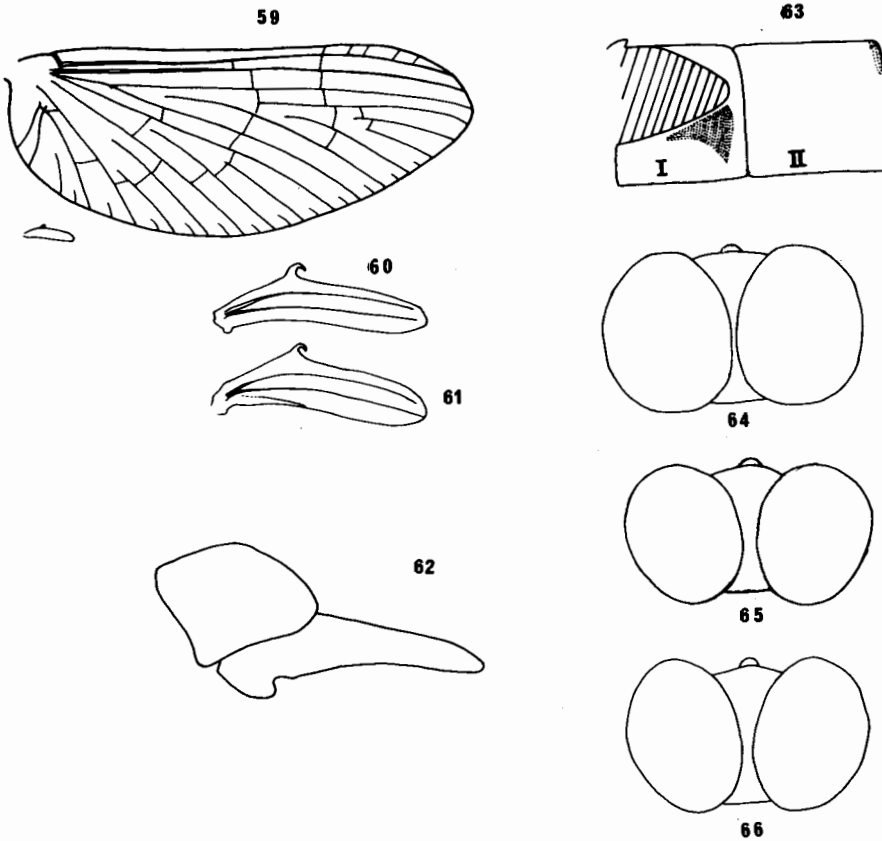
(3) *A. sudanense* group.

Afroptilum sudanense (Ulmer) comb. n. (Figs. 61, 64, 67-71, 84, 85)

Centroptilum sudanense Ulmer, 1916, Arch. Natur. 81 (A) 7: 18.

Described by Ulmer from southern Sudan, *A. sudanense* was subsequently recorded by Kimmins (1955, 1956) from the Ugandan shore of Lake Victoria (Jinja, Entebbe) and the Victoria Nile. In his 1956 paper Kimmins gave a good figure of the highly characteristic forceps of this species. I have specimens with similar forceps from the River Gambia as well as from Guinea and the Ivory Coast. However, despite this similarity the adults from localities in the latter two countries, both from the forest zone, can be distinguished by their markings from those from the savanna to the north. There are also distinct differences in the mouthparts of the nymphs. It is not possible to be certain from Ulmer's description as to which form he had in front of him. But given the fact that his material came from the Sudan I am restricting the name *sudanense* to the savanna form and treating the material from the forest belt as a new species. I was able to rear one male nymph from the River Gambia, the nymphal skin of which is now in rather poor condition. The partial description of the nymph which follows is based on this specimen.

Nymph. Mouthparts (Figs. 67-71); outer margin of glossa indented above base, as if "pinched in", labial palps with second segment projecting inwards at apex; mandible with a row of fine hairs between prostheca and molar surface; maxilla (now lost) with three segments. Legs with scattered blunt, spinous setae (Fig. 84); tarsal claws toothed and without a seta before apex. Gills present on segment

