

The larval and pupal stages of *Ugandatrichia* Mosely (Trichoptera: Hydroptilidae) from Rhodesia, with the description of a new species

by

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ABSTRACT

A new species of *Ugandatrichia* Mosely, *U. rhodesiensis* (Hydroptilidae), is described from the Chimanimani National Park in Rhodesia, as are its larval and pupal stages. The larval and pupal stages of this genus were previously unknown, as are the immature stages of *Microptila* Ris, with which it may be synonymous. The relationships of the young stages are briefly discussed.

INTRODUCTION

The specimens described in this paper were collected in the mountains in the Chimanimani National Park near Melssetter in eastern Rhodesia, by Professor (then Dr) A. D. Harrison, who kindly submitted the Trichoptera to me for identification. Dr Harrison informed me (*in litt.* 3.vi.1963), that these mountains are composed largely of old quartzites, and that the water coming from them is acid as in the Western Cape mountains (pH 5,6; conductivity 6,8). The water is clear in the main river and brown in the small side streams.

The collection included imagos, larvae and pupae of two species of Hydroptilidae, one in the genus *Ugandatrichia* Mosely (given as a synonym of *Microptila* Ris by Schmid, 1960), and one in *Afritrichia* Mosely, synonymized with *Stactobia* McLachlan, also by Schmid (1959). Both are hydropetric species, inhabiting waterfalls on the Bundi River at a considerable altitude (1 580–1 700 m); both appear to be new species. The *Ugandatrichia* is described in this paper, as *Ugandatrichia rhodesiensis* sp. nov., and I hope to describe the *Afritrichia* at a later stage. These were the only Hydroptilidae represented in the collection. The larval and pupal stages of the *Ugandatrichia* are particularly interesting, not only in their own right as being most unusual, but also because the young stages of neither *Ugandatrichia* nor *Microptila* have to my knowledge as yet been described.

Note: Specimen numbers refer to collections and catalogues in the Albany Museum, Grahamstown, South Africa.

Family HYDROPTILIDAE

Ugandatrichia rhodesiensis n. sp.

MATERIAL STUDIED: Rhodesia: Chimanimani National Park, Bundi River, main waterfall (c. 1 580 m), 17 ♂♂, 4 ♀♀, on rocks beside fall and flying over it (SRE 3D(1)–3D(21)), 24 larvae of various sizes, many damaged, collected from most torrential part of fall (SRE 3G), 9 pupae collected in fall (SRE 3H), all these 19.v.1963; Bundi River, main waterfall pool, 1 ♂ 1 ♀ flying low over pool at dusk (SRE 6C, 17.v.1963); Bundi River, small waterfall about 1,6 km below main fall, 4 pupae collected in splash zone (SRE 4A, 15.v.1963); Bundi River, upper waterfall (c. 1 700 m), 1 ♀ (SRE 5A(1), 16.v.1963). Holotype ♂ (SRE 3D(1)) deposited in the Albany Museum Freshwater Collection, also ♂ paratypes SRE 3D(2)–3D(12) and SRE 6C(1); also ♀♀ SRE 3D(18)–(20), SRE 5A(1) and SRE 6C(2); also larvae and pupae. ♂ paratypes SRE 3D(16) and (17), with ♀ SRE 3D(21), larvae and pupa, to the Smithsonian Institution, Washington, D.C.; ♂ paratype SRE 3D(13) to the British Museum (Natural History); ♂ paratype SRE 3D(14) to the National Museum, Bulawayo, Rhodesia, and ♂ paratype SRE 3D(15) to the Musée Royal de l'Afrique Centrale, Tervuren.

DESCRIPTION OF ♂ HOLOTYPE (in alcohol) (Figs 1–8)

A medium-sized Hydroptilid, length of forewings 4,5 mm, dark brown in colour when first collected, possibly black in life. Insect densely hairy, dorsal surface of abdomen rather less so; forewings covered with both recumbent and stiff, thickened, erect setae; genitalia short, with blackened apices.

