

A New Genus of Oligoneuriidae (Ephemeroptera) from Madagascar

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ABSTRACT *Rianilaneuria diminuta* Pescador & Peters, a new genus and species from the mideastern slopes of Madagascar, is described from male and female adults and eggs. The adults are defined by the presence of vein IR and the absence of vein IMP in the forewing; male genitalia with two-segmented forceps, short penes and a small truncate styli; absence of mesoscutellar filaments; and elongate coxae. The egg chorion is adorned with widely spaced and circularly clustered sponge-like microsetae.

KEY WORDS Oligoneuriinae, *Rianilaneuria diminuta*, Madagascar

The Oligoneuriidae are a unique group and perhaps the most highly evolved among adult mayflies because of their adaptation for swift flight. The adults, with the exception of the plesiomorphic genus *Chromarcys*, no longer exhibit the conventional type of mayfly flight and have developed the sculling type of flight that provides superior speed and power (Edmunds and Traver 1954). This mostly pantropic family currently includes two extant subfamilies, Oligoneuriinae and Chromarcyinae, and the extinct subfamily Colocrurinae (McCafferty 1990). The Chromarcyinae, presently known from the Oriental Region, and Colocrurinae, known from Lower Cretaceous fossils from the Santana Formation in Ceará Crato, Brazil (McCafferty 1990), are both monogeneric. The subfamily Oligoneuriinae currently includes 10 genera. Six (*Fittkaueria*, *Homoeoneuria*, *Lachlania*, *Oligoneuria*, *Oligoneurioides*, and *Spaniophlebia*) occur in the Neotropics, and two of these genera (*Homoeoneuria* and *Lachlania*) extend their geographic range into the Nearctic Region. *Oligoneuriella* is known from the Palearctic Region, *Oligoneuriopsis* is known from the Afrotropical and Palearctic regions, and *Elassoneuria* and *Oligoneurisca* occur in the Afrotropical and Palearctic regions, respectively.

Demoulin (1973) established the monotypic subgenus *Madeconeuria* for *Elassoneuria* (*M.*) *insulicola* Demoulin from Madagascar. *Madeconeuria* is presently the only oligoneuriine taxon known from Madagascar.

In this article, we describe a new oligoneuriid genus and species based on male and female adults and eggs collected from rivers of the mideastern slopes of Madagascar.

Materials and Methods

Eggs for scanning microscopy were dehydrated through a graded series of ethanol, critical-point dried,

stub-mounted, and sputter-coated with gold palladium. The eggs were examined with a JEOL JSM-840 scanning electron microscope (JEOL, Tokyo, Japan). Comparative eggs of *Oligoneuriopsis* were taken from mature female nymphs determined by G. F. Edmunds and collected from streams of Mt. Elgon by H. Hynes.