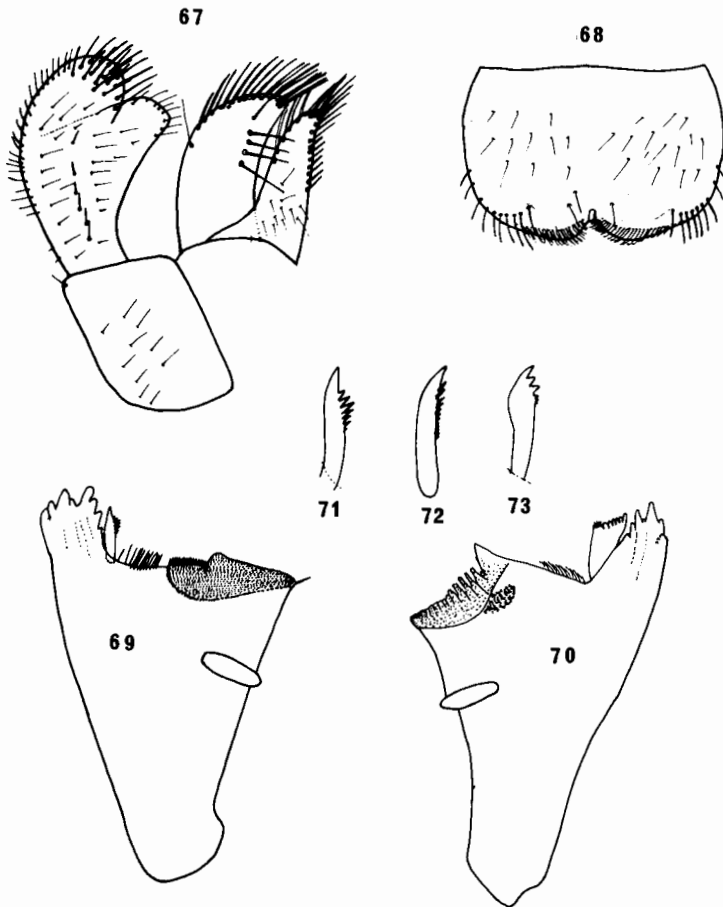


Figs. 59-66. *Afroptilum sudanense* complex. 59, 60. *A. griseum*, fore, hind wings. 61. *A. sudanense*, hind wing. 62. *A. guineense*, forceps, side view. 63. *A. guineense*, abdominal tergal marking. 64. *A. sudanense*, turbinate eyes from above. 65. *A. guineense*, the same. 66. *A. griseum*, the same.

I-VII, obovate, with blunt spines along outer part of anterior margin. Paraproct (fig. 85). Tails; terminal filament well developed.

Material: GAMBIA: R. Gambia, Wali Kunda, 4.ix.74. A single nymph was netted from amongst emergent *Phragmites* in a silted backwater in the tidal zone of the river.

Apart from the adult associated with this skin, I have a series of males from other sites along the River Gambia, 30-80 kilometres further inland (Bansang, Basse). Field notes record the following characteristics in fresh specimens: - turbinate eyes either grey or dull red; thorax generally fawn, bases of subcosta and radius 1 and costal brace deeply pigmented reddish-brown; legs unmarked except for a faint subapical, femoral stain on fore leg; abdomen translucent white with paired submedian orange markings on terga II, III, V-IX, tails white. In the hind wing there is a distinct, if rudimentary, third vein (Fig. 61).



Figs. 67-73. *Afroptilum sudanense*. 67. Labium. 68. Labrum. 69. Right mandible. 70. Left mandible. 71. Prosthema of right mandible. 72. *A. guineense*, the same. 73. *A. griseum*, the same.

***Afroptilum guineense* sp. n. (Figs. 62, 63, 65, 72)**

Male imago (in spirit). Eyes reddish-orange, well separated, in dorsal aspect almost circular (Fig. 65), in lateral view the "stalk" is less than half of the total height. Notum fawn, darker round the sides, tinged with pink immediately anterior to scutellum. [Fore legs missing in all specimens.] Mid and hind legs cream, a conspicuous deep red spot at apex of hind femur and in some specimens an additional red spot present at 2/3 of distance to apex of femur. Wings hyaline, base of costa, subcosta and radius 1 dark red as far as costal brace; marginal intercalaries absent from anterior 5 or 6 interspaces. Hind wing narrow with recurved spur and 2 veins. Abdominal tergum I pink in median area, laterally with

a deep blood-red triangular patch (Fig. 63); a broad, median pink band extends along dorsum of abdomen of abdomen from posterior $\frac{1}{2}$ of II-III and V-VII, more intense along posterior border including IV; VIII-IX pink, X pinkish-white; in some specimens (4/24) there is a dark red streak along the lateral margin of tergum IV. Tails white. Venter cream, sternum VIII pink; forceps (Fig. 62) white.

Female not known.

Nymph. Generally as in *A. sudanense* and *A. griseum* (see below). It differs in the prostheca of the right mandible (Fig. 72), which has about 10 very fine teeth on the inner surface and a single large tooth at the apex.

Body, ♂ 4.5-5 mm; wing, ♂ 4.5-5 mm

Material: GUINEA: holotype ♂ imago, R. Cavally at Oueyakolé, 2.ii.88, [in British Museum (Nat.Hist.)]. Paratypes, 23 ♂♂, 3 ♂ subimagines, same provenance; 2 ♂ subimagines and associated nymph skins, tributary of R. Lofa, 8 km east of Macenta, 30.i.88. IVORY COAST: 1 ♂ subimago, R. Cavally at Tiboto near Grabo, 11.ii.88, all collected by J.-M. Elouard.

The male of *A. guineense* differs from both *A. sudanense* and *griseum* in the markings on the legs and abdominal terga. The forceps appear to be the same in all 3 species, but it may be noted that in nearly all the specimens of *A. guineense* the forceps were held in the abducted position, thus differing from the material of *A. sudanense* from other regions and also from Kimmin's (1960) figure.