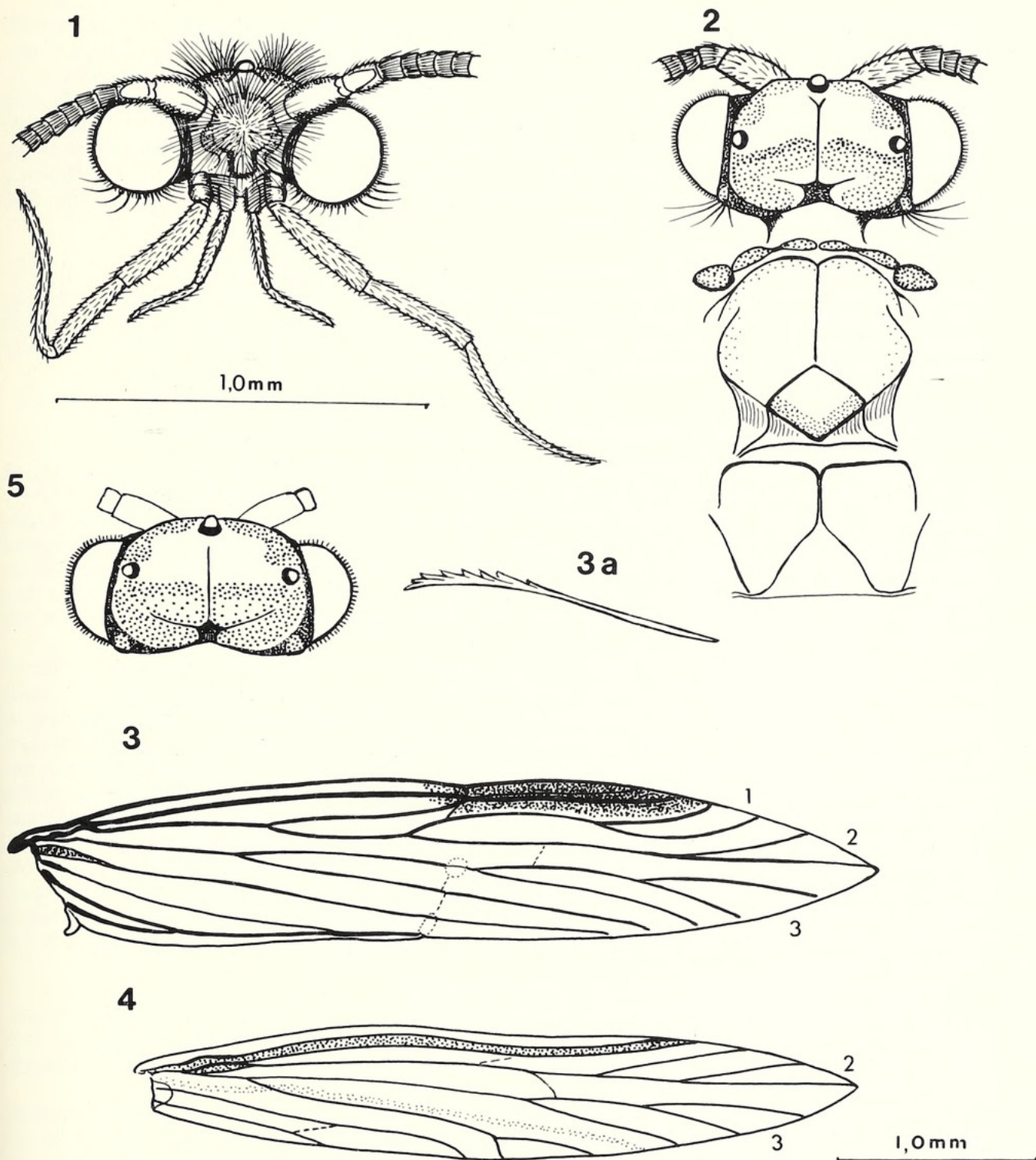
Head (Figs 1, 2): ocelli present, white ringed with dark brown to black, very conspicuous; antennae with 42 segments; eyes large, dark, pubescent; maxillary palps long, dark, first two segments very short, with inner tufts of long setae, third and fourth segments long, considerably longer than one and two together, third slightly longer than fourth, fifth longest, slender, flexible; labial palps considerably shorter, paler, with first segment small, second and third longer, subequal, third flexible.

Tibial spurs 0, 3, 4.

Wings (Figs 3, 4): forewings with forks 1, 2, 3 present; hind wings with forks 2 and 3 only. Wing membrane thickly covered with micro- and macrotrichia; forewings in addition with a dense covering of strong, erect, serrate setae (Fig. 3a). Nearly all veins in the forewing take the form of thickened, pitted bands, the pits indicating the positions of the serrate setae. Sc and Sc + R1 are particularly thick, the latter set in an apical pterostigma. This thickening makes it easy to follow the course of the veins, but the cross-veins are very difficult to distinguish except at the anastomosis where parts are clear (white). In the hind wings, which lack the erect setae, veins are narrow except for Sc + R1, which is very much broadened; there is also a brown streak between M and Cul, running close to the latter and crossing it near its base. No basal cross-veins could be found in either wing, except for one faint vein joining 1A and 2A in the hind wing. In the forewing the veins stop short of the costa along the anal margin.

Abdomen: the terga of abdominal segments II to VII each have two patches of light brown pigment near the proximal margin, on I and VIII these merge to form one diffuse patch; there is a small, pointed, sclerotized ventral process on VII.

