



Two New Genera of Baetidae (Ephemeroptera; Insecta) from Madagascar

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Abstract

Two new genera of Baetidae (Ephemeroptera), *Scutoptilum* gen. n. and *Echinopus* gen. n., are described to accommodate three new species from Madagascar: *Scutoptilum verrucosum* sp. n., *Echinopus giboni* sp. n., *Echinopus minutus* sp. n.. They all share a unique apomorphy; they possess a subapico-transverse arc of long setae on the outer margin of femora. *Scutoptilum* presents important adaptations to fast flowing waters and mouthparts modified for scraping. Moreover, *Scutoptilum* shows an unusual general habitus with a prothorax broadly expanded laterally, forewing pads extremely developed and shape of the head subrectangular. *Echinopus* appears less derived and possesses more plesiomorphic features. Both genera are closely related to the Afrotropical genus *Afroptilum* and belong to the *Centroptiloides* complex.

Keywords: Ephemeroptera, Baetidae, *Scutoptilum*, *Echinopus*, new genus, new species, Madagascar.

Introduction

The knowledge of the mayfly family Baetidae in Madagascar recently has improved conspicuously. Important systematic works have been published, including the description of more than 40 new species all endemic to Madagascar (Gattolliat 2000, 2001a, b; Gattolliat & Sartori, 1998, 1999, 2000a, 2000b; Gattolliat et al., 1999; Lugo-Ortiz & McCafferty, 1997a, 1997b, 1997c, 1997d, 1998a, 1998b, 1998c, 1999; Lugo-Ortiz et al., 1999). The description of these new species greatly enlarges generic distributions that were previously restricted to continental Afrotropical regions. The most notable range extensions are for the genera *Afrobaetodes* Demoulin, *Afroptiloides* Gillies, *Cheleocloeon* Wuillot & Gillies, *Dabulamanzia* Lugo-Ortiz & McCafferty and *Demoulinia* Gillies (Gattolliat, 2000; Gattolliat & Sartori, 1999, 2000a; Lugo-Ortiz and McCafferty, 1997c, 1997d). Six genera strictly endemic to

Madagascar have also been described: *Delouardus* Lugo-Ortiz and McCafferty, *Edmulmeatus* Lugo-Ortiz and McCafferty, *Guloptiloides* Gattolliat and Sartori, *Herbrossus* Lugo-Ortiz and McCafferty, *Nesydemius* Lugo-Ortiz and McCafferty and *Rheoptilum* Gattolliat (Gattolliat, 2001b; Gattolliat and Sartori, 2000b; Lugo-Ortiz and McCafferty, 1997a, 1998b, 1998c, 1999).

I describe here two new genera that possess a rather unusual synapomorphy. The outer margin of femora presents a subapico-tranverse arc formed of 3 to 6 long setae. This character is unique among the Baetidae. Moreover, the general habitus of *Scutoptilum* is rather remarkable, with a prothorax conspicuously expanded laterally, quadrangular shape of the head and forewing pads extremely developed. *Scutoptilum* presents important adaptations for fast flowing waters such as the median caudal filament reduced to a single segment and protuberances on the pro- and mesothorax. It also possesses mouthparts modified for scraping the top of the stones.

The holotypes and part of the paratypes are housed in the Museum of Zoology, Lausanne, Switzerland. Other paratypes are deposited in the Museum National d'Histoire Naturelle, Paris.

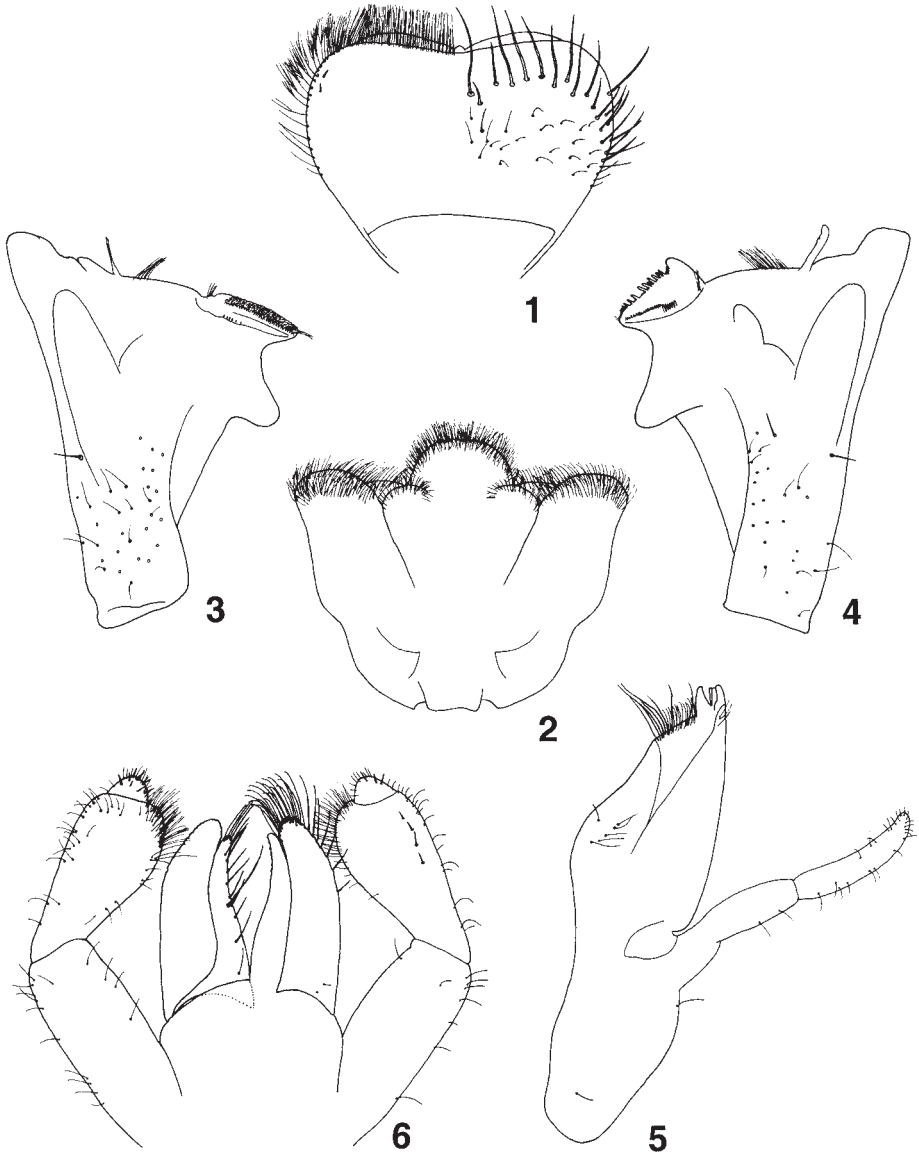
Scutoptilum Gattolliat gen. n.

