

## ***Edmulmeatus grandis* : an extraordinary new genus and species of Baetidae (Insecta : Ephemeroptera) from Madagascar**

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Keywords : Ephemeroptera, Baetidae, *Edmulmeatus grandis*, new genus, new species, Madagascar.

*Edmulmeatus grandis*, n. gen. and sp. (Ephemeroptera : Baetidae) is described from larvae collected from eastern Madagascar. The genus is distinguished primarily by having a relatively very large head capsule, large and robust mandibles with specialized armature, and gills on abdominal segments 2-7 only. The relatively massive mandibles suggest that larvae have unusual feeding habits compared to other baetids, being probably a macrovore-herbivore adapted for cutting and crushing plant food items. *Edmulmeatus* is possibly related to other Afrotropical genera having two rows of denticles on the tarsal claws.

***Edmulmeatus grandis* : extraordinaires nouveaux genre et espèce de Baetidae (Insecta : Ephemeroptera) de Madagascar**

Mots clés : Ephemeroptera, Baetidae, *Edmulmeatus grandis*, genre nouveau, espèce nouvelle, Madagascar.

*Edmulmeatus grandis*, n. gen. et n. sp. (Ephemeroptera : Baetidae) est décrit à partir de larves récoltées à l'Est de Madagascar. Le genre se distingue essentiellement par sa capsule céphalique relativement très développée, ses grandes mandibules robustes dotées d'une armature spécialisée, et ses branchies, implantées sur les segments abdominaux 2 à 7 seulement. Les mandibules relativement massives suggèrent un régime trophique larvaire inhabituel, comparativement aux autres Baetidae, probablement de type macrovore-herbivore, adapté à sectionner et à broyer les éléments végétaux. Il est possible qu'*Edmulmeatus* soit apparenté aux autres genres Afrotropicaux et Baetidae possédant deux rangées de denticules aux griffes tarsales.

### **1. Introduction**

The faunal composition of the family Baetidae (Insecta : Ephemeroptera) in Madagascar is poorly known and in serious need of being documented. Only seven species have been variously described in *Centroptilum* Eaton, *Cloeon* Leach, *Nesoptiloides* Demoulin, and *Pseudopannota* Waltz and McCafferty (Navás 1926, 1930, 1936 ; Demoulin 1966, 1968, 1970, 1973 ; Waltz & McCafferty 1987). Reports of *Centroptilum* are questionable because species assigned to it in Africa have been shown to represent diverse evolutionary lineages (Gillies 1990 ; Wuillot & Gillies 1994 ; Lugo-Ortiz & McCafferty 1996abc ; Barber-James & McCafferty 1997), and those of *Cloeon* remain provisio-

nal because the specimens upon which they are based consist only of subimagos and damaged adults, whose descriptions are too brief. This dearth of baetid reports from Madagascar is particularly worrisome because the island probably has a diverse array of endemic species similar to that shown by other insect groups (Stork 1997), and human population and agricultural pressures are resulting in the rapid degradation and fragmentation of habitats and generalized extinction of species and extirpation of geographic populations (Myers 1988ab ; Wilson 1992). Thus, the documentation of the baetid fauna, as well as other mayflies, needs to be prioritized not only to elucidate aspects related to their evolutionary and biogeographic history, but to identify species of particular concern that may lead to the protection of their habitats.

In keeping with that philosophy, and as part of our on going survey of the baetid fauna of the Afrotropics (McCafferty & de Moor 1995 ; Lugo-Ortiz & McCaf-

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ferty 1996abc, 1997ab), we herein describe a distinctive new genus and species of Baetidae based on larval specimens collected from eastern Madagascar. The fact that the new taxon is from eastern Madagascar is of special significance because it has been regarded to be the most environmentally threatened region on the island (Myers 1988a), and it is possible that the mayflies we describe herein are also threatened or even endangered in that region. The specimens upon which this study is based are housed in the Purdue Entomological Research Collection, West Lafayette, Indiana.

## 2. *Edmulmeatus* Lugo-Ortiz & McCafferty, n. gen.

### 2.1. Description

#### LARVA

##### — Head

Capsule enlarged relative to body, hemispherical (Figs. 1, 2).

Labrum (Fig. 3) anteriorly broadly rounded, with deep anteromedial notch.

Hypopharynx (Fig. 4) with somewhat broad lingua and superlinguae.