Genitalia (Figs 6–9): (cleared in KOH and examined in clove oil), ninth segment short, partially retracted within eighth, proximally emarginate both dorsally and ventrally; a raised membranous dorsal plate with median incision occupying most of the centre, very difficult to see except in lateral view; beneath this can be seen the aedeagus (large, with central canal and an apparently membranous fringe, encircled by a coiled sheath or titillator, see Fig. 9); beneath that again lies the lower penis cover, ending in a pair of curious apical sclerotizations each bearing a



Figs 1-5, *Ugandatrachia rhodesiensis* n. sp., holotype, ♂ (SRE 3D(1)), or paratypes or ♀ if other numbers given. 1. Anterior view of head including palps and bases of antennae. 2. Dorsal view of head, pro-, meso- and metanota. 3. Forewing of paratype SRE 3D(3). 4. Hind wing of paratype SRE 3D(3). 5. ♀, SRE 3D(18), dorsal view of head.

long, horn-like seta. The distal margins of the ninth sidepieces are swollen and heavily studded with long, recurved setae; proximal to each of these on the dorsal side is a smaller, setose bulge, and towards the apex of each, on the inner side, a thumb-like spur, seen in lateral view to be down-turned. On the ventral side the inferior appendages are widely divergent, each terminating in a blackened median boss or knob, and an outer membranous lobe set with large blade-like setae; the appendages themselves are ventrally pubescent and thickly covered with longer setae. Within each a large, stout seta can be seen by transparency. The base of the segment shows a deep, U-shaped emargination, the ninth sternite being narrow. ♂ genitalia are more or less symmetrical, but not entirely so in details.

Comparison with ♂ paratypes

The ♂ Holotype and the 17 ♂ paratypes are all very similar in general appearance, but differ slightly in size, wing length (forewing) ranging from 3,5 to 4,5 mm, and the antennae having from 42 to 45 segments. In most specimens the genitalia are deeply retracted into the eighth segment, or even both eighth and ninth retracted within the seventh; the aedeagus is usually exerted. The shape of the sidepieces varies with the state of retraction of the genitalia.

DESCRIPTION OF ♀ PRESUMED TO BELONG TO ♂ (in alcohol) (Figs 5, 10)

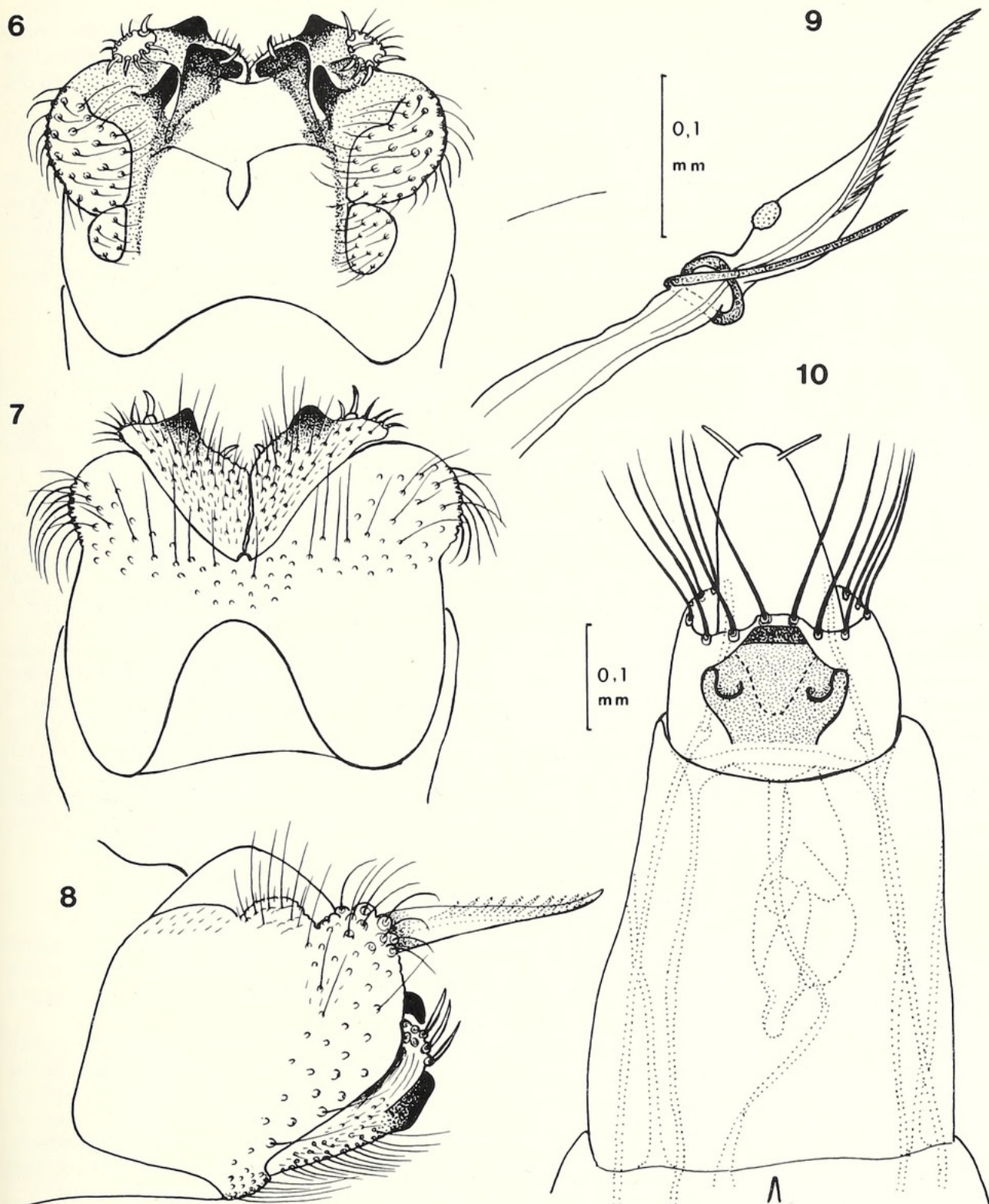
Similar to ♂ in general appearance, also very hairy, size variable as in ♂, description based on the six specimens available. It has been assumed that these are probably the females of *U. rhodesiensis* since they were the only females of the genus *Ugandatrachia* taken, and were taken with the males, but there is as yet no proof. The females show several minor but constant differences from the males. The antennae are shorter (c. 36 segments), and have a conspicuous white section from about segment 13 to 25; the head warts, although very similar, differ in that the basal warts are completely separated (cf. Figs 2, 5); there are also small differences in the proportions of the wing veins.