Description

Larva

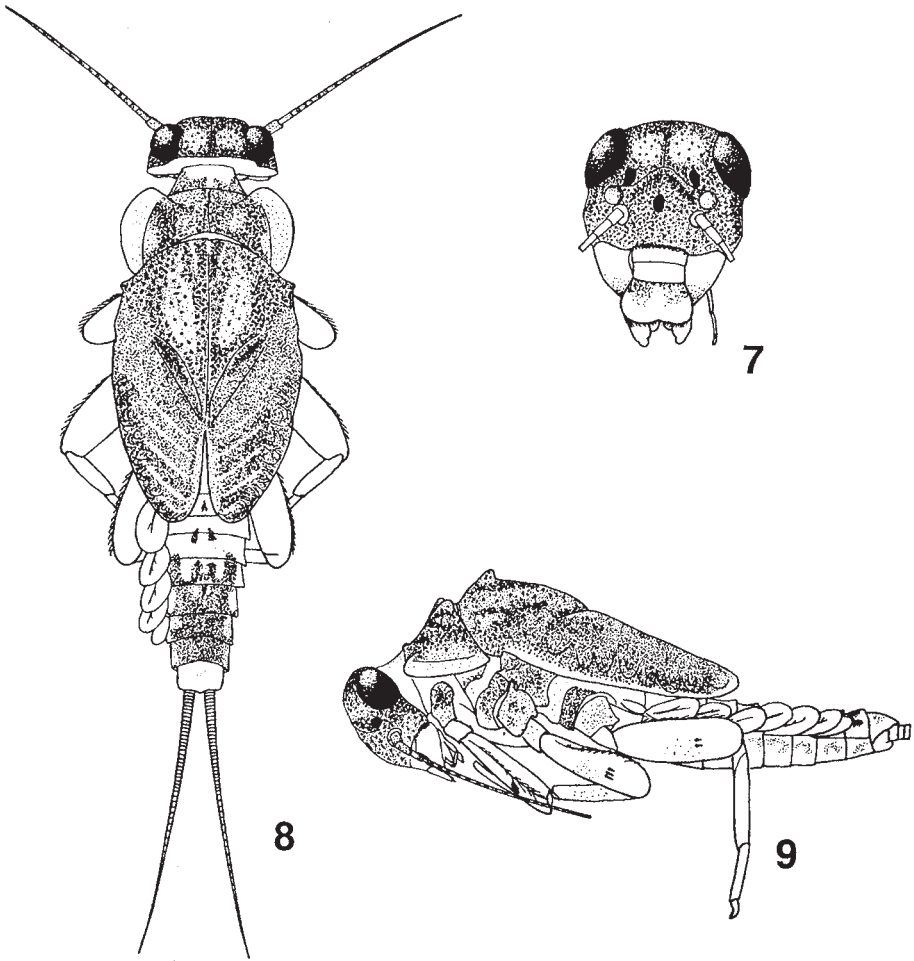
Head. Subrectangular with prominent eyes; covered with black warts (Fig. 7). Labrum (Fig. 1) broad, with distal margin almost straight, arc of abundant long stout setae subparallel to the distal margin. Hypopharynx (Fig. 2) covered with numerous thin setae; lingua trilobate. Right mandible (Fig. 3) with two sets of incisors, the outer formed only by one single well-developed and laterally reinforced tooth and the inner one reduced to a single small tooth; prostheca slender, without apical teeth; tuft of setae between prostheca and mola present. Left mandible (Fig. 4) with incisors fused into a single well-developed and laterally reinforced tooth; prostheca with reduced apical teeth; tuft of setae between prostheca and mola present. Maxillae (Fig. 5) with 4 teeth, the distal one opposite to the three others; palp 2-segmented, subequal in length to galea-lacinia. Labium (Fig. 6) with glossae shorter than paraglossae; palp three segmented, second segment produced apicomediaally, segment 3 short subconical.

Thorax. Prothorax (Fig. 8) broadly expanded laterally, pro- and mesothorax covered with warts. Forewing pads extremely developed. Hindwing pads present. Forelegs (Fig. 10) short and stout. Outer margin of femora with a subapico-tranverse arc of long spatulate setae; villopore absent; dorsal margin with a row of stout setae, the apical ones spatulate; apical patch of setae absent. Tibio-patellar suture present only on middle and hindlegs. Tibiae and tarsi without any kind of arc of setae. Dorsal margin of tibiae and tarsi with a few thin setae. Ventral margin of tarsi with a row of small and pointed setae ending with an extremely developed seta; tarsal claws (Fig. 11) with 2 rows of teeth, the second one reduced, two subapical setae.



Figures 1–6. Larval structures of *Scutoptilum verrucosum* sp. n.: 1: labrum (left: ventral; right: dorsal). 2: hypopharynx. 3: right mandible. 4: left mandible. 5: left maxilla. 6: labium.

Abdomen. Terga (Fig. 12) with warts and thin setae, without scales or scale bases; distal margin with widely spaced blunt spines. Sterna without setae, warts, scales or scale bases; distal margin smooth. Asymmetrical gills (Fig. 13) on segments 1 to 7; margin smooth not serrated. Two cerci without swimming setae (Fig. 15), except the



Figures 7–9. Larval structures of *Scutoptilum verrucosum* sp. n.: 7: head (frontal view). 8: in toto (dorsal view). 9: in toto (lateral view).

last third of the inside margin; median caudal filament reduced to a single segment. Paraproct (Fig. 14) broadly expanded.

Adult

Unknown.

Etymology

The generic name is from the Latin *scuto*, which means shield, with an apposition of *-ptilum* in reference to the related genus *Afroptilum*. The gender is neuter.

Type and only species included: *Scutoptilum verrucosum* Gattolliat sp. n.

