CI.—EPHEMEROPTERA FROM NYASALAND, WITH DESCRIPTIONS OF THREE NEW SPECIES AND SOME INTERESTING NYMPHAL FORMS.

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The material dealt with in this paper is part of a collection made by Professor Lewis Berner, of the University of Florida, whilst on a visit to East Africa during the months June to September, 1952. The Trichoptera from this expedition will form the subject of a later paper. All the material was preserved in alcohol and Professor Berner has generously allowed me to retain for the British Museum (Nat. Hist.) many specimens, including the holotypes of the new species. Representatives of almost all the species dealt with here have been deposited in the University of Florida. .I should like to express my thanks to Professor Berner for the opportunity of studying this interesting collection.

One species of *Caenis*, one of *Cloëon* and one of *Procloëon* are described as new, and figures and descriptions are given of the more interesting and distinctive nymphal forms. Specific names have not been given to these, as it is not my practice to make the immature stages the types of new species.

The order of the superfamilies and families adopted in this paper is that recently proposed by Edmunds and Traver, 1954, Proc. ent. Soc. Wash., lvi. p. 236.

The following notes on the localities visited were sent me by Professor Lewis Berner.

July 4th, 1952.—South-east side of Lake Nyasa at village of Machemba. Beach cleared of vegetation ; composed of coarse sand. Behind the beach was a fairly large dambo (swamp) in which many culicine mosquitoes were found. The water was shallow and the ground mucky. The usual plants were abundant here including papyrus, cattail, etc. We collected many insects at this particular spot.

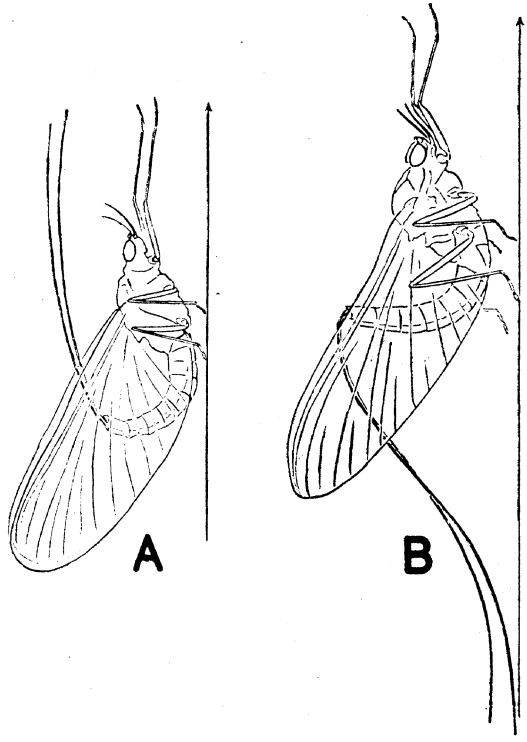
July 7th, 1952.—13½ miles up Namwera Road from Fort Johnston. Small stream flowing swiftly down the side of the mountain. It was a typical mountain brook, which was cutting a V-shaped gorge down through the rock. During the rains it was probably torrential but now running swiftly in its descent. Ranged from about 12 to 36 inches in width. It was very shallow, being only a few inches in depth. It was pooled in spots, and there were also residual pools to one side. Mayfly nymphs were fairly common on loose rocks and on dead leaves lying in the stream bed.

July 12th, 1952.—Small stream, now stagnant, 18 miles from Blantyre on the Salisbury Road. Pools were formed in many spots in the stream bed. Algæ were thick ; mayfly came from these clumps of algæ.

July 12th, 1952.—Shire River; Mpatamanga rapids at the gorge. The stream boiled between rock outcrops, shooting spray high into the air. Boulders along the banks have many large potholes, in some of which there was water. Several were covered with duckweed. Mayfly adults (resemble American genus *Callibaëtis*) were floating on the surface by the hundreds.

July 16th, 1952.—Tengadzi Camp, about 10 miles north of Chiromo on the Chiromo-Chickwawa Road. Found many mayflies (*Cloëon*)

Figs. A–B.



Resting position of female adults of A. *Cloëon perkinsi* Barnard; B. *Cloëon smaeleni* Lestage. (Drawn by Miss Esther Coogle.)

resting on the screens. Females had assumed an unusual posture with the posterior portion of the abdomen bent sharply forward and resting between the upheld wings almost reaching back over the thorax, resulting in the tails being held parallel with the head and being directed forward (fig. A). Males have a more normal posture.

July 17th, 1952.—Village of Gande on the Chiromo-Chickwawa Road. Large dambo (swamp) behind village. This dambo is a marginal extension of the enormous elephant marsh. In the marsh itself cattails grew

in profusion. The ground was mucky. We worked in shallow water and collected a number of mosquitoes which were fairly common, along with a few mayflies. Worked here for about 2½ hours.

July 20th, 1952.—Tengadzi Camp, north of Chiromo. Collected mayfly adults from the screens of the camp house. The *Cloëon* adults sit vertically on the screen with the abdomen flexed back between the wings and with the tails directed posteriorly (fig. B). All the females and some of the males took this posture.

July 22nd, 1952.—Tengadzi Camp. Mayflies (*Cloëon*) swarming at 8.30 a.m. near the house and around the lower limbs of a mango tree in front of the house. They were flying 5 to 15 feet in height. Some were flying in the sunlight, others in the shade. I collected intermittently until 9.30 a.m. All specimens taken were males. By 10.15 a.m. the flight seemed to have dissipated. The insects were flying in the usual mayfly pattern up and down and the wings glittered in the sunlight, so that the specimens were easily detected.

July 22nd, 1952.—Tengadzi Stream about 1 mile north of camp. This was a swift, rocky, mountain stream with patches of sand between the rocks. Some of the stretches were relatively placid while others had small rapids with the water moving very swiftly. The stream was about 30 feet wide and relatively shallow varying from a few inches to about 1 foot in depth. There were numerous rocks and large pebbles in the stream which were covered with a slippery species of alga. Marginal grasses on which a small species of *Simulium* larva was found were trailing in the slow water. There was also some vegetation and debris in the swiftest water. Mayflies were collected from the rocks and vegetation and by scraping in the sand.

July 24th, 1952.—Chiromo. Mayfles taken resting on the screen of the railway resthouse which was being used as a camp by us.

July 24th, 1952.—Stream about 19 miles north of Chiromo on the Blantyre-Chiromo Road. Rather dirty stream with pigs and humans wading in it. It was fairly small being about 4 feet wide and about 6 inches deep. I collected upstream, above the clothes-washing and the pigs, and found the water to be flowing swiftly. It runs down from the mountains to the north-east. *Simulium* larvæ were relatively common on trailing grasses in the water. Mayflies also from this vegetation.

