Chthonius (Chthonius) minotaurus (Heterosphyronida, Chthoniidae), a new troglobitic pseudoscorpion from Crete

Hans Henderickx

Abstract. *Chthonius (Chthonius) minotaurus* **sp. n.**, an eyeless troglobitic pseudoscorpion discovered in a limestone cave in Crete, is described.

Samenvatting. *Chthonius (Chthonius) minotaurus* **sp. n.**, een blinde troglobionte pseudoschorpioen, gevonden in een kalkgrot op Kreta, wordt beschreven.

Résumé. *Chthonius (Chthonius) minotaurus* **sp. n.**, une nouvelle espèce de pseudoscorpion anophtalme, trouvée dans une cave calcaire en Crête, est décrite.

Key words: Pseudoscorpion - cavernicole fauna - *Chthonius (Chthonius) minotaurus* - new species - Crete.

Henderickx, H.: Hemelrijkstraat 4, B-2400 Mol, Belgium.

Introduction

Cave dwelling pseudoscorpions are well represented on Crete. The relatively constant microclimate of low temperature and high humidity provides survival possibilities for small and local populations. The epigeic ancestors might have been widespread in times of high humidity before the Pleistocene ice ages, resulting in cavernicolous relict populations nowadays. In July 1996 an expedition to Crete was organised to examine such populations.

A number of cavernicolous species were collected, most of them troglophylic or troglotoxenous. The majority of the invertebrates were found near the cave entrances, amongst moss and organic detritus where they made advantage of the moisture and lower temperatures.

On 7 July 1996 the "Kournas cave" (fig. 1), a limestone cave in NW Crete was examined. In a deep gallery a depigmented *Chthonius* adult male specimen was found, completely anophthalmous, with prolonged pedipalps, all characteristics of a true troglobiont.

Mahnert (1980) mentions eight *Chthonius* species from caves on Crete, six of them belonging to the subgenus *Ephippiochthonius*, two to the subgenus *Chthonius* s. str. The absence of a dorsal depression on the hand of the pedipalps assigns the species from the Kournas cave to the latter subgenus.

Chthonius (*Chthonius*) *lindbergi* Beier, 1956 from the Neraido Spilia cave near Iraklion differs clearly from the species of the Kournas cave in the shape of the pedipalp. Smaller differences could be noticed between the captured species and the illustration in the original description of *Chthonius* (*C.*) *herbarii* Mahnert, 1980. The latter is a troglobitic species from the Aghios Ioannis cave on the peninsula Akrotiri, about 40 km NW from the Kournas cave. It was possible to trace and collect some adult specimens of *C. herbarii* in the type locality during the same expedition, so an adult male of *C. herbarii* could be compared in detail with the male specimen from the Kournas cave. The latter species differs clearly from *C. herbarii* in relative length of the fixed finger of the pedipalp and in dentition of the movable finger. Therefore, the former specimen must be regarded as an undescribed species that is described hereafter.

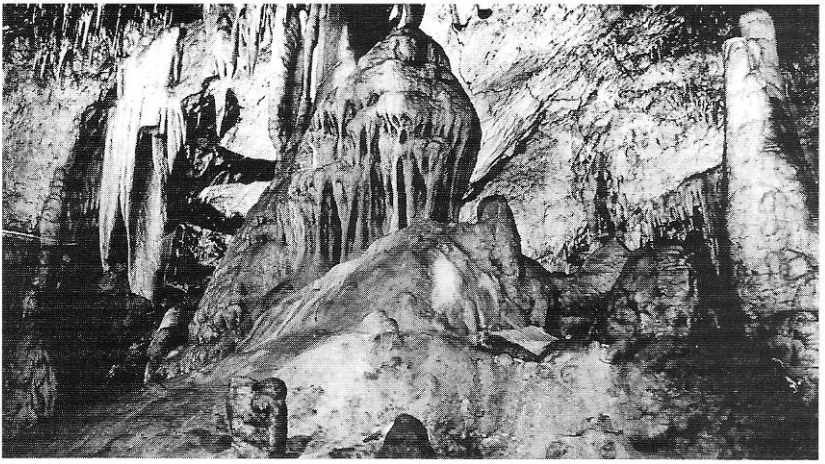

Fig. 1: Inside view of the type-locality of *Chthonius* (*Chthonius*) *minotaurus* **sp. n.**, Kournas cave, Crete.