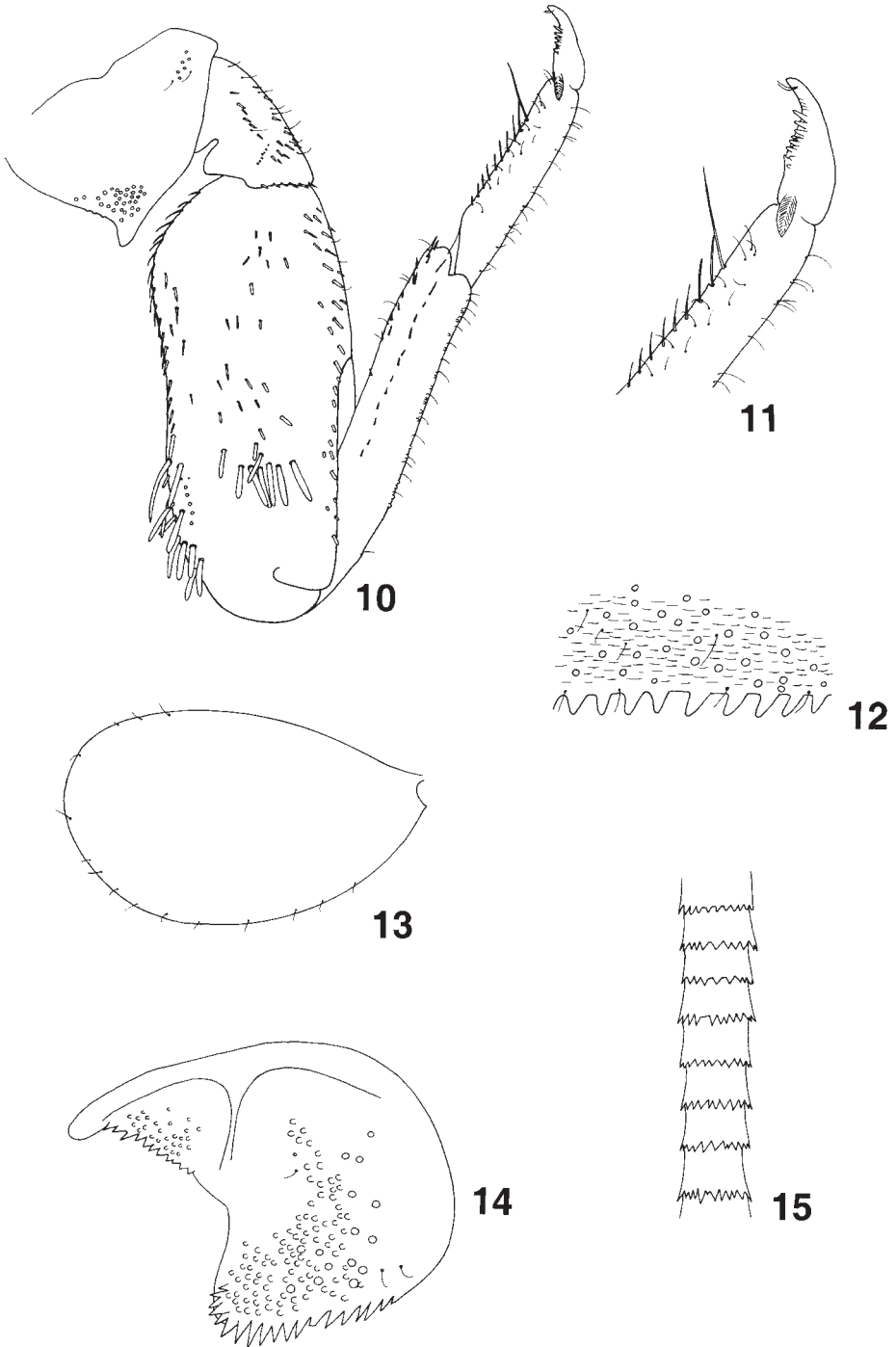
Scutoptilum verrucosum Gattolliat sp. n.

Larva

Maximal length: Body 4.0 mm. Cerci 1.9 mm.

Head. Dark brown with two light brown patches on the front (Fig. 7). Antennae light brown except scapus, pedicellus and apex of each segment brown. Labrum (Fig. 1) dorsally with an arc of about 12 stout long setae ending with a submedian long seta, a few small setae in the proximal half; with two small pointed setae ventrally; distal margin bordered with multifid setae. Hypopharynx (Fig. 2) with median lobe of the lingua well-developed covered only with fine setae. Right mandible (Fig. 3) with a reduced tuft of long setae between prostheca and mola; tuft of setae at the apex of the mola reduced to two or three setae; basal half with thin setae dorsally, one seta perpendicular to the outer margin. Left mandible (Fig. 4) prostheca with 3 poorly defined teeth without comb-shaped structure; tuft of setae at the apex of the mola reduced to 1 or 2 minute setae; basal half with long thin setae dorsally, one seta perpendicular to the outer margin. Maxillae (Fig. 5), apex of galea with 2 rows of setae, the first one formed by abundant small setae and the second by long, simple and stout setae, without pectinate or spine-like setae in the middle of the range; 3 setae at the basis of the teeth; 5 setae at the basis of the galea roughly arranged in a row; 1 single small seta perpendicular to the margin of the galea; palp 2-segmented, first segment subequal to the second; second segment slightly falcate with thin setae more abundant at the apex. Labium (Fig. 6) with glossae slender with long setae on the inner margin and apically, an extremely long seta near the inner margin; paraglossae apically rounded, with simple setae on the second half of the outer margin and apically. First segment of the labial palp subequal in length to the second and third combined; second segment with a row of 4 small setae, abundant thin setae apico-medially; third segment broader than long, with thin small setae and a few short and stout setae.

Thorax. Brown, with lighter pattern poorly marked; lateral extension pale yellowish brown. Two processes on the distal margin of the prothorax (Fig. 9). A single process on the anterior margin of the mesothorax (Fig. 9). Legs pale yellowish brown. Forelegs (Fig. 10), coxa with abundant, minute and pointed setae. Femora dorsally with a row of abundant, small and pointed setae proximally, long and spatulate apically; ventral and outer margins with abundant, small and pointed setae. Outer margin of femora with a subapico-transverse arc formed by at least 6 long spatulate setae. Tibiae dorsally with only few thin setae and warts; ventral margin with few minute setae, not longer apically; outer margin with a row of small setae. Tarsi dorsally with only a few thin setae; ventral margin with small pointed setae, last seta (Fig. 11) subequal in length to tarsal claw; tarsal claws (Fig. 11) with one row of 6 to 7 teeth increasing in length toward the apex, second row of 4 teeth.