Abdomen: not as hairy as in the ♂ except apically, where there is a very thick fringe of terminal dorsal and lateral setae on VIII, within which is a circle of widely spaced movable setae round the apex of IX; these may be closed inwards or spread widely outwards like the spokes of an open umbrella (see Fig. 10). In preserved specimens the ♀ genitalia may be so tightly tucked in that the ends of these dense fringing setae are tucked in too, making it difficult to elucidate the genitalia. The abdomen shows the same paired brown patches on the terga as in the ♂, but on the venter there is a thin scattering of brown microscales not seen in the ♂, and the eighth sternite has a large apico-median area densely furred with short setae. There is a small sclerotized process on the seventh sternite. Eighth segment long, ninth short, with a somewhat urn-shaped ventral plate, clearly visible in uncleared specimens. Tenth segment very lightly chitinized, with oval apex bearing a pair of slender rod-like processes. VIII, IX and X appear to be supported by an internal framework of sclerotized rods as indicated in Fig. 10. Vagina etc. visible by transparency, lying within the framework.

Comparison with Mosely's species of Ugandatrachia

The genus *Ugandatrachia* was described by Mosely (1939) from East Africa, including three species, *U. minor*, ♂, from Thompson's Falls, 7 500 ft., N. of Nakuru, Kenya; *U. nigra*, ♂ and ♀, from Namwamba Valley, 6 500 ft., Ruwenzori, Uganda, and *U. acuta*, ♀ only, from Chania Falls, 4 000 ft., near Nairobi, Kenya.

The present species, *U. rhodesiensis*, clearly falls into the same genus, but does not appear to be any of Mosely's species. The wings of both ♂ and ♀ closely resemble those figured for *U. minor* and *U. acuta*, being closer to the latter in shape, and differing from both only in the thickened pterostigma and the virtual absence of basal cross-veins. In size, and in structure of ♂ genitalia, *rhodesiensis* is close to *nigra*, though showing differences in the wide U-shaped proximal emargination of the ninth tergite and sternite, the expansion of the apico-lateral margins



Figs 6–10, *Ugandatrachia rhodesiensis*, figures of genitalia. 6–8, holotype, ♂, SRE 3D(3). 6. ♂ genitalia, dorsal view, tilted obliquely so that the parts do not obscure one another; aedeagus omitted. 7. ♂ genitalia, ventral view. 8. ♂ genitalia, lateral view. 9. ♂ genitalia: dorsal view of aedeagus (taken from SRE 3D(2), as that of holotype has the titillator uncoiled and atypical). 10. ♀, SRE 3D(18), ventral view of segments VII–X, showing ♀ genitalia (dense fringe of setae surrounding VIII omitted).

of the side-pieces, and in details of the structure of the other parts, including the aedeagus. The ♀ is much closer to *acuta* than to the ♀ of *nigra*, possessing a similar ventral plate, and lacking the forked ventral process of *nigra*. It differs from *acuta* both in the shape of the ventral plate and the absence of the paired ventral patches of scales.

Taken all in all, *rhodesiensis* definitely appears to be a new species, and has been named after its country of origin.

I am aware that Schmid (1960) has synonymized *Ugandatrichia* with *Microptila* Ris, and he may well be correct, although there do appear to be constant differences in wing venation and details of genitalia. I am, however, retaining *rhodesiensis* in *Ugandatrichia* for the present on account of its most interesting and unusual larval and pupal stages, described below. Once the immature stages of *Microptila* have been discovered, the matter can doubtless be satisfactorily settled.

