

Troglobius coprophagus, a new genus and species of cave Collembola from Madagascar, with notes on its ecology

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SUMMARY

Troglobius coprophagus n. g., n. sp. a cave Collembola from Madagascar is characterized by an elongate and serrate mucro, a non spines dens. Description and illustrations of the new genus and species are given. Some ecological data of this highly cave adapted species is also included.

Much excellent work has been published on the Symphypleona of Madagascar (Betsch, 1980) but the Arthropleona Collembola, which make up most of the order and are most often found in caves, have received little attention. Indeed, only about eight species have been recorded from Madagascar (Börner, 1907; 1913; Denis, 1925 and 1929; Delamare-Deboutteville, 1948).

Ankarana is a small limestone massif in the extreme north of Madagascar, about 70 km south of Antsiranana (Diego-Suarez). The 98 km of surveyed passages within it represent the largest and most extensive cave systems in Madagascar and probably in the whole tropical Africa. These numerous caves provide many diverse subterranean habitats for cave adapted animals. Some passages, dried to a humidity of only 50% by through draughts, contain 10 m high guano beds dominated by *Periplaneta americana* while others are filled with clean silt and the humidity approaches 100%.

In 1981 members of a Southampton University Expedition (Wilson, 1985; Wilson, 1987a), carried out the first study of the ecology of a

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Malagasy cave and at this time collected two new Troglopedetine cave-adapted Collembola. Further field work was carried out in 1986 by members of the Crocodile Caves of Ankarana Expedition (Wilson, 1987b). One Collembola species, *Troglopedetes madagascarensis* has been described elsewhere (Wilson, 1982). The other did not fit into any known genus and is described here.

The richest site for collecting both *Troglopedetes madagascarensis* (*Cyphoderopsis madagascarensis*, after Thibaud & Najt, 1988), and the new genus and species, was in the dark zone of the 11 km cave known as La Grotte d'Andraliabè. About one kilometre into this cave is a roost of several hundred leaf-nosed bats *Hipposideros commersoni* and beneath this roost there is an abundance of organic material (guano and carcasses) which enables fungi to grow. This provides food for the Collembola and other detritivores. Sympatric invertebrates on these guano beds included other Collembola: *Isotomiella minor* and a species close to *Xenylla yucatanica* Mills, 1938; also woodlice: *Synarmadillo madagascariensis*, and undescribed troglobitic millepedes. These detritivores fall prey to mites, ants (*Pheidole megacephala*), and pigmented centipedes (*Cormocephalus lambertoni*).

At this particular site in the cave, the temperature is constant at about 25° C and the humidity is almost 100%. The two Collembola are active, white, glistening, insects which are able to jump 5 cm with ease. They were observed grazing on fungi, specially that growing on bat carcasses. Collembola cease moulting when starved, so the finding of abundant exuviae at this site indicates that they are gaining adequate nutrition from this source.

Living examples of both species were kept at ambient temperatures and 100% humidity by putting them in small containers lined with damp plaster of Paris mixed with charcoal. These were kept cool in the shade of the cave entrance, but both *C. madagascarensis* and the new *Troglobius coprophagus* died within 24 hours of being brought out to the entrance zone implying they are very temperature sensitive.

The two Collembola were found, in lesser numbers, in other locations within caves of the Ankarana limestone massif where the humidity was around 100% and fungus was growing.

Troglobius n. gen.

Diagnosis

The new genus can be differentiated from other Paronellids because: in the labial chaetotaxy there is not setae "r"; the mucro is elongate, with many serrations, and the dens lacks rows of spines.

Type species

Troglobius coprophagus, n.g., n. sp. from Grotte d'Andraliabè, Ankarana, Antsiranana, North Madagascar.

Discussion

All the known species of *Troglopedetes*, s.l. (Cf. Palacios-Vargas, Ojeda & Christiansen, 1985; Wilson, 1982), have one or two rows of dorsal spines on the dens, the new genus *Troglobius* lacks such spines, and only has setae and scales. Old World species of *Troglopedetes*, have antennal segment IV subdivided (recently Thibaud & Najt, 1988 have confined the *Troglopedetes* to the species with Ant. IV subdivided). The new genus also has a sub-divided fourth antennal segment. Labial chaetotaxy is more similar to some *Pseudosinella* than to the paronellids or cyphoderids.

