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A new *Troglosiro* species (Opiliones, Cyphophthalmi, Troglosironidae) from New Caledonia

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Abstract

A new species of Cyphophthalmi belonging to the New Caledonian endemic genus *Troglosiro* Juberthie, 1979 is described and illustrated using SEM, including the first description of a troglosironid ovipositor. *T. longifossa* sp. nov., known only from its type locality in Port Boisé, and found at low elevation near sea level, constitutes the seventh species of *Troglosiro* to be described to date. The new species has a unique disposition of the four ventral opisthosomal gland pores in the anterior portion of a long depression of the sternal segments 3 to 7. Information on other specimens recently collected in New Caledonia indicates that the number of described species in the island is a gross underestimate of the real diversity of New Caledonian Cyphophthalmi, both in number of species and morphology.

Key words: Taxonomy, new species, Arachnida

Introduction

Among the less known opilionid taxa, the genus *Troglosiro* Juberthie, 1979 was described by Juberthie (1979) on the basis of a single species, *Troglosiro aelleni* Juberthie, 1979, collected in the Grotte dAdio (also known as Ninrin-Reu), near Poya, New Caledonia. The placement of the genus in the system of Cyphophthalmi was indefinite, though it was suggested by Juberthie (1979, 1989) and Shear (1980, 1985) that *Troglosiro* was somehow related to the families Pettalidae Shear, 1980 and Sironidae Simon, 1879. With the description of five additional species attributed to this genus, Shear (1993) erected the family Troglosironidae Shear, 1993, based on a number of apomorphies, namely (1) the two to four median exocrine gland orifices on the male opisthosomal sterna, (2) the basally fused and enlarged apical microtrichia of the penis, and (3) the enlarged movable fingers of the penis with dentate lateral margins. Based on these and other morphological characters, Shear (1993) explicitly proposed a sister group relationship of Troglosironidae

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to Sironidae + Pettalidae (see also de Bivort and Giribet 2004). Molecular data, however, have suggested a relationship of Troglosironidae to Neogoveidae Shear, 1980 (Giribet and Boyer 2002; Boyer et al. 2005) or to Sironidae (mitochondrial data in Boyer et al. 2005), but not to Pettalidae.

In order to broaden our knowledge of the Cyphophthalmi in general, and the Troglosironidae in particular, we examined new material from a number of research expeditions to New Caledonia, made by G.B. Monteith from October 2000 to November 2002. These collections include 116 specimens currently deposited at the Museum of Comparative Zoology, Harvard University (USA). A preliminary analysis of these specimens and of material from other collections has revealed nine morphospecies, seven of which differ considerably from the six previously described species of *Troglosiro*. Here we describe the first new species belonging to the genus *Troglosiro* from that collection and present the first description of a troglosironid ovipositor.

Material and methods

Abbreviations. Examined specimens are lodged in the following institutions:

MCZ = Museum of Comparative Zoology, Harvard University, Cambridge, MA (USA).
FMNH = Field Museum of Natural History, Chicago, IL (USA).
AMNH = American Museum of Natural History, New York, NY (USA).
MHNG = Muséum d'histoire naturelle, Genève (Switzerland).
MNHN = Muséum National d'Histoire naturelle, Paris (France).

One male and one female specimen were examined with a Scanning Electron Microscope (SEM) FEI Quanta 200. The holotype was photographed in dorsal, ventral and lateral positions using a JVC KY-F70B digital camera mounted on a Leica MZ 12.5 stereomicroscope. A series of images (from 10 to 15) were taken at different focal planes and assembled with the dedicated software package Auto-Montage Pro Version 5.00.0271 by Syncroscopy. The same microscopy system was used to illustrate the ovipositor of a female paratype. The penis of a male paratype was examined with a compound microscope with Nomarski Interference Contrast optics, and measured with an ocular micrometer. All measurements are given in mm unless otherwise indicated. Nomenclature on body ornamentation follows Murphree (1988).

Taxonomy

Troglosironidae Shear, 1993

Type genus. *Troglosiro* Juberthie, 1979; type species by monotypy, *Troglosiro aelleni* Juberthie, 1979.

Types. Male holotype (MNHN [ex MCZ DNA100867]) from Gîte Kanua (S 22°21', E 166º58'), Port Boisé, New Caledonia, 20 m elevation, collected 21 November 2001 by G.B. Monteith (Queensland Museum Berlesate 1043, from sieved rainforest litter). 2 male (1 dissected for genitalia, 1 used for DNA extraction following the non-destructive protocol described in Boyer et al. 2005) and 4 female (2 dissected for genitalia) paratypes (MCZ 65204 [ex MCZ DNA100867]), same collecting data as holotype; 1 male and 1 female paratypes mounted on SEM stubs (MCZ 65206, 65207, 65208), same collecting data as holotype. 1 male paratype (MCZ 62505) from a human dung trap, Gîte Kanua (S 22°21', E 166º58'), Port Boisé, New Caledonia, 20 m elevation, collected 28–29 January 2002 by G.B. Monteith. 1 female paratype (MCZ 51944 [ex MCZ DNA101587]), same locality as holotype, collected 18 November 2002 by G.B. Monteith (Queensland Museum Berlesate 1087, from sieved rainforest litter).

Additional material studied. 3 females and 3 juveniles (MCZ DNA100867), same collecting data as holotype.

Material examined for comparison. *T. aelleni* Juberthie, 1979: 2 syntypes (1 male and 1 juvenile) (MHNG) from the Grotte d'Adio, New Caledonia, collected 2 April 1977 by Aellen & Strinati.

