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GOMPHIDS FROM CAMEROON, WEST AFRICA (ANISOPTERA: *GOMPHIDAE*)

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In a collection of gomphids from Cameroon the following stages are described for the first time: *Ictinogomphus fraseri* Kimmins – female imago, egg and larva; *Paragomphus abnormis* (Karsch) – female imago and larva. The larvae of *Microgomphus camerunensis* Longfield and *Phyllogomphus montanus* Fraser are redescribed. An enigmatic gomphid larva with a remarkably long siphon is described and compared with a probably congeneric larva from Uganda. The collection included a *Gomphidia* that is to be described by R.M. Gambles as *G. nigeriensis* Gambles.

INTRODUCTION

The dragonfly fauna of the forested region of Cameroon is rich but poorly known. This paper describes the gomphids in a collection of dragonflies made during two visits to West Cameroon in March and April (just before the rainy season) in 1970 and 1972. Gomphids are under-represented in this collection, as in most others, because they are so hard to catch. Those that we have were caught by Dr. John Griffith, by Barombi fishermen, or by good fortune. Most of the specimens came from three crater lakes near Kumba: the deep clear lake Barombi Mbo (9° 22′ E, 4° 38′ N) (TREWAVAS, GREEN & CORBET, 1972) and two shallow eutrophic lakes, Lake Kotto and Mboandong (9° 16′ E, 4° 28′ N) (CORBET, GREEN, GRIFFITH & BETNEY, 1973). The dragonflies of the small crater lake at Debundsha (8° 29′ E, 4° 6′ N) have been described elsewhere (GREEN, CORBET & BETNEY, 1974).

The terminology for the larval labium follows CORBET (1953); the figures are drawn from labia mounted on slides and so somewhat flattened. Larval

lengths are measured, to the nearest half millimeter, from the anterior margin of the head excluding antennae to the tip of the paraprocts. It is my intention to deposit the specimens described here in the British Museum (Natural History).

ICTINOGOMPHUS FRASERI KIMMINS, 1958
Figures 1-2

M a t e r i a l. – Imagines: 4♂, 1 ♀, Barombi Mbo; 1 ♂, Tung Nsuria, a stream flowing into Lake Kotto; 1 ♀ (caught ovipositing), Tung Nsuia, another stream flowing into Lake Kotto. – Larvae: 1 exuvia, Barombi Mbo; 1 exuvia, Mboandong; 10 exuviae, 1 larva, Lake Kotto.

M a l e (imago). – In our five males the shapes of the hamules and of the anal appendages fit well with KIMMINS' (1958) description of *I. fraseri*, but the head, thorax and abdomen are darker in our specimens and the pale areas are smaller or absent. In ours the elevated points on the vertex are black, the labrum is black with two yellow spots, the stripe just anterior to the humeral suture is interrupted and the pale markings on the abdomen are less extensive than those of the specimens that Kimmins described. The male from Tung Nsuria, near Lake Kotto, has the pale markings yellow; and in the four males from Barombi Mbo these markings are greenish and even less extensive than those of the specimen from Tung Nsuria.

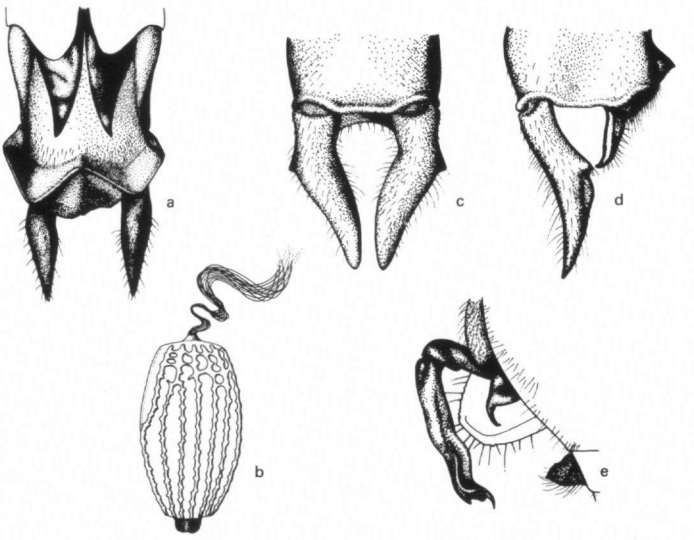

Fig. 1. *Ictinogomphus fraseri* Kimmins: (a) tip of female abdomen from below (dried specimen); – (b) an egg from the surface of the female's abdomen. Only the bases of the filaments are illustrated; – (c) male appendages, dorsal view; – (d) the same, from the right; – (e) accessory genitalia of a male, from the left.

