

New Baetidae (Insecta : Ephemeroptera) from Lake Malawi

by W.P. McCafferty

Department of Entomology, Purdue University, West Lafayette, IN 47907 USA

ABSTRACT

Two new species of small minnow mayflies (Insecta : Ephemeroptera : Baetidae) were discovered in Lake Malawi, Africa. *Cheleocloeon littorale* McCafferty, n. sp., is the seventh species of the genus known from the Afrotropics. Larvae, upon which the species is based, are distinguished from all other species by such characteristics as the short maxillary palp, the well-developed single row of claw denticles, and the extensive marginal spination of the paraproct. It is the third species of *Cheleocloeon* with hindwings present in males but absent in females, and it is the first known from lacustrine habitats. *Maliqua abdallahi* McCafferty, n. sp. is also based on larvae and represents the second species known of the genus and first taken in lacustrine habitats. It is distinguished mainly by its adenticulate claws, leg armature, and undeveloped gill tracheation. Generic characterization is discussed as are habitat and assemblages of mayflies taken in Lake Malawi.

Key-words : Ephemeroptera, Baetidae, *Cheleocloeon*, *Maliqua*, new species, Lake Malawi.

RÉSUMÉ

Nouveaux Baetidae (Insecta : Ephemeroptera) du Lac Malawi

Deux espèces nouvelles d'éphémères Pisciforma (Insecta : Ephemeroptera : Baetidae) ont été découvertes dans le Lac Malawi, Afrique. *Cheleocloeon littorale* McCafferty, n. sp., est la septième espèce du genre connue de la région Afrotropicale. Les larves, sur lesquelles est basée la description de l'espèce, se distinguent de toutes les autres par des caractères tels que le court palpe maxillaire, la rangée unique et bien développée de denticules tarsaux, et les épines marginales de la paraprocte bien développées. Il s'agit de la troisième espèce de *Cheleocloeon* avec des ailes postérieures présentes chez le mâle mais absentes chez la femelle, et c'est la première à être signalée d'habitats lacustres. *Maliqua abdallahi* McCafferty, n. sp. est décrite aussi à partir de larves et représente la seconde espèce connue de ce genre et la première capturée en habitats lacustres. Elle se distingue principalement par ses griffes dépourvues de denticules, l'armature des pattes et la faible trachéation branchiale. Les caractères génériques sont discutés ainsi que l'habitat et les groupements d'espèces d'éphémères du Lac Malawi.

Mots-clés : Ephemeroptera, Baetidae, *Cheleocloeon*, *Maliqua*, espèces nouvelles, Lac Malawi.

INTRODUCTION

Species originally placed in the formerly polyphyletic Africa and Madagascar genus *Afroptilum* Gillies (GILLIES 1990, 1991, WUILLOT & GILLIES 1993b) have recently been revised to numerous genera, some of which are related to the now restricted concept of *Afroptilum*, i.e., the *Centropiloides* complex (LUGO-ORTIZ & MCCAFFERTY 1998a), and some of which are represented in distantly related clades within the family Baetidae. The 30 such species now reside in *Acanthiops* Waltz & McCafferty, *Afroptilum*, *Bugilliesia*

Lugo-Ortiz & McCafferty, *Cheleocloeon* Wuillot & Gillies, *Crassabwa* Lugo-Ortiz & McCafferty, *Dabulamanzia* Lugo-Ortiz & McCafferty, *Dicentroptilum* Wuillot & Gillies, *Maliqua* Lugo-Ortiz & McCafferty, *Micksiops* McCafferty, Lugo-Ortiz & Barber-James, *Puehlella* Lugo-Ortiz & McCafferty, and *Susua* Lugo-Ortiz & McCafferty (WUILLOT & GILLIES 1994, LUGO-ORTIZ & MCCAFFERTY 1996a,b,c, 1997a,b, 1998a,b, BARBER-JAMES & MCCAFFERTY 1997, MCCAFFERTY et al. 1997). A more recent revision of the genus *Acanthiops*, which clarifies the integrity of that genus, has been given by LUGO-ORTIZ et al. (2001).

Cheleocloeon has consisted of six species: *C. dimorphicum* (Soldán & Thomas) from Algeria, *C. carinitum* Wuillot from Guinea and Mali, *C. yolandae* Wuillot (type species) from Guinea, *C. exisum* (Barnard) and *C. falcatum* (Crass) from South Africa, and *C. mirandei* Lugo-Ortiz & McCafferty from Madagascar. The only review of the genus was given by LUGO-ORTIZ & McCAFFERTY (1997a). As pointed out by LUGO-ORTIZ & McCAFFERTY (1998b), the genus is highly distinctive as larvae but adults are peculiar because the hindwings may be present in both sexes, present in neither sex, or present only in the males. As a result, the concept of the genus has somewhat expanded since its inception.

The genus *Maliqia*, a member of the *Cloeodes* complex of baetid genera along with *Bernerius* Lugo-Ortiz & McCafferty, *Cloeodes* Traver, *Crassabwa*, *Dabulamanzia* and *Nesydemius* Lugo-Ortiz & McCafferty (WALTZ & McCAFFERTY 1987, LUGO-ORTIZ & McCAFFERTY 1998c, 1999), has been considered monobasic, although the concept of the genus is relatively very new (LUGO-ORTIZ & McCAFFERTY 1997b). *Maliqia plumosa* (Wuillot), which was originally described in *Afrotitulum*, has been known from male adults and larvae from Guinea and Mali (WUILLOT & GILLIES 1993b). Any discovery of additional species could allow a more comprehensive generic concept.

