

**REVIEW OF THE *DABULAMANZIA* AND  *NESYDEMIUS*  
(EPHEMEROPTERA: BAETIDAE) SPECIES OF MADAGASCAR**

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*Abstract.*—We examined the type material of *Dabulamanzia improvida*, *D. duci*, and *Nesydemius polhemusorum*, and series of new material from throughout Madagascar that correspond to the concept of each of these three species. Characters used to diagnose the three species vary among series of specimens, and these particular characters cannot be correlated with any specific populations. As a result, we recognize the following new species synonyms: *Dabulamanzia improvida* Lugo-Ortiz and McCafferty, 1996 [= *Nesydemius polhemusorum* Lugo-Ortiz and McCafferty, 1998, *new synonym*; = *Dabulamanzia duci* Gattolliat and Elouard, 1999, *new synonym*]. We consider *Nesydemius* to be a junior synonym of *Dabulamanzia* Lugo-Ortiz and McCafferty, 1996 [= *Nesydemius* Lugo-Ortiz and McCafferty, 1998, *new synonym*].

*Key words:* Ephemeroptera, Baetidae, *Dabulamanzia*, *Nesydemius*, new synonyms, Madagascar.

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The genus *Afroptilum* Gillies (Ephemeroptera: Baetidae) was established for all African species previously assigned to *Centroptilum* Eaton (Gillies, 1990). Gillies (1990) divided his new genus into two subgenera and three groups of species. However, *Afroptilum* soon was discovered to be polyphyletic (McCafferty and De Moor, 1995), and subsequently several new genera have been established for certain species groups. For example, certain species of the *tarsale* group of *Afroptilum* were reassigned to the new genus *Dabulamanzia* Lugo-Ortiz and McCafferty (1996). Larvae of this genus are characterized by having labial palp segment 3 bulbous, a right mandible with two sets of incisors united for about two thirds of their length, and tibiae with a small proximal arc of setae; adults are characterized by having the hindwing with a hooked costal process, segment 2 of the male genital forceps with a small baso-medial projection, and forceps segment 3 elongate and ellipsoidal.

Lugo-Ortiz and McCafferty (1997) described a new species that represented the first report of *Dabulamanzia* from Madagascar, and since then, four additional species have been described from the island (Gattolliat et al., 1999; Gattolliat and Sartori, 2000). Lugo-Ortiz and McCafferty (1998) also described the monotypic genus *Nesydemius* Lugo-Ortiz and McCafferty from Madagascar, and they discussed affinities between this genus and *Dabulamanzia*. Two recent studies (Gattolliat and Sartori, 2000, 2003) have cast some doubt on the differences between two Malagasy *Dabulamanzia* species (*Dabulamanzia improvida* Lugo-Ortiz and McCafferty and *D. duci* Gattolliat and Elouard) and the monotypic *Nesydemius*.

*Dabulamanzia improvida* was reported originally from the Eastern Coast [Tsaratango and Namorona Rivers, near Ranomafana, Fianarantsoa Prov. (Type locality); Ifasina River, 46 km from Brickaville, Tamatave Prov.] and also from the Nosy Be Island [stream near Andrikido, Diego Suarez Prov.] (Lugo-Ortiz and McCafferty, 1997). Only one larva from this material was slide mounted and examined in detail. Gattolliat et al. (1999) were not aware of

*D. improvida* when they described *D. duci* based primarily on adults collected in and around the Integral Nature Reserve of Andohahela (southern Madagascar). Their description of the larva of this latter species was based on the exuviae from a single individual. The description of *Nesydemius polhemusorum* was based on five larvae collected from the Manankazo Forest Station [Antananarivo Prov.] (Lugo-Ortiz and McCafferty, 1998).

