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Description of three new caddisfly species from Mayotte Island, Comoros Archipelago (Insecta: Trichoptera)

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Abstract

We report five new species records from the Comoros Archipelago. Two of the species are known from outside the Archipelago, *Hydroptila cruciata* Ulmer (Hydroptilidae) and *Anisocentropus voeltzkowi* Ulmer (Calamoceratidae), and three species are described as new to science: *Pisulia stoltzei* ,new species (Pisuliidae), and: *Chimarra mayottensis*, new species and *Chimarra koulaeensis*, new species (Philopotamidae). Five species have been previously recorded from the Comoros Islands: *Cheumatopsyche comorina* (Navás), *Macrostemum capense* (Walker), *Cheumatopsyche vala* Malicky (Hydropsychidae), *Hydroptila voticia* Malicky (Hydroptilidae), and *Oecetis atpomarus* Malicky (Leptoceridae). With this report the number of species from the Comoros is doubled. These findings also represent the first records of Trichoptera from Mayotte.

Key words: Pisuliidae, *Pisulia*, Philopotamidae, *Chimarra*, taxonomy, new species

Introduction

The Comoros Archipelago is composed principally of four islands in the northern Mozambique Channel. The westernmost of the four larger archipelago islands, Grande Comore, is located 300 km east of the northern coast of Mozambique. Mayotte Island is the easternmost of the four larger islands, situated approximately 300 km west of the northwestern coast of Madagascar. The youngest of the islands are western Grande Comore and Mohéli (formed about 0.5 million year ago), and the oldest are Anjouan (11.5 million years old) and Mayotte (10-15 million years old) (Warren *et al.* 2003). Mayotte Island is nearly 4 km long and covers an area of slightly less than 42 km^2. Due to the volcanic origin the Comoros Archipelago, the islands have a fauna and flora that is primarily the result of dispersal from the mainland sources of Madagascar and the African continent (Rocha *et al.* 2005).

The Trichoptera fauna of the Comoros Islands is poorly known, with only five species previously recorded. *Cheumatopsyche comorina* (Navás, 1931) (Hydropsychidae) was the first species described from the islands, and is apparently endemic to Mohéli Island and Anjouan, and the only species recorded from Mohéli Island. Scott (1983) listed *Macrostemum capense* (Walker, 1852) from the Comoros without indicating from which island it was collected. Malicky (1992) described three more species from the archipelago: *Hydroptila voticia* Malicky, 1992 (Hydroptilidae); *Cheumatopsyche vala* Malicky, 1992 (Hydropsychidae); and *Oecetis atpomarus* Malicky, 1992 (Leptoceridae), all from Anjouan Island. No species were previously recorded from Grande Comore or Mayotte Island.

The new species described belong to the families Pisuliidae and Philopotamidae. The Pisuliidae are presently divided into the 2 genera *Silvatares* Navas, 1931 (formerly *Dyschimus* Barnard, 1934), with 10 species, and *Pisulia* Marlier, 1943, with 6 previously described species. The family is restricted to the

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Afrotropical Region and the two genera have similar distributions, except that *Pisulia* has so far not been recorded from Madagascar. An undescribed species or unassociated female of *Pisulia* species from the Comoros Islands was illustrated by Malicky (1992), and this could be conspecific with the species described below from Mayotte Island. Philopotamidae occur in all faunal biogeographical regions and are divided into 20 extant genera of which 4 are recorded from the Afrotropical region. *Paulianodes* Ross, 1956, is monotypic and endemic to Madagascar and the Afrotropical endemic genus *Thylakion* Barnard, 1934, is composed of 4 species. *Wormaldia* McLachlan, 1865, is represented in the Afrotropical region by 7 species, and *Chimarra* Stephens, 1829 is a species-rich genus with 78 previously described species in the Afrotropical region.

The two described species representing new records for Mayotte are *Anisocentropus voeltzkowi* Ulmer, 1909 (Calamoceratidae), which is also known from Madagascar, and *Hydroptila cruciata* Ulmer, 1912 Hydroptilidae), a widely distributed species known from Cape Verde Islands, Yemen, Niger, Ivory Coast, Ghana, Guinea, Benin, Togo, Tanzania, South Africa, and Madagascar.