July 24th, 1952.—Stream crossing the Chiromo-Blantyre Road, about 22 miles north of Chiromo. The stream was fairly wide, being about 20 to 30 feet in width at the road, narrowing to 5 or 6 feet beyond a drift which had been built of rocks and used as a road across the stream. Found a *Baëtis*-like mayfly to be very common.

July 26th, 1952.—Chiromo ; railway resthouse. Mayflies taken from the screen.

July 27th, 1952.—Chiromo ; railway resthouse.

August 6th, 1952.—Aboard the Lake Nyasa steamer " Ilala," opposite the village of Chileka about 1 mile from shore. At 6.15 p.m. it became dark but the moon had not yet risen. The lights of the boat were turned

on and hordes of mayflies came in. I collected until 7.30 p.m. when my supply of vials was exhausted.

August 7th, 1952.—Hung a lighting sheet at the bank of the Shire River at the Ntundu Camp south of Fort Johnston. I started before dusk. As dark began to fall, a few insects came to the lighted "Tilly" lamp. After dark, midges, mayflies and caddisflies came in some numbers. The larger mayflies were not common. I collected from dark, which started at 5.45 p.m., to 7.00 p.m. The air was calm and it was dark. The moon rose at 8.30 p.m.

August 8th, 1952.—Ntundu, at lighting sheet. Put up the sheet at river's edge. However, it was windy on this evening but clear and moonless. Relatively few mayflies came to the light which I ran from 6 to 7 p.m.

August 8th, 1952.—In Fort Johnston. Collected mayflies which were swarming in town at 8.30 a.m. in bright sunlight on one of the main streets of the village.

August 11th, 1952.—Ntundu Camp south of Fort Jackson. Collected from screen of the camp.

August 11th, 1952.—Small stream on the Namwera Road 13½ miles from Fort Johnston. Stream was about the same as when it was examined on July 7th. Water was about 2 to 3 inches deep, 6 inches to 3 feet across, flows swiftly in some parts, stagnant pools in others.

August 11th, 1952.—Small stream 11 miles north of village of Namwera. Slow flowing stream with milky-coloured water and loose, reddish silt on the bottom. The stream is about 4 inches deep and 18 to 24 inches wide. Insects were scarce in this particular stream.

August 11th, 1952.—Stream at the southern edge of the village of Namwera. Swift flowing, rock and sand bed. Stream about 5 to 6 feet wide and 3 to 5 inches deep, occasional pools and rocky riffles. Collected with a dip net and by scuffing loose material up into the net. Mayflies scarce.

August 12th, 1952.—Ntundu Camp south of Fort Johnston. Collected mayflies from the screens of the camp house.

August 19th, 1952.—Stream about 10 to 11 miles east of Limbe, at the bridge on the Mlanje Road. Has a fairly large stream bed which cuts down through rock banks; spills through a deeply worn groove at a swift rate; water confined to the rock channel. At the edges where the water courses in sheet-like fashion over the rocks, *Simulium* larvæ were attached in abundance. Mayfly nymphs collected from small clumps of vegetation present in the stream.

August 19th, 1952.—On the road leading to the Timber Depot on the slope of Mount Mlanje; Likabula Stream. Stream bed large; huge boulders strewn along the banks. In places the water was deep and formed pools large enough for swimming. Water was extremely cold and clear. Likabula comes from the top of the mountain. As it flowed across the rock bed, especially where there were small falls, the water was very swift and spread out in a sheet-like fashion. *Simulium* larvæ

and pupæ were abundant in this shallow water where it was extremely swift. Mayfly nymphs were also present here as well as countless caddisflies.

August 22nd, 1952.—Port Herald. Adults found resting on the screen of the railway resthouse.

September 2nd, 1952.—Shire River at Mpatamanga Gorge. Found a place where I could get down to the weeds that were growing up along the edge of the river. Managed to get some that were trailing in the water. Collecting here was extremely difficult because of the steep banks, the slippery clay, and the deepness and swiftness of the water, plus the presence of crocodiles. Mayflies and caddisflies were present on the trailing vegetation.

Superfamily HEPTAGENOIDEA.

Family **Heptageniidae (=Ecdyonuridae).**

Afronurus sp.

Stream 13·5 miles east of Fort Johnston, 7. vii. (1 nymph). Tengadzi Stream, 22. vii. (1 nymph). Eleven miles east of Limbe, 19. viii. (1 nymph). Mt. Mlanje, Likabula Stream, 19. viii. (1 nymph).

Family **Baëtidae.**

Cloëon perkinsi Barnard.

Ntundu, 3. vii. (1 ♀), 9. viii. (2 ♂). Tengadzi Camp, 16–22. vii. (5 ♂, 14 ♀ imagines, 2 ♀ subimagines). Stream three miles south of Gande, 17. vii. (22 ♂, 1 ♀). Chiromo, 24, 26. vii. (7 ♂, 3 ♀). L. Nyasa, Chipoka, 6. viii. (1 ♀). Port Herald, 22. viii. (10 ♂, 9 ♀).

Distribution.—S. Africa.

Cloëon smaeleni Lestage.

Shire River, Mpatamanga, 12. vii. (30 ♀). Tengadzi Camp, 16–22. vii. (22 ♂, 29 ♀). Chiromo, 24–26. vii. (3 ♂, 13 ♀). Port Herald, 22. viii. (8 ♂).

C. smaeleni nymphs ?

South shore of L. Nyasa, off-shore lagoon, with much vegetation, Machembo, 4. viii. (8 nymphs). South shore of L. Nyasa, 4. vii. (15 nymphs).

Distribution.—Central Africa.

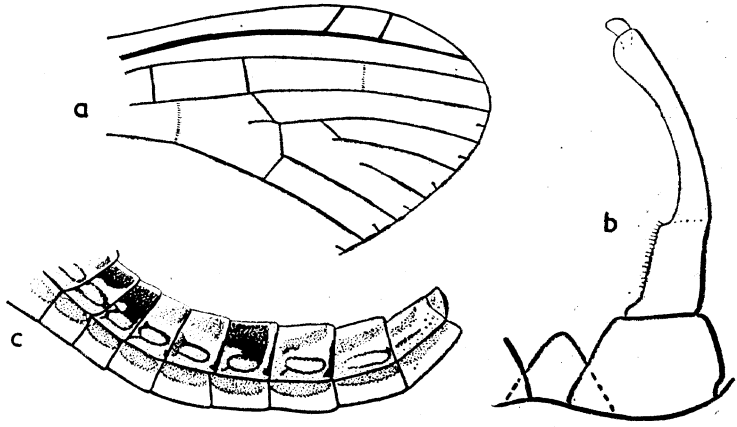
Cloëon scitulum, sp. n. (Fig. 1.)