Apart from the West African material, I have similar males from the vicinity of lowland streams in north-east and central Tanzania and also from forested rivers in the East Usambara Mountains and Pare Mountains of the same country. The specimens from mountain torrents, however, differ in certain minor characteristics in the adult, while the nymphs associated with them show clearcut differences from the West African skins. They are described as a distinct species below.

Afroptilum griseum sp. n. (Figs. 59, 60, 66, 73, 74-83)

Closely resembles *A. sudanense*, differing in the following characters:

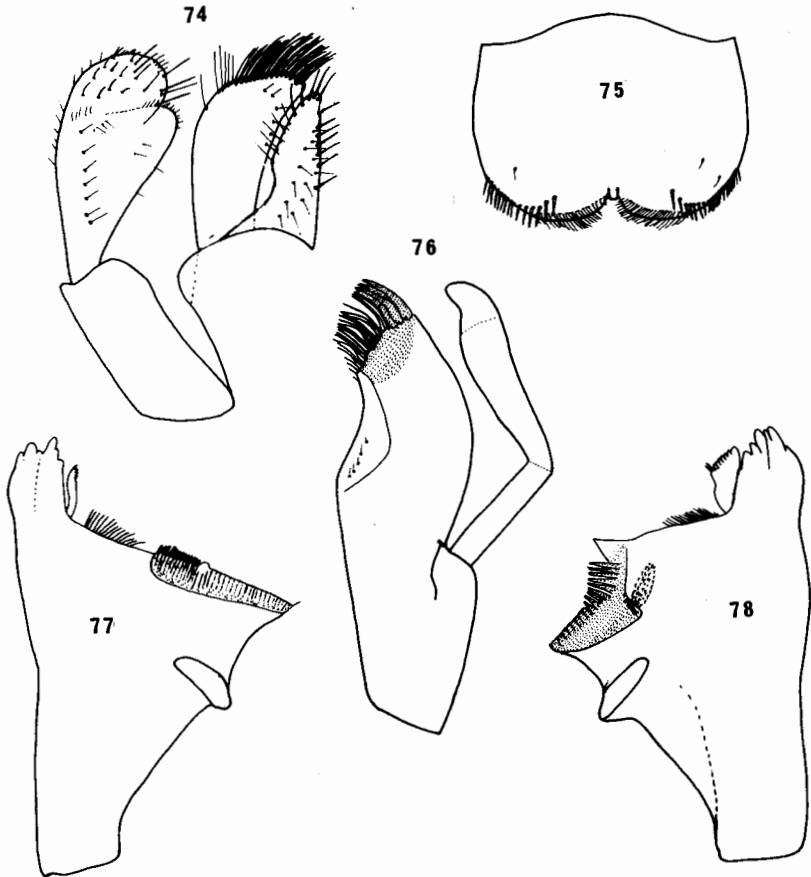
Male imago (in life). Turbinate eyes grey, notum mahogany brown; base of costa as far as, and including, costal brace mahogany brown, base of subcosta and radius I the same, extending about the same distance beyond brace as before it; abdominal terga with posterior $\frac{1}{2}$ - $\frac{1}{3}$ of II, III and V orange, on VI the same but extending almost to anterior margin and with submedian clear areas, VIII-X mahogany brown. Legs unmarked except for dark knee-spot, most marked on hind leg.

(In spirit). Turbinate eyes dark red, elliptical in dorsal aspect (Fig. 66); when viewed from the side the side-walls are about $\frac{1}{3}$ of the total height measured from upper surface of lateral ocellus to upper surface of turbinate eye. Notum dark brown. Stigma of fore wing with 4-5 cross-veins, marginal intercalaries absent

from the first 4-5 spaces behind stigma (Fig. 59); hind wing narrow, rounded with 2 veins and slightly curved spur (Fig. 60). Legs white except for a chestnut-brown patch at the apex of all femora. Abdominal terga white, tracheolar line black; a dark chestnut triangle on lateral corner of I, fainter orange-brown, postero-lateral triangles on II, IV and V, partly merging with each other in the median line, VIII-X opaque fawn, posterior margins of II-VIII narrowly ringed dark brown in medial 2/3. Forceps as in *A. sudanense*, basal segment brown, forceps limb white.

Female imago (in spirit). Thorax and legs as in male; base of costa, subcosta and radius 1 reddish-brown but costal brace mainly hyaline; abdominal terga cream tinged with pink, posterior margins of II-VIII narrowly ringed pinkish-red; tails white.

Nymph. Mouthparts (Figs. 74-78). Prosthema of right mandible differing from *A. sudanense* by the teeth on the inner margin being continuous with the apical tooth (Fig. 73) rather than stopping well short of the apex as in that species (Fig.



Figs. 74-78. *Afroptilum griseum*. 74. Labium 75. Labrum. 76. Maxilla. 77. Right mandible. 78. Left mandible.