A female pupa of the genus *Anisocentropus* (Calamoceratidae) was reported from Anjouan by Malicky (1992). This specimen may be *Anisocentropus voeltzkowi* as this species was collected from Mayotte Island. A species of *Chimarra* was also reported from Anjouan (Malicky 1992) and that species might belong to one of the new species described below. The new material doubles the number of caddisfly species known from the Comoros Archipelago, and demonstrates also that the diversity of the area is probably much higher than indicated by previous records. This is supported by the fact that Malicky (1992) listed unidentifiable larvae of Polycentropodidae and Psychomyiidae, and the Leptoceridae genera *Athripsodes* and *Triaenodes* from Anjouan Island, all of which are not yet recorded from the Comoros Islands by species names.
9) and Blahnik (1998).

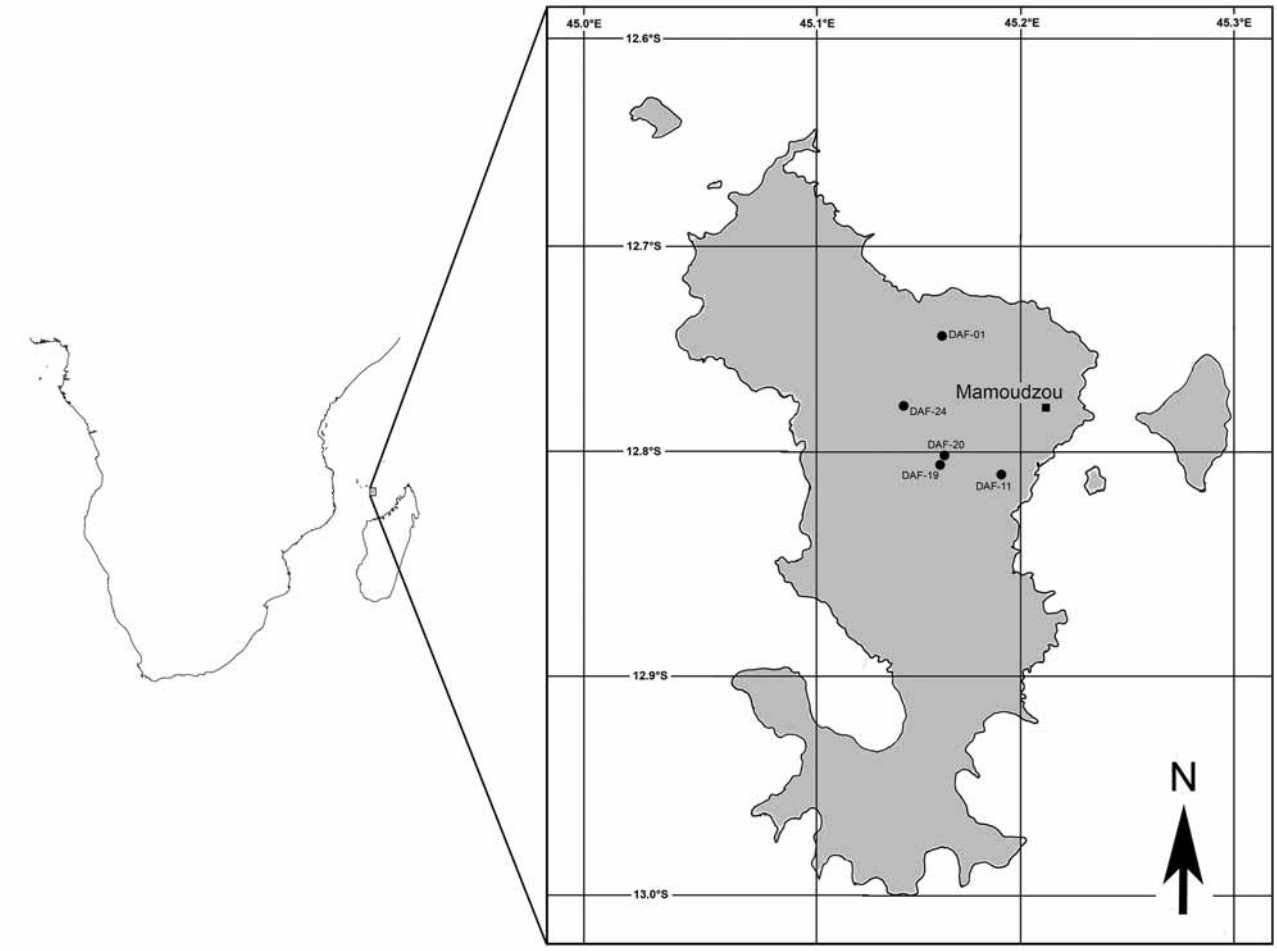


FIGURE 1. Geographical position of Mayotte, with sampling localities indicated as filled circles. The DAF numbers refer to locality data in the text.

Material and methods

Pupae of five identified Trichoptera species were collected from Koualé River basin and Mroni Mouala retention dam (Ourovéni) on Mayotte Island on May 13-21, 2006 (Fig. 1). During this field trip, twenty-three sites were sampled within 10 catchments. At each site, the major habitats were sampled in proportion of their occurrence over a 50-m reach of the stream. Eight samples of macroinvertebrates were collected by means of a "Surber" sampler (0.05 m², 250 µm mesh). Samples were fixed in 5% formaldehyde solution immediately after collection. In the laboratory, macroinvertebrates were sorted and preserved in 70% ethanol.

The holotypes of the new species are deposited in Muséum National d'Histoire Naturelle, Paris, France (MNHN). All paratypes and non-types are deposited in the Swedish Museum of Natural History (NRM).

The terminology applied to the genitalia follows Stoltze (198

Descriptions

Pisuliidae

***Pisulia stoltzei*, new species**
Figs. 2–4