Chiromo, 24. vii. (1 ♂), 25. vii., swarming at 8.15 a.m. (30 ♂), 26. vii. (14 ♂, 1 ♀). Ntundu, 7–9. viii. (1 ♂). Port Herald, 22. viii. (2 ♀).

♂. Turbinate eyes wider than their bases, dull orange, lower eyes grey, with two horizontal, purplish-brown bands. Head brownish, two basal antennal segments whitish, with brownish apical rings. Thorax shining fuscous, with paler or whitish markings. Legs whitish. Abdomen

with segments one to seven translucent whitish, eight to ten opaque yellowish brown. Most segments have faint traces of reddish-purple markings and the tracheal trunk shows as a dark grey, lateral line. The third tergite has a distinct reddish purple spot on each side before the apex, triangular in shape, and there are indications of another such spot on the sixth tergite. Venter whitish. Cerci greyish white with sparse, faint, purplish annulations. Forceps whitish, with a sclerotized, triangular projection above and between their bases. Forceps-base stout, tapering towards its apex. Basal and second segments more or less fused, long, curved, a little narrower at base than forceps-base somewhat narrowed on inner surface just beyond base and again narrowed abruptly at about one-third from base, apex slightly clavate. Terminal segment minute, arising from upper surface of second segment, curved,

Fig. 1.



Cloëon scitulum, sp. n. *a*, apex of wing, ♂; *b*, genitalia ♂, ventral (paratype); *c*, abdomen, ♀ allotype, lateral.

somewhat dilated apically. Wings hyaline, with pale venation, slightly fuscescent at base. Two costal cross-veins in pterostigma.

♀. Head pale buff, dorsally with two median, longitudinal, orange-brown stripes running caudad from the posterior ocelli, separated by a narrow white stripe, which widens anteriorly to enclose a reddish, V-shaped mark behind the anterior ocellus. There is also a whitish stripe bordering each eye. Eyes greyish, with two horizontal purplish bands. Antenna whitish, basal segment marked beneath with purplish brown at base and apex, second segment with an apical ring of the same colour. Pronotum pale buff, with three pairs of longitudinal, orange-brown stripes, the median pair continuing those of the head, second pair shorter, not reaching anterior margin, third pair lateral. There is a transverse, purplish-brown line on each side linking the first and second pairs at their bases. Mesonotum buff, with three fine, longitudinal, white lines above, and a

short, curved, purplish-brown line, bordered with white, in front of the wing-bases. Metanotum buff, with purplish-brown marks anteriorly. Sides of thorax buff, with white and orange-brown markings. Legs buff, femora each with a purple-brown line on anterior surface. Abdomen buff, with a faint, narrow, orange-brown, median line on the second to the sixth tergites, and with purple-brown and white markings towards the lateral margins, most pronounced on the second, third and sixth tergites. Sternites pale buff, with a pale, reddish brown, lateral band. Cerci whitish, with widely spaced, purplish-brown annulations. Wings hyaline, venation fuscous, whitish at base, humeral cross-vein marked with purplish red at each end. Two costal cross-veins in pterostigma.

Length of fore wing, ♂, 4·5 mm., ♀, 4·5 mm.
Length of cerci, ♂, 10 mm., ♀, 7·5 mm.

Holotype ♂ (Chiromo, 26. viii.), allotype ♀ (Port Herald, 22. viii.), both mounted in euparal as microscope preparations, in British Museum (Nat. Hist.), paratypes in Brit. Mus. N. H. and University of Florida. In general appearance the females of this species show considerable resemblance to those of *Procloëon africanum* (Esben-Petersen), but they lack the distinct rounded spot on the side of the first abdominal tergite, and the strong tergal markings are on the second, *third* and *sixth*, not second, *fourth* and *seventh* segments. The male forceps are also more slender. In addition, there are two costal cross-veins in the pterostigma and the basal segment of the hind tarsus is only about twice as long as the second, not three times as long as in *P. africanum*.

The colour markings, particularly the purple-brown, are probably not very permanent and may well disappear in course of time in alcohol or formalin. The types have therefore been mounted whole in euparal in the hope that the pattern will prove less fugitive.

Cloëon sp.

L. Malombe, Nalikolo, "Traverse Camp", marsh on shore, 2. vi. (3 nymphs). L. Nyasa, south shore, 4. vii. (18 nymphs). L. Nyasa, south shore, Machembo, off-shore lagoon with much vegetation, 4. viii. (8 nymphs). Gande, Elephant Marsh, 17. viii. (7 nymphs).

Procloëon cylindroculum, sp. n. (Fig. 2.)

Tengadzi Camp, 22. viii. (27 ♂).

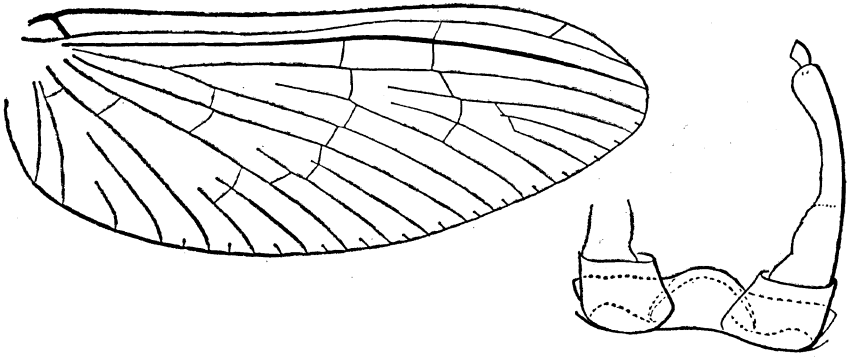
♂. Turbinate eyes orange-brown or orange, cylindrical, scarcely wider than their bases, about one-and-a-half times as high as wide; lower eyes dark reddish purple. Head pale yellowish brown, posterior ocelli bordered on inner margins with dark brown, basal segment of antenna marked apically (except on dorsum) with brown. Thorax shining medium fuscous, marked with cream near wing-bases and on sides, ventrally pale fuscous. Legs whitish. Abdomen with basal segments fuscous basally, apices translucent whitish. Second to sixth, and basal two-thirds of seventh, segments also whitish, lateral tracheal trunks visible as a pair of thin blackish lines. Apical third of seventh tergite, and

eighth to tenth tergites light castaneous. Sternites eight and nine opaque, pale brownish. Cerci very pale greyish. Forceps pale fuscescent. Forceps-base broad, basal and second segments more or less fused, stout at base, tapering about midway and then expanding to a clavate apex. Terminal segment small, apex obliquely truncate. A broadly rounded, sclerotized plate between bases of forceps. Wings hyaline, venation fuscous, as is extreme base of wing. One costal cross-vein in pterostigma, no distal cross-veins between Sc, R_1, R_2 and IR_2.

