

Chapter 10

New Heptageniidae (Insecta: Ephemeroptera) from the Réserve Naturelle Intégrale d'Andringitra, Madagascar

Michel Sartori and Jean-Marc Elouard

Abstract

Two new species of Heptageniidae (Insecta: Ephemeroptera) are described from the nymphal stage from the Réserve Naturelle Intégrale d'Andringitra. One species belongs to the genus *Afronurus* and the second to the genus *Thalerosphyrus*.

Résumé

Deux nouvelles espèces d'Heptageniidae (Insecta: Ephemeroptera) sont décrites à partir des larves de la Réserve Naturelle Intégrale d'Andringitra. Une d'entre elles appartient au genre *Afronurus*, la seconde au genre *Thalerosphyrus*.

Introduction

Malagasy mayflies (Ephemeroptera) belonging to the family Heptageniidae are poorly known. The first report from the island is a larva identified as *Notonurus* sp. by Demoulin (1973). In the following years Edmunds (1975, 1979) mentioned undescribed species from Madagascar belonging to genera *Afronurus*, *Compsohuriella*, and *Thalerosphyrus*. In these publications he drew a general outline of the biogeography of these taxa.

Three new taxa from the Réserve Naturelle Intégrale (RNI) d'Andringitra are discussed here. The nymphs of two forms are described as new species for which the imagos are unknown, and the nymph of a third species is briefly discussed but not formally named. Genus attribution is provisional and awaits the availability of adults, especially male imagos. For details on collection techniques and stations see Chapter 9.

In order to avoid any confusion, some terms are defined, as follows (Hubbard, 1995). Nymph: a larva that possesses black or extremely dark wing

pads and is almost ready to molt to the subimaginal stage; larva: any other immature stage younger than the nymph; and pecten(s): "any comb-like structure or organ" (Torre-Bueno, 1989); we use this term to name the "comb-shaped structures" that are found on the outer margin of the galea-lacinia of the maxillae (see Fig. 10-25).

Descriptions

Afronurus matitensis Sartori & Elouard, new species
(Figs. 10-1 to 10-16)

NYMPH—Total length without caudal filaments: male nymph up to 9.5 mm; female nymph up to 11.0 mm. Overall coloration dark brown, pale brown head, dark brown thorax and abdomen; pale brown femora with a dark dorsal spot at midline and apex (Fig. 10-1); yellow-brown ventral side with the same spots as on dorsum; yellow-