Diagnosis. *Pisulia stoltzei*, new species, is distinguished from all other *Pisulia* species in that segment IX is anteriorly rounded and ellipsoid and the dorsal lobe is rectangular in lateral view; the superior appendage lobes are large, with apices directed ventrad; and the median lobes of segment X are broad and slightly narrowed, with apices directed ventrad. The species resembles *P. pinheyi* Kimmins, 1957, from Zimbabwe, from which it is easily distinguished in lateral view by segment IX being more strongly produced anterad and by the shorter superior appendages; and in ventral view by the apex of the internal lobe of the dorsal branch of the inferior appendages being produced mesad.

Description. Male genitalia: Segment IX ellipsoid anteriorly in lateral view (Fig. 2); dorsal margin slightly concave, ending in rectangular dorsal lobe (Fig. 2); strongly narrowing ventrad (Fig. 2); dorsal bridge (Fig. 3) narrow, parallel-sided. Median lobes of segment X nearly black, originating from segment IX immediately below dorsal bridge (Fig. 2); fused with superior appendages along basal half; carrying 2 long setae on elevated setal bases near base in each side (Figs. 2, 3). Superior appendages nearly black, tall in lateral view (Fig. 2), apices cornute, each with short, smooth, digitate dorsal process curving ventrolaterad (Figs. 2, 3); bases wide, with short, stout setae along posterior margins. Inferior appendages with pair of long, digitate ventral branches, straight in lateral and ventral views and with long apical setae and minute ventral setae near bases. Each inferior appendage with external lobe of dorsal branch irregularly rectangular, broad, with apex pointing slightly dorsad, its posterior margin bearing 2 long, stout setae (Fig. 2); in ventral view (Fig. 4) nearly Y-shaped, with large marginal tubercles. Each inferior appendage with internal lobe of dorsal branch oriented posterodorsad (Fig. 2), narrowing along its length before rounded, dorsad-curved apex; in ventral view (Fig. 4) wide, with apex pointing mesad. Triangular, compressed, plate-like process located above external lobe of dorsal branch of each inferior appendage, with band of setae along convex dorsal margin; apex pointing ventrad (Fig. 2). Phallus unknown.

