

Descriptions of some Afrotropical Baetidae (Ephemeroptera) II. *Baetis* Leach, s.l., West African Species

M.T. GILLIES

M.T. GILLIES: Descriptions of some Afrotropical Baetidae (Ephemeroptera). II. *Baetis* Leach, s.l., West African species. Aquatic Insects, vol. 15 (1993), No. 4, pp. 213-223.

Descriptions are given of the adults and nymphs of 3 new species of *Baetis* s.l. (*B. boussoulius*, *B. elouardi*, *B. gambiae*) from rivers in West Africa, including the tidal zone of the River Gambia.

Keywords: Mayflies, *Baetis*, West Africa.

M.T. GILLIES, Whitfeld, Hamsey, Lewes, Sussex BN8 5TD, England.

INTRODUCTION

In perhaps no family of mayflies is the importance of parallel taxonomic studies on adults and nymphs greater than in the Baetidae. In recent years I have been concerned with this problem in the Afrotropical Region (Gillies, 1980, 1988, 1990, 1991; Gillies, Elouard and Wuillot, 1990). These studies were dedicated to the genera *Cloeon* Leach, *Rhithrocloeon* Gillies, *Afroptilum* Gillies, *Tanzaniella* Gillies and *Ophelmatostoma* Waltz and McCafferty. Elouard et al. (1990) and Elouard and Hideux (1991) have also published studies of the adults and nymphs of *Pseudopannota* Waltz and McCafferty.

Here, attention is focussed on the genus *Baetis* Leach, the name including species that would formerly have been placed in *Pseudocloeon* Klapálek. Dr. J.-M. Elouard of Orstom arranged for me to share the task of collecting and rearing material in several West African countries in the dry seasons of 1986 and 1988, while other specimens had been collected in the lower River Gambia some years earlier. The associated adults and nymphs of three new species are named and described. Discussion of the systematic position of these species is presented in the second part of this paper (Gillies, in the press).

One object of this study was to see to what extent the African fauna of *Baetis*-like species could be assigned to the species-groups, subgenera and genera recognised in other regions. As will be discussed below, this object has not been successful and the less ambitious course of treating all these species as *Baetis* s.l. has had to be adopted.

The genus *Baetis* s.l. incorporates Baetidae that have paired marginal intercalaries in the fore wings, while the hind wing may be present or absent: the right mandible lacks a tuft of short setae at the base of the prostheca (in Afrotropical species),

the labial palps have three segments, the mesothoracic wingpads are not fused, even at the base, and the fore tibia lacks a continuous line of fine hairs.

Descriptions of new species follow. The types have been deposited in the Natural History Museum, London.

DESCRIPTION OF SPECIES

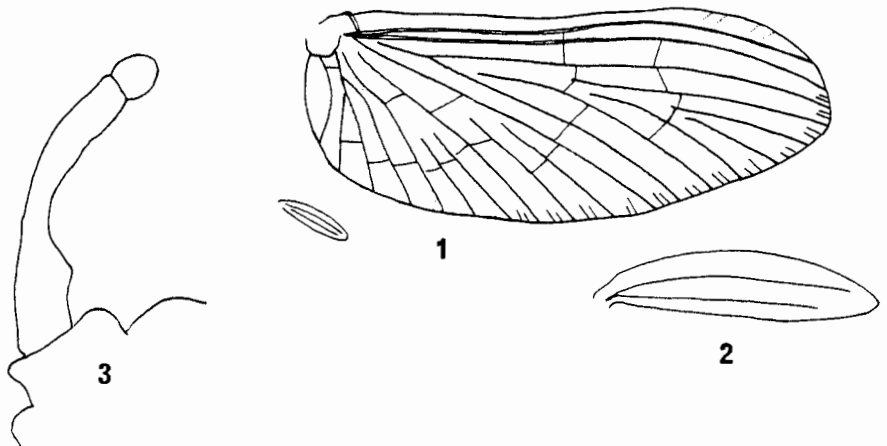
Baetis boussoulius sp. nov.

♂ *imago*. Turbinate eyes brownish orange; thorax chestnut, legs white; wings clear, fore wing (Fig. 1) with 0-4 partial crossveins in stigma; hind wing (Fig. 2) narrow, subacute at apex, lacking costal spur and with 2 long veins. Abdominal segments I-VI white, VII-X cream, sterna and terminalia white; tails white. Basal forceps segment narrow (Fig. 3), swollen at apex on inner margin, 2nd segment broader in apical 2/3, apical segment globose, broader than long segment.