Recent sampling of the aquatic insect fauna associated with littoral habitats off three small islands in the southern part of Lake Malawi, Africa, revealed the presence of previously unknown species of both the genera *Cheleocloeon* and *Maliqia*, along with a limited number of other mayflies, some of which were identifiable to species and others only to genus (see below). These are important findings both from a biodiversity standpoint, because of the relative dearth of information regarding the two mentioned genera and the emerging knowledge of Afrotropical Baetidae in general, and from an ecological standpoint, because little is known of the Ephemeroptera fauna of African lakes other than that concerning polymitarcyid burrowers in the genera *Povilla* Navás and *Ephoron* Williamson. Larvae of *Cheleocloeon* and *Maliqia* have not been reported from lacustrine habitats previously. The new species are described below, along with brief habitat information and a review of the assemblages of mayflies with which they were found.

SPECIES DESCRIPTIONS

1. *Cheleocloeon littorale* McCAFFERTY, n. sp.

— Description

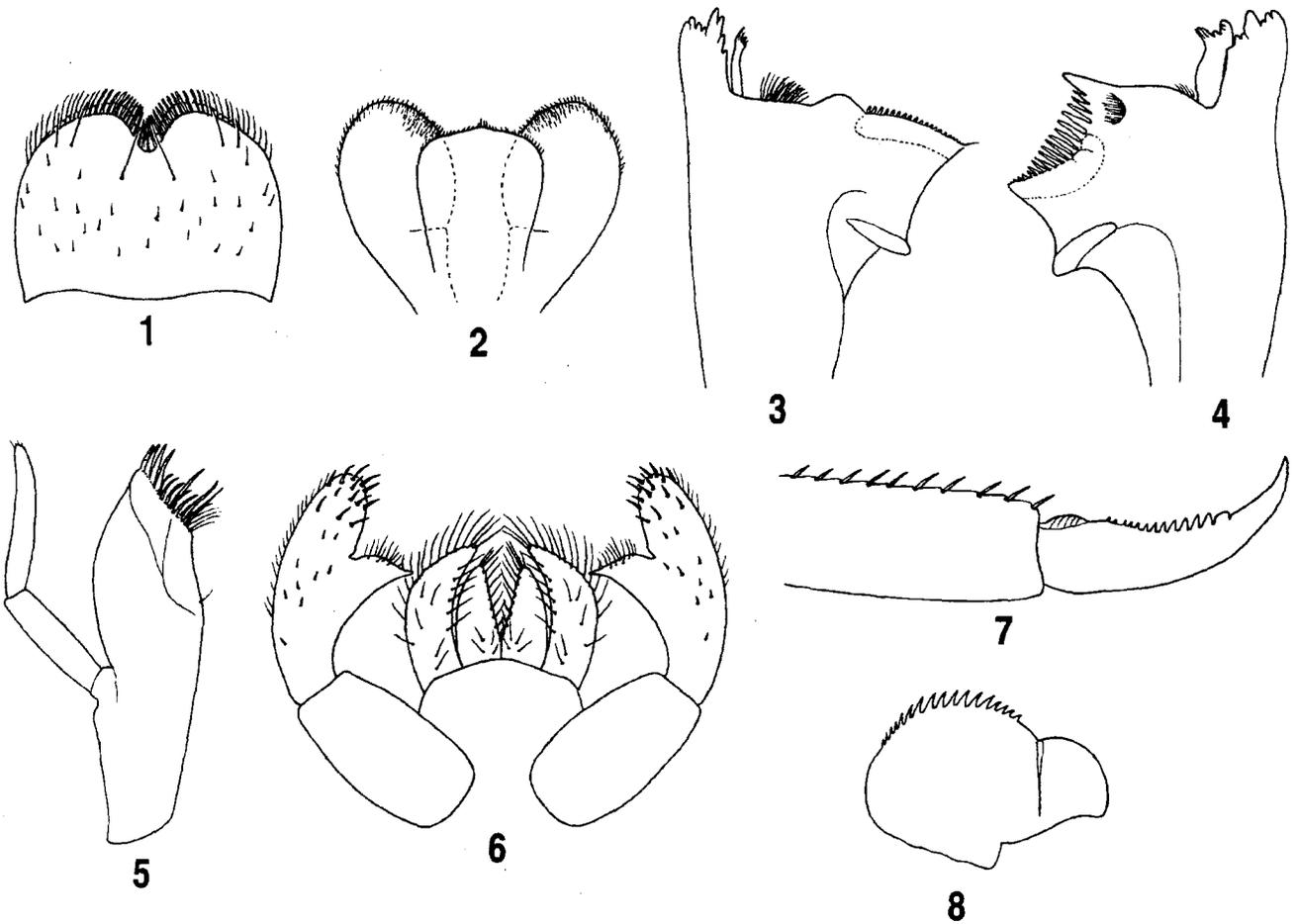
Larva

Body: Mature length 3.9-4.2 mm. Cerci length 1.6-1.8 mm. Median caudal filament subequal to, or slightly shorter than, cerci. General coloration cream with light brown-umber markings variously developed.

