Bull. Soc. Hist. Nat., Toulouse, 133, 1997, 47-53

New Species and First Reports of the Genera *Cheleocloeon, Dabulamanzia,* and *Mutelocloeon* (Insecta : Ephemeroptera : Baetidae) from Madagascar

by C.R. Lugo-Ortiz and W.P. McCafferty

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

ABSTRACT

The small minnow mayflies (Insecta : Ephemeroptera : Baetidae) *Cheleocloeon mirandei* LUGO-ORTIZ and MCCAFFERTY, n. sp., *Dabulamanzia improvida* LUGO-ORTIZ and MCCAFFERTY, n. sp., and *Mutelocloeon thomasorum* LUGO-ORTIZ and MCCAFFERTY, n. sp., are described from Madagascar and represent the first reports of each genus from the island. Larvae of *C. mirandei* are distinguished by numerous mouthpart characteristics, presence of two conspicuous rows of denticles on the tarsal claws, and numerous small paraproctal spines. Larvae of *D. improvida* are distinguished by numerous mouthpart characteristics, poorly denticulate tarsal claws, and short paraproctal spines. Male adults of *M. thomasorum* are distinguished by abdominal coloration and genital forceps segment 2 morphology.

Keywords : Ephemeroptera, Baetidae, *Cheleocloeon, Dabulamanzia, Mutelocloeon*, new species, Madagascar.

RÉSUMÉ

Espèces nouvelles et premières citations des genres *Cheleocloeon, Dabulamanzia* et *Mutelocloeon* (Insecta : Ephemeroptera : Baetidae) de Madagascar.

Les Ephémères Pisciforma (Insecta : Ephemeroptera : Baetidae), *Cheleocloeon mirandei* LUGO-ORTIZ et MCCAFFERTY, n. sp., *Dabulamanzia improvida* LUGO-ORTIZ et MCCAFFERTY, n. sp., et *Mutelocloeon thomasorum* LUGO-ORTIZ et MCCAFFERTY, n. sp., sont décrits de Madagascar et représentent les premières citations de chacun de ces genres de l'île. Les larves de *C. mirandei* se distinguent par de nombreux caractères sur les pièces buccales, la présence de deux rangées marquées de denticules sur les griffes tarsales et de nombreuses petites épines sur les paraproctes. Les larves de *D. improvida* se distinguent par de nombreux caractères sur les pièces buccales, les griffes tarsales faiblement denticulées et de courtes épines sur les paraproctes. Les adultes mâles de *M. thomasorum* se distinguent par la coloration abdominale et la morphologie du segment 2 des forceps.

Mots clés : Ephemeroptera, Baetidae, *Cheleocloeon, Dabulamanzia, Mutelocloeon*, espèces nouvelles, Madagascar.

INTRODUCTION

The faunal composition of small minnow mayflies (Ephemeroptera : Baetidae) in Madagascar requires description and documentation. Only 14 species have been reported in nine genera (NAVÁS 1926, 1930, 1936 ; DEMOULIN 1966, 1968, 1970, 1973 ; WALTZ and MCCAFFERTY 1987 ; LUGO-ORTIZ and MCCAFFERTY 1997b, c, e, 1998a). Reports of *Centrop-tilum* EATON (1869) are questionable because species assigned to it in Africa have been shown to represent diverse evolutionary lineages (GILLIES 1990 ; WUILLOT and GILLIES 1994 ; LUGO-ORTIZ and MCCAFFERTY 1996a, b, c, 1997a, d, 1998a, b ; BARBER-JAMES and MCCAFFERTY 1997 ; MCCAFFERTY et al. 1997). Also reports of *Cloeon* LEACH (1815) should be considered provisional because the specimens upon which they are based consist of subimagos and damaged adults whose descriptions are too brief (NAVÁS 1926, 1930, 1936). This scarcity of data on Madagascar Baetidae is of concern because the island has a diverse array of aquatic habitats that suggests the presence of a unique fauna, but overpopulation and economic pressures are resulting in the rapid fragmentation of habitats, extinction of spe-

cies, and extirpation of geographic populations (MYERS 1988a, b ; WILSON 1992). From the systematic and biogeographic viewpoint, this situation may result in hindering attempts at posing hypotheses about the phylogeny and history of evolutionary lineages.