71). In the labrum, the line of setae posterior to the antero-lateral margin are spine-like rather than hair-like as in *A. sudanense*. Labial glossae as in *A. sudanense*. Legs slender (Figs. 79-81) with fewer spine-like setae than in *A. sudanense*. Gills (Fig. 82). Spines on paraproct (Fig. 83) not reaching to apex.

♂ body 5-5.5 mm, ♀ 6 mm; ♂ wing 4.5-5 mm, ♀ 6 mm; ♂ tail 10 mm

Material: TANZANIA: Holotype male imago, associated nymph skin on slide, R. Dodwe, Amani, 900 m, 25.ii.85 [deposited in British Museum (Nat. Hist.)]. Paratypes, female imago, associated nymph skin on slide, *ibid.* Male imago, associated nymph skin on slide, R. Sigi, Mpendeni, below Amani (c.2-300 m), 6.xii.62. 6 males at light, *ibid.*, 2.xii.62. 4 males, 1 female at light, Amani, 3.vi.51, 3.ix.52, 25.i.53, 10.x.55, 26/27.vi.63. 2 males, R. Sassaneh, nr. Mamba, Upare, c.1500 m, 23.ix.61.

I have been unable to discover any reliable characters for separating all adults of *A. sudanense* and *A. griseum*. As in certain other baetidae, Müller-Liebenau (1970), Gillies (1979), the taxon shows variation in the degree of development of the turbinate eyes in the male. Six out of seven specimens of *A. griseum* from mountain torrents at Amani (900 m) and Upare (1500 m) have relatively tall eyes, the "stalk" of the eye forming more than half the distance between the dorsal surfaces of the lateral ocellus and the turbinate eye. In *A. sudanense* from the River Gambia this distance is only 1/3 to 1/2. In males from a sluggish lowland stream at Muheza, Tanzania, and from the River Kilombero, they are similar to those from the Gambia. On the other hand, males from the lower reaches of the River Sigi at an altitude of 200-300 m but still forested and torrential, are also low-eyed forms. Yet the nymph of one of them shows it to be *A. griseum*. On the evidence available it appears that the tall eyes are diagnostic of *A. griseum*, but that males of the *A. sudanense* complex with shorter eyes can only be separated by the characters of the nymph.

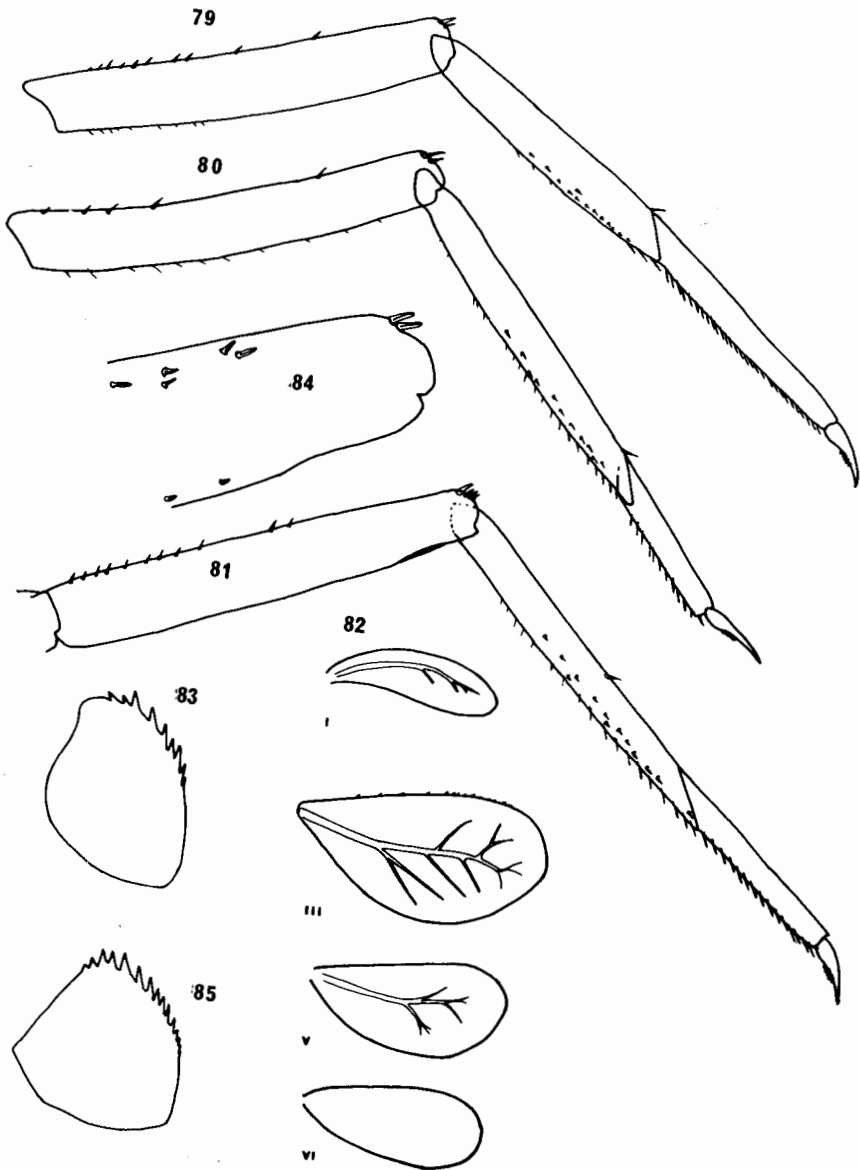
The *A. sudanense* complex is widely distributed in rivers in tropical Africa. It appears possible that *A. guineense* replaces *A. sudanense* in the West African forest belt although this requires confirmation. The identity of lowland East African forms has yet to be established by rearing of the nymphs. *A. griseum* is a torrential member of the complex, which may have evolved in isolation from lowland populations and become adapted to cool, fast-running waters.