THE IMMATURE STAGES OF *UGANDATRICHIA RHODESIENSIS* n. sp. (Figs 11–22)

When the imagos of this species were collected by Dr Harrison, the young stages were fortunately collected at the same time, mainly from the most torrential parts of the waterfall on the Bundi River. This material comprised 24 larvae, including several different instars, and 13 pupal cases. Of the latter, two of the cases contained prepupal larvae, the same as those collected with them, nine contained immature pupae, together with larval sclerites evidently belonging to the same larvae, one was empty, and one contained a mature ♂ pupa, disclosing genitalia like those of the *Ugandatrichia rhodesiensis* described above, and together with them the same larval sclerites. Thus there is a positive and complete correlation between the larvae, pupae and ♂ imagos of *Ugandatrichia rhodesiensis*.

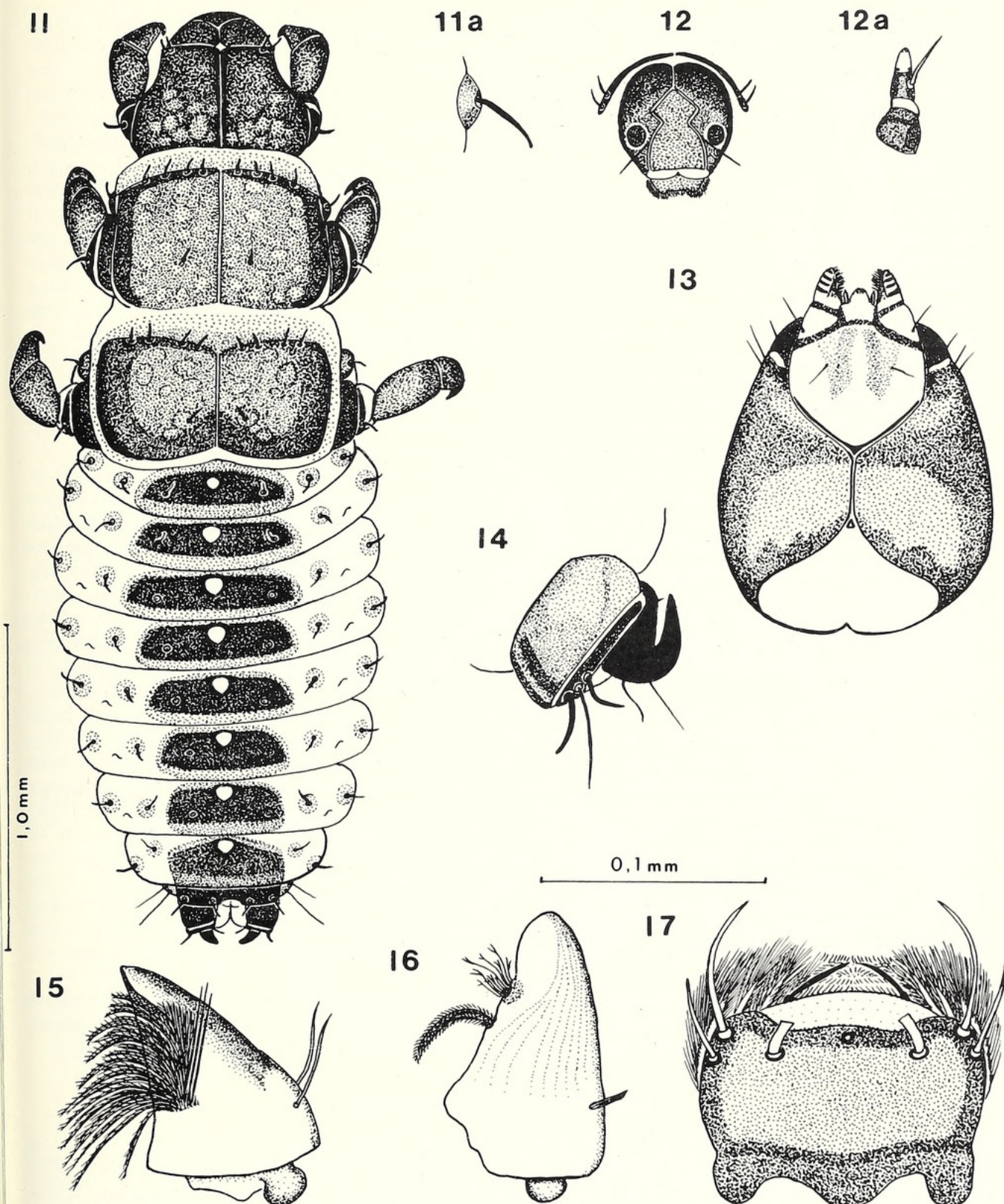
The Trichoptera may be divided into two groups, one with free-living larvae, the other with larvae which construct cases in which to live. The Hydroptilidae are unique among the Trichoptera in that they are free-living in the first five instars, but make cases at the beginning of the sixth and last instar, in which they live, and which they usually modify for pupation. The larvae of *Ugandatrichia rhodesiensis* are therefore particularly interesting because, although Hydroptilids, they are evidently free-living at all stages, and that under the most stringent of living conditions, only making cases when ready to pupate. No doubt in response to their torrential habitat, the larvae are strong, stout and muscular, resembling beetle larvae (particularly those of the Coccinellid *Vedalia*) rather than Trichoptera in general appearance.