♂ *subimago*. Thoracic notum chestnut brown, pleurae and rest of body cream, without markings; wings pale grey.

♂ body 4 mm; wing 4 mm; tails 6 mm.

Nymph. Mouthparts (Figs. 4-8): labrum with well developed median spur on anterior lip; canines of both mandibles completely fused, prosthecae broad, toothed at apex, right molar surface stepped at 1/4 distance from outer margin; maxillary palp with 3 segments, the division between segments 2 and 3 indistinct; labial palps with apical medial process of 2nd segment strongly produced. Legs (Figs. 9-11): femora narrow, posterior margin with a sparse line of 10-12 stout setae; a



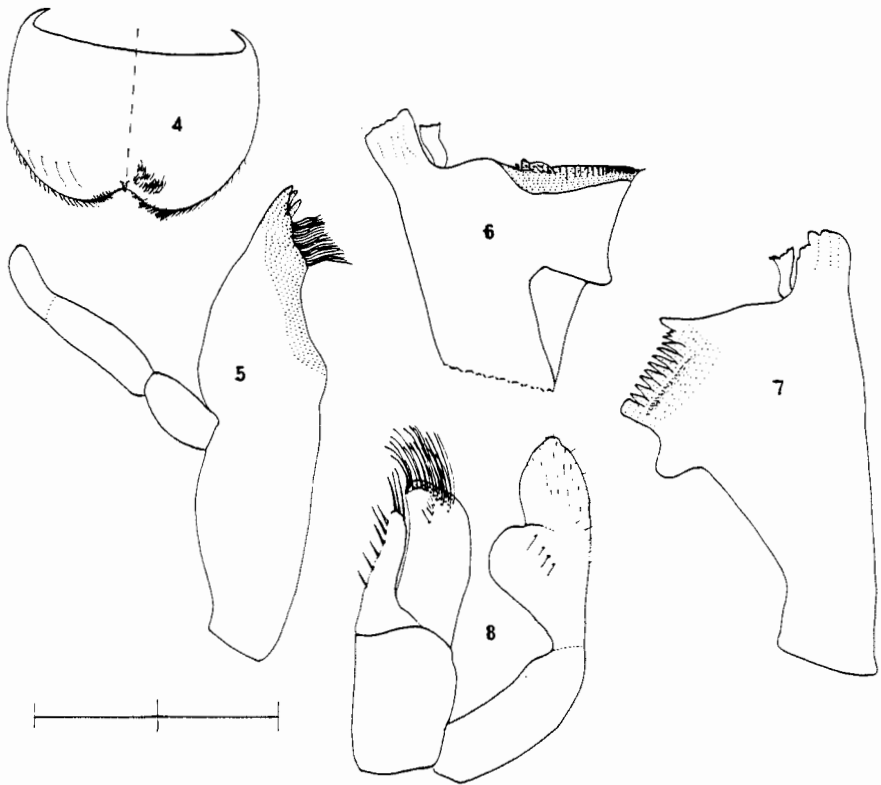
Figs. 1-3. *B. boussoulius*, adult. 1. Fore wing. 2. Hind wing. 3. Forceps limb.

discrete line of minute villi present along anterior margin at base (Fig. 11); tarsal claws with 10-12 stout teeth.