Head: Orientation strongly hypognathous. Coloration cream with large, inverted U-shaped brown marking on anterior face. Developing turbinate portion of male eyes cream to burnt or vivid orange. Antennae pale. Labrum (Fig. 1) with relatively deep medial notch, with extensive marginal setae becoming more robust and thick toward center; dorsal surface with pair of long, simple, submedial setae, and row of two long, simple, submarginal setae and third, shorter seta lateral and somewhat basad of submarginal setae; few scattered, short, simple setae with some sometimes forming indistinct row in one or both halves. Hypopharynx (Fig. 2) with lingua broad, more or less quadrate, slightly narrowing basally and with nearly indistinct medioapical projection; superlinguae pear shaped, with rounded apical margins. Right mandible (Fig. 3) fused incisors with seven prominent denticles; prosthema sharply multidentulate and less robust than left prosthema; moderately extensive tuft of setae midway between prosthema and mola. Left mandible (Fig. 4) fused incisors with three small outer denticles, one large, prominent medial denticle, and two small inner denticles; prosthema robust, apically with broad, short, outer denticle and three narrow-sharp, more elongate, inner denticles; small tuft of setae between prosthema and mola adjacent to base of prosthema; process at outer base of mola well developed. Maxillae (Fig. 5) with five broad-based spines and extensive row of long, robust setae along crown of galealaciniae; two-segmented palps extending slightly beyond apex of galealaciniae, with segment 2 slightly longer than segment 1. Labium (Fig. 6) with numerous long, sharp, simple bristlelike setae marginally on glossae and paraglossae, without thick apical tufts of fine setae; relative size and shapes of glossae and paraglossae as shown; palps segment 2 slightly longer than segment 1, with well-developed medial process, with medially oriented apex acute and spinelike; long distal margin of medial process of palps segment 2 broadly rounded medially, with only few moderately long, bristlelike setae.

Thorax: Coloration cream with light brown penciling. Pronotum usually with pair of prominent, juxtaposed, longitudinal, submedial brown bars. Femora with divided, light brown patch subapically to submedially on outer face (poorly developed in some). Tibiae with inner-basal, short, dark marking in some. Tarsi (Fig. 7) with somewhat sparse row of short, weak spines along inner margin. Claws (Fig. 7) moderately long, slightly curved, with inner marginal row of 12-14 short, more or less conical denticles (except terminal denticle broad-flattened) extending from near the base of the claw to approximately two-thirds length of claw. Hindwingpads present in males; hindwingpads absent in females.

Abdomen: Gills with first pair (on segment 1) elongate-paddle shaped and successive pairs broader in the posterior aspect as per WUILLOT & GILLIES (1993a) and LUGO-ORTIZ & McCAFFERTY (1997a). Terga without posteromedial tubercles; tergum 1 mostly light brown with variously exten-



Figs. 1-8. *Cheleocloeon littorale* McCafferty, n. sp.

Fig. 1 : Labrum (dorsal). Fig. 2 : Hypopharynx. Fig. 3 : Right mandible. Fig. 4 : Left mandible. Fig. 5 : Maxilla. Fig. 6 : Labium. Fig. 7 : Tarsus (partial) and claw. Fig. 8 : Paraproct.

Figs. 1-8. *Cheleocloeon littorale* McCafferty, n. sp.

Fig. 1 : Labre (vue dorsale). Fig. 2 : Hypopharynx. Fig. 3 : Mandibule droite. Fig. 4 : Mandibule gauche. Fig. 5 : Maxille. Fig. 6 : Labium. Fig. 7 : Partie distale du tarse et griffe. Fig. 8 : Paraprocte.

sive pale submedian areas ; tergum 2 with light brown to faded pigmentation in medial third but extended more laterally in anterior portion ; tergum 3 light brown throughout mostly, with pair of oblique pale dashes submedially in anterior half, and in some pigmented area broken by longitudinal pale areas at approximately one-third and two-thirds distance across tergum ; tergum 4 light brown in middle third to not pigmented, and if pigment distinct, then pair of pale, submedial, oblique dashes also distinct ; tergum 5 mostly light brown with distinct pair of pale, submedial, oblique dashes to having only sublateral patches of light brown ; tergum 6 generally well pigmented as in tergum 3 (see above) ; tergum 7 with medial pigmentation often limited to medial, longitudinal, light brown marking to entirely pale ; tergum 8 generally similar to tergum 7, often with pigment, if present,

more narrowly developed ; tergum 9 light brown with paler submedial patches variously evident ; tergum 10 not pigmented except for slight light brown spot or cloud medially in some. Sterna pale throughout ; brown dashes evident in ventral view confined to extreme lateral margins of segments. Paraprocts (Fig. 8) with approximately 18 marginal spines, most well developed. Cerci cream, with hairlike setae along medial margin. Median caudal filament translucent, with hairlike setae laterally.

Adult

Unknown.

— Material examined

Holotype : Female larva, Malawi, Nakatenga Island, Lake Malawi, exposed eastern shore, XI-11-1998, A.M. Adallah

(site 4) [deposited in the Purdue Entomological Research Collection, West Lafayette, Indiana]. *Paratypes* : two male larvae and one female larva, Malawi, Nakatenga Island, Lake Malawi, sheltered northern shore, XI-11-1998, A.M. Abdallah (site 3) ; one female larva, Malawi, Mumbo Island, Lake Malawi, XI-11-1998, A.M. Abdallah (site 5) [all paratypes with same deposition as holotype]. *Other material* : 20 larvae (one slide mount in Euparal of labium and hypopharynx), same data as holotype, except collected XI-28-1998 ; three larvae, same data as holotype, except collected XI-12-1998 ; 16 larvae (one slide mount in Euparal of labrum, mandibles, maxillae, paraproct and hindleg), same data as holotype, except collected from sheltered northern shore on XI-11-1998 ; two larvae, same data as holotype, except collected off Mumbo Island on XI-29-1998.