(4) *A. dimorphicum* group.

Afroptilum dimorphicum (Soldán and Thomas)

Centroptilum dimorphicum Soldán and Thomas, 1985, Acta ent. Bohemoslov. 82: 180.

The nymph of *A. dimorphicum* has a number of characters that place it in *Afroptilum* rather than *Centroptilum*. These include oval, asymmetrical gills, fused canines on the mandibles and the shape of the labial palp. The authors mentioned



Figs. 79-85. *Afropitulum griseum*. 79. Fore leg. 80. Mid leg. 81. Hind leg. 82. Gill lamellae I, III, V, VI. 83. Paraproct. 84. *A. sudanense*, detail of apex of mid femur. 85. Paraproct.

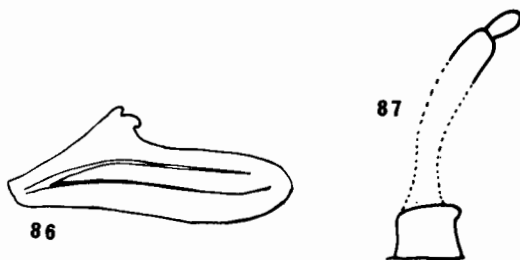
the presence of lateral abdominal spines (a character of *Centropitulum* s.str.), but as noted above, this would appear to be a question of interpretation. The hind wing in the ♂ has a single spur but in the ♀ the hind wing is completely missing.

As noted above, in a species from West Africa the hind wing is absent in both sexes. This introduces the possibility of confusion between the adults of the *A. dimorphicum* group of *Afroptilum* with *Cloeon* Leach.

(5) Subgenus *Afroptiloides*

Afroptilum (*Afroptiloides*) *bicaudatum* sp. nov. (Figs. 86-98)

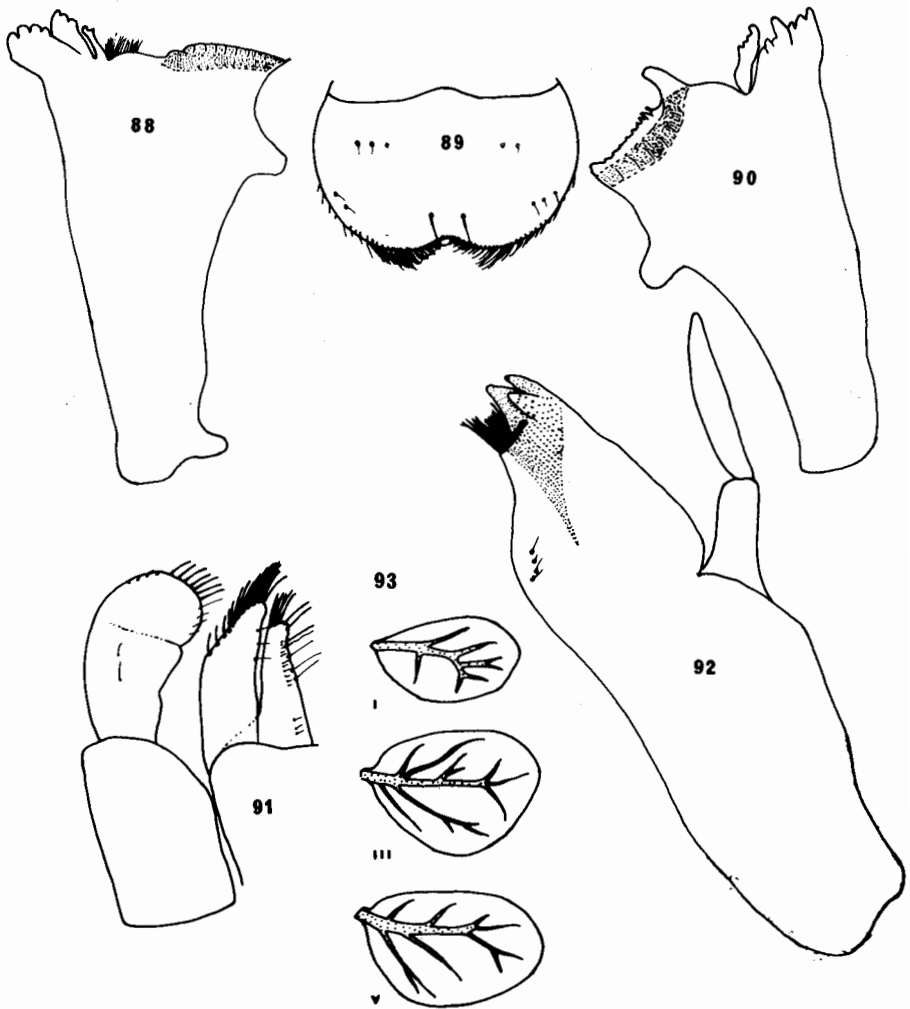
Male imago (in spirit). Eyes purplish-brown (chocolate-brown in life), round, well-separated and inclined outwards. Thorax brown; legs white, femora with apical greyish bands; fore wing hyaline, hind wing narrow with 2 veins and double spur (Fig. 86). Abdominal terga I-VI white, narrowly tan along lateral borders, II and III with a median patch of the same colour along posterior border, IV largely tan, VII-X tan; venter white except for a broad, median, brown stripe between the bases of individual forceps limbs; forceps white, rather stout, basal segment with a marked inner, apical tooth (Fig. 87); tails white.