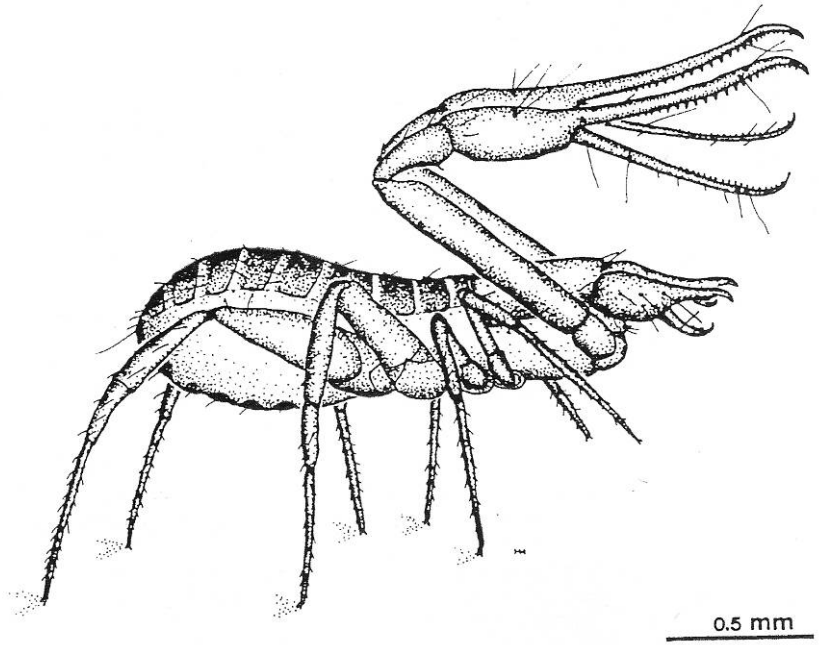

Fig. 2: *Chthonius* (*Chthonius*) *minotaurus* **sp. n.**, holotype ♂, habitus.

***Chthonius (Chthonius) minotaurus* sp. n.**

Holotype ♂, Crete, Kournas cave, 35°19'00"N, 24°17'13"E, 250 m, 7.VII.1996, H. Henderickx leg., deposited in the Royal Belgian Institute of natural Sciences, Brussels.

Description. Habitus as illustrated (fig. 2). Cream white, cephalothorax, tergites and fingers of the pedipalp pale brownish, sclerotised. Total length (excluding chelicerae) 1.6 mm.

Carapace (fig. 3a) subquadrate (0.49 mm long, 0.47 mm wide), glossy, with 18 setae, two of which are on the posterior margin. Setal formula 4-6-4-2-2. Epistome absent, but the anterior margin of the cephalothorax has small serrations. No trace of eyes.

Abdomen of usual Chtoniid facies. Tergal chaetotaxy 2-4-4-4-6-6-6-6-6-4 (fig. 3c).

Chelicerae (fig. 3b) carrying 6 setae and 2 microsetae plus 1 seta on the movable finger. Fixed finger with respectively (towards the apex) a dentate comb (8 rudimental teeth), 1 large and 1 smaller tooth. Movable finger with respectively a row of 6 small teeth, 1 isolated large tooth and 1 small sharkfin-like apical tooth. Galea represented by a low convex tubercle.

Pedipalpcoxa 3 setae, coxa I 3 setae + 3 setae on the inner edge, coxa II 4 + (7-8) setae, coxa III 5+4 setae, coxa IV 6 setae. Intercoxal tubercle 2 setae.

Anterior genital opercula 6 setae, posterior opercula 12 setae.

Sternite IV 10 macrosetae and 2 small lateral setae, sternite V 6 + 2 setae, the next 4 + 2 setae, last segment with 4 short plus 2 long setae.

Pedipalps (fig. 4a): femur (0.89 x 0.13 mm) 6.84 times as long as broad and 0.31 larger than tibia (0.28 x 0.14 mm). Hand without dorsal depression. Total length of hand + fixed finger 1.24 mm, hand without finger (0.42 x 0.16 mm) 2.62 times as long as broad.

Fixed finger (0.82 x 0.04 mm) 1.95 times longer than movable finger. Fixed finger with 30 erect and pointed teeth, larger towards the apex. Movable finger with 23 erect teeth and 15 rudimental teeth towards the hand. Both fingers with terminal claw. **ist** clearly distally from **esb, sb** closer to **b** than to **st.**

Pedal proportions:

Leg I: femur I (0.35 x 0.06 mm) 5.83 times as long as broad; tibia I (0.22 x 0.05 mm) 4.4 times as long as broad; metatarsus I: 0.21 x 0.33 mm; tarsus I: 0.33 x 0.05 mm.