DESCRIPTION OF MATURE LARVA

(In alcohol. Figs 11–20). Length 2.5–3.0 mm, abdomen up to 0.8 mm across widest part (segments II–IV); abdomen gradually tapers from IV to VIII, but IX is considerably narrower than VIII. Larvae are blackish in dorsal view as they are heavily sclerotized and all sclerites are dark brown to black in colour.

Head (Figs 12, 13): small, smooth, oval, black; eyes large, dark brown, within paler area and under lens-like modifications of cuticle; frontoclypeus with one pair of deep lateral indentations and seven pairs of setae, sutures, including frontoclypeal stem, clearly marked; tentorial pits obscure, probably due to heavy sclerotization. Antennae (Fig. 12a) situated next to anterolateral corners of frontoclypeal apotome; well developed, with two sclerotized segments, the apical one bearing a seta, and a membranous tip. Ventral surface of head with anterior and posterior ventral apotomes very small, former very narrow with long, slender anterior arms.

Mouthparts (Figs 13, 15–17): labrum large, dark, with two pairs of long dorsal setae, a median short pair (either truncated or broken), and a slender anterior pair (shown black in Fig. 17



Figs 11–17, *Ugandatrachia rhodesiensis*, mature larva. 11. Habitus drawing of mature larva (composite drawing from several mature specimens). 11a. Modified seta, further enlarged. 12. Dorsal view of head, anterior margin of pronotum also shown. 12a. Antenna further enlarged (same magnification as mandibles and labrum). 13. Ventral view of head. 14. Right anal proleg, including claw; lateral view. 15. Left mandible. 16. Right mandible. 17. Labrum: dorsal view.

but actually colourless); extremely dense bushes of setae, apparently arising from basal stems, beneath labrum. Labium with large, clearly visible, maxillary and labial palps. Mandibles with blunt apex, no lateral teeth; left mandible with dense inner brush of feathered spines, also several plain spines and two outer setae; right mandible ridged, with long, apparently double, feathered inner spine and a tuft of shorter bifid spines, also a thick, short outer seta, possibly broken off.

Thorax (Fig. 11): pronotum divided longitudinally, black in colour, narrowed anteriorly, forming a collar round back of head and terminating in triangular antero-lateral points, each bearing two modified setae; there are also four pairs of modified setae towards the middle of the pronotum. Meso- and metanota blackish, also longitudinally divided; they have four pairs of modified setae along the anterior margin and one median pair. All three nota show obscure muscle marks, more evidenced by smooth texture than by a change in colour, though the whole central part of both meso- and metanota is somewhat lighter in colour than the margins, being brownish black rather than shining black. This is more noticeable in the younger of the large larvae than in the oldest ones, in which the sclerites tend to be mainly shining black. Anterior to both meso- and metanota there is a band of sclerotized points. Thoracic nota, bases of legs, and abdominal sclerites bear modified setae, black in colour, thicker than normal, comparatively short, usually curved, blunt-ended and conspicuous (see Fig. 11a); main positions of these setae indicated in Fig. 11. There are also a few small, inconspicuous, colourless, normal setae, not shown in the figure. Thoracic sterna entirely membranous, strongly muscular.

Legs (Figs 18–20): stout, powerful, sclerites blackish, a large modified seta on outer side of coxae, rest of setae comparatively few and small, shown in the figures. Coxa large; trochanter divided, with short blade-like setae; femora large, with a few blade-like setae, fine fringing setae along dorsal margin, and small patches of setulae in the case of mid- and hind legs (also present on trochanter in mid-leg and, in hind leg, on both trochanter and coxa); tibiae and tarsi evidently fused to form a single stout joint, which bears a few dorsal fringing setae in addition to two pairs of long, blade-like setae just proximal to the claws (these are shown double in Fig. 19, of the mid-leg; they are also paired in fore- and hind legs). Pleural sclerites black, comprising pre-episternum (first pleural sclerite), second pleural sclerite and epimeron; the last bears a modified seta.

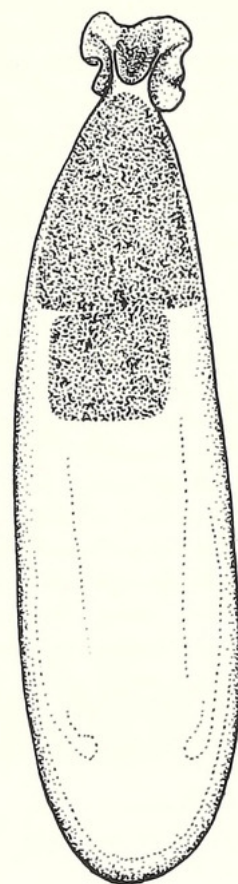
Abdomen (Fig. 11): gills absent; no anal gills visible. All abdominal segments with large sclerotized tergites, mainly black in colour, with brownish border, a few obscure muscle marks and a central clear spot, oval in shape. Each tergite bears a pair of modified setae and at least three pairs of small, colourless ones. Tergite on IX lacks central clear spot and has an emarginate posterior border, bearing three pairs of large modified setae in addition to the usual pair. The tergite on each segment from I to IX is flanked on each side by two small, round, brownish or blackish sclerites, each bearing a modified seta (Fig. 11a); in the case of IX these sclerites are small and contiguous with or fused to IX, being situated at the posterolateral corners of the tergite. The abdominal segments are clearly demarcated and strongly muscular. On the ventral side of the abdomen, which is dorsoventrally flattened and evidently modified for clinging to the rocks, each segment from II to VIII bears what appears to be a pair of suction pads or suckers, close to the lateral margins.