We herein report for the first time the baetid genera *Cheleocloeon* WUILLOT and GILLIES (1993), *Dabulamanzia* LUGO-ORTIZ and MCCAFFERTY (1996a), and *Mutelocloeon* GILLIES and ELOUARD (1990) from Madagascar. The discovery of these genera in Madagascar is significant because it indicates that they had already become established as distinct evolutionary lineages before the separation of the island and the African continent approximately 100 million years ago (e.g., PIELOU 1979). Congeneric species distributions in Southern Hemisphere landmasses separated for such a period of time is furthermore predictive of similar possible instances between once-connected landmasses that have been separated for even less time (e.g., Australia and New Zealand).

The materials upon which this study is based are housed in the Purdue Entomological Research Collection, West Lafayette, Indiana, USA.

1. *Cheleocloeon mirandei* LUGO-ORTIZ and MCCAFFERTY, n.sp.

— Description

Female larva

Body : Length 5.1 mm. General coloration medium yellow-brown.

Head : Coloration medium yellow-brown, with no distinct markings. Labrum (Fig. 1) with submedial setae absent and with submarginal row of three to four long, fine, simple setae ; dorsal surface with abundant minute, fine, simple setae. Hypopharynx as in Fig. 2. Left mandible (Fig. 3) incisors with 3 + 1 + 3 denticles ; prostheca robust, apically denticulate ; tuft of setae present between prostheca and mola ; triangular process at base of mola somewhat short. Right mandible (Fig. 4) incisors with seven denticles ; prostheca apically denticulate, less robust than left prostheca ; tuft of setae present between prostheca and mola ; small tuft of setae present at base of mola. Maxillae (Fig. 5) with four sharp, falcate denticles on crown of galealaciniae ; medial hump with four to five short, fine, simple setae ; palps two segmented, extending beyond galealaciniae ; palp segment 2 approximately 1.75x length of segment 1. Labium (Fig. 6) with abundant fine, simple setae of various lengths marginally on glossae and paraglossae ; palps two segmented ; palp segment 1 as long as segment 2 ; segment 2 with well-developed, distally pointed medial process and abundant fine, simple setae of various lengths scattered over surface.

Thorax : Coloration medium yellow-brown, with no distinct markings. Hindwingpads present. Legs pale yellow-brown ; femora dorsally with 10-12 robust, apically pointed, simple setae and ventrally with 20-22 robust, apically pointed, simple setae ; tarsi dorsally with numerous long, fine, simple setae, ventrally with 10-12 robust, apically pointed, simple setae, somewhat increasing in length apically ; tibiae dorsally with numerous long, fine, simple setae, ventrally with 20-22 robust, apically pointed, simple setae ; tarsal claws (Fig. 7) approximately 0.35x length of tarsi, with two subparallel rows of 14-16 minute denticles.

Abdomen : Coloration medium yellow-brown. Segment 1 pale yellow-brown, with no distinct markings ; segments 2 and 3 medium brown, with bowlike faint yellow-brown submedial markings ; segments 4-10 medium yellow-brown. Gill 1 (similar to LUGO-ORTIZ and MCCAFFERTY 1997a : Fig. 11) elongate, paddle-shaped, poorly tracheated, without marginal serrations ; gills 2-7 (similar to LUGO-ORTIZ and MCCAFFERTY 1997a : Figs. 12, 13) broadest in middle, well tracheated, with minute marginal serrations. Paraprocts (Fig. 8) with numerous minute marginal spines. Caudal filament length : unknown.

Adult

Unknown.

— Material examined

Holotype : Female larva, Madagascar, Fianarantsoa Prov., Namarona R., at Ranomafana, 22°C, 5-XI-1971, G.F. and C.H. Edmunds, F. Emmanuel.

