



Hydroptilidae (Trichoptera) of Angola, a new genus, seven new species, and five new records

ALICE WELLS^{1,2,3*} & FERDINAND C. DE MOOR^{4,5,6,7,8,9}¹Australian National Insect Collection, CSIRO, PO Box 1700, Canberra, ACT 2601 Australia.²✉ alice.wells@csiro.au; <https://orcid.org/0000-0001-5581-6056>³<http://zoobank.org/urn:lsid:zoobank.org:author:0D7A8359-1249-4DED-9D5F-DBF5FCD17876>⁴Department of Freshwater Invertebrates, Albany Museum, Somerset St., Grahamstown, South Africa⁵Department of Zoology and Entomology, Rhodes University, Grahamstown, South Africa⁶South African Institute of Aquatic Biodiversity, Grahamstown, 6139, South Africa⁷National Geographic Okavango Wilderness Project, Wild Bird Trust, 20 Loch Avenue, Parktown 2193 South Africa⁸✉ f.demoor@ru.ac.za; <https://orcid.org/0000-0003-4624-7191>⁹<http://zoobank.org/urn:lsid:zoobank.org:author:03D33129-9858-468E-B38F-E84F0E8E654A>

*Corresponding author

Abstract

A collection of microcaddisflies from sites on the Cuito, Cuanavale, Cuembo, Cuando, Cubango, and Lungue Bungo Rivers in Angola has yielded seven new species and led to new records for a further five species. The new species include *Hydroptila cuembica* **sp. nov.**, *Hydroptila moxica* **sp. nov.**, *Oxyethira palisada* **sp. nov.**, *Orthotrichia ferreirae* **sp. nov.**, *Or. meyi* **sp. nov.**, and *Or. mlamboi* **sp. nov.**, and another species for which we erect a new genus, *Aenigmatrichia asymmetrica* **gen. et sp. nov.** The new records are for *Catoxyethira kunenica* Mey & de Moor 2019, *Hydroptila brigittae* Gibon 1987b, *Hydroptila cruciata* Ulmer 1912, *Hydroptila maoae* Gibon, Guenda, & Coulibaly 1994, *Oxyethira sechellensis* Malicky 1993, and a larva identified as that of a species of *Tricholeiochiton*. Beyond the known Angolan microcaddisfly fauna we resolve several taxonomic problems: We refer to *Orthotrichia* a species described by Jacquemart in *Hydroptila*, to become *Orthotrichia trifurcata* (Jacquemart 1962), comb. nov., with *Orthotrichia hydroptiloides* Wells & Andersen 1995 (from Tanzania) as a junior synonym; and we recognise *Orthotrichia kivuensis* Jacquemart 1956 (from Bukana, on Lake Kivu) as a junior synonym of *Or. sanya* Mosely 1948a from the Orange and Fish rivers. A list is given of the 16 microcaddisfly species now known from Angola: Representation is probably typical of sand and silt-based streams and pools, with the exception of *Catoxyethira* and *Orthotrichia*.

Key words: Huambo Province, Huila Province, Moxico Province, caddisflies, larvae, pharate adult, faunal composition, checklist

Introduction

Patchy information is available on the microcaddisflies of the vast Sub-Saharan region of Africa, amounting to some 163 described species, presently assigned to 13 genera. The genera are *Catoxyethira* Ulmer 1912, *Pseudoxyethira* Schmid 1958 and *Stactobia* McLachlan 1880 in the subfamily Stactobiinae; *Orthotrichia* Eaton 1873 in the Orthotrichiinae; and *Cyclopsiella* Kjaerendsen 1997, *Dhatrichia* Mosely 1948b, *Hydroptila* Dalman 1819, *Jabitrachia* Wells 1990, *Microptila* Ris 1897, *Oxyethira* Eaton 1873, *Tangatrichia* Wells & Anderson 1995, *Ugandatrichia* Mosely 1939, and *Wlitrichia* Kjaerendsen 1997 in the Hydroptilinae. Two further genera, *Ithytrichia* Eaton 1873 (Orthotrichiinae) and *Tricholeiochiton* Kloet & Hincks 1944 (Hydroptilinae), have been reported based on larvae only. In terms of genera, the fauna is moderately rich, and several of these genera are quite rich in species. Thirty-four described species are recorded in *Orthotrichia*; 23 in *Hydroptila*; and 57 in the African endemic genus *Catoxyethira*. Included among these Sub-Saharan microcaddisflies are several species described recently by Mey and de Moor (2019) from river systems on the border between Namibia and Angola.

Unsurprisingly given their very small size, most Sub-Saharan microcaddisflies appear to be strongly localised.

Only five established species have been identified among the Angolan samples examined in this study, four of which are known elsewhere from western Africa—*Hydroptila brigittae* Gibon 1987b, *H. maoae* Gibon, Guenda, & Coulibaly 1994, *H. cruciata* Ulmer 1912, and *Catoxyethira kunenica* Mey & de Moor 2019. The other is *Oxyethira sechellensis* Malicky 1993 from the Seychelles. This contrasts with the conspicuous and far more vagile Odonata—‘about half of Angola’s species are widespread across the continent’ (Kipping et al. 2019).

Here we describe a further six new species from Angola in *Orthotrichia*, *Hydroptila*, and *Oxyethira*. In addition, from two of the Angolan localities we have four males of a new species for which no entirely satisfactory generic placement can be found. For these, a new monotypic genus is erected, *Aenigmatrichia* **gen. nov.**

Examination of type specimens of a number of established Central African microcaddisfly species has confirmed our concern about the status of several species. Here we refer to *Orthotrichia* a species described by Jacquemart (1962) in *Hydroptila*, to become *Orthotrichia trifurcata* (Jacquemart 1962), with *Orthotrichia hydroptiloides* Wells & Andersen 1995 as a junior synonym. We also recognise *Orthotrichia kivuensis* Jacquemart 1956 as a junior synonym of *Or. sanya* Mosely 1948a.

The streams beside which the adult hydroptilids were collected were from two major aquatic systems: The upper Cuito-Cuanavale, and the Cuembo, Cuando and Lungue-Bungo Rivers with their ‘mainly sand-bed substrates flowing through sub-humid and semiarid rangeland and miombo woodland’ in the Moxico Province of Angola and respectively joining the Okavango and Zambezi Rivers (Fig. 48; de Moor & Ferreira 2020); and from the Upper Cubango River catchment flowing over bedrock and sand-bed substrata, from ‘mainstream rivers, isolated pools, wetlands and seeps in the Huambo and Huila Provinces’ joining the Okavango River (Fig. 49; Barber-James et al. 2018).

In addition to the light trap and sweep-net collections of adults, immature microcaddisflies were collected by kick-net sampling and hand-picking from trailing and submerged marginal vegetation or stones. Among these a single pharate male taken with several larvae is identifiable and is probably safely associated with the larvae. Yet another cased larva is referred to the ever-elusive *Tricholeiochiton* (Fig. 19); as for other reports of this genus for Africa (de Moor & Scott 2003 [2004]) no adults have been identified. Similarly, other larvae collected can be identified only to genus (e.g., Figs 12–13, 16–18).

Given the nature of the systems beside which the adults were collected, the trophic representation of the microcaddisfly fauna is not surprising—most are probably algae feeders, living on or among algae on submerged marginal reeds, sedges, or woody vegetation or on aquatic macrophytes.

Material and methods

Most specimens were collected from pan traps, lured by 12V or 6V Superactinic light sources set overnight or for a few hours into the night. Some were taken at light sheets and preserved directly in 80% ethanol. Larvae were collected by kick-net sampling and hand picking from stones.

Images of larvae and a pharate adult were prepared by AW in the Australian National Insect Collection (ANIC) from spirit specimens and microscope slide preparations using a stereomicroscope linked to a Leica Application Suite (Version 4.2) using Automontage to integrate multiple images. Plates were prepared in Adobe Photoshop V. 12.

On male genitalic figures, labelling mostly follows Marshall (1979), but determination of homologies or even origins or insertions of structures among these very small micro-caddisflies has proven very difficult. Reference to figures is advised for users of this work.

A number of Serge Jacquemart’s and George Marlier’s types were examined, made available on loan from the Royal Belgian Institute of Natural Sciences (RBINS) and the Royal Museum for Central Africa [Tervuren] (RMCA). Unfortunately, we were unable to borrow other Marlier types from the Museu do Dundo, Angola.

All other specimens are deposited in the Albany Museum, Grahamstown (AMG). The labelling of specimens refers to catalogue entries for the Central African Waters (CAW) catalogue. Each number specifies a particular sampling event (date, locality name and coordinates, biotope sampled, and collectors). The alphabetic letters after the number refer to the specimen/s of a particular species collected at that event. Where specimens are mounted on slides this is mentioned. If no mention is made, they are stored in preservative. All GPS locality information is recorded in decimal degrees and based on WGS84 datum information.

Taxonomy

Genus *Catoxyethira* Ulmer 1912

Surprisingly, although more species of *Catoxyethira* have been described than for any other hydroptilid genus in West Africa (Gibon 1985, 1987a, 1987b, 1991), only one species was collected, represented by a single male. It is somewhat surprising more broadly that the female of only one *Catoxyethira* species has ever been described (see Statzner 1977).

The genus is a member of the subfamily Stactobiinae, among which some species have diurnally active adults that seldom are attracted to light. However, this is unlikely to be an explanation for the paucity of specimens in this collection, since the many species described by Gibon from Cameroon, Guinea, and Ivory Coast were collected at lights. Stactobiinae larvae tend to be madicolous, living on rocks where they feed upon the microfilm on the surfaces, so the unsuitable nature of the stream bed in the sand-bed rivers is probably the explanation for its absence in these rivers. Typical stactobiine habitat is illustrated in Figure 49.

Features that distinguish *Catoxyethira* from the other genera in the Angolan hydroptilid fauna are the combination of presence of ocelli, the transverse median suture on the mesoscutellum, the rectangular and short and broad shape of the metascutellum; the spur count of 1,3,4; and paired spines on male abdominal segment VIII.

Catoxyethira kunenica Mey & de Moor

(Fig. 1)

Catoxyethira kunenica Mey & de Moor, 2019: 141, figs 4–6.

Material examined. ANGOLA: 1 male, [CAW 820J], Huambo Province, Cubango River, Site 10—downstream of main rapids, light trap, -13.045, 16.37523, 8/v/2017, I.S. Ferreira & M. Mlambo.

Diagnosis. Distinguished among similar members of the *Catoxyethira mali*-group by ‘... the architecture of segments IX and X and the position of the elongate spines on the ventral and dorsal corner of segment VIII’ (Mey & de Moor 2019).