Figs. 86-87. *Afroptilum* (*Afroptiloides*) *bicaudatum*. 86. Hind wing. 87. Forceps (partly drawn from dissected subimago).

Male subimago. Eyes black, wings pale grey; body very pale tan, abdominal terga very narrowly dark along posterior border, terga VI-VIII mottled, dark brown.

Nymph (Fig. 95). Antennae long, 3-4 times as long as width of head. Mouthparts (Figs. 89-93); left mandible with fused canines, prostheca with blunt teeth, hair fringe absent; right mandible with partly fused canines, prostheca stout, divided at apex, well-developed hair fringe; maxillae with 3 stout, blunt teeth at apex and fine hair fringe, palp with 2 segments; labial palp with rounded apical segment. Legs (Figs. 96-98) with coarse fringe of hairs along posterior margins of all femora and a finer fringe along tibiae, extending on mid and hind legs to tarsi; claws with stout terminal hook and a single row of coarse denticles. Abdomen brown without obvious markings; gills (Fig. 94) present on segments I-VII, asymmetrical, rounded, with a few very fine hairs on anterior margins. Tails about 2/3 length of body, entirely devoid of hairs; terminal filament reduced to a minute stump.

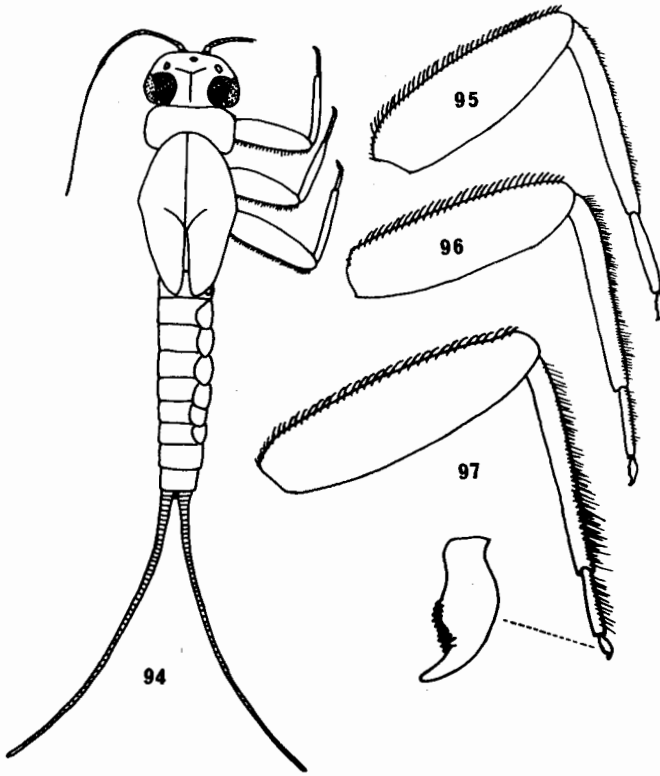


Figs. 88-93. *Afroptilum (Afroptiloides) bicaudatum*. 88. Right mandible. 89. Labrum. 90. Left mandible. 91. Labium. 92. Maxilla. 93. Gill lamellae I, III, V.

Body, ♂ 4.5 mm; wing, ♂ 4-4.5 mm; tails 7 mm; mature nymph, 4.5 mm

Material: GUINEA: holotype ♂ imago and associated nymph skin, north-west of Mount Nimba, stony stream, tributary of R. Cavally, 550 m, 1.ii.88, [in British Museum (Natural History)]. Paratypes, ♂ subimago and associated nymph skin, 6 nymphs, same provenance.