— Etymology

The specific epithet is from the neuter form of the Latin "littoralis" (of the seashore), which is an allusion to the littoral ecological zone of Lake Malawi from which the species is originally described.

— Discussion

All species of African *Cheleocloeon* are known in the larval stage, except for *C. falcatum*. Although the adults of *C. littorale* are unknown, its larval stage cannot represent that unknown stage of the southern African species *C. falcatum*. This is because the female larvae of *C. littorale* are devoid of any hindwingpads, therefore precluding the possibility they are associated with the female adults of *C. falcatum*, which do indeed possess hindwings, and in fact are the only African species of *Cheleocloeon* currently known to do so (CRASS 1947, LUGO-ORTIZ & McCAFFERTY 1998b). Female adults of *C. mirandei* from Madagascar, also presumably possess hindwings, as evidenced by the presence of hindwingpads in the female larvae (LUGO-ORTIZ & McCAFFERTY 1997c).

Cheleocloeon littorale differs considerably from the Madagascar species *C. mirandei*, as apparently do all African species (e.g., with respect to claw denticulation, prosthema form, and labral setation : see LUGO-ORTIZ & McCAFFERTY 1997c).

As per all known African larvae of *Cheleocloeon*, there is a fairly well-developed dorsal abdominal color pattern present in *C. littorale*. The pattern, however, although apparently subtly distinctive in each species, does have the common denominator of generally having at least terga 3, 6, and 9 more heavily pigmented and often terga 1 and 5 also. In the latter respect, *C. littorale* may be most similar to *C. excisum* (see BARNARD 1932, LUGO-ORTIZ & McCAFFERTY 1997a) or *C. dimorphicum* (see SOLDAN & THOMAS 1985).

Although the size of the larvae of *C. carinitum* and *C. yolandae* were not given by WUILLOT & GILLIES (1993a), it may be extrapolated from adult size data given that these species are in the smallest size range (approximately 4.0 mm mature larval body length), similar to that of the larvae of *C.*

littorale. Mature larvae of all other species are larger, with *C. dimorphicum* being the next closest in size (approximately 5.0 mm).

A structural comparison of African species of *Cheleocloeon* shows that larvae of *C. littorale* differ substantially from those of *C. carinatum* (see WUILLOT & GILLIES 1993a) by lacking dorsal abdominal tuberculation and having male hindwingpads. Larvae of *C. littorale* also differ from the latter in having more developed dorsal setation of the labrum, a more limited setal patch on the left mandible, the relatively shorter maxillary palps and possibly more extensive armature of the galealacinae, and denticulation of the tarsal claws. (Several larval characters have not been described for *C. carinitum*.) *Cheleocloeon littorale* larvae differ substantially from those of *C. yolandae* (see WUILLOT & GILLIES 1993a) by the presence of long submarginal and submedial setae on the dorsal face of the labrum, the more denticulate right prosthema, the relatively longer maxillary palp and possibly the armature associated with the galealacinae, the rounded margin and setation of the apical margin of the medial process of the labial palp segment 2, the presence of male hindwingpads, and the denticulation of the tarsal claw. (Several larval characters have not been described for *C. yolandae*.) *Cheleocloeon littorale* larvae differ substantially from those of *C. dimorphicum* (see SOLDAN & THOMAS 1985) by their possession of extensive marginal setation of the labrum along with the presence of a second long, submarginal seta on the dorsal face of the labrum, the shape of the hypopharynx (both lingua and superlinguae), the relatively shorter maxillary palp, the much more medially acute medial process of the labial palp segment 2, the much more extensive denticulation of the tarsal claws, and slightly greater number of spines associated with the paraproct. *Cheleocloeon littorale* larvae differ substantially from those of *C. excisum* (see LUGO-ORTIZ & McCAFFERTY 1997a) by the more deeply emarginate labrum and submarginal and marginal labral setation, the less developed apicomedial projection on the lingua, the relatively shorter maxillary palp, the sparser and longer setae on the apical margin of the medial process of the labial palp segment 2, the much more extensive denticulation of the tarsal claws, and the much greater number of spines associated with the paraproct.

Based on the discovery of *C. littorale*, the larval generic diagnosis given by LUGO-ORTIZ & McCAFFERTY (1997a) requires some expansion to include variable denticulation of the tarsal claws (having no row of denticles, to a short single row of denticles, to an extensive row of well-developed denticles, to two rows of poorly developed denticles), along with a highly variable hindwingpad situation (present in both sexes, absent in both sexes, and present only in the males). This leaves the relative development of the medial process of the labial palp segment 2 as being highly diagnostic. In addition to this, however, there is a somewhat common dorsal color pattern in the African species, a consistently two-segmented maxillary palp, mandible tuft

and prostheca similarities, consistent gill characterization, and the lack of characteristics that are often uniquely diagnostic of other baetid genera, all of which may also aid in recognition of the genus *Cheleocloeon*.