T. raveni Shear, 1993: 3 male paratypes and 3 juveniles (FMNH) from Col des Roussettes, near Bourail, New Caledonia, 500 m elevation, collected 7 August 1978 by S. and J. Peck; 1 female paratype (FMNH) from Berlese of litter from dry forest, Col des Roussettes, New Caledonia, 490 m elevation, collected 29 May 1987 by N.I. Platnick and R. Raven.

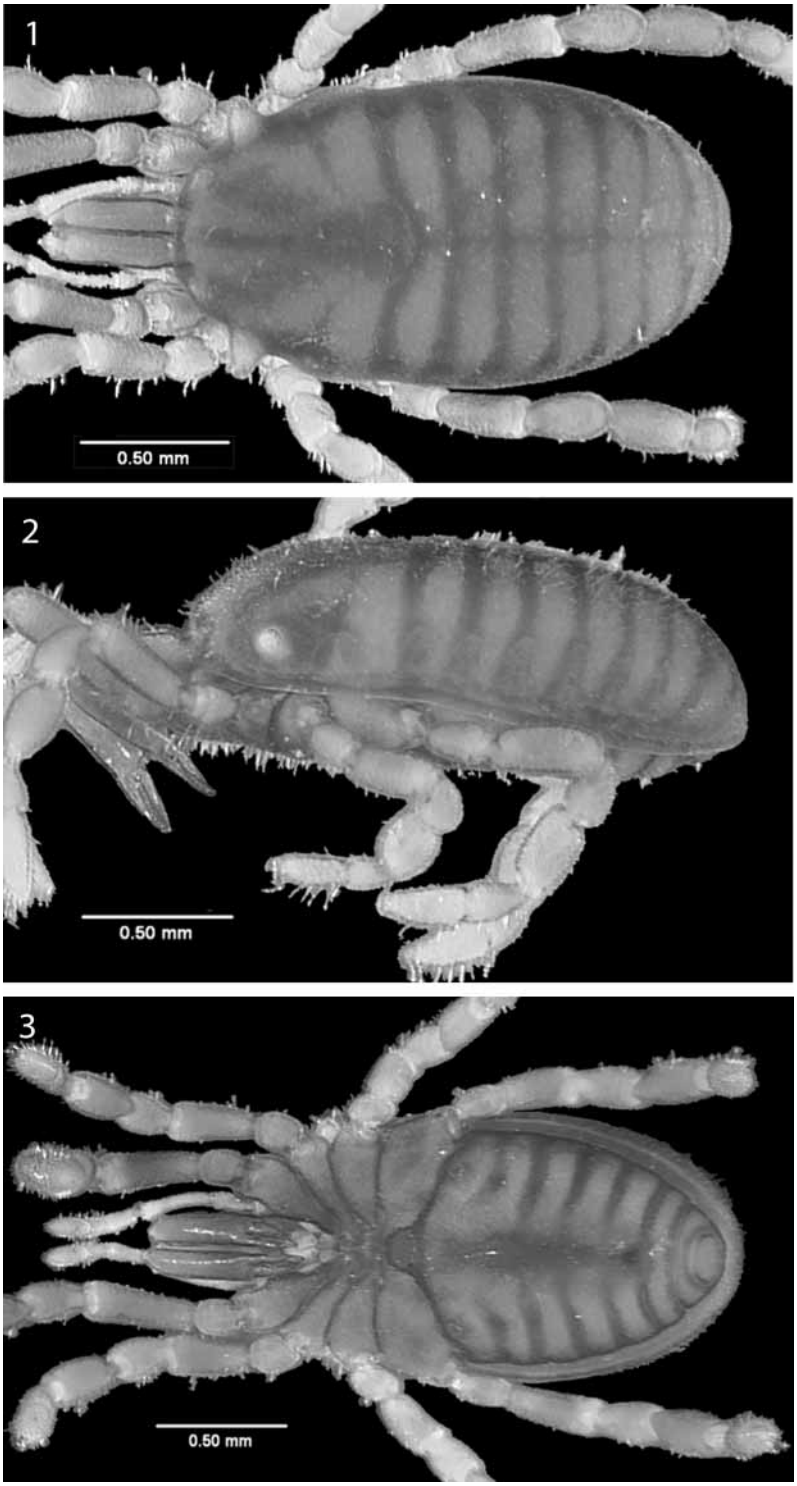
T. juberthiei Shear, 1993: 6 male and 2 female paratypes (FMNH) from Berlese of litter from montane forest, Riviere Bleue, New Caledonia, 280 m elevation, collected 21 May 1987 by N.I. Platnick and R. Raven.

T. platnicki Shear, 1993: 3 male and 6 female paratypes, and 4 juveniles (FMNH) from Col de Mouirange, 30 km East of Noumea, New Caledonia, collected 30 August 1978 by S. and J. Peck (FM[HD]#78-260, from Berlese of leaf litter near pond).

Comparative specimens from 6 other morphospecies not decribed at present.