The adult of this species differs from the South African species, *A. varium* (Crass), in the double spur of the hind wing and markings on the abdomen. The nymph



Figs. 94-97. *Afroptilum* (*Afroptiloides*) *bicaudatum*. 94. Mature nymph. 95. Fore leg. 96. Mid leg. 97. Hind leg (claw more highly magnified).

differs in the shape of the gill lamellae and in the absence, in *A. bicaudatum*, of setae on the tails.

The nymphs of at least 3 other species, all from eastern Africa and originally described in *Acentrella* or *Pseudocloeon*, are referable to *Afroptiloides*.

***Afroptilum* (*Afroptiloides*) sp. (Kimmins, 1955)**

Acentrella sp. A Kimmins, 1955, Ann. Mag. nat. Hist. (12) 8: 870

Centroptilum sp. A (Kimmins), Demoulin, 1970, S. Afr. Animal Life 14 (iii): 50

This species, collected in Malawi by Prof. L. Berner, differs from both *A. varium* and *A. bicaudatum* in the presence of median hooked spines on the metanotum and terga I-VI.

Afroptilum (Afroptiloides) sp. (Demoulin, 1956)

Acentrella sp. Demoulin, 1956, Expl. Hydrobiol. Lac Tanganyika III (7): 7

This nymph, from eastern Zaire, also bears median spines on terga II-IX but they are much smaller than in Kimmins's species and there is no spine on the metanotum. A dorsal fringe of setae on the tibiae is evidently absent. Demoulin (1965) quoted the opinion of J. D. Agnew that this species was apparently *C. varium*. However, the complete absence of median abdominal spines in *A. varium* would seem to argue against such a conclusion.

Afroptilum (Afroptiloides) sp. (Gose, 1964)

Pseudocloeon sp. CPA Gose, 1964, Kontyu 32: 58.

This species, from eastern Zaire, has well-formed medial spines on the metanotum and all abdominal terga up to IX. An almost identical species has been collected in Kenya, as recorded by Barnard and Biggs (1989). I also have specimens of a species closely resembling this from the River Diani in Guinea. As in the Kenyan specimens, a hind wing bud is present and the right mandible has a distinct fringe of fine hairs between the base of the prosthema and the molar region. The placing of all these specimens in *Afroptiloides* therefore seems justified.

Demoulin (1964) described a nymph from Mount Kenya, under the name *Centroptilum* sp. n° 3, which, except for its large size and the lack of mention of any flattening of the body, would appear to be typical of *Afroptiloides*. Gose (1964) also described another 2-tailed nymph from Zaire under the name *Baetis* sp. CBB. It is not clear from Gose's figure as to whether a mandibular hair fringe is present in these nymphs, but it seems likely that it represents another species of *Afroptiloides*. In short, this subgenus appears to be widespread in stony streams and rivers throughout the Afrotropical Region.

Afroptiloides has certain characters in common with *Acanthiops marlieri*, described in *Centroptilum* by Demoulin (1967), notably the flattening of the body and the loss of the terminal filament. However, this species, known from the nymph only, has a number of features reminiscent of the Ephemerellidae, notably its stocky build, spinous terga and closely fitting gill lamellae. The maxillary palp is also extremely small for a baetid. Waltz and McCafferty (1987a) transferred it to the monotypic new genus *Acanthiops*. They considered that *Centroptilum* sp. No. 3, Demoulin, 1964, was probably congeneric with *A. marlieri*. Since a subimago associated with this nymph had a hind wing with double spur, they suggested that all the African "*Centroptilum*" with double spurs would eventually prove to belong to *Acanthiops*. However, Demoulin does not mention any ephemerellid-like features in his sp. No. 3 and the maxilla is normal for a baetid. Moreover, the

nymphs of 3 double-spurred species, *A. sudafricanum*, as described by Barnard (1932), and *A. decipiens* and *A. montanum* described here, are quite unlike *A. marlieri*. While *Acanthiops* is to be regarded as a sister group to *Afroptilum*, it appears to be phylogenetically quite distinct. Its adult stage for the moment remains unknown.

As defined here, *Afroptilum* is seen as a major element in the fauna of the Afrotropical Region with extension to the north of the Sahara. It may be asked if it occurs in the Oriental Region also. Only 3 species of *Centroptilum* s.l. have been described in the adult stage from this Region. However, among the numerous Baetids described as nymphs, there is one possible candidate for inclusion in *Afroptilum*. This is Genus no. 1 Müller-Liebenau, 1984, which was collected in West Malaysia. This nymph has no hind wing pad, but in other characteristics it fits the definition of *Afroptilum* very well.