F e m a l e (imago). – The female of *I. fraseri* has not been described. We have one female in poor condition from Barombi Mbo and another, in good condition, caught ovipositing in Tung Nsuia near Lake Kotto. The greenish-yellow markings on the head and thorax of this latter female are as described for the males above. Abdominal segment 1 has an apical pale band, widening ventrally; on segment 2 the short dorsal stripe is separate from an oblique lateral band on each side; segment 3 has two small basal spots near the mid-dorsal line; segments 4, 5 and 6 are quite black; segment 7 has a broad pale basal band interrupted by a mid-dorsal black line; and segments 8, 9 and 10 are quite black. The foliations on segment 8 are about the same size as those of the males. The vulvar scale and cerci are black, and the vulvar scale is deeply bifid (Fig. 1a).

E g g. – One of the eggs taken from the surface of the abdomen of the ovipositing female is shown in Figure 1b. It was 1.00 mm long and 0.55 mm wide, with a terminal skein of about 20 entangled filaments at least ten times as long as the egg. In eggs from the ovary of the female from Barombi Mbo the filaments were coiled into a neat cone. The eggs of *Ictinogomphus ferox* (Ramb.) bear similar skeins of filaments (CORBET, 1962). Comparable tangle-strands are found singly on the eggs of *Lestinogomphus africanus* (Fraser) (GAMBLES & GARDNER, 1960) and in other groups too: as an apical tassel of crimped fibres on each mericarp of the angiosperms *Geranium robertianum* L. and *G. purpureum* Vill., and as rope-like aggregation of coiled hyphae on each peridiole of basidiomycetes in the genus *Cyathus* (YEO, 1973; BRODIE, 1956).

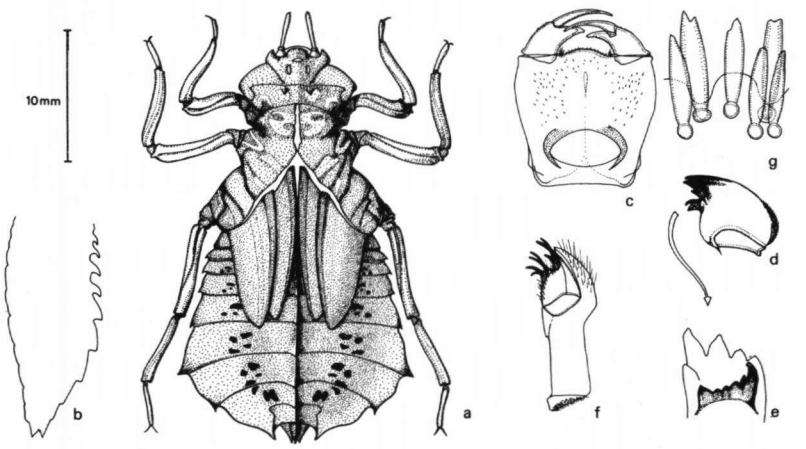

Fig. 2. *Ictinogomphus fraseri*, exuvia: (a) dorsal view of exuvia; – (b) profile of abdomen, with dorsal to right; – (c) labium; – (d) right mandible, with (e) a postero-medial view of its proximal teeth; – (f) right maxilla; – (g) dorsal view of part of anterior margin of prementum, showing setae.

L a r v a e. – The exuviae from Barombi Mbo, Mboandong and Lake Kotto and the larva from Lake Kotto have the general form of larvae of *Ictinogomphus* or *Gomphidia* (cf. FRASER, 1956) and are presumed to be *I. fraseri* because they resemble the larva of *I. ferox* described by CORBET (1956a) and *I. fraseri* was the only species of *Ictinogomphus* that we found; and because a teneral imago found beside an exuvia at Lake Kotto had the wing venation of *I. fraseri*. (A rat ate all but the wings of this adult before the latter could be examined.)