Anal prolegs (Fig. 14): short, stout, each with a large, partly blackened lateral sclerite, distal to which is a second, narrow, inturned black sclerite bearing two modified setae, between which is a longer, normal one. Anal claws simple, large, hooked, bearing a few small colourless setae.

EARLIER LARVAL INSTARS

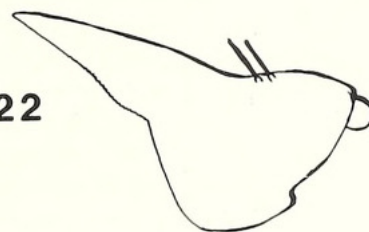
Most larvae appear to be in their final or penultimate instar (though the abdomen may be in various stages of expansion), but there are also two younger larvae, which could be in their third and fourth instars respectively; it is these which are particularly reminiscent of *Vedalia* larvae.

21



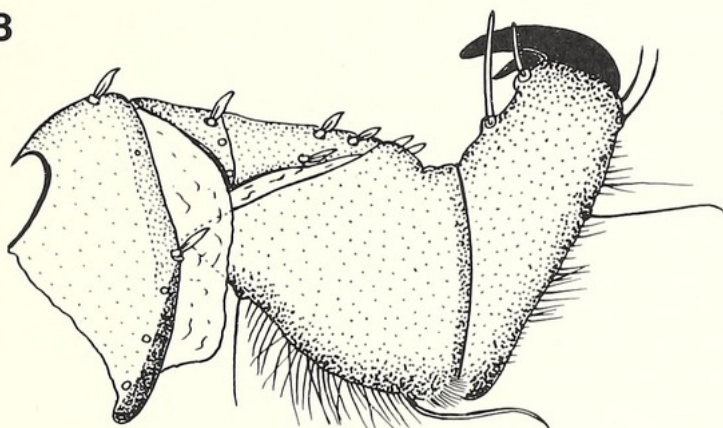
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22

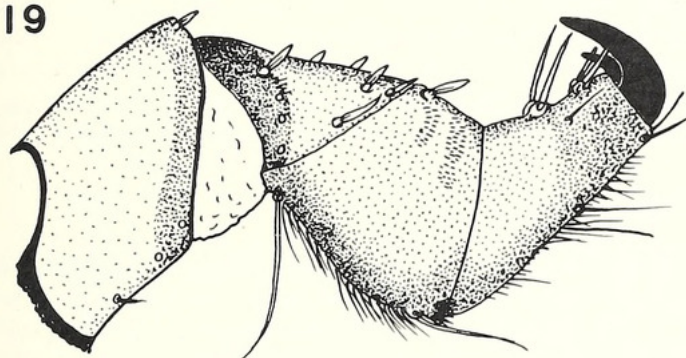


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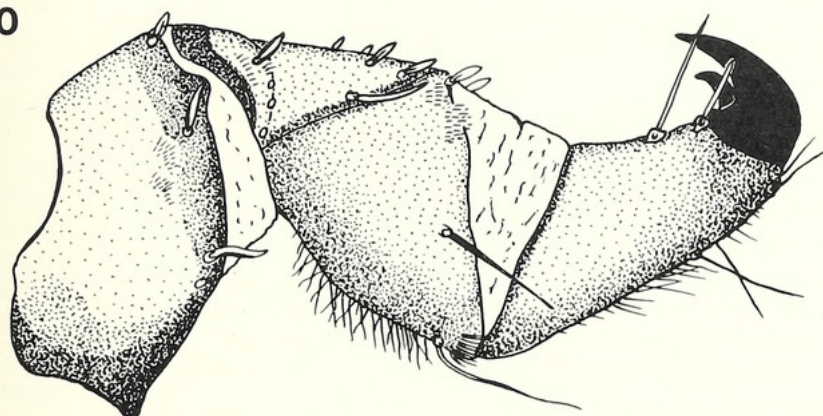
18



19



20



0,1 mm

Figs 18–22, *Ugandatrachia rhodesiënsis*, mature larva and pupa. 18. Right fore-leg of larva: median view. 19. Right mid-leg: median view. 20. Right hind leg: median view; shown extended, with large membranous area visible between femur and tibio-tarsus. 21. Pupal case (showing position of pupa and larval sclerites through case). 22. Mandible of pupa.