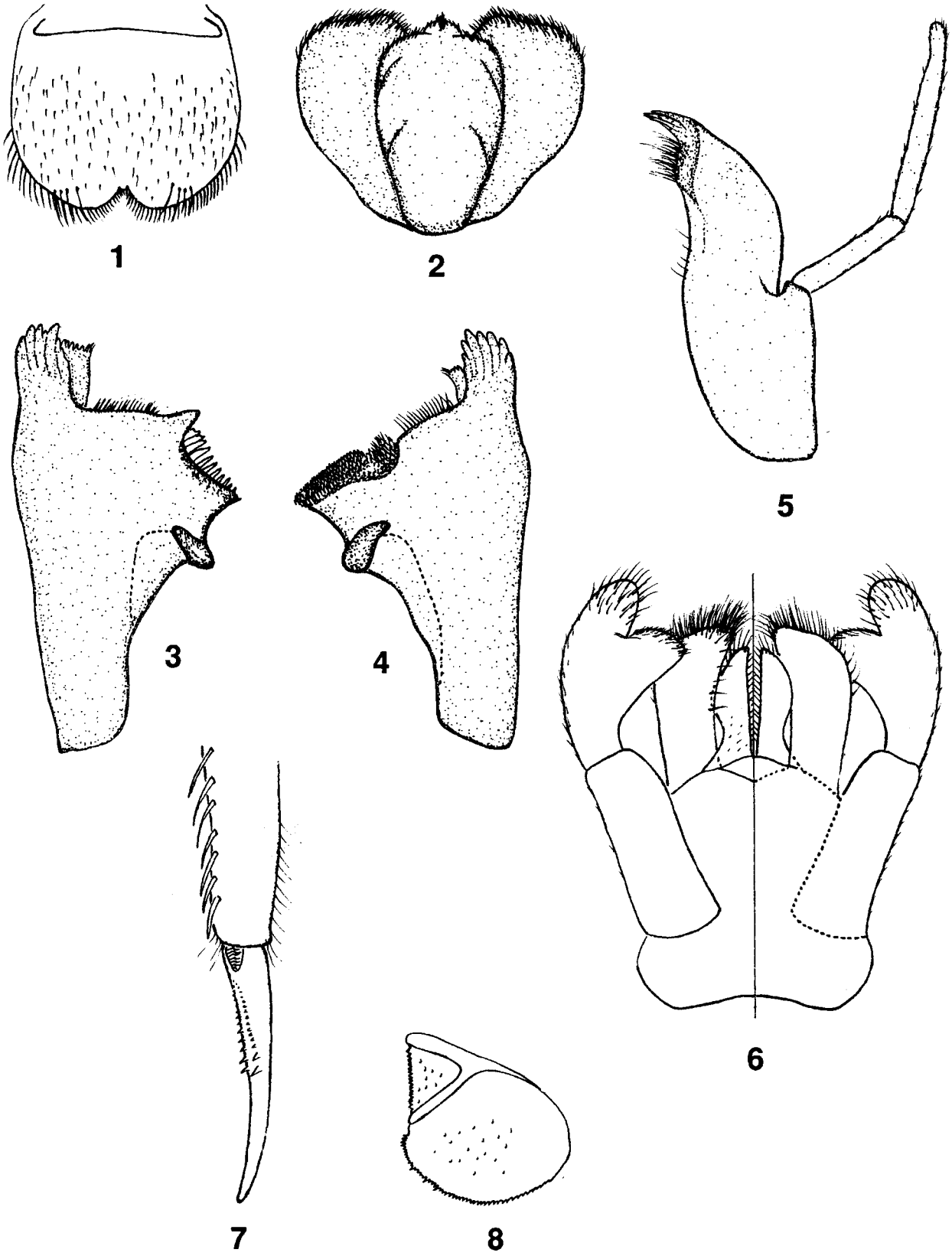
— Etymology

We are pleased to name this species after Mr. André Mirande, who has contributed exceptional effort in the production of many Ephemeroptera papers.

— Discussion

Cheleocloeon mirandei is most similar to the southern African species *C. excisum* (BARNARD) (1932). However, *C. mirandei* is distinguished from *C. excisum* in the following features : lack of a submedial pair of setae and presence of abundant short, fine, simple setae dorsally on the labrum (Fig. 1) ; more robust hypopharynx (Fig. 2) ; more extensive tufts of setae between the prosthecae and mola of both mandibles and fanlike arrangement of the left mandibular incisors (Figs. 3, 4) ; longer maxillary palp segment 2 (Fig. 5) ; presence of two conspicuous rows of denticles on the tarsal claws (Fig. 7) ; and more numerous and smaller marginal spines on the paraprocts (Fig. 8).