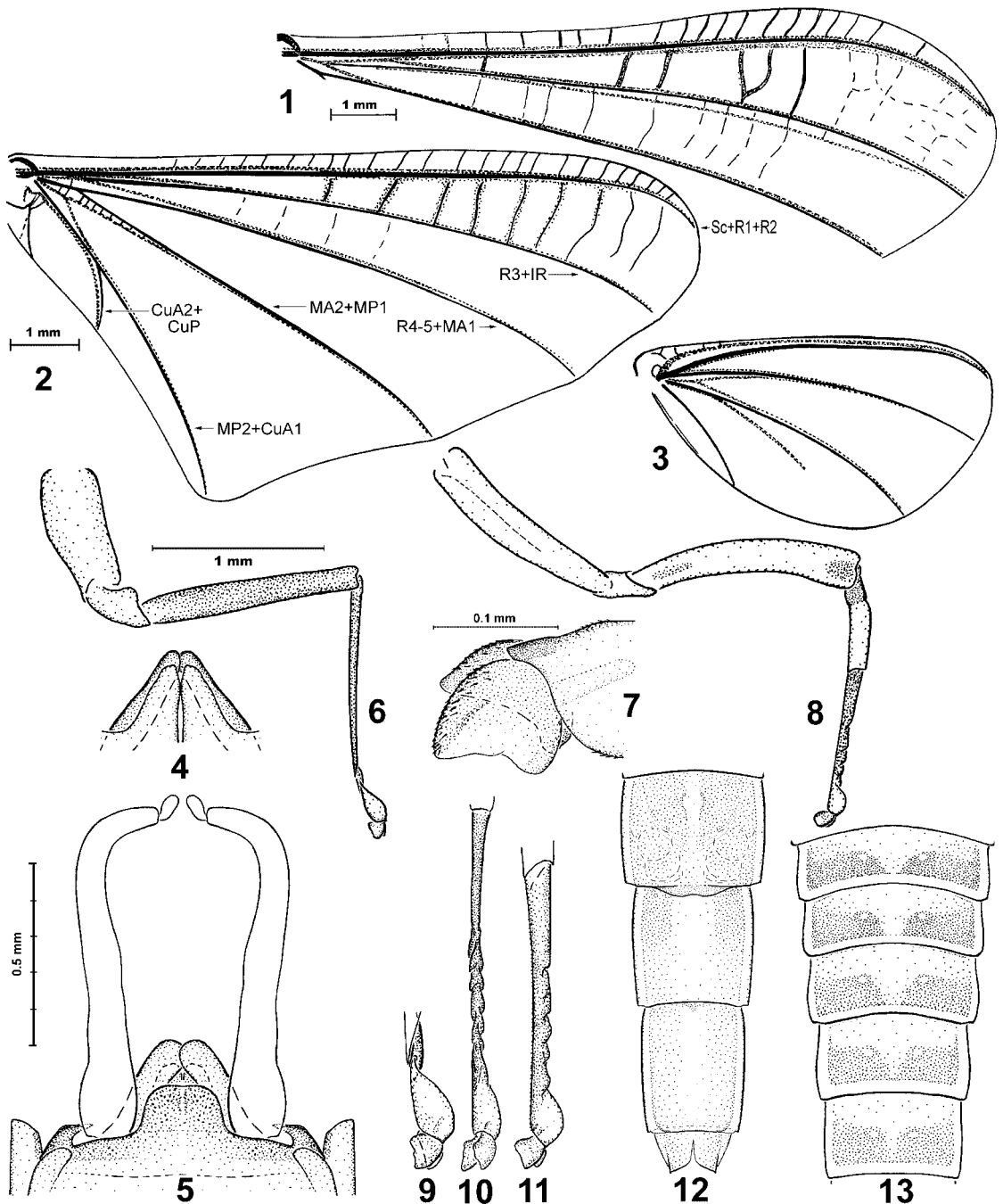
Terminology follows Pescador and Peters (1980). Although Kukulová-Peck (1985) and Riek and Kukulová-Peck (1984) recognized that the concave veins of the radial field (R2–R5) actually represent veins of the radius posterior (RP1–RP4), we continue to follow the classical terminology of Tillyard (Edmunds and Traver 1954) for purposes of comparison with earlier works (especially Crass 1947). Among Ephemeroptera, only the subfamily Oligoneuriinae has intercalary and cross veins reduced to folds or vein traces, so we have borrowed terminology from Hymenoptera to express these modifications: “nebulous” refers to vein traces with some pigmentation but no other definable structure; “spectral” refers to vein traces represented by folds visible only in reflected light (Huber and Sharkey 1993).

Type specimens are deposited at Florida A&M University (FAMU), Tallahassee, FL; Museum National d’Histoire Naturelle (MNHN), Paris, France; and the Museum of Zoology (MZL), Lausanne, Switzerland.