The mean length of the exuviae is 30.0 mm (range 28.0 to 31.0 mm) and the mean head width is 7.5 mm (range 7.0 to 8.0 mm). The larvae (Fig. 2a) are dark brown and very sturdy, with a strongly flattened abdomen which is squarer than that of *I. ferox*, with the lateral extension of segment 7 forming a more distinct angle. From the tip of the dorsal spine on segment 7 the ratio of the distance to the lateral extremity of that segment to the distance to the tip of the paraprocts is 1.4:1.0, whereas for the larva of *I. ferox* illustrated by CORBET (1956a) that ratio is 1:1. This difference in abdominal shape is the major feature distinguishing *I. fraseri* from *I. ferox*. In other respects, including the form of the labium and antennae, the larvae of the two species are alike.

GOMPHIDIA SP.

M a t e r i a l. – Imago: 1 ♂, near Lake Kotto, 11.IV.1970.

This species is to be described by R.M. Gambles as *G. nigeriensis* Gambles.

MICROGOMPHUS CAMERUNENSIS LONGFIELD, 1951

Figure 3

M a t e r i a l. – Imagines: 2 ♂, 1 ♀, Barombi Mbo, March/Apr., 1970. One of the males was found newly emerged near an exuvia on a stick driven into the lake bed to secure a Barombi fish trap in shallow water. (These sticks were often used as emergence sites or perching places by anisopterans). – Larvae: 5 (other) exuviae, 6 larvae, Barombi Mbo.

I m a g o. – *M. camerunensis* was described by LONGFIELD (1951) from a female from 'Kumga' (Kumba, near Barombi Mbo). The male has been described by GAMBLES (1968) from specimens from North Nigeria and West Cameroon. Our specimens resemble Longfield's description except in the following respects: our female has no yellow on the vulvar scale, anal appendages or mid or hind femora; the female and the mature male have white pruinosity ventrally on the thorax; the males lack lateral pale spots on the abdomen; and the female has one anal crossing vein (Ac) on the left forewing and two on the right. Our males fit Gambles' description very well, but in both the discoidal field on the hindwing starts with three cells on one side and with two on the other; and a faint opalescence surrounds the pterostigma on the fore and hindwings. The conspicu-

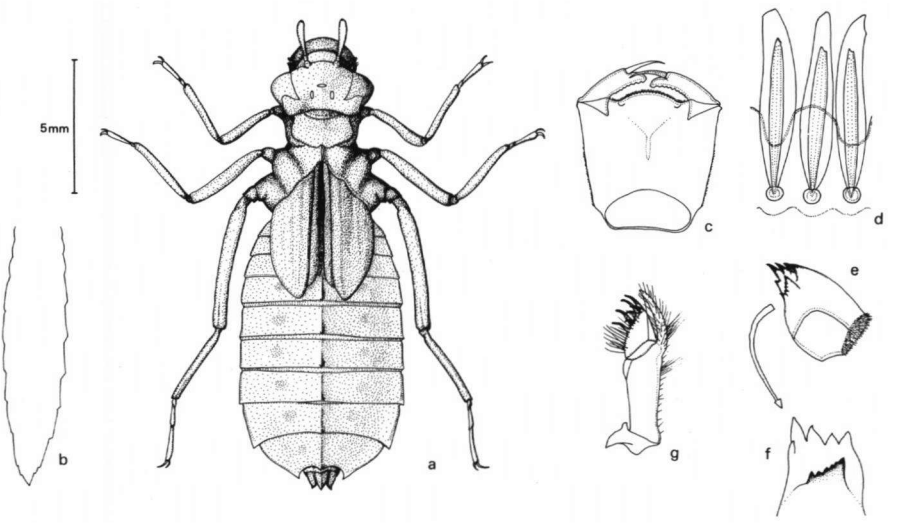

Fig. 3. *Microgomphus camerunensis* Longfield, larva: (a) dorsal view (drawn from the exuvia found with a teneral adult); – (b) profile of abdomen; – (c) labium; – (d) detail of setae on anterior margin of prementum; – (e) right mandible, with (f) postero-medial view of its proximal teeth, with distal teeth in outline; – (g) right maxilla.

ous white pruinosity on the thorax of our two mature specimens is not mentioned in Gambles' account, perhaps because that refers to teneral individuals. The two rows of black spines on the hind femur of Longfield's and our females are absent from our two males. Their hind femora are set with much shorter spines, which are irregularly scattered and not noticeably longer in mid-femur than at either end.