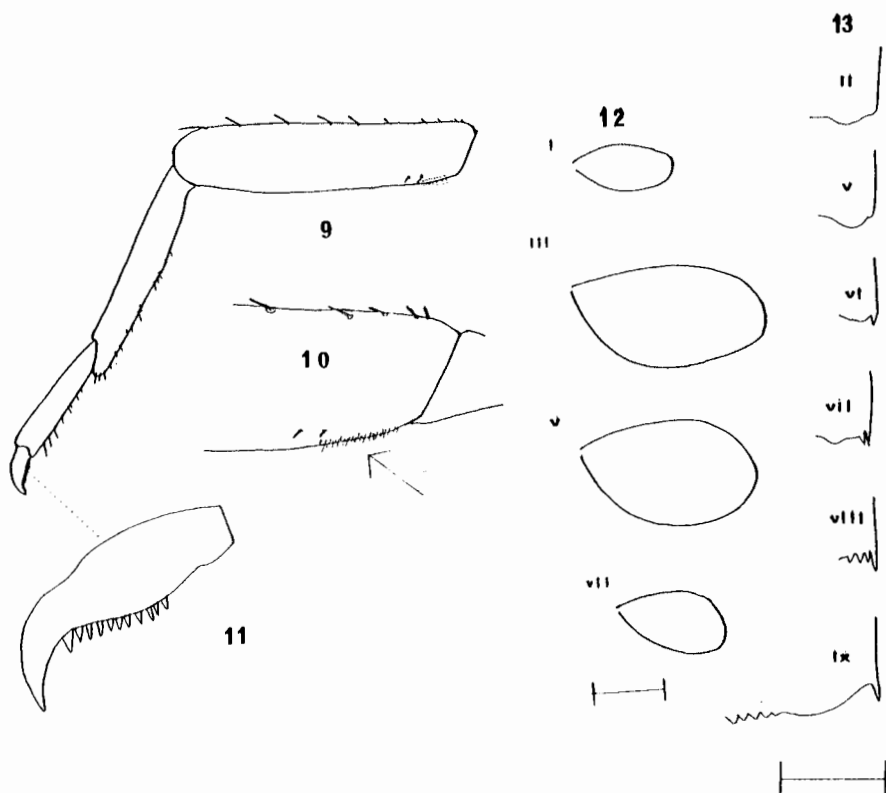
Abdominal gill lamellae broadly ovoid (Fig. 12), present on segments I-VII, first gill about half the length of succeeding gills, apex and posterior margin with short hair-like spines. Tergal markings well developed, II and VI mainly pale, III-V dark, each with three submedian pale areas, margins mostly pale, VII-X largely dark; lateral margins with a single (sometimes 2) apical spines projecting backwards, longest on IX (Fig. 13), decreasing in size on VIII and VII; posterior margins of terga with sharply pointed teeth. Terminal filament subequal to cerci.

Material. Holotype ♂ imago with associated nymph skin, GUINEA: R. Milo, Boussoulé, 13.ii-86. Paratypes 1 ♂ imago, 2 ♂ subimagines, all with associated nymph skins, same provenance.

The adult of *B. boussoulius* is a small, pale species without obvious markings and lacking a hind wing spur. The basal 4-5 marginal spaces of the fore wing lack intercalaries. The nymph differs from those of all other species described here in



Figs. 4-8. *B. boussoulius*, mouthparts. 4. Labrum. 5. Maxilla. 6 and 7. Right and left mandibles. 8. Labium.

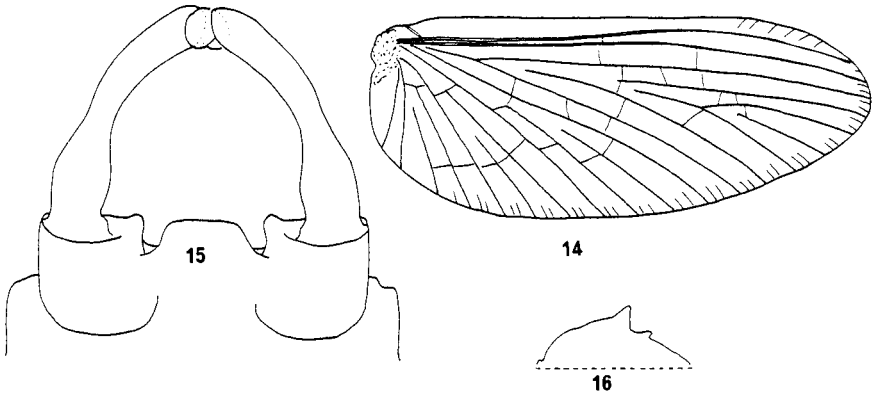


Figs. 9-13. *B. boussoulius*, nymphal parts. 9. Fore leg, ventral. 10. Base of fore femur, arrow indicates ventral line of villi. 11. Tarsal claw, enlarged. 12. Outline of gill lamellae, I, III, V and VII; scale 0.1 mm. 13. Postero-lateral angles of terga II, V-IX; scale 0.1 mm.

the development of the villopore (McCafferty and Waltz, 1990) as a narrow line along the anterior margin of the femur at the base. From those of *B. cataractae* Crass, *B. monticola* (Crass) and *B. natalensis* (Crass) it differs in the three-segmented maxillary palp, from *B. lawrencei* Crass in the much greater breadth of the labial paraglossa and from *B. bellus* Barnard in the shape of the gill lamellae.

