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First records of water mites from La Réunion Island with the description of one new species (Acari, Hydrachnidia)

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Original research

ABSTRACT

New records of water mites (Acari: Hydrachnidia) from La Réunion Island are presented. One species new to science, i.e. *Diplodontus insulanus* Pešić & Smit **sp. nov.** (Hydryphantidae) is described; a second species, *Neumania nodosa* (Daday, 1898) (Unionicolidae) is reported for the first time from La Réunion.

Keywords water mites; new species; taxonomy; DNA-barcoding; running waters
Zoobank http://zoobank.org/E9C367CC-9721-4AAC-A3A1-4A3DA2D46EB6

Introduction

La Réunion Island, a French overseas department is located in the western Indian Ocean, in the southeastern rim of the Mascarene Basin, approximately 679 km east of Madagascar. It is a volcanic island formed from two volcanoes, the dormant and slightly taller Piton des Neiges (3070 m asl), and the active Piton de la Fournaise (2632 m asl), on the southern end of the island (Schlüter 2008).

Nothing is known about the water mites of La Réunion. Oceanic islands like La Réunion are in general poor in species, or water mites are even absent. Gerecke *et al.* (1995) could not find water mites in the Galápagos Archipelago, and Smit (2002) did not find water mites on the Falkland Islands. Water mites do occur on Hawaii as Smith & Cook (2004) described a *Piona* species. However, this is very likely an introduced species. Furthermore, *Arrenurus* larvae have been reported from Hawaii by Viets (1939), but it is not known to which species they belong. Imamura (1981) and Smit (2004) were unable to collect adult *Arrenurus* specimens on Hawaii.

In an inventory of the freshwater biodiversity of La Réunion, funded by l'Office de l'Eau de la Réunion (OLE) and Le Parc National de la Réunion under the direction of Ocea Consult'(a consulting organization in aquatic environment), a number of water mites were collected. The paper is aimed to describe this material in order to enlarge our knowledge on the occurrence of water mites on La Réunion island.

Material and methods

All material was collected by Nathalie Mary and the team of Ocea Consult' and was fixed in 70% EtOH. Benthic samples were collected using a Surber sampler. Collected water mite specimens were sent to the Canadian Centre for DNA Barcoding, Guelph, Canada for molecular analysis (see below). Water-mite specimens successfully barcoded in this study are listed in Table 1. After DNA extraction, the specimen vouchers were stored in 96% EtOH and returned

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to the senior author for morphological examination. Some of these vouchers were dissected and slide mounted in Faure's medium, while the rest was transferred to Koenike-fluid. The holotype of the new species will be deposited in Muséum National d'Histoire Naturelle, Paris (MNHN), non-type material in Naturalis Biodiversity Center, Leiden (RMNH). DNA sequences prepared in the course of this study were deposited in the BOLD system (DNA Barcode of Life Data System) and GenBank (Table 1). The DNA extracts were archived in −80 °C freezers at the Centre for Biodiversity Genomics (CBG; https://biodiversitygenomics.net).

Morphological nomenclature follows Gerecke *et al.* (2016). All measurements are given in µm. The palps were measured on both sides, and therefore their dimensions are given as a range. The following abbreviations are used: Ac = acetabula; asl = above sea level; Cx-I to -IV = coxae I to IV (numbered from anterior to posterior); dL = dorsal length; H = height; I-IV-L-4-6 = fourth to sixth segments of first to fourth legs; L = length; P-1 to -5 = palp segments 1 to 5; W = width.

Molecular analysis

Molecular analyses was conducted at the Canadian Centre for DNA Barcoding (CCDB; http://ccdb.ca/). In this institution the specimens were sequenced for the barcode region of COI using standard invertebrate DNA extraction, amplification and sequencing protocols (Ivanova *et al.* 2007, Ivanova and Grainger 2007a, b).

Sequence comparisons were performed using MUSCLE alignment (Edgar 2004). None of the DNA sequences showed evidence of pseudogenes. Data related to each BIN, including the minimum *p*-distance to the nearest neighbouring BIN, was estimated through BOLD. Intra- and interspecific genetic distances were calculated based on the *p*-distance model using MEGA X (Kumar *et al.* 2018).