Cheleocloeon littorale was collected on both the exposed, wave-swept eastern shore and the more sheltered northern shore of the thickly forested Nakatenga Island (ca. 415 m x 155 m in size). This island is in the southern part of Lake Malawi close to the mouth of the Linthipe River, the largest inlet river in the southern part of the lake. Both littoral areas off Nakatenga Island where the species was found have substrates ranging from bedrock to gravel. The species was also taken off Mumbo Island, another small (600 m x 400 m), thickly forested island in the south of Lake Malawi. The littoral area where the species was taken off Mumbo Island consisted of a sheltered heterogeneous shore with substrate ranging from boulders to gravel.

Cheleocloeon littorale was taken together with *Adenophlebiodes bicolor* (Crass), *Afronurus* sp., *Caenis* spp., *Euthraulius* sp., and *Povilla adusta* Navás from the sheltered northern shore of Nakatenga Island. It was taken together with *Afronurus* sp., *Caenis* spp., and *Euthraulius* sp. on the exposed eastern shore of Nakatenga Island. It was taken together with *A. bicolor*, *Caenis* spp., *Euthraulius* sp., and *Maliqia abdallahi*, n. sp., off Mumbo Island.

2. *Maliqia abdallahi* MCCAFFERTY, n. sp.

— Description

Larva

Body : Mature length 3.8-4.0 mm. Antennae length 1.7-1.8 mm. Cerci length 1.4-1.5 mm. Median caudal filament length subequal to cerci. General coloration light to medium brown, with few pale markings.

Head : Coloration medium brown, darker on dorsal vertex, and sometimes with narrow, medial, longitudinal pale line. Antennae pale and very long (longer than caudal filaments). Labrum (Fig. 9) narrowly emarginate medially, with well-developed, branched, hairlike, marginal setae ; dorsal surface with long, simple, submedial seta, three or four shorter, far lateral, simple, submarginal setae, and one very long, simple seta basad of innermost submarginal seta. Hypopharynx (Fig. 10) with lingua and superlinguae somewhat elongate, narrowing basally ; lingua with distinct medioapical projection over middle fourth of apical margin ; superlinguae truncate apically, with lateral row of short, stout, slightly hooked setae along narrowly flattened medial section of lateral margin. Right mandible as in Fig. 11, with inner and outer incisors separated ; prostheca smaller than left prostheca, short but robust ; tuft of setae between prostheca and mola well developed, extending from base of prostheca to beyond midway between prostheca and mola. Left mandible as in Fig. 12, with incisors entirely fused ; prostheca robust throughout ; tuft of setae between prostheca and mola clear, somewhat sparse (often difficult to detect), and lo-

cated near base of prostheca. Maxillae (Fig. 13) with crown of galealacinae with four broad-based, somewhat dull spines near apex, and with four very long (? sensory) setae at the base of crown ; palps not reaching apex of galealacinae, two segmented, with segment two much longer than segment 1 and somewhat bent at tip. Labium as in Fig. 14, with palp segment 3 narrowly rounded apically and narrowed abruptly at base along medial margin (giving segment 2 appearance of having slight apicomedial process).

Thorax : Notum generally light to medium brown throughout except mesonotum sometimes with pair of pale sublateral spots anteromedial of forewingpads and with postero-medial irregular shaped blotch. Legs (Fig. 15) pale with dark brown shading at juncture of tibia and tarsus on outer margin, subapically on femur at outer margin and in anterior third at outer margin sometimes extending to dorsal face of femora especially in midfemora. Few long, clear, fine, hair-like setae confined to small area near base of outer margin of tibiae and tarsi (tibiae and tarsi without arcs of fine setae) and to midregion of outer margin of femora ; short spurs along inner margin of femora and tibiae smooth, not fimbriate ; single robust, fimbriate spur at distal apex of femora only. Foreleg (Fig. 15) without arc suture. Midleg with very poorly developed arc suture (without setae) or no arc suture. Hindleg with poorly developed arc suture (without setae). Claws (Fig. 15) adentulate, but with short series of minute striations subapically. Hindwingpads absent in males and females.

Abdomen : Gills as per WULLOT & GILLIES (1993b) (for *A. plumosum*) and LUGO-ORTIZ & MCCAFFERTY (1997b), except with median tracheal trunk not pigmented, and lateral branches not evident. Terga without tufts of long hairlike setae, but with well-developed marginal spination posteriorly, those well pigmented often with pair of minute pale spots ; tergum 1 pale ; tergum 2 somewhat mottled light brown, sometimes with pair of distinct pale areas in anterior half ; tergum 3 diffuse light brown in posterior two-thirds or light brown throughout with pair of pale areas in anterior half ; tergum 4 with diffuse light brown or pale brown pigment often confined to medial third ; tergum 5 brown in posterior half to completely brown ; tergum 6 brown in posterior two-thirds to completely brown ; tergum 7 diffuse light brown throughout ; tergum 8 pale ; terga 9 and 10 medium brown throughout. Sterna pale to light brown. Paraproct (Fig. 16) with seven large marginal spines and three or four minute marginal spines.

Adult

Unknown.

— Material examined

Holotype : Male larva, Malawi, Thumbi West Island, Lake Malawi, exposed northern shore, X-18-1998, A.M. Abdallah (site 1) [deposited in the Purdue Entomological Research Collection, West Lafayette, Indiana]. *Paratype* : Male larva (slide mounted in Euparal), Malawi, Mumbo

Island, Lake Malawi, sheltered southwestern shore, XI-28-1998 (site 5), same collector and deposition as holotype. *Other material* : four larvae, same data as holotype, except collected on X-20-1998 and I-23-1999 ; nine larvae (labrum, hypopharynx, mandibles, labium, legs, and paraproct on one slide), same data as paratype, except collected X-28-1998 and XI-29-1998.