Baetis elouardi sp. n.

♂ *imago* (in spirit). Eyes yellowish, rounded, in lateral view domed, well separated. Thorax fawn; metascutellar hump well marked (Fig. 16); legs cream, outer surface of fore femur with a very thin black line running along whole length; wings (Fig. 14) with marginal intercalaries from Sc or R1 interspace to second cubital interspace, stigma with 6-9 incomplete, oblique crossveins. Abdominal terga cream, lateral 1/3 of posterior margins of I-IV very narrowly dark brown;



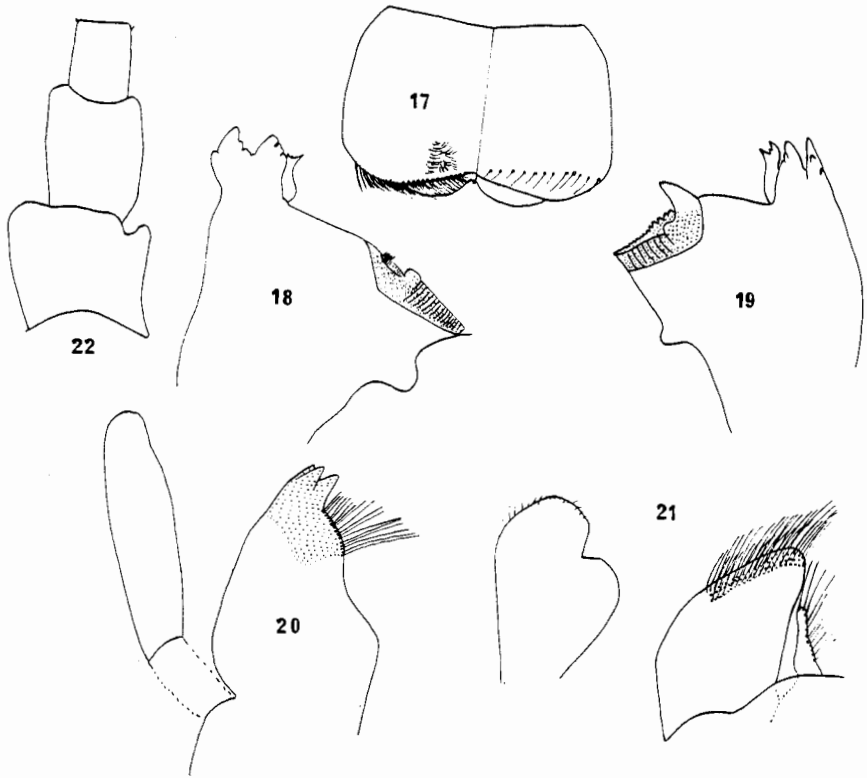
Figs. 14-16. *B. elouardi*, adult. 14. Fore wing. 15. ♂ forceps. 16. Lateral view of thorax in outline to show metascutellar hump.

venter cream. Forceps cream, (Fig. 15); forceps-base extending backwards as a rectangular plate between the basal segments.

♀ *imago* (in spirit). Basal 2/3 of antennal pedicel reddish-brown. Anterior and posterior margins of pronotum bordered with reddish-orange, metascutellum similarly but more narrowly bordered reddish-brown; legs cream, fore femur with thin black line as in ♂. Abdominal terga cream, lateral 1/3 of I-VIII orange-brown, more strongly marked on I and on posterior portion of each segment, posterior margins of I-VIII reddish-brown. Tails white.

Body, ♂ 5 mm, ♀ 5-6 mm; wing, ♂ 5 mm, ♀ 5-5.5 mm.

Nymph. Mouthparts (Figs. 17-21), upper surface of labrum with a continuous line of setae immediately behind anterior margin; maxillary palp (damaged in the only available skin) apparently with two segments; mandibular canines fused in basal 2/3, obtuse on right side, acute on left, no setae between prostheca and molar region; glossae of labium extremely small and skittle-shaped, inner margin of 2nd palpal segment strongly produced. Distal margin of basal antennal segment deeply notched at outer angle (Fig. 22). Legs (Fig. 23), posterior margin of femora sparsely bordered with stout, blunt setae; tarsal claws with a single row of about 14 denticles. Abdomen; gill insertions present on segments II-VII, gills obovate (Figs. 24-25), serrated on anterior margin, finely haired on posterior; posterior margin of terga with spines of uniform size; postero-lateral corners of terga II-VII each with a single long spine, sometimes a smaller one internal to this (Fig. 27), cuticular scales on dorsal surface distributed at random. Plate of paraproct with three large spines at inner apex (Fig. 26). Terminal filament well developed, densely haired, inner borders of cerci likewise.



