The water mites of Madagascar (Acari, Hydrachnidia): a revised list completed by original material conserved at the Muséum national d'Histoire naturelle, Paris

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ABSTRACT
The previously unstudied collection of water mites from Madagascar conserved at the Muséum national d'Histoire naturelle, Paris, is investigated. Most of the 282 specimens, from 36 localities, were collected by J. Millot from stagnant waters at low altitude or on the High Plateau (surroundings of Antananarivo) during 1945-1955. Twenty-five taxa are identified, six of which recorded for the first time from Madagascar: the family Anisitsiellidae (*Sigthoria nilotica* Nordenskiöld, 1905); a genus and species new to science of the family Hygrobatidae; the genus *Wuria* (represented by a species new to science); the subgenera *Bargena* (*Hydrachna*) and *Polyatax* (*Unionicola*); and a species of the genus *Eylais*. *Moramangabates pauliani* n. gen., n. sp. is characterized by the absence of a suture line extending between the caudal apodeme on cx-4 and the glandular opening on this sclerite, 13 pairs of acetabula, and a central hump on the ventral surface of P-3. *Wuria milloti* n. sp. is characterized by larger pores between the medial margins of cx-3+4 and the facing margins of cx-2/3, acetabula arranged in rather distant rows, and stout palpal setae. First description of male and female adults is given for *Hydrachna amplexa* Koenike, 1898. The present state of knowledge is discussed from a zoogeographical point of view and necessities for future research are outlined. An updated list is included of all published information on the water mite fauna of Madagascar.

KEY WORDS
Acari,
Hydrachnidia,
diversity,
zoogeography,
freshwater fauna,
Africa,
new genus,
new species.

RÉSUMÉ

Les acariens aquatiques de Madagascar (Acari, Hydrachnidia) : liste revue et complétée par du matériel du Muséum national d'Histoire naturelle, Paris.

La collection non étudiée d'acariens aquatiques de Madagascar conservée au Muséum national d'Histoire naturelle, Paris, est ici étudiée. La plupart des 282 spécimens, de 36 localités, furent collectés par J. Millot dans des eaux stagnantes à basse altitude ou sur le Haut Plateau (environs d'Antananarivo) entre 1945 et 1955. Vingt-cinq taxons sont identifiés, dont six mentionnés de Madagascar pour la première fois : la famille Anisitsiellidae (*Sigthoria nilotica* Nordenskiöld, 1905) ; un genre et une espèce nouveaux d'Hygrobatidae ; le genre *Wuria* (représenté par une espèce nouvelle) ; les sous-genres *Bargena* (*Hydrachna*) et *Polyatax* (*Unionicola*) ; et une espèce du genre *Eylais*. *Moramangabates pauliani* n. gen., n. sp. est caractérisé par l'absence d'une ligne de suture s'étendant entre l'apodème caudal sur cx-4 et l'ouverture glandulaire de ce sclérite, 13 paires d'acetabula et une bosse centrale sur la surface ventrale du P-3. *Wuria milloti* n. sp. est caractérisé par des pores plus larges entre les marges médiales de cx-3+4 et les marges frontales de cx-2/3, des acetabula disposés en rangs plutôt distants et des fortes soies palpales. Les adultes mâles et femelles d'*Hydrachna amplexa* Koenike, 1898 sont décrits pour la première fois. L'état actuel des connaissances est discuté d'un point de vue zoogéographique et les nécessités des recherches futures sont mises en évidence. Une liste mise à jour de toutes les publications sur les acariens aquatiques de Madagascar est incluse.

MOTS CLÉS
Acari,
Hydrachnidia,
diversité,
zoogéographie,
faune d'eau douce,
Afrique,
nouveau genre,
nouvelles espèces.

INTRODUCTION

The water mite fauna of Madagascar is still poorly documented, with information available from only very restricted areas, mostly in the Western lowlands and on the island of Nossi-Bé, and nearly exclusively referring to stagnant waters (Goldschmidt & Gerecke 2003). Furthermore, the early descriptions given by Koenike (1898) do not meet present-day standards of morphological documentation and the material on which they were based is now in poor condition or lost. Against this background, the detection of unstudied material in the arachnology collections at the MNHN not only allows for important additions to our knowledge of the water mite fauna of the "Grande Île", but also provides useful material for the comparative analysis of previously described species. Twenty-five of the now totally known 64 Madagascan water mite (sub)species are conserved at MNHN, including the type specimens of four new taxa described by Gerecke (2004) and in this paper.

ABBREVIATIONS

cx	coxae;
H	height;
I-L-5	first leg, fifth segment;
L	length;
MNHN	Muséum national d'Histoire naturelle, Paris;
P-2	palp, second segment;
W	width.

MATERIAL AND METHODS

The material considered here has been conserved in ethanol for several decades. For detailed morphological investigation, 82 specimens were dis-

sected and slide-mounted in glycerine jelly. The undissected material remains in ethanol. All measurements are given in µm. For the species discussed in detail, slide numbers are given at the end of the locality records. Information on the quantitative composition of the samples is given as follows: males / females / deutonymphs. Unless more recent papers are cited, distributional information is based on the catalogues of K. Viets (1953) and K. O. Viets (1970).
All records dealt with in this publication are included in the detailed faunistic list of the Appendix.

SYSTEMATICS

Family HYDRACHNIDAE Leach, 1815
Genus *Hydrachna* Müller, 1776

Hydrachna* (*Hydrachna*) *amplexa Koenike, 1898 (Fig. 1)

MATERIAL EXAMINED. — **Madagascar.** Centre, Lac Alaotra, 1946, J. Millot, 1 ♂ (B 15 A); west, Marais Marovoay près Majunga, no date, Waterlot, 1 ♀ (E 14 M).

DISTRIBUTION. — Madagascar.

DESCRIPTION

Male

Measurements: idiosoma L/W 2000/2000, coxal field L 850, frontal shield L/W 850/1300, eye capsule distance 440; genital field L/W 330/320, gonopore L/W 140/60; ejaculatory complex L 240, W of brachia proximalia 250; gnathosomal rostrum L 290, chelicera L 800, palp segments L/H P-1 130/200, P-2 150/110, P-3 185/65, P-4 85/40, P-5 35/17. Frontal shield (Fig. 1A) covering 1/3 of the dorsal surface, including the dorsocentral setae 1, but not the slit organs posterolaterad of the eye capsules, with equally rounded, but irregular posterior margin; coxae with extended borders of secondary sclerotization as typical for mature adults in the genus; genital field (Fig. 1D) posteriorly truncated, but with a convex margin of secondary sclerite, anteriorly with a weak indentation; about 12 paired hairs scattered between the medial acetabula, gonopore anteriorly elevated into a nose-like structure, flanked by a posteriorly-extending cover of fine hairs; gnathosoma with a straight rostrum (Fig. 1C), palp with only a few, fine setae as shown in Figure 1B.

Female

Obviously a recently hatched specimen with weak sclerotization and appendages misshapened by distortion; idiosoma L/W about 1500/1500, coxal field L 600, frontal shield 500/800, posteriorly indented, eye distance 320; genital field L/W 180/240; gnathosomal rostrum 280; palp segments L/H P-1 150/170, P-2 130/100, P-3 (200/65), P-4 (75/50), P-5 (40/20) (distal segments probably deformed due to weak sclerotization); genital field anteriorly convex (damaged in Fig. 1E), with a few mediocaudal setae.

Discussion

This species was previously known from only one single deutonymph. The two adults bear an entire frontal shield while the frontal sclerotization of the deutonymph (as usual in this subgenus) comprises a pair of sclerites located medially from the lateral eye capsules. The female was found in the same area as the holotype (surrounding of Majunga, W coast, an arid area), while the male is from a far distant area with a different climate. For the time being, in view of the general agreement in measurements the two specimens should be considered as conspecific. However, for a definitive diagnosis of *H. amplexa*, collecting of adults of both sexes and developmental stages at the same site is desirable.

Hydrachna* (*Rhabdohydrachna*) *signata Koenike, 1898

MATERIAL EXAMINED. — **Madagascar.** West, northwest, centre, south; Ankarana, Alaotra, Sambirano, 11 specimens (3/6/2).

DISTRIBUTION. — Ethiopian Region, Madagascar.

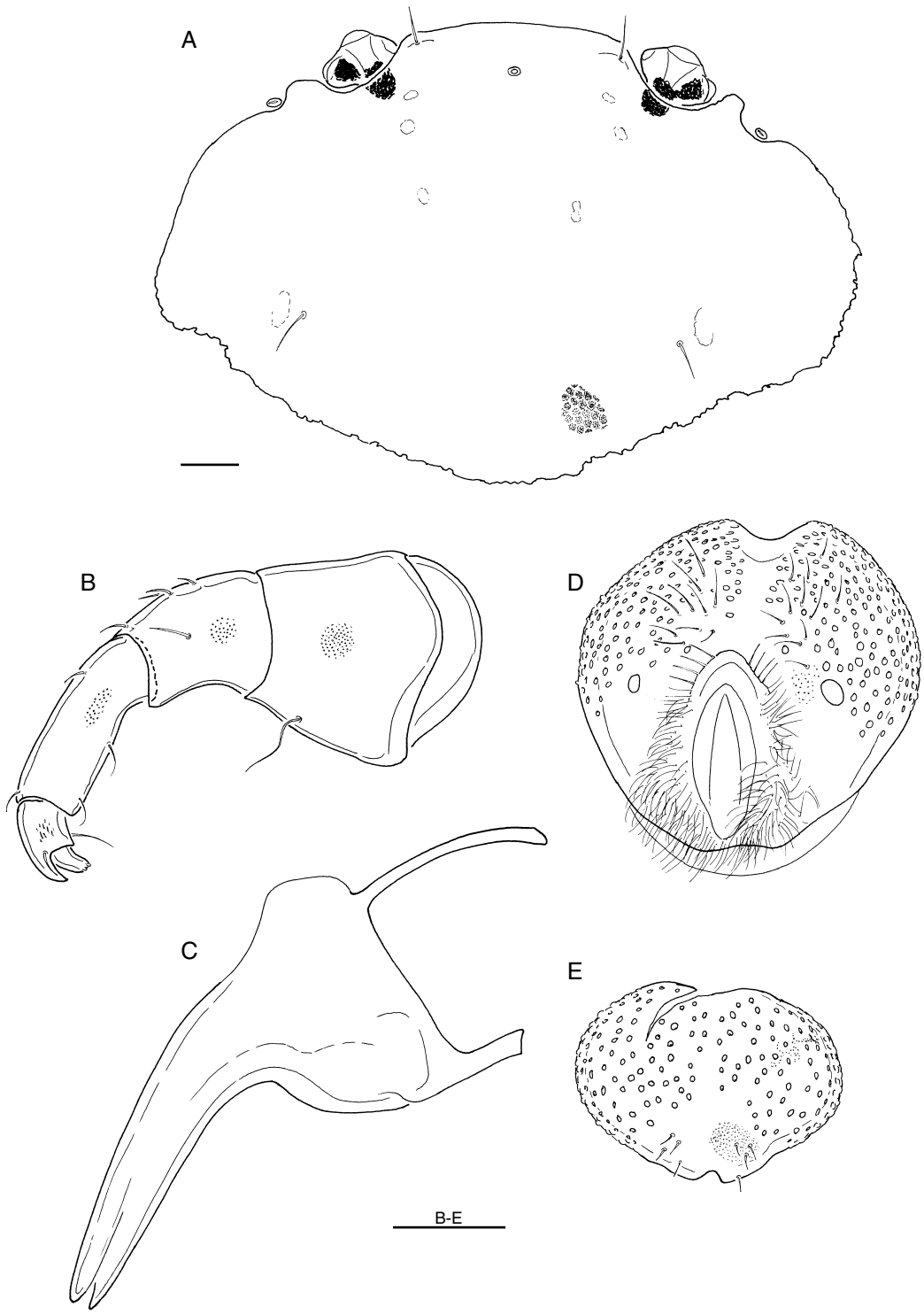

FIG. 1. — *Hydrachna amplexa* Koenike, 1898; **A**-**D**, ♂ (MNHN B 15 A); **A**, frontal shield; **B**, palp; **C**, gnathosoma in lateral view; **D**, genital field; **E**, ♀ (MNHN E 14 M), genital field. Scale bars: 100 µm.