L a r v a. – GAMBLES (1968) pointed out that the larvae of *M. camerunensis* resemble Fraser's (1956) supposed *Microgomphus* from East Cameroon. The exuvia found with the teneral male imago at Barombi Mbo is shown in Figure 3a. Such larvae were not uncommon at Barombi Mbo. For six final-instar larvae the mean length was 16.4 mm (range 15.5-17.0 mm) and the mean head width was 4.0 mm. For five exuviae the mean length was 16.2 mm (range 16.0-17.0 mm) and the mean head width 3.7 mm (range 3.5-4.0 mm).

PHYLLOGOMPHUS MONTANUS FRASER, 1957
Figures 4-5

M a t e r i a l. – Imago: 1 ♂, Starkers Crossing, near Lake Kotto (where the track from Ekumbe Bonji crosses Lake Kotto's outflow), 11.IV.1970. – Larvae: 14 exuviae, 1 ♂ final-instar, Barombi Mbo. The larva died when ready to emerge; its hamule and penis confirm its identity as *P. montanus*.

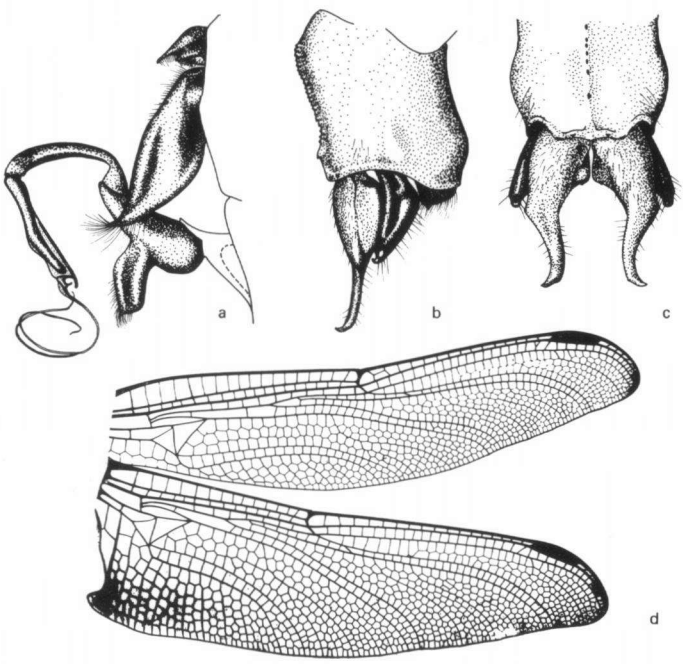

Fig. 4. *Phyllogomphus montanus* Fraser, male imago from Lake Kotto, 11th April 1970: (a) penis, from the left; – (b) abdominal appendages from the right, and (c) in dorsal view; – (d) wings.

M a l e (imago). – FRASER (1957) described *P. montanus* from a female from Cameroon. PINHEY (1962) gives as a synonym of *P. montanus* ('teste Fraser, Buchholz') *P. hartwigi* Buchholz, described by BUCHHOLZ (1958) from a male from 'Koto-Barombi-See' (Lake Kotto). Our male conforms with FRASER's (1957) description of a female *P. montanus* except that, as in the male described as *P. hartwigi* by Buchholz, in our specimen the occiput is black; there is a pale dorsal streak on abdominal segment 2 (as in the males from Cameroon in the American Museum of Natural History, mentioned by FRASER, 1957); and the yellow 'broad basal annules' on segments 3 to 6 of the type are replaced in our male by pairs of lateral spots. Our male differs from Buchholz's description of *P. hartwigi* in that its antehumeral stripe is narrowly confluent with the mesothoracic collar; the wings are smoky brown only near the base; and the superior appendages are a little less strongly recurved at the tip (Fig. 4b, c).

L a r v a. – FRASER (1957) illustrated a larva, which he supposed to be of this species, from Cameroon.