The fact that *C. mirandei* has two rows of denticles on the tarsal claws (Fig. 7) would ostensibly indicate that the species belongs to the *Centroptiloides* complex of Afrotropical genera (LUGO-ORTIZ and MCCAFFERTY 1998a). The genera in the latter complex, however, have relatively large, robust denticles that are subconical, whereas those of *C. mirandei* are minute and laterally compressed. LUGO-ORTIZ and MCCAFFERTY (1997a) indicated that *C. excisum* has only one row of denticles on its tarsal claws, but subsequent examination has revealed that there is a second row of denticles that is barely discernible. *Cheleocloeon carinatum* WUILLOT (WUILLOT and GILLIES 1993), *C. dimorphicum* (SOLDÁN and



Figs. 1 to 8. *Cheleocloeon mirandei* LUGO-ORTIZ and MCCAFFERTY, n. sp.
Fig. 1 : Labrum (dorsal). Fig. 2 : Hypopharynx. Fig. 3 : Left mandible. Fig. 4 : Right mandible. Fig. 5 : Left maxilla. Fig. 6 : Labium (left-ventral ; right-dorsal). Fig. 7 : Tarsal claw. Fig. 8 : Paraproct.

Figs. 1 à 8. *Cheleocloeon mirandei* LUGO-ORTIZ et MCCAFFERTY, n. sp.
Fig. 1 : Labre (vue dorsale). Fig. 2 : Hypopharynx. Fig. 3 : Mandibule gauche. Fig. 4 : Mandibule droite. Fig. 5 : Maxille gauche. Fig. 6 : Labium (vue ventrale à gauche ; vue dorsale à droite). Fig. 7 : Griffe tarsale. Fig. 8 : Paraprocte.

THOMAS) (1985), and *C. yolandae* WUILLOT (WUILLOT and GILLIES 1993) either lack or have one reduced row of denticles on the tarsal claws, thus indicating that this feature varies considerably within *Cheleocloeon*.

2. *Dabulamanzia improvida* LUGO-ORTIZ and McCAFFERTY, n. sp.

— Description

Larva

Body : Length 5.4-6.0 mm. General coloration medium yellow-brown.

Head : Coloration medium yellow-brown, with no distinct markings. Antennae approximately 3.0x length of head capsule. Labrum (Fig. 9) broadly rounded anteriorly, with submedial pair of long, fine, simple setae and row of four to five long, fine, simple setae submarginally. Hypopharynx as in Fig. 10. Left mandible (Fig. 11) incisors with six denticles. Right mandible (Fig. 12) outer incisors with four denticles, medial incisors with three denticles. Maxillae (Fig. 13) with five to six long, fine, simple setae near medial hump ; palp segment 2 approximately 1.28x length of segment 1. Labium (Fig. 14) with palp segment 1 approximately 0.77x length of segments 2 and 3 combined ; palp segment 2 with five to six minute, fine, simple setae dorsally ; palp segment 3 slightly produced medially.

Thorax : Coloration medium yellow-brown, with complex light yellow-brown markings ; femora with light brown subrectangular marking proximally, with six to eight long, simple setae dorsally and scattered small, stout, simple setae ventrally ; tibiae bare dorsally and with eight to ten small, stout, simple setae ventrally ; tarsi with fine, simple setae and 12-14 short, stout, simple setae ventrally ; tarsal claws (Fig. 15) with five to six denticles, and basal denticles poorly developed.

Abdomen : Coloration medium yellow-brown to medium brown. Segment 1 uniformly light to medium yellow-brown ; segment 2 medium yellow-brown, with medium brown subtriangular marking medially ; segment 3 medium brown anteriorly, light yellow-brown posteriorly, with three small round dots anteromedially ; segment 4 medium to light yellow-brown, usually with medium brown subrectangular marking and three small round dots anteromedially ; segments 5 and 6 uniformly medium yellow-brown, with three small round dots anteromedially, segment 6 usually light yellow-brown posteriorly ; segments 7 and 8 uniformly light to medium yellow-brown ; segment 9 medium brown, usually with medium yellow-brown subrectangular marking medially ; segment 10 medium brown, usually with large subtriangular pale marking medially. Terga (Fig. 16) with regular triangular spination and abundant large scale bases. Paraprocts (Fig. 17) 13-15 marginal spines, increasing in length apically, with scattered scale bases on surface. Caudal filaments light to medium yellow brown ; length : 2.7-2.9 mm.

Adult

Unknown.