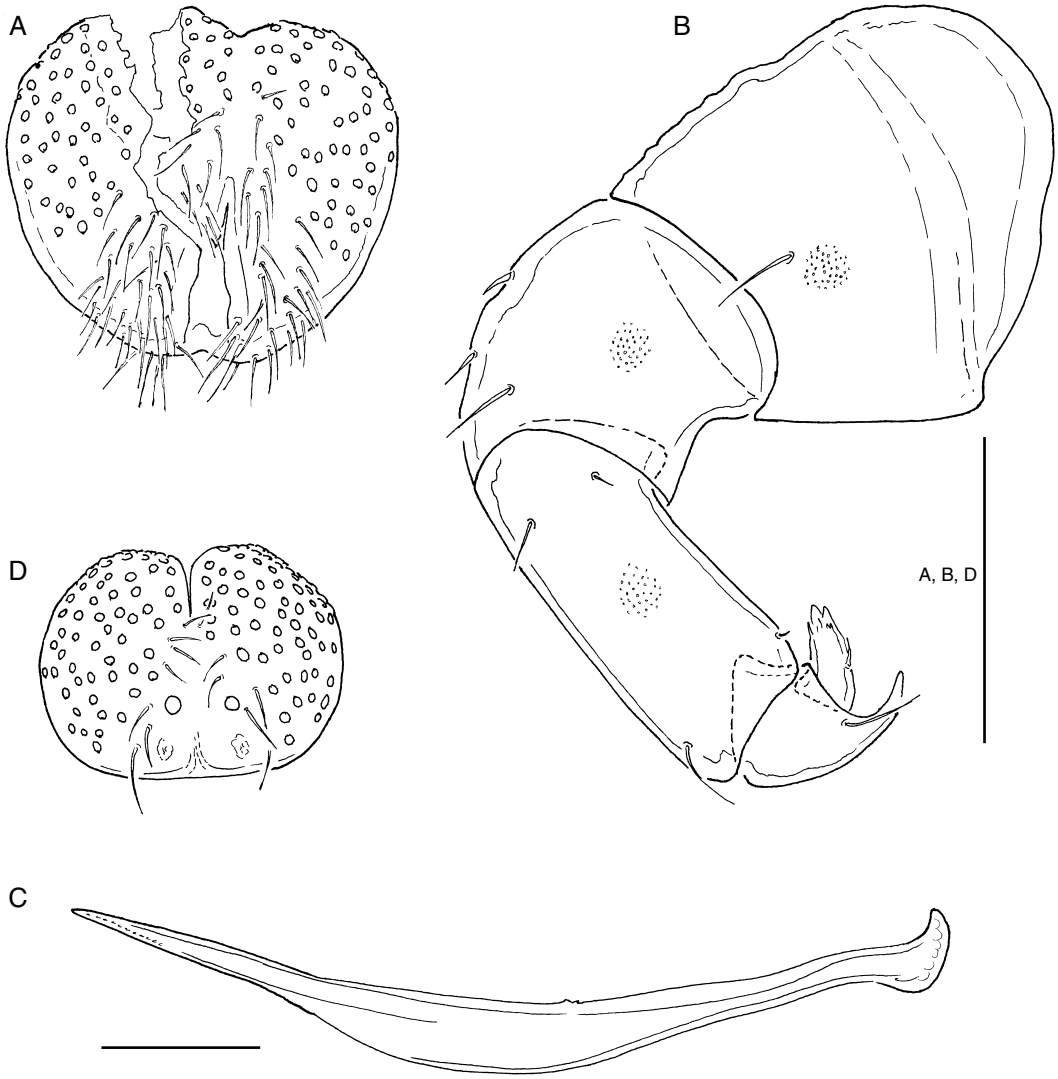

FIG. 2. — *Hydrachna* (*Bargena*) *mirifica* Koenike, 1893; **A**-**C**, ♂; **A**, genital field (damaged); **B**, palpus; **C**, chelicera; **D**, ♀, genital field. Scale bars: 100 µm.

Hydrachna (*Bargena*) *mirifica* Koenike, 1893 (Fig. 2)

MATERIAL EXAMINED. — **Madagascar.** Northwest, Ankarana, 3 specimens (1/1/1).

DISTRIBUTION. — Ethiopian Region. First record of the subgenus from Madagascar.

DESCRIPTION

Male

Idiosoma L/W 1150/1000; genital field (Fig. 2A) L/W 230/230, with 60+60 acetabula; chelicera (Fig. 2C) L/H 555/45; palp (Fig. 2B) segments L/H P-1 90/130, P-2 95/85, P-3 125/55, P-4 60/38, P-5 35/20.

Female
Idiosoma L/W 1200/1050; genital field (Fig. 2 D) L/W 150/190, with 55+55 acetabula; chelicera L/H 590/48; palp segments L/H P-1 120/150, P-2 110/100, P-3 150/60, P-4 65/38, P-5 37/20.

Family EYLAIDAE Leach, 1815

This monogeneric family needs worldwide revision. For this purpose, fresh material is necessary, and rearing experiments should be done in order to obtain immature stages for comparative morphological investigation. Here, the material of the MNHN is very provisionally identified on the basis of the frontal shield ("eye glasses") morphology of two species recorded from the study area by Koenike (1898).

Genus *Eylais* Latreille, 1796

Eylais cf. ***degenerata*** Koenike, 1897

MATERIAL EXAMINED. — **Madagascar.** West, northwest, east, centre; Tamatave, Alaotra, Ankarana, Sambirano, 34 specimens.

DISTRIBUTION. — Asia, Africa, Madagascar, Southern Europe.

Eylais cf. ***megalostoma*** Koenike, 1897

MATERIAL EXAMINED. — **Madagascar.** West, south; Majunga, Tsiombe; 5 specimens.

DISTRIBUTION. — Ethiopian Region. First record from Madagascar (but reported from the island Aldabra by Koenike 1898).

Family LIMNOCHARIDAE Grube, 1859
Genus *Limnochares* Latreille, 1796

Limnochares crinita Koenike, 1898

MATERIAL EXAMINED. — **Madagascar.** Northwest; Ambilobé, Nossi-Bé; 22 specimens.

DISTRIBUTION. — Madagascar.

Genus *Neolimnochares* Lundblad, 1937

Neolimnochares cf. ***tenuiscutata*** (K. Viets, 1914)

Limnochares tenuiscutata K. Viets, 1914: 312, tf. 12, figs 1-3, 6.

Neolimnochares tenuiscutata – Cook 1966: 18, 264.

MATERIAL EXAMINED. — **Madagascar.** Centre; Antananarivo, Ambatoloana; 52 specimens.

DISTRIBUTION. — South Africa, Madagascar.

REMARK
This species was recorded for the first time from Antananarivo by Walter & Bader (1953), possibly based on the same collections (Waterlot). The morphological analysis of the material from MNHN confirms the presence of at least two limnocharid species in Madagascar (obviously bound to several levels of altitude, with *N.* cf. *tenuiscutata* restricted to the highlands). However, as stated by K. O. Viets (1964), the attribution to *N. tenuiscutata*, originally described from S Africa, should be verified by studies of variability in continental and insular populations.

Family HYDRYPHANTIDAE Piersig, 1896
Subfamily HYDRYPHANTINAE Piersig, 1896
Genus *Hydryphantes* Koch, 1841

Hydryphantes incertus Koenike, 1893

MATERIAL EXAMINED. — **Madagascar.** Northwest; Ankarana, Sambirano, Nossi-Bé; 9 specimens.

DISTRIBUTION. — Ethiopian Region. Previously, this species was recorded from the island of Nossi-Bé only, but not from mainland Madagascar.

Subfamily MAMERSINAE K. Viets, 1931
Genus *Mamersa* Koenike, 1898

Mamersa testudinata Koenike, 1898

MATERIAL EXAMINED. — **Madagascar.** Northwest; Ankarana; 2 specimens.

DISTRIBUTION. — Ethiopian Region, Madagascar.

Family HYDRODROMIDAE K. Viets, 1936
Subfamily HYDRODROMINAE K. Viets, 1936
Genus *Hydrodroma* Koch, 1837

Hydrodroma despiciens (Müller, 1776)

Hydrachna despiciens Müller, 1776: 190.

Hydrodroma despiciens – K. Viets 1936: 140, Figs 135 a, b.

MATERIAL EXAMINED. — **Madagascar.** Northwest, centre; Angavakely, Ankaratra, Nossi-Bé; 42 specimens.

DISTRIBUTION. — Nearly world-wide; cosmopolitan distribution doubted by Cook (1986).

DESCRIPTION

Twelve specimens from Central Madagascar and Nossi-Bé were analysed for the swimming seta numbers (numbers given as anterior/posterior setae): II-L-5 0/1-2; III-L-4 0/8-15; III-L-5 0/5-10; IV-L-4 6-13/7-13; IV-L-5 0-1/5-8. The variability of this taxonomically important character agrees with the limits found by Wiles (1985) and Gerecke (1991) in European populations.

Subfamily DIPLODONTINAE K. Viets, 1936
Genus *Diplodontus* Dugès, 1834

Diplodontus schaubi (Koenike, 1893)

Eupatra schaubi Koenike, 1893: 37, tf. 3, fig. 30.

Diplodontus schaubi – Lundblad 1949: 17, fig. 9A-H, tf. 4, fig. 16.

MATERIAL EXAMINED. — **Madagascar.** Northwest, west; Sambirano, Majunga; 6 specimens.

DISTRIBUTION. — Ethiopian Region, Madagascar.

REMARKS

The African species of this genus, including also material from MNHN and from field work on Madagascar in 2001 have been recently revised (Gerecke 2004).

Family ANISITSIELLIDAE Koenike, 1910

First record of the family from Madagascar.

Genus *Sigthoria* Koenike, 1907

Sigthoria nilotica (Nordenskiöld, 1905)
(Figs 3; 4)

Amasis niloticus Nordenskiöld, 1905: 9, fig. 5a-b.

Sigthoria nilotica – Koenike 1907, 127.

MATERIAL EXAMINED. — **Madagascar.** Northwest; Sambirano; 1 ♀.

DISTRIBUTION. — Widely distributed in the tropics, but only rarely found, generally as single specimens only, recently detected also in The Netherlands, far outside the previously known distribution area (Smit & Van der Hammen 1992).