Description. Male. (See Mey & de Moor 2019)

Remarks. This record extends further to the north the known range of this species, described from the Kunene River in Namibia by Mey and de Moor (2019). Females were included among the paratypes listed for this species, however they were not described.

Genus *Hydroptila* Dalman 1819

Four species of *Hydroptila* were collected during the study, two of which are among the 23 species previously reported for Sub-Saharan Africa, the other two are newly described here. Several females are available in the samples under study but cannot be associated with any certainty.

Hydroptila maoae Gibon, Guenda & Coulibaly

(Figs 2, 3)

Hydroptila maoae Gibon, Guenda & Coulibaly 1994: 110, figs 34–37.

Material examined. ANGOLA: 2 males, [CAW 757BA], Moxico Province, Cuembo River, Site 6—Cuembo River campsite bridge, at light, -13.5265, 19.27971, 01/xi/2016, I.S. Ferreira; 4 males, [CAW 764R, one on slide], Moxico Province, Cuando River, Site 8—Quando campsite bridge, light trap, -13.607, 19.53235, 02/xi/2016, I.S. Ferreira; 1 male, [CAW 804AB], Moxico Province, Cuanavale, Site 12—Cuanavale River tributary at confluence, at light, -13.1233, 18.89875, 18/xi/2016, I.S. Ferreira.

Diagnosis. The male of this species shares with *H. aegyptia* Ulmer 1963 and others the Y-shaped ventral plate

in the male genitalia, a characteristic of the *H. pulchiformis*-group of Marshall (1979) (as noted by Gibon et al. (1994)), but is distinguished by the sinuous form of the tip of the very elongate phallus and the deep almost V-shaped form of abdominal segment IX in ventral view.

Remarks. The phallus appears to lack an associated titillator. Several females taken in the same sample may be associated with this species, or with the closely similar new species, *Hydroptila moxica* **sp. nov.**

Distribution. This species, described from Burkina Faso, was taken at two sites on the Cuembo River and also on the Cuando and Cuanovale Rivers in Moxico Province of eastern Angola, and was reported by Gibon et al. (1994) from a number of sites across West Africa.

Hydroptila moxica **sp. nov.**

(Figs 4, 5)

Material examined. Holotype male: [CAW 764Z, slide], **ANGOLA**, Moxico Province, Cuando River, Site 8—Cuando campsite bridge, light trap, -13.607, 19.53235, 02/xi/2016, I.S. Ferreira.

Diagnosis. *Hydroptila moxica* shows close resemblance to *H. maoae* and, similarly, groups with *H. aegyptia* with which it shares the Y-shape form of the ventral plate in the male genitalia. It is distinguished from *H. maoae* by the sharp right-angled spine on the tip of the phallus and the almost quadrate basal section of the ventral plate and more abruptly formed narrow posterior extension of the ventral plate which is more gradually tapered in *H. maoae*.

Description. Male. Length of each forewing 1.6 mm (n = 1). Head: antennae damaged, flagellomeres almost square in profile, bearing abundant sensilla placodea on flagellomeres; scent organs visible beneath occipital lobes on dorsal head. Genitalia: Abdominal segment IX with short lobes at apicolateral angles; dorsal plate (segment X) elongate, slightly exceeding length of inferior appendages, round apically; ventral plate in ventral view broadly 'Y-shaped' with basal half almost quadrate, sharply narrowed to slender distal projection; inferior appendages elongate, rod-shaped, equal width throughout length in ventral view, broader basally in lateral view, with sharp dorsal spur at apex; phallus with median fine titillator and sharply right-angled spine apically.

Etymology. The name '*moxica*' refers to the type locality.

Distribution. Known only from type specimen from Moxico Province of eastern Angola.

Hydroptila cuembica **sp. nov.**

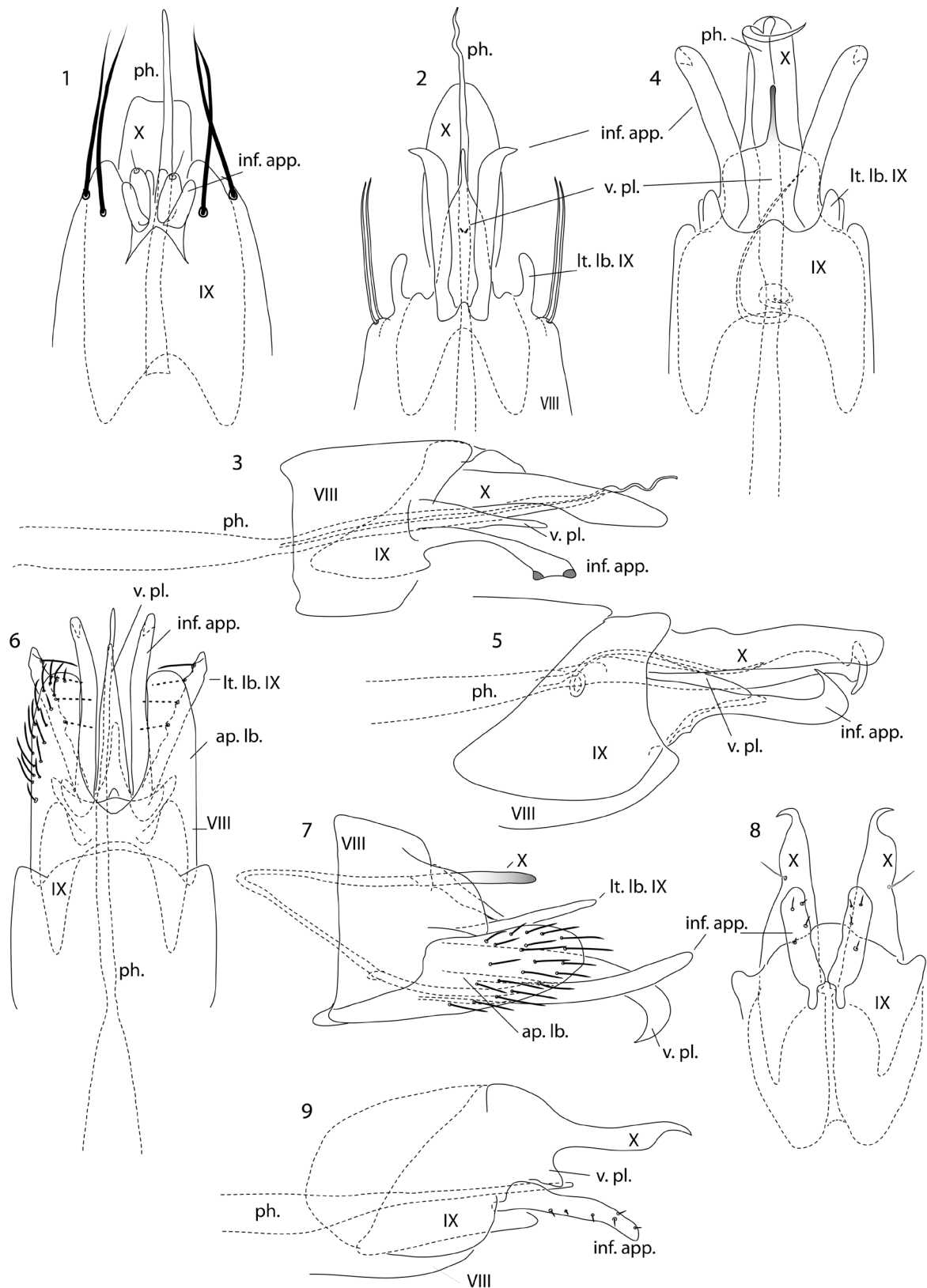
(Figs 6, 7)

Material examined. Holotype male, [CAW 757AZ, slide], **ANGOLA**, Moxico Province, Cuembo River, Site 6—Cuembo campsite bridge, at light, -13.5265, 19.27971, 01/xi/2016, I.S. Ferreira.

Paratypes, ANGOLA: 7 males, data as for holotype; 1 male [CAW 891F], Moxico Province, Lungue Bungo River Collecting event 3, downstream of bridge, light trap, -12.57898, 18.67073, 21/iv/2018, H.M. Barber-James & F.C. de Moor; 3 males [CAW 895X], Moxico Province, Lungue Bungo River Collecting event 5, new campsite along river bank downstream of bridge, light trap, -12.58440, 18.66790, 22/iv/2018, H.M. Barber-James & F.C. de Moor.

Diagnosis. Males are distinguished by the stout apicolateral angles of abdominal segment VIII which envelop segment IX ventrally, the slender mid-dorsal process, and elongate, setate lateral lobes on segment IX. In having the elongate apicomeresal process on segment IX, this species shows some resemblance to *H. mariatheresae* Gibon 1987, described from Mali, but is otherwise distinct from other species of *Hydroptila*.

Description. Male. Length of each forewing 2.0 mm (n = 11). Head: antennae damaged, remaining flagellomeres subquadrate in profile, sensilla placodea few, clustered distally. Genitalia: Abdominal segment VIII produced ventrally into stout, apically rounded lateral lobes extending about 2/3 length of inferior appendages; segment IX dorsally short, bearing slender elongate process mid apically, and long slender setate lateral lobes; ventral plate elongate, slender, about length of inferior appendages, sharply tapered to acute apex in ventral view; inferior appendages slender, elongate rod-shaped, each bearing single downturned apical spur; phallus extremely long, narrow, needle-like, without titillator.



FIGURES 1–9. Hydroptilidae, male genitalia. 1, *Catoxyethira kunenica* Mey & de Moor, 2019 [CAW 820J], ventral. 2, 3, *Hydroptila maoae* Gibon, 1994 [CAW 764R]: 2, ventral; 3, left lateral. Figures 4, 5, *Hydroptila moxica* **sp. nov.** [CAW 764Z]: 4, ventral; 5, left lateral. 6, 7, *Hydroptila cuembica* **sp. nov.** [CAW 757AZ]: 6, ventral; 7, left lateral. 8, 9, *Hydroptila brigittae* Gibon, 1987 [CAW 855J]: 8, ventral; 9, left lateral. Abbreviations: IX, X—abdominal segment IX and tergite X; ap. lb = apicolateral lobe of segment VIII (paired); .inf. app. = inferior appendage (paired); lt. lb. IX = lateral lobe of segment IX (paired); ph. = phallus; v. pl. = ventral plate.

Etymology. The name ‘*cuembica*’ refers to the type locality on the Cuembo River.

Distribution. Known from the Cuembo River and two sites on the Lungue Bungo River in Moxico Province of Angola.

***Hydroptila brigittae* Gibon**

(Figs 8, 9)

Hydroptila brigittae Gibon 1987b: 128, fig. 27.