— Material examined

Holotype : Larva, Madagascar, Fianarantsoa Prov., Tsaratango R., 9 km E of Ranomafana, 6-XI-1971, G.F. and C.H. Edmunds, F. Emmanuel. *Paratypes* : five larvae, same data as holotype [mouthparts, forelegs, tergum 3, paraproct of one larva mounted on slide (medium : Euparal)] ; four larvae, Madagascar, D.S. Prov., Nosy Be, stream nr Andrikibo, 23-X-1971, G.F. and C.H. Edmunds, F. Emmanuel ; two larvae, Madagascar, Fianarantsoa Prov., Namarona R., at Ranomafana, 5-XI-1971; G.F. and C.H. Edmunds, F. Emmanuel ; larva, Madagascar, Tamatave (= Toamasina) Prov., Ifasina R., at Bedary RN 2, 46 km W of Brickaville, 15-X-1971, G.F. and C.H. Edmunds, F. Emmanuel. *Other material* : four larvae, Madagascar, D.S. Prov., Nosy Be, stream nr Andrikibo, 23-X-1971, G.F. and C.H. Edmunds, F. Emmanuel ; six larvae, Madagascar, Fianarantsoa Prov., Namarona R., at Ranomafana, 5-XI-1971, G.F. and C.H. Edmunds, F. Emmanuel ; five larvae, Madagascar, Tamatave (= Toamasina) Prov., Ifasina R., at Bedary RN 2, 46 km W of Brickaville, 15-X-1971, G.F. and C.H. Edmunds, F. Emmanuel.

— Etymology

The specific epithet is Latin for unexpected.

— Discussion

Dabulamanzia improvida is most similar to the southern African species *D. fica* LUGO-ORTIZ and McCAFFERTY (1996a). However, *D. improvida* differs from *D. fica* in the following features : apically denticulate right prostheca (Fig. 12) ; more slender and longer maxillary palps (Fig. 13) ; less compact labium with longer palps and with palp segment 3 less medially produced (Fig. 14) ; fewer and less developed tarsal claw denticles (Fig. 15) ; larger tergal scales (Fig. 16) ; and shorter paraproctal spines (Fig. 17).

3. *Mutelocloeon thomasorum* LUGO-ORTIZ and McCAFFERTY, n. sp.

— Description

Larva

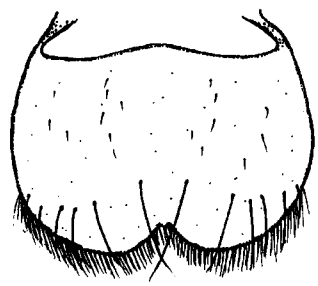
Unknown.

Male adult

Body length 4.5 mm. Forewing length : 5.0. Caudal filaments length : unknown.

Head (Figs. 18, 19) : Coloration cream to dark brown. Antenna approximately as long as head capsule width ; scapes medium brown, pedicels light brown, filament cream to white. Turbinate eyes ovoid, enlarged, strongly divergent anteriorly ; coloration dark brown.

Thorax : Coloration light to medium brown. Legs cream ; forefemora approximately 0.71x length of tibiae. Hindwings absent.



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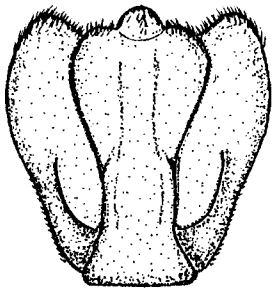

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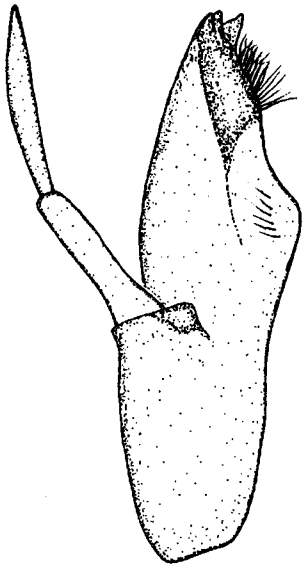

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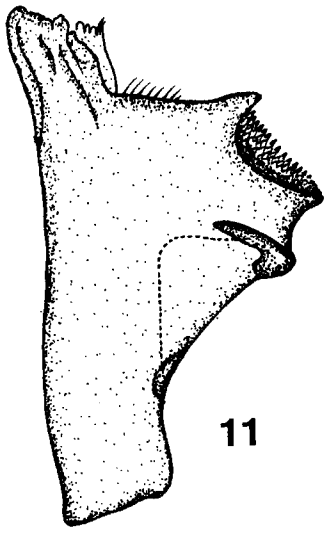