DESCRIPTION

The female from Madagascar has the following measurements: idiosoma L/W 600/480, dorsal shield L/W 550/440; lateral eye distance (as measured between the median lenses) 155; distance between insertion points IV-L 350; IV-L segments 2-6 dorsal L 82, 90, 123, 147, 150; genital field L/W 145/130; chelicera basal segment L 190, claw L 70, maximum H 40; palp segments L/H P-1 25/35, P-2 90/60, P-3 55/45, P-4 112/30, P-5 25/12. Lateral eyes, together with the frontal glandularia, imbedded into the frontal part of the ventral shield (see Fig. 3C). Dorsal shield (Fig. 3A) with a characteristic pattern of paired sulci and elevations; IV-L (Fig. 4 D) bearing some very long distal setae on segments 2-5, swimming hair numbers: IV-L-3 1; IV-L-4 2, IV-L-5 1; claws of this leg reduced to a pair of minute, peg-like setae. Ventral shield (Fig. 3B) with an extended postgenital area, excretory pore close to posterior margin; genital field with 16 pairs of minute acetabula; gnathosoma (Fig. 4 A) ventral margin with a well developed central hump the anterior part of which is concave; cheliceral basal segment distinctly enlarged near the claw insertion (Fig. 4B); palp (Fig. 4C) elongated, with rugose ventral surface of P-2 and P-4, ventral seta of P-2 tiny and curved.

DISCUSSION

Harvey (1990) found differences in the swimming hair equipment between populations

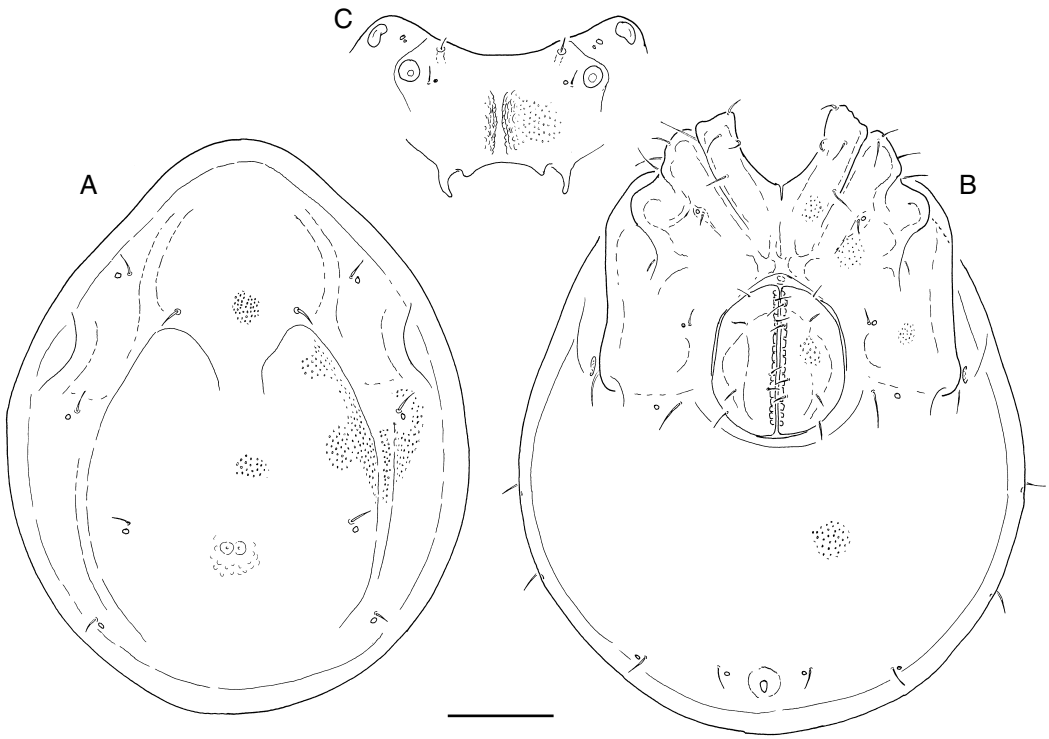

FIG. 3. — *Sigthoria nilotica* (Nordenskiöld, 1905), ♀; **A**, dorsal shield; **B**, ventral shield; **C**, region of lateral eyes. Scale bar: 100 µm.

from different areas in Australia and discussed the possible taxonomic significance of this character. However, from this point of view the specimen from Madagsacar agrees well with populations from Asia and continental Africa.

Family LIMNESIIDAE Thor, 1900
Genus *Limnesia* Koch, 1836

Members of both the subgenera of *Limnesia* previously recorded from the islands were found in the collection. Verification of the identifications through the examination of male specimens from the collecting areas in question is desirable. Furthermore, these taxa need revision, including populations from continental Africa, where numerous more or less doubtful (sub)species have since been described.

Limnesia* (*Limnesia*) *scutellata Koenike, 1898

MATERIAL EXAMINED. — **Madagascar.** Centre, east; Alaotra, Moramanga; 2 ♀♀.

DISTRIBUTION. — Ethiopian Region, Madagascar.

Limnesia* (*Tetralimnesia*) *aspera Koenike, 1898

MATERIAL EXAMINED. — **Madagascar.** Northwest; Ankrana, Nossi-Bé; 4 ♀♀.

DISTRIBUTION. — Madagascar. *Limnesia macropora* (K. Viets, 1921), previously described as a subspecies of *L. aspera*, is widely distributed in the Ethiopian Region.

Family HYGROBATIDAE Koch, 1842

Moramangabates n. gen.

TYPE SPECIES. — *Moramangabates pauliani* n. sp.

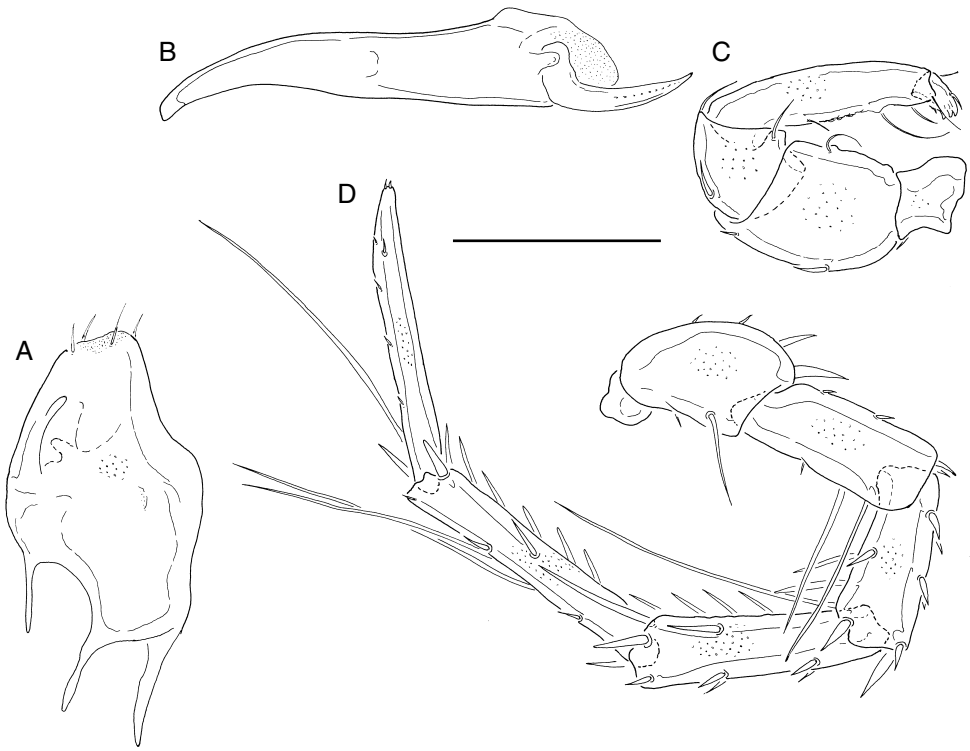

FIG. 4. — *Sigthoria nilotica* (Nordenskiöld, 1905), ♀; **A**, gnathosoma in lateral view; **B**, chelicera; **C**, palp in lateral view; **D**, fourth leg. Scale bar: 100 µm.

ETYMOLOGY. — Combining the name of the area where the holotype of the type species was collected with the suffix *-bates* (Greek: walking), often employed for *Hygrobates*-like genera.

DIAGNOSIS. — Female (male unknown): characters of the family Hygrobatidae; no fusion between coxae and gnathosoma; gnathosoma with a long caudal projection extending between the medial margins of the anterior coxal plates; apodeme at the projecting posterior margin of cx-4 distinct, but not continuing as a sclerotized line to the glandular opening on this coxa; genital field with 13 pairs of acetabula; P-2 with a ventrodistal projection, P-3 with a ventral hump; legs provided with long, stiff setae at the distal margins, and partly also on the ventral surface, of segments 2-5.

DISCUSSION

This new taxon is most closely related to *Australiobates* Lundblad, 1941, a genus with a typical Gondwanan distribution including South America, South Africa, Australia, New Zealand and Papua New Guinea (Harvey 1998). Shared characters are: 1) cx-1 medially not fused with the gnathosoma; 2) gnathosoma bearing a long posterior process; 3) presence of a fine curved seta at the anterior margin of I-L-5; and 4) suture line cx-3/4 not extending abruptly anteriorly near the glandulare of cx-4 (see Cook 1974, 1986; Harvey 1998). All known *Australiobates* species differ from *Moramangabates* n. gen. in having a distinct suture line extending from the base of the caudal apodeme on cx-4 to the glandular opening on this sclerite, the plesiomorphic number of three pairs of acetabula, and the ventral surface of P-3 straight, not thickened into a central hump. The presence of two strong ventrodistal setae at I-L-5 in *Australiobates* is probably a plesiomorphic condition found only in the species of the nominate

subgenus; the fine whip-like seta on this segment could be interpreted as a synapomorphy of a group of "*Atractides*-like" hygrobatid mite genera (Gerecke 2003). At present, this is the only water mite taxon above species level endemic to Madagascar. For a discussion of its zoogeographical significance, a study of the male sex is highly desirable: in the family Hygrobatidae, males often display sexual characters of particular importance for the understanding of sister group relationships (Cook 1974).

Moramangabates pauliani n. sp.
(Figs 5, 6)

Dodekabates sp. – Goldschmidt & Gerecke 2003: fig. 3.

TYPE MATERIAL. — Holotype ♀, east; Moramanga; Institut scientifique de Madagascar, Sondrangato (eau stagnante), 29 km route d'Anoibe, IX.1953, J. Millot, mounted in glycerine jelly; paratype ♀, same data as holotype, undissected in ethanol (C 20 O).

ETYMOLOGY. — In remembrance of the important contribution of Renaud Paulian to our knowledge of the biodiversity of the "Grande Île".

DIAGNOSIS. — As for the genus.