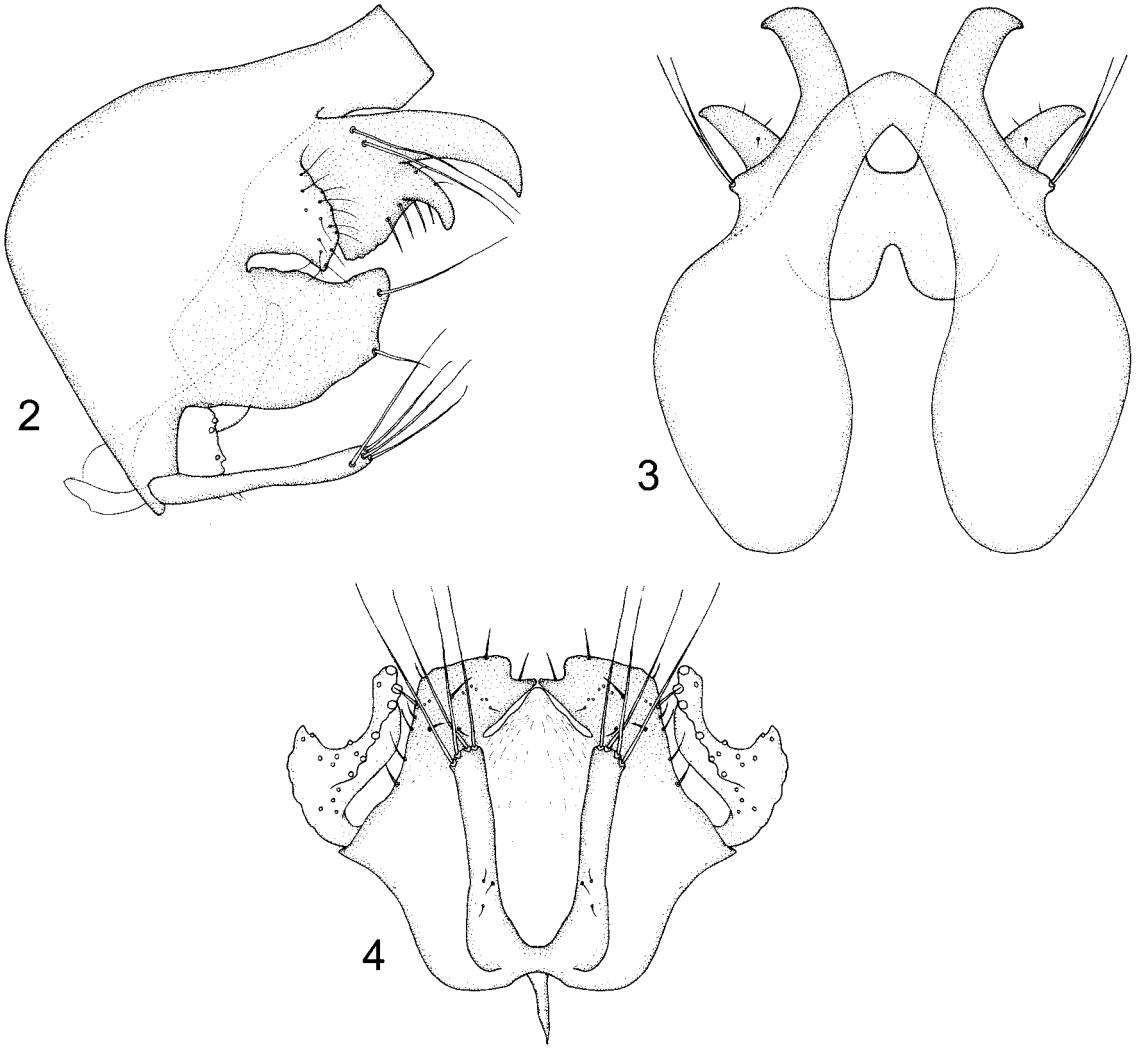
Holotype (pharate male): MAYOTTE: Koualé river, affluent forêt 1 (DAF-19), 12°47'57.84''S, 45°09'51.77''E, 201 m, 18.v.2006. Abdomen mounted in Euparal on microscope slide, rest of body in alcohol (MNHN).

Paratype (1 pupa): Same data as holotype — 1 pupa (in alcohol, NRM).

Distribution. Comoros Archipelago.

Etymology. *Stoltzei*, named after Dr. Michael Stoltze, in honor of his contribution to understanding the systematics of Pisuliidae.