#### METHODS

The examination of type material, as well as comparison of descriptions, diagnoses, and figures, revealed only slight differences between *D. improvida*, *D. duci* and *N. polhemusorum*, which include the number and size of claw denticles (Lugo-Ortiz and McCafferty, 1997: fig. 15; Lugo-Ortiz and McCafferty, 1998: fig. 9; Gattolliat et al., 1999: fig. 28), the shape of labial palp segment 3 (Lugo-Ortiz and McCafferty, 1997: fig. 14; Lugo-Ortiz and McCafferty, 1998: fig. 7; Gattolliat et al., 1999: fig. 23), the setation of the dorsal margin of the tibiae and tarsi (Lugo-Ortiz and McCafferty, 1998: fig. 8; Gattolliat et al., 1999: fig. 27), and the shape of the apex of maxillary palp segment 2 (Lugo-Ortiz and McCafferty, 1997: fig. 13; Lugo-Ortiz and McCafferty, 1998: fig. 6; Gattolliat et al., 1999: fig. 22).

Intraspecific variation could not have been evaluated adequately for the larvae of any of the species above, because only a small number of specimens were examined in detail. Moreover, due to the isolated descriptions of these taxa, no comparisons among them have been made. Analysis of material collected between 1990 and 2000 by the Laboratoire de Recherche sur les Systèmes Aquatiques et leur Environnement (LRSAE), program of Biodiversity and Biotypology of Malagasy Freshwaters, has shown that this complex of species has a wide distribution in Madagascar and is relatively abundant in certain localities (Elouard and Gibon, 2001). Therefore, we now have a relatively large amount of material available for a global comparison of specimens representing each of these three putative species.

Specimens roughly corresponding to the three species in question were found in samples from about 70 of 600 Malagasy localities prospected by the LRSAE lab. Fig. 1 shows those locations sampled by LRSAE, and Fig. 2 indicates the locations from which specimens corresponding to the three species were collected. These localities included the type localities of *D. duci* and *D. improvida*. Our examination of these long series of specimens revealed that the size and arrangement of claw denticles graded between, and included, each of the forms associated with *D. duci*, *D. improvida*, and *N. polhemusorum* (Figs. 3–7). The shape of labial palp segment 3 and the setation of the dorsal margin of tarsi and tibiae vary among the specimens we examined, and we observed all intermediate states. States of these characters could not be correlated with any particular populations.

On slide mounted specimens, the shape of the apex of maxillary palp segment 2 appears pointed in some specimens but papillaform in others. We compared specimens in alcohol to those mounted temporarily on a slide and noticed that the papillaform tip of the maxillary palp sometimes is recurved and difficult to observe using standard light microscopy. Thus, we recognize the differences in palp shape as artifacts of the slide mounting process. Based on our experience, this has been the case also with all African *Dabulamanzia* species. In contrast to published descriptions and figures, each actually has the apex of the maxillary palp papillaform in shape.

*Nesydemius* and *Dabulamanzia* had been separated by this dubious maxillary palp character and by the number, arrangement, and shape of claw denticles. The claw of *Nesydemius* had been described with relatively few denticles, but with the apical two enlarged [as in Figs. 6, 7].

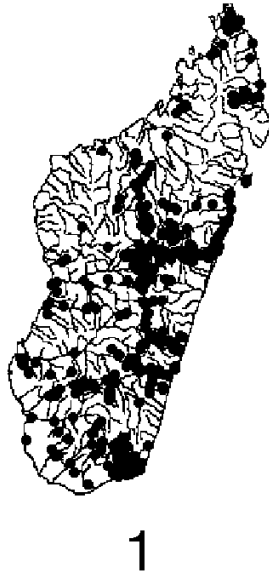


Fig. 1. Sites sampled recently by LRSAE.

The claw of *Dabulamanzia* had been described with more numerous denticles, none of which are enlarged. All African *Dabulamanzia* species have claws with about ten denticles, each similar in size to the others. In contrast, the Malagasy species of *Dabulamanzia* (and *Nesydemius*) have claws with five or fewer denticles, and the two distal denticles are enlarged.

#### RESULTS

No reliable characters consistently distinguish *D. improvida*, *D. duci*, and *N. polhemusorum* from one another. Therefore, we propose new synonyms for *D. improvida* Lugo-Ortiz and McCafferty [= *D. duci* Gattolliat and Elouard, *new synonym*; = *N. polhemusorum* Lugo-Ortiz and McCafferty, *new synonym*]. Support for separating *Nesydemius* from *Dabulamanzia* is restricted to only slight differences in larval claw denticulation. Therefore, we prefer to regard *Nesydemius* as a junior synonym of *Dabulamanzia* [= *Nesydemius*, *new synonym*]. Recent phylogenetic analyses of molecular and morphological data from both African and Malagasy Baetidae species confirm the monophyletic nature of this grouping (Monaghan et al., 2005; Gattolliat et al., unpubl.).