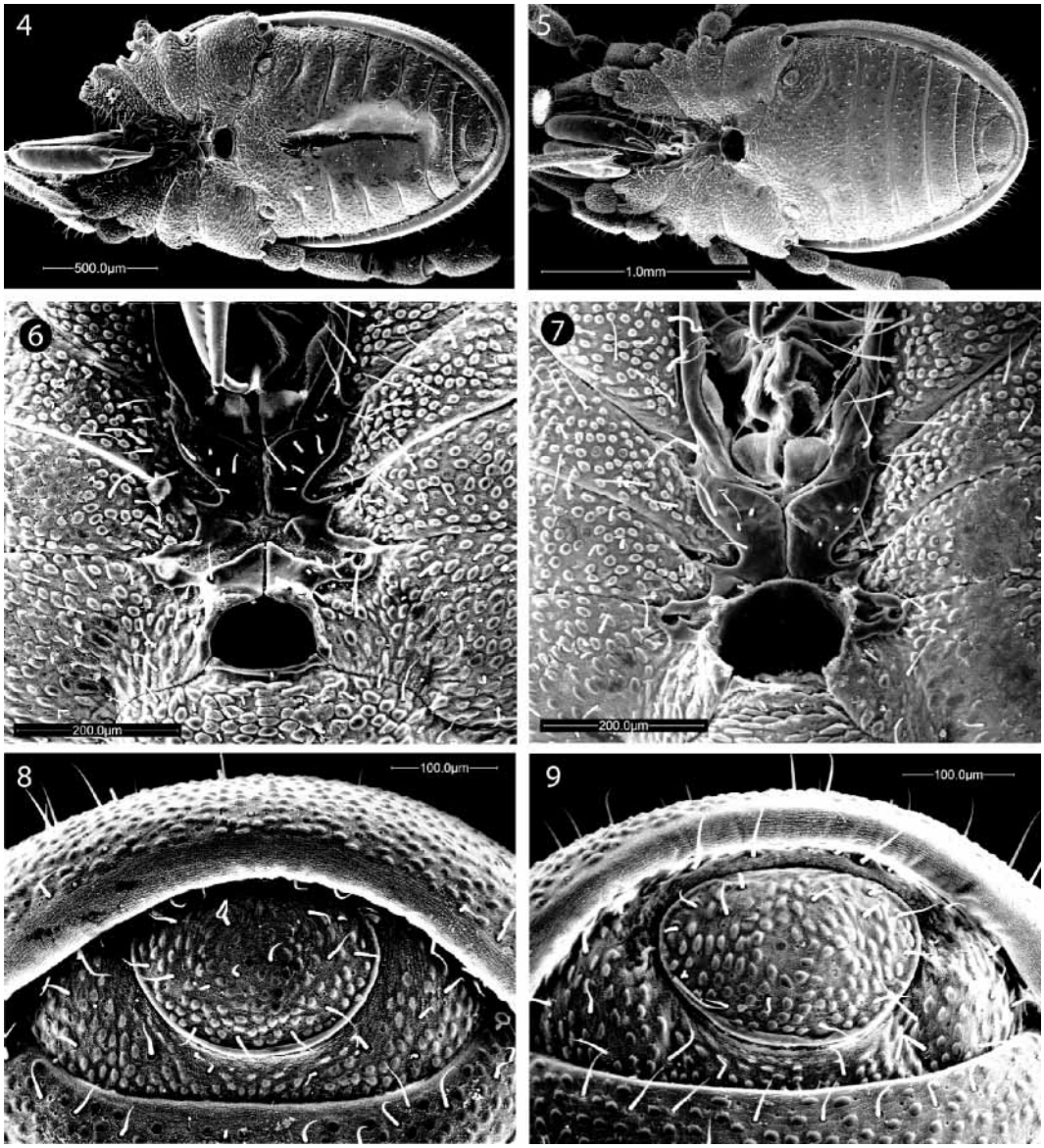
Etymology. The specific epithet, an invariable noun in apposition, refers to the length of the sternal opisthosomal depression in the males of this species. Derived from Latin, longus meaning long, and fossa meaning ditch, trench or channel.

Diagnosis. Troglosironid with distinct opisthosomal ventral depression along the midline extending from sternites 3 through 7, widest and deepest in sternite 5. Two pairs of sternal exocrine gland pores arranged in parallel across the edges of sternal depression delimiting the anterior and posterior portion of opisthosomal sternite 3 (Figs. 10–11). Proximal article of chelicerae with dorsal crest (Fig. 13); distal article of chelicerae with regular dentition (Fig. 14). Penis with four ventral microtrichia; six dorsal microtrichia with bases distant from the midline of the penis (Figs. 31–32).



FIGURES 1–3. *Troglosiro longifossa* sp. nov., male holotype 1, Dorsal view, 2 , Lateral view, 3, Ventral view.

Description. Total length of male holotype (female paratype [MCZ 65204] in parentheses) 1.86 (1.81), width across ozopores 0.95 (0.89), greatest width 1.06 (1.01) between second and third opisthosomal segments (Figs. 1–3); length-width ratio 1.75 (1.79).



FIGURES 4–9. *Troglosiro longifossa* sp. nov. 4, Ventral view of male paratype; 5, Ventral view of female paratype; 6, Sternal region of male paratype; 7, Sternal region of female paratype; 8, Anal region of male paratype; 9, Anal region of female paratype.

Body oval, dark orange to reddish brown (in alcohol) depending on incidence of light. Body almost entirely with a dense tuberculate-microgranulate surface microstructure.

Ozophores conical, of type 2 according to Juberthie (1970; see a re-definition of the types of ozophores in Giribet 2003). Eyes absent (Fig. 15). Transverse opisthosomal sulci and mid-dorsal longitudinal opisthosomal sulcus inconspicuous (Fig. 1). Posterior end of body evenly rounded. Opisthosomal sternites 3 through 7 deeply depressed along the midline without forming lateral rims on both sides of the depression (Figs. 3–4, 10). Depression widest and deepest in sternite 5, terminating abruptly at the anterior end of sternite 7, and features a few scattered setae. Two pairs of sternal pores aligned in parallel on the edge of sternal depression, delimiting the anterior and posterior portion of opisthosomal sternite 3, not on midline (Fig. 11). Female opisthosomal sternites without modifications (Fig. 5).