Figures 10–15. Larval structures of *Scutoptilum verrucosum* sp. n.: 10: left foreleg. 11: tarsal claw. 12: detail of tergum. 13: fourth gill. 14: paraproct. 15: cercus.

Abdomen. Terga 1 to 5 uniformly pale yellowish brown, except tergum 3 with a brown triangular pattern and tergum 5 with two triangular brown patterns, terga 6 to 9 dark brown with light pattern; tergum 10 light yellowish brown (Figs. 8, 9). Terga (Fig. 12) shagreened. Sterna uniformly yellow. Gills (Fig. 13) with tracheation extremely reduced or not visible, margin with only a few thin setae apically and posteriorly. Paraproct (Fig. 14) covered with tubercles and warts, without scale bases; apically with about 25 pointed marginal spines; postero-lateral extension covered with tubercles, margin with pointed denticules.

Material examined

Holotype: 1 female larva (P0893), Madagascar, Ampary bas., Anlanbe riv., Loc. Anjanaharibe Sud-Ouest Camp1, Long. 49°26'53" E, Lat. 14°47'00" S, Alt. 1200 m, 26.10.1999. Doumenq, E..

Paratypes: 1 larva 893a (on slide) and 2 larvae (P0893), same data as holotype. 1 larva (P0875), Madagascar, Betaolana bas., Ambolokopatrika riv., Loc. Betaolana Camp 1, Long. 49°26'47" E, Lat. 14°32'25" S, Alt. 800 m, 10.10.1999. Doumenq, E.

Etymology

The specific epithet indicates that the body is covered with warts (in Latin *verruca*).

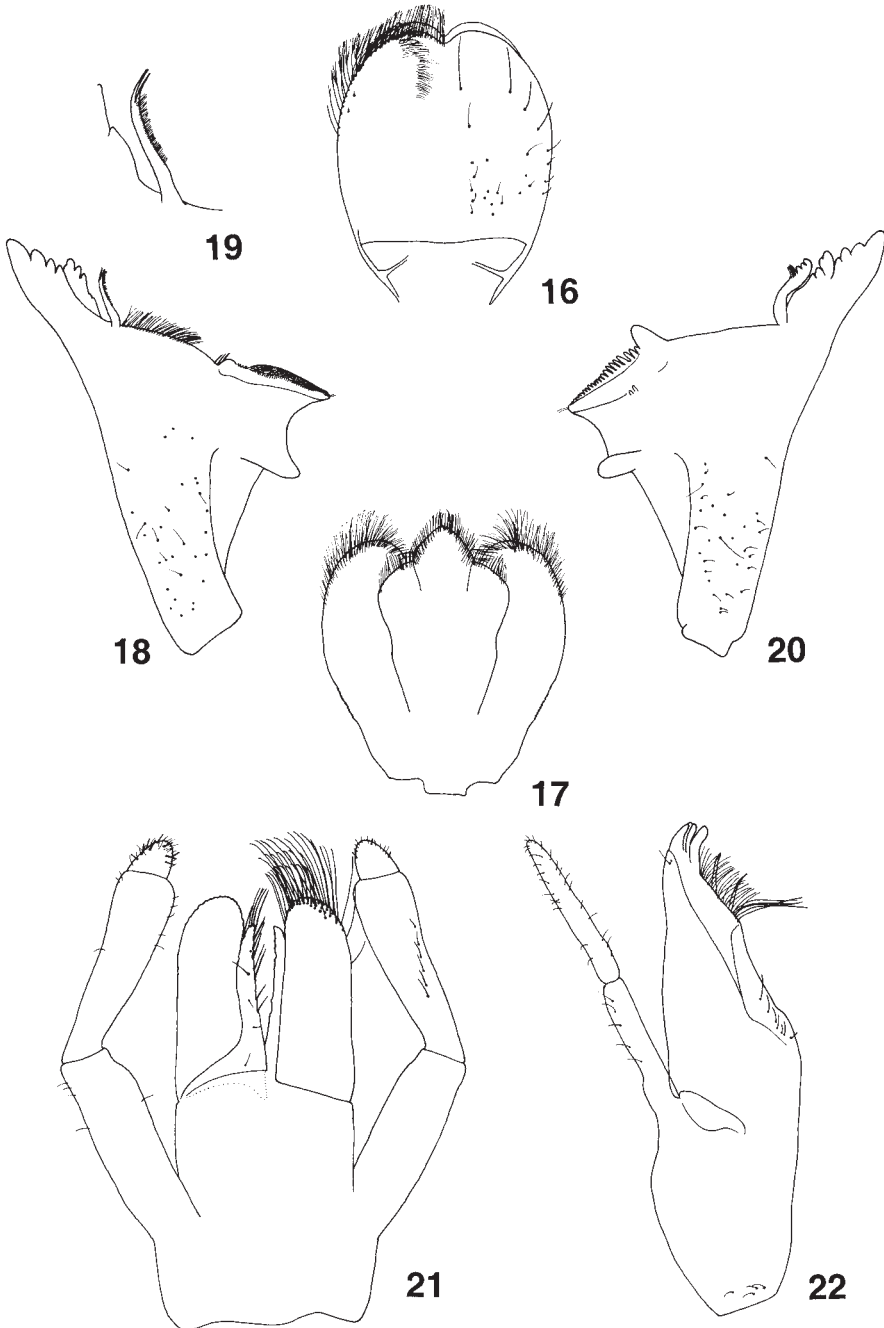
Echinopus Gattolliat gen. n.