Systematics

Family Hydryphantidae Piersig, 1896

Subfamily Diplodontinae K. Viets, 1936

Genus *Diplodontus* Dugès, 1834

Diplodontus insulanus Smit & Pešić sp. nov.

Zoobank: 84778292-DBC8-41BD-B3FB-7A1C394AC8A7

Figures 1-2

Material examined — Holotype ♀, dissected and slide mounted, La Réunion, Ravine des Trois Cascades, 21.0694537°S, 55.5136127°E, 967 m asl., 7 Oct. 2021, leg. N. Mary (MNHN).

Diagnosis (Female) — Idiosoma with sclerotized muscle arrangements arranged in pattern plesiotypically found in hydryphantoid mites, frontalia similar in size to pre- and postfrontalia,

Table 1 Details of barcoded *Neumania nodosa* (Daday, 1898) specimens, including data and coordinates of sampling sites, the barcode index number (N indicates a new BIN that contains only current sequences) and associated data obtained from BOLD. NN BIN = nearest neighbour BIN; NN taxonomy = species assigned to nearest neighbour BIN. For Genbank accession numbers of *N. paratribreviseta* see Ding et al. (2020).

Locality	Coordinates	Voucher Code	BOLD/GenBank Acc Nos	BIN BOLD	NN BIN BOLD	NN taxonomy
Neumania nodosa (Daday, 1898)						
La Réunion, Bras du Bernica	20.9777° S, 55.5201° E	CCDB_44300_H02	HYDOC086-22/OR501727	BOLD:AEZ7137N	BOLD:AEG1862	*Neumania paratribreviseta* (= *N.* sp. 2 ZD-2020)
		CCDB_44300_H03	HYDOC087-22/OR501726			
		CCDB_44300_H04	HYDOC088-22/OR501725			
		CCDB_44300_H05	HYDOC089-22/OR501724			