Coxae of legs I and II movable, coxae of legs III and IV fused (Figs. 6–7). Ventral prosomal complex of male with coxae of legs II and IV meeting in the midline, but coxae I and III not so (Fig. 6). Sternum absent. Gonostome ovoid, width greater than length. Ventral prosomal complex of females with only coxae II meeting in the midline (Fig. 7).

Spiracles (Fig. 12) in the shape of a closed circle. Opisthosomal sternites 8 and 9 and tergite IX fused in males and females, forming a corona analis (Figs. 8–9). Anal plate without modifications. Anal plate 0.17 (0.16) long and 0.24 (0.23) wide. Anal gland pores absent.

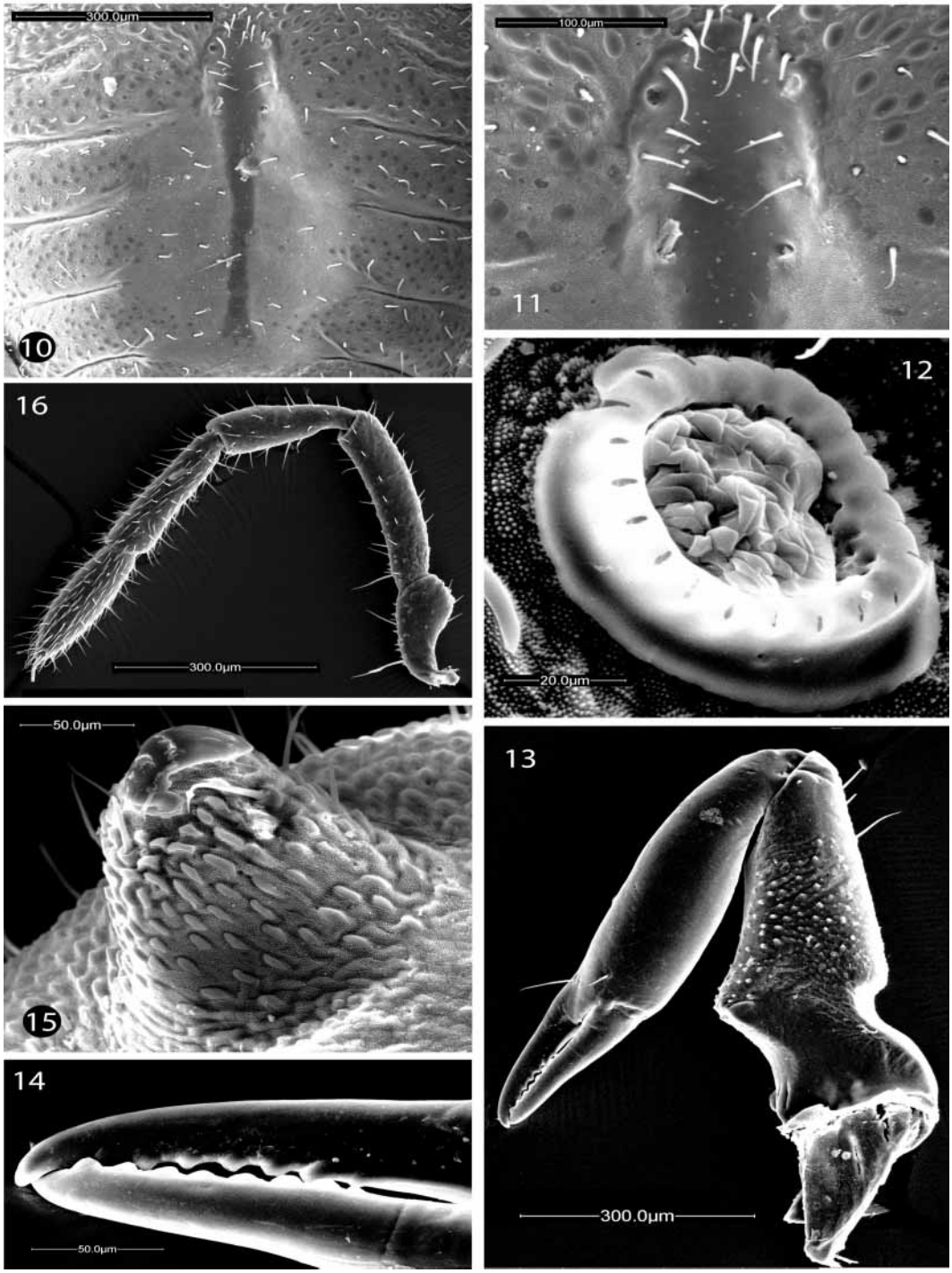
Chelicerae (Fig. 13) slightly protruding, with the dorsal crest visible from above (Figs. 1–2); relatively stocky; with few setae. Granulation restricted to the proximal article, covering part of the surface between the dorsal crest and the anterior terminus. Proximal article of paratype used for SEM 0.56 long, 0.23 deep, with relatively small dorsal crest and single (posterior) ventral process. Second article 0.70 long, 0.14 deep, widest near the middle of its length. Distal article 0.23 long, 0.05 deep. Dentition uniform (Fig. 14).

Palp (Fig. 16) without ventral process on proximal end of trochanter; without conspicuous modifications. Length/width (length-width ratio in parentheses) of palpal articles from trochanter to tarsus of male paratype used for SEM: 0.21/0.08 (2.6); 0.33/0.07 (4.7); 0.23/0.08 (2.9); 0.26/0.07 (3.7); 0.23/0.07 (3.3); total length 1.26. Palpal claw 40 µm long.