Description

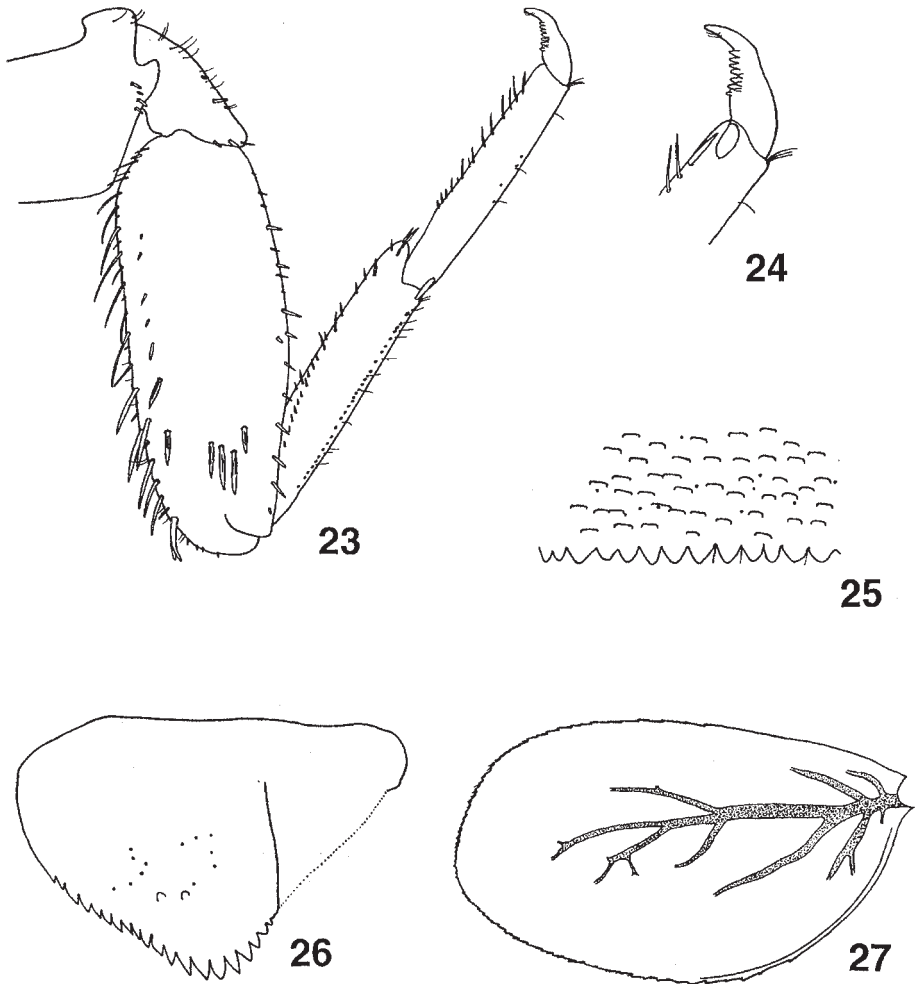
Larva

Head. Labrum (Figs. 16, 28) rounded with a medial emargination, arc of setae poorly developed. Hypopharynx (Fig. 17) covered only with numerous thin setae, bristle tuft absent, lingua trilobate. Right mandible (Figs. 18, 29) with two sets of incisors, outer margin distally concave; prosthema (Fig. 19) bifid with inner margin covered with numerous short and thin setae, tuft of setae between prosthema and mola well developed. Left mandible (Figs. 20, 30) with incisors not fused; stout prosthema with denticules and a comb-shaped structure; margin between prosthema and mola almost straight tuft of setae absent or extremely reduced. Maxillae (Figs. 22, 32) with 4 teeth, the distal one not opposite to the three others; palp 2-segmented, slightly or clearly longer than galea-lacinia. Labium (Figs. 21, 31) with glossae slightly shorter than paraglossae; glossae slender; paraglossae apically rounded; palp three segmented, segment 3 conical, longer than broad.

Thorax. Thorax not expanded laterally, without warts. Hindwing pads present. Forelegs (Figs. 23, 33), outer margin of femora with an apico-transverse arc of 3 or 4 long setae; villopore absent; dorsal margin with a row of stout and long setae reduced in number; subapical patch of setae present. Tibiae and tarsi without any kind of arc of setae. Dorsal margin of tibiae with only a row of minute setae. Dorsal margin of tarsi without a row of numerous thin setae; ventral margin of tarsi with a row of small and pointed setae, not ending with an extremely developed seta; tarsal claws (Figs. 24, 34) with 2 rows of teeth, the second one reduced in number, two small subapical setae.



Figures 16–22. Larval structures of *Echinopus giboni* sp. n.: 16: labrum (left: ventral; right: dorsal). 17: hypopharynx. 18: right mandible. 19: right prostheca. 20: left mandible. 21: labium. 22: right maxilla.



Figures 23–27. Larval structures of *Echinopus giboni* sp. n.: 23: left foreleg. 24: tarsal claw. 25: detail of tergum. 26: paraproct. 27: fourth gill.

Abdomen. Terga (Fig. 25) with scale bases; distal marginal with regular blunt spination. Sterna without scale bases; distal margin smooth. Asymmetrical gills (Figs. 27, 35) on segments 1 to 7; margin serrated. Two cerci with abundant setae on the inside margin; median caudal filament slightly shorter than cerci, with abundant setae on both margins.

Adult

Unknown.

Etymology

The generic name is derived from the Latin name of the hedgehog, *Echinus*, in reference to the high development of the setae on the femora. The gender is masculine.

Types species: *Echinopus giboni* Gattolliat sp. n.

Species included: *Echinopus giboni* Gattolliat sp. n., *Echinopus minutus* Gattolliat sp. n.

Echinopus giboni Gattolliat sp. n.*Larva*

Maximal length: Body 4.1 mm. Cerci 1.8 mm. Median caudal filament 1.6 mm

Head. Bicolorous: brown above ocelli, yellow brown below ocelli; without vermiform marks. Turbinate eyes dark brown. Labrum (Fig. 16) dorsally with an arc of 3 setae, ending with a submedian long seta, none of the setae reaching the distal margin, a few short setae in the proximal half; two small pointed setae ventrally; distal margin bordered with thin setae. Hypopharynx (Fig. 17) slender with superlingua only slightly expanded. Right mandible (Fig. 18) with tuft of abundant short setae between prosthema and mola; tuft of setae at the apex of the mola reduced to 2 or 3 small setae; basal half with abundant thin setae dorsally. Left mandible (Fig. 20) without setae between prosthema and mola; basal half with thin setae dorsally. Maxillae slender (Fig. 22), apex of galea with 2 rows of setae, the first one formed by abundant small setae and the second by 2 spine-like setae and apically by long setae; 2 setae at the basis of the teeth; 6 small setae at the basis of the galea roughly arranged in a row; 1 minute seta perpendicular to the margin of the galea; palp slender, slightly longer than galealacinia, first segment 1.2 longer than the second. Labium (Fig. 21), glossae with setae on the inner margin and apically; paraglossae with 3 rows of simple setae apically. Second and third segment of labial palps combined 1.2 times longer than first; second segment slender very slightly expanded disto-medially, with a row of 6 small setae, very few thin setae; third segment with thin small setae and few short and stout setae.