Rianilaneuria Pescador & Peters, new genus

Imago. Length: ♂ body 11.6–13.0 mm, forewing 9.9–11.4 mm, caudal filaments 8.6–9.6 mm, foretibia 1.1–1.2 mm; ♀ body 11.2–13.0 mm, forewing 11.0–11.5 mm, caudal filaments 3.4–4.1 mm. Male eyes large, contiguous on meson of head (Fig. 14); ♀ eyes narrowly separated by a distance approximately equal the maximum width of antennal pedicel, frons with prominent median ridge between antennal bases reaching from median ocellus to anterior margin, most structures of nymphal mouthparts retained (Fig. 15).

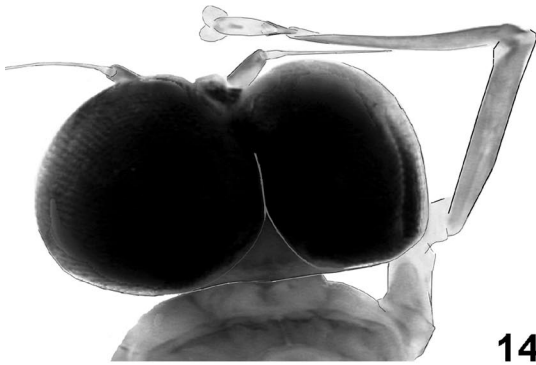
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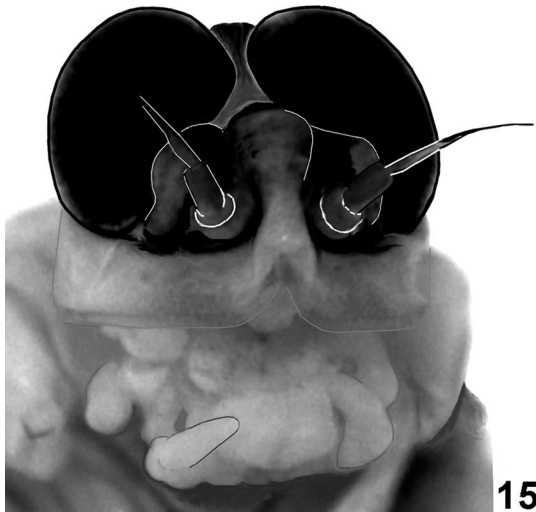
Figs. 1-13. *R. diminuta*. 1, radial field of ♀ forewing; 2-3, ♂ fore- and hind wings; 4, ♂ dorsal detail of penes; 5, ♂ genitalia, ventral view; 6, ♂ foreleg; 7, ♂ foreclaw; 8, ♂ metathoracic leg; 9-11, ♂ fore-, meso- and metathoracic tarsi; 12, ♀ sterna 7-9 and paraprocts (subimago); 13, ♀ abdominal terga 2-6 (subimago). In wings, convex veins are represented by solid lines, concave veins by stippled lines, and nebulous or spectral veins by dashed lines.

Length of antennae subequal to head length. Thorax: width of pronotum $\approx 4.0\times$ maximum length; mesoscutellar filaments absent. Wings (Figs. 1-3). Length of hind wing $\approx 0.4\times$ length of forewing; in forewing, veins Rs and MA forked near base of wing (Figs. 1-2), vein IR present, vein IMP absent; well-developed

cross veins present only between veins C and IR but nebulous cross veins reaching MA and spectral cross veins rarely present in MA and MP fields; cross veins of hind wing absent (Fig. 3); forewing of female similar except additional longitudinal vein visible in Rs field (Fig. 1). Legs (Figs. 6-11, 14). Coxae of all legs



14



15

Figs. 14–15. *R. diminuta*. 14, ♂ head, dorsal; 15, ♀ head, ventral. Figures have been lightly retouched to emphasize detail.