Leg II: femur II (0.35 x 0.06 mm) 5.83 times as long as broad; tibia II (0.20 x 0.05 mm) 4 times as long as broad; metatarsus II: 0.18 x 0.05 mm; tarsus II: 0.27 x 0.04 mm.

Leg III: femur III (0.56 x 0.10 mm) 5.6 times as long as broad; tibia III (0.33 x 0.07 mm) 4.71 times as long as broad; metatarsus III: 0.19 x 0.05 mm; tarsus III: 0.50 x 0.04 mm.

Leg IV: femur IV (0.63 x 0.10 mm) 6.3 times as long as broad; tibia IV (0.38 x 0.08 mm) 4.75 as long as broad; metatarsus IV: 0.21 x 0.05 mm; tarsus 0.52 x 0.04 mm.

Diagnosis. Males of the new species can be distinguished by the shape and chaetotaxy of the pedipalp and the carapace. The teeth on the movable finger differ significantly from the allied *Chthonius* (*Chthonius*) *herbarii* Mahnert, 1980. The new species can be distinguished from epigean *Chthonius*-species by the absence of eyes.

Etymology. Minotaurus is a noun in apposition, referring to the legendary creature Minotauros, sun of Pasifaë, who was locked up in the labyrinth under the palace of king Minos of Crete.

Distribution. The species is known only from the type locality.

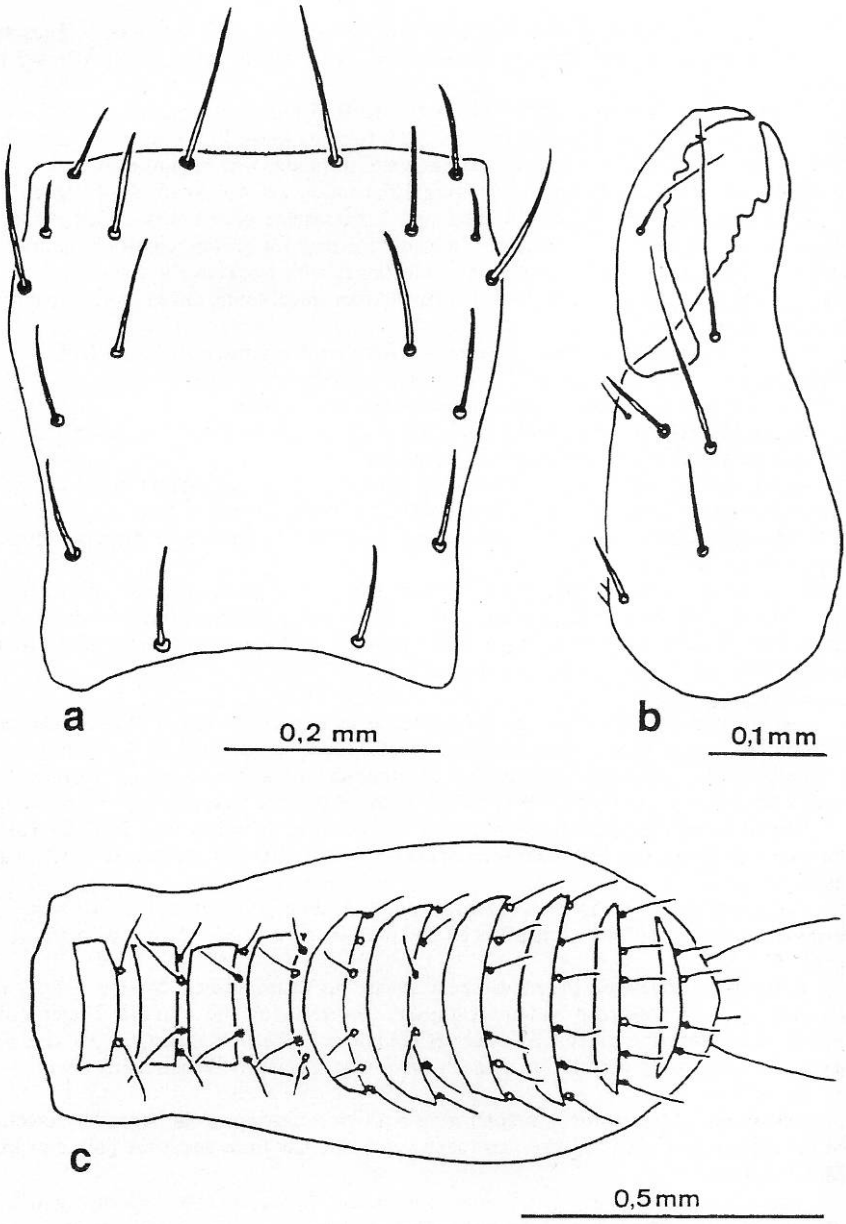

Fig. 3: *Chthonius* (*Chthonius*) *minotaurus* **sp. n.**, holotype ♂, a. carapace, b. dorsal view of left chelicera, c. dorsal view of opisthosoma..