DISTRIBUTION. — Madagascar. Only known from the type locality

DESCRIPTION

Female (male unknown): idiosoma L/W 1250/1000, integument smooth, without sclerotized muscle attachments; L/W cx-1+2 375/210, cx-3+4 500/330; ventral idiosoma: see Figure 5C; caudal margin of cx-4 with a projecting, "*Piona*-like" apodeme, but no sclerotized line extending from the base of this apodeme in the direction of the glandular opening on the coxa; legs (Fig. 6) slender, bearing strong claws with well developed ventral clawlet and claw blades; all basal segments with stout, nail-like dorsal setae; long, stiff ventral setae arranged as follows: I-L-2 one distally, I-L-3 two centrally and two distally; I-L-4 three distally; II-L as I-L; III-L-2 two distally, III-L-3 two centrally, two distally; III-L-4 three distally (one of them slightly distanced from segment margin), III-L-5 two distally; IV-L-2 one distally, IV-L-3 three centrally, three distally; IV-L-4 three centrally, three distally; IV-L-5 three distally; furthermore rows of shorter, strong ventral setae on central leg segments increasing in thickness from I-L to IV-L; distal margin of I-L-5 with a fine whip-like seta, several further fine hairs and two strong ventral setae, distal margin of II/III-L-5 each with a curved, dorsally-directed, unilaterally pennate seta; all terminal segments with numerous, fine, ventral hairs, particularly dense on IV-L-6; leg measurements (segments 1-6, L/H): I-L 108/72, 157/76, 229/67, 302/58, 310/45, 260/49; II-L 100/72, 144/72, 225/67, 290/67, 302/50, 270/50; III-L 108/72, 148/72, 243/67, 329/38, 342/49, 333/49; IV-L 170/112, 189/76, 284/72, 360/58, 400/50, 387/50; genital plates each with 13 acetabula, L/W 210/140; gonopore L 520; excretory pore surrounded by a sclerite ring; gnathosoma L 450, W 160, with a long, distally enlarged and rounded caudal projection extending between the medial margins of the anterior coxal plate, but not fused to cx-1; chelicera basal segment L 300, H 100, claw L 145, with a ventrodistal series of very fine, smooth denticles (Fig. 5A); palpus (Fig. 5B) with a distinct projection at distal end of ventral margin of P-2, and a central hump on P-3, both covered by fine, flat denticles.

DISCUSSION

The unusual setation of legs (lacking true swimming hairs, but with very long, hyaline stiff setae at distal margin of II-L-4, III-L-4/5 and IV-L-3-5) suggests that *Moramangabates pauliani* n. gen., n. sp. is adapted for life in stagnant waters.

Family UNIONICOLIDAE Oudemans, 1909
Subfamily ENCENTRIDOPHORINAE K. Viets, 1935
Genus *Encentridophorus* Piersig, 1897

Encentridophorus brevispinus Lundblad, 1946

MATERIAL EXAMINED. — **Madagascar.** Northwest, east; Ankarana, Ambohivangy; 1 ♂, 2♀♀.

DISTRIBUTION. — Madagascar.

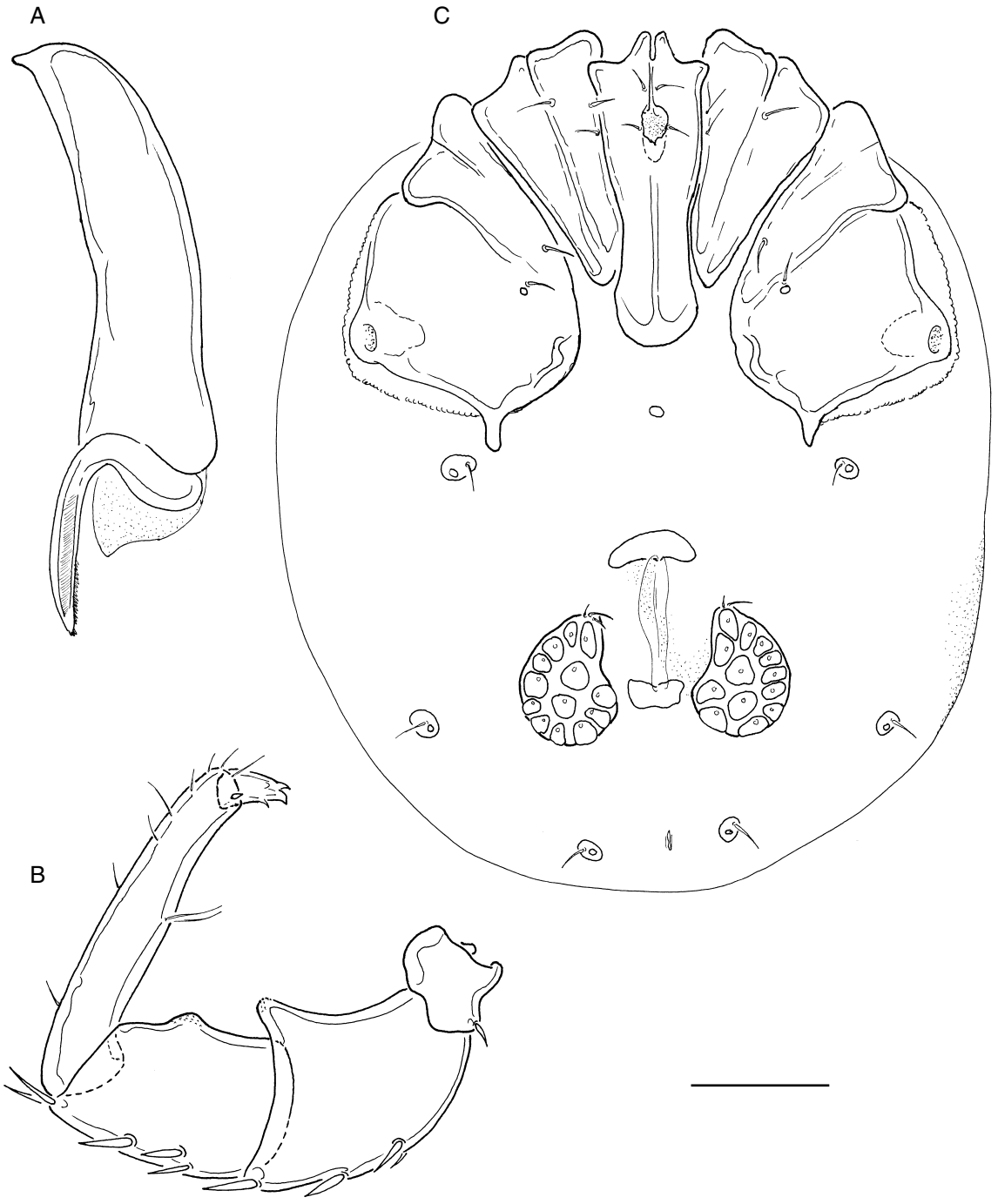

FIG. 5. — *Moramangabates pauliani* n. gen., n. sp.; **A**, chelicera; **B**, palp in medial view; **C**, idiosoma, ventral view. Scale bar: 100 µm.

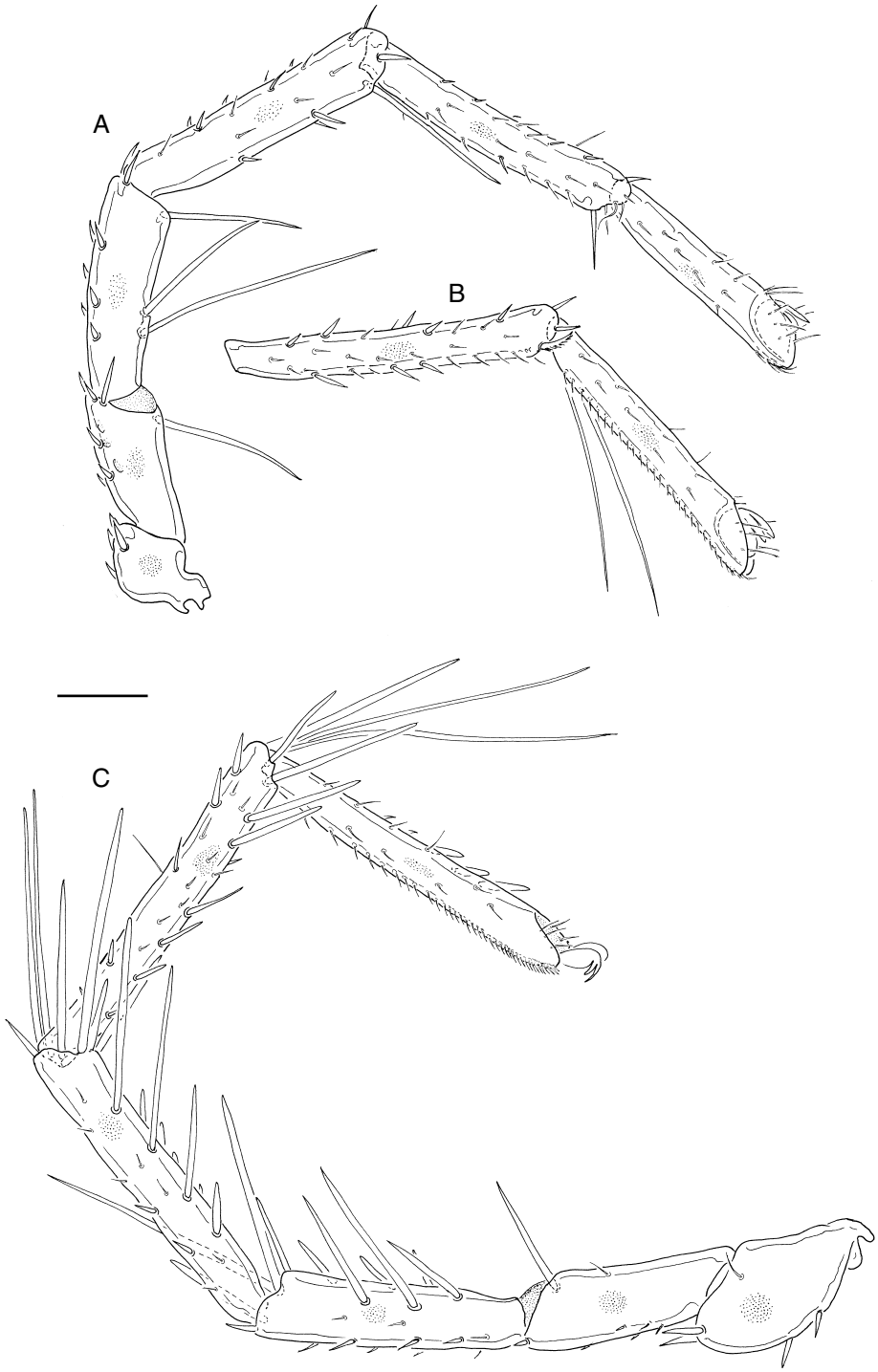

FIG. 6. — *Moramangabates pauliani* n. gen., n. sp.; **A**, first leg; **B**, segments 4 and 5 of third leg; **C**, fourth leg. Scale bar: 100 µm.

REMARK
The material includes the first record of the male of this species, but because it is represented by a juvenile specimen it is not suitable for a description.

Subfamily UNIONICOLINAE Oudemans, 1909

Numerous species of this subfamily have been described from tropical Africa. Most of the material cannot be determined without a revision of the genus in this area.

Genus *Unionicola* Haldeman, 1842

Unionicola* (*Hexatax*) *harpax (Koenike, 1898)

Atax harpax Koenike, 1898: 421, tf. 26, figs 135, 136.

Unionicola (*Unionicola*) *harpax* – K. Viets 1921: 425.