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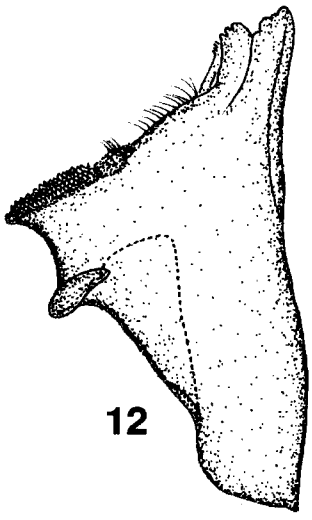

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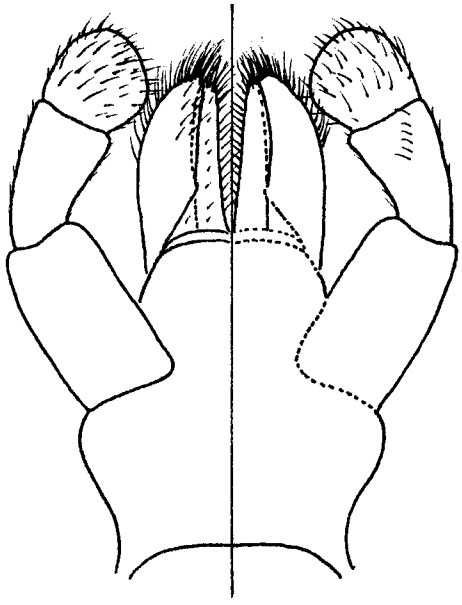

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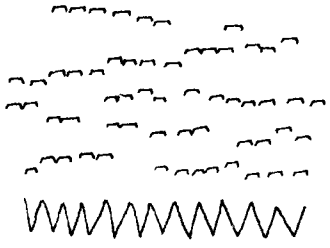

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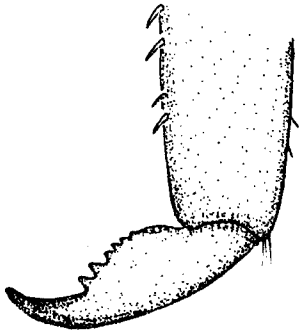

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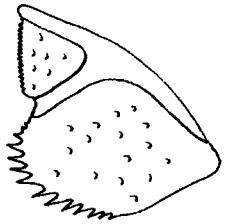

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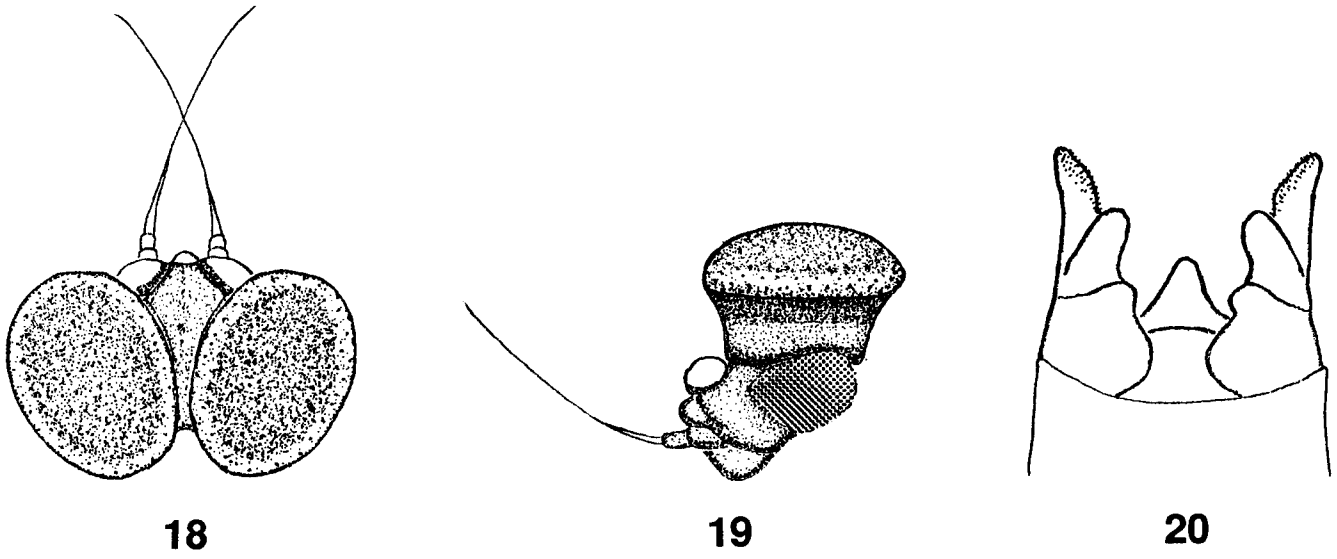
Figs. 9 to 17. *Dabulamanzia improvida* LUGO-ORTIZ and MCCAFFERTY, n. sp.