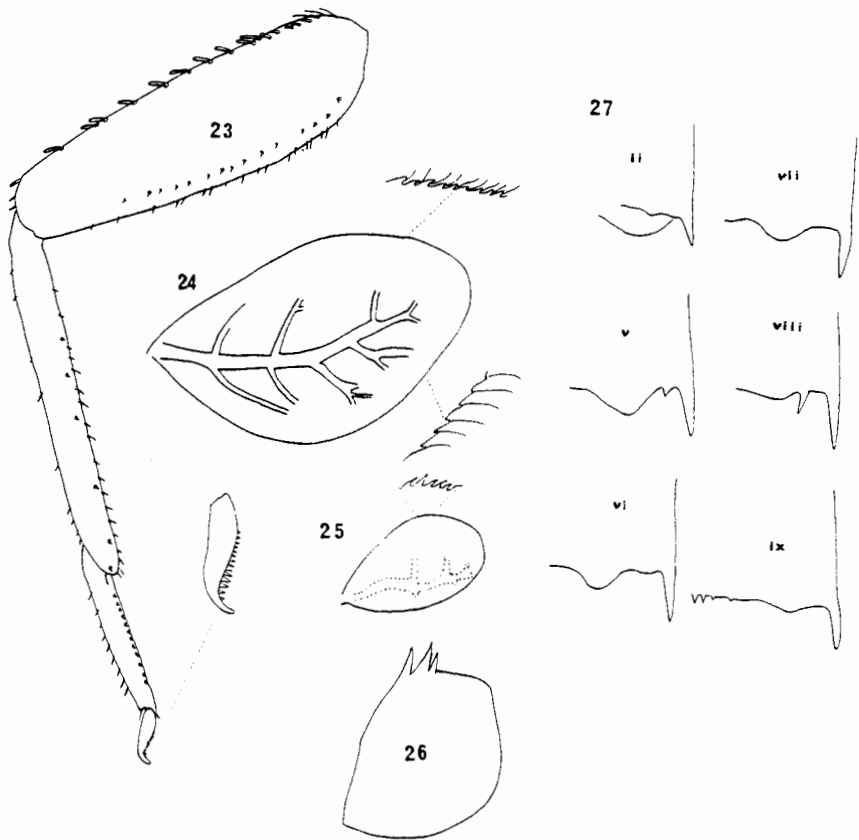
Figs. 17-22. *B. elouardi*, mouthparts. 17. Labrum. 18 and 19. Right and left mandibles. 20. Maxilla. 21. Labium. 22. Base of antenna.

Material. GUINEA: tributary of River Cavally near Ouéyakolé, north of Mount Nimba, 2.ii.88, holotype ♂ imago, 2 ♀♀ with nymph skin fragments, J.-M. Elouard; 1 ♂ imago with associated nymph skin, M.T. Gillies, *ibidem*.

The adults of both sexes of *B. elouardi* are readily distinguished from all other described species by the markings on the fore femora. The long postero-lateral spines on the abdominal segments are more highly developed than in any other species described here. They are reminiscent of those seen in the Siphonurid genus *Ameletus* Eaton. McCafferty (1981) refers to similar processes in certain North American species of *Baetis*.

Baetis gambiae sp. n.

