Received 15 December 2009; revised and accepted 20 January 2010

The larva of *Nesolestes* sp. from Madagascar (Odonata: Megapodagrionidae)

Kai Schütte

Entomologie, Biozentrum Grindel und Zoologisches Museum Hamburg,
20146 Hamburg, Germany.
<Kai.Schuette@uni-hamburg.de>

Key words: Odonata, dragonfly, Zygoptera, Megapodagrionidae, Madagascar, larva.

Abstract

The larva of the genus *Nesolestes* is described and figured for the first time. Specimens were found in small brooklets in littoral swamp forest in south-eastern Madagascar. The larva is compared with the two other Madagascan genera of Megapodagrionidae, *Protolestes* and *Tatocnemis*, and diagnostic characters are given. The caudal lamellae are held in a horizontal plane. Similar types of caudal lamellae are found in some megapodagrionids of the south-east Asian and Australian region. It can be easily distinguished from the genera *Protolestes* and *Tatocnemis* by the shape of the caudal lamellae.

Introduction

Three genera of Megapodagrionidae are known from Madagascar. These are *Nesolestes* Selys, 1891 with 15 spp., *Protolestes* Förster, 1899 with eight spp., and *Tatocnemis* Kirby, 1889 with 10 spp. (Legrand 2001). The larvae of one species of *Protolestes* and one species of *Tatocnemis* have been described (Paulian 1958). To date no larva of *Nesolestes* has been described.

Apart from *N. pauliani* Fraser, 1951 from the Comoros the species of all three genera are endemic to Madagascar and occur mainly in the eastern rain forest belt (e.g. Schmidt 1951; Lieftinck 1965; Donnelly & Parr 2003). Although *N. nigeriensis* Gambles, 1970 from Gabon is currently placed in *Nesolestes*, it probably belongs in the closely related genus *Neurolestes* Selys, 1882. The latter is otherwise known only from one species, *Neurolestes trinervis* Selys, 1885 from Cameroon, and is probably the sister group to *Nesolestes* (K.-D.B. Dijkstra pers. comm.).

Recently, the author examined samples of larvae collected during inventory studies carried out in the littoral forests of south-eastern Madagascar (Schütte &

Razafindraibe 2007). Two specimens had horizontal caudal lamellae, a character found only in Megapodagrionidae. They did not correspond with the larvae of the genera *Protolestes* and *Tatocnemis* described by Paulian (1958) and were inferred to belong to *Nesolestes*. This supposition was confirmed by J. Legrand (pers. comm.) who has reared larvae of the genus to adults.

Adult specimens of two species of *Nesolestes* were collected at the locality where the larvae were found. However, these could not be identified to species level, hence the larvae are described here as *Nesolestes* sp.

Material and methods

Larvae were collected with a dip net and were stored in absolute ethanol.

Preserved specimens were examined and dissected under a stereo microscope Leica MZ 9.5 and photographed using a digital microscope Keyence VHX-500F. Figures were made with the aid of the photographs and a drawing tube.

Larva of *Nesolestes* sp.

(Fig. 1)

Specimens examined

Two male larvae, F-2, collected in forest fragment S9 (24°47'12"S, 47°10'60"E), Manafiafy (Sainte Luce), 40 km north of Tolagnaro (Fort-Dauphin), December 2006. The larvae are deposited in the Zoological Museum of the University of Hamburg (ZMH).

Diagnosis

A robust larva with long legs. The caudal lamellae are oriented in the horizontal plane. Their length is ca 1/2 of the body length from the head to the end of the abdomen (Fig. 1a). The ground colour of the larva is light brown with darker patches and markings; caudal lamellae with two brown bands and speckled with darker dots. The legs are paler brown with the femora weakly banded.