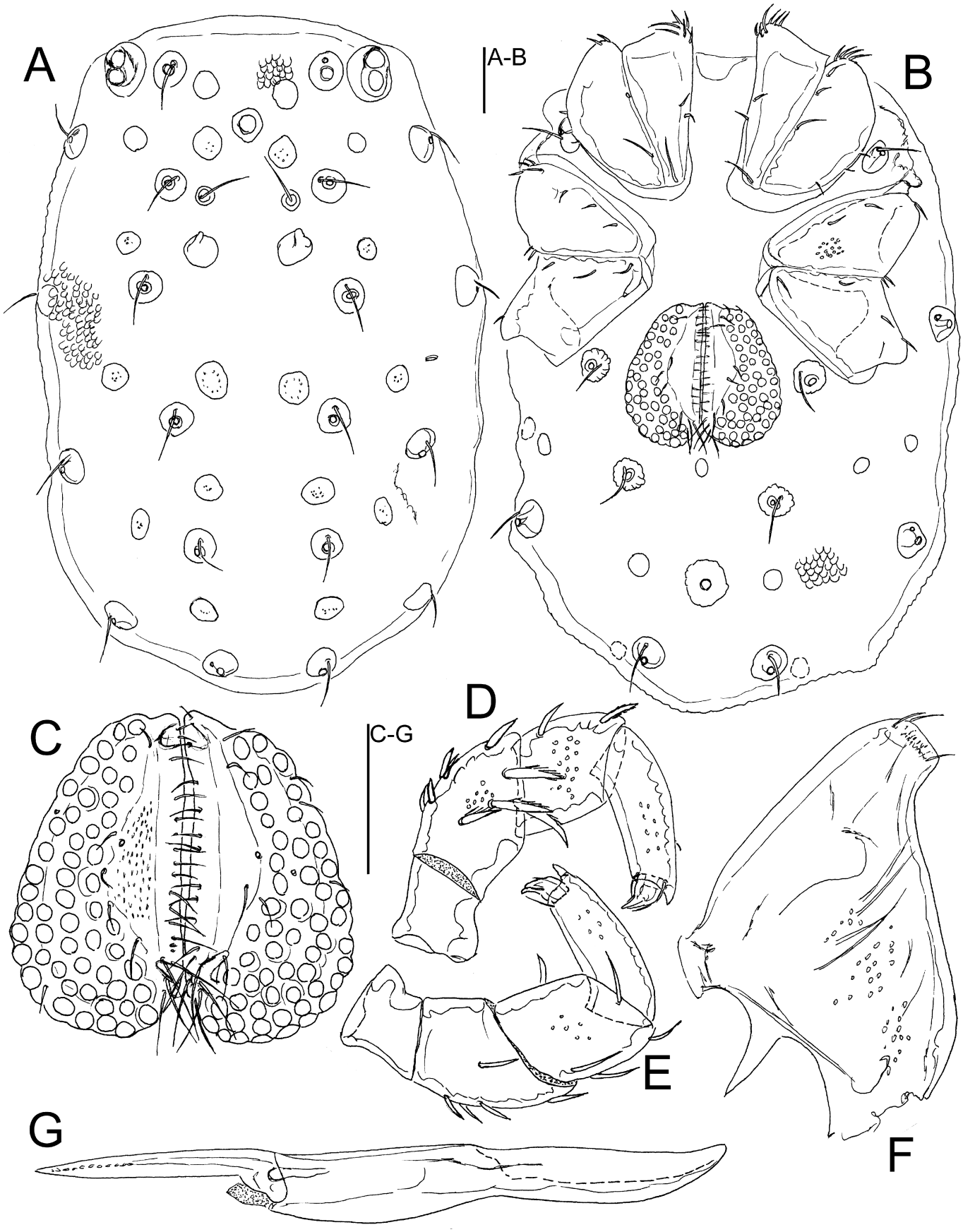

Figure 1 *Diplodontus insulanus* Smit & Pešić **sp. nov.**, ♀ holotype, Ravine des Trois Cascades, La Réunion. A – idiosoma, dorsal view; B – idiosoma, ventral view; C – genital field; D – palp, medial view; E – palp, lateral view; F – gnathosoma; G – chelicera. Scale bars = 100 µm.

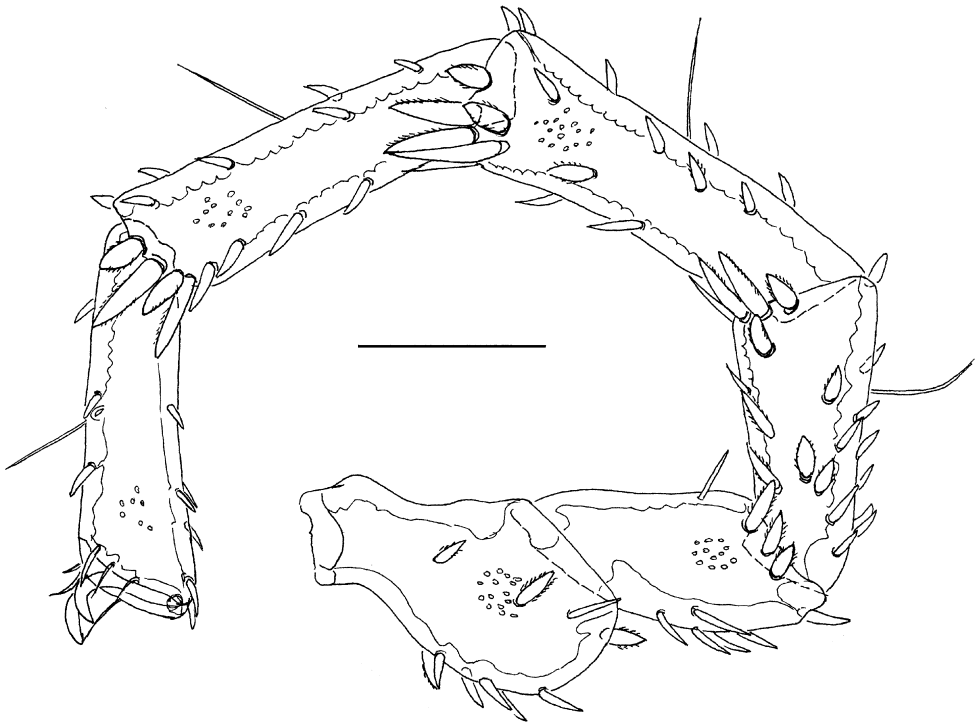

Figure 2 *Diplodontus insulanus* Smit & Pešić **sp. nov.**, ♀ holotype, Ravine des Trois Cascades, La Réunion, IV-L. Scale bar = 100 µm.