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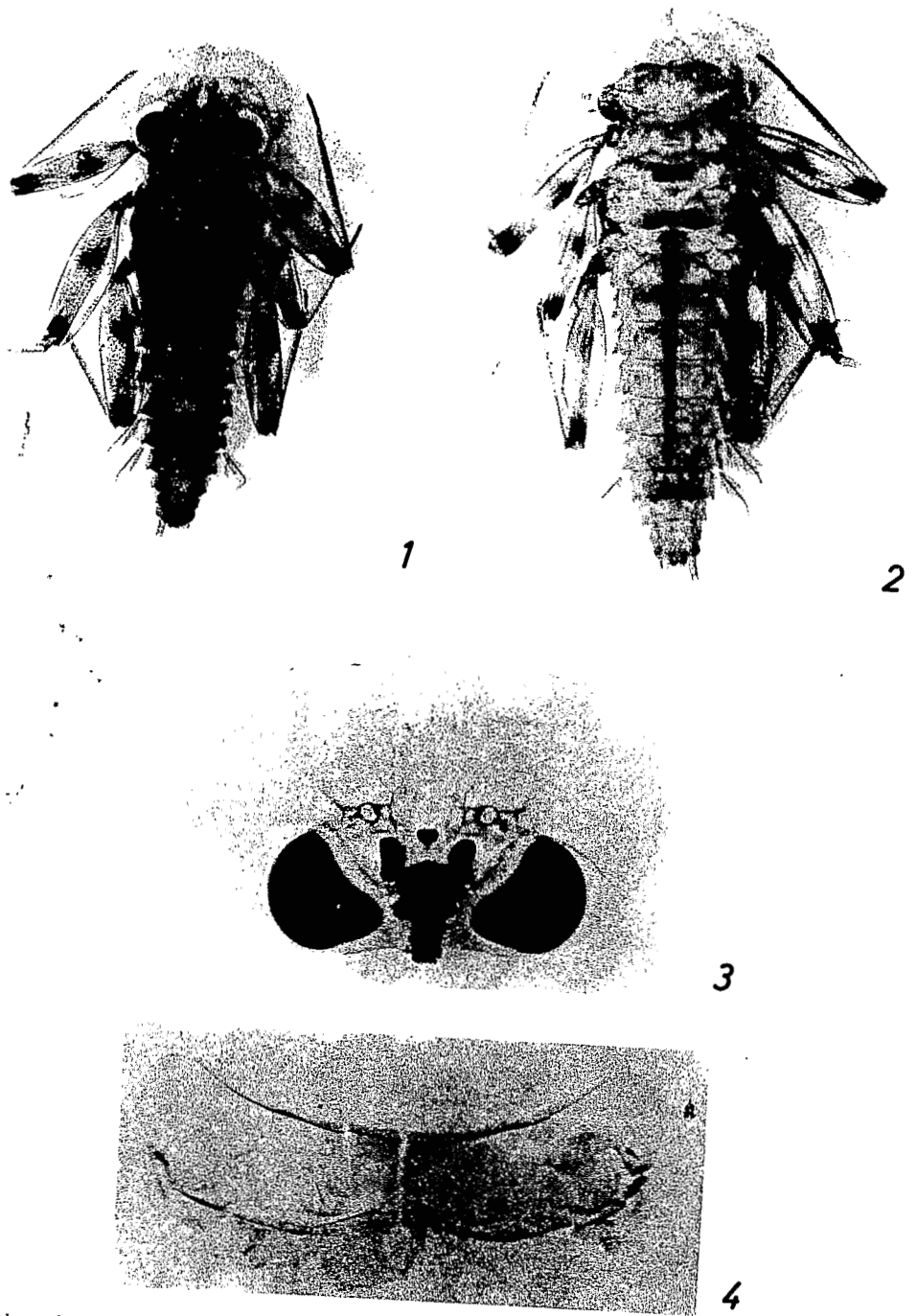
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Figs. 10-1 through 10-4. *Afromurus matitensis* n. sp. 1: dorsal view of nymph; 2: ventral view of nymph; 3: details of head of a female nymph; 4: prothorax (arrows indicate chitinous creases).

brown tibiae, dark brown tarsi; gray-brown sternites with paired small pale spots on each sternite; gray-brown meso- and metasternite with a dark brown transverse stripe (Fig. 10-2). Purple and blackish abdominal gills with visible tracheation; yellow-brown caudal filaments with dark brown rings.

HEAD—Very broad head capsule, broadest part at level of the insertion of antennae; female head with posterolateral margins rectilinear to slightly concave (Fig. 10-3); male characterized by a slightly rounded head. Trapezoidal labrum, about four times wider than long (3.75–4.25); internal margin with a well-marked medium notch; rounded lateral projections slightly bent backward (Fig. 10-5). Mandibles with long sharp-pointed incisors, bearing six to eight small teeth in the internal margin. Asymmetrical prostheca, fine on the left mandible, thicker and slightly indented on the right one. Hypopharynx with lateral lobes rounded and covered with long bristles up to the inner side (Fig. 10-6). Maxillae densely covered with scattered bristles (Fig. 10-8). Apex of galea-lacinia with about 14–16 pectens, fifth pecten with 11–12 long sharp-pointed teeth. Maxillary palpi three-segmented: segment I very long, at least the length of galea-lacinia, with 18–22 stout bristles on the external margin; segment II narrower and equal in length to segment I; and segment III about 2.5 times shorter than segment II, with the apex gradually narrowing to form a sharp-pointed tip (Fig. 10-8). Apical part of segment II and segment III form a brush made of bristles on their outer margins. Rib-shaped glossae, rounded apically. Paraglossae moderately bent laterally (Fig. 10-7). Labial palpi three-segmented. Inner margin of segment III markedly sinuous, apex of segment II and entire segment III covered with a brush structure similar to that of maxillary palpi (Fig. 10-9).