Length of fore wing, ♂, 4 mm., of cerci, 8 mm.

Holotype ♂ (mounted as microscope preparation) in British Museum (Nat. Hist.), paratypes in Brit. Mus. (N. H.) and University of Florida. The absence of the distal cross-veins suggests a relationship with *Procloëon africanum* (E.–P.), but it differs from that species in the translucent middle segments of the abdomen, more slender claspers and in its smaller size. The brownish thorax and castaneous apical segments of the

Fig. 2.



Procloëon cylindroculum, sp. n. ♂ wing and genitalia, ventral.

abdomen contrast strongly with the whitish middle segments and give this insect a very attractive appearance.

Pseudocloëon sp.

Chiromo, 24–27. vii. (3 ♀). L. Nyasa, Chipoka, 6. viii. (2 ♂). Eleven miles east of Limbe, 19. viii. (17 nymphs, determination confirmed by dissection of subimaginal wing).

Pseudocloëon sp. A (nymph). (Fig. 3.)

Tengadzi Stream, 22. vii. (3 nymphs).

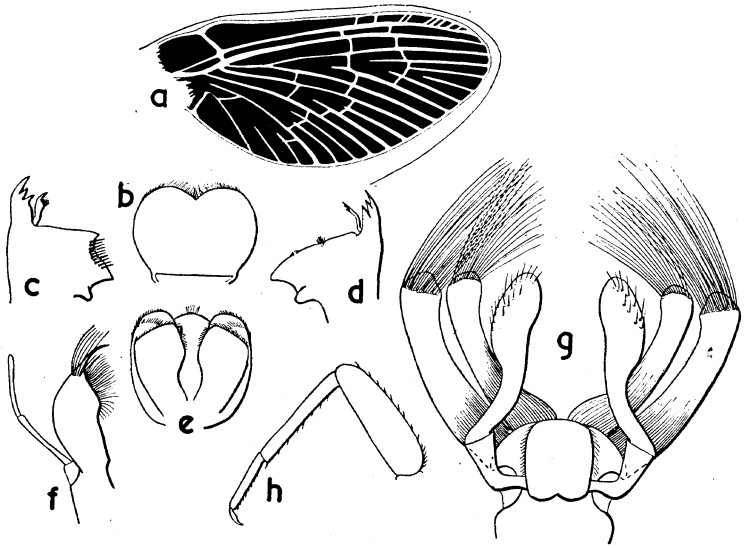
Nymph of the swimming type, fuscous, with a longitudinal, median, cream stripe on head and thorax above, and with an unusually developed labium.

Head fuscous, with a median, longitudinal, cream stripe on vertex, another whitish stripe across the frons, from eye to eye through the

antennal bases. Antennæ very pale fuscous. Mouth-parts whitish, mandibles with well-developed prosthecæ, outer canines acutely denticulate. Maxilla with a very slender, two-segmented palp, the blade of the maxilla terminating in a slender, acute claw, the apex and inner margin of the blade fringed. Labium very unusual in form, the glossæ and paraglossæ extended in long, divergent fingers, their apices crowned with a ring of wide-spreading, long, fine setæ. The palpi are three-segmented, segments two and three fused to form a club, basal segment abruptly angled so that the apices of the palpi rest between the divergent glossæ.

Pronotum fuscous, with a longitudinal, median, cream stripe and a narrow, whitish, lateral border. Mesonotum and wing-pads fuscous,

Fig. 3.



Pseudocloëon sp. A (nymph). Wing-venation, mouth-parts and leg. *a*, wing ; *b*, labrum ; *c–d*, left and right mandibles ; *e*, hypopharynx ; *f*, maxilla ; *g*, labium ; *h*, leg.

the former with a continuation of the median cream stripe. No hind wing-pad. Legs whitish, femora with the upper margins bearing a sparse double row of spines.

Abdomen with seven pairs of flat, oval gills, anterior pair small, tracheæ visible, not heavily branched. Abdominal tergites fuscous, the median cream line a little less conspicuous than on the thorax, and bordered on each side with darker fuscous on the second to seventh tergites. Apical margins of each tergite finely toothed. Cerci whitish, median caudal appendage present.

Length of nymph (? penultimate instar), 4 mm.
Length of cerci, 1·5 mm.

The development of the labium in these nymphs is most striking. At first sight it is not easy to decide which of the processes are the labial palpi, and it is difficult to suggest a reason for such development. The nymph figures by Crass as *Pseudocloëon* sp. shows a probable stage in the evolution of this type of labium. Here the glossæ and paraglossæ are somewhat lengthened and tufted apically and the palpi have clavate, fused apical segments. In his species, however, the labial palpi are not angled inwards, the maxillary palpi are three-segmented and the prosthecæ of the mandibles are much less developed. The nymphal wing-pad, while showing the general arrangement of the wing-venation, is not sufficiently developed to show any marginal intercalaries.

Baëtis sp.

Chiromo, 27. vii. (1 ♂).

Baëtis sp.

Thirteen miles east of Fort Johnston, 7. vii, 11. viii. (13 nymphs). Tengadzi, 22. vii. (21 nymphs). Stream 22 miles north of Chiromo, 24. vii. (14 nymphs). Mt. Zomba, Mlunguzi Stream, 15. viii. (1 nymph). Mt. Mlanje, Likabula Stream, 19. viii. (3 nymphs). Eleven miles east of Limbe, 19. viii. (2 nymphs).

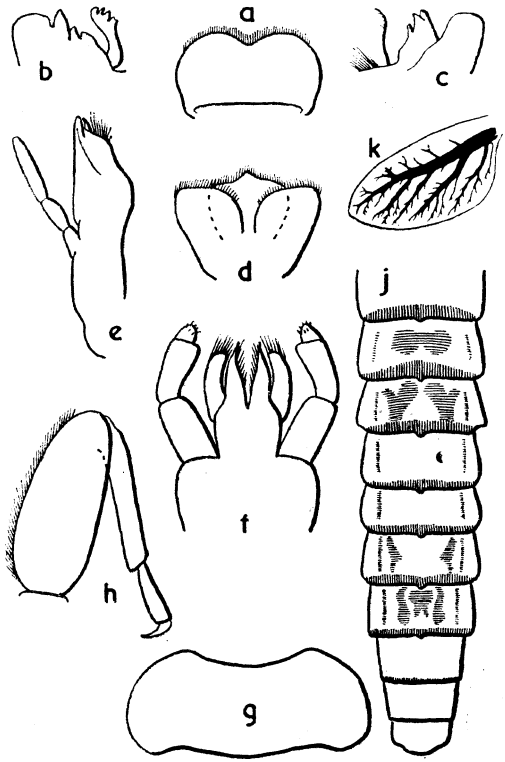
Baëtis sp. A (nymph). (Fig. 4.)