The larva and exuviae from Barombi Mbo (Fig. 5) are dark brown and

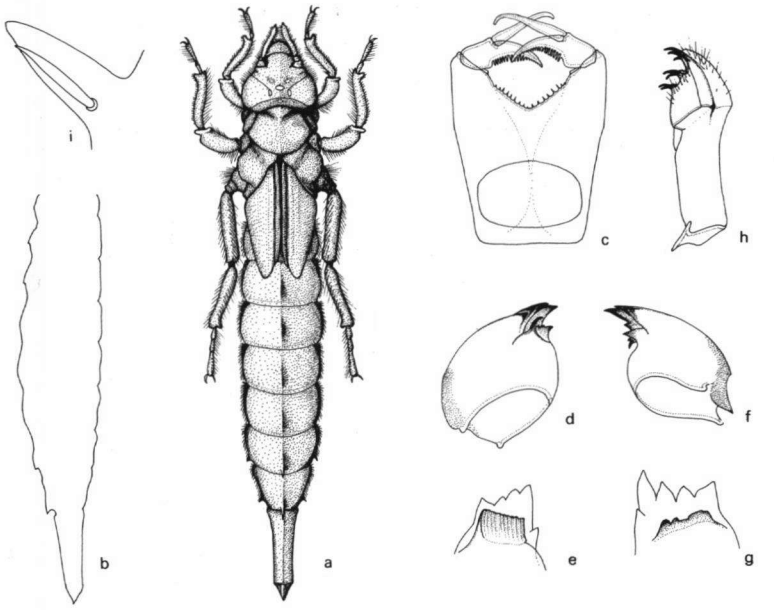

Fig. 5. *Phyllogomphus montanus*, final-instar larva: (a) dorsal view; – (b) profile of abdomen, dorsal to the left; – (c) labium; – (d) left mandible with (e) a postero-medial view of its proximal teeth; – (f) right mandible, with (g) a postero-medial view of its proximal teeth; – (h) right maxilla; – (i) detail of setae on anterior margin of prementum, in dorsal view.

elongate, with robust legs. The convergent four-segmented antennae overlying the rounded anterior margin of the labrum give the head a pointed appearance. The abdomen is nearly cylindrical but has dorsal and lateral keels. Segments 8 and 9 have dorsal teeth and the postero-lateral angles of those segments are produced into spines. The tenth abdominal segment is tubular and about as long as the eighth and ninth segments together. The mean length of twelve exuviae is 44.9 mm (range 41.0-46.0 mm) and the mean head width is 6.0 mm (range 6.0-6.5 mm).

On the labium (Fig. 5c, i) the distal border of the prementum is excavated into a triangular sinus whose margins are nearly straight, not convex like those of *P. orientalis* Fraser (described, as *P. aethiops* Selys, by CORBET, 1956b) (PINHEY, 1959; CORBET, 1977). On each margin of the sinus is a row of 8-10 curved spines with a spiniform seta at the base of each. The inner margin of each palp bears 16 or 17 spines, more than are shown in CORBET's (1956b) figure of *P. orientalis*. Those near the base are long and straight but they dwindle to mere bumps distally on the palp. The movable hook is sharply curved near the tip and

its inner margin is finely serrated. On both the individuals whose mandibles were examined in detail, the proximal teeth on the right mandible were more sharply reflexed than those on the left mandible (Fig. 5d-g).

PARAGOMPHUS ABNORMIS (KARSCH, 1890)
Figures 6-7

M a t e r i a l. – Imago: 1 ♀ (newly emerged), Barombi Mbo (on the strandline of a sandy beach beside an exuvia presumed to be its own), 7.IV.1970. It was kept alive for six days. – Larva: 1 (other) exuvia, Barombi Mbo, March 1970.

F e m a l e (imago). – *P. abnormis* was described by KARSCH (1890) from a male from Barombi Station (presumably from Barombi Mbo). CAMMAERTS (1969) redescribed the holotype, distinguishing it from *P. moka* Longfield 1936 from Fernando Po (synonymised with *P. abnormis* (Karsh) by PINHEY, 1966) from which it differs chiefly in the presence of basal subcostal veins and in details of the male appendages and of the anal triangle in the male hindwing; and from specimens from Bambesa described by FRASER (1949) as *P. abnormis* but redescribed by CAMMAERTS (1969) as a new species, *P. nigroviridis* Cammaerts. Our female (Fig. 6) conforms with Cammaerts's redescription of the male holotype of *P. abnormis* well enough to be regarded as conspecific, but it is a little larger and, perhaps partly because it may not yet have achieved its mature colouration, paler. The abdomen (without appendages) is 31.0 mm long. The hind-wing lengths are 27.0 and 26.0 mm, the width at the nodus is 8.0 mm, and