Mandibles (Figs. 5, 6) massive and robust, with fused but distinctive incisors and molar region with well-developed, broad-based denticles.

Maxillae (Fig. 7, 8) short and broad ; palps two segmented.

Labium (Figs. 9, 10) reduced relative to other mouthparts ; glossae with slight apicomedial emargination ; paraglossae somewhat narrow elongate ; palps relatively long, extending beyond apices of glossae and paraglossae ; palp segment 2 with well-developed distomedial projection ; segment 3 somewhat elongate, subconical.

##### — Thorax

Legs (Fig. 11) robust ; femora without villopore ; tarsal claws (Fig. 12) with two rows of denticles.

##### — Abdomen

Terga (Fig. 13) with scale bases and well-defined posterior marginal spination.

Gills (Figs. 14, 15) on abdominal segments 2-7, plate-like, marginally serrate.

Paraprocts (Fig. 16) with marginal spines.

Three caudal filaments present, with abundant fine, long, simple setae medially.

#### ADULT

Unknown.

### 2.2. Etymology

The generic name is constructed from the sequence of the first three letters of the last names of three world-renowned ephemeropterists, G.F. Edmunds, G. Ulmer, and A.E. Eaton, and it is given a Latin masculine ending.

### 2.3. Type species

*Edmulmeatus grandis* Lugo-Ortiz & McCafferty, n. sp.

### 2.4. Species included

*Edmulmeatus grandis* Lugo-Ortiz & McCafferty, n. sp.