Stream 13·5 miles east of Fort Johnston, 7. vii. (1 nymph). Stream 19 miles north of Chiromo, 24. vii. (4 nymphs). Mt. Zomba, Mlunguzi Stream, 15. viii. (2 nymphs). Mt. Mlanje, Likabula Stream, 19. viii. (1 nymph).

Nymph of the dorso-ventrally flattened, crawling type. General colour of the full-grown nymph fuscous above, pale luteous beneath. Head flattened, posterior margin overlapping the pronotum ; eyes black, turbinate eyes of the male appearing very dark brown. Antennæ very pale fuscous. Mandibles with prosthecæ, that of the right very slender ; outer canines blunt. Maxilla with two-segmented palpus. Labium with apices of glossæ produced a little beyond paraglossæ, tapering to a narrow pointed apex, armed with a short spine. Third segment of palpus small, rounded, narrower than apex of second segment. Pronotum about three times as broad as long, narrowed anteriorly, posterior angles rounded, slightly produced caudad and extending beyond shoulders of mesonotum. The thorax is mottled with underlying tints of reddish castaneous. Wing-pads fuscous, hind wing present but small. Legs pale fuscous, femora with ventral surface pale luteous, apices piceous ; tibiæ also with piceous apices, tarsi with a broad, pale luteous, median ring. Anterior femur with dorsal margin gently convex. Metanotum and first seven abdominal tergites with centre of apical margin more or less produced in a short truncate tooth. Seven pairs of pale, single gills, rather elongate, anterior margin straight, posterior convex, tracheæ blackish, strongly branched caudad. Dorsum of abdomen yellowish

fuscous, with underlying tinges of reddish orange, the apical margins dark reddish purple, second to seventh tergite each with a reddish purple line on each side towards the lateral margins, segments two, three, six and seven with more extensive markings of the same dark colour, giving the appearance (to the naked eye) of two dark bands across the abdomen. Median caudal filament present, cerci fringed internally, light fuscous, paler basally.

Fig. 4.



Baëtis sp. A. (nymph). *a*, labrum; *b–c*, apices of left and right mandibles; *d*, hypopharynx; *e*, maxilla; *f*, labium; *g*, outline of pronotum; *h*, leg; *j*, abdomen, dorsal; *k*, gill.

Length of mature nymph (without cerci) ♂, 5 mm., ♀, 6·25 mm.
Length of cerci ♂, ♀, 5 mm.

Examples in the British Museum (Nat. Hist.) and University of Florida. These nymphs resemble superficially those of *Acentrella* sp., with which they occurred in some localities. The main differences are the presence of a median caudal filament, broader and more flattened head and thorax, the shape and colour of the gills and the shape of the anterior femur. They also resemble the nymphs of *Baëtis cataractae* Crass, but in this species the mandibles are said to be without prosthecæ.

A third example from Mt. Zomba, Mlunguzi Stream, is referred here with some doubt. The abdominal pattern, dorsal spines and shape of gills agree reasonably well, but the median caudal filament is missing. The nymph is almost mature (although the wing-pads have not darkened, the wings within are folded), and it is possible that the median filament may have accidentally lost and has not had time to be regenerated.

Fig. 5.

Acentrella sp. A (nymph). *a*, labrum ; *b–c*, left and right mandibles ; *d*, hypopharynx ; *e*, maxilla ; *f*, labium ; *g*, outline of pronotum ; *h*, leg ; *j*, abdomen, lateral.

Acentrella sp. A (nymph). (Fig. 5.)

Mt. Zomba, Mlunguzi Stream, 15. viii. (1 exvium of nymph). Mt. Mlanje, Likabula Stream, 19. viii. (2 nymphs).

Nymph of the crawling type, body rather dorso-ventrally compressed. General colour of mature nymph fuscous above, creamy beneath. Head

and thorax mottled with paler fuscous. Antennæ fuscous, about as long as head and pronotum. Maxillary palpus two-segmented, short and stout. Labial palpi three-segmented, terminal segment semicircular, narrower than second segment, which projects on its inner surface. Pronotum broad, strongly narrowed anteriorly, posterior margin straight, angles not produced backward. Legs fuscous, with paler markings on femora; anterior femur with its dorsal margin straight. Hind wing present, small. Abdomen moderately broad, tapering, fuscous, tergites four, five and eight paler. Metanotum and first six tergites with centre of apical margin produced in a raised, backwardly-directed spine. Seven pairs of single rounded gills (first somewhat reduced), in mature nymph opaque fuscous with whitish posterior margins, tracheæ with few branches. Cerci fuscous, median caudal filament reduced to a small point.

Length (excluding cerci) of mature nymph ♂, 4 mm.
Length of cerci ♂, 4·4 mm.

One nymph (in fluid), one exuvium (mounted on microscope slides) in British Museum (Nat. Hist.), one nymph (in fluid) in University of Florida.

Centroptilum loweae Kimmins.

L. Nyasa, Chipoka, 6. viii. (1 ♂ imago, 1 ♂ subimago). Ntundu, 7. viii. (2 ♂ imagines).

Distribution.—Nyasaland.

Centroptilum falcatum Crass.

L. Nyasa, Chipoka, 6. viii. (1 ♂). Ntundu, 7–9. viii. (44 ♂).

Distribution.—Natal.

Centroptilum sp. ♀.

L. Nyasa, Chipoka, 6. (viii. 179 ♀). Ntundu, 7–9. viii. (39 ♀).

Probably a mixture of *loweae* and *falcatum*.

Baëtidae nymph A, ? near *Centroptilum*. (Figs. 6–7.)

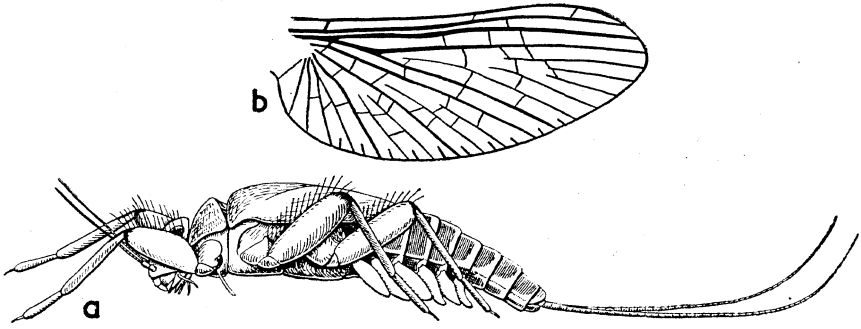
Stream 13·5 miles east of Fort Johnston, 7. vii. (1 nymph). Tengadzi Stream, 22. vii. (1 nymph ♀). Stream 22 miles north of Chiromo, 24. vii. (1 nymph ♀).