elongate, more than twice length of trochanter and almost equal to length of femur in meso- and metathoracic legs (Figs. 6 and 8); femur of forelegs subequal to a little longer than length of tibia; foretarsus two-segmented, basal segment sclerotized, distal segment bulbous (Figs. 6 and 9); ratio of foretarsal segments to foretibia = 0.18:0.20; meso- and metathoracic tibiae $\approx 0.5\times$ length of femora; mesothoracic tarsus longer than metathoracic tarsus; tarsal segments partially fused with indistinct segmentation (generally five to seven apparent segments on mesothoracic tarsus, five on metathoracic tarsus), only bulbous distal segment distinct (Figs. 8 and 10–11); tarsal claws similar, somewhat truncate apically (Fig. 7). Coxae, trochanters, and femora of ♀ legs similar to legs of ♂, but weak (somewhat atrophied); meso- and metathoracic legs with segments distal to femur atrophied. Abdomen: posterolateral projections of segments absent. Male genitalia: width of styliger plate $\approx 2\times$ length, apical margin truncate, styliger bar sclerotized (Fig. 5); genital forceps two-segmented, segment I $>10\times$ length of segment II (Fig. 5); penes short and apically blunt, with sclerotized, straight lateral lobes (Figs. 4–5). Posterior margin of abdominal sternum 7 of ♀

with median expansion with submedian openings; apex of ♀ sternum 9 straight; paraprocts as in Fig. 12. Caudal filaments: ♂, terminal filament and cerci subequal in length, slightly longer than length of abdomen, annulations ringed with long setae; ♀, terminal filament a little shorter than cerci, $\approx 0.3\times$ length of abdomen, cerci with fine setae along inner margins, terminal filament with fine setae on lateral margins.

Egg. Measurements: 330 by 285 μm . Polar cap absent; chorion adorned with relatively widely spaced and circularly clustered sponge-like microsetae (Figs. 16–17).

Mature Nymph. Unknown.

Etymology. Named after Rianila Basin where the holotype and some of the paratypes were collected; feminine.

Type Species. *Rianilaneuria diminuta* n. sp.

Distribution. Madagascar.

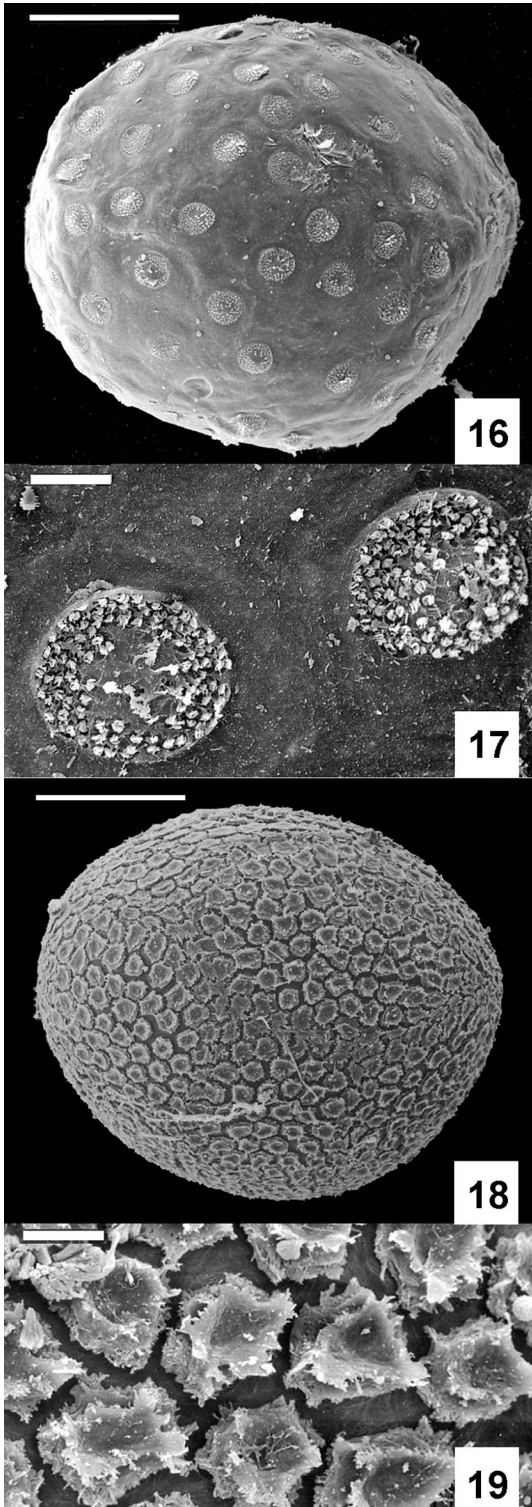
Diagnosis. *Rianilaneuria* can be distinguished from other genera of Oligoneuriidae in the imagos by the following combination of characters: 1) three caudal filaments; 2) vein IR of forewing present and free to near wing base (Figs. 1–2); 3) vein IMP of forewing absent (Fig. 2); 4) genital forceps present, two-segmented (Fig. 5); 5) foretibia subequal in length to forefemur (Fig. 6); and 6) coxae of all legs elongate (Figs. 6 and 8). In addition to the adult characters, the eggs have chorionic sculptures that are different from presently known eggs of other genera of the family, having widely spaced circularly clustered sponge-like microsetae (Figs. 16–17).