Remark: The inferior appendages were impossible to separate from segment IX, which might be due to the pharate stage of the individual.

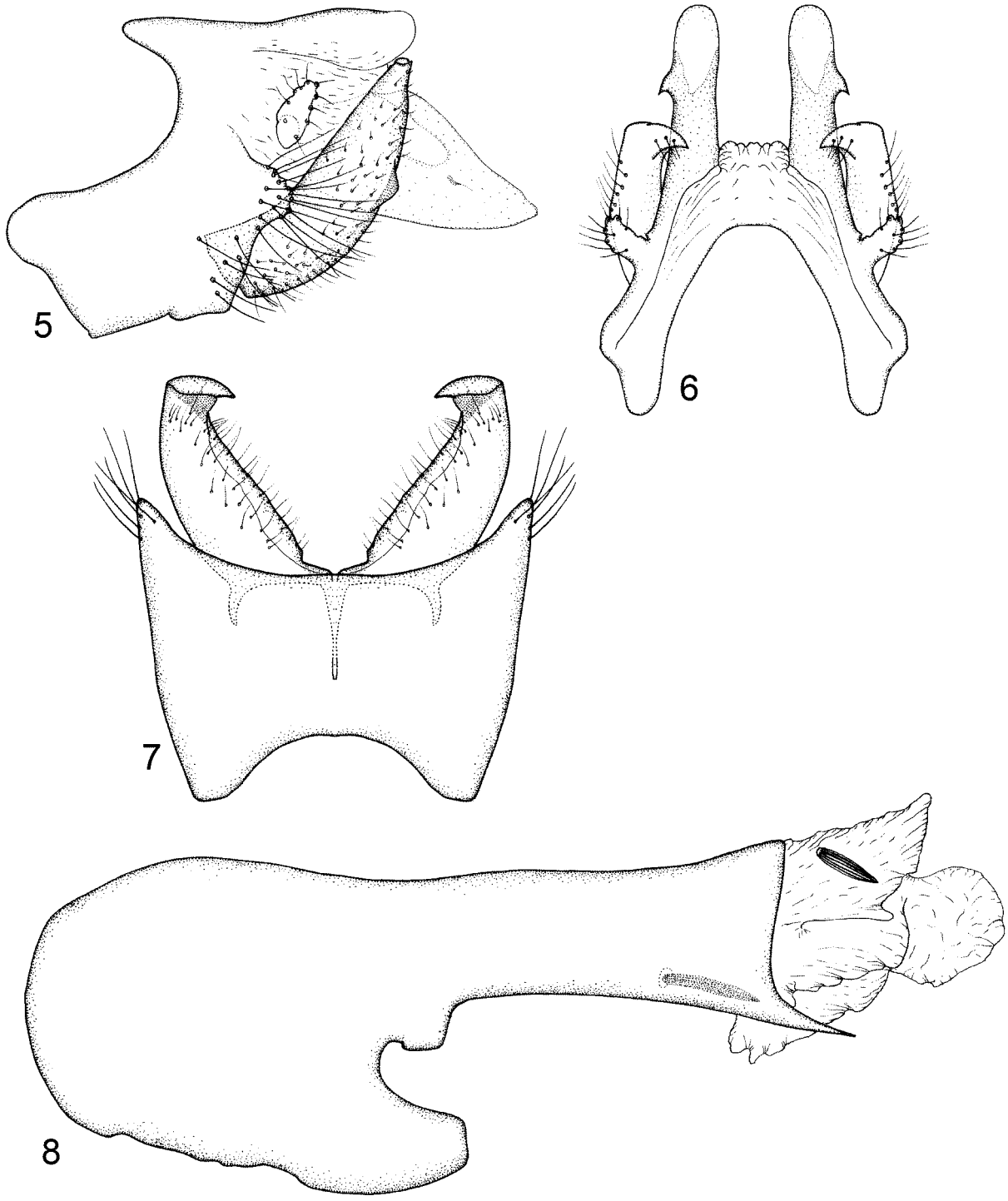


FIGURES 2–4. *Pisulia stoltzei*, new species. Pharate male holotype: 2—genitalia, left lateral; 3—genitalia, dorsal; 4—genitalia, ventral. The "ventral branch," "external lobe of dorsal branch," and "internal lobe of dorsal branch" are all parts of the inferior appendages.