MATERIAL EXAMINED. — **Madagascar.** Northwest; Ankarana; 1 ♂.

DISTRIBUTION. — East Africa, Madagascar.

***Unionicola* (*Polyatax*)** sp.

MATERIAL EXAMINED. — **Madagascar.** Northwest; Ankarana; 1 ♀.

DISTRIBUTION. — *Polyatax* is probably a polyphyletic taxon including species from widely scattered areas of the world (Cook 1974), but it had not previously been recorded from the Ethiopian Region; first record of the subgenus from Madagascar.

***Unionicola* (*Pentatax*)** sp.

MATERIAL EXAMINED. — **Madagascar.** Northwest; Ankarana; 7 specimens.

REMARK
The specimens from MNHN clearly do not belong to any of the species of the subgenus described from Madagascar.

Family PIONIDAE Thor, 1900
Genus *Piona* Koch, 1842

Piona* (*Piona*) *madagascariensis Lundblad, 1946

MATERIAL EXAMINED. — **Madagascar.** East, centre, west; Ambohivoangy, Ankaratra, Majunga; 14 specimens.

DISTRIBUTION. — Madagascar.

Piona* (*Piona*) *seyrigi Lundblad, 1946

MATERIAL EXAMINED. — **Madagascar.** Northwest, east, south; Ankarana, Ambohivoangy, Fort Dauphin; 4 specimens.

DISTRIBUTION. — Madagascar; the subspecies *P. s. continentalis* Lundblad, 1952 is recorded from E and W Africa.

Piona sp.

MATERIAL EXAMINED. — **Madagascar.** Northwest; Ankarana; 1 deutonymph (indeterminable).

Family ARRENURIDAE Thor, 1909

Genus *Arrenurus* Dugès, 1834

Numerous species of this genus have been described from Madagascar, often based on the female sex only and leaving doubts concerning their diagnostic features. The arrenurids of the collection in the MNHN are of particular interest due to the presence both of specimens of such little understood species, and additional material probably representing undescribed species. The study of this part of the collection can be done only as part of an extended research including the revision of several species described from the African continent.

Arrenurus* (*Megaluracarus*) *pectinatus Koenike, 1893

MATERIAL EXAMINED. — **Madagascar.** Northwest, east; Ankarana, Ambohivoangy; 11 specimens.

DISTRIBUTION. — Ethiopian Region, Madagascar.

Arrenurus (*Micruracarus*) *voeltzkowi* Koenike, 1898

MATERIAL EXAMINED. — **Madagascar.** Northwest, centre; Ankarana, Sambirano, Antananarivo; 7 specimens.

DISTRIBUTION. — Southern and Eastern Ethiopian Region, Madagascar.

Arrenurus spp. indet.

MATERIAL EXAMINED. — **Madagascar.** All parts of the island; overall there are 18 specimens representing at least four species.

Wuria milloti n. sp. (Figs 7-9)

TYPE MATERIAL. — Holotype ♂, mounted in glycerine jelly together with one paratype ♀, northwest, Ankarana, IX.1946, J. Millot (A 20 J); further paratypes: northwest, Ankarana (marais), IX.1946, J. Millot, 2 ♂♂, 1 ♀ (A 01 D).

ETYMOLOGY. — Named in honour of J. Millot, the collector of a large part of the water mites dealt with in this paper.

DIAGNOSIS. — Coxae with fine porosity, but a stripe of idiosoma surface with large pores separating the medial margins of cx-3/4 as well as the facing margins of cx-2 and cx-3; distinct, nose-shaped projections associated with the insertions of IV-L; palpus robust, with very stout setae; P-4 curved (dorsal margin convex, ventral margin concave); IV-L showing sexual dimorphism.

DISTRIBUTION. — Northwest Madagascar.

DESCRIPTION

Both sexes

Surface of coxae and appendages with a fine, regular porosity, surface of idiosoma shields (Fig. 7A) covered by groups of these pores, each joined to a larger subcutaneous cavern by fine channels; a stripe of idiosoma surface with large pores extending between the medial margins of cx-3/4 as well as the facing margins of cx-2 and cx-3; legs with pointed distal extensions at distal margins of segments 2-5; III- and IV-L (see Figs 8B; 9) bearing numerous swimming hairs; genital field completely lacking surface porosity, but many acetabula in the genital field linked in a similar manner as the idiosomal pores in groups of two to four each to a subcutaneous cavern, gnathosoma (Fig. 8A) flattened and enlarged rostrally, with a robust chelicera bearing a strongly hooked claw; palp with eight stout setae scattered on the medial surface of P-2 and one remarkably strong seta inserted at the base of the ventrodistal extension of P-4; P-5 curved and directed medially.

Male

Idiosoma L/W 630-650/520-550; dorsal furrow incomplete (dorsal shield posteriorly fused with ventral shield), maximum W 400-410; distance between projections near insertion IV-L 500-545; IV-L (Fig. 9) with long and stout setae at distal margins of segments 3-5; IV-L-2-5 dorsal L 95, 115, 125, 160; genital field L/W 180-200/310-315; gonopore short and narrow, flanked by a group of fine setae (see Fig. 7A), L/W 50-55/25-32 (gnathosoma not measured due to unsuitable position in preparations).

Female

Idiosoma L/W 800/710; dorsal furrow complete, dorsal shield L/W 710-720/570-590; distance between projections near insertion IV-L 630; setae on distal margins of IV-L-3-5 distinctly shorter than in males (Fig. 8B); IV-L-2-6 dorsal L 110, 110, 155, 175, 180; genital field L/W 300-310/430-510; gonopore large, flanked by a line of fine setae (Fig. 7B), L/W 125-140/100-140; gnathosoma L 140-160; chelicera basal segment 100, claw 55, maximum H 55; palp segments L/H P-1 25/50, P-2 65/60, P-3 50/52, P-4 80/43, P-5 30/18.

DISCUSSION

W. milloti n. sp. differs from *W. falciseta* K. Viets, 1916, from continental Africa, in the presence of a stripe of sclerite surface with larger pores extending between the medial margins of cx-3+4 and the facing margins of cx-2/3, and in the distinctly thicker palpal setae. *W. sumatrensis* K. Viets, 1935, a species known from the female sex only, is similar to *W. milloti* n. sp. in the presence of sclerite stripes with larger pores between coxal plates, but

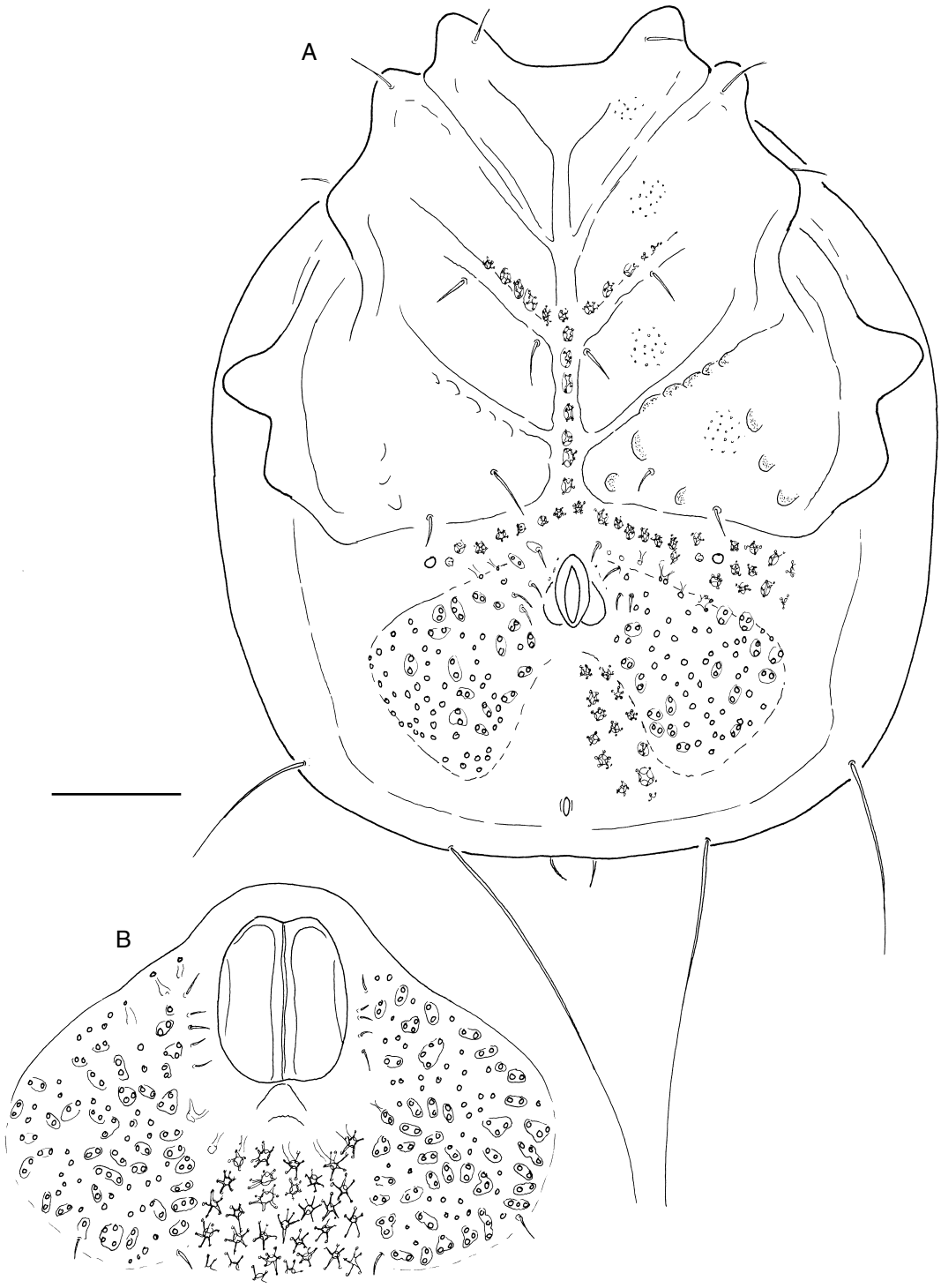

FIG. 7. — *Wuria milloti* n. sp.; **A**, ♂, ventral view; **B**, ♀, genital field. Scale bar: 100 µm.