The phylogenetic relationships inferred by Lugo-Ortiz and McCafferty (1998) place *Dabulamanzia* as the sister group of a clade containing *Nesydemius* and the genus *Crassabwa* Lugo-Ortiz and McCafferty. These relationships were hypothesized primarily on the basis of the claw denticulation and maxillary palp characters discussed above. *Dabulamanzia* (= *Nesydemius*) and *Crassabwa* both have serrate gill margins (Lugo-Ortiz and McCafferty, 1998), but an evaluation of the phylogenetic and biogeographic relationships of these genera to one another and to other small minnow mayflies (Lugo-Ortiz and McCafferty, 1998; McCafferty, 1999) will require additional considerations.



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Fig. 2. Sampling localities from which specimens corresponding to *Dabulamanzia improvida*, *D. duci* and *Nesydemius polhemusorum* were taken.

SYNOPSIS OF *DABULAMANZIA* SPECIES FROM MADAGASCAR

*Dabulamanzia concolorata* Gattolliat, 2000

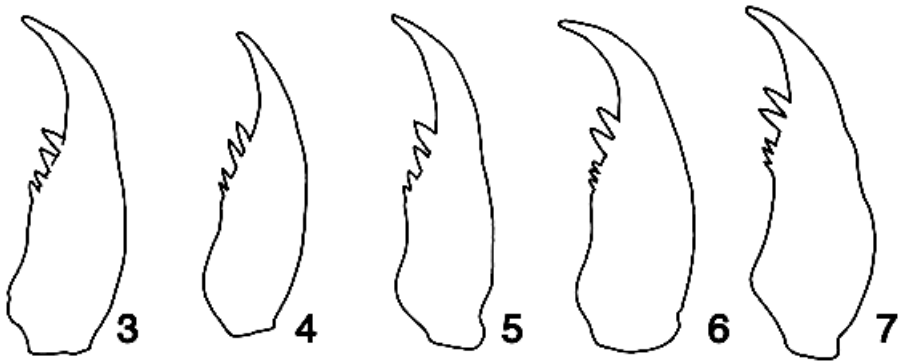
*Dabulamanzia gigantea* Gattolliat, 2000

*Dabulamanzia gladius* Gattolliat, 2000

*Dabulamanzia improvida* Lugo-Ortiz and McCafferty, 1997

=*Dabulamanzia duci* Gattolliat and Elouard, 1999, **new synonym**

=*Nesydemius polhemusorum* Lugo-Ortiz and McCafferty, 1998, **new synonym**



Figs. 3–7. *Dabulamanzia improvida*, variation in claw denticulation. Fig. 3. Variant 1. Fig. 4. Variant 2. Fig. 5. Variant 3. Fig. 6. Variant 4. Fig. 7. Variant 5.

## MATERIAL EXAMINED

Specimens examined as part of this study are deposited in the Musée Cantonal de zoologie, Lausanne, Switzerland [MZL] and the Purdue University Entomological Research Collection, West Lafayette, Indiana, USA [PERC].

**Type material examined.** MADAGASCAR: Mandrare bas., Mananara R., at Hazofotsy, 24°48'57"S, 46°35'46"E, 100 m, 2/VI/1994, 1 male subimago and associated exuviae (*Dabulamanzia duci* paratype, N° 339-31) [MZL]. Antananarivo (Tananarive) Province, Manankazo R., Manankazo Forest Station, 1,417 m, 7-XI-1986, JT & DA Polhemus, 6 larvae (*Nesydemius polhemusorum* holotype, paratype [parts on slide], and additional material) [PERC]. D. S. Province, Nosy Be, stream near Andrikibo, 23-X-1971, GF & CH Edmunds, F Emmanuel, 4 larvae (*Dabulamanzia improvida* paratypes) [PERC]. Fianarantsoa Province, Namorona River, at Ranomafana, 5-XI-1971, GF & CH Edmunds, F Emmanuel, 2 larvae (*Dabulamanzia improvida* paratypes) [PERC]; Tsaratango River, 9 kilometers east of Ranomafana, 6-XI-1971, GF & CH Edmunds, F Emmanuel, 6 larvae (*Dabulamanzia improvida* holotype and paratypes [parts on slide]). Tamatave (=Toamasina) Province, Ifasina River, at Bedary RN2, 46 kilometers west of Brickaville, 15-X-1971, GF & CH Edmunds, F Emmanuel, 1 larva (*Dabulamanzia improvida* paratype).