Material examined. ANGOLA: 1 male, [CAW 855J, slide], Huila Province, Cubango River, Site 21—downstream of rapids at ruins of hydropower plant, at light, -14.3384, 16.29331, 15/v/2017, I.S. Ferreira.

Diagnosis. The male is distinguished from other African species, including the structurally similar *H. zairiensis* Statzner 1977 by the robustly bilobed dorsal plate. However, it differs from *H. zairiensis* by having each lobe more elongate, about twice length of inferior appendages, and narrowly hooked caudoventrad apically, rather than having an apical or subapical spur as in several other species, and inferior appendages short, stout, length about 3X width.

Remarks. In describing this species, Gibon (1987b) distinguished it from other Ivory Coast species by the absence of a branch on the inferior appendages, but so far no Angolan species have been found to have such a branch.

Distribution. Described from three specimens from Guinea, and now recorded from further south in southwestern Angola.

***Hydroptila cruciata* Ulmer**

(Figs 10, 11)

Hydroptila cruciata Ulmer 1912: 83, fig. 4. For details of multiple synonyms see Morse (2020).

Material examined. ANGOLA: 1 pharate adult male in sandgrain case, [CAW 797J], Moxico, Cuando River, Site 20—Quando River long bridge at village, in sand, -13.0923, 19.35946, 16/xi/2016, I.S. Ferreira.

Distribution. This species was described from East Africa and is now known to be more widespread in tropical and southern Africa and the West Palearctic.

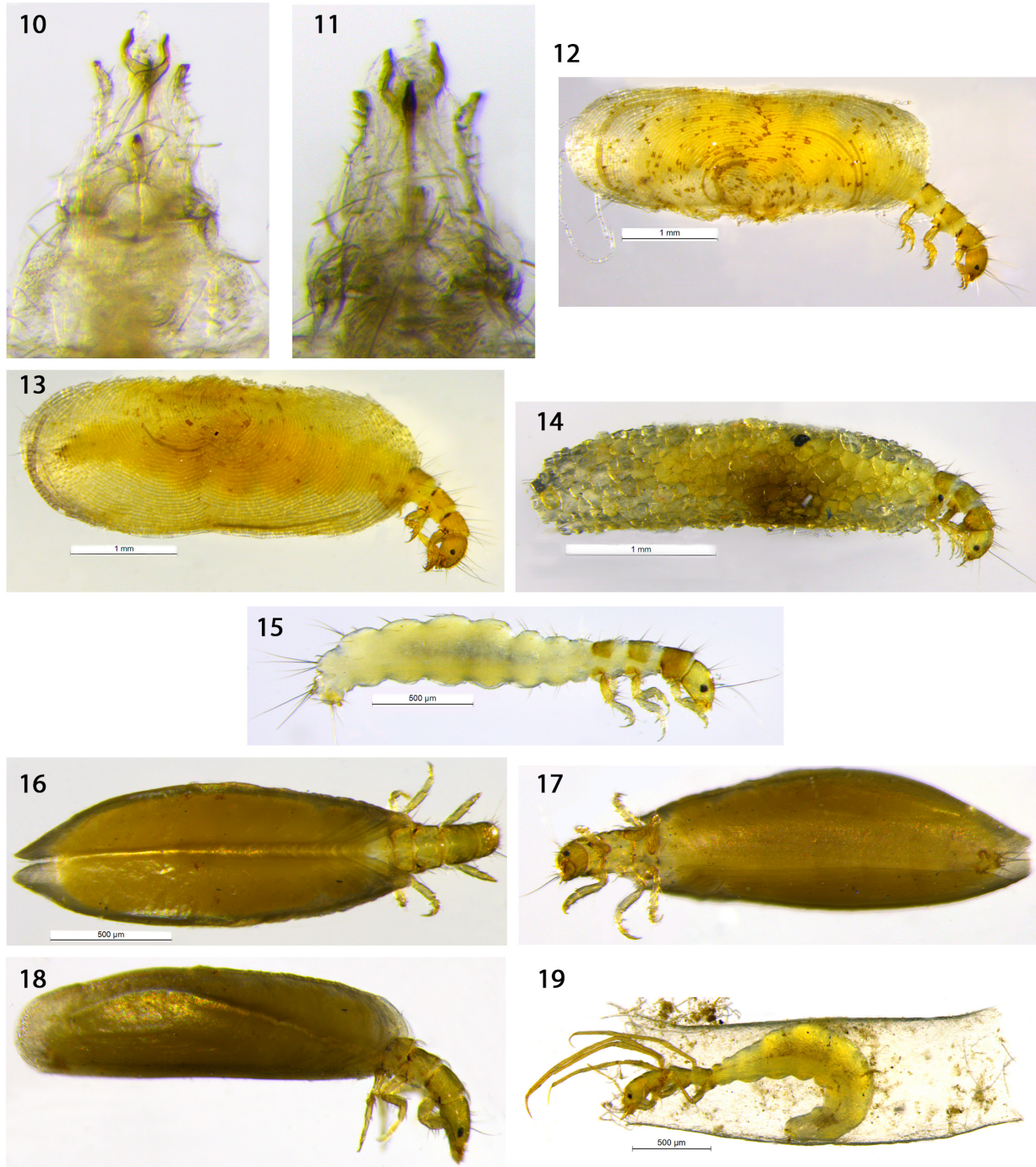
Remarks. *Hydroptila cruciata* is readily distinguished by the pair of elongate, stoutly sinuous, sclerotised structures in the male genitalia that arise above the bases of the inferior appendages, converge and usually cross distally. The pharate adult in a sandgrain case is unusual, as larvae of *H. cruciata* in South Africa use filamentous algae (*Spirogyra* sp.) to construct their cases (de Moor 2015). It could indicate that this species comprises an aphanic (cryptic, see Steyskal 1972) species complex.

***Hydroptila* larvae**

(Figs 12–15)

Material examined. ANGOLA: 1 larva (no case), [CAW 750F], Moxico Province, Cuanavale River, Site 4—Outflow of Cuanavale source lake (swim area), sand, -13.0946, 18.89641, 31/x/2016, I.S. Ferreira; 4 larvae, (3 one species, 1 another), [CAW 759D], Moxico Province, Cuando River, Site 7—Quando River tributary, sand, -13.6029, 19.52924, 02/xi/2016, I.S. Ferreira; 1 filamentous algae case, 1 larva, [CAW 771P], Moxico Province, Cuanavale River, Site 11—Cuanavale River, at confluence, Sand, -13.1255, 18.89914, 08/xi/2016, I.S. Ferreira; 3 larvae, 1 in algae case, [CAW 795M], Moxico Province, Cuando River, Site 20—Quando River longbridge at village, sand, -13.0043, 19.14684, 16/xi/2016, I.S. Ferreira; 3 larvae, 2 sand grain cases, [CAW 797J], Moxico Province, Cuando River, Site 20—Quando River longbridge at village, sand, -13.0923, 19.35946, 16/xi/2016, I.S. Ferreira; 2 empty sand cases, 1 cased larvae, [CAW 798J], Moxico Province, Cuando River, Site 20—Quando River longbridge at village, vegetation, sand, -13.0923, 19.35946, 16/11/2016, I.S. Ferreira; 2 empty cases, one chain diatoms and detritus, other sand grains, [CAW 805AF], Moxico Province, Cuanavale River, Site 12—Cuanavale River tributary at con-

fluence, aquatic and marginal vegetation, -13.447, 19.96404, 18/xi/2016, I.S. Ferreira; 6 larvae, dark thoracic nota, [CAW 805L], Moxico Province, Cuanavale River, Site 12—Cuanavale River tributary at confluence, aquatic and marginal vegetation, -13.447, 19.9604, 18/xi/2016, I.S. Ferreira; 1 pharate adult, (too immature for identification), numerous cases, several sand grain, [CAW 828F], Huambo Province, Cubango River, Site 13—SASS handnet, gravel, -13.04443, 16.37483, 9/v/2017, I.S. Ferreira, & M. Mlambo; 3 cases, 1 larva, [CAW 846U], Huambo Province, Cubango River, Site 18—Cubango River downstream of rapids, SASS handnet, gravel, -13.33582, 16.41361, 12/v/2017, I.S. Ferreira & M. Mlambo; 1 cased larva, [CAW 862R] Huila Province, Cubango River, Site 23—rapids, SASS handnet, stones, -14.38744, 6.28793, 16/v/2017, I.S. Ferreira & M. Mlambo.



FIGURES 10–19. Hydroptilidae, male genitalia. 10, 11, *Hydroptila cruciata* Ulmer, 1912 [CAW 797J]: 10, ventral; 11, dorsal. 12, 13, *Hydroptila* species [CAW 828F, 830E]: larvae in cases built with strands of filamentous algae. 14, 15, *Hydroptila* ?*cruciata* [CAW 797J], larva in sand grain case and isolated larva. 16–18, *Orthotrichia* sp. [CAW 798S], mature fifth-instar cased larva: 16, dorsal; 17, ventral; 18, right lateral. 19, *Tricholeiochiton* sp. [CAW 755M], early fifth-instar cased larva; note characteristic long legs and tarsal claws.

With the exception of the pharate adult identified as *Hydroptila cruciata* and, possibly, the associated sand grain cased larvae, the immature stages of *Hydroptila* species cannot be identified to species. Most of the larval cases in the above listed samples were constructed using filaments of unidentified green algae, probably also the food source of the larvae.

Genus *Oxyethira* Eaton 1873

Only two species of *Oxyethira* were taken in the collections under study and only a few males of each. Several females referable to *Oxyethira* were collected but cannot be associated with either species with any certainty.