Philopotamidae

***Chimarra mayottensis*, new species**
Figs. 5–8

Diagnosis. This species is distinguished from other Afrotropical species of *Chimarra* in possessing an exceptionally large phallus; a broad and anteriorly produced sternite IX; a small setose lobe below mid-height of the posterior margin of segment IX; and segment X with large ventrolateral lobes, each having a lateral hook; and a small triangular, strongly sclerotized process at the posteroventral margin of each inferior appendage. The shape of the inferior appendages of the new species resembles that of *C. crocifera* Morse, 1974, and *C. pondoensis* (Barnard, 1941), from South Africa; *C. krugeri* (Jacquemart, 1962), from South Africa and Zimbabwe; *C. falcifera* Jacquemart, 1966, and *C. trispina* (Jacquemart, 1961), from the Democratic Republic of Congo; and *C. zoria* (Mosely, 1939), from the Ruwenzori Mountains in Uganda. All these species lack the process on their posteroventral margin of each inferior appendage.



FIGURES 5–8. *Chimarra mayottensis*, new species. Pharate male holotype: 5—genitalia, left lateral view; 6—genitalia, dorsal; 7—genitalia, ventral; 8—phallus, left lateral.

Description. Male genitalia: Lateral portions of sternum IX strongly produced anterad, (Fig. 5); lateral margin, above these productions semicircularly incised; their anteroventral corners nearly right-angled; dorsal apodeme long, directed anterad, narrowly triangular in lateral view (Fig. 5). Posterior margin of segment IX with rounded, setose process located immediately below mid-height on each side (Fig. 5); sternite, in ventral view (Fig. 7), with anterior margin shallowly and widely incised; anteromedian margins, in dorsal view (Fig. 6), forming narrow U-shaped excavation. Segment X incompletely developed, composed of short dorsal lobe

and pair of large ventral lobes (Figs. 5–6); ventral lobes tapering from midway in lateral view (Fig. 5); proximally membranous, distally slightly sclerotized, in dorsal view (Fig. 6) forming pair of posteriorly oriented processes, each with rounded apex and lateral, subapical hook, processes less sclerotized beyond these hooks. Preanal appendages setose, originating from membranous part of segment X, bean-shaped in lateral view (Fig. 5), cylindrical in dorsal view (Fig. 6). Inferior appendages slender, curving dorsad along their lengths, densely covered by small setae; each with short, strongly sclerotized triangular process at posteroventral margin immediately after midlength; tapering from midlength, apices strongly curving mesad (Figs. 6–7). Phallus, in lateral view (Fig. 8), very large, nearly two times longer than rest of genitalia; phallobase rounded anteriorly; dorsal margin nearly straight; phallobase produced posterad ventrally, height equal to height of rest of genitalia; posteroventral part of phallobase produced into ventral spine directed posterad; endotheca with pair of dark endothecal spines about as long as apical spine of phallobase.

Holotype (pharate male): MAYOTTE: Koualé river, affluent forêt 2 (DAF-20), 12°47’42.65’’, 45°09’58.93’’E, 220 m, 18.v.2006. Abdomen in slide mounted in Euparal, rest of body in alcohol (MNHN).

Paratypes: Same data as holotype — 1 pharate male, 5 pupae (in alcohol, NRM); **MAYOTTE:** Longoni, Mro oua Longoni (DAF-01), 12°44’21.12’’S, 45°09’54.97’’E, 25 m, 14 June 2006 — 1 pharate male (in alcohol, NRM).

Distribution. Comoros Archipelago.

Etymology. *Mayottensis,* named after the type locality, Mayotte Island.