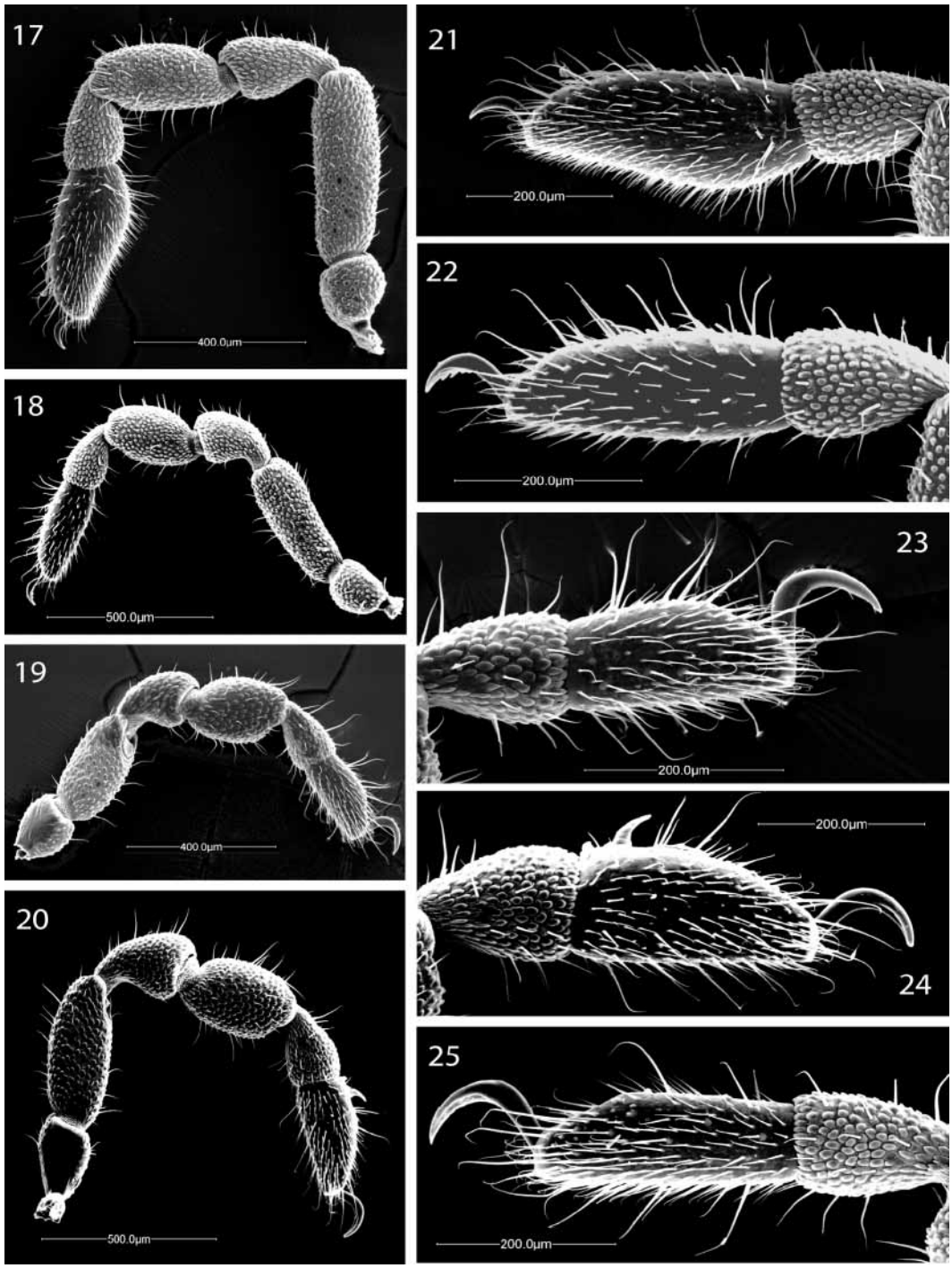
Legs (Figs. 17–20) robust; surface of all trochanters, femora, patellae, tibiae and metatarsi thickly and uniformly granulated.

Leg measurements of male paratype (MCZ 65204): length/width (length-width ratio in parentheses):

	Tr	Fe	Pa	Ti	Mt	Ta	Total
Leg I	0.17/0.16 (1.1)	0.39/0.15 (2.6)	0.25/0.15 (1.7)	0.30/0.17 (1.8)	0.23/0.13 (1.8)	0.40/0.17 (2.3)	1.74
Leg II	0.15/0.14 (1.1)	0.33/0.13 (2.5)	0.21/0.14 (1.5)	0.26/0.17 (1.5)	0.19/0.11 (1.7)	0.29/0.12 (2.4)	1.43
Leg III	0.15/0.13 (1.2)	0.28/0.14 (2.0)	0.17/0.15 (1.1)	0.24/0.17 (1.4)	0.16/0.12 (1.3)	0.23/0.11 (2.1)	1.23
Leg IV	0.18/0.14 (1.3)	0.32/0.16 (2.0)	0.23/0.16 (1.4)	0.31/0.19 (1.6)	0.20/0.14 (1.4)	0.26/0.13 (2.0)	1.50