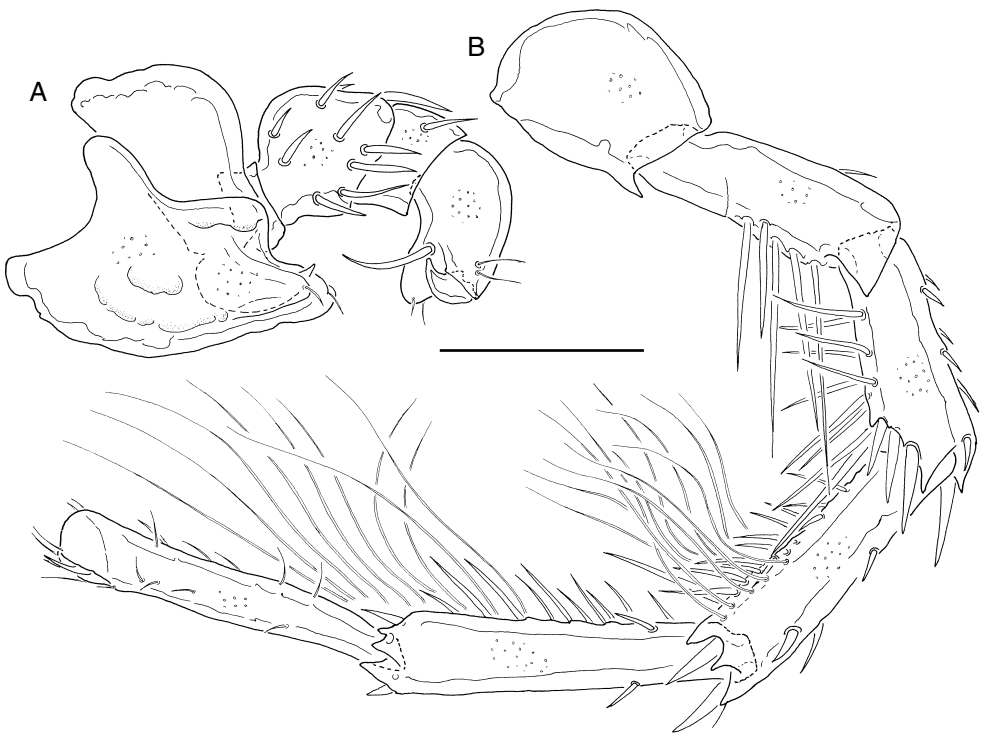

FIG. 8. — *Wuria milloti* n. sp., ♀; **A**, gnathosoma, chelicera and palp in medial view; **B**, fourth leg. Scale bar: 100 µm.

has a more slender palp. *W. boutit* Harvey, 1989 from Australia differs in having the acetabula arranged in more narrow rows. The characters of *W. expansipalpis* Smit, 2002 from New Caledonia differ greatly from all other species of the genus – from many points of view the described female resembles *Arrenurus*. As previously no attention has been paid to details of leg shape and setation in the genus, it is still unclear if the sexual leg dimorphism in *W. milloti* n. sp. is limited to this species.

DISCUSSION

The presence of 64 identified species and one subspecies of water mites is now ascertained for the fauna of Madagascar and one additional taxon is recorded without species identification (*Unionicola*, subgenus *Polyatax*; see Appendix). In a preliminary report on recent fieldwork, Goldschmidt & Gerecke (2003) document the presence of three further genera (*Albia* Thon, 1899, *Nilotonia* Thor, 1905 and *Sperchon* Kramer, 1877), but without specifying collection sites.

Thirty-five of the species (58%) are at present only known from the "Grande Île", while 24 (38%) have been recorded from Africa and Madagascar, and four (6%) have wider distribution areas, including Asia, Europe and/or America. In the available documentation of water mite diversity on Madagascar, standing water habitats are strongly over-represented: only five (less than 10%) of the recorded species belong to genera typically comprising running-water species (*Kongsbergia*, *Monatractides*, *Torrenticola* and possibly *Hygrobates*). Furthermore, most records derive from very restricted parts of Madagascar (the northwestern edge, including the island of Nossi-Bé, and the surroundings of Majunga), while most of the important mountain chains,

FIG. 9. — *Wuria milloti* n. sp., ♂, fourth leg. Scale bar: 100 µm.

the large river basins draining the South, as well as the rain forests of the East coast are completely unstudied (Goldschmidt & Gerecke 2003). Correspondingly, the emerging zoogeographical scenario reflects the unbalanced state of our present knowledge rather than the colonization history of this highly interesting part of the earth. The semiarid western areas of Madagascar are known to be generally colonized by more widespread species, often of African origin, while the nucleus of autochthonous freshwater invertebrate diversity lies in the eastern mountain chains (Elouard & Gibon 2001). Furthermore, many water-mite species of pools and standing waters colonize extended areas, while an increasing tendency towards endemism in localized refuges can be observed in species living in running waters, particularly springs and the hyporheic interstitial (e.g. Smit *et al.* 2000). Against this background, an enormous increase in our knowledge of the water mite diversity is to be expected when the fauna of neglected areas and habitats on Madagascar are analyzed in detail. As a result of such studies, the number of documented species is likely to rise by an order of magnitude, as has been the case for other groups of invertebrates that have been investigated with intense fieldwork during the 1990s (Elouard & Gibon 2001).

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APPENDIX

List of the water mites of Madagascar. Taxa are given in alphabetical order (genus/species). For each species, records follow the alphabetical order of province names, and within provinces the date of publication. Province names are used as in present official maps of the country. In the column Site, original language of publication or museum labels is maintained. As far as possible, individual numbers are given as total (males/females/deutonymphs) or (if no sex specification is given): total (adults//deutonymphs). In the column Publ., the reference that contains the faunistic information is given for the respective line.

Species	Province	Site	Number	Date	Leg.	Publ.	MNHN No.
***Allokrendowskia dentipes* Lundblad, 1941**	Mahajanga Mahajanga	Majunga Majunga, Lac Sahapy	1 (1/0/0) 6 (4/1/1)	1931 31.X.1960	Seyrig Therezien	Lundblad 1946 K. O. Viets 1968	
***Arrenurus abruptus* Lundblad, 1946**	Mahajanga	Majunga	1 (1/0/0)	1931	Seyrig	Lundblad 1946	
***Arrenurus auritus* Koenike, 1898**	Mahajanga	Majunga	4 (1/3/0)	?	Voeltzkow	Koenike 1898	
***Arrenurus bidens* Koenike, 1898**	Nossi-Bé	Nossi-Bé, Djabala-See	14 (2/12/0)	?	Voeltzkow	Koenike 1898	
***Arrenurus concavus* Koenike, 1893**	Mahajanga Mahajanga Mahajanga	Amparangidro Majunga Morondava	2 (0/2/0) 4 (3/1/0) 2 (1/1/0)	? ? ?	Voeltzkow Voeltzkow Voeltzkow	Koenike 1898 Koenike 1898 Koenike 1898	
***Arrenurus cupitor* Koenike, 1898**	Mahajanga	Morondava	1 (0/1/0)	1.VI.1893	Voeltzkow	Koenike 1898	
***Arrenurus dentifer* Lundblad, 1946**	Mahajanga	Majunga	2 (1/1/0)	1931	Seyrig	Lundblad 1946	
***Arrenurus dumazeri* Motaș, 1932**	Toamasina	Tributaire du Lac Ampitabi, 760 km S Tamatave	2 (0/2/0)	?	Dumazer	Motaș 1932	
***Arrenurus farsilis* Koenike, 1898**	Nossi-Bé	Nossi-Bé, Djabala-See	1 (0/1/1)	1.X.1895	Voeltzkow	Koenike 1898	
***Arrenurus frustrator* Koenike, 1898**	Mahajanga Mahajanga Nossi-Bé	Majunga Majunga Nossi-Bé, Djabala-See	5 (1/2/2) 2 (1/1/0) 1 (0/0/1)	1.V.1892 1931 11.VIII.1895	Voeltzkow Seyrig Voeltzkow	Koenike 1898 Lundblad 1946 Koenike 1898	
***Arrenurus geniculatus* Koenike, 1898**	Nossi-Bé	Nossi-Bé, Djabala See	1 (1/0/0)	?	Voeltzkow	Koenike 1898	
***Arrenurus laticodulus* Piersig, 1898**	Mahajanga	Majunga	1 (1/0/0)	1931	Seyrig	Lundblad 1946	
***Arrenurus limbatus* Koenike, 1898**	Mahajanga Mahajanga	Majunga Majunga	1 (1/0/0) 1 (1/0/0)	? 1931	Voeltzkow Seyrig	Koenike 1898 Lundblad 1946	
***Arrenurus obliquus* Koenike, 1898**	Nossi-Bé	Nossi-Bé, Djabala-See	36 (23/12/1)	?	Voeltzkow	Koenike 1898	
***Arrenurus pectinatus* Koenike, 1893**	Antsiranana Mahajanga Mahajanga Mahajanga Toamasina	NO Ankarana Amparangidro (Reissee) Majunga Majunga E, Maroantsetra, Ambohivoangy. Lagunes/eaux presque douces	10 (5/5/0) 5 “a few” 2 (1/1/0) 1 (1/0/0)	IX.1946 ? ? 1931 X.1946	Millot J. Voeltzkow Voeltzkow Seyrig Millot J.	this paper Koenike 1898 Koenike 1898 Lundblad 1946 this paper	A 01 B B 10 D

Species	Province	Site	Number	Date	Leg.	Publ.	MNHN No.
***Arrenurus plenipalpis* Koenike, 1893**	Mahajanga	Majunga	?	1.V.1892	Voeltzkow	Koenike 1898	
	Mahajanga	Morondava	?	1.VI.1893	Voeltzkow	Koenike 1898	
	Nossi-Bé	Nossi-Bé	131 (54/75/2)	1.VIII.1895	Voeltzkow	Koenike 1898	
***Arrenurus pudens* Koenike, 1898**	Nossi-Bé	Nossi-Bé, Djabala-See	17 (6/11/0)	?	Voeltzkow	Koenike 1898	
	Taolanaro	Fort-Dauphin, Tilapia-Teich	1 (0/1/0)	8.IX.1958	Starmühlner	K. O. Viets 1961, 1964b	
***Arrenurus rudiferus* Koenike, 1898**	Antananarivo	Tananarive	1 (1/0/0)	?	Waterlot	Walter & Bader 1953	
	Mahajanga	Majunga	20 (0/20/0)	?	Voeltzkow	Koenike 1898	
	Mahajanga	Majunga	1 (1/0/0)	1931	Seyrig	Lundblad 1946	
	Mahajanga	Morondava	7 (1/6/0)	?	Voeltzkow	Koenike 1898	
***Arrenurus sarcinatus* Koenike, 1898**	Mahajanga	Majunga	1 (0/1/0)	1.V.1892	Voeltzkow	Koenike 1898	
***Arrenurus vigorans* Koenike, 1898**	Nossi-Bé	Nossi-Bé, Djabala-See	1 (0/0/1)	1.X.1895	Voeltzkow	Koenike 1898	
***Arrenurus voeltzkowi* Koenike, 1898**	Antananarivo	Tananarive	1 (0/1/0)	?	Waterlot	Walter & Bader 1953	
	Antananarivo	Tananarive; Tsimbazaza	1 (1/0/0)	VII.1949	Paulian R.	this paper	C 60 C
	Antsiranana	NO Ankarana	2 (2/0/0)	IX.1946	Millot J.	this paper	A 01 B
	Antsiranana	NO Bas Sambirano massaban A	4 (2/1/1)	IX.1945	Millot J.	this paper	B 10 I
	Mahajanga	Majunga	2 (1/1/0)	1931	Seyrig	Lundblad 1946	
	Mahajanga	Morondava	2 (1/1/0)	?	Voeltzkow	Koenike 1898	
	Toamasina	Im Walde südl-Moramanga	6 (3/2/1)	20.II.1931	Durry	Walter & Bader 1953	
***Arrenurus* sp. indet.**	Antananarivo	Tsimbazaza (rizière)	1 (0/1/0)	X.1947	Millot J.	this paper	B 15 E
	Antsiranana	Ankarana (marais)	6 (1/5/0)	IX.1946	Millot J.	this paper	A 01 D
	Antsiranana	N Sambirano (marais A)	1 (0/1/0)	?	Millot J.	this paper	B 15 I
	Antsiranana	NO Ankarana	1 (0/1/0)	IX.1946	Millot J.	this paper	A 20 J
	Mahajanga	Betsiboka, Ambato Boeni, marais province de Maevatanana	1 (0/1/0)	?	Waterlot	this paper	E 14 K
	Mahajanga	Marais Marovoay près Majunga	1 (0/1/0)	?	Waterlot	this paper	E 14 M
	Nossi-Bé	Nossi-Bé, L. Djabol-Bé	1 (0/1/0)	IX.1947	Millot J.	this paper	E 14 E
	Taolanaro	S, Fort Dauphin, Mandrare (eau douce)	2 (0/2/0)	VIII.1948	Millot J.	this paper	E 17 J
	Toamasina	Im Walde südl-Moramanga	1 (0/0/1)	20.II.1931	Durry	Walter & Bader 1953	
	Toamasina	Centre, bords du lac Alaotra	5 (2/3/0)	XI.1946	Mollotrec?	this paper	A 48 F
***Atractides madagascariensis* K. O. Viets, 1962**	Antananarivo	Ankaratra-Gebirge, südl. Teil, Antsirabe, Antsampranrano-Bach	1 (0/1/0)	25.VII.1958	Starmühlner	K. O. Viets 1964a	
***Atractides thoracatus* Koenike, 1898**	Nossi-Bé	Nossi-Bé, Djabala See	52 (40/11/1)	1.VIII.1895	Voeltzkow	Koenike 1898	
	Nossi-Bé	Nossi-Bé, Djabala See	4 (0/4/0)	1.X.1895	Voeltzkow	Koenike 1898	