THORAX—Pronotum laterally rounded, with two chitinous creases along symmetrical line, but with no posterolateral projections (Fig. 10-4). Legs thick with dilated femora. Tarsal claws with two small subapical teeth. Outer margin of femora covered with long and fine bristles; dorsal surface of all femora covered with thick short heart-shaped spines (Fig. 10-10), longest not exceeding 1.5 times width.

ABDOMEN—No lateral projections on segment I, small projections on segment II through IV but increasing in length towards segment VIII, where they reach the middle of segment IX. Posterior margin of tergite V, with one to two rows of sharp

microdenticles and a posterior row of stout spatulate scales with rounded apex (Fig. 10-11). Seven pairs of gills, gill VII without tracheal filaments (Figs. 10-12 to 10-16). Gills I elongated with subparallel margins and slightly acute apex; gills II–IV more rounded and slightly asymmetrical; gills VII elongated with rounded apex. Distal part of each segment of caudal filaments with a whorl of stout spines apically rounded, as well as long and fine bristles.

Examined Material

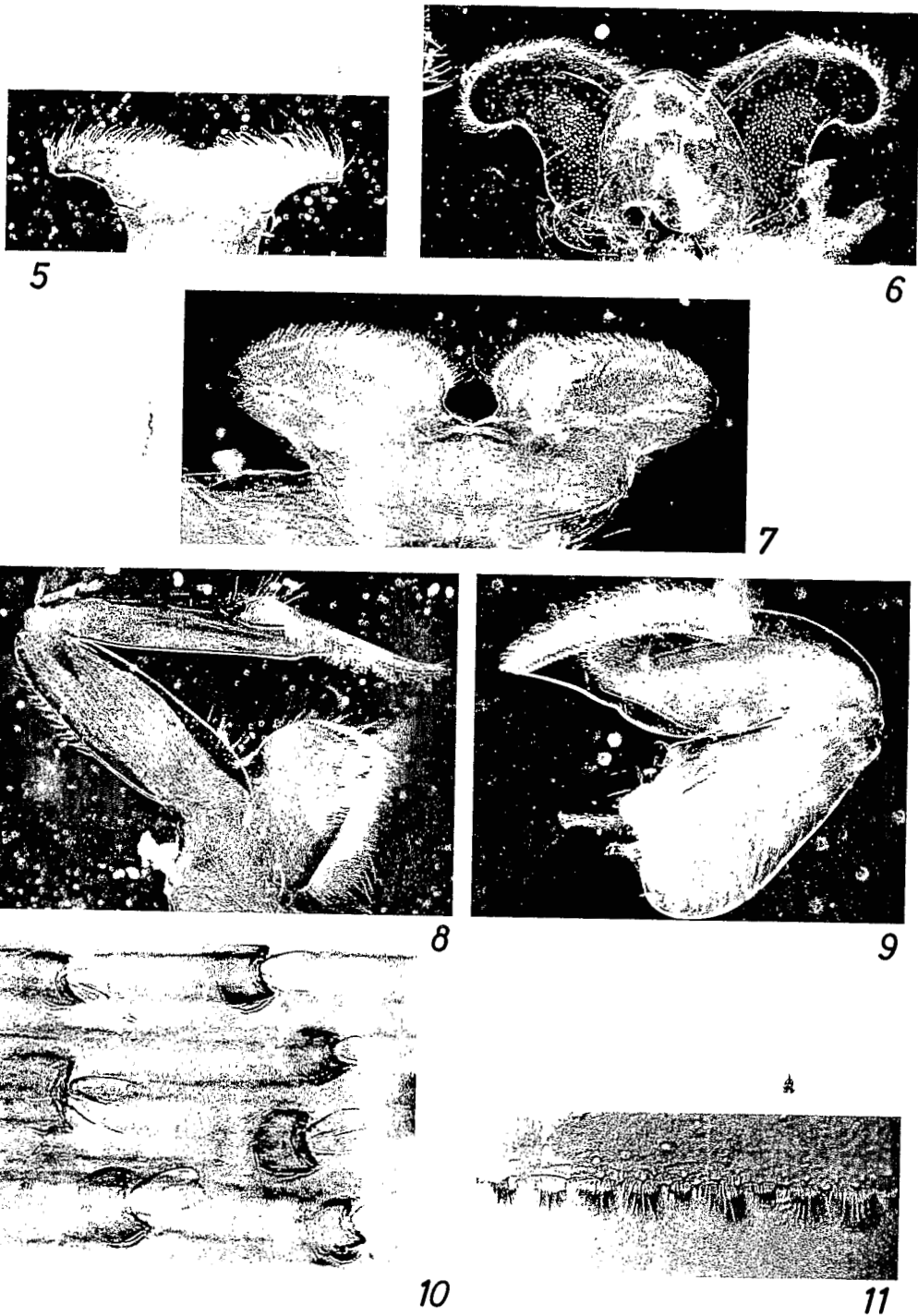
HOLOTYPE—One female nymph; Madagascar, Fianarantsoa Province, approximately 45 km S Ambalavao, RNI d'Andringitra, the Matitanana Basin, station 1, 717 m, 22°13'S, 47°01'E, 17 November 1993. It is deposited in the Musée Cantonal de Zoologie, Lausanne, Switzerland. The type locality is the original collection sample station number P0165 of the LRSAE field series, associated with the "Biodiversity and Biotypology of Malagasy Rivers" program.