the latter developed as rounded platelets; dorsocentralia and dorsolateralia with the same diameter as glandularia; genital field with 51-55 pairs of Ac; chelicera basal segment/claw ratio 1.7; legs without swimming setae, stout, covered with numerous thick and strong setae.

Description (Female) — Idiosoma with sclerotized muscle arrangement platelets (Fig. 1A), frontalia with a border of a secondary sclerotization, similar in size to pre- and postfrontalia, the latter developed as small, rounded platelets, dorsocentralia and dorsolateralia in the same diameter as glandularia or slightly smaller, only four pairs of dorsocentral plates present due to the fusion of the first and second dorsocentralia. Coxae with fine setae, concentrated at the distal margin of Cx-I, Cx-I+II with a rounded, medially directed projection at the posterior margin of the gnathosomal bay. Genital field with halfmoon shaped genital flaps, medially with an acetabula-free, porose area flanked by two rows of fine setae, mediocaudally with a tuft of longer setae (Fig. 1C).

Gnathosoma with an equally S-shaped ventral margin, rostrum distinct (Fig. 1F); chelicera slender with a strong straight claw (Fig. 1G); palp setation as illustrated in Figure 1D-E, P-2 mediodistally with a group of four to five strongly developed, apically curved setae (Fig. 1D).

Legs with high number of uniformly thick and stout setae, scattered over the dorsal and lateral surface of segments 1-5 and arranged in dense rows at distal margins of these segments as illustrated in Fig. 2 for IV-L.

Measurements — Idiosoma L 1044, W 681; coxal field: L 520; Cx-III W 597; genital field L/W 222/238, ratio 0.93, 51-55 pairs of Ac. Eggs maximum diameter (n = 3) 131-144.

Chelicera total L 453, L basal segment 288, claw 166, L basal segment/claw ratio 1.73. Palp: total L 398-415; dL/H, dL/H ratio: P-1, 56/47, 1.2; P-2, 103-106/72-73, 1.4-1.5; P-3, 78/66-69, 1.13-1.19; P-4, 125-141/41, 3.1-3.5; P-5, 33-37/19-19, 1.8-23; P-2/P-4 ratio 0.73-0.85.

Legs: dL of I-L: 75, 98, 114, 153, 155, 178, I-L-6 H 63, dL/H I-L-6 ratio 2.85. dL of IV-L-1-6: 163, 122, 172, 231, 231, 216.

Male — Unknown.

Etymology — Named for the occurrence on an island.

Remarks — In regard to the reinforced idiosoma sclerotization with muscle attachment platelets arranged in a pattern plesiotypically found in hydryphantoid mites and absence of swimming setae on II-IV-L, the new species resembles *Diplodontus torrentium* Gerecke, 2004, and *D. antsirananus* Gerecke, 2004, known from small running waters in the rain forest of Madagascar (Gerecke 2004). The new species from La Réunion differs in a comparatively more enlarged muscle attachment platelets, with the frontalia similar in size to the pre- and postfrontalia platelets (the latter platelets not illustrated for the two abovementioned species from Madagascar, see Gerecke 2004, fig. 4). *Diplodontus torrentium* differs in an increased number of genital acetabula, > 250, and a comparatively more developed leg setation (Gerecke 2004, fig. 8A); *Diplodontus antsirananus,* a species known only in the male sex, differs in a relatively short cheliceral claw (L basal segment/claw ratio > 1.9) (Gerecke 2004) and the distal setae of IV-leg-4 and-5 are more slender.