Oxyethira sechellensis Malicky

(Figs 20, 21)

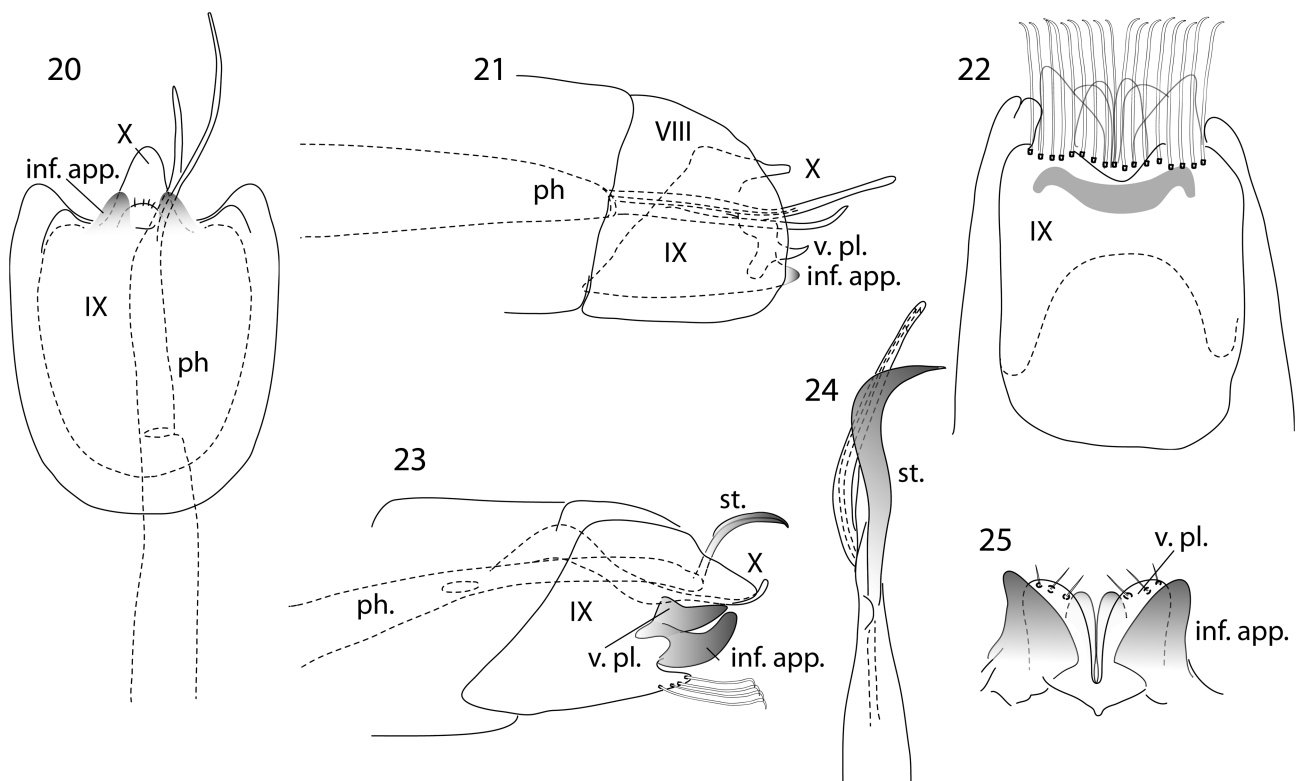
Oxyethira sechellensis Malicky 1993: 19, figs.

Material examined. ANGOLA: 1 male, [CAW 804AA], Moxico Province, Cuanavale River, Site 12—Cuanavale River tributary at confluence, at light, -13.1233, 18.89875, 18/xi/2016, I.S. Ferreira.

Diagnosis. Suggested by Malicky (1993) to be a member of subgenus *Argyrobothrus* in *Oxyethira* with members of which it shares the curious phallic structure, but in other features this species is most closely similar to *Ox. minima* Kimmins 1951, from Myanmar, which also shares the arrangement of small rounded inferior appendages and a short, rounded ventral plate.

Distribution. Described from the Seychelles and here reported from Angola.

Remarks. Specimens from Guinea and Mali described and illustrated by Gibon (1987b) as '*Stenoxyethira* cf. *minima*', resemble this species closely, and possibly could also represent *Ox. sechellensis*.



FIGURES 20–25. *Oxyethira* spp., male genitalia. 20, 21, *Oxyethira sechellensis* Malicky 1993 [CAW 804AA]: 20, ventral, 21, left lateral. 22–25, *Oxyethira palisada* sp. nov. [CAW 756T]: 22, ventral; 23, left lateral; 24, phallus, ventral; 25, inferior appendages and ventral plate, ventral. Abbreviations: IX, X = abdominal segment IX and tergite X; inf. app. = inferior appendage (paired); ph. = phallus; st. = strap on phallus; v. pl. = ventral plate.

Oxyethira palisada sp. nov.

(Figs 22–25)

Material examined. **Holotype male** [CAW 756T, slide], **ANGOLA**, Moxico Province, Cuanavale River, Site 3—Cuanavale source lake (at Mokoro), Light trap. -13.0898, 18.89395, 31/x/2016, I.S. Ferreira.

Diagnosis. Distinguished among African species of *Oxyethira* by the palisade of long, even-length setae posteroventrally on abdominal segment IX, the conical inferior appendages, and the broad, curved strap-like process on the phallus; the latter feature places this species in subgenus *Argyrobothrus* with *Ox. sechellensis*.

Description. Male. Length of each forewing 1.7 mm (n = 1). Antennae damaged. Genitalia: Abdominal segment IX rounded anteroventrally, apical margin bordered by robust-looking setae with apices downturned; tergite X fused with IX, in lateral view conical; ventral plate bifid, paired conical lobes dorsal of ventral plate; inferior appendages cone-shaped, length slightly exceeding ventral plate and tergite X; phallus stout basally, strap-like stout process arising at close to half length.

Etymology. The Latin '*palisada*' describes the ventral palisade of strong setae on the male abdominal segment IX.

Distribution. Known from only the type locality in Moxico Province of Angola.

Remarks. With the palisade of strong setae on the apical margin of segment IX, this species resembles the Northern Australian species *Oxyethira artuvillosus* Wells 1981, in *Oxyethira* subgenus *Dampftrichia*. A single female of a species of *Oxyethira* was collected with the type, but since females of *Oxyethira* are all so similar, such associations can only be tentative.

Oxyethira larvae

Material examined. **ANGOLA:** 1 cased larva, 1 free, [CAW 784M], Moxico Province, small unnamed tributary of Tempué River, Site 15—tributary of Cuenovale River, vegetation, -13.4428, 18.8749, 12/xi/2016, I.S. Ferreira; 2 cased larvae, [CAW 786B], Moxico Province, Cuando River, Site 16—Cuando source lake (outflow and lake), vegetation, mud, -13.0038, 19.12725, 13/xi/2016, I.S. Ferreira; 1 empty pupal case, [CAW 794L], Moxico Province, Cuando River, Site 19—Cuando River headwater site, vegetation, sand, -13.0043, 19.14684, 15/xi/2016, I.S. Ferreira; 1 cased larva, [CAW 797H], Moxico Province, Cuando River, Site 20—Cuando River longbridge at village, MV, sand, -13.0923, 19.35946, 16/xi/2016, I.S. Ferreira.

Remarks. All larvae collected were in their 5th (final) instar. The cases are the characteristic flattened flask shape, comprising two tightly joined valves. The larvae are recognised by their general form, with body laterally compressed and mid- and hind legs 1.5 to 2X length of forelegs (see Marshall 1979 for full details). *Oxyethira* larvae are usually found in slower-flowing waters among filamentous green algae, upon which they are reported to feed (Marshall 1979).

Genus *Aenigmatrichia* gen. nov.

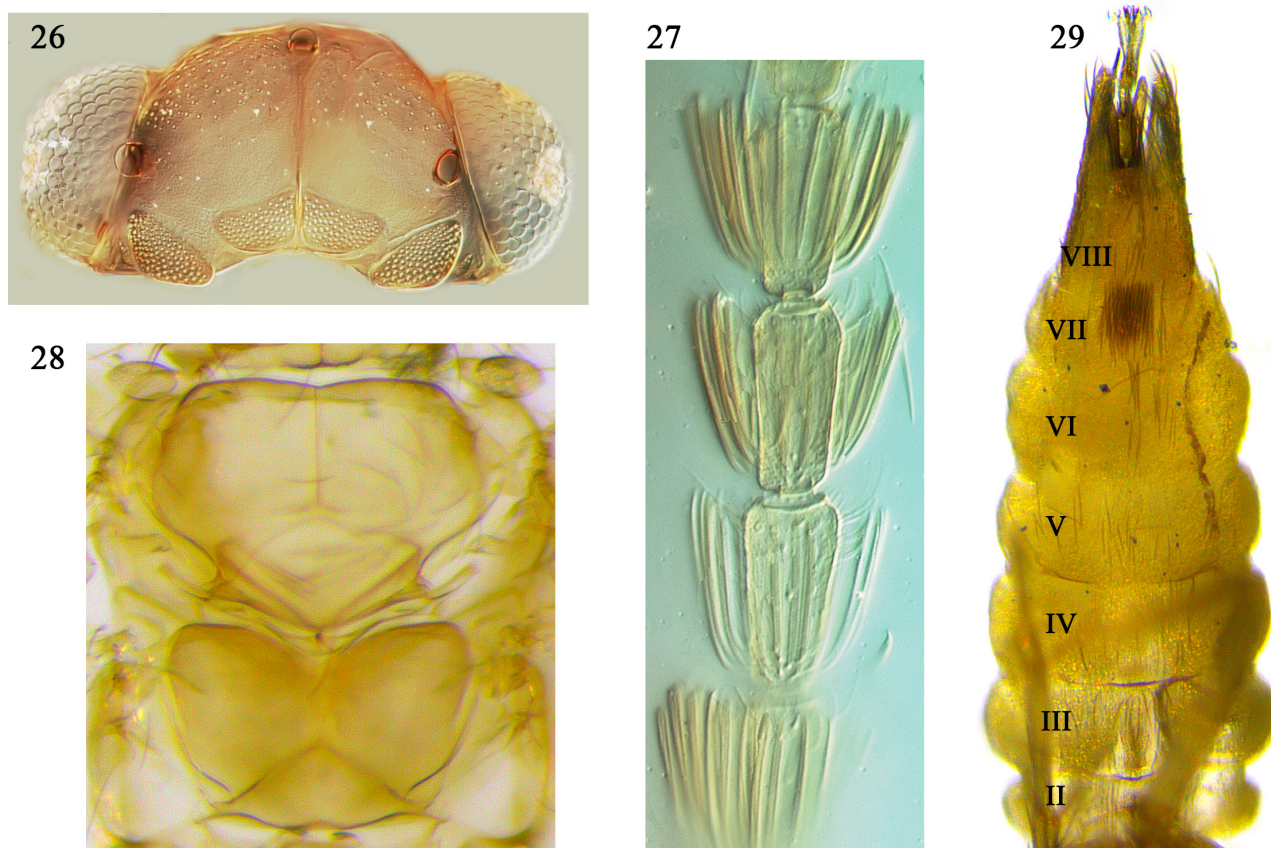
Type species: *Aenigmatrichia asymmetrica* sp. nov., here designated.