Thorax. Medium brown with 2 to 3 yellow spots at the basis of forewing pads. Forewing pads bicolor, proximally medium brown and apically light brown. Legs with coxa medium brown, femora medium brown with center of the outer margin lighter, tibiae and tarsi yellow brown except dorsal and ventral margins medium brown. Forelegs (Fig. 23), coxa with thin setae and few pointed setae. Femora dorsally with a row of about 12 long pointed setae, with a few small pointed setae between them; subapical patch formed by two setae; row of pointed setae increasing in length toward the apex, subparallel to the dorsal margin; apico-transverse arc of 3 pointed setae; ventral margins with pointed setae. Tibiae dorsally with a row of minute rounded setae and few thin setae; a row of small pointed setae in the position of the tibio-patellar suture; ventral margin with few minute pointed setae, not longer apically. Tarsi dorsally with very few thin setae; ventral margin with a row of about 14 pointed setae; tarsal claws (Fig. 24) with one row of about 8, second row of 3 teeth. Second and third legs similar to foreleg, except femora more slender,

apico-transverse row formed by shorter and reduced in number setae and tibio-patellar suture faintly visible.

Abdomen. Terga 1 to 5 medium brown, lighter laterally, terga 6 and 7 dark brown; terga 8 to 10 light yellowish brown with light brown pattern. Terga as in Fig. 25. Sterna 1 to 7 light brown, sterna 8 and 9 light yellowish brown. Gills (Fig. 27) with tracheation poorly branched, margin with only few thin setae. Paraproct (Fig. 26) with few scale bases and trace of insertion of setae; apically with about 20 pointed marginal spines increasing in length toward the apex.

Material examined

Holotype: 1 larva (P0868), Madagascar, Mangoro bas., unnamed river, Loc. 13 km from Moramanga (road to Anosibe an'ala), Long. 48°13'57" E, Lat. 19°03'00" S, Alt. 895 m, 11.04.1999. Gattolliat, J.-L. and Raberiaka, N.

Paratypes: 1 larva 868a (on slide) and 2 larvae (P0868), same data as holotype. 1 male larva 867c (on slide), Madagascar, Mangoro bas., unnamed river, Loc. 21 km from Moramanga (road to Anosibe an'ala), Long. 48°14'13" E, Lat. 19°05'57" S, Alt. 940 m, 11.04.1999. Gattolliat, J.-L. and Raberiaka, N. 1 larva 458b (on slide), Madagascar, Matitanana bas., Maintimbahatra riv., Loc. Faliarivo, Long. 47°19'28" E, Lat. 22°06'10" S, Alt. 500 m, 21.06.1995. Andriamihaja, M.R. and Ralaitferana, A. 1 larva 636b (on slide), Madagascar, Namorona bas., Tsaratango riv., Loc. Tsaratango, Long. 47°31'50" E, Lat. 21°16'33" S, Alt. 585 m, 08.11.1996. Gattolliat, J.-L. and Rochat, C. 1 larva (P0644), Madagascar, Namorona bas., Namorona riv., Loc. Ranomafana (Hôtel Manja), Long. 47°27'28" E, Lat. 21°15'40" S, Alt. 725 m, 08.11.1996. Gattolliat, J.-L., Rochat, C. and Randriamasimanana, D.

Etymology

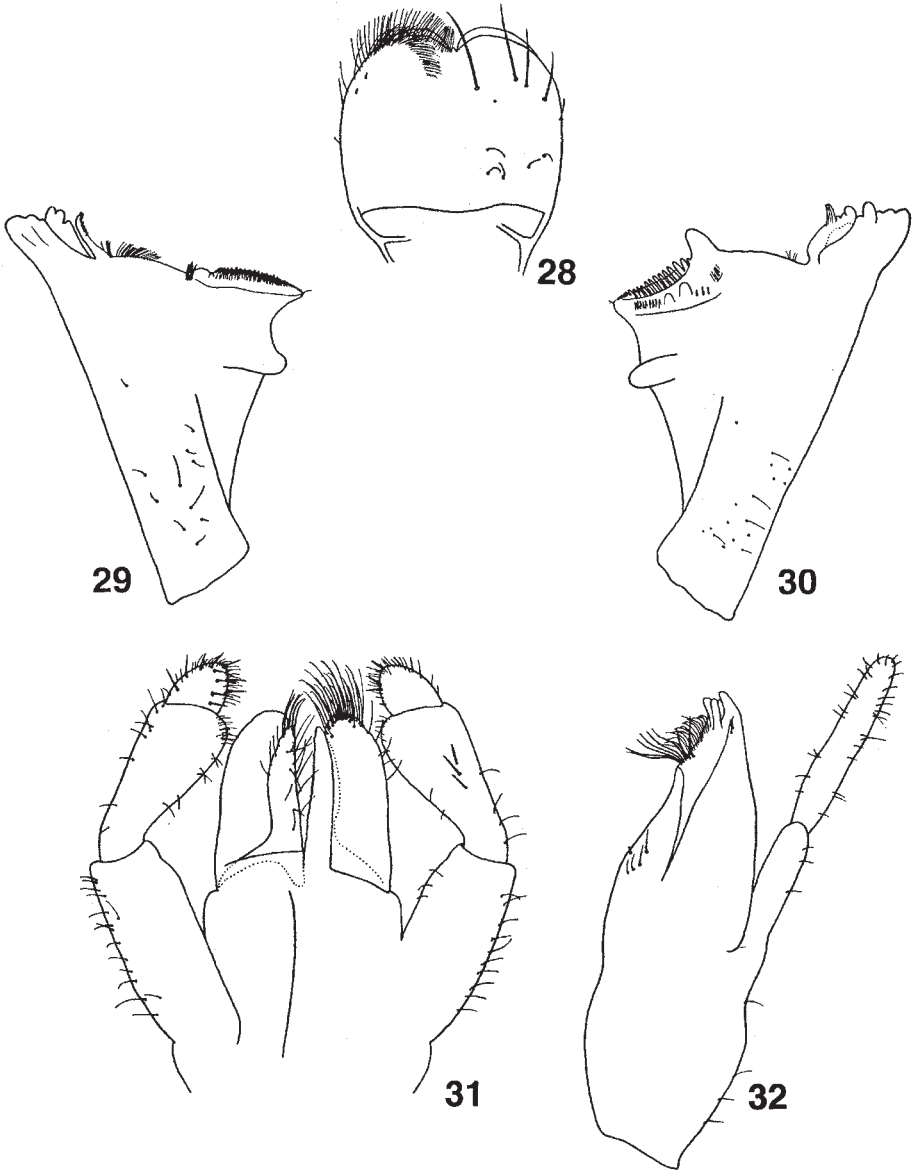
This species is dedicated to the French entomologist F.-M. Gibon, specialist of the African and Malagasy Trichoptera.