Both are basically similar to the mature larvae in appearance, but show the following differences: colour of sclerites brown, not black; thoracic nota each a single sclerite, undivided; modified setae present but relatively larger; each abdominal segment with only one pair of setate lateral sclerites flanking the tergite, not two (and these lateral sclerites are long and oblong or oval, not round); abdominal tergites plain brown, with central spot only faintly visible, as is also a pair of lateral spots (possibly muscle marks, faintly seen as such in older larvae); limb claws and anal claws as in mature larvae, but latter relatively larger.

DESCRIPTION OF PUPA

The pupal material included prepupae, immature pupae, and one mature ♂ pupa, all in cases. Larval sclerites were present within the cases in all instances.

Pupal case (Fig. 21): although the larvae are free-living, they pupate in cases. These cases are made of secretion, are tough and parchment-like in texture, and semi-transparent, so that the black larval sclerites (retained in case) and outline of the pupa can be distinguished through the wall. The cases are sac-like in shape, tubular, not flattened, and anchored to the substratum by a holdfast at one end only.

Pupa (Fig. 22): of usual Hydropsilid type; antennae, palps, tibial spurs as in adult. Dorsal abdominal sclerites all very small in size, rounded to oval in shape, with minute teeth or scabrosities, present on abdominal terga as follows: on abdominal segments III, IV and V, paired pre- and postsegmental sclerites; on segments VI and VII, paired presegmental sclerites only. Mandibles (Fig. 22) blade-like, with rounded base, blade with microscopical serrations along the proximal part, two short, blunt setae on outer margin of base; labrum rounded, not sclerotized.

DISCUSSION

On searching through the literature to find accounts of other free-living Hydropsilid larvae, the only genus that I encountered whose larvae seemed to bear some similarity to those of *Ugandatrichia*, was *Alisotrichia* Flint, a New World genus from Central America and the Caribbean islands. Flint has placed *Alisotrichia* in his subfamily Leucotrichinae (Flint, 1970), and regards it as a unit on its own within that subfamily, chiefly because of its larvae and larval habits, having found them to be unique in that the larvae appear to be free-living up to the end of the last instar; they then spin a silken shelter within which they pupate. The larvae are thus free-living until pupation, just as in the case of *Ugandatrichia*. Whether *Ugandatrichia* larvae spin a shelter under which to pupate or not is unknown, but the form of the pupal case (quite unlike that of *Alisotrichia*) seems to render this unlikely, as it is complete in itself, with its own holdfast.

Dr Flint very kindly sent me some *Alisotrichia* larvae for comparison, and they certainly show strong similarities to—and differences from—those of *Ugandatrichia*. The similarities could well be due, in part at least, to a similar mode of life, as Dr Flint informed me (*in litt.* 15.4.75), that *Alisotrichia* larvae are primarily hydropetric. These resemblances include the habitus of the larvae, the strong limbs, the stout modified setae, the muscular abdomen with sclerotized tergites, the lateral abdominal setate sclerites, and the stout anal claws. Differences are more difficult to define, as a number of species of *Alisotrichia* are known in the larval stage and they cover a wide range of forms, as indeed do the adults; in fact Dr Flint (1970) suggests that they may eventually prove to include several different genera or subgenera. Thus the various features seen in *Ugandatrichia* seem to be found in one or another species of *Alisotrichia*, though not all together. There do, however, seem to be some valid generic differences, which include the following points: in *Ugandatrichia* the head sutures are well developed; the abdominal tergites have a central clear spot instead of a dark area with three pores, and have paired lateral setiferous

sclerites, not single ones (except in the young instars); the legs are much more powerful, and have the tibiae fused with the tarsi; the abdomen appears to have paired ventral suckers, the anal prolegs are short, not long, and the anal claw lacks the enlarged seta.

Imagos of the two genera also show certain resemblances; in both genera there are ocelli, and possible spur counts in *Alisotrichia* include 0, 3, 4. The pronotum in *Ugandatrichia* is not, however, produced dorsally, the mesoscutellum lacks a transverse suture, and the ♂ genitalia are much less complex than most *Alisotrichia* species, though not so far from *A. hirudopsis*. On the other hand, there are two very striking differences: *Alisotrichia* ♂♂ have strongly modified, enlarged, antennae and maxillary palps, quite unlike the simple ones found in *Ugandatrichia*.

None the less, it is extremely interesting that such similar larvae should occur so far apart, unless, as Dr Flint tentatively suggested (*in litt.* 15.4.75), there might be some very old, gondwanan, pantropical pattern being shown here; that is a fascinating speculation, even if it is never proved.

ACKNOWLEDGEMENTS

I am much indebted to Dr Harrison for submitting his very interesting collection to me for identification; although identified many years ago the *Ugandatrichia* is only now being described. I also owe grateful thanks to Dr O. S. Flint, jun., of the Smithsonian Institution, Washington, for the gift of *Alisotrichia* larvae and pupae, and to Mr C. F. Jacot-Guillarmod, Director of the Albany Museum, for accommodation in the Museum, and for reading the manuscript. The permission of the Director of the National Institute for Water Research to publish this work is gratefully acknowledged.

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