PARATYPES—One female nymph, one male nymph, five larvae, same data as for holotype; 14 larvae at station 5 (P0167), 19 November 1993; seven larvae at station 4 (P0168), 20 November 1993, RNI d'Andringitra (see Chapter 9); two larvae, Manampanihy River, 24°41'00"S, 46°53'39"E (P0091), 15 April 1992; one male nymph, Namorona River, Ranomafana, Ifanadiana, 21°15'15"S, 47°27'34"E (P0212), 17 April 1994. All specimens collected by J.-M. Elouard, F.-M. Gibon, M. Sartori, and others. Some paratypes deposited in the Muséum National d'Histoire Naturelle (MNHN), Paris, and Centre National sur l'Environnement, Antananarivo.

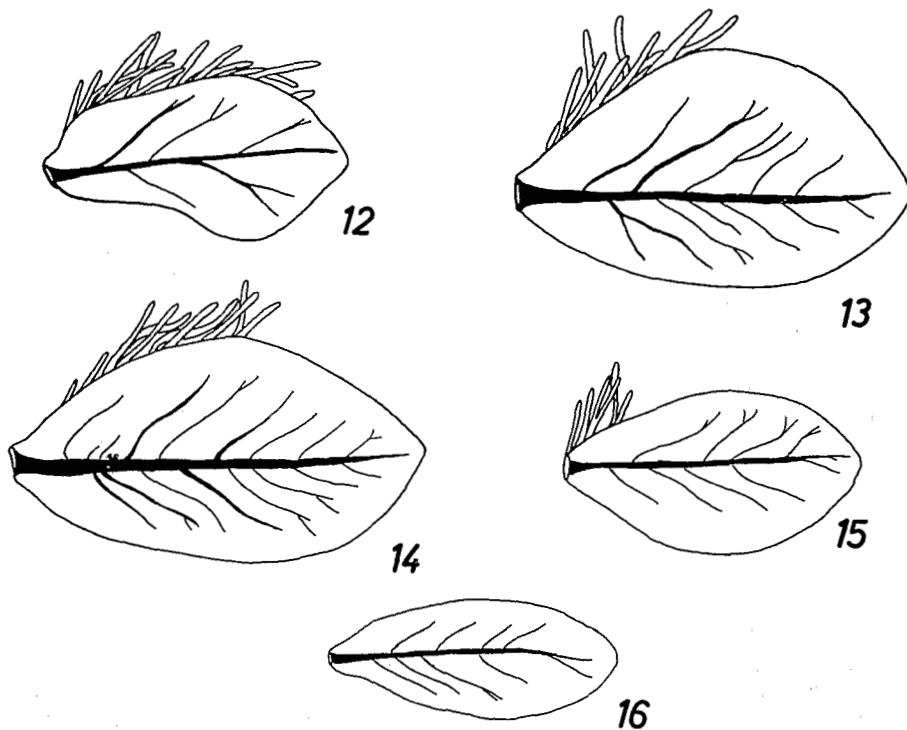
OTHER MATERIAL NOT CONSIDERED AS PARATYPES—Nine larvae, stream near Ambatolampy, near confluence with the Namorona River, 7 August 1958; two larvae, Amborompotsy River, Antsampandrano (forest station), 25 July 1958; five larvae, Andranomalona River (forest station Andasibe), along Antananarivo–Toamasina Road, 31 July 1958. Collected by F. Starmühlner and J. Fontaine.