Perhaps this genus deserves the creation of a new tribe between the Cyphoderidae and Paronellidae, but a revision of the group is necessary first.

Troglobius coprophagus n. sp. (Figs. 1-11)

Description

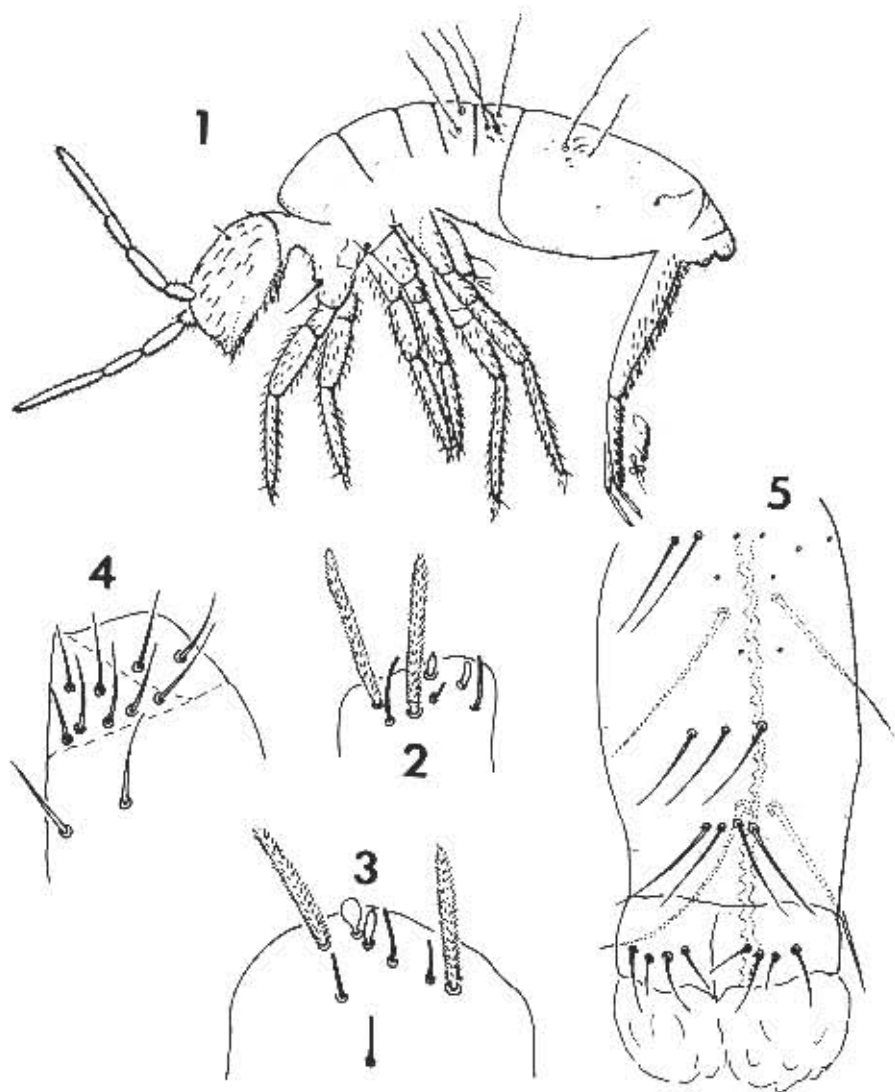
Habitus of Cyphoderidae (Entomobryoidea) (Fig. 1). Length 1.4 mm (0.9-1.4 mm). Blind without pigment. Body with smooth or ciliated setae, scales and some trichobothria. Antennae with sensillae of different size and shape.