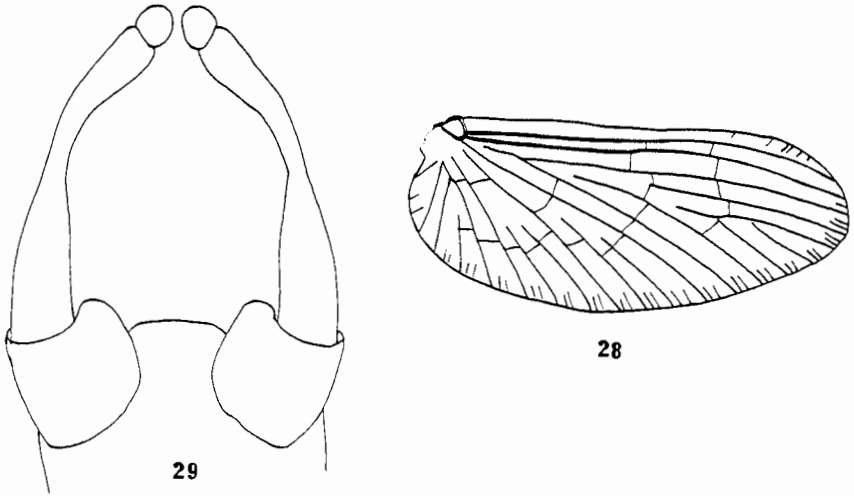
♂ *imago* (in life). Eyes brick-red; abdominal terga II-VII yellowish with red-brown lateral wedges, interrupted medially with a yellow streak. (In spirit): Turbinate eyes reddish-orange, well separated, more or less circular in outline.



Figs. 23-27. *B. elouardi*, nymphal parts. 23. Fore leg; claw enlarged. 24. Gill lamella III, anterior and posterior margins enlarged. 25. Gill VII. 26. Paraproct. 27. Postero-lateral angles of terga II, V-IX.

Thorax chestnut-brown, femora orange brown, rest of legs clear; wings clear (Fig. 28), fore wing with 5-6 incomplete, oblique veinlets; hind wing a minute, veinless strap. Abdomen cream, lateral 1/3 of anterior terga tinged with brown, tracheolar line blackish, sterna cream, sternum IX and forceps orange; tails white; forceps (Fig. 29), basal segment narrow, evenly tapered, second segment broadest in distal half, apical segment globular.

♀ *imago* (in spirit). Scape orange-brown, pedicel cream; vertex with a striking variegated pattern of dark brown and cream markings. Thorax chestnut, apex of scutum and whole of scutum with a broad cream stripe; a small metascutellar hump present; legs orange brown; hind wing as in ♂ or more reduced still. Abdominal terga dark orange brown; tergum I with a median white stripe, II-VI with paired submedian cream stripes, on III and VI an additional posterior median



Figs. 28-29. *B. gambiae*, adult. 28. Fore wing; vestigial hind wing (0.15 mm) at base.

stripe, also present a fainter, posterior stripe above lateral margins of II-VI, VII-VIII with less well defined sub-median stripe; sterna fawn, brownish-orange towards margins of I-VII, II-V with a small, oblique, dark dash at postero-lateral corners. Tails white.

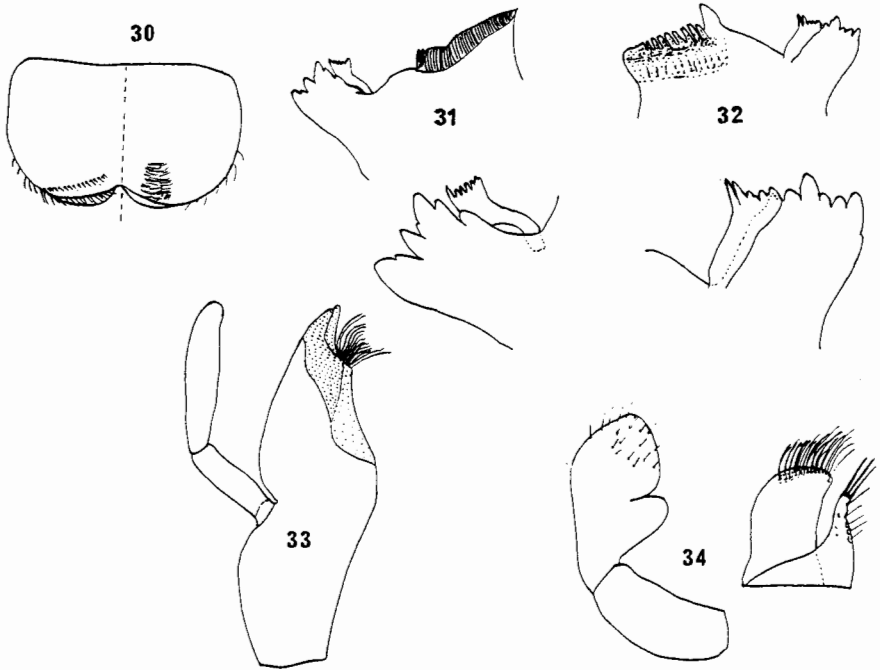
♂ body 4 mm, wing 4 mm, tails 8 mm. ♀ body 5 mm, wing 4.5-5 mm.