Affinities

Considering the morphology of its mouthparts, this new species probably belongs to the genus *Afronurus*. *Afronurus matitensis* resembles some



FIGS. 10-5 THROUGH 10-11. *Afronurus matitensis* n. sp. 5: labrum; 6: hypopharynx; 7: glossae and paraglossae; 8: maxilla; 9: labial palp; 10: spines on dorsum of hind femora; 11: posterior margin of tergite V.



Figs. 10-12 through 10-16. *Afronurus matitensis* n. sp. 12: gill I; 13: gill III; 14: gill V; 15: gill VI; 16: gill VII.

African species, such as *A. oliffi* Schoonbee and *A. harrisoni* Barnard, but it is easily distinguished by the shape of the gills (distinctly more asymmetrical in the African species), by the shape of the maxillary palpi (first segment shorter in *A. oliffi* and *A. harrisoni*), by the number of pectens of the galea-lacinia (more than 20 for the above two species), and by the shape of the spines on the dorsum of the femora (sharp-pointed for *A. harrisoni*; see Schoonbee, 1968).

Thalerosphyrus josettae Sartori & Elouard, new species
(Figs. 10-17 to 10-32)

NYMPH—Body length without caudal filaments: male nymph up to 9.5 mm, female nymph up to 10.5 mm. Overall coloration chestnut brown to pale brown; evenly colored head and thorax. Abdominal tergites with distinctively dark brown on yellowish brown ground (Fig. 10-17). Sternites also distinctive, yellowish beige, with paired elongated dark brown spots and paired points all along the median line, the complete structure lampshade shaped (Fig. 10-18). Evenly yellowish

brown colored legs, apex of femora of nymphs with dark brown spots. Brown tibia and tarsi dark brown.

HEAD—Labrum about four times wider than long, with nearly rectilinear outer margins and a wide median notch. Lateral projections slightly bent backward (Fig. 10-21). Hypopharynx with lateral lobes rounded and covered with long bristles that do not extend to the inner side. Mandibles with indented incisors. Asymmetrical prostheca. Galea-lacinia of maxillae covered with scattered long bristles (Fig. 10-24). Apex with 14–16 pectens, fifth with 10–11 thick sharp-pointed teeth (Fig. 10-25). Maxillary palpi three-segmented. Segment I shorter than galea-lacinia, with 25–28 stout bristles on its outer margin. Segment II about 1.2 times longer than the first. Segment III short, with a rounded apex (Fig. 10-24). Rib-shaped glossae, paraglossae moderately stretched toward lateral side (Fig. 10-23). Labial palpi three-segmented. Subrectilinear internal margin for third segment.

THORAX—Prothorax markedly rounded on both sides with a beginning of rounded projections in latero-posterior part (Fig. 10-19). Prothoracic creases not heavily sclerotized. Well-developed



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Figs. 10-17 through 10-20. *Thalerosphyrus josettae* n. sp. **17**: dorsal view of nymph; **18**: ventral view of nymph; **19**: prothorax (arrows indicate chitinous creases); **20**: details of thoracic margin (arrows indicate supracoxal spurs).

supracoxal spurs for meso- and metathorax (Fig. 10-20). Legs with stout tarsal claws generally with three sharp-pointed subapical teeth. Dorsum of hind femora with spines more than two times longer than wide, with diverging rounded to slightly opened apices (Fig. 10-26).