These Baëtid nymphs are distinctly atypical in general appearance, resembling more the sprawling Ephemerellid type. One of the most striking features is the arrangement of the abdominal gills, which occur on the first six segments and are situated ventrad of the lateral line of the abdomen (the gills probably pertain to the tergite but the differentiation between the tergite and sternite is obscure), and are directed obliquely downward below the abdomen. There is a slender filamentous gill at the tip of the first segment of the maxillary palpus, and two other such gills arise on the prosternum between the coxæ. The two cerci are *apparently* not fringed on their inner surfaces. Fortunately the nymphs were fairly mature and one was ready for emergence. From this, one fore

wing was extracted and spread out, revealing that the venation was clearly of the Baëtid type, with single marginal intercalaries. There is a small hind wing-pad. Comparison of the nymphal mouth-parts suggests an affinity with the genus *Centroptilum*.

Ground-colour of nymph fulvous, head and thorax with fuscous or reddish markings, abdomen more or less completely shaded with reddish purple. Antennæ slender, about as long as head and prothorax, pale fuscous. Eyes and ocelli black. Vertex of the head obscurely fuscous, clypeus, labrum and mouth-parts pale fulvous. Mandibles with outer canines blunt, prostheca of left mandible stout, right prostheca slender and sinuous. Maxilla with palpus weak, two-segmented, with a slender, filamentous gill proceeding from the tip of the basal segment. Terminal segment slender, curved, rather longer than basal segment or gill. Labium with glossæ and paraglossæ of about equal length, fringed apically with bristles. Palpi three-segmented, third segment rounded apically and more or less fused to the second segment.

Fig. 6.



Baëtidae nymph A, ? near *Centroptilum*. *a*, nymph in side-view ; *b*, subimaginal wing dissected out of nymph.

Pronotum broader than long, slightly narrowed anteriorly and with posterior margin elevated. A pair of slender filamentous gills arising from the prosternum, between the widely separated coxæ. Mesonotum dark fulvous, anterior margin reddish fuscous, and a fuscous stripe down centre of dorsum. Wing-pads of mature nymph extending back almost to apex of third abdominal tergite. Wing-pad of metanotum very small, narrow. Under surface of thorax whitish. Legs fulvous, rather stout, femora broad, apices fuscous, upper margins fringed with long setæ. Abdomen stout, tapering to apex, segments not clearly divided into sternite and tergite, but with a lateral carina down each side, below which arises, on the first six segments, a thin, ovate, whitish gill-plate, directed obliquely downward and curving beneath the abdomen. Branched tracheæ are faintly visible on each gill. Two long cerci, not noticeably fringed on inner surfaces, but fine setæ are visible in a preparation under high magnification.

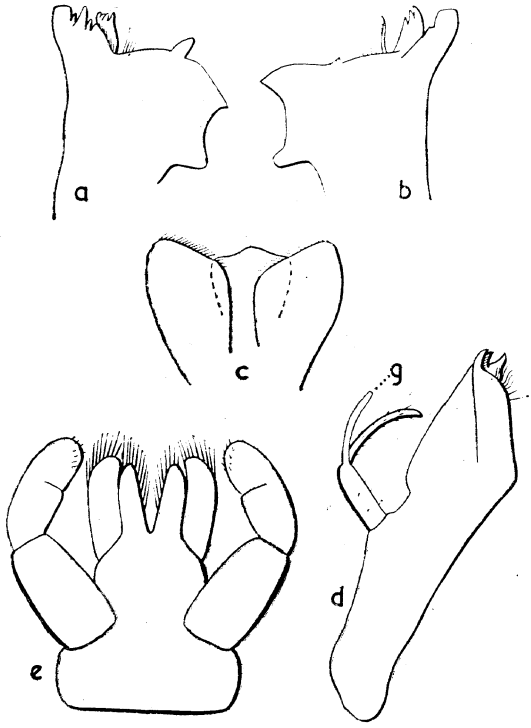
Length (without cerci) of mature nymph, ♀, 3·2 mm.
Length of cerci 2·7 mm.

One nymph (mounted on microscope slides), one in fluid in British Museum (Nat. Hist.), one in University of Florida.

Centroptiloides sp.

Shire River, Mpatamanga, 2. ix. (1 nymph).

Fig. 7.



Baëtidae nymph A, ? near *Centroptilum*. *a–b*, left and right mandibles; *c*, hypopharynx; *d*, maxilla, with palpal gill (*g*); *e*, labium.

Superfamily LEPTOPHLEBIOIDEA.

Family **Leptophlebiidae.**

Euthraulus elegans Barnard.

Chiromo, 24. vii. (1 ♀). L. Nyasa, Chipoka, 6. viii. (7 ♂, 4 ♂). Port Herald, 22. viii. (8 ♂, 2 ♀).

Distribution.—S. Africa.

Euthraulus sp.

Eleven miles east of Fort Johnston, 11. viii. (3 nymphs).

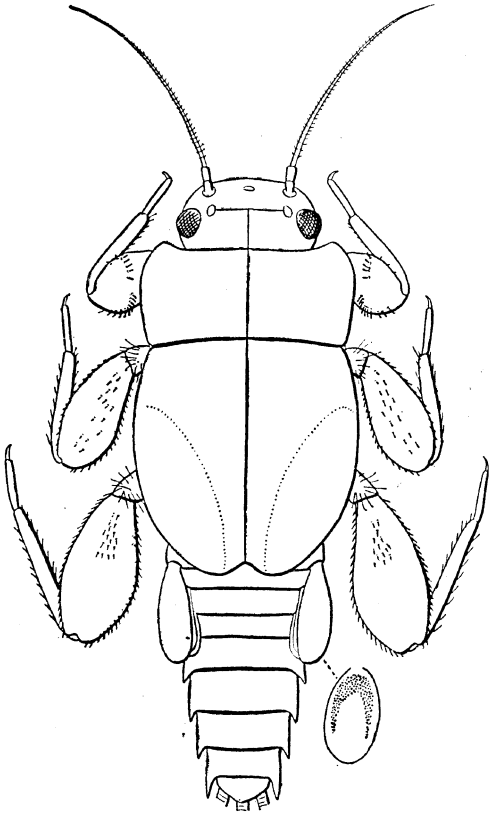
Family **Ephemerellidae.**

Ephemerellid nymph (genus uncertain). (Figs. 8–9.)

Stream 13·5 miles east of Fort Johnston, 7. vii., 11. viii. (14 nymphs).