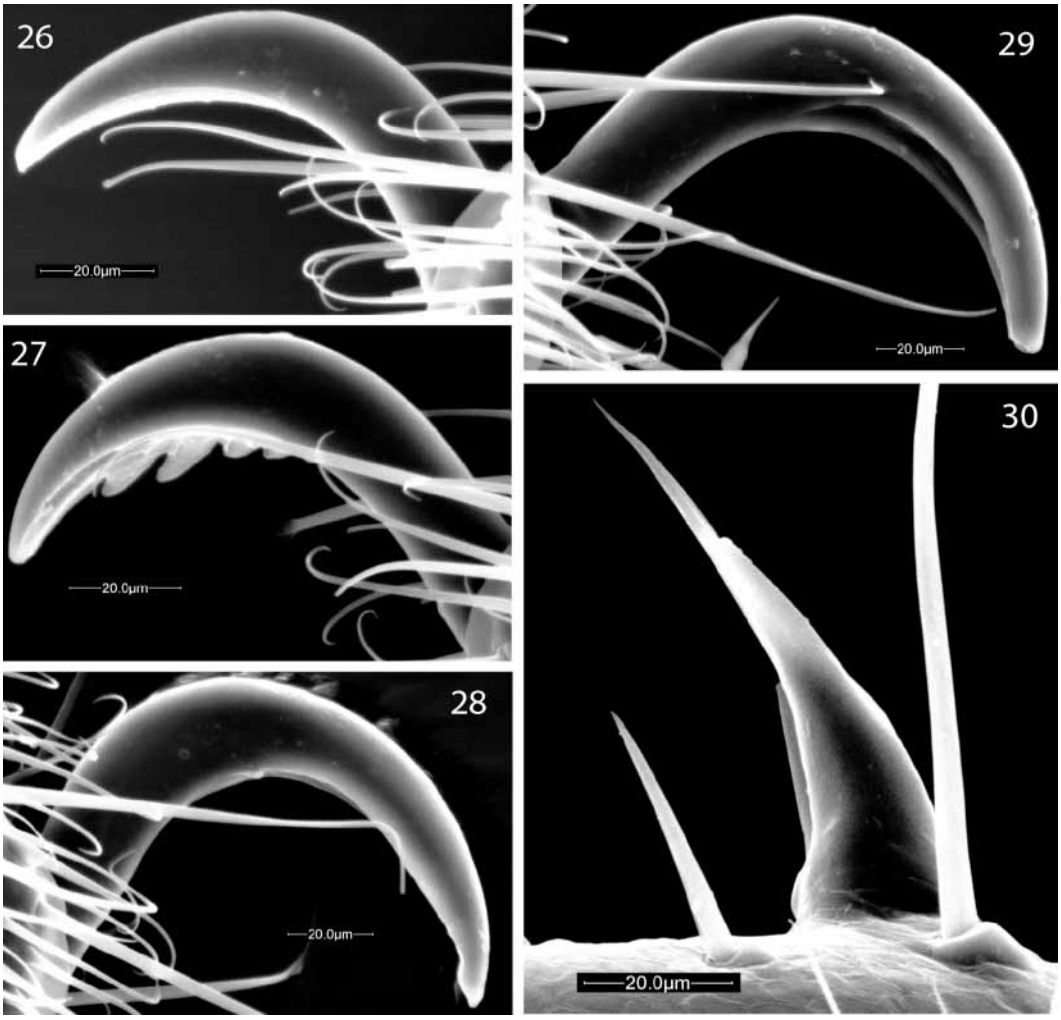
FIGURES 10–16. *Troglosiro longifossa* sp. nov. 10, Detail of sternal depression of male paratype; 11, Detail of sternal pores; 12, Spiracle of male paratype; 13, External view of left chelicera of male paratype; 14, Detail of dentition of distal cheliceral segments; 15, Ozophore of male paratype; 16, Left palp of male paratype.



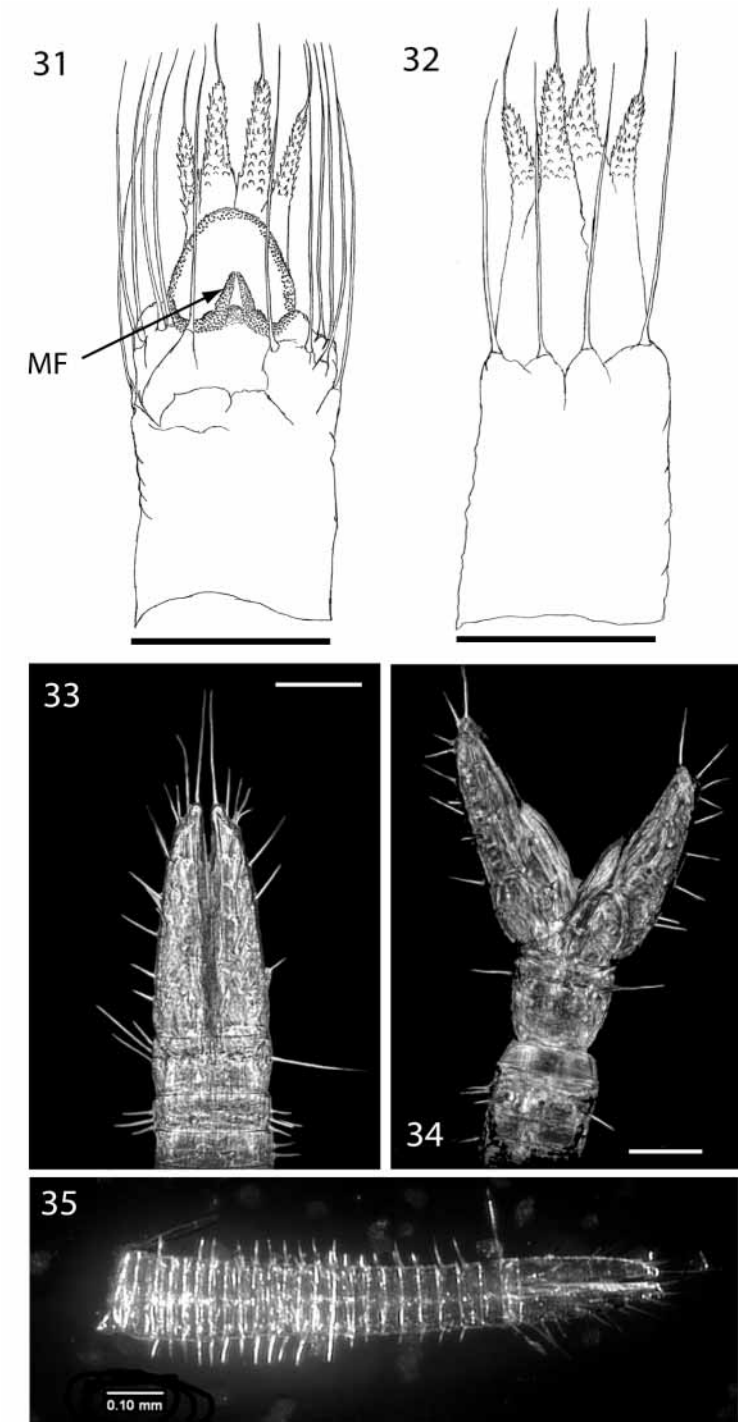
FIGURES 17–25. *Troglosiro longifossa* sp. nov. 17, Male left leg I; 18, Male left leg II; 19, Male right leg III; 20, Male right leg IV; 21, Detail of male left tarsus I; 22, Detail of male left tarsus II; 23, Detail of male right tarsus III; 24, Detail of male right tarsus IV; 25, Detail of female left tarsus IV.