Among the numerous Baetidae described by Crass (1947) from Natal in South Africa was *Centroptilum pulchrum* (renamed *C. crassi* by Demoulin (1970)). Crass noted that the adult, which lacked hind wings in both sexes and had a most unusual third forceps segment, could scarcely be treated as a *Centroptilum*. The nymph with broad, highly asymmetrical gills and the second segment of the labial palps strongly produced inwards, is likewise equally aberrant. At the time, Crass preferred not to create a new genus for a single species. However, in the light of the broader knowledge of the Afrotropical Baetidae that has accumulated over the past 40 years, this course of action now seems appropriate.

Demoulinia gen. nov.

Differs from *Centroptilum* Eaton as follows:

Adult; single marginal intercalaries present in all interspaces behind radius 1; hind wing absent in both sexes. Forceps with 3 segments, the third small, arising from the inner aspect of the apex of the second and strongly hooked. *Nymph*; maxillary palp long with 2 segments, glossae and paraglossae of labium about equal in width, inner aspect of apex of second segment of palp strongly produced so as to be more than twice the width of third segment. Tarsal claws very long, finely pectinate. Gills on segments I-VII single, broad, palette-shaped and strongly asymmetrical.

Type species. *Demoulinia crassi* (Demoulin).

Named for the distinguished authority on African Ephemeroptera, Dr. G. Demoulin.

D. crassi shares with *Rhithroclaeon* the derived character state of loss of hind wing, and the forceps have also departed from the ancestral pattern. But the gills of *Rhithroclaeon* are narrow and symmetrical, the canines of the mandibles are fused and the second segment of the labial palp is more or less evenly swollen at the tip. The tarsal claws of *Rhithroclaeon* are also strongly hooked and adapted for

anchorage in fast currents, while those of *D. crassi* are long and delicate and with fine teeth. *Demoulinia*, therefore, is quite distinct.

The genus is known from the one species only. Crass recorded that the nymphs occurred in still, deep stretches of the River Mooi in Natal, South Africa.

THE AFROTROPICAL CLOEONINAE

The outstanding feature of the baetid fauna of Africa is the predominance of forms with single marginal intercalaries in the wings. In running waters, *Afroptilum* is probably the most widespread and abundant of these. I have proposed elsewhere, Gillies (1990), that the subfamily Cloeoninae Kazlauskas should be redefined so as to incorporate those genera of Baetidae in which the cuticular stippling, characteristic of the Callibaetinae, was lacking and the marginal intercalaries of the fore wing were single. This adult state was frequently associated with two nymphal characters, a tuft of fine setae at the base of the protheca of at least the right mandible and the presence of a double row of denticles on the tarsal claws. One or both of these characters are present in the nymphs of all members of the African Cloeoninae. It was suggested that the richness and variety of the African Cloeonine fauna pointed to an African origin for the subfamily.

As recognised here, the fauna consists of the following 8 genera: *Acanthiops* Waltz and McCafferty, *Afrobaetodes* Demoulin, *Afroptilum* Gillies, *Centroptiloides* Lestage, *Cloeon* Leach, *Demoulinia* Gillies, *Mutelocloeon* Gillies and Elouard and *Rhithrocloeon* Gillies. Descriptions of a further 2 Cloeonine genera (*Potamocloeon* Gillies [in press], *Thraulobaetodes* Elouard and Cummins, [in press] are being published elsewhere).

The significance of the mandibular setal fringe was first pointed out by Demoulin (1965). It is present in all known Afrotropical Cloeoninae except *Centroptiloides*, in which the mouthparts are highly modified in association with a carnivorous way of life.

Demoulin (1979) appeared to have revised his earlier opinion by using the presence of a hair fringe as a key character for *Pseudocloeon* as well as for *Centroptilum*. This confusion may have arisen from his study of a nymph from South Africa, in which the hair fringe was present but which, from the absence of hind wing buds, he identified as *Pseudocloeon* sp. no. 1 Demoulin, 1970. However, in the light of the studies reported here it seems this nymph was more likely to have been a species of the *dimorphicum* group of *Afroptilum* in which the hind wing was absent.

A distinctive nymphal character state, restricted to certain genera within the Cloeoninae, is the presence of spines along the sides of the abdomen, as discussed under *Afroptilum* above. This apparently arose in the stem leading to *Centroptilum* s.str., *Cloeon* and related genera only after they split off from the stem leading to *Afroptilum*, *Demoulinia* and *Rhithrocloeon*.

ACKNOWLEDGEMENTS

I am greatly indebted to Dr. J.-M. Elouard of ORSTOM for free access to material collected by himself and for providing me with the opportunity to study Baetidae in Mali, Guinea and the Ivory Coast. I am also grateful to M. Jean Wuillot for information about *Afrotiptilum* species in Guinea. Dr W. P. McCafferty kindly provided me with specimens of North American species of *Centroptilum*. Robert G. Lowen gave me valuable help with morphological details of species occurring in Canada. I have to thank Dr. William L. Peters and Dr. Wills Flowers for valuable discussions of problems of classification of the Baetidae. I am also grateful to Mr Stephen Fedha of the Amani Centre of the Medical Research Institutes of Tanzania for assistance in collecting in the field.

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