Description

Head: In dorsal view it has the shape of a stout compressed pentagon, broader than the thorax; labrum rounded; occiput concave, post ocular lobes rounded with short spiniform setae on the posterior and lateral margin, posterior occipital

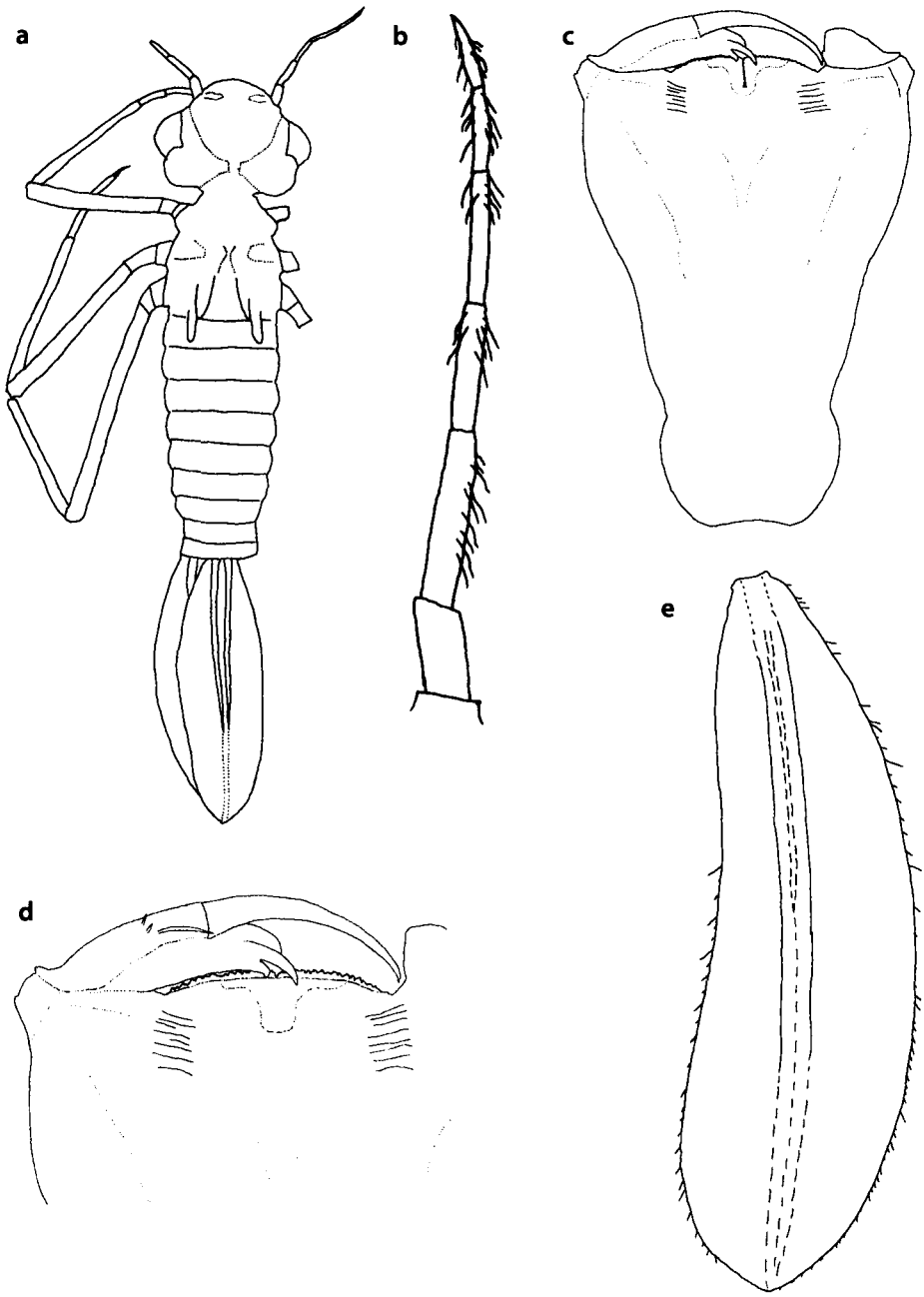

Figure 1: Details of a F-2 larva of *Nesolestes* sp. from Madagascar — (a) habitus, right caudal lamella removed; (b) antenna; (c) prementum and labial palp, right labial palp removed, dorsal view; (d) anterior margin of prementum and left labial palp in detail, dorsal view; (e) right caudal lamella in detail, dorsal view. Not to scale.