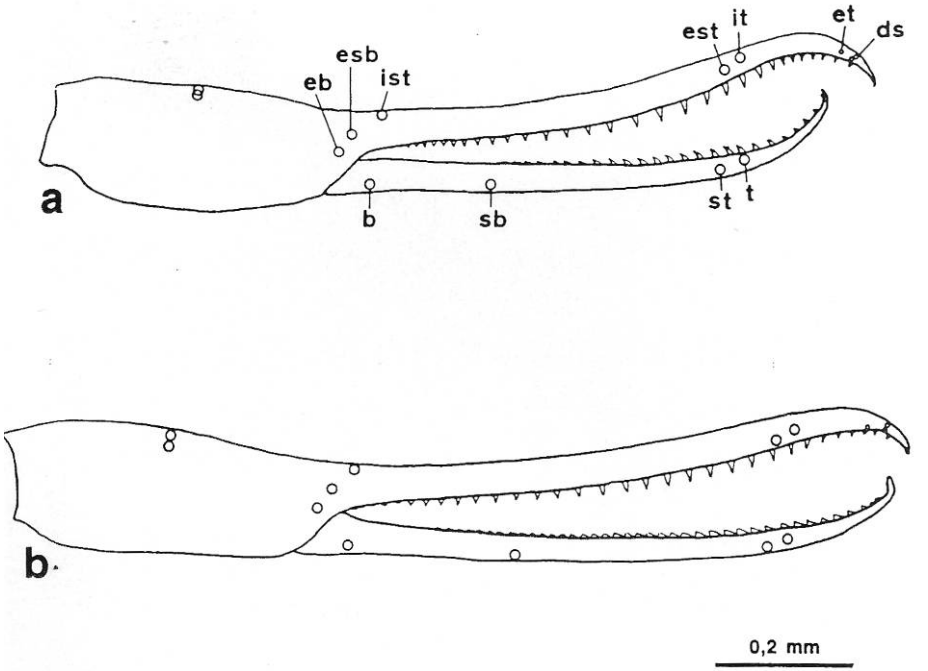

Fig. 4: Lateral view of the hand of the right pedipalp; a. *Chthonius* (*C.*) *minotaurus* **sp. n.**, holotype ♂ (Crete, Kournas Cave, 7.VII.1996); b. *Chthonius* (*C.*).*herbarii* Mahnert, 1980 (Crete, Aghios Ioannis Cave, 8.VII.1996).

Discussion

The new species is closely related to *C.* (*C.*) *herbarii*. The teeth towards the apex of the movable finger are erect and pointed, while *C.* (*C.*) *herbarii* shows sharkfin-like teeth in the same area (fig. 5a). The fixed finger of the hand is more elongated in the case of *C.* (*C.*) *minotaurus* **sp. n.** (fig. 4a). Because of this elongated shape, the trichobotria are inserted in a more distal position. **Est** and **it** are situated more distal than **st** and **t**. In the case of *C.* (*C.*) *herbarii*, these pairs of trichobotria are located almost opposite of each other (fig. 5a). The pedipalp femur of both species differs in size: it is relatively longer in the case of *C.* (*C.*) *herbarii* (7.7–8.3 times longer than broad according to Mahnert 1980, 8.5 times with our *C.* (*C.*) *herbarii* specimen and only 6.84 times with *C.* (*C.*) *minotaurus* **sp. n.**).

C. (*C.*) *sestaesi* Mahnert, 1980 from the Greek mainland (Ossa mountains), which also shows an elongated fixed finger, differs from *C.* (*C.*) *minotaurus* **sp. n.** in chaetotaxy of the carapace (4 setae on the posterior margin). The pedipalp femur is more elongated (8.2–8.4 times longer than broad in males according to Mahnert 1980).

The nearest cave where a troglobitic *Chthonius* was found is situated on a peninsula, 40 km from the Kournas cave. *C.* (*C.*) *minotaurus* **sp. n.** shows extreme adaptations to cave life, and is obviously an obligate troglobiont, so it can be considered geographically completely isolated.