Habitat — Collected in a low-order stream.

Distribution — La Réunion; known only from the type locality.

Family Unionicolidae Oudemans, 1909

Subfamily Pionatacinae K. Viets, 1916

Genus *Neumania* Lebert, 1879

Neumania nodosa (Daday, 1898)

Figure 3

Material examined — La Réunion, Bras du Bernica, 20.977706°S, 55.5201394°E, 1245 m asl., 6 Oct. 2021, leg. N. Mary 4♀ (barcoded, see Table 1), 1♀ and 1♂ dissected and slide mounted (RMNH).

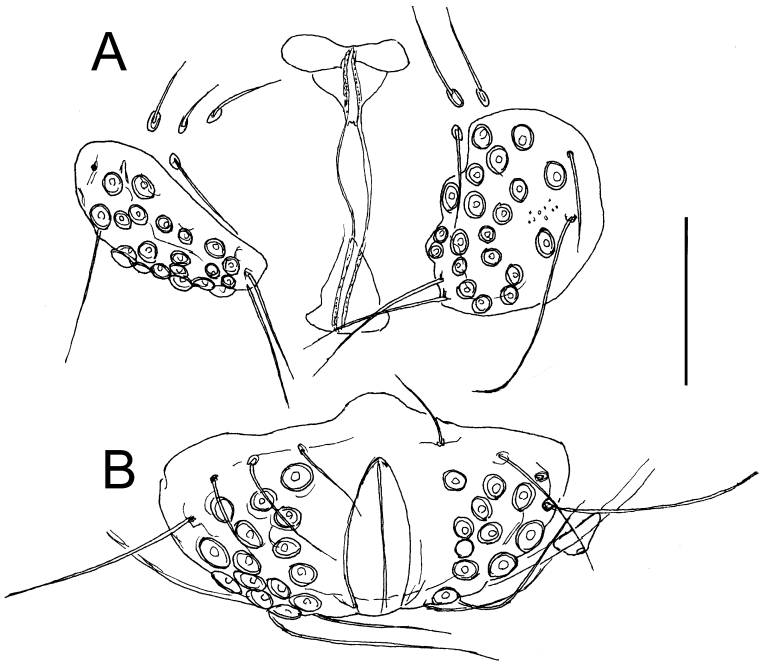

Figure 3 *Neumania nodosa* (Daday, 1898), A – ♀, Bras du Bernica, La Réunion, genital field [CCDB_44300_H03]; B – ♂, Bras du Bernica, La Réunion, genital field. Scale bar = 100 µm.

Remarks — The specimens from La Réunion match the description of *Neumania nodosa*, a species originally described from Sri Lanka (Daday 1898), and later on reported throughout the Oriental and Australasian region (Cook 1967, Smit 2021). They share a dorsum with two pairs of small platelets anteriorly, and a pair of glandularia tubercles posteriorly, excretory pore on a sclerotized plate and in both sexes the genital field has 15-20 acetabula on each side as illustrated in figure 3A-B. The individuals from La Réunion molecularly analysed in this study form a unique BIN (BOLD:AEZ7137), with a *p*-distance of 13.06% from the nearest neighbouring BIN (BOLD:AEG1862), which consists of specimens of *N. paratribreviseta* Ding & Jin, 2020 from Yunnan Province, China (Ding *et al.* 2020). The only available sequences of *N. nodosa* (BOLD:AEH8867) in the BOLD database belong to specimens from Australia (see Carew *et al.* 2022, and Smit & Pešić 2023a). The *p*-distance between the specimens from La Réunion and Australia is 14.6% indicating a need for taxonomic revision of the *N. nodosa* complex for identifying possibly undescribed cryptic species. To be able to make such a revision, barcoded material of *N. nodosa* from Sri Lanka would be helpful. Quite a number of water species of standing waters have a wide distribution, e.g. species of the genus *Arrenurus*. Many species of the latter genus occur througout SE Asia, and often extending their distribution into the Australasian region (Smit & Pešić 2023b). Therefore, barcoded material from *N. nodosa* from SE Asia will be useful too for a revision.

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