— Etymology

This species is named in honor of Amin M. Abdallah (Waterloo, Ontario), who collected the original material upon which the description of the species is based.

— Discussion

Overall, *M. abdallahi* is quite similar to the congeneric *M. plumosa* (see WUILLOT & GILLIES 1993b), as is to be expected, but obviously because only two species are now known of the genus it remains to be seen if they are sister species. Differences that may be significant include in *M. abdallahi* the presence of a much longer seta above the submarginal row on the dorsal surface of the labrum (Fig. 9) compared to the very short seta in this position in *M. plumosa* (WUILLOT & GILLIES 1993b : Fig. 42) ; the position of the weak setal tuft, made up of long, clear setae, adjacent to the base of prostheca on the left mandible (Fig. 12) compared to the evidently more medially located tuft made up of dense setae on that mandible in *M. plumosa* (WUILLOT & GILLIES 1993b : Fig. 44) ; the labial palp segment 3, which in *M. abdallahi* is somewhat constricted mediobasally, narrowly rounded apically and has several bristlelike setae on its ventral face (Fig. 14) compared with the basally and apically broader segment 3 of *M. plumosa*, which evidently has bristles confined to the medial margin (WUILLOT & GILLIES 1993b : Fig. 45) ; the presence of a several long hairlike setae at the base of the tibiae and tarsi and subapically on the femora (Fig. 15) compared with the absence of such in *M. plumosa* (WUILLOT & GILLIES 1993b : Figs. 47 and 48) ; the inner row of narrow, smooth spurs on the tarsi (Fig. 15) compared with the distinctly broader and fimbriate spurs along the margin of the tarsi of *M. plumosa* (WUILLOT & GILLIES 1993b : Fig. 47) (only one such spur is found on the legs of *M. abdallahi* and it is confined to one of a pair of spurs at the distal apex of the tibiae) ; the poor development of the arc suture on the hind-legs and its poor or non-development on the midleg compared to its evidently distinct development on these legs in *M. plumosa* (WUILLOT & GILLIES 1993b : Fig. 48) ; the complete lack of denticles on the claws (Fig. 15) compared with the short subapical row of denticles present in *M. plumosa* (WUILLOT & GILLIES 1993b : Fig. 47) ; the non-pigmented tracheal trunk of the gills along with the absence of lateral tracheal branches compared to the thick and strongly pigmented tracheal trunk and well-developed branches in *M. plumosa* (WUILLOT & GILLIES 1993b : Fig. 49) ; and the brown abdominal tergum 7 compared to the evidently very light or pale tergum 7 in *M. plumosa* (WUILLOT & GILLIES 1993b : Fig. 50). Those characters dealing with armature may prove to be the most significant.

The generic description of *Maliqia* given by LUGO-ORTIZ & McCAFFERTY (1997b) must now be modified to include species without claw denticles. There are other possibly significant generic characteristics that may be applicable to *Maliqia*. Out of all the larval material of *M. abdallahi* that were examined, there was only one fully intact, unbroken antenna. This antenna was remarkably long, nearly half as long as the body and considerably longer than the caudal filaments. Because WUILLOT & GILLIES (1993b) made no mention of the antennae of *M. plumosa*, I suspect the antennae had been generally broken off the Wuillot and Gillies material as is often typical of baetid larval specimens when they are collected and handled. Unfortunately, however, it remains unknown as to whether the very long antennal length of *M. abdallahi* is typical of the genus or is only of specific consequence. WALTZ & McCAFFERTY (1987b) demonstrated some dramatic differences in antennal length amongst species of the closely related genus *Cloodes*. Another characteristic possibly of some significance involves the unusual flattened area with small, somewhat hooked, robust setae (tiny spines) of the lateral margins of the superlinguae of the hypopharynx. In *M. abdallahi*, this character is present, but again unfortunately it is not known whether the characteristic is common to *M. plumosa*, although it may very well be. As stated by LUGO-ORTIZ & McCAFFERTY (1997b) attempts to obtain material of *M. plumosa* from the Paris Museum, where it supposedly was deposited, have been unsuccessful. Hopefully the material will be available for further comparison in the future. Finally, the unique maxillary palp that is bent near its tip is found in both *M. abdallahi* and *M. plumosa* and may therefore also prove to be a generic characteristic.

Maliqia abdallahi was collected off Thumbi West Island, a thickly forested island near the margin of the western arm of Lake Malawi. The littoral zone off Thumbi West Island from which the larvae were collected was exposed to both wind and wave action, with a substrate ranging from boulders to gravel and coarse sand. The species was also found off Mumbo Island (see discussion of that site under *C. littorale*).

Maliqia abdallahi was taken together with *Adenophlebiodes bicolor*, *Afronurus* sp., *Caenis* spp., and *Euthraulius* sp. off Thumbi West Island. Subimagos of *Eatonica crassi* McCafferty were also taken at a light source near this locality, as were unidentifiable baetid subimagos. *Maliqia abdallahi* was taken together with *A. bicolor*, *Caenis* spp., *C. littorale*, and *Euthraulius* sp. off Mumbo Island.