ABDOMEN—Lateral projections unmarked on

segments I–VI, barely visible on segments VII and VIII. Posterior margin of tergite V presenting two to three rows of microdenticles as well as a row with teeth alternating with pyriform scales about 1.5 times longer than the teeth (Fig. 10-27). Seven pairs of gills, last pair without tracheal filaments. All gills are markedly asymmetrical and



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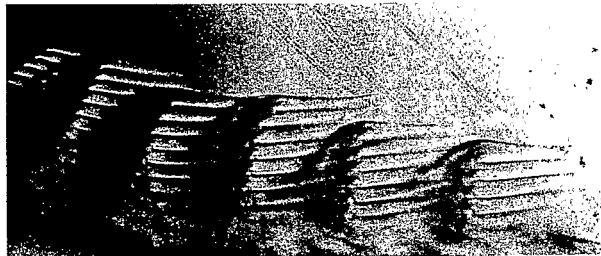
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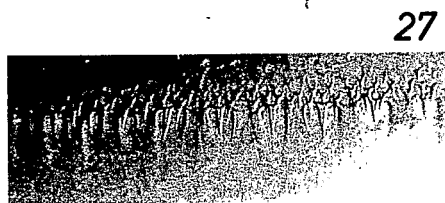
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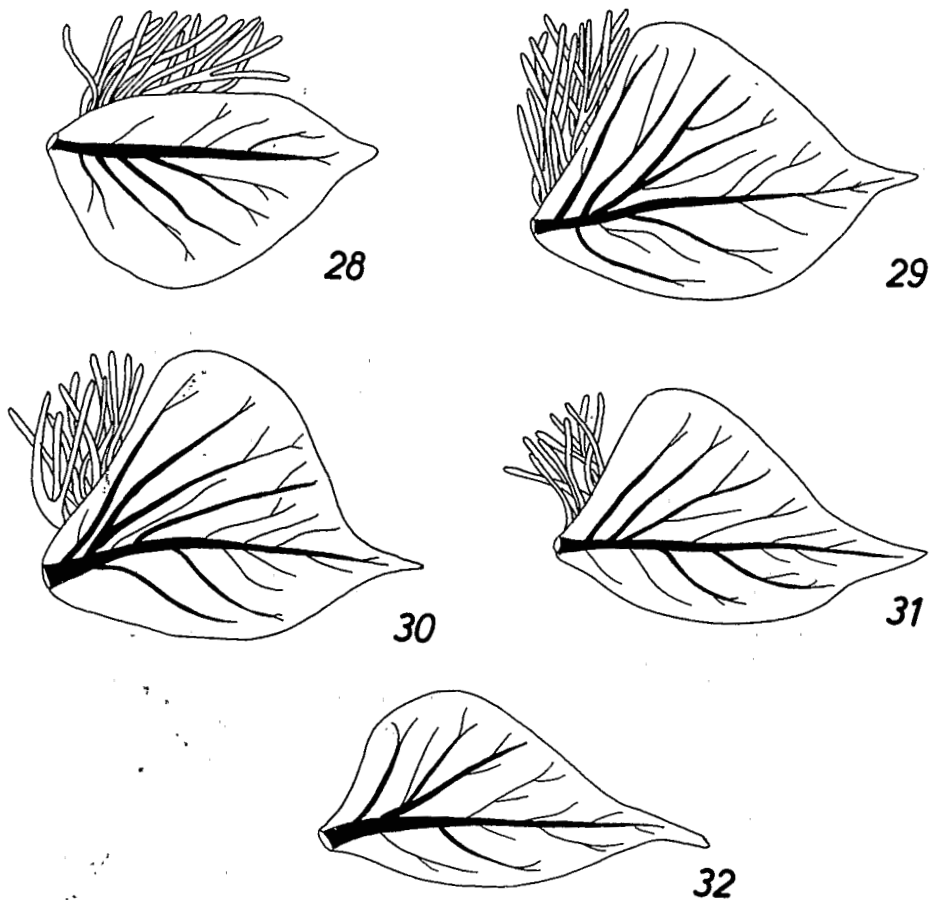


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FIGS. 10-21 through 10-27. *Thalerosphyrus josettae* n. sp. 21: labrum; 22: hypopharynx; 23: labium; 24: maxilla; 25: median pectens of galea-lacinia; 26: spines on dorsum of hind femora; 27: posterior margin of tergite V.



FIGS. 10-28 through 10-32. *Thalerosphyrus josettae* n. sp. 28: gill I; 29: gill III; 30: gill V; 31: gill VI; 32: gill VII.

with sharp-pointed apices, gills V most prominent (Figs. 10-28 to 10-32). Caudal filaments with whorls of stout spines at articulation of each segment.