Ratio of antenna to head = 1.7:1.0 and antenna to body length = 1:2.3. Antenna without scales. Ratio of antennal segments I-IV as = 1:1.2; 5.6; 13.3 (i.e. 5%; 6%; 27%; 63%). Ant. II with some sensilla differentiated (Fig. 2), as in *Troglopedetes*. Sensory organ of Ant. III, with two different microsensilla (Fig. 3). Ant. IV unsegmented, with rows of setae and sensilla, without apical bulb.

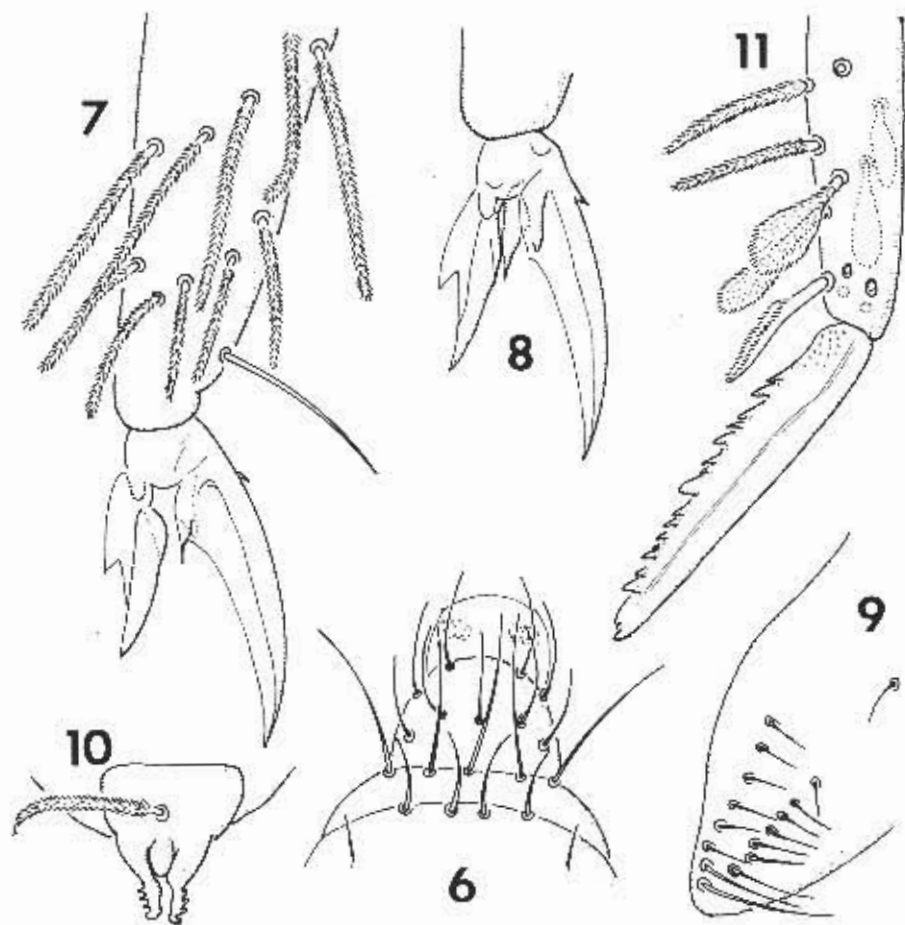
Head without any trace of eyes or pigment, with two pairs of trichobothria. Labrum with 4 rows of smooth setae (Fig. 6); all the setae are smooth. Labral formula is: 4:5/5/4. Labial triangle with four smooth setae on row A. In posterior row, there is no seta "r". Posterior setae smooth can be named: M1, M2, E, L1 and L2 (Fig. 4).

Distribution of body trichobothria is two on the second segment and three on the third and fourth abdominal segments (Fig. 1). Head, thorax, abdomen, and furcula with scales. Legs with ciliated setae. Coxa of leg with one large seta. Trochanteral organ with at most 17 setae (Fig. 9). Tenent hairs are shorter than ventral unguis and acuminate (Fig. 7); unguis with two inner basal winged teeth of different size; no median inner teeth and with a very small outer tooth. Unguiculus with outer lamella very developed and the inner small (Figs. 7 and 8).