Nymph. Antennae long, $2\frac{1}{2}$ x width of head. Mouthparts (Figs. 30-34): labrum with a single line of fine hairs behind anterior margin; maxillary palp with 2 segments; canines of mandibles fused, prosthecae broad, toothed at apex; paraglossae of labium much larger than glossae, apical medial process of 2nd palpal segment well developed.

Legs (Fig. 35): femora narrow, posterior border with a sparse line of spine-like setae, the two most apical setae stouter and longer than the rest; anterior border with a line of short spine-like setae immediately behind the margin, no ventral villopore; a single, small, spine-like seta at apex of tibia.

Abdomen with elongate, oval gill lamellae (Fig. 36), smallest on I, margins without ribs, a few small teeth on anterior border towards apex; postero-lateral corners of terga II-IX with well-formed spines (Fig. 37); posterior margins of terga with broad teeth; inner border of paraprocots with numerous fine teeth. Cerci feathered on inner surfaces in basal $\frac{1}{2}$, markedly tapered and bare in outer half; terminal filament $\frac{1}{2}$ length of cerci, well feathered.

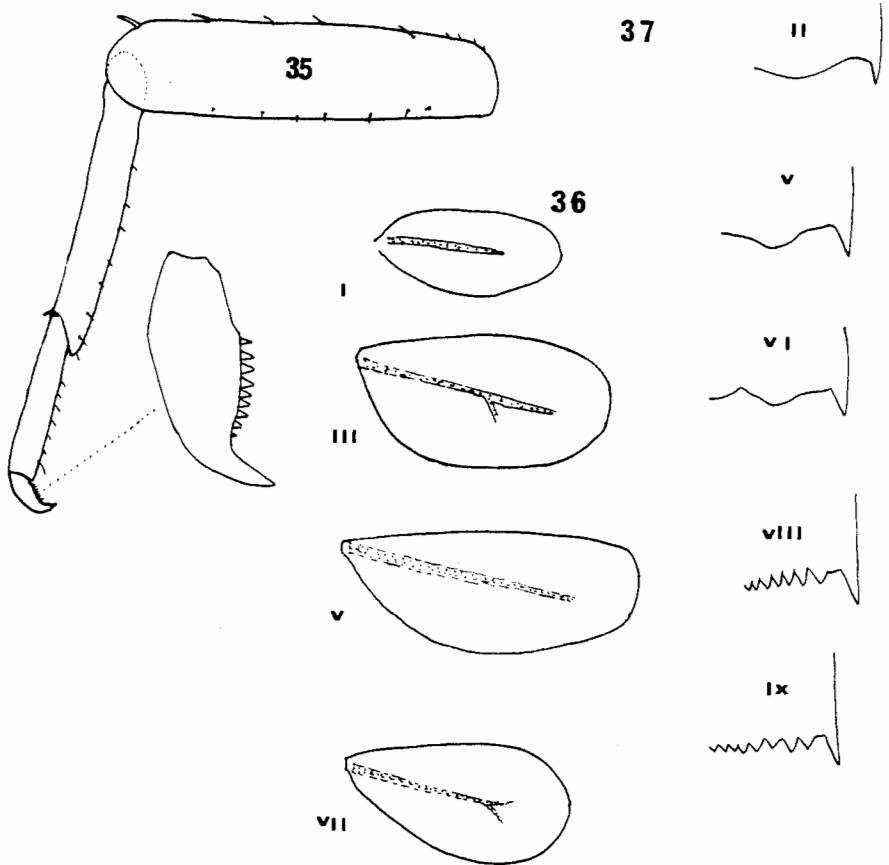
Material. GAMBIA: holotype ♂ imago, R. Gambia, Wali Kunda, 28.x.76: same provenance, ♂ imago with associated nymph skin, 4.ix.74, ♂ imago with nymph skin, 27.vii.75, 2 ♂♂, vii.78, ♀ imago with nymph skin, 15.x.74, ♀ imago with nymph skin, 27.vii.75, ♀ imago with nymph skin, 7.x.81, 1 nymph 25.ii.76, 8 nymphs ix.74, 2 nymphs 7.ix.79, 12 nymphs 1. x. 81. MALI: 1 nymph, R. Niger, Tyenfala, downstream Bamako, 5.ii.86.