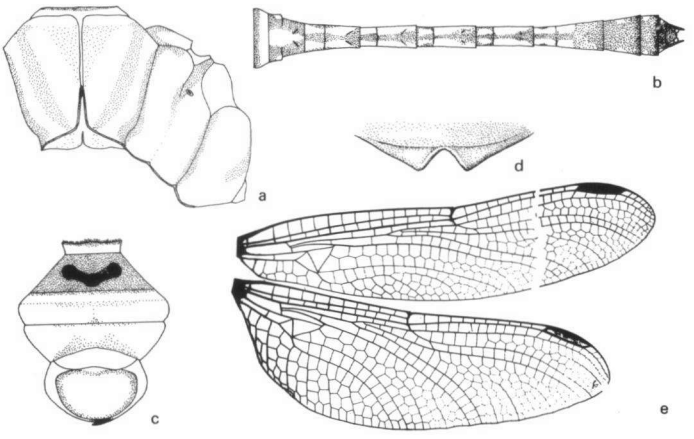

Fig. 6. *Paragomphus abnormis* (Karsch), female imago: (a) thorax; – (b) dorsal view of abdomen; – (c) face; – (d) vulvar scale, ventral view; – (e) wings.

the pterostigma on the hindwing is 3.3 mm long. The hind femur is 4.5 mm long, and the anterior margin of the occipital plaque is 1.0 mm.

The colouration of the face and mouthparts conforms with Cammaerts' account of the male, but the occipital plaque is faintly convex in the centre, its posterior border is not quite straight (Fig. 6c), and the second antennal segment is all black.

The pattern of brown markings on the yellow thorax (Fig. 6a) resembles that of the type, but the antehumeral brown stripe is quite separate from the humeral stripe; and there is no anterodorsal process from the middle of the brown stripe on the second lateral suture. The colour pattern on the legs, though pale, agrees with Cammaerts's description.

A transverse basal subcostal vein is present on all four wings, as in the holotype. Behind the pterostigma are 4½ and 4¼ cells in the forewings, and 3½ and 5 cells in the hindwings. The nodal formula is

9 : 13	14 : 10
9 : 11	10 : 10

and thus similar to that of the holotype. The position of the arculus and the form of the discoidal field fit Cammaerts's description.

The markings on the abdomen (Fig. 6b) agree with those of the holotype except that the lateral pale areas are generally more extensive in our female. The vulvar scale (Fig. 6d) is bifid, with a V-shaped sinus.

L a r v a. – The exuvia (Fig. 7a) is pale brown, translucent and rather delicate. The abdomen is nearly cylindrical with obtuse lateral keels and no dorsal keel. There are small spines mid-dorsally on segments 2, 3, 8 and 9, and on the posterolateral angles of segments 6, 7, 8 and 9. The abdominal tergites are set with sparse fine hairs except for a glabrous area on each side of segments 3 to 9. Longer hairs line the lateral and posterior borders of the tergites. There is a posterior dark spot mid-dorsally on segments 3 to 9, and there are four smaller dark spots on segments 3 to 8 and two spots on segment 10. The paraprocts are twice the length of the tenth segment. The legs are short and set with long hairs. The wing sheaths, widely divergent in the exuvia, have been reconstructed parallel in Fig. 7, but since no larva was available their natural position is unknown. They may be divergent like those of *P. cognatus* (Rambur) and *P. hageni* (Selys) described by CORBET (1957).

The antennae have four segments, the upturned fourth less than one quarter as long as the third. On the labium (Fig. 7c) the convex distal margin of the median lobe of the prementum is finely toothed and bordered with jagged-tipped palisade setae (Fig. 7d), and there are three stout setae at the outer corner of the prementum on each side. The inner margin of the palp is irregular but not serrate.