Species	Province	Site	Number	Date	Leg.	Publ.	MNHN No.
Diplodontus antsirananus **Gerecke, 2004**	Antsiranana	Mgne. d'Ambre, R. Manques 3 (3/0/0)	18.XI.2001	Gerecke & Goldschmidt	Gerecke 2004	holo- and paratype	
Diplodontus opimus **(Koenike, 1896)**	Mahajanga	Amparangidro	3	spring 1892	Voeltzkow	Koenike 1898	
	Mahajanga	Majunga	13 (11//2)	?	Voeltzkow	Koenike 1898	
Diplodontus schaubi **(Koenike, 1893)**	Antsiranana	N Sambirano (marais A)	2 (0/1/1)	?	Millot J.	this paper	B 15 I
	Antsiranana	NO Bas Sambirano massaban A	1 (0/0/1)	IX.1945	Millot J.	this paper	B 10 I
	Mahajanga	Amparangidro	1 (1/0/0)	spring 1892	Voeltzkow	Koenike 1898	
	Mahajanga	Morondava	3	?	Voeltzkow	Koenike 1898	
	Mahajanga	Marais Marovoay près Majunga	2 (0/2/0)	?	Waterlot	this paper	E 14 M
	Antsiranana	Maroambihy (Sambava)	1 (0/0/1)	12.XI.2001	Gerecke & Goldschmidt	Gerecke 2004	
Diplodontus torrentium **Gerecke, 2004**	Antsiranana	Andapa, affl. R. Ambendrana	7 (2/4/1)	11.XI.2001	Gerecke & Goldschmidt	Gerecke 2004	holo- and paratype
Diplodontus **cf. *torrentium*** **Gerecke, 2004**	Fianarantsoa	Mediorano, Andrambovato	2 (0/0/2)	18-20.VIII.2001	Gerecke & Goldschmidt	Gerecke 2004	
Ecpolus tuberatus **Koenike, 1898**	Nossi-Bé	Nossi-Bé, Djabala-See		?	Voeltzkow	Koenike 1898	
	Toamasina	Tributaire du Lac Ampitabi, 760 km S Tamatave	1	1930	Dumazer	Motaș 1932	
Encentridophorus brevispinus **Lundblad, 1946**	Antsiranana	Ankarana (marais)	1 (1/0/0)	IX.1946	Millot J.	this paper	A 19 G
	Mahajanga	Majunga	1	1931	Seyrig	Lundblad 1946	
	Toamasina	E, Maroantsetra, Ambohivoangy. Lagunes/eaux presque douces	2 (0/2/0)	X.1946	Millot J.	this paper	B 10 D
Eylais **cf. *degenerata*** **Koenike, 1897**	Antsiranana	Ankarana (marais)	2	IX.1946	Millot J.	this paper	A 01 D
	Antsiranana	NO Ankarana	2	IX.1946	Millot J.	this paper	B 21 L
	Antsiranana	NO Ambanja (flaques) Bas Sambirano	8	1947	Millot J.	this paper	B 32 J
	Antsiranana	Tsaratanana, Bas Manongarivo (S Ambanja) (eau douce)	1	VIII.1947	Millot J.?	this paper	B 06 K
	Antsiranana	NO Bas Sambirano (marais)	5	VI.1948	Millot J.	this paper	C 14 F
	Mahajanga	Amparangidro (Reissee)	"numerous"		Voeltzkow	Koenike 1898	
	Mahajanga	Majunga	"very numerous"	?	Voeltzkow	Koenike 1898	
	Mahajanga	Morondava	?	?	Voeltzkow	Koenike 1898	
	Toamasina	Inst. scient. Madagascar Tamatave	2	IV.1951	?	this paper	A 45 G
	Toamasina	E L. Alaotra	12	1946	Millot J.	this paper	B 15 A
	Toamasina	Ivondro, F. de Didy	1	III.1947	Millot J.?	this paper	B 06 J
	Toamasina	Lac Alaotra (A.R.)	1	VI.1951	Inst. scient. Madagascar	this paper	C 43 M

Species	Province	Site	Number	Date	Leg.	Publ.	MNHN No.
***Eylais* cf. *megalostoma* Koenike, 1897**	Mahajanga	Marovoay près Majunga, rizière	1	?	Waterlot	this paper	E 14 L
	Mahajanga	Marais Marovoay près Majunga	3	?	Waterlot	this paper	E 14 M
	Taolanaro	S Tsihombe; Poches Manambavo	1	VIII.1948	Millot J.	this paper	C 14 I
	?	?	1	IX.1947	Millot J.	this paper	B 32 E
***Eylais voeltzkowi* Koenike, 1897**	Mahajanga	Majunga (Reissee)	3		Voeltzkow	Koenike 1898	
***Eylais* sp.**	Mahajanga	Antsalova (Bemaraha), Anjohimavo near Antsiareza	1 (0/1/0)	16.VIII.1959	Therezien	K. O. Viets 1964a	
***Hydrachna mirifica* Koenike, 1898**	Antsiranana	NO Ankarana	1 (0/0/1)	IX.1946	Millot J.	this paper	A 01 B
	Antsiranana	Ankarana (marais)	2 (1/1/0)	IX.1946	Millot J.	this paper	A 01 D
***Hydrachna amplexa* Koenike, 1898**	Mahajanga	Marais Marovoay près Majunga	1 (1/0/0)	?	Waterlot	this paper	E 14 M
	Mahajanga	Majunga	1 (0/0/1)	1.V.1892	Voeltzkow	Koenike 1898	
	Toamasina	E L. Alaotra	1 (1/0/0)	1946	Millot J.	this paper	B 15 A
***Hydrachna fissigera* Koenike, 1898**	Mahajanga	Amparangidro	1 (0/0/1)	1.V.1892	Voeltzkow	Koenike 1898	
	Mahajanga	Majunga	13 (1/2/10)	1.V.1892	Voeltzkow	Koenike 1898	
***Hydrachna madagascariensis* Lundblad, 1946**	Mahajanga	Majunga	1 (1/0/0)	1931	Seyrig	Lundblad 1946	
***Hydrachna propinqua* Koenike, 1898**	Antananarivo	Tananarive	1 (0/0/1)	?	Waterlot	Walter & Bader 1953	
	Mahajanga	Morondava	3 (0/3/0)	1.VI.1893	Voeltzkow	Koenike 1898	
***Hydrachna signata* Koenike, 1898**	Antananarivo	Centre; Carion (road to Tamatave), 1400 m, Angavakely, étangs	1 (0/0/1)	IX.1946	Millot J.	this paper	B 16 C
	Antsiranana	Diego Suarez, Anivorano du Nord, Dorf Matsaboribe	1 (1/0/0)	28.IV.1959	Therezien	K. O. Viets 1964a	
	Antsiranana	Ankarana (marais)	2 (1/1/0)	IX.1946	Millot J.	this paper	A 01 D
	Antsiranana	NO Bas Sambirano (marais)	4 (0/4/0)	VI.1948	Millot J.	this paper	C 14 F
	Mahajanga	Amparangidro (Reissee)	4 (2/2/0)	1.V.1892	Voeltzkow	Koenike 1898	
	Mahajanga	Majunga	14 (8/4/2)	1.V.1892	Voeltzkow	Koenike 1898	
	Taolanaro	Mandrare, Riv. Imanambo	1 (0/0/1)	VI.1900	Dr Decorse	this paper	C 19 F
	Toamasina	Im Walde südl-Moramanga	1 (0/1/0)	20.II.1931	Durry	Walter & Bader 1953	
	Toamasina	E L. Alaotra	2 (1/1/0)	1946	Millot J.	this paper	B 15 A
	Toamasina	Canal des Pangalanes (Brickaville), Ambila; Lemaitso; eau douce	1 (1/0/0)	IV.1951	Inst. scient. Madagascar	this paper	C 20 M
***Hydrodroma capensis* (K. Viets, 1914)**	Mahajanga	Majunga	2 (1/1/0)	1931	Seyrig	Lundblad 1946	
	Taolanaro	Fort-Dauphin, Mandena	32 (12/20/0)	8.IX.1958	Starmühlner	K. O. Viets 1964a	