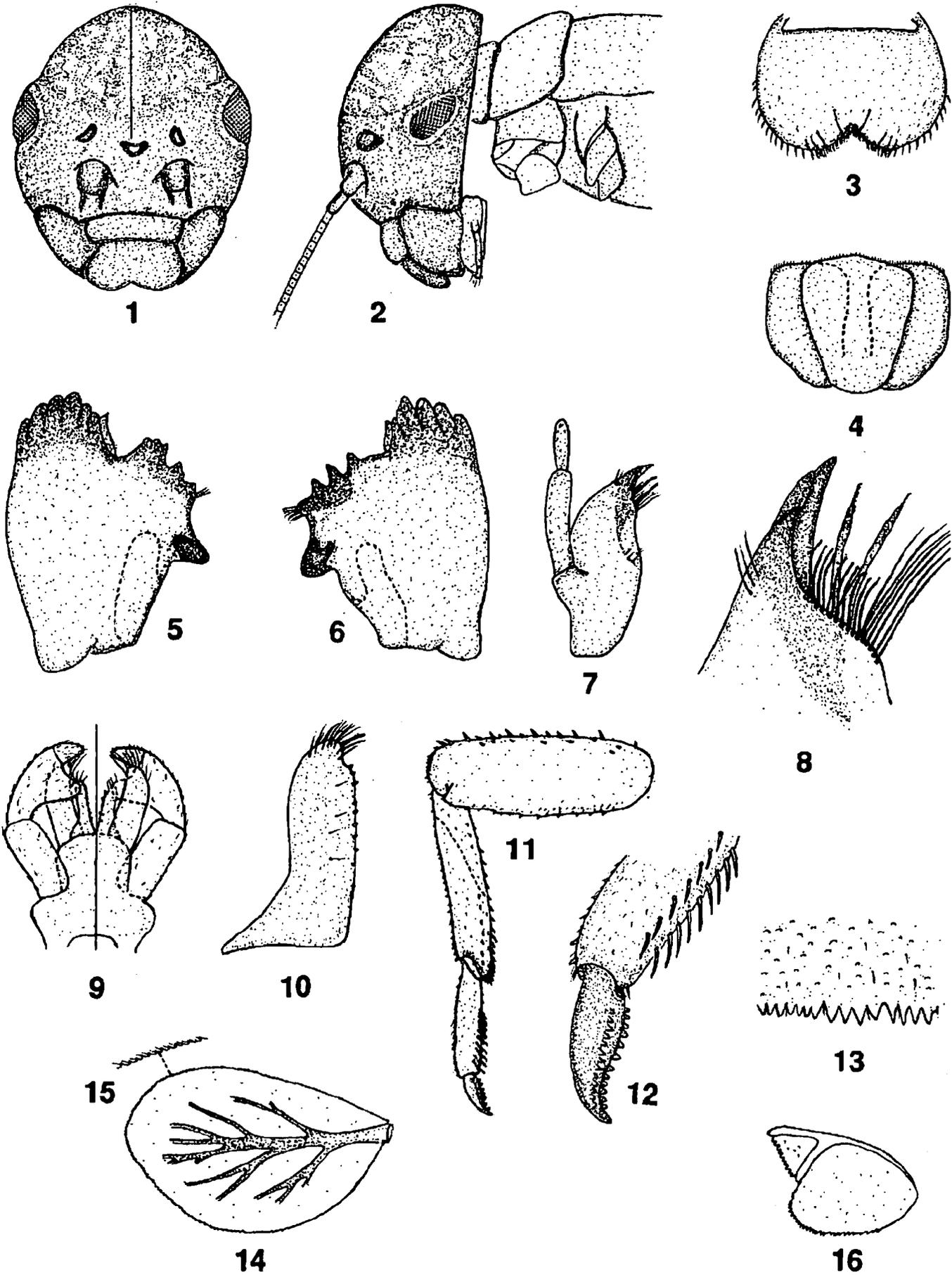
### 2.5. Distribution

Madagascar.

### 2.6. Discussion

Larvae of *Edmulmeatus* are distinguished by the enlarged head capsule (Figs. 1, 2), massive mandibles with strongly denticulate incisors across the entire apical margin (Figs. 5, 6), relatively small maxillae (Fig. 7) and labium (Fig. 9), distomedial projection of segment 2 of the labial palps (Fig. 9), apicomedial emargination of the glossae (Fig. 10), and presence of gills on abdominal segments 2-7 only.

The nature of the mandibles (Figs. 5, 6) suggests that larvae of *Edmulmeatus* are macrovores capable of cutting and crushing large food items. The absence of the molae that are found on the mandibles of all other mayflies (e.g., McShaffrey & McCafferty 1990) would indicate that food is not strained and probably not compacted by *Edmulmeatus*. The general sparseness of mouthpart setae suggests that small particles are neither handled nor filtered by *Edmulmeatus*, as in most mayflies (e.g., Brown 1961 ; McShaffrey & McCafferty 1986). Furthermore, none of the mouthparts appear adapted for impaling, and some acute mouthparts are always associated with carnivory in mayflies (e.g., McCafferty & Provonsha 1986). The extremely large head capsule (Figs. 1, 2) houses very large flexor and abductor muscles attached to the mandibles that evidently can generate a force necessary for cutting or crushing large items. Based on all of the above, we hypothesize that larvae of *Edmulmeatus* are macrovore-herbivores, possibly feeding on large filamentous algae or even aquatic tracheophytes. If this hypothesis is correct, *Edmulmeatus* would represent the first instance of such a macrovore-herbivore in the family Baetidae. We also hypothesize that the two rows of relatively robust setae on the ventral margin of the tarsi (Figs.



Figs. 1 to 16. Larval structures of *Edmulmeatus grandis*. 1 : head (frontal). 2 : head (lateral). 3 : labrum (dorsal). 4 : hypopharynx. 5 : left mandible. 6 : right mandible. 7 : right maxilla. 8 : detail of galealacinia. 9 : labium (left : ventral ; right : dorsal). 10 : detail of left glossa. 11 : right foreleg. 12 : tarsal claw. 13 : detail of tergum 4. 14 : gill 4. 15 : detail of gill margin. 16 : paraproct.

Figs. 1 à 16. Structures larvaires d'*Edmulmeatus grandis*. 1 : tête (vue frontale). 2 : tête (vue de profil). 3 : labre (vue dorsale). 4 : hypopharynx. 5 : mandibule gauche. 6 : mandibule droite. 7 : maxille droite. 8 : détail de la galealacinia. 9 : labium (à gauche : vue ventrale ; à droite : vue dorsale). 10 : détail de la glosse gauche. 11 : patte antérieure droite. 12 : griffe tarsale. 13 : détail du 4<sup>e</sup> tergite. 14 : 4<sup>e</sup> branchie. 15 : détail du bord de la 4<sup>e</sup> branchie. 16 : paraprocte.

12, 13) aid larvae of *Edmulmeatus* in climbing among the vegetation that they possibly feed on.