Figs. 30-34. *B. gambiae*, mouthparts. 30. Labrum. 31 and 32. Right and left mandibles, two enlargements. 33. Maxilla. 34. Labium.

B. gambiae represents an advanced stage in the progressive loss of the hind wing that has occurred in the *Baetis* lineage. The reduction is greater than has been described for any other African species, and the adult can be distinguished by this from all other species of the genus known at the present time. The nearest to it is *Baetis cataractae* from Southern Africa. In this species, however, the hind wing has a distinct longitudinal vein and there are a number of important differences in the gills and labium of the nymph. The nymph of *B. gambiae* is nearest to *B. mtonis* Gillies (in the press) from East Africa. It differs from this in the shape of the gills, the divided canines of the mandibles and the reduced setation of the femora.

B. gambiae is one of the few mayflies able to maintain themselves in the unstable conditions of the tidal zone of the River Gambia. The river at the point where most of the collections were made is some 200 km from the sea and about 1 km broad. The direction of flow of the water reverses twice in the 24 hours although this is less marked at the height of the annual flood. River levels rise and fall about 1 m with the tides at all seasons. Water temperatures are consistently high. *B. gambiae* nymphs were most commonly found on the leaves of overhanging



Figs. 35-37. *B. gambiae*, nymphal parts. 35. Fore leg, claw enlarged. 36. Gill lamellae I, III, V, VII. 37. Postero-lateral angles of terga.

trees trailing in the water. Since these were largely exposed at low tide it is evident that the nymphs must have been constantly on the move. The bed of the river was covered with a deep layer of unstable silt, and suitable substrates for crawling species were very limited. The only other site where *Baetis* nymphs were found was at a point where the tidal race between two islands had exposed the roots of marginal bushes. The nymphs show considerable tolerance to conditions in static water, periodically making rhythmic pumping movements of their bodies. Adults were never seen on the wing and, curiously enough, none were ever seen at light over several seasons despite the proximity to the larval habitat.

DISCUSSION

These three species are the first *Baetis* s.l. to be described from West Africa. Their position in relation to the Afrotropical fauna as a whole is discussed in the second part of this paper, Gillies (in the press).

ACKNOWLEDGEMENTS

I am grateful to Dr. J.-M. Elouard for enabling me to take part in surveys of West African rivers and for making his own collections available to me.

REFERENCES

- ELOUARD, J.-M., M.T. GILLIES and J. WUILLOT (1990): Ephemeroptera from West Africa: the genus *Pseudopannota* (Baetidae). – Rev. Hydrobiol. trop. 23 (1): 27-39.
- ELOUARD, J.-M. and P. HIDEUX (1991): Ephémères de L' Afrique de l' Ouest. – Bull. Soc. ent. France 95: 247-252.
- GILLIES, M.T. (1980): An introduction to the study of *Cloeon* Leach (Baetidae, Ephemeroptera) in West Africa. – Bull. I.F.A.N. 42A: 135-156.
- (1988): Descriptions of the nymphs of some Afrotropical Baetidae (Ephemeroptera) I. *Cloeon* Leach and *Rhithrocloeon* Gillies. – Aquatic Insects 10: 49-59.
- (1990): A revision of the African species of *Centroptilum* Eaton (Baetidae, Ephemeroptera). – Aquatic Insects 12: 97-128.
- (1991): A diphyletic origin for the two-tailed baetid nymphs occurring in East African stony streams with a description of the new genus and species *Tanzaniella spinosa* gen. nov. sp. nov. – in J. Alba-Tercedor and A. Sanchez-Ortega: Overview and Strategies of Ephemeroptera and Plecoptera, Sandhill Crane Press, Gainesville, Florida, pp. 175-187.
- GILLIES, M.T., J.-M. ELOUARD and J. WUILLOT (1990): Ephemeroptera from West Africa: the genus *Ophelmatostoma* (Baetidae). – Rev. Hydrobiol. trop. 3(2): 115-120.
- MCCAFFERTY, W.P. (1981): Distinguishing larvae of North American Baetidae from Siphonuridae (Ephemeroptera). – Entomol. News 92: 138-140.