Echinopus minutus Gattolliat sp. n.

Larva

Maximal length: Body 3.0 mm. Cerci 2.3 mm. Median caudal filament 1.8 mm

Head. Cream with a medium brown pattern between ocelli. Turbinate eyes brown. Labrum (Fig. 28) dorsally with an arc of 3 long setae ending with a submedian long seta, few small setae in the proximal half; with two small pointed setae ventrally; distal margin bordered with thin setae. Hypopharynx similar to Figure 17. Right mandible (Fig. 29) with tuft of abundant short setae between prosthema and mola; tuft of setae at the apex of the mola reduced to 2 setae; basal half with thin setae dorsally. Left mandible (Fig. 30) with few small thin setae at the basis of the prosthema; basal half with thin setae dorsally. Maxillae stout (Fig. 32), apex of galea with 2 rows of setae the first one formed by abundant small setae and the second by 2 spine-like setae and apically long and thin setae; 2 small setae at the basis of the teeth; 4 small setae at the basis of the galea roughly arranged in a row; 1 minute seta perpendicular to the margin of the galea; palp clearly longer than galea-lacinia, first segment subequal to the second; second segment relatively stout. Labium (Fig. 31) with glossae with long setae on the inner margin and apically; paraglossae apically with 3



Figures 28–32. Larval structures of *Echinopus minutus* sp. n.: 28: labrum (left: ventral; right: dorsal). 29: right mandible. 30: left mandible. 31: labium. 32: left maxilla.

rows of simple setae apically. Second and third segment of labial palps combined 1.1 times longer than first; second segment moderately produced apicomediaally, with a row of 3 setae; abundant thin setae apicomediaally; third segment with thin small setae and short and stout setae.

Thorax. Medium brown with 2 to 3 yellow spots at the basis of forewing pads. Forewing pads bicolour, proximally medium brown and apically light brown. Legs pale yellowish brown, except coxa medium brown. Forelegs (Fig. 33) with coxa with few pointed setae. Femora somewhat stocky, dorsally with a row of about 8 very long, pointed or blunt setae, with small pointed setae between them; subapical patch formed by two setae; apex with abundant thin setae and pointed setae; row of short pointed setae ending with a very long blunt setae subparallel to the dorsal margin; apico-transverse arc of setae formed by 3 to 4 blunt well-developed setae and 2 or 3 smaller ones; ventral margins with pointed setae. Tibiae dorsally with a row of minute rounded setae and a few thin setae; ventral margin with pointed setae. Tarsi dorsally with very few thin setae; ventral margin with a row of 9 pointed setae increasing in length toward the apex; tarsal claws (Fig. 34) with one row of about 7 teeth, second row reduced to 2 teeth. Second and third legs similar to foreleg, except reduction of the number of setae of dorsal margin, setae of the submarginal row as long as those the dorsal margin and tibio-patellar suture faintly visible.

Abdomen. Terga 1 to 7 medium to dark brown, lighter laterally, terga 8 and 9 light brown, tergum 10 cream. Terga similar to Figure 25. Sterna 1 to 8 light brown, sternum 9 cream. Gills (Fig. 35) with tracheation poorly branched, margin conspicuously serrated. Paraproct similar to Figure 26.

Material examined

Holotype: 1 male larva (P0720), Madagascar, Rianila bas., tributary to Sahatandra riv., Loc. Moramanga, Long. 48°29'12" E, Lat. 18°56'27" S, Alt. 800 m, 28.04.1998. Raberiaka, N. and Oliarinony, R.

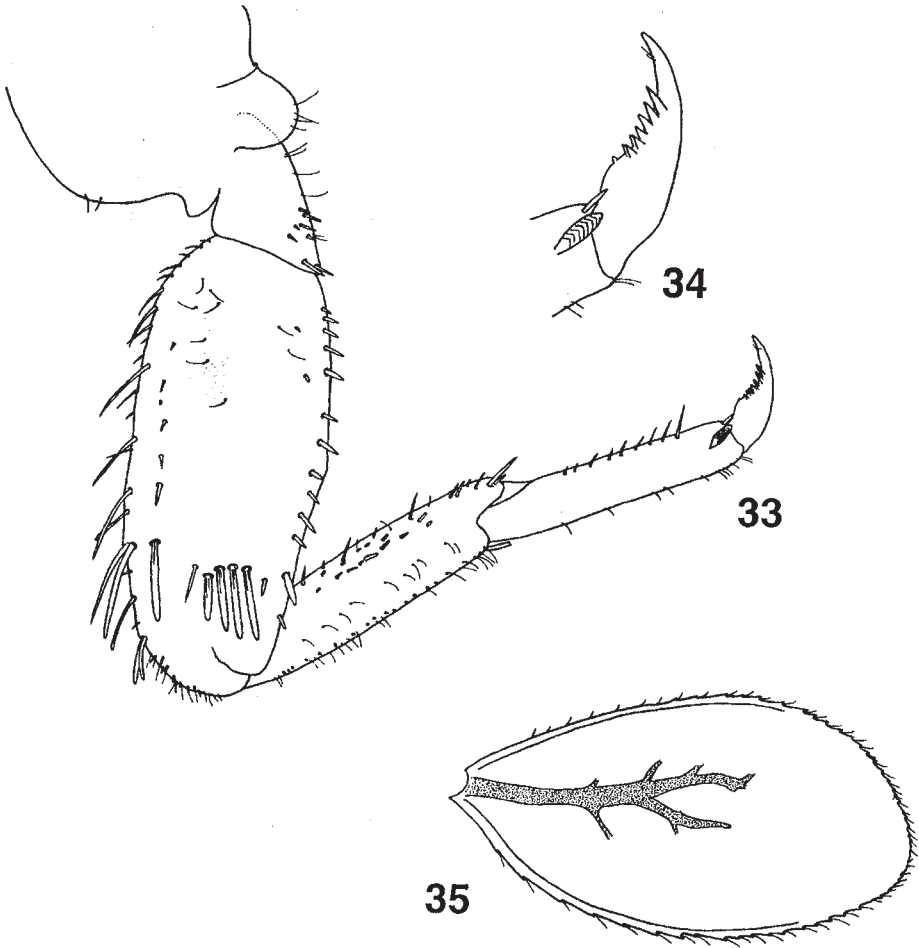
Paratypes: 1 male larva (P0498), Madagascar, Mangoro bas., small tributary to Andranotobaka riv., Loc. 143 km from Antananarivo (road Antananarivo-Toamasina), Long. 47°09'18" E, Lat. 19°42'31" S, Alt. 1650 m, 02.11.1995. Elouard, J.-M. 1 female larva 721a (on slide), Madagascar, Rianila bas., Sahatandra riv., Loc. Ambodirina, Long. 48°20'28" E, Lat. 19°01'32" S, Alt. 980 m, 29.04.1998. Elouard, J.-M., Sartori, M., Raberiaka, N. and Oliarinony, R. 1 male larva 766a (on slide), Madagascar, Mangoro bas., unnamed river, Loc. PK 20.4 road Anosibe an'ala, Long. 48°14'00" E, Lat. 19°05'53" S, Alt. 960 m, 23.10.1998. Elouard, J.-M., Legrand, J. and Raberiaka, N. 1 female larva (P0860), Madagascar, Rianila bas., Sahatandra riv., Loc. Ambodiriana, Long. 48°20'19" E, Lat. 19°01'30" S, Alt. 980 m, 07.04.1999. Gattolliat, J.-L., Doumenq, E. and Raberiaka, N.