Last instar nymph.—General colour olive-brown with underlying fuscous markings of the subimago showing through. Head with frons entirely fuscous, vertex with a fuscous reticulated pattern. Clypeus with a whitish, median, basal spot. Eyes black. Antennæ very pale

Fig. 8.



Nymph of Ephemerellidae (genus uncertain).

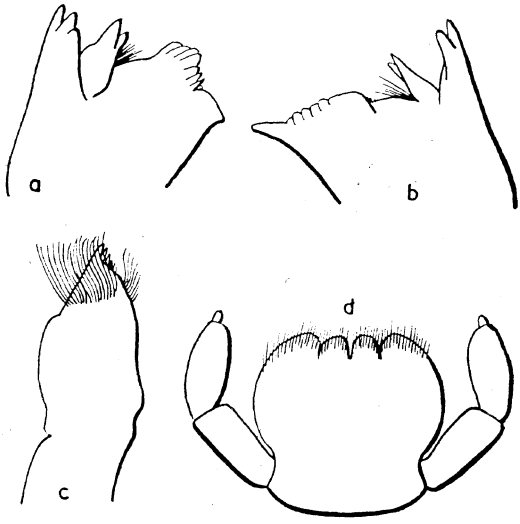
fuscous, apices of segments finely whitish. Mouth-parts whitish. Mandibles with canines acutely dentate, prosthecæ weak. Maxilla without palp, apex finely toothed, the dentition much obscured by a dense tuft of sinuous bristles. Labium with glossæ and paraglossæ much reduced, palpi with very small third segment. Pronotum flattened, transverse, anterior angles projecting and rounded, lateral margins flanged, slightly convex. Mesonotum with wing-cases fused

almost to their apices, extending to beyond the apex of the second abdominal segment, a small excision at its centre. Enclosed wing almost piceous. Wing-pad of metanotum appearing as a very small dark lobe on the margin. Legs luteous, femora broad, shaded apically with fuscous, and armed with sparse, spatulate setæ, which on anterior femur form an interrupted transverse line. Abdomen with four pairs of gills only, on segments two to five, the basal pair elongate, oval, elytroid, covering the succeeding pairs. Tergites without dorsal processes, lateral angles of tergites six to nine becoming progressively more acutely pointed.

Length (without cerci), 5·4 mm.
Length of cerci, 3·8 mm.

These nymphs differ from those of *Ephemerellina* and *Lithogloea* described by Barnard in having only four pairs of gills, the mesonotal

Fig. 9.



Nymph of Ephemerellidae (genus uncertain). *a*, apex of left mandible ; *b*, apex of right mandible ; *c*, maxilla ; *d*, labium.

wing-pads being fused almost to their apices, and the abdominal tergites not produced dorsally.

Family **Tricorythidae.**

Subfamily *Tricorythinae.*

Tricorythus maculatus Kimmins.

Ntundu, 1. viii.–10. viii. (31 ♂, 24 ♀),
Distribution.—L. Nyasa.

Tricorythus sp.

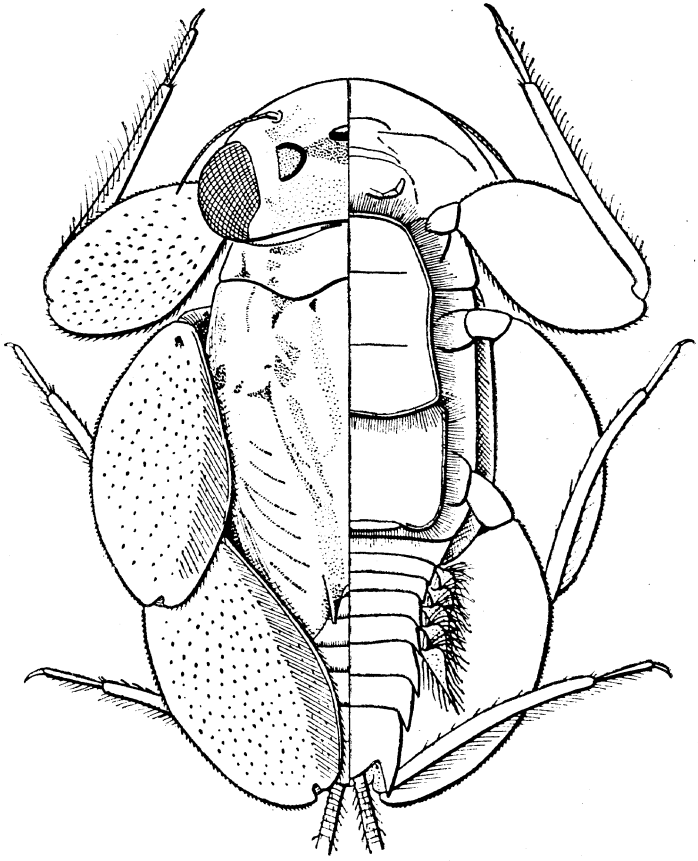
Tengadzi Stream, 22. vii. (3 nymphs). Mwanza Stream, 28. vii. (7 nymphs). Shire River, Mpatamanga, 2. ix. (5 nymphs).

Subfamily *Dicercomyzinae*.

Dicercomyzon sp. (Figs. 10–12.)

Namwere, 11. viii. (4 nymphs).

Fig. 10.



Dicercomyzon, sp. ♂, nymph. Dorsal (left) and ventral (right) aspects.

Specialized nymph of the sprawling type, convex above, flattened beneath, with thoracic sternites modified to form a "sucking-disc", femora very thin and widely dilated, five pairs of fringed gills, no median caudal appendage.

♂. *Last instar nymph*.—Head somewhat of the Heptageniid pattern, broad and flattened, eyes on dorsal surface but situated at lateral margins,

anterior margin convex, projecting beyond the labrum. Antennæ short, slender, scarcely as long as the head. Head above pale yellowish brown, with a chestnut area between the ocelli and pale fuscous markings on the vertex. Mandibles long, narrow, apparently without prosthecæ; canines short, those of the right mandible sharper than those of the left. Hypopharynx with narrow, wide-spread lateral lobes. Maxilla incurved, its apex densely fringed with curved setæ, with a small, almost obsolete, two-segmented palp. Labium with glossæ and paraglossæ fused to form a wide, truncate plate, apical margin densely fringed and with a short, narrow, median slit. Palpi short, three-segmented.

Pronotum short, transverse, pale yellowish brown, with obscure fuscous markings. Mesonotum rather convex, together with the wing-

Fig. 11.