***Chimarra koualeensis,* new species**
Figs. 9–12

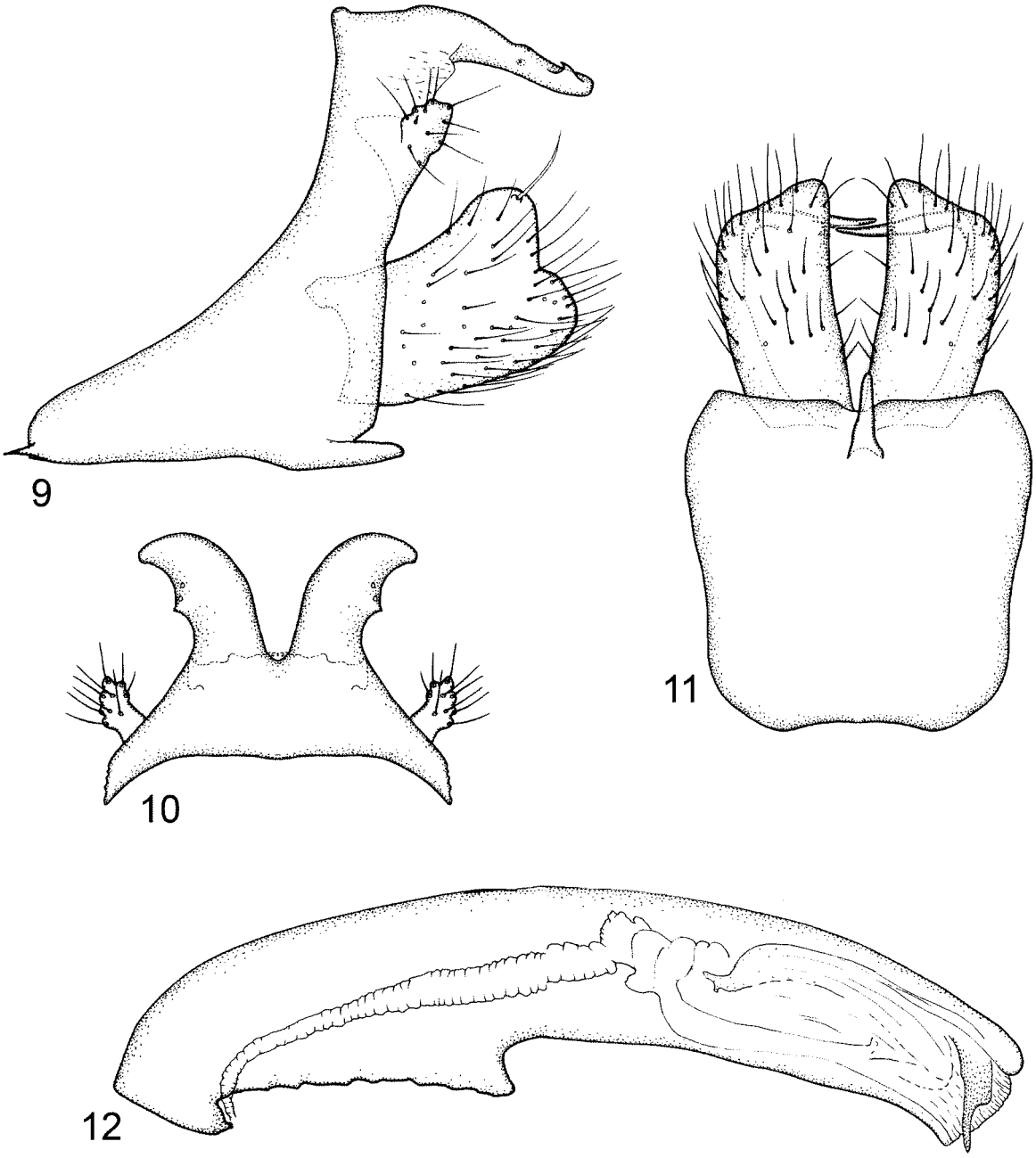
Diagnosis. This species is separable from other Afrotropical *Chimarra* species by a combination of characters in the genitalia: in the lateral view by possessing anteriorly a strongly produced and tapering sternite IX; presence of a narrow, projecting ventral process at the posterior margin of sternite IX; in dorsal view by the unique shape of segment X; the presence of slender, median processes of inferior appendages directed mesad; and bilobed posterior margins of the inferior appendages. The species resembles *C. bertrandi* Scott, 1974, from Zimbabwe; *C. callasae* Gibon, 1982, from Mali; and *C. sassandrae* Gibon, 1982, from West Africa, from which it is separated by the above characters.