EXAMINED MATERIAL

HOLOTYPE—One female nymph, Madagascar, Amborompotsy stream, Antsampsandrano (forest station), 25 July 1958. Collected by F. Starmühlner and J. Fontaine. Deposited in the Musée Cantonal de Zoologie, Lausanne.

PARATYPES—Six larvae, Andringitra Massif, station 14 (P0178; see Chapter 9), 29 November 1993; two larvae, Fenoovo, on tributary of Manampanihy River, 24°41'00"S, 46°53'39"E (P0091), 15 April 1992. Some paratypes deposited in MNHN and Centre National sur l'Environnement, Antananarivo.

Affinities

Two genera are known whose larvae possess well-developed supracoxal spurs: *Compsoneurilla* Ulmer (syn. *Notonurus* Crass fide Gillies, 1984) and *Thalerosphyrus* Eaton. On the basis of the shape of the pronotum, the glossae of the labium, and the arrangement of scattered bristles on the ventral side of the galea-lacinia, this new species probably belongs to the genus *Thalerosphyrus*, according to Jensen (1972). The 10 known species are all from the Oriental Realm, except one from the Afrotropical Realm. Three are known only at the imaginal stage. The remaining species are *T. ethiopicus* Soldán, 1977 (Sudan); *T. determinatus* (Walker, 1853), *T. sinuosus* (Navás, 1933), *T. sumatranus* (Ulmer, 1939) (all from the Sunda Islands); *T. vietnamensis* (Dang, 1967) (Vietnam); *T. bishopi* Braasch and Soldán, 1986 (Malaysia); and *T. flowersi* Venkataraman and Sivaramakrish-

nan, 1987 (South India). *Thalerosphyrus josettae* can be distinguished from all of these species except *T. ethiopicus* and *T. sinuosus* by the lack of well-developed lateral projections on the abdomen, as well as by the shape of the gills. Gill I is more slender in *T. ethiopicus*, *T. determinatus*, and *T. sumatranus*. Gill VII is especially elongated in *T. sinuosus* (see Ulmer, 1939, p. 668), whereas in *T. flowersi* it does not possess an acuminate apex.

Thalerosphyrus species A

Young larvae similar to *T. josettae* were also captured in the RNI d'Andringitra. These larvae differ from *T. josettae* in the uniform whitish coloration of abdominal tergites VI and VII. Apart from tergite coloration, the other main differences are in the maxillae. In *Thalerosphyrus* sp. A the first segment of the palpi has 15–17 bristles on its outer margin, and the galea-lacina crown bears 12–13 pectens, the fifth of which has 12–13 teeth. The remaining characteristics are similar to those of *T. josettae*, including pronotum shape, spines on the dorsum of femora, tarsal claws, and denticulation on posterior margin of tergite V.

Because only young larvae of *Thalerosphyrus* sp. A were available for this study, it is possible that they represent younger stages of *T. josettae*, and we refrain from giving them a specific epithet.

Examined Material

Four larvae from station 14 (P0178; see Chapter 9), 29 November 1993; two larvae, Amborompotsy stream, Antsampandrano (forest station), 25 July 1958. Collected by F. Starmühlner and J. Fontaine. Deposited in the Museum Cantonal de Zoologie, Lausanne.

Ecology of Heptageniidae from RNI d'Andringitra

Afronurus matitensis n.sp. was found exclusively on the eastern slope of the Andringitra Massif, in primary and degraded forest at altitudes ranging between 715 and 750 m. Water temperatures at the time of sampling were 16°–18°C. On the basis of the stream order of the colonized rivers (medium to large), *A. matitensis* is a species