Leg measurements of female paratype (MCZ 65204): length/width (length-width ratio in parentheses):

	Tr	Fe	Pa	Ti	Mt	Ta	Total
Leg I	0.16/0.16 (1.0)	0.38/0.14 (2.7)	0.24/0.15 (1.6)	0.30/0.15 (2.0)	0.19/0.13 (1.5)	0.33/0.15 (2.2)	1.60
Leg II	0.12/0.13 (0.92)	0.33/0.13 (2.5)	0.21/0.14 (1.5)	0.25/0.15 (1.7)	0.20/0.11 (1.8)	0.27/0.11 (2.5)	1.38
Leg III	0.14/0.13 (1.1)	0.28/0.14 (2.0)	0.19/0.15 (1.3)	0.24/0.15 (1.6)	0.16/0.11 (1.5)	0.24/0.11 (2.2)	1.25
Leg IV	0.17/0.14 (1.2)	0.35/0.14 (2.5)	0.21/0.15 (1.4)	0.26/0.15 (1.7)	0.19/0.11 (1.7)	0.26/0.11 (2.4)	1.44



FIGURES 26–30. *Troglosiro longifossa* sp. nov., male. 26, Left tarsal claw I; 27, Left tarsal claw 2; 28, Right tarsal claw III; 29, Right tarsal claw IV; 30, Detail of adenostyle.



FIGURES 31–35. *Troglosiro longifossa* sp. nov. 31, Total penis, dorsal view; 32, Total penis, ventral view; 33, Detail of ovipositor terminus; 34, Detail of expanded ovipositor terminus, dorsal view; 35, Total ovipositor view. Scale bars: Figs. 31–32 = 130 μm, Figs. 33–34 = 800 μm. MF: Movable finger.

Tarsi (Figs. 21–25) of all legs not appreciably ornamented. Tarsus I with a distinct solea (Fig. 21); ventral concentration of setae not significant in other legs. Tarsus IV of

males not divided, carrying a lamelliform adenostyle close to most basal region of tarsus (Fig. 24). Adenostyle 60 μm long, slightly curved, and acutely triangular (Fig. 30). Tarsus IV of female without modifications (Fig. 25). Tarsal claws I and IV smooth; tarsal claw II comb-like, with a special prolateral row of tooth-like projections; tarsal claw III with a pair of small lateral pegs near its thickest portion (Figs. 26–29).

Penis (Figs. 31–32) typical of troglosironids, with four ventral microtrichia; three dorsolateral microtrichia on each side; and six dorsal microtrichia, innermost pair somewhat distant from the midline. Apical microtrichia typical for genus, with enlarged and toothed bases fused in pairs. Ventral plate with gonopore large, semicircular, and toothed at the margin. Movable fingers with laterally protruding basal lobes and toothed margins.

Ovipositor (Figs. 33–35) composed of two apical lobes and 24 circular articles (two ovipositors studied), each article with eight equally long setae. Two terminal articles before apical lobes longer than remaining articles; setae on second terminal article ca. three times longer than more proximal setae; setae on terminal articles also longer. Each apical lobe carrying a long terminal seta, a shorter subterminal seta, and a bi- or trifurcated sensitive process. Receptacula seminis situated in an elongate chamber in the proximal half of each apical lobe.

Variation. Range of measurements in males (n=4) and females (n=8; in parentheses): Body length 1.72–1.81 (1.76–1.86), maximum width 1.01–1.06 (1.00–1.06).

Distribution. Known only from the type locality.