Posterior part of ventral tube with several long setae and 4 distal pairs of small setae; anterior part with only two pairs of very large setae (Fig. 5). Tenaculum with 4 + 4 teeth and only one ciliated setae on the corpus (Fig. 10). Furcula composed of manubrium, dens and mucro in the ratio 5.7; 3.4; 1.0 (i.e. 56%; 34%; 10%). Dens without spines, but



Figs. 1-5 — *Troglobius cuprophagus* n. gen. n. sp. 1, habitus; 2, sensorial organ of Ant. II; 3, sense organ of Ant. III; 4, labial triangle; 5, ventral tube.



Figs. 6-11 — *Troglabius coprophagus* n. gen. n. sp. 6, labrum; 7, tibiotarsus and claw of leg I; 8, unguis and unguiculus of leg I; 9, trochanteral organ; 10, tenaculum; 11, distal part of dens and mucro.

with ciliated setae and scales. Mucro is elongated and bears four large teeth, and numerous serrations, from 8 to 24.

Discussion

Troglobius coprophagus lacks eyes and pigment, and has a highly modified foot complex. Like some cave species of *Troglopedetes*, and *Pseudosinella* has ungues without inner median teeth, and a relative short and acuminate tenent hair. Consideration of these features, combined with the difficulties of maintaining them outside of the cave environment, leads us to assume that *Troglobius coprophagus* is a troglomorphic species, highly adapted to life in caves.

Type material

The holotype and 8 paratypes are held the senior author, 19 paratypes are deposited at the British Museum (Natural History) London (Brit. Mus. 1982-160) and 12 have been deposited in the Malagasy National Collection, Parc Tsimbazaza, Antananarivo, Madagascar.

Type locality

La Grotte d'Andrafiabé cave system, about 4 km from Andrafiabé village, Ankarana Massif; 70 km south of Antsiranana, North Madagascar.

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LITERATURE CITED

- BESTCH, J.-M. 1980. Eléments pour une monographie des collemboles Symphylecones (Hexapodes, Aptérygotes). Mém. Mus. natn. Hist. nat. (Paris) (A) 116: 1-205.
BÖRNER, C. 1907. Collembolen aus Ostafrika und Süd America. In Voeltzkow, Reise in Ostafrika in der Jahre 1903-1905 (Stuttgart) 11: 147-177.
BÖRNER, C. 1913. Zur collembolenfauna Java. Tijdschr. v. entom. (Netherlands) 56: 44-61.
DELAMARE DEBOUTEVILLE, C. 1948. Collemboles de Madagascar. Bull. soc. entom. France 53 (3/4): 38-46.
DENIS, J. R. 1925. Sur deux Collemboles de Madagascar. Bull. Mus. Nat. Hist., Paris 5: 104-1-6.
MILLS, H. B. 1938. Collembola of Yucatan caves. Carnegie Inst. Wash., Publ. 491: 183-190.

- PALACIOS-VARGAS, J.G., M. OJEDA & K.A. CHRISTIANSEN. 1985. Taxonomia y Biogeografía de *Troglopedetes* (Collembola: Paronellidae) en América, con énfasis en las especies cavernícolas. *Folia Entomol. Mex.* 65: 3-35.
- THIBAUD, J. M. & J. NAJT. 1988. Collembola (Insecta) de l'Equateur. IV. Paronellidae avec révision de quatre genres. *Bull. Mus. natn. Hist. nat., Paris* (4a.) 10, Sect. A. (4): 719-730.
- WILSON, J. M. 1982. A review of world *Troglopedetini* (Insecta, Collembola, Paronellidae) including an identification table and descriptions of new species. *Cave Science* 9 (3): 210-226.
- WILSON, J.M. 1985. Ecology of the Crocodile Caves, Madagascar. *Cave Science* 12 (4): 135-138.
- WILSON, J.M. 1987a. The Crocodile Caves of Ankarana, Madagascar. *Oryx* 21 (1): 43-47.
- WILSON, J.M. 1987b. The Crocodile Caves of Ankarana: Expedition to Northern Mad, 1986. *Cave Science* 14 (3): 107-119.