that preferentially lives in the metarhithral zone. *Thalerosphyrus josettae* n.sp. was found at one station located in a zone of savannah on the western slope of the massif at 1900 m. Water temperature at the time of sampling was at 19°C. Station physiognomy would imply that this species lives in small streams and would be characteristic of the epirhithral zone. There are obvious ecological differences between these two species. *A. matitensis* lives in rivers of eastern humid forest, whereas *T. josettae* appears to be restricted to warmer streams running through eastern coast savannah. In continental Africa, *Afronurus* is associated with mountain streams and turbulent waters (Schoonbee, 1968; Gillies, 1984). Little is known about the ecological requirements of *Thalerosphyrus* larvae. They live in perennial streams or brooks where water flow is moderate, with shallow and warm water (Soldán, 1977, 1991; Braasch & Soldán, 1986; Venkataraman & Sivaramakrishnan, 1987). This information fits what we actually know about the ecology of *T. josettae*. Nevertheless, both species have been collected once at the same place outside Andringitra (Fenoovo, on tributary of Manampanihy River), suggesting that more data are needed before a precise typology can be drawn for these two species.

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Literature Cited

- BRAASCH, D., AND T. SOLDÁN. 1986. Die Heptageniidae des Gombak River in Malaysia (Ephemeroptera). *Reichenbachia*, **24**: 41–52.
- DANG, T. N. 1967. Nouveaux genres, nouvelles espèces de la faune des invertébrés des eaux douces et suamates du Nord Vietnam. *Tap San Sinh Vat-dia Hoc VI*, ser. 3, **4**: 155–165.
- DEMOULIN, G. 1973. Ephéméroptères de Madagascar III. *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique*, **49**(7): 1–20.
- EDMUNDS, G. F., JR. 1975. Phylogenetic Biogeography of Mayflies. *Annals of the Missouri Botanical Garden*, **62**: 251–263.
- . 1979. Biogeographical relationships of the Ori-

- ental and Ethiopian mayflies, pp. 11–14. In Pasternak, K., and R. Sowa, eds. Proceedings of the Second International Conference on Ephemeroptera. Polish Academy of Sciences, Krakow, 312 pp.
- GILLIES, M. T. 1984. On the synonym of *Notonurus* Crass with *Componeuriella* Ulmer (Heptageniidae), pp. 21–25. In Landa, V., et al., eds. Proceedings of the IVth International Conference on Ephemeroptera. Czechoslovak Academy of Sciences, 345 pp.
- HUBBARD, M. D. 1995. Towards a standard methodology for the description of mayflies (Ephemeroptera), pp. 361–369. In Corkum, L., and I. Ciborowski, eds. Current directions in research on Ephemeroptera. Canadian Scholars' Press, Toronto, 478 pp.
- JENSEN, S. L. 1972. A generic revision of the Heptageniidae of the world (Ephemeroptera). Ph.D. thesis, University of Utah (unpublished).
- NAVÁS, L. 1993. Insecta Orientalia. XII. Memoire Pontificia Accademia delle Scienze Nouvi Lincei, 17: 75–108.
- SCHOONBEE, H. J. 1968. A revision of the genus *Afonurus* Lestage in South Africa. Memoirs Entomological Society of Southern Africa, 10: 1–46 + 7 plates.
- SOLDÁN, T. 1977. Three new species of mayflies (Ephemeroptera) from the mist oasis of Erkwit, Sudan. Acta Entomologica Bohemoslovaca, 74: 289–294.
- . 1991. An annotated list of mayflies (Ephemeroptera) found in the Nam Cat Tien National Park, pp. 4–9. In Spitzer, K., et al., eds. Nam Cat Tien, Czechoslovak Vietnamese Expedition. November 1989, Research Report. Institute of Entomology, CAS, Ceske Budejovice, 45 pp.
- TORRE-BUENO, J. R. DE LA. 1989. The Torre-Bueno glossary of entomology, revised edition. American Museum of Natural History, New York.
- ULMER, G. 1939. Eintagsfliegen (Ephemeroptera) von den Sunda-Inseln. Archiv für Hydrobiologie, Supplement, 16: 443–692.
- VENKATARAMAN, K., AND SIVARAMAKRISHNAN, K. G. 1987. A new species of *Thalerosphyrus* from South India (Ephemeroptera: Heptageniidae). Current Science, 56(21): 1126–1129.
- WALKER, F. 1853. Catalogue of the specimens of neuropteroid insects in the collection of the British Museum. London, 658 pp.

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A Floral and Faunal Inventory of the Eastern Slopes of the Réserve Naturelle Intégrale d'Andringitra, Madagascar: With Reference to Elevational Variation

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