Diagnosis. Assigned to subfamily Hydroptilinae, members of this genus share a combination of features with the monotypic Tanzanian genus *Tangatrachia* Wells & Andersen 1995, having three ocelli; the antennal flagellomeres are as in *Oxyethira* species with a basal whorl of clothing hair and scattered sensilla auricillica, without sensilla placodea; each forewing is without a jugal lobe; the tibial spur formula is 0,3,4; and the metascutellum is triangular. However, the males differ significantly, with the structure of the terminal abdominal segments showing superficial resemblance to those of *Pseudoxyethira*: Anteroventral margins of segments VIII and IX produced, rounded and retracted well within VII, not in the form of slender apodemes; externally having abdominal segment VIII deeply cleft mid-ventrally and forming elongate lateral lobes flanking paired lightly sclerotised rod-shaped structures, interpreted as inferior appendages; the ventral plate is well developed; and the phallus has a median titillator and the apex flared.

Among females collected with the males is a single equally unusual one, here assumed to be that of *Aenigmatrichia asymmetrica* **sp. nov.** and distinguished from other known females by the prominent conical ventral structure interpreted as abdominal sternite VIII.

Etymology. The generic name *Aenigmatrichia*, with feminine gender, was chosen because this taxon is an enigma, exhibiting features of both Hydroptilinae and Stactobiinae.

Remarks. All efforts to accommodate completely the set of four small adult males in any existing genus failed. Superficially, genitalia of these males resemble those of some stactobiine genera such as *Catoxyethira*—dorsally they are equipped with a pair of stout black spiny structures—or *Pseudoxyethira* which shares the general appearance of abdominal segments VIII and IX. In superficial appearance, the male genitalia closely resemble those of *Catoxyethira pinheyi* Kimmins 1958 from Zimbabwe (which is probably a species of *Pseudoxyethira*). However, the dorsal spines are unlike any seen in species of *Catoxyethira*: They are divided into two clearly distinct parts, the distalmost jet black and more slender than the paler proximal part.



FIGURES 26–29. *Aenigmatrichia asymmetrica* **gen. et sp. nov.** male [CAW 895V]: 26, head, dorsal, showing ocelli, postero-lateral and posterior setal warts; 27, antennal flagellomeres, showing rings of clothing hairs, and curved sensilla towards apices; 28, thorax, dorsal; 29, abdomen, ventral. Abbreviations: II–VIII = abdominal segments II to VIII.

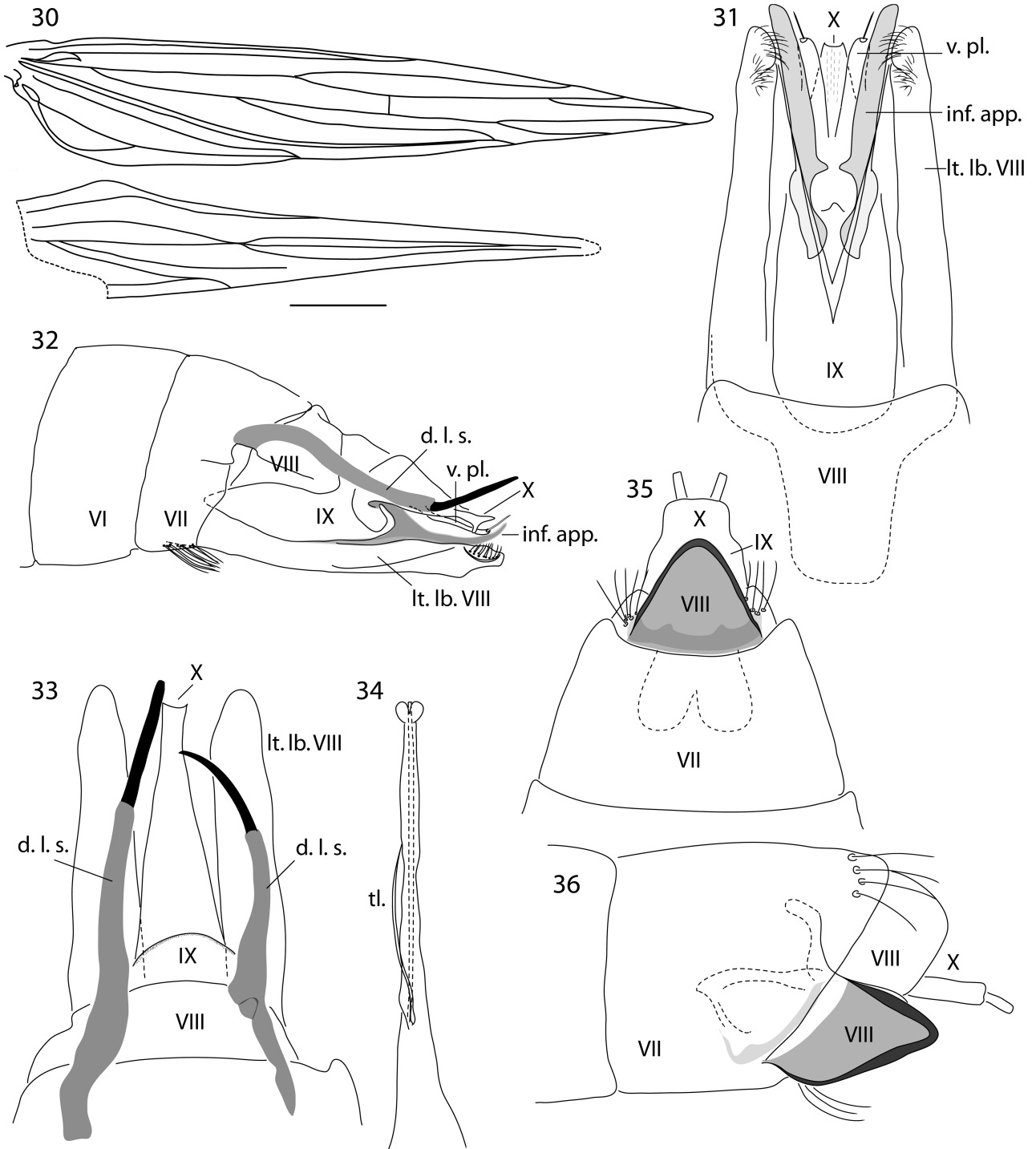
Among 6 females collected with 3 of the males, was the very distinctive specimen, illustrated in Figures 35 and 36. We associate this female, tentatively, with the males of *Aenigmatrichia asymmetrica* which also exhibit unusual modifications.

Possible assignment of this new species to *Ithytrichia*, subfamily Orthotriichinae, immatures of which are known from Sub-Saharan Africa fail, although again genitalic features of males of both genera are somewhat similar superficially, especially in the form of the phallus which resembles that of most species of *Orthotrichia*; however, the head and thoracic features differ significantly. Within the subfamily Hydroptilinae, the combination of features in *Aenigmatrichia* is distinct from all known Hydroptilinae genera. Thus, we reluctantly erect another monotypic genus among Sub-Saharan Hydroptilidae.

Aenigmatrichia asymmetrica sp. nov.

(Figs 26–36)

Material examined. Holotype male, [CAW 891BC], ANGOLA, Moxico Province, Collecting event 3—Lungue Bungo River, along marshy river banks with swift flowing river containing trailing and marginal aquatic vegetation, light trap downstream of road-bridge, -12.58391 18.66511, 21/iv/2018, H.M. Barber-James & F.C. de Moor.



FIGURES 30–36, *Aenigmatrichia asymmetrica* sp. nov. [CAW 895V]: 30, male right forewing and hind wing (incomplete), dorsal; 31–34, male genitalia: 31, ventral; 32, left lateral; 33, dorsal; 34, phallus, ventral. 35, 36, female terminalia: 35, ventral; 36, left lateral. Abbreviations: VII, VIII, IX, X = abdominal segments VII–IX and tergite X; d.l.s. = dorso lateral spine of VIII; d. pl. = dorsal plate; inf. app. = inferior appendage (paired); lt. lb. VIII = lateral lobe of segment VIII (paired); ph. = phallus; v. pl. = ventral plate; tl. = titillator. Scale bar = 0.2 mm.

Paratypes, ANGOLA: 2 males, 1 female, same data as for holotype; 2 males, [CAW 895V, slide], Moxico Province, Collecting event 5—Lungue Bungo River, along marshy river banks with swift flowing river containing trailing and marginal aquatic vegetation, light trap downstream of road-bridge near second camp site, -12.58440, 18.66790, 22/iv/2018, H.M. Barber-James & F.C. de Moor.

Diagnosis. As for genus.

Description. Male. Length of each forewing 1.4–1.8 mm (n = 4). Antennae with 19 flagellomeres, flagellomeres bearing scattered sensilla auricillica and clothed in basal whorl of long setae (Fig. 27). Genitalia: Abdominal segment VIII with pair of unequal length sclerotised spines dorsolaterally and ventrally with mesal patch of stout strong setae, produced distally to form extended lateral lobes; tergite X short, tapered to shallowly concave apex, lateral pair of stout membranous lobes tipped by single seta interpreted as representing ventral plate; inferior appendages elongate, rod-shaped, lightly sclerotised; phallus tapered, apically flared, slender titillator arising at about one-third length.

Female. Length of each forewing 2.0 mm (n = 1). Antennae damaged, remaining flagellomeres rectangular in profile. Terminalia: Abdominal segment VIII modified, short dorsally, ventrally forming prominent cone-shaped structure; segment IX fused with tergite X.

Etymology. The specific name *asymetrica* refers to the unequal size and shape of the dorsolateral spines on abdominal segment VIII.

Distribution. Collected at two sites on the Lungue Bungo River in the Moxico Province.

Remarks. Six females taken with the sample CAW891BC, probably represent 3 different species.

Genus *Tricholeiochiton* Kloet & Hincks 1944

Tricholeiochiton larvae

(Fig. 19)

Material examined. ANGOLA: 1 cased larva, [CAW 740H], Moxico Province, Cuanavale River, Site 1—upstream of source lake (closer to lake), aquatic vegetation, handnet, -13.0882, 18.89298, 30/x/2016, I.S. Ferreira; 1 cased larva, [CAW 755M], Moxico Province, Cuanavale River, Site 3—upstream of source lake (further from lake), aquatic vegetation, handnet, -13.0935, 18.89627, 31/x/2016, I.S. Ferreira.

Remarks. The larvae clearly key to this genus, but collection of adults or pharate adults is required for confirmation of identity. Larvae of *Tricholeiochiton* generally live among aquatic macrophytes and, like other members of the subfamily Hydroptilinae, feed on filamentous green algae according to Marshall (1979).