Discussion. The nymph of *Rianilaneuria* is currently unknown. However, the genus seems closely related to the rare European genus *Oligoneurisca* based on adult characters, especially the venation of the forewings, leg ratios, and structure of the mesotarsi. It is distinguished from *Oligoneurisca* by the two-segmented genital forceps and two-segmented foretarsi.

Among described genera, only *Homoeoneuria* and *Oligoneurisca* have elongated coxae in the adults, a character probably related to the elongate coxae of their burrowing nymphs. Although Crass (1947) did not illustrate or discuss the legs of *Oligoneuriopsis* (an African genus with similar venation), figures of species of *Oligoneuriopsis* provided by Helen Barber-James and Jean-Luc Gattolliat show short coxae and long femora typical of most members of the family. The overall similarity of *Rianilaneuria* to *Oligoneurisca* and the similarity of the legs of *Rianilaneuria* to sand-burrowing Oligoneuriidae suggest that the nymph may eventually be found in a similarly cryptic habitat.

The chorionic sculpturing and attachment structures of the eggs of *Rianilaneuria* and *Oligoneuriopsis* genera are distinctly different. The egg chorion of *Rianilaneuria* is adorned with widely spaced and circularly clustered sponge-like microsetae (Figs. 16–17) as opposed to the dense and pentagonally shaped structures in *Oligoneuriopsis* (Figs. 18–19). A photograph of the egg of *Oligoneurisca* is given by Keffermüller (1964).

The female forewing of *R. diminuta* has a weakly developed basally detached longitudinal vein be-



Figs. 16–19. Scanning electron micrographs of eggs. 16–17, *R. diminuta*; 18–19, *Oligoneuriopsis* sp. Scale bars = 100 μm (16, 18); detail 10 μm (17, 19).

tween veins IR and R4–5 (Fig. 1), which occasionally occurs as a spectral vein in a few males. The vein is also present in males of *Oligoneuriopsis lawrencei* Crass and an examined male of *Oligoneurisca borysthena* (Tshernova). Crass (1947) thought this vein to represent R3b, but this is unlikely. Spectral remnants of other veins indicated by Crass (1947) are also present, more in females than males, but it is impossible to homologize these veins at present.

Kluge (2004), using an independent terminology, stated that R2 and R3 do not fork, and that one unspecified branch is always lost in Oligoneuriinae, which is contrary to the statement of Crass (1947) concerning *Oligoneuriopsis* and the discussion of Koss and Edmunds (1970) on *Lachlania*. After reexamining the specimens of Koss and Edmunds (1970) and comments of Crass (1947), it is clear that at least part of R2 is present apically, although not always distinct in the base of the wing. The basal branching of R2 from R3 is indistinct in the male of *Rianilaneuria*, but clear in the female; it is also clear in the examined male of *Oligoneurisca*. Loss or reduction of wing veins is a common occurrence in the family; hence, caution must be exercised in the interpretation of wing venation of the various genera.