Discussion

Troglosiro longifossa sp. nov. is smaller than most previously described species, apart from *T. juberthiei* Shear, 1993, which remains the smallest in the genus. *T. longifossa* sp. nov. is clearly distinct in comparison to previously described species on account of the dimensions of the unique sternal opisthosomal depression and the presence of four sternal gland pores. The only other species with four sternal gland pores is *T. tillierorum* Juberthie, 1993, although the configuration of the pore openings is different in *T. longifossa* sp. nov., forming a rectangle with the openings on its edges, thereby delimiting opisthosomal sternite three, whereas in *T. tillierorum* the pores are arranged along the midline and extend to the sulcus of sternites 6 and 7. In comparison to *T. platnicki* Shear, 1993, which features deeply depressed sternites 2, 3, and 4, the depression in *T. longifossa* sp. nov. is longer, extending from sternites 3 through 7, and significantly wider. *T. longifossa* sp. nov. is also unique in the configuration of its four sternal pores, which are not located along the midline, but rather flank the midline in parallel pairs and are clearly separated. The new species is easily distinguished from *T. raveni* Shear, 1993 in the lack of a color pattern, and from *T. tillierorum* and *T. juberthiei* in the cheliceral dentition, which is irregular in these species but regular in *T. longifossa* sp. nov.

Troglosiro longifossa sp. nov. clearly belongs to the genus *Troglosiro* on the basis of a number of apomorphies listed by Shear (1993) for the taxon. The most important of these are: coxae of walking legs I and II are free, whereas III and IV are fused; the ozophores are of type 2; absence of eyes; opisthosomal sternites 8 and 9 and tergite IX are fused into a corona analis; tarsal claw II is toothed; the adenostyle is lamellar; and the opisthosomal sternites bear small exocrine gland pores.

Troglosironidae have been suggested to present affinities or an explicit relationship to both Pettalidae and Sironidae (Shear 1979; Shear 1993; de Bivort and Giribet 2003), but molecular data have suggested otherwise (Giribet and Boyer 2002; Boyer et al. 2005). The relationship suggested by the molecular data supports homology of the different opisthosomal sternal glands found in Troglosironidae, Ogoveidae Shear, 1980 and Neogoveidae (see Giribet and Prieto 2003), a possibility rejected by Juberthie (1993). Interestingly Juberthie (1979: 229) considered the possibility of homology of the opisthosomal sternal glands of *Troglosiro* and the anal glands of other Cyphophthalmi, typically those of Sironidae and Pettalidae (Juberthie 1979; Shear 1980), but also known in Stylocellidae Hansen and Sørensen, 1904 (see Rambla 1994; Schwendinger et al. 2004) through a migration of the gland opening. de Bivort and Giribet (2004) already described the variation observed in the opening of the anal gland pores in Sironidae, Pettalidae and Stylocellidae (de Bivort and Giribet 2004: character 42), which can be located on tergites VIII, IX, or both. The homology of these two glands is certainly worth studying in the future and a case for their homology is the absence of any specimens with both sets of glands.

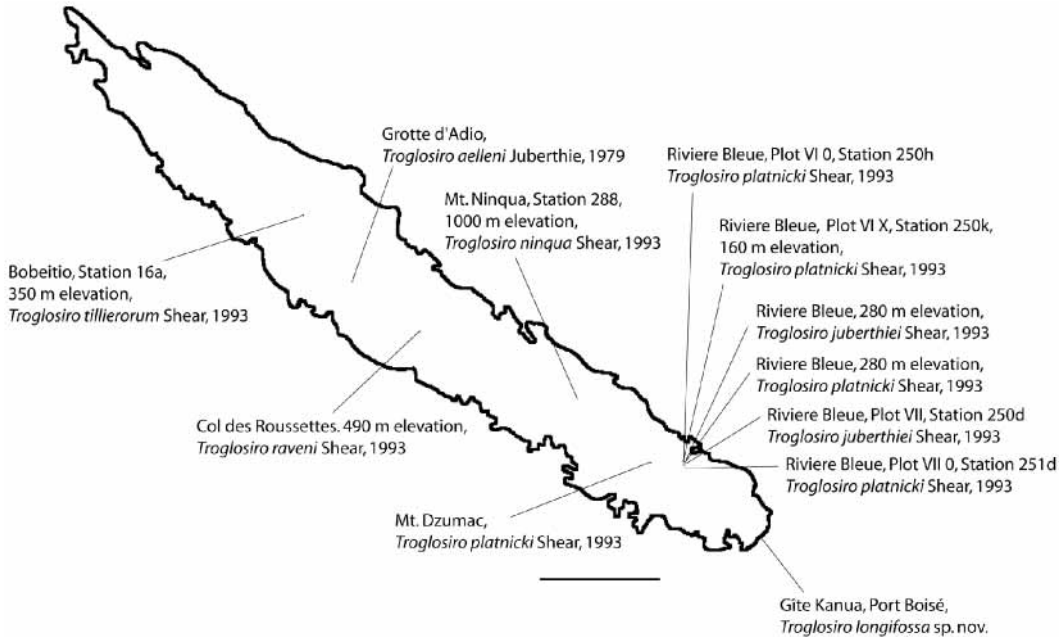


FIGURE 36. Map of New Caledonia showing known localities for *Troglosiro* species. Scale bar = 50 km.

In addition to the described *Troglosiro* species (refer to locality map of all described species in Fig. 36), as many as six additional new species may be available for description and study from the 2000–2002 collecting trips to New Caledonia by G.B. Monteith. The occurrence of these species in a relatively small area suggests significant diversity of the cyphophthalmid fauna in New Caledonia. Due to the species small size and leaf-litter habitat, it is probable that additional species could be discovered in the south Pacific region. Studying this fauna could be of extreme importance not only for characterizing a putative radiation in New Caledonia, but also for elucidating the biogeographical history of the island.

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