Genus *Orthotrichia* Eaton 1973

Our literature study of descriptions of males of the 34 species of *Orthotrichia* presently recorded from Sub-Saharan Africa suggested a number of possible synonymies. It seemed these may have arisen as a consequence of the remarkable complexity and asymmetry of the male genitalia of some of the equatorial African species, rendering almost impossible the alignment of genitalic preparations for exact or even comparable ventral, dorsal or lateral views for description. Male genitalia of a number of species show very close similarities. Nonetheless, examination of a number of type species on loan from RBINS and RMCA, gave a better appreciation of the variability among the Central African species in this genus, confirming close similarities between some species, but also consistent differences. Thus, we are satisfied that *Or. petiti* Jacquemart 1962 from Zaire, *Or. nova* Marlier 1978 described from Mali; *Or. spinicauda* Kimmins 1958 from Zimbabwe; *Or. verbekei* Jacquemart 1957 from (now) Democratic Republic of Congo (DRC); *Or. guinkoi* Guenda 1996, *Or. dapola* Guenda 1996, *Or. mussoi* Guenda 1996, and *Or. cazaubonae* Guenda 1996, from Burkina Faso; and *Or. gudiel* Malicky 2015 and *Or. thariel* Malicky 2015 from Ethiopia are all valid species. We were unable to access the types of one Angolan species, *Or. benguelensis* Marlier 1965[1966], deposited by Marlier in the Museu do Dundo. However, types available from RBINS of *Or. kivuensis* Jacquemart 1956 are clearly conspecific with *Or. sanya* Mosely 1948a, *Or. kivuensis* is here recognised to be a junior synonym of *Or. sanya*.

Diagnostic features for *Orthotrichia* species are the form of the final instar larva and its case; and in the male genitalia the characteristic phallus, straight, cupped apically and unadorned by any distal spines or spurs, but usually with a median titillator; and much-reduced inferior appendages with a pair of (usually) slender, membranous lobes, variously termed ‘bilobed processes’, ‘setal lobes’ or ‘basal processes’, arising dorsally at the base of the inferior appendages and each bearing an apical seta. At the base of the unit formed by the inferior appendages and bilobed processes, a slender apodeme, extends anteriorly in the IXth segment, but does not reach the proximal margin of the segment. Often the inferior appendages are fused, and the bilobed processes are modified: one or both may be strongly asymmetrical. The female terminalia usually form a short, often stout, oviscap, generally with a ventral cleft in the distal margin of abdominal sternite VIII, often around a small ventral gland in the centre and with a row of setae on the distal margin.

Hydroptila trifurcata Jacquemart 1962 is here referred to *Orthotrichia*, with *Orthotrichia hydroptiloides* Wells & Andersen 1995, from Morogoro in Tanzania, recognised here as a junior synonym. This species is listed in *Pseudoxyethira* in the Trichoptera World Checklist, but we are unable to trace the author of the changed combination. Examination of the types of *Hydroptila trifurcata*, in the RBINS, from ‘Congo, Katanga’ (now DR Congo)—‘Holotype: 1 exemplaire [dissected, on 4 slides], paratypes: 8 exemplaires en préparations microscopique’ (Jacquemart 1962: 4) reveals that the slide labelled ‘Type’ is of a female of *Orthotrichia*, and that five slides labelled ‘Paratype’ are of male specimens or parts of males, sharing diagnostic features of *Orthotrichia*. Two further slides of ‘Paratypes’ bear specimens (three specimens in total) conspecific with the ‘Type’ female.

A number of the African species of *Orthotrichia*, including 2 of the new species described here, share the features of the widespread *Or. angustella*-group (Marshall 1979) ‘characterised by the development of the lateral processes of segment IX in the males and the row of subcostal scales on the forewings of males of most species’ (see Fig. 44).

***Orthotrichia mlamboi* sp. nov.**

(Figs 37–39)

Material examined. Holotype male, [CAW 855M, slide], ANGOLA, Huila Province, Cubango River, Site 21—downstream of rapids at ruins of hydropower plant, at light, -14.3384, 16.29331, 15/v/2017, I.S. Ferreira & M. Mlambo.

Diagnosis. A member of the *Or. angustella*-group, this species resembles very closely *Or. straeleni* Jacquemart 1956 from Lake Kivu, (now) DRC, but differs in several features of male genitalia, particularly the length of the inferior appendages about 2X longer, the inferior appendages in lateral view more slender and the proximal spine on tergite X more slender.

Description. Male. Length of each forewing 1.8 mm (n = 1); short pocket of jet-black scales proximally on costal margin (Fig. 44). Antennae 29 flagellomeres, rectangular in profile, surface bearing close-packed sensilla placodea.

Abdominal sternite VIII with well-developed medial lobe bearing stoutish setae. Genitalia: segment IX with lateral margins produced distally to form unequal mesally curved processes, left longer than right, each bearing long stout seta subapically, tergite X (‘dorsal plate’) membranous, stout in dorsal view, with 2 sharp opposing spurs at about 2/3 length curved toward right; inferior appendages unequal, discrete basally, left constricted at distal 2/3, apical region forming slender twisted process, bilobed processes slender, closely associated, ventral apodeme (mesoventral apotome at base of inferior appendages) short narrow; phallus long, slender, with spiral titillator at about half length.

Etymology. The species is named *mlamboi* after Musa Mlambo a scientist and colleague at the Albany Museum.

Distribution. Known only from Angola.

Remarks. The new species of *Orthotrichia* is one of a set of closely similar African species all with strongly asymmetric male genitalia. AW examined types where available on loan, including the very large collection of slides of *Orthotrichia straeleni* from the RBINS (58 slides in total), including the holotype (dissected and in parts on 4 slides) and several paratypes. The slides are very poor, a number of the specimens squashed beyond recognition. All the ‘adequate’ preparations of males show features consistent with Jacquemart’s (1956) description and are distinct

from *Or. mlamboi*. AW also examined the holotypes of *Or. petiti* Jacquemart 1962 (on loan from RBINS; from Zaire), and *Orthotrichia nova* Marlier 1978 (on loan from RMCA; from Angola), again finding all distinct from *Or. mlamboi*. The type male of *Or. verbekei* Jacquemart 1957 (on loan from RBINS), from (now) Democratic Republic of Congo, also differs.

***Orthotrichia ferreirae* sp. nov.**

(Figs 40–44)

Material examined. Holotype male, [CAW 757AW, slide], **ANGOLA**, Moxico Province, Cuembo River, Site 6—Cuembo campsite bridge, Light trap, -13.5265, 19.27971, WGS84, 01/11/2016, I.S. Ferreira.

Paratypes, ANGOLA: 9 males [CAW 757F], collected with holotype, same data; 3 males (one on slide) [CAW 891AZ], Moxico Province, Lungue Bungo River, Collecting event 3—downstream of road-bridge Light trap, -12.57898 18.67073, 21/iv/2018, H.M. Barber-James & F.C. de Moor; 1 male [CAW 892U], Moxico Province, Lungue Bungo River, Collecting event 3—upstream of road-bridge, Light trap, -12.58670, 18.66928, 21/iv/2018, H.M. Barber-James & F.C. de Moor.

Diagnosis. Males are distinguished from other central African *Orthotrichia* species by strongly asymmetric male inferior appendages and the sclerotised inwardly turned L-shaped spine on tergite IX and the L-shaped inwardly turned paramere crossing the spine.

Description. Male. Length of each forewing 1.7–1.8 mm (n = 10); short pocket of jet-black scales proximally on costal margin. Antennae (all damaged) with flagellomeres rectangular in profile, bearing abundant sensilla placodea.

Abdominal sternite VII bearing small sharp spur medially on distal margin; sternite VIII bearing medial lobe of stoutish setae. Genitalia: segment IX bearing short row of strong setae mid ventrally towards apex, dorsally equipped with one sclerotised L-shaped spine, lateral margins produced distally to form unequal processes, in dorsal view right side longer than left, and bearing 2 stout setae towards apex, left more slender and bearing single seta apically; tergite X ('dorsal plate') stout with irregular excavation at apex; inferior appendages unequal, fused basally, right appendage curved, strongly tapered towards spinelike apex, left appendage stout, irregular in shape, with curved spine subapicomeresally, membranous lobes of bilobed processes slender, closely associated, mesoventral apodeme reaching to proximal margin of segment VIII; phallus elongate, slender, with spiral titillator at about half length; paramere slender, L-shaped.

Etymology. Named for Ina S. Ferreira who collected much of the material upon which this study is based.

Distribution. From sites along the Cuembo and Lungue Bungo Rivers in Moxico Province.

Remarks. Specimens were all collected 'along marshy riverbanks with swift flowing river containing trailing and marginal aquatic vegetation' as in Figure 48.

The male genitalic structures of this species are extremely difficult to understand: their homologies are almost impossible to interpret and even determination of their spatial relationships is difficult, so much being dependent upon the extent to which the ninth segment is retracted within the eighth, and the aspect in which they are viewed.

***Orthotrichia meyi* sp. nov.**

(Figs 45–47)