Species	Province	Site	Number	Date	Leg.	Publ.	MNHN No.
***Hydrodroma despiciens* (Müller, 1776)**	Antananarivo	Centre; Carion (road to Tamatave), 1400 m, Angavakely, étangs	39	X.1946	Millot J.	this paper	B 16 C
	Antananarivo	Ankaratra, C.F. Manjakatompo; eaux douces	1	XI.1946	Millot J.	this paper	B 21 F
	Antsiranana	Ankarana (marais)	1	IX.1946	Millot J.	this paper	A 01 D
	Mahajanga	Majunga	7 (4//3)	?	Voeltzkow	Koenike 1898	
	Nossi-Bé	Nossi-Bé, Djabala-See	77 (63//14)	1.VIII.1895	Voeltzkow	Koenike 1898	
	Nossi-Bé	Nossi-Bé, Djabala-See	7 (5//2)	1.X.1895	Voeltzkow	Koenike 1898	
	Nossi-Bé	Nossi-Bé, L. Djabol-Bé	2	IX.1947	Millot J.	this paper	E 14 E
***Hydryphantes incertus* Koenike, 1893**	Antsiranana	NO Bas Sambirano (marais)	4 (0/3/1)	VI.1948	Millot J.	this paper	C 14 F
	Antsiranana	Mahavavy (S Ankarana), Ambilobé	1	IV.1951	Paulian R.	this paper	C 60 B
	Antsiranana	Ankarana (marais)	3 (1/2/0)	IX.1946	Millot J.	this paper	A 01 D
	Nossi-Bé	Nossi-Bé	19 (15//4)	1.VIII.1895	Voeltzkow	Koenike 1898	
	Nossi-Bé	Nossi-Bé	3	1.X.1895	Voeltzkow	Koenike 1898	
	Nossi-Bé	Nossi-Bé, L. Djabol-Bé	1	IX.1947	Millot J.	this paper	E 14 E
***Hygrobates latilimbatus* Motaș, 1932**	Toamasina	R. Fotsimato (affl. De la rive gauche de l'Ivoloino), 150 m	1 (1/0/0)	1930	Dumazer	Motaș 1932	
***Kongsbergia angulata* Walter, 1926**	Toamasina	Moramanga, station forestière	1 (0/0/1)	1.V.1925	Louvel	Walter 1926	
***Limnesia aspera* Koenike, 1898**	Antsiranana	NO Ankarana	4 (3/1/0)	IX.1946	Millot J.	this paper	A 20 J
	Antsiranana	Ankarana (marais)	1 (1/0/0)	IX.1946	Millot J.	this paper	A 01 D
	Mahajanga	Lac d'Ambivy	?	?	?	K. O. Viets 1970: "unpubl."	
	Nossi-Bé	Nossi-Bé, Djabala See	338 (197/115/26)	1.VIII.1895	Voeltzkow	Koenike 1898	
	Nossi-Bé	Nossi-Bé, Djabala See	10 (5/4/1)	1.X.1895	Voeltzkow	Koenike 1898	
	Nossi-Bé	Nossi-Bé, L. Djabol-Bé	1 (1/0/0)	IX.1947	Millot J.	this paper	E 14 E
***Limnesia aspera macropora* K. Viets, 1914**	Antananarivo	Tananarive	3 (0/3/0)	?	Waterlot	Walter & Bader 1953	
***Limnesia lucifera* Koenike, 1898**	Mahajanga	Majunga	2 (0/2/0)	1.IV.1892	Voeltzkow	Koenike 1898	
	Nossi-Bé	Nossi-Bé, Djabala See	18 (11/5/2)	1.X.1895	Voeltzkow	Koenike 1898	
***Limnesia scutellata* Koenike, 1898**	Mahajanga	Morondava	3 (2/1/0)	1.VI.1893	Voeltzkow	Koenike	
	Nossi-Bé	Nossi-Bé, Dorf Ambatokiritsa	2 (0/2/0)	15.VIII.1958	Starmühlner	K. O. Viets 1964a	
	Toamasina	Centre, bords du lac Alaotra	1 (0/1/0)	XI.1946	Mollotrec?	this paper	A 48 F
	Toamasina	Moramanga, Sondrangato (eau stagnante) 29 km route d'Anoibe	1 (0/1/0)	IX.1953	Millot J.	this paper	C 20 O

Species	Province	Site	Number	Date	Leg.	Publ.	MNHN No.
Limnochares tenuiscutata **K. Viets, 1914**	Antananarivo	Tananarive No. 234	1 (0/1/0)	?	Waterlot	Walter & Bader 1953	
	Antananarivo	Tananarive	4 (3/1/0)	?	Waterlot	Walter & Bader 1953	
	Antananarivo	Tananarive No. 183	31	?	Waterlot	this paper	C 19 D
	Antananarivo	Angavo, Manjakandriana Ambatoloana, Lac II	25	XI.1950	?	this paper	C 43 A
Limnochares crinita **Koenike, 1898**	Antananarivo	Tananarive No. 234	1 (0/1/0)	?	Waterlot	Walter & Bader 1953	
	Antananarivo	Tananarive	4 (3/1/0)	?	Waterlot	Walter & Bader 1953	
	Antananarivo	Ankaratra-Gebirge, bei Forststation Manjakatompo	1 (1/0/0)	10.X.1958	Therezien	K. O. Viets 1964a	
	Antsiranana	Mahavavy (S Ankarana), Ambilobé	1	IV.1951	Paulian R.	this paper	C 60 B
	Mahajanga	Amparangidro (Reissee)	8	?	Voeltzkow	Koenike 1898	
	Mahajanga	Majunga	42 (40//2)	?	Voeltzkow	Koenike 1898	
	Mahajanga	Majunga	1 (1/0/0)	1931	Seyrig	Lundblad 1946	
	Mahajanga	Majunga, Lac Sahapy	1 (0/1/0)	31.X.1960	Therezien	K. O. Viets 1968	
	Nossi-Bé	Nossi-Bé, Djabala-See	41		Voeltzkow	Koenike 1898	
	Nossi-Bé	Nossi-Bé, L. Djabol-Bé	20 + 1 larva	IX.1947	Millot J.	this paper	E 14 E
	Toamasina	Tamatave Marais sur sables	38	17.II.1961	Therezien	K. O. Viets 1968	
Mamersa testudinata **Koenike, 1898**	Antsiranana	NO Ankarana	2	IX.1946	Millot J.	this paper	A 20 J
	Mahajanga	Majunga	28 (0/26/2)	1.V.1892	Voeltzkow	Koenike 1898	
	Mahajanga	Morondava	2 (0/2/0)	1.VI.1893	Voeltzkow	Koenike 1898	
	Taolanaro	Fort-Dauphin, Mandena	1 (0/1/0)	8.IX.1958	Starmühlner	K. O. Viets 1964a	
	Toamasina	Tributaire du lac Ampitabi, 760 km S Tamatave	1 (0/0/1)	?	Dumazer	Motaş 1932	
Monatractides magnivalvaris **(Walter & Bader, 1953)**	Toamasina	Im Walde südl- Moramanga	1 (1/0/0)	20.II.1931	Durry	Walter & Bader 1953	
Moramangabates pauliani **n. gen., n. sp.**	Toamasina	Marovoalavo, Sondrangato (eau stagnante) 29 km route d'Anoibe	2 (0/2/0)	IX.1953	Millot J.	this paper	C 20 O
Neumania projecta **Lundblad, 1941**	Mahajanga	Majunga	2 (1/1/0)	1931	Seyrig	Lundblad 1946	
Piona angulata **K. Viets, 1921**	Antsiranana	Tsaratanana, Lac Combes, 2850 m	1	?	Paulian	Paulian 1954	
Piona madagascariensis **Lundblad, 1946**	Antananarivo	C.F. Manjakatompo; eaux douces	17 (9/4/4)	XI.1946	Millot J.	this paper	B 21 F
	Mahajanga	Majunga	2 (1/1/0)	1931	Seyrig	Lundblad 1946	
	Mahajanga	Morovoay près Majunga, rizière	1 (0/1/0)	?	Waterlot	this paper	E 14 L

Species	Province	Site	Number	Date	Leg.	Publ.	MNHN No.
	Toamasina	E, Maroantsetra, Ambohivoangy. Lagunes/eaux presque douces	1 (0/1/0)	X.1946	Millot J.	this paper	B 10 D
***Piona setacea* Koenike, 1898**	Antananarivo	Tananarive	8 (0/7/1)	?	Waterlot	Walter & Bader 1953	
	Mahajanga	Majunga (Reissee)	2 (0/2/0)	?	Voeltzkow	Koenike 1898	
***Piona seyrigi* Lundblad, 1946**	Antsiranana	Ankarana (marais)	1 (1/0/0)	IX.1946	Millot J.	this paper	A 01 D
	Mahajanga	Majunga	2 (1/1/0)	1931	Seyrig	Lundblad 1946	
	Taolanaro	Fort-Dauphin, Tilapia-Teich	6 (5/1/0)	8.IX.1958	Starmühlner	K. O. Viets 1964a	
	Taolanaro	S Fort-Dauphin (eau douce)	1 (1/0/0)	VIII.1948	Millot J.	this paper	E 17 J6
	Toamasina	E, Maroantsetra, Ambohivoangy. Lagunes/eaux presque douces	2 (0/0/2)	X.1946	Millot J.	this paper	B 10 D
***Piona caligifer* Koenike, 1898**	Mahajanga	Amparangidro	2 (0/2/0)	spring 1892	Voeltzkow	Koenike 1898	
	Mahajanga	Majunga	21 (4/3/14)	1.V.1892	Voeltzkow	Koenike 1898	
***Piona* sp.**	Antsiranana	NO Ankarana	1 (0/0/1)	IX.1946	Millot J.	this paper	A 20 J
***Sigthoria nilotica* Nordenskiöld, 1905**	Antsiranana	N Sambirano (marais A)	1	?	Millot J.	this paper	B 15 I
***Torrenticola marginata* Walter, 1926**	Toamasina	Moramanga, station forestière	1 (1/0/0)	1.V.1925	Louvel	Walter 1926	
***Torrenticola starmühlneri* K. O. Viets, 1964**	Nossi-Bé	Nossi-Bé, Androatra-Bach, bei Androatra	1 (0/1/0)	22.VIII.1958	Starmühlner	K. O. Viets 1964a	
	Nossi-Bé	Nossi-Bé, Djabala-Bach	2 (0/2/0)	22.VIII.1958	Starmühlner	K. O. Viets 1964a	
***Unionicola digitata* Koenike, 1898**	Nossi-Bé	Nossi-Bé, Djabala See	1 (0/1/0)	27.VIII.1895	Voeltzkow	Koenike 1898	
***Unionicola harpax* Koenike, 1898**	Antsiranana	NO Ankarana	1 (1/0/0)	IX.1946	Millot J.	this paper	A 20 J
	Nossi-Bé	Nossi-Bé, Djabala See	10 (0/10/0)	1.VIII.1895	Voeltzkow	Koenike 1898	
	Nossi-Bé	Nossi-Bé, Djabala See	5 (0/1/4)	1.X.1895	Voeltzkow	Koenike 1898	
***Unionicola curtipalpis* Bader, 1978**	Antananarivo	Environs de Tananarive; cavité palléale de *Pyla madagascariensis*	8 (2/3/3)	1960	Brygoo	Bader 1978	
***Unionicola* (*Pentatax*) sp.**	Antsiranana	NO Ankarana	5 (1/4/0)	IX.1946	Millot J.	this paper	A 20 J
	Antsiranana	NO Ankarana	1 (0/1/0)	IX.1946	Millot J.	this paper	A 01 B
	Antsiranana	Ankarana (marais)	1 (0/1/0)	IX.1946	Millot J.	this paper	A 01 D
***Unionicola* (*Polyatax*) sp.**	Antsiranana	NO Ankarana	1 (0/1/0)	IX.1946	Millot J.	this paper	A 20 J
***Wuria milloti* n. sp.**	Antsiranana	Ankarana (marais)	3 (2/1/0)	IX.1946	Millot J.	this paper	A 01 D
	Antsiranana	NO Ankarana	2 (1/1/0)	IX.1946	Millot J.	this paper	A 20 J
Hydrachnidia gen. sp. (larvae)	Antsiranana	Diego Suarez, registre 982 coll. Trouessart	larvae	?	Alloued	this paper	19 C 12

Species	Province	Site	Number	Date	Leg.	Publ.	MNHN No.
	Antsiranana	? Registre 982	larva	?	?	this paper	19 C 15
	Fianarantsoa	Midongy du Sud, Pce de Farafangana	numerous	24.VIII.1926	Decary	this paper	E 14 D
	Nossi-Bé	Nossi-Bé, L. Djabol-Bé	several	IX.1947	Millot J.	this paper	E 14