**Other material examined.** MADAGASCAR: Manambolo bas., Manambolo R., at Andakana bridge, 18°43'30"S, 46°02'00"E, 800 m, 9/X/1995, MR Andriamihaja, 2 larvae (N°474a,b; P0474) [MZL]. Manampanihy bas., trib. Andranohela R., at Camp I Andohahela, 24°36'37"S, 46°45'31"E, 575 m, 24/XI/1995, J-M Elouard, 1 larva (N°540a, P0540) [MZL]; Manampanihy bas., trib. Manampanihy R., at Fenoevo, 24°41'00"S, 46°53'39"E, 70 m, 15/IV/1992, ORSTOM, Antananarivo, 1 larva (N°91a, P0091) [MZL]. Mandrare bas., Antranatra R., between Esira and Maroasara, 24°17'37"S, 46°39'04"E, 325 m, 28/IV/1995, J-M Elouard, T Pilaka, 1 male larva (N°417a, P0417) [MZL]; Mandrare bas., Mananara-Sud R., near Amboasary, 24°51'03"S, 46°26'34"E, 45 m, 1/VI/1994, ORSTOM, Antananarivo, 1 larva (N° 337a, P0337) [MZL]. Mangoro bas., Manambolo R., at Mandraka, 18°55'23"S, 47°56'10"E, 1,025 m, 18/X/1995, D Randriamasimanana, ZP Andriambelo, 1 female larva (N°509-11, P0509) [MZL]. Namorona bas., Namorona R., at Ranomafana, 21°15'37"S, 47°27'18"E, 725 m, 5/XI/1996, F-M Gibon, J Legrand, J-L Gattolliat, C Rochat, D Randriamasimanana, 1 female larva (N°641a, P0641) [MZL]; Namorona bas., Namorona R., at Ranomafana, 21°15'40"S, 47°27'28"E, 725 m, 8/XI/1996, J-L Gattolliat, C Rochat, D Randriamasimanana, 1 larva (N°644a, P0644) [MZL]; Namorona bas., Tsaratango riv., Loc. Tsaratango, Long. 47°31'50"E, Lat. 21°16'33"S, 585 m, 8/XI/1996, J-L Gattolliat, C Rochat, 1 male larva (N°636a, P0636) [MZL]. Onilahy bas., Ihazofotsy R., at Andiolava, 22°30'18"S, 45°37'25"E, 900 m, 7/IV/1991, ORSTOM, Antananarivo, 1 male larva (N°30a, P0030) [MZL]. Rianila bas., stream 6 km west of Sahavalaina, 18°34'43"S, 49°04'03"E, 45 m, 15/II/1997, T Pilaka, H Ranarijaona, 1 larva (N°679b, P0679) [MZL]; Rianila bas., unnamed river on road to Lakato, 19°02'40"S, 48°21'48"E, 1,050 m, 8/IV/1999, J-L Gattolliat, N Raberiaka, 1 female larva (N°861a, P0861) [MZL]. Sahankazo bas., Daraina R., 12°29'12"S, 49°24'02"E, 90 m, 4/IV/1994, ORSTOM, Antananarivo, 2 larvae (N°205a,c; P0205) [MZL]; Sahankazo bas., Sakaramy R., 12°26'50"S, 49°17'21"E, 275 m, 5/IV/1994, ORSTOM, Antananarivo, 1 female larva (N°207a, P0207) [MZL]. Tsiribihina bas., small stream, 19°42'05"S, 46°37'00"E, 1,075 m, 14/V/1996, F-M Gibon, D Randriamasimanana, 1 larva (N°589a, P0589) [MZL].

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