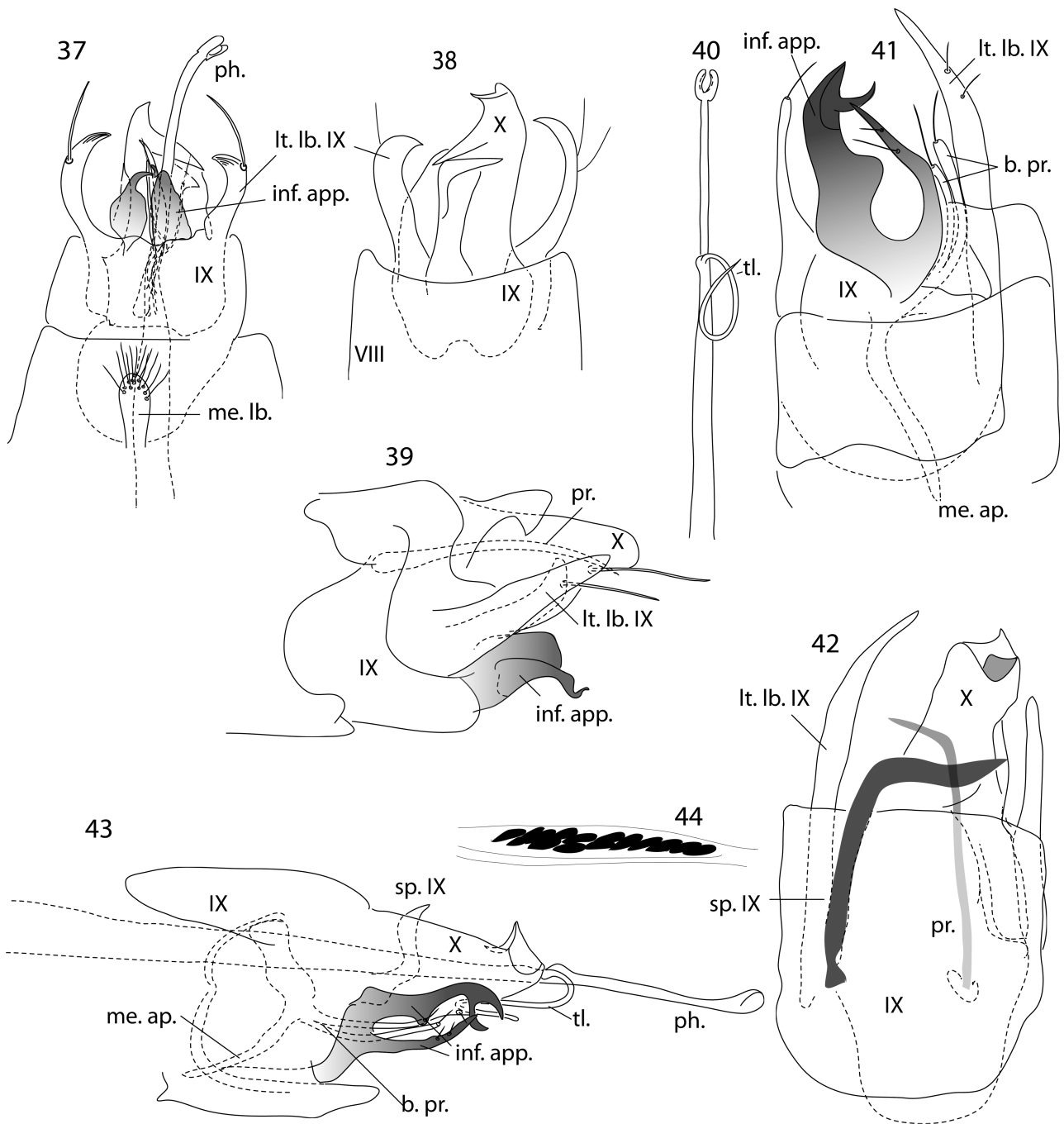
Holotype male, [CAW 765A, slide], **ANGOLA**, Moxico Province, Cuembo River, Site 9—Cuembo source lake (Salia Kembo), Light trap, -13.1363, 19.04529, 04/xi/2016, I.S. Ferreira.

Diagnosis. Distinct from most other central African species of *Orthotrichia* in having the male genitalia more or less symmetrical and having the bilobed processes of the inferior appendages widely divergent.

Description. Male. Length of each forewing 1.7 mm (n = 1). Antennae damaged, flagellomeres rectangular in profile. Abdominal segment VII with stout midventral lobe bearing strong setae. Genitalia: segment IX with apical angles produced distally to form processes, each tipped with one seta, dorsally with slender, curved strap terminating in pair of hooks; inferior appendages forming pair of sclerotised pincer-like processes ventrally with stouter pair of conical processes dorsally and bilobed processes slender, elongate and widely divergent.

Etymology. The species *meiyi* is named for Wolfram Mey a Trichoptera researcher and colleague from Germany.

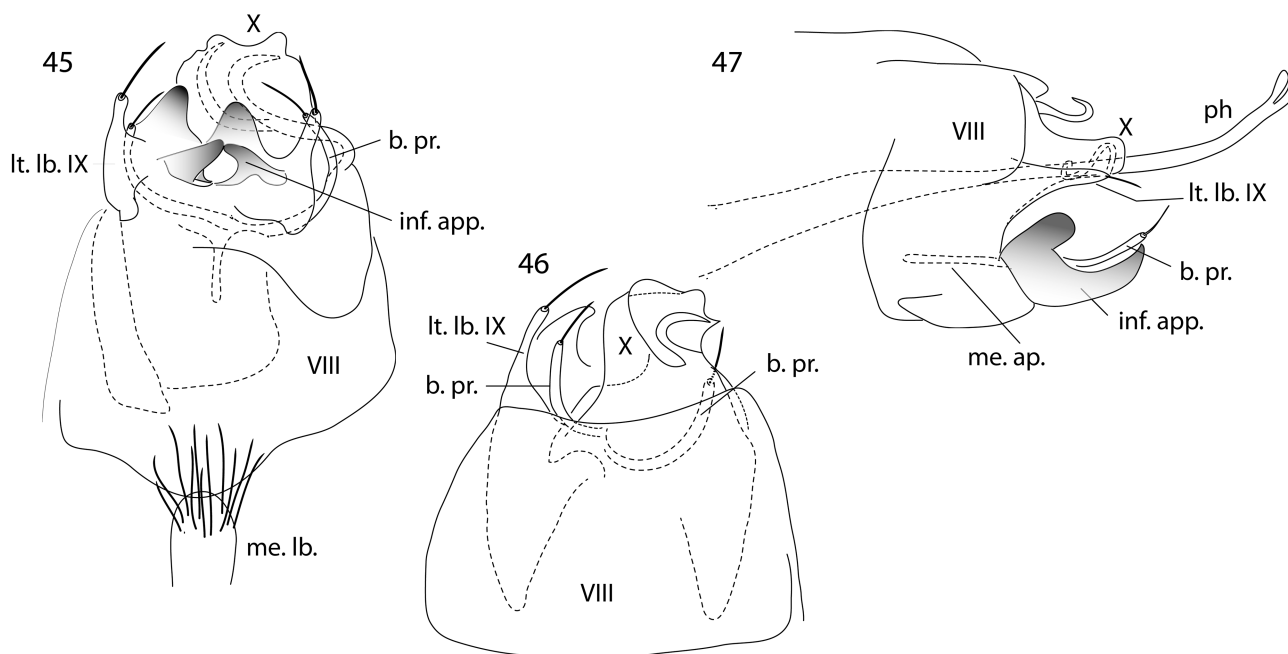
Distribution. Known only from the type locality.



FIGURES 37–44. *Orthotrichia* spp.: 37–39, *Orthotrichia mlamboi* sp. nov., [CAW 855M], male genitalia: 37, ventral; 38, dorsal; 39, left lateral. 40–44, *Orthotrichia ferreirae* sp. nov., male [CAW 757AW]: 40, phallus, ventral; 41, ventral; 42, dorsal; 43, left lateral, slightly skewed. 44, forewing costal scales. Abbreviations: IX, X = abdominal segment IX and tergite X; b. pr. = bilobed process; inf. app. = inferior appendage (paired); lt. lb. IX = lateral lobe of segment IX (paired); me. ap. = mesoventral apotome at base of inferior appendages and bilobed process; me. lb. = medial lobe on segment VIII; pr. = paramere; ph. = phallus; sp. IX = spine on tergite IX; tl. = titillator.

Remarks. No other African species has been described as having the bilobed processes of the inferior appendages in the form of widely divergent lobes; however, these structures are often extremely difficult to see, so simply may have been missed in some species descriptions. In some respects, this species resembles *Jabitrichia flagellum*

(Marlier 1965 [1966]) from a similar Angolan site, the shores of Lake Calundo, which was described in *Orthotrichia* but, as recognised by Kjaerandsen and Andersen (2002), *J. flagellum* has a long filament at the apex of the phallus and is clearly misplaced in that genus.



FIGURES 45–47. *Orthotrichia meyi* sp. nov. [CAW 765A], male genitalia. 45, ventral; 46, dorsal; 47, left lateral. Abbreviations: IX, X = abdominal segment IX and tergite X; b. pr. = bilobed process; inf. app. = inferior appendage (paired); lt. lb. IX = lateral lobe of segment IX (paired); me. ap. = mesoventral apotome at base of inferior appendages and bilobed process; me. lb. = medial lobe on segment VIII; ph. = phallus.

Orthotrichia larvae

(Figs 16–18)

Material examined. ANGOLA: 1 final instar larva, [CAW 758M], Moxico Province, Cuembo River, Site 6—Cuembo campsite bridge, vegetation, -13.5265, 19.27971, 02/xi/2016, I.S. Ferreira; 1 cased larva, [CAW 798S], Moxico Province, Cuando River, Site 20—Cuando River longbridge at village, vegetation, sand, -13.0923, 19.35946, 16/xi/2016, I.S. Ferreira; 1 early final instar cased larva, [CAW 803N], Moxico Province, Lungue Bungo River, Site 22—Lungue Bungo River tributary at Samanunga, vegetation, -12.9334, 18.81691, 18/xi/2016, I.S. Ferreira.

Remarks. The cases of *Orthotrichia* spp. larvae are usually described as ‘wheat or caraway seed’ shaped so that the cases of final instar *Orthotrichia* larvae are readily recognised. Only two cased larvae were collected in this study, which is not surprising, as usually the larvae in this genus are found in swiftly flowing waters, usually well attached to rocks, and possibly also to vegetation, as is likely in the many sandbed rivers in Angola. There are some records of larvae attached to Mollusc cases in lakes Kivu and Edward (Jacquemart 1957).



FIGURES 48, 49. Collection sites representative of those surveyed: 48, Lungue Bungo River flowing through Kalahari sand substrate with marginal, trailing aquatic and some woody vegetation [Photo F.C. de Moor]; 49, rapids on Cubango River. [Photo I.S. Ferreira].

Checklist of Hydroptilidae of Angola

Stactobiinae

Catoxyethira kunenica Mey & de Moor 2019

Hydroptilinae

Aenigmatrichia asymmetrica **sp. nov.**

Hydroptila brigittae Gibon 1987

Hydroptila calundoensis Marlier 1965

Hydroptila cruciata Ulmer 1912

Hydroptila cuembica **sp. nov.**

Hydroptila maoae Gibon, Guenda, & Coulibaly 1994

Hydroptila moxica **sp. nov.**

Jabitrichia flagellum (Marlier 1965)

Oxyethira (*Argyrobothrus*) *palisada* **sp. nov.**

Oxyethira (*Argyrobothrus*) *sechellensis* Malicky 1993

Tricholeiochiton sp.

Orthotrichiinae

Orthotrichia benguelensis Marlier 1965

Orthotrichia ferreirae **sp. nov.**

Orthotrichia meyi **sp. nov.**

Orthotrichia mlamboi **sp. nov.**

Orthotrichia nova Marlier 1978

Acknowledgements

A number of institutions and people made funding available for research and travel assistance. These include The National Research Foundation (NRF) incentive funding for rated researchers; the Directorate of Museums and Heritage, Eastern Cape, for supporting the research at the Albany Museum; and the National Geographic Okavango Wilderness Project, Wild Bird Trust, South Africa (NGOWP) for funding fieldwork, undertaking logistics for setting up camps, flying, feeding and driving researchers to collecting sites, and contributing to costs for sorting specimens; the Wild Bird Trust for administering the funds and coordinating the collecting trips; and the Halo Trust team for ensuring that researchers were in “landmine-cleared” areas when surveying. Rainer von Brandis, Chris Boyes, and Paul Skelton are also thanked for scientific and exploration leadership; and Nonkazimulo Mdidimba and Zezethu Mnqeta for laboratory assistance in sorting samples. Ina Ferreira is thanked for providing the photo of the Cubango River.