Etymology

The specific epithet indicates the very small size of the larva.

Discussion

Scutoptilum and *Echinopus* can be easily distinguished from other baetid genera by the unique subapico-transverse arc of long setae (Figs. 10, 23, 33). These two new genera present evident similarities with the genus *Afroptilum* and other genera of the *Centroptiloides* complex; in particular the tarsal claws with two rows of teeth (Figs. 11, 24, 34), the shape of the labial palp (Figs. 6, 21, 31), the tibio-patellar suture present only on second and third pairs of legs, the presence of setae between prostheca and mola at least for the right mandible (Figs. 3, 4, 18, 29, 30), the shape



Figures 33–35. Larval structures of *Echinopus minutus* sp. n.: 33: left foreleg. 34: tarsal claw. 35: fourth gill.

of the left prosthema (Figs. 4, 20, 30) (Gillies, 1990; Lugo-Ortiz & McCafferty 1998c). *Scutoptilum* and *Echinopus* differ from *Afroptilum*, because they do not present the well-developed bristle tufts at the apex of the lingua (Figs. 2, 17), which is considered an apomorphic character of *Afroptilum* (Lugo-Ortiz & McCafferty, 1998c). Despite the *Centroptiloides* complex being in great need of reorganization, *Scutoptilum* and *Echinopus* possess the apomorphies of this complex and can be considered as belonging to it.

Scutoptilum presents a rather unusual combination of features. Its general habitus is unique with a prothorax conspicuously expanded laterally (Fig. 8), forewing pads extremely developed (Figs. 8, 9), body covered with warts (Figs. 8, 9) and quadran-

gular shape of the head (Fig. 7). *Scutoptilum* possesses a combination of two important adaptations.

On the one hand, it exhibits a median caudal filament reduced to a single segment (Fig. 8), tarsal claws with the second row of teeth highly reduced (Fig. 11) and protuberances on the pro- and mesothorax (Fig. 9). These features are also present in *Rheoptilum*, *Afrobaetodes*, *Acanthiops* or *Afroptiloides* and are considered important adaptations to the fast flowing waters (Demoulin, 1967; Gillies, 1991a, b; Gattolliat, 2001b). The usual associated row of long and thin setae on the dorsal margin of tibiae and tarsi is absent in *Scutoptilum*.

On the other hand, its mouthparts present modifications for scraping the top of stones: labrum broad with an almost straight distal margin (Fig. 1), incisors of the left mandible fused in a single laterally reinforced tooth (Fig. 4), prostheca reduced and slender (Figs. 3, 4). These kinds of adaptations appear frequently among Malagasy baetid genera. They can be found in *Xyrodromeus* Lugo-Ortiz and McCafferty, *Rheoptilum* Gattolliat, *Cloeodes* Traver (in part) and *Dabulamanzia* Lugo-Ortiz and McCafferty (in part) (Gattolliat, 2001a, b; Gattolliat & Sartori, 2000a; Lugo-Ortiz & McCafferty, 1997c). The combination of these two adaptations is shared only with *Rheoptilum*.

The extremely developed subapical seta on the ventral margin of the tarsi (Fig. 11) also appears in the Afrotropical genus *Afroptiloides* and the Oriental genera *Platybaetis* and *Liebebiella* (Müller-Liebenau, 1980; Waltz & McCafferty, 1987). This similarity must be considered as a strict convergence at least in the case of *Platybaetis* and *Liebebiella*: both genera belong to the *Baetis* complex and share the main apomorphies of this complex (especially the villopore on foreleg (Lugo-Ortiz & McCafferty, 1997b)).

Echinopus appears to be less derived than *Scutoptilum*. It does not present important modifications or adaptations related to environmental factors or feeding behavior. *Echinopus* can be distinguished from *Scutoptilum* by the following features: labrum slender with a dorsal arc of setae extremely reduced (Figs. 16, 28), left mandible with tuft of setae between prostheca and mola absent or extremely reduced (Figs. 20, 30), right prostheca bifid with a row of numerous setae on the inner margin (Fig. 19), gills serrated (Figs. 28, 35). The mouthparts of *Echinopus giboni* are extremely slender, the second segment of the labial palp is only slightly expanded disto-medially (Fig. 21), and the lateral margins of the mandibles concave (Figs. 18, 20). They present important similarities with those of *Afroptiloides spinosum* Gattolliat and *A. delphinae* Gattolliat (Gattolliat, 2000). On the other hand, the mouthparts of *Echinopus minutus* and *Afroptiloides namorona* Gattolliat are also fairly similar. They appear to be less modified and consequently more plesiomorphic. These modifications observed in *Echinopus giboni*, *Afroptiloides spinosum* and *A. delphinae* must be rather considered as homoplasies, derived independently in two different lineages from a similar plesiomorphic state. These convergences are probably due to similar feeding behavior.

Besides the mouthparts, the legs, especially the femora, allow separation of the two species of *Echinopus*. *Echinopus minutus* has stocky femora with strongly developed setae on the dorsal margin; the setae of the subapico-transverse arc also well

developed (Fig. 33). The femora of *Echinopus giboni* are more slender, the setae of the dorsal margin are more abundant and less developed, and the subapico-transverse arc is less developed or even poorly developed on middle and hindlegs (Fig. 23).

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