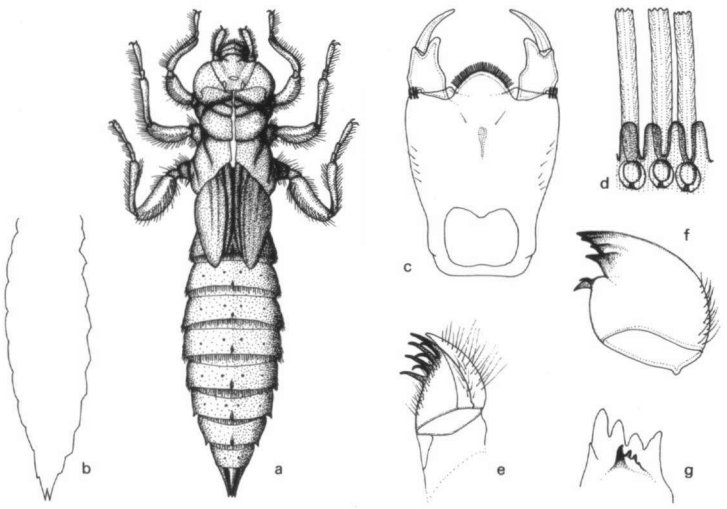

Fig. 7. *Paragomphus abnormis*: (a) exuvia; – (b) profile of abdomen, dorsal to the right; – (c) labium; – (d) part of the anterior border of the prementum, showing the teeth and setae; – (e) right maxilla; – (f) right mandible; – (g) postero-medial view of the proximal teeth on the right mandible, with the distal teeth in outline.

The exuvia found beside the female adult is 24.0 mm long and its head is 4.5 mm wide. Another exuvia matching this description, found at Barombi Mbo in March 1970, is 22.0 mm long, with a head 4.5 mm wide.

ENIGMATIC GOMPHID LARVA
Figures 8-9

M a t e r i a l. – Larvae: we have four exuviae and three pickled larvae of a gomphid which could not be placed with confidence in any genus known from Africa. The specimens were all from two small streams that flow into Lake Kotto: Tung Nsuia and Tung Nsuria. The larvae were sieved from deep accumulations of muddy silt, where their long siphons (Fig. 9a) may have enabled them to take water for respiration from above the surface of the silt.

D e s c r i p t i o n. – The larvae are slender with a long cylindrical abdomen and a very elongate tenth abdominal segment (Fig. 8a). There are no dorsal or lateral spines on the abdomen. The exuviae are delicate and pale. The labium (Fig. 8c) is stout and the anterior border of the prementum is concave and edged with pairs of curved setae (Fig. 8g). There are 13 pairs on one side and 14 on the other. The inner margin of the palp is indented to form teeth, the longer of which are parallel-sided. Of the six palps of three larvae, five have 10 teeth and one has eleven.

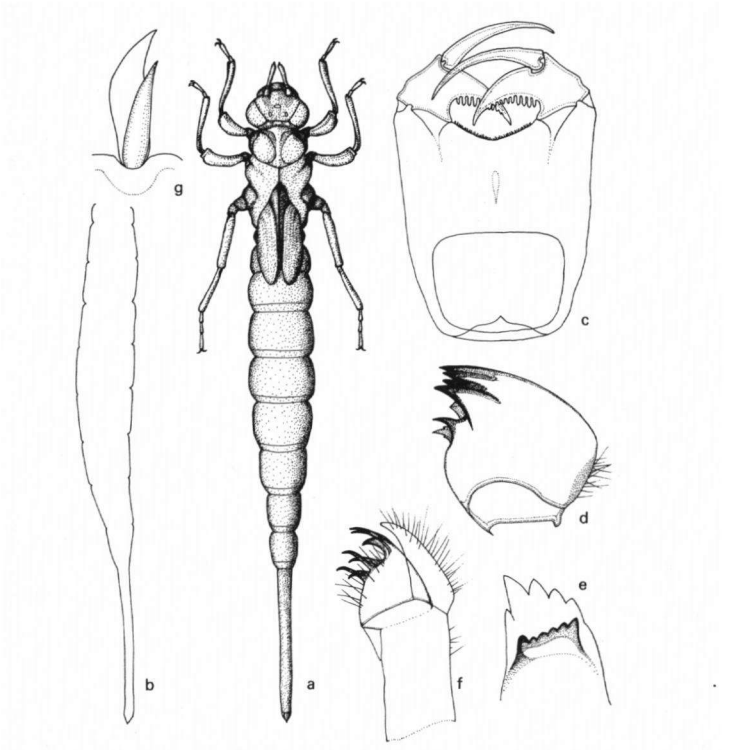

Fig. 8. Enigmatic gomphid larva from a stream flowing into Lake Kotto: (a) dorsal view of exuvia; – (b) abdomen in profile, with dorsal to the left; – (c) labium; – (d) right mandible, with (e) a postero-medial view of its proximal teeth; – (f) right maxilla; – (g) dorsal view of a pair of setae from the anterior margin of the prementum.