Phylogenetic relationships of *Edmulmeatus* are difficult to establish at present because the genus is so unusual. It is possible, however, that *Edmulmeatus* is related to African and Malagasy genera with two rows of denticles on the tarsal claws, including *Acanthiops* Waltz & McCafferty, *Afroptilum* Gillies, *Centroptiloides* Lestage, *Dicentroptilum* Willot & Gillies, *Nesoptiloides* Demoulin and *Thraulobaetodes* Elouard & Hideux.

## 2.7. *Edmulmeatus grandis* Lugo-Ortiz & McCafferty, n. sp.

### 2.7.1. Description

#### LARVA

Body length (early to middle instar) : 7.3-7.5 mm ; caudal filaments length : 4.9-5.1 mm.

#### — Head

Coloration light yellow-brown, with faint complex markings on vertex (Figs. 1, 2). Antennae nearly 2.0x as long as head capsule.

Labrum (Fig. 3) dorsally with submedial pair of long, fine, simple setae and anterior submarginal row of three to four long, fine, simple setae.

Hypopharynx as in Figure 4.

Left mandible (Fig. 5) incisors with six denticles ; molar region with two sets of denticles.

Right mandible (Fig. 6) incisors with six denticles ; molar region with three somewhat sharp denticles.

Maxillae (Figs. 7, 8) with four sharp denticles on crown of galealaciniae ; three to four long, fine, simple setae at base of denticles ; three to four short, fine, simple setae on medial hump ; palp segment 1 nearly twice as long as segment 2.

Labium (Figs. 9, 10) with glossae shorter than paraglossae ; glossae (Fig. 10) medially with short, simple setae, apically with long, fine, simple setae ; paraglossae apically with numerous long, fine, simple setae ; palp segments with minute, fine, simple setae scattered over surface ; palp segment 1 subequal in length to segments 2 and 3 combined.

#### — Thorax

Coloration pale yellow-brown, with no distinct color pattern.

Hindwingpads absent.

Legs (Fig. 11) pale yellow-brown, with no distinct color pattern ; femora dorsally with row of relatively long, somewhat robust, apically acute, simple setae

and randomly spaced short, fine, simple setae and ventrally with short, fine, apically acute, simple setae ; tibiae dorsally with short, fine, simple setae and ventrally with somewhat robust, simple setae increasing in length distally ; tarsi dorsally with short, fine, simple setae and ventrally with two rows of somewhat robust, simple setae increasing in length distally ; tarsal claws (Fig. 12) with two rows of 10-12 denticles each.

#### — Abdomen

Coloration pale yellow-brown, with no distinct color pattern ; terga usually somewhat darker in posterior half.

Terga (Fig. 13) with abundant small scale bases and scattered minute, fine, simple setae ; posterior marginal spination somewhat irregular, spines usually 1.5x longer than basal width.

Sterna pale yellow-brown. Gills 3-6 (Fig. 14) well tracheated, 2 and 7 untracheated, margins (Fig. 15) with minute serrations.

Paraprocts (Fig. 16) with 25-30 sharp marginal spines.

Caudal filaments pale yellow-brown, with somewhat broad medium brown band in mid region ; medial caudal filament as long as cerci.

#### ADULT

Unknown.

### 2.7.2. Material examined

Holotype : Larva, Malagasy, Fianarantsoa Province, Tsaratango R, 9 km E of Ranomafana, 23°C, XI-6-1971, G.F. and C.H. Edmunds and F. Emmanuel.

Paratypes : Two larvae, same data as holotype [mouthparts, forelegs, tergum 4, gills 4, and paraproct of one larva mounted on slide (medium : Euparal)].

### 2.7.3. Etymology

The specific epithet reflects the Latin meaning of magnificent.

### 2.7.4. Discussion

Although no comparative species of *Edmulmeatus* are known, we expect that the dorsal setation of the labrum (Fig. 3), mandibular denticulation (Figs. 5, 6), relative lengths of the maxillary palps (Fig. 7), degree of development of the medial projection on labial palp segment 2 (Fig. 9), absence of hindwingpads, somewhat irregular posterior spination of the terga (Fig. 13), paraproctal spination (Fig. 16), and general body coloration may prove to be of importance for specific diagnosis. The untracheated gills 2 and 7, compared to gill 5 and others, may also be of some specific importance.

The specimens upon which the description is based are early to middle instar larvae. We therefore expect

mature larvae to be nearly twice as large. We do not expect, however, any substantial allometric changes associated with growth and development to affect the relative large size of the head capsule or mandibles because such changes are atypical of Baetidae.

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