References

- Barber-James, H.M., Ferreira, I.S., de Moor, F.C. & Mlambo, M.C. (2018) *Freshwater invertebrate fauna of the upper Cubango River, Angola. Preliminary findings of the NGOWP May 2017 Expedition*. [unpublished Report]
- Dalman, J.W. (1819) Nagra nya insekt-genera, beskrifna. *Kongliga Svenska Vetenskaps-Akademiens Handlingar*, 40, 117–127.
- Eaton, A.E. (1873) On the Hydroptilidae, a family of the Trichoptera. *Transactions of the Royal Entomological Society, London*, 1873, 125–150.
<https://doi.org/10.1111/j.1365-2311.1873.tb00639.x>
- de Moor, F.C. & Scott, K.M.F. (2003) Chapter 5. Trichoptera. In: de Moor, I.J., Day, J.H., & de Moor F.C. (Eds.), *Guides to the Freshwater Invertebrates of southern Africa. Volume 8: Insecta II: Hemiptera, Megaloptera, Neuroptera, Trichoptera & Lepidoptera*. Water Research Commission, Pretoria, pp. 84–181. [2004, ISBN 1-77005-055-8]
- de Moor, F.C. (2015) Chapter 16. Trichoptera. In: Griffiths, C., Picker, M. & Day, J.A. (Eds.), *Freshwater Life: A Fieldguide to the Plants and Animals of Southern Africa*. Struik, Cape Town, pp. 228–239.
- de Moor, F.C. & Ferreira, I.S. (2020) Preliminary report on Trichoptera from the headwaters of the Cuanavale, Cuito, Cuembo and Cuando Rivers in Angola. In: Laudee, P. & Morse, J.C. (Eds.), *Proceedings of the 16th International Symposium on Trichoptera*. Magnolia Press, New Zealand, *Zoosymposia*, 18, 34–45.
<https://doi.org/10.11646/zoosymposia.18.1.7>

- Gibon, F.-M. (1985) Recherches sur les Trichoptères d’Afrique occidentale, II. Stactobiini (Hydroptilidae) de Côte-d’Ivoire. *Revue française d’Entomologie*, New Series, 7, 149–155.
- Gibon, F.-M. (1987a) Studies on West African Trichoptera 7. Two new *Catoxyethira* from Guinea (Hydroptilidae), *Aquatic Insects*, 9, 115–118.
<https://doi.org/10.1080/01650428709361281>
- Gibon, F.-M. (1987b) Recherches sur les Trichoptères d’Afrique occidentale, 8—Hydroptilini (Hydroptilidae). *Revue d’Hydrobiologie Tropicale*, 20, 121–130.
- Gibon, F.-M. (1991) Trichoptères d’Afrique occidentale (XIII). Trois nouvelles *Catoxyethira* de Guinée (Hydroptilidae). *Revue française d’Entomologie*, New Series, 13, 125–130.
- Gibon, F.-M., Guenda, W. & Coulibaly, B. (1994) Observations sur la zonation des cours d’eau de la savane ouest-africaine: Trichoptères du Sud-Ouest du Burkina Faso. *Annales de Limnologie*, 30 (2), 101–121.
<https://doi.org/10.1051/limn/1994007>
- Guenda, W. (1996) Contribution à l’étude des Hydroptilidae (Insecta: Trichoptera) de l’Afrique de l’Ouest: le genre *Orthotrichia* Eaton de la rivière Mouhoun (Burkina Faso). *Annales de Limnologie*, 32 (1996), 241–249.
<https://doi.org/10.1051/limn/1996023>
- Jacquemart, S. (1956) Trois *Orthotrichia* nouveaux du Lac Kivu (Trichoptera, Hydroptilidae). *Bulletin de l’Institut Royal des Sciences Naturelles de Belgique*, 32 (9), 1–9.
- Jacquemart, S. (1957) Trichoptera des Lacs Kivu et Édouard. *Résultats scientifiques de l’Exploration hydrobiologique des Lacs Kivu, Édouard et Albert (1952–1954)*, 3 (2), 67–129.
- Jacquemart, S. (1962) Trois Trichoptères nouveaux d’Afrique Centrale (Trichoptera, Hydroptilidae). *Bulletin de l’Institut Royal des Sciences Naturelles de Belgique*, 38 (34), 1–11.
- Kimmins, D.E. (1951) XX.—Indian caddis flies.—IV. New genera and species of the family Hydroptilidae. *Annals and Magazine of Natural History*, Series 12, 4, 193–213.
<https://doi.org/10.1080/00222935108654144>
- Kimmins, D.E. (1957) New and little-known species of African Trichoptera. *Bulletin of the British Museum (Natural History) Entomology*, 6 (1), 1–37.
<https://doi.org/10.5962/bhl.part.17102>
- Kimmins, D.E. (1958) On some Trichoptera from S. Rhodesia and Portuguese East Africa. *Bulletin of the British Museum (Natural History)*, 7 (7), 359–368.
- Kipping, J., Clausnitzer, V., Fernandes Elizalde, S.R.F. & Dijkstra, K.-D.B. (2019) The dragonflies and damselflies of Angola: An updated synthesis. In: Huntley, B.J., Russo, V., Lages, F. & Ferrand, N. (eds), *Biodiversity of Angola, Science & Conservation: A Modern Synthesis*. Springer Open, Cham, pp. 141–166.
https://doi.org/10.1007/978-3-030-03083-4_9
- Kjaerandsen, J. (1997) *Wlitrichia intropertica* new genus, new species, and *Cyclopsiella anderseni* new genus, new species, two new monobasic genera of microcaddisflies from Ghana (Trichoptera: Hydroptilidae: Hydroptilini). In: Holzenthal, R.W. & Flint, O.S. Jr. (Eds.), *Proceedings of the 8th International Symposium on Trichoptera*. Ohio Biological Survey, Columbus, Ohio, pp. 227–237.
- Kjaerandsen, J. & Andersen, T. (2002) A review of *Jabitrachia* Wells, 1990 (Trichoptera: Hydroptilidae), with the description of a new African species. In: Mey, W. (Ed.), *Proceedings of the 10th International Symposium on Trichoptera*, Potsdam, Germany, July 30–August 5, 2000. *Nova Supplementa Entomologica. Vol. 15*. Deutsches Entomologisches Institut, Goecke & Evers, Keltern, pp. 133–144.
- Kloet, G.S. & Hincks, W.D. (1944) Nomenclatorial notes on two generic names in the Trichoptera. *Entomologist*, 77, 97.
- Malicky, H. (1993) Three new caddisflies from Mahé Island, Seychelles. *Braueria*, 20, 19–21, figs.
- Malicky, H. (2015) Einige neue afrikanische Köcherfliegen (Trichoptera). *Braueria*, 42, 31–35.
- Marlier, G. (1965) Les Trichoptères du Musée de Dundo. *Publicações Culturais da Companhia de Diamantes Angola, Lisboa*, 72, 13–80. [1966]
- Marlier, G. (1978) Sur une collection de Trichoptères de l’Afrique occidentale. *Revue Zoologique Africaine*, 92 (2), 283–301.
- Marshall, J.E. (1979) A review of the genera of the Hydroptilidae (Trichoptera). *Bulletin of the British Museum (Natural History) Entomology*, 39, 135–239.
- McLachlan, R. (1880) s.n. In: *A Monographic Revision and Synopsis of the Trichoptera of the European Fauna. Part 9*. Napier Printers, London, pp. 501–523; with supplement pp. xiii–lxxxix (13–84), pls. LII–LIX (52–59).
<https://doi.org/10.5962/bhl.title.28556>
- Mey, W. & de Moor, F.C. (2019) The Trichoptera (Insecta) of the lower Kunene River in Namibia and Angola. *Zoosymposia*, 14, 134–150.
<https://doi.org/10.11646/zoosymposia.14.1.16>
- Morse, J.C. (2020) Trichoptera World Checklist. Available from: <http://entweb.clemson.edu/database/trichopt/index.htm> (accessed 30 April 2020)
- Mosely, M.E. (1939) *Ruwenzori Expedition 1934–5. 3 (1). Trichoptera*. The British Museum (Natural History), London, 40 pp., 3 pls.
- Mosely, M.E. (1948a) II.—Trichoptera collected by Miss R.H. Lowe at Lake Nyasa. *Annals and Magazine of Natural History*, Series 12, 1 (1), 31–47.

<https://doi.org/10.1080/00222934808653886>

- Mosely, M.E. (1948b) Trichoptera. In: *British Museum Expedition to South-West Arabia, 1937–1938. Vol. 1. Part 9*. British Museum (Natural History), London, pp. 67–85.
- Ris, F. (1897) Neuropterologischer sammelbericht 1894–96. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft*, 9, 415–442. [in German]
- Schmid, F. (1958) Trichoptères de Ceylan. *Archiv für Hydrobiologie*, 54 (1/2), 1–173. [in French]
- Steyskal, G.C. (1972) The meaning of the term “sibling species.” *Systematic Zoology*, 21, 446.
<https://doi.org/10.2307/2412441>
- Statzner, B. (1977) Taxonomische Studien an den Hydroptilidae-Imagines aus dem zentralafrikanischen Bergbach Kalengo (Trichoptera). *Beiträge zur Entomologie*, 24, 393–405. [in German]
<https://doi.org/10.1002/mmnd.4800240413>
- Ulmer, G. (1912) Trichoptera aus Äquatorial-Afrika. *Wissenschaftliche Ergebnisse der Deutschen Zentral-Africa-Expedition*, 4, 81–125. [in German]
- Ulmer, G. (1963) Trichopteren (Kocherfliegen) aus Ägypten. *Archiv für Hydrobiologie*, 59, 257–271. [in German]
- Wells, A. (1981) The genera *Oxyethira* Eaton, *Gnathotrichia* Ulmer and *Stemoxyethira* Kimmins (Trichoptera: Hydroptilidae) in Australia. *Australian Journal of Zoology*, 29 (1), 103–118.
<https://doi.org/10.1071/ZO9810103>
- Wells, A. (1990) New species and a new genus of micro-caddisfly from Northern Australia including the first Australian record of the tribe Stactobiini (Trichoptera: Hydroptilidae). *Transactions of the Royal Society of South Australia*, 114 (3–4), 107–128.
- Wells, A. & Andersen, T. (1995) Tanzanian micro-caddisflies (Trichoptera: Hydroptilidae). *Tijdschrift voor Entomologie*, 138, 143–167.