ACKNOWLEDGMENTS

I thank A. Abdallah (Waterloo, Ontario) for providing Ephemeroptera materials from his ecological studies of Lake Malawi ; A. Provonsha (West Lafayette, Indiana) for original illustrations used herein ; R. Waltz (Indianapolis, Indiana) for technical assistance ; L. Jacobus and R. Randolph (West Lafayette, Indiana) for critiquing the ma-

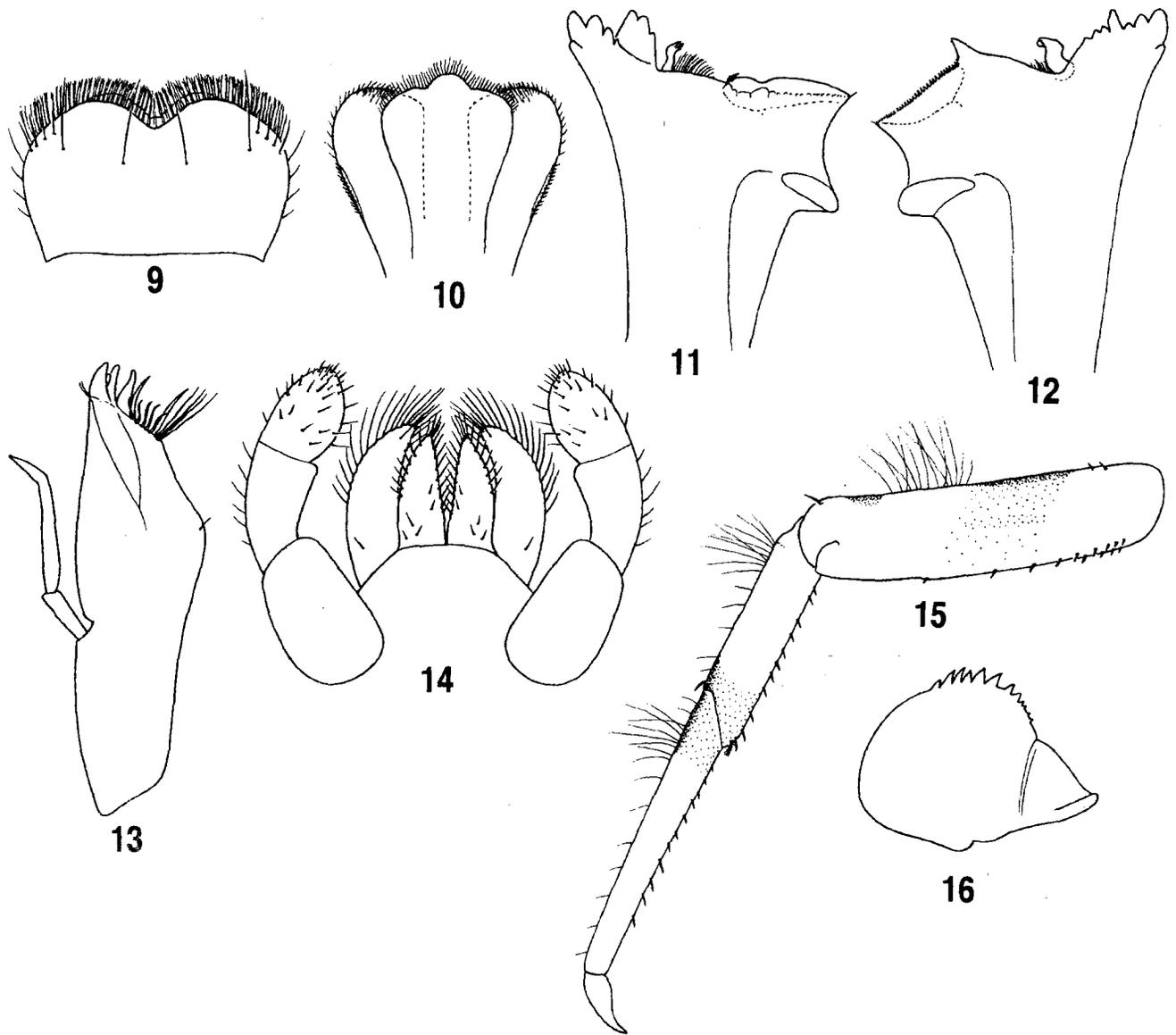
Figs. 9-16. *Maliqua abdallahi* McCafferty, n. sp.

Fig. 9 : Labrum (dorsal). Fig. 10 : Hypopharynx. Fig. 11 : Right mandible. Fig. 12 : left mandible. Fig. 13 : Maxilla. Fig. 14 : Labium. Fig. 15 : Foreleg. Fig. 16 : Paraproct.

Figs. 9-16. *Maliqua abdallahi* McCafferty, n. sp.

Fig. 9 : Labre (vue dorsale). Fig. 10 : Hypopharynx. Fig. 11 : Mandibule droite. Fig. 12 : Mandibule gauche. Fig. 13 : Maxille. Fig. 14 : Labium. Fig. 15 : Patte antérieure. Fig. 16 : Paraprocte.

nuscript ; and A. Thomas (Toulouse) for the French version of the abstract and his general assistance with the manuscript. This paper has been assigned Purdue ARP Journal No 16425.