and inner occipital margin rectangular, posterior border of post occipital lobe at ca 115° to body axis (Fig. 1a); antenna 6-segmented (Fig. 1b), with the 2nd antennomere the longest, evenly tapered. Labium elongate, prementum apically about twice as broad as basally, length/width index of prementum ca 1.4, lateral margin of distal part with very small teeth, subapical ridges situated on both sides near the base of the labial palps (Fig. 1c); ligula of prementum slightly convex with well developed median cleft, margin of ligula with small teeth; labial palp with three robust incurved inner teeth; movable outer tooth long and robust; dorsally one median longer seta and a few shorter setae (some shorter setae broken) (Fig. 1d).
Thorax: Pronotum trapezoidal, with blunt posterolateral marginal processes. Wing pads little developed in F-2, reaching to the distal margin of S2. Legs thin and long, becoming disproportionately longer from fore to hind leg, mid femur 1.36 times as long as fore femur. Legs paler brown than thorax and abdomen, femora with 2-3 darker brown bands, faint suggestion of 1-2 darker brown bands on the tibia.
Abdomen: Moderately robust and elongate. Gonapophyses and cerci barely visible in F-2. Caudal lamellae horizontal, leaf shaped, margins are covered with fine setae, tips are pointed (Fig. 1e), distinct carina on the ventral side in the middle of each caudal lamella reaching from the proximal to the distal end. In death the asymmetrical leaf shaped lateral lamellae are covered to 2/3 by the median lamella. Median lamella with symmetrical leaf-like shape. All lamellae almost equal in length and light brown with two distinct darker brown bands and speckled with darker brown dots.

Habitat and behaviour

The specimens were collected from a small stream in swampy littoral forest. The stream contained a layer of dead leaves with scattered sandy patches on the ground. Very few submerged plants were present. Maximum water depth was ca 20 cm. No observations on the living larvae were made. Adults of two unidentified species of *Nesolestes* were observed at the site, resting up to ca 1 m above the ground on plants in the understorey. They flew for only a few metres when disturbed.

Discussion

The larvae of two other megapodagrionid species known from Madagascar have been described (Paulian 1958), namely that of *Protolestes proselytus* Lieftinck, 1965 (as *P. fickei* Förster, 1899) and that of *Tatocnemis malgassica* Kirby, 1889. Lieftinck (1965) based his description of *P. proselytus* on the adult which emerged from Paulian's larva, hence there is no doubt as to its identity. The larvae of *Tatocnemis* have inflated saccoid gills bearing a terminal filament and are clearly dis-

tinct from both *Nesolestes* and *Protolestes*. The latter two have horizontal gills but in *Nesolestes* no filament is present at the tip of the gills. Apart from *Nesolestes* and *Protolestes*, horizontal gills are only found in the Asian genus *Podolestes* (Choong & Orr 2010) and in several Australasian genera. A discussion on the phylogenetic relation between these genera can be found in Kalkman et al. (2010).

Diagnostic characters of the other genera of Madagascan Megapodagrionidae are shown in Table 1.

Table 1. Diagnostic features of head, thorax, and caudal lamellae of the larvae of the three Madagascan Megapodagrionidae genera. Characteristics of *Protolestes* and *Tatocnemis* are from Paulian (1958).

	Nesolestes sp.	*Protolestes proselytus*	*Tatocnemis malgassica*
Head	Broader than long	Broader than long	Ca as broad as long
Antenna	6-segmented	6-segmented	7-segmented
Pronotum	Trapezoidal, lateral blunt processes	Cylindrical, narrower, transverse	Oval, transverse
Caudal lamellae	No filament at tip, tips pointed; less oval, median lamella only partly covers lateral ones	Very short filament at tip; oval, convex median lamella completely covers lateral ones	Long filament at tip; triangular, saccoid

The most recent taxonomic work on *Nesolestes* was carried out by Lieftinck (1965) and Aguesse (1968). Identification of *Nesolestes* adults is difficult and a revision of the genus and a key to the species is needed. Dijkstra & Clausnitzer (2004) listed all Madagascan Megapodagrionidae as "of primary conservation concern". Observations suggest that the forest-dwelling species do not fly long distances and might be trapped in the highly fragmented and threatened littoral forests in south-eastern Madagascar (Ganzhorn et al. 2001). Due to the lack of knowledge and distribution data, Madagascan Megapodagrionidae assessed for the IUCN Red List are classified "data deficient" (IUCN 2009) except for *T. malgassica* (assessed "least concern").

Acknowledgements

I would like to thank Vincent Kalkman (Leiden) and Bert Orr (Caloundra) who initiated the study, gave valuable advice, and improved the manuscript. I am grateful to Jean Legrand (Paris) who gave helpful comments and confirmed the identity of the larvae of *Nesolestes*. Ralph Peters (Hamburg) made comments on an earlier version of the manuscript.

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