Dicercomyzon sp. nymph. *a–b*, left and right mandibles, with apices more enlarged; *c*, maxilla; *d*, labium; *e*, hypopharynx; *f*, gill of fifth segment.

pads extending to the apex of the sixth abdominal segment, and completely hiding the metanotum, which is without wing-pads. Apices of the fore-wing pads rounded, separated by a triangular excision, the sides of which are elevated and produced tailward in two small acute teeth. Ground-colour of the mesonotum pale yellowish brown, with pale fuscous markings as shown in fig. 10. Some of the wing-veins and the costal margin are purplish black. Ventrally the central area of the thorax is bordered by a narrow, raised ridge, densely fringed with soft hairs, the pro- and mesosterna separated from the metasternum by a similar transverse ridge, the whole clearly forming a "sucking-disc", enabling the nymph to adhere more easily to stones in swift water. Legs with the femora very thin and wide, their upper margins overlapping

the body and probably assisting in deflecting the current over the body and away from the vulnerable junction of body and stone. Tibiæ and tarsi slender. Abdomen short, tapering, lateral angles of the segments towards the apex becoming progressively more produced in acute points. Centre of dorsal surface somewhat elevated in a median ridge, margins finely spinose. Five pairs of gills, situated on segments two to six, greyish, semi-cordate, the lobe projecting anteriorly, margins with long dense finger-like fringes. Cerci two.

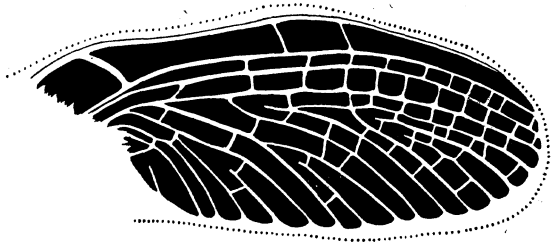
Length (without cerci), 3·8 mm.

Length of cerci (incomplete), 6 mm. or more.

Examples in the British Museum (Nat. Hist.) and University of Florida.

At first glance this nymph appears to be an Heptageniid with rather unusually dilated femora, but the mouth-parts prove to be very differently formed, the gills are merely fringed, not lamellate with a gill-tuft beneath,

Fig. 12.



Dicercomyzon sp. Nymph. Venation of fore wing.

and there is only one pair of wings. The general form of the mouth-parts recalls that of the Ephemerellidae, but the nymphs differ from that family in the structure of the gills and the absence of the hind wing.

The genus *Dicercomyzon* was described briefly by Demoulin (1954, Inst. R. Sci. nat. Belg., Bull. 30, 6, pp. 1–4, 1 fig.) in a preliminary note. I believe that the present examples will prove to be a different species, but in the absence of the adult it seems wiser to leave them without a specific name. The genus appears to be widely distributed in Central Africa, since Demoulin's material is from the Belgian Congo, and Dr. M. T. Gillies has sent me nymphs of possibly two species and the adults of one of them, from Amani, Tanganyika Territory. This material will be dealt with in a subsequent paper.

Superfamily CAENOIDEA.

Family **Caenidae.**

Caenis cibaria Eaton.

L. Nyasa, Chipoka, 6. viii. (numerous ♂ ♀).

Distribution.—L. Nyasa.

Caenis sp.

Mpatamanga, 12. vii. (2 ♀).
Stream 20 miles north of Chiromo, 24. vii. (6 ♀).

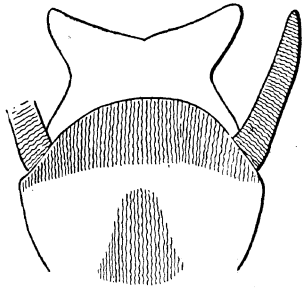
Caenis berneri, sp. n. (Fig. 13.)

Caenis sp. ?*kungu* Eaton, Kimmins, 1949, Ann. & Mag. Nat. Hist. (12), i, pp. 833.

L. Nyasa, Chipoka II, 14. viii. 1946, 0700 hours, R. H. Lowe (4 ♂). L. Nyasa, Chipoka, 6. viii. (32 ♂, 12 ♀). Gandi, Elephant Marsh, 17. vii. (2 ♂).

♂. Head medium fuscous, posterior ocelli ringed with black, eyes purplish black. Antennæ whitish, faintly annulated with fuscous at the joints. Pronotum medium or pale fuscous, mesonotum shining yellow-brown or brown, sides with obscure blackish marks over the coxæ. Legs whitish, femora striped longitudinally with fuscous. Wings greyish

Fig. 13.



Caenis berneri, sp. n. ♂ genitalia, ventral.

hyaline, costal margin purplish. Abdomen translucent whitish, tergites one to three and eight to ten shaded with purplish grey, the intervening tergites also sometimes very feebly marked with grey. Sternites faintly fuscous, forceps-base marked with fuscous in a more or less distinct fashion. Cerci white, forceps and base yellowish brown or fuscous. Forceps-base broadly rounded, its apical margin fuscous and with a sub-triangular fuscous spot at its base. Forceps short, stout, slightly tapered. Penis flattened, upturned at its apex, with two widely divergent lobes.

♀. Larger and rather paler, mesonotum usually with yellowish markings Abdomen yellowish white before oviposition, with grey markings dorsally, most pronounced at base and apex. Cerci white.

Length of wing, ♂ 2–3 mm., ♀, 2·6–3·2 mm.

Holotype ♂, allotype ♀ (in fluid) and paratypes in British Museum (Nat. Hist.), paratypes also in University of Florida.

This species somewhat resembles *C. kungu* Eaton, but differs in having the abdomen marked with grey and in the more divergent lobes of the penis, which are not separated by a narrow median excision. There

appear to be two forms of this species, one being larger and paler than the other, but I can see no appreciable difference in the male genitalia. The specimens of the type-series are not in good condition. They were mixed with a long series of *Caenis cibaria* Eaton, and in the course of their travels had become seriously interlocked and were separated only with some difficulty and damage. It is possible that some may have been collected in spider's webs, as there seemed to be strands of silk entangled with the specimens.

Caenis sp.

L. Nyasa, South shore, 14. vii. (1 nymph). Gandi, Elephant Marsh, 17. vii. (2 nymphs). Tengadzi Stream, 22. vii. (2 nymphs).

Superfamily EPHEMEROIDEA.

Family **Ephemeridae.**

Ephemera natalensis Barnard.

L. Nyasa, Chipoka, 6. vii (4 ♂, 6 ♀ subimagines). Ntundu, 7–12. viii (35 ♂, 23 ♀ imagines, 10 ♂, 22 ♀ subimangines).
Distribution.—Natal, Nyasaland.

Eatonica schoutedeni Navás.

L. Nyasa, Chipoka, 6. viii. (2 ♂). Ntundu, 9–12. viii. (2 ♂, 1 ♀ imagines, 5 ♂, 2 ♀ subimagines).
Widely distributed in Africa.

Family **Polymitarcidae.**

Povilla adusta Navás.

Ntundu, 7. viii. (2 ♂, 4 ♀).
Distribution.—Central Africa.

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