REFERENCES

- Barber-James (H.M.) & McCafferty (W.P.). 1997. — Review and new species of the African genus *Acanthiops* (Ephemeroptera : Baetidae). *Ann. Limnol.*, 33 : 85-92.
- Barnard (K.H.). 1932. — South African mayflies (Ephemeroptera). *Trans. roy. Soc. S. Afr.*, 20 : 201-259.
- Crass (R.S.). 1947. — The mayflies (Ephemeroptera) of Natal and Eastern Cape. *Ann. Natal Mus.*, 11 : 37-110.
- Gillies (M.T.). 1990. — A revision of the African species of *Centroptilum* Eaton (Baetidae, Ephemeroptera). *Aquat. Insects*, 12 : 97-128.
- Gillies (M.T.). 1991. — A new species of *Afroptilum* (*Afroptiloides*) from east Africa (Ephem., Baetidae). *Entomol. mon. Mag.*, 127 : 109-115.
- Lugo-Ortiz (C.R.) & McCafferty (W.P.). 1996a. — The *Bugilliesia* complex of African Baetidae (Ephemeroptera). *Trans. Am. Entomol. Soc.*, 122 : 175-197.

- Lugo-Ortiz (C.R.) & McCafferty (W.P.). 1996b. — *Crassabwa*: a new genus of small minnow mayflies (Ephemeroptera: Baetidae) from Africa. *Ann. Limnol.*, 32: 235-240.
- Lugo-Ortiz (C.R.) & McCafferty (W.P.). 1996c. — The composition of *Dabulamanzia*, a new genus of Afrotropical Baetidae (Ephemeroptera), with descriptions of two new species. *Bull. Soc. Hist. nat., Toulouse*, 132: 7-13.
- Lugo-Ortiz (C.R.) & McCafferty (W.P.). 1997a. — Contribution to the systematics of the genus *Cheleocloeon* (Ephemeroptera: Baetidae). *Entomol. News*, 108: 283-289.
- Lugo-Ortiz (C.R.) & McCafferty (W.P.). 1997b. — *Maliqua*: a new genus of Baetidae (Ephemeroptera) for a species previously assigned to *Afroptilum*. *Entomol. News*, 108: 367-371.
- Lugo-Ortiz (C.R.) & McCafferty (W.P.). 1997c. — New species and first reports of the genera *Cheleocloeon*, *Dabulamanzia*, and *Mutelocloeon* (Insecta: Ephemeroptera: Baetidae) from Madagascar. *Bull. Soc. Hist. nat., Toulouse*, 133: 47-53.
- Lugo-Ortiz (C.R.) & McCafferty (W.P.). 1998a. — The *Centroptiloides* complex of Afrotropical small minnow mayflies (Ephemeroptera: Baetidae). *Ann. entomol. Soc. Am.*, 91: 1-26.
- Lugo-Ortiz (C.R.) & McCafferty (W.P.). 1998b. — *Cheleocloeon falcatum* (Crass), a new combination for a southern African species previously assigned to *Afroptilum* Gillies (Ephemeroptera: Baetidae). *Afr. Entomol.*, 6: 379-380.
- Lugo-Ortiz (C.R.) & McCafferty (W.P.). 1998c. — Phylogeny and biogeography of *Nesydemius*, n. gen., and related Afrotropical genera (Insecta: Ephemeroptera: Baetidae). *Bull. Soc. Hist. nat., Toulouse*, 134: 7-12.
- Lugo-Ortiz (C.R.) & McCafferty (W.P.) 1999. — Global diversity of the mayfly family Baetidae (Ephemeroptera): a generic perspective. *Trends Entomol.*, 2: 45-54.
- Lugo-Ortiz (C.R.), Barber-James (H.M.), McCafferty (W.P.) & de Moor (F.C.). 2001. — A non-paraphyletic classification of the Afrotropical genus *Acanthiops* Waltz & McCafferty (Ephemeroptera: Baetidae). *Afr. Entomol.*, in press.
- McCafferty (W.P.), Lugo-Ortiz (C.R.) & Barber-James (H.M.). 1997. — *Micksiops*, a new genus of small minnow mayflies (Ephemeroptera: Baetidae) from Africa. *Entomol. News*, 108: 363-366.
- Soldán (T.) & Thomas (A.G.B.). 1985. — *Centroptilum dimorphicum* sp. n., a new species of mayfly (Ephemeroptera, Baetidae) from Algeria. *Acta entomol. Bohemoslov.*, 82: 180-186.
- Waltz (R.D.) & McCafferty (W.P.) 1987a. — Generic revision of *Cloeodes* and description of two new genera (Ephemeroptera: Baetidae). *Proc. entomol. Soc. Wash.*, 89: 177-184.
- Waltz (R.D.) & McCafferty (W.P.) 1987b. — Revision of the genus *Cloeodes* Traver (Ephemeroptera: Baetidae). *Ann. entomol. Soc. Am.*, 80: 191-207.
- Wuillot (J.) & Gillies (M.T.). 1993a. — *Cheleocloeon*, a new genus of Baetidae (Ephemeroptera) from West Africa. *Rev. Hydrobiol. trop.*, 26: 213-217.
- Wuillot (J.) & Gillies (M.T.). 1993b. — New species of *Afroptilum* (Baetidae, Ephemeroptera) from West Africa. *Rev. Hydrobiol. trop.*, 26: 269-277.
- Wuillot (J.) & Gillies (M.T.). 1994. — *Dicentropilum*, a new genus of mayflies (Baetidae, Ephemeroptera) from Africa. *Aquat. Insects*, 16: 133-140.