Fig. 9 : Labrum (dorsal). Fig. 10 : Hypopharynx. Fig. 11 : Left mandible. Fig. 12 : Right mandible. Fig. 13 : Right maxilla. Fig.14 : Labium (left-ventral ; right-dorsal). Fig. 15 : Tarsal claw. Fig. 16 : Detail of tergal surface. Fig. 17 : Paraproct.

Figs. 9 à 17. *Dabulamanzia improvida* LUGO-ORTIZ et MCCAFFERTY, n. sp.

Fig. 9 : Labre (vue dorsale). Fig. 10 : Hypopharynx. Fig. 11 : Mandibule gauche. Fig. 12 : Mandibule droite. Fig. 13 : Maxille droite. Fig. 14 : Labium (vue ventrale à gauche) ; vue dorsale à droite). Fig. 15 : Griffe tarsale. Fig. 16 : Détail de la surface d'un tergite. Fig. 17 : Paraprocte.



Figs. 18 to 20. *Mutelocloeon thomasorum* LUGO-ORTIZ and MCCAFFERTY, n. sp.
Fig. 18 : Male head (dorsal). Fig. 19 : Male head (lateral). Fig. 20 : Male genitalia (ventral)

Figs. 18 à 20. *Mutelocloeon thomasorum* LUGO-ORTIZ et MCCAFFERTY, n. sp.
Fig. 18 : Tête du mâle (vue dorsale). Fig. 19 : Tête du mâle (vue latérale). Fig. 20 : Genitalia mâles (vue ventrale).

Abdomen : Coloration pale to translucent yellow-brown ; segments 1-7 translucent yellow-brown ; segment 8 anteriorly translucent yellow-brown, posteriorly pale yellow-brown ; segments 9-10 pale yellow-brown. Genitalia as in Fig. 20.

— Material examined

Holotype : Male adult, Madagascar, Toamasina (= Tamatave) Prov., Amboasary R., Perinet (= Andasibe), 18°C, 16-X-1971, G.F. and C.H. Edmunds, F. Emmanuel [genitalia mounted on slide (medium : Euparal)].

— Etymology

We are honored in naming this species after Alain and Nicole Thomas for their friendship and support.

— Discussion

Mutelocloeon thomasorum represents the first known occurrence of any of the *Bugilliesia* complex genera (see LUGO-ORTIZ and MCCAFFERTY 1996c) outside of Africa. Furthermore, because *Mutelocloeon* is relatively apotypic within that compex (LUGO-ORTIZ and MCCAFFERTY 1996c), it would indicate that the complex was present in the Southern Hemisphere prior to the breakup of Africa and Madagascar. This report also indicates for the first time the occurrence of a symbiotic mayfly-mussel association in Madagascar because the African *M. bihoumi* (the only species of the genus known from larva) has been shown to have such an association (GILLIES and ELOUARD 1990).

Mutelocloeon thomasorum differs from *M. bihoumi* GILLIES and ELOUARD (1990) and *M. corbeti* (KIMMINS) (1956) in lacking dorsal abdominal markings. It is further distinguished from *M. bihoumi* in having a longer genital forceps segment 2, and from *M. corbeti* in having the basomedial protuberance of genital forceps segment 2 slightly acute apically (Fig. 20).

Acknowledgments

We thank G.F. Edmunds, Jr. (Salt Lake City, Utah) for the donation of the specimens used in this study. We also thank A. Thomas (Université Paul Sabatier, Toulouse, France) for assistance in the preparation of the manuscript. This paper has been assigned Purdue Agricultural Research Program Journal No. 15589.

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