Description. Male genitalia: Sternite IX strongly produced and tapering anterad in lateral view (Fig. 9); anterior margin uniformly concavely rounded; segment narrow and nearly parallel-sided dorsally, with minute dorsal apodeme; posterior margin nearly straight; ventral process present posteriorly on sternite IX (Figs. 9, 11); sternite in ventral view (Fig. 11) with weakly concave anterior and posterior margins; in dorsal view anterior margins shallowly concave (Fig. 10). Segment X forming pair of short, depressed, plate-like processes; in lateral view nearly straight with rounded apices (Fig. 9), each with small, subapical thorn-like process; in dorsal view uniformly curving laterad (Fig. 10); each process with apex pointing laterad, lateral tooth present at midlength (Fig. 10); cleft between processes V-shaped. Preanal appendages directed posterodorsad (Figs. 9–10), short, slightly club-shaped; covered by setae. Inferior appendages nearly rectangular in lateral view, apicodorsal corner slightly produced dorsad into rounded lobe (Fig. 9); posterior margin weakly incised at mid-height; in ventral view (Fig. 11) inferior appendages slightly diverging; each inferior appendage with smooth, cylindrical, median process basally directed posterad before sharply curving mesad, apices exceeding median margins of inferior appendages (Fig. 11). Phallus (Fig. 12) long, slender; dorsal margin uniformly convex; border between phallotheca and endotheca invisible; phallobase shallow, long; single endothecal spine present at left side of apex.

Holotype (male): MAYOTTE: Koualé river, affluent forêt 1 (DAF-19), 12°47’57.84’’S, 45°09’51.77’’E, 201 m, 18.v.2006. Abdomen slide mounted in Euparal, rest of body in alcohol (MNHN).

Paratypes: Same data as holotype — 2 pupae (in alcohol, NRM).

Distribution. Comoros Archipelago.
Etymology. *koualeensis*, named after the type locality, Koualé on Mayotte Island.



FIGURES 9–12. *Chimarra koualeensis*, new species. Male holotype: 9—genitalia, left lateral; 10—genitalia, dorsal; 11—genitalia, ventral; 12—phallus, left lateral.

New species records

Hydroptilidae

Hydroptila cruciata Ulmer

Hydroptila cruciata Ulmer, 1912: 83.
Hydroptila capensis Barnard, 1934; Botosaneanu, 2002: 323.

Hydroptila hirra Mosely, 1948; Malicky, 1983: 106.
Hydroptila aierensis Jacquemart, 1980; Malicky, 1983: 106.

Material examined: MAYOTTE: Mro oua Koualé (DAF-11), 12°48'23.72''S, 45°11'56.54''E, 3 m, 17.v.2006. — 1 pharate male (slide mounted in Euparal, NRM), 1 larva (in alcohol, NRM).

Distribution. Benin, Comoros Archipelago, Ghana, Guinea, Ivory Coast, Kape Verde Islands, Madagascar, Niger, South Africa, Tanzania, Togo, Yemen.

Calamoceratidae

Anisocentropus voeltzkowi Ulmer

Anisocentropus voeltzkowi Ulmer, 1909: 357.
Anisocentropus fulvescens Navás, 1934; Schmid, 1949: 393.

Material examined: MAYOTTE: Ourovéni, retention dam of Mroni Mouala (DAF-24), 12°46'18.34''S, 45°08'51.25''E, 142 m, 19.v.2006. — 1 pharate male (in alcohol, NRM).

Distribution. Comoros archipelago, Madagascar.

Discussion

During our study, more than 2,140 Trichoptera larvae were collected, representing nine families: Ecnomidae, Hydropsychidae, Hydroptilidae, Leptoceridae, Pisuliidae, Calamoceratidae, Philopotamidae, Psychomyidae, and Polycentropodidae. The most frequently collected taxa were *Chimarra* sp. (occurring in 70% of the sites, about 1000 individuals), *Pisulia sp*. (60% of the sites, 434 larvae) and the *Hydroptila* sp. (40% of the sites, 96 individuals). Such family-level richness indicates that more than the presently known ten species exist on the Comoros Islands. Future sampling of adults from the islands will certainly reveal a more complete picture of the Trichoptera diversity of the Mayotte Island and the other islands in the archipelago.

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