Rianilaneuria diminuta Pescador & Peters,
new species

Male Imago (in Alcohol). Head black around bases of ocelli, margins of head pale. Eyes black. Scape of antennae whitish, pedicel and flagellum brown. Thorax: pronotum light brown with submedian brown bars; mesonotum light brown, paler medially, medioparapsidal sutures pale and midtransversely connected by whitish band obscurely forming an H-shaped figure; anterior half of median longitudinal suture with thin brown lining; mesoscutellum and metanotum brown. Prosternum yellowish brown with pale brownish median sclerite; meso- and metasterna yellowish brown, sternal sutures slightly darker. Wings: membrane of fore- and hind wings translucent, veins pale yellowish, a little darker at base of wing. Legs: foreleg coxa and trochanter light brown, femur and tibia brown, segment 1 of tarsus light brown, segment 2 including claws whitish (Figs. 6 and 9, 14); meso- and metathoracic legs pale yellowish brown with blackish brown streak at base of femora and blackish brown macula at apex of femora and base of tibiae, tarsi brown except bulbous distal segment pale (Figs. 8 and 10–11). Abdominal terga cloudy white, terga faintly washed with light brown, darker on terga 2–4 and becoming progressively paler on posterior terga except tergum 10 light brown; sterna 1–8 pale yellowish brown with darker posterolateral shading on sterna 7–8; sternum 9 light brown, paler apically, darker laterally. Styliiger plate brown; genital forceps whitish, penes light brown. Caudal filaments whitish.

Male Subimago (in Alcohol). Coloration as in male imago, except a richer brown with small blackish maculae on inner posterior margins of posterior scutal protuberances, metanotum brown with small submedian blackish horizontal streaks, a very narrow dark

brown band present on posterior margin of abdominal terga, this posterior band heavier medially on terga 4–9 or 6–9, tergum 10 brown.

Female Imago (in Alcohol). Color as in male except: head brownish between eyes, black markings around bases of ocelli and antennae broader; frontal median ridge, and margins whitish; weakly developed legs membranous and uniformly whitish. Abdominal terga and sterna cloudy white with light brown pattern on anterior terga, pattern becoming progressively paler on posterior terga.

Female Subimago (in Alcohol). Color as in female imago except overall color a darker brown, brown wash on abdominal terga more extensive covering at least posterior half of terga 2–6 (Fig. 13).

Etymology. *diminuta* L., meaning diminutive or small. Feminine.

Type Material. HOLOTYPE: ♂ imago (in alcohol), MADAGASCAR: Rianila Basin, Marongolo River, Aff. de Rongaronga, Local. Antanandava PK 285 RN2, PO255, 3-XI-1994 (MZL). ALLOTYPE: 1 ♀ imago (FAMU) same data. PARATYPES: 2 ♂ imagos, same data (FAMU, MNHN); 1 ♂ imago, 2 ♂ subimagos, 3 ♀ subimagos, Mangoro Basin, Mangoro River, Pont routier de Mangoro, PO106, 2-IV-1992 (FAMU, MZL). We have seen slides of additional specimens from the collection of J.-M. Elouard, IRD, Montpellier.

Discussion

Presently, *R. diminuta* is the only species known in the genus. The coloration of the material from the Rianila Basin (imagos) is more faded than that of the specimens from the Mangoro Basin (subimagos), leading us to suspect that a creamy white base color with rich brown markings may be characteristic of fresh specimens. The abdominal coloration on the female imago covers the posterior one third of anterior abdominal terga and in the three female subimagos from Mangoro it varies from extending over the posterior half of terga 2–6 (Fig. 13) to covering most of each tergum. We consider the extent of shading to represent intraspecific variation between stages and localities. The margin of sternum seven of one of the Mangoro female subimagos is straight with oviducts clearly marked; on another Mangoro subimago, the posterior margin is partially extended (Fig. 12); on the female imago, this extension is more developed and the two openings of the oviducts are distinct.

Collection data for the adults indicate emergence in November and April; specimens were collected at morning light traps.

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