For the four exuviae the mean length is 56.8 mm (range 56.0-58.0 mm) and the mean head width is 5.7 mm (range 5.5-6.0 mm).

S y s t e m a t i c p o s i t i o n. – From one male larva that died in captivity when ready to emerge, it has been possible to dissect the imaginal accessory genitalia (Fig. 9) and to recognise parts of the wing venation. In the forewing the triangles, hypertriangles and subtriangles all appear free, and there are three (or four?) cross veins between MA and the radial sector before it bifurcates.

The larva of *Lestinogomphus angustus* Martin has an elongate tenth abdominal segment, but differs from mine in the broader abdomen with dorsal and lateral spines on some segments; in the convex median lobe of the prementum; and in the presence of serrations, instead of teeth, on the labial palps (CORBET, 1956b). PINHEY (1959) described a supposed *L. africanus* (Fraser) larva from Zambezi as more slender than Corbet's *L. angustus*, 48 mm long and with the

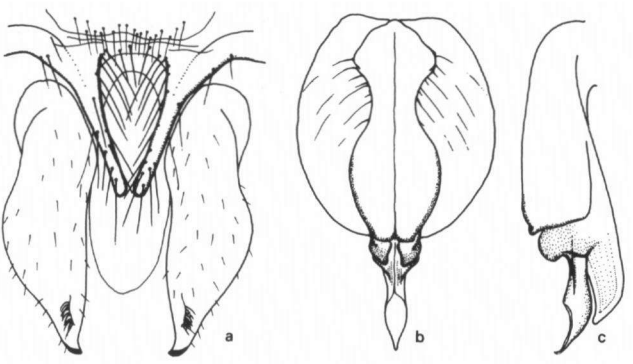

Fig. 9. Enigmatic gomphid larva from a stream flowing into Lake Kotto (see also Fig. 8), accessory genitalia dissected from a metamorphosing larva: (a) accessory genitalia in ventral view; – (b) penis in ventral view and (c) in lateral view.

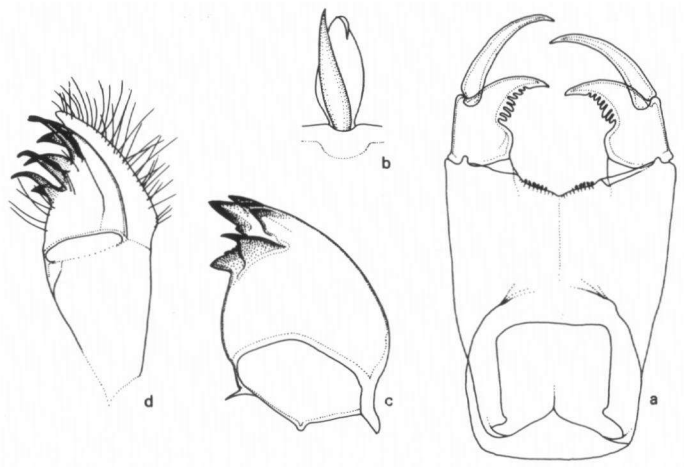

Fig. 10. P.S. Corbet's enigmatic gomphid from Uganda, mouthparts of exuvia: (a) labium; – (b) dorsal view of a pair of setae from the anterior margin of the prementum; – (c) right mandible; – (d) right maxilla.

terminal segment of the abdomen 11 mm long. The larva figured by CORBET (1962) was assigned by him to *L. africanus*-(supposition) because of its close resemblance to the larva described by PINHEY (1959) but because it differs markedly from *L. angustus* it is probably not a *Lestinogomphus* (CORBET, 1977). It resembles my larva very closely in shape. P.S. Corbet has kindly lent me one of his specimens of that species, an exuvia collected at Pakwach on the

White Nile, Uganda, on 3rd September 1959. It is 49.0 mm long (terminal abdominal segment 10.5 mm) and its head is 5.0 mm wide. Its labium, maxilla and mandible (Fig. 10) resemble those of my larvae very closely, but it has only seven teeth on each labial palp where mine has ten; and there are about ten pairs of curved setae (Fig. 10b) on each side of the margin of the prementum. Possibly P.S. Corbet's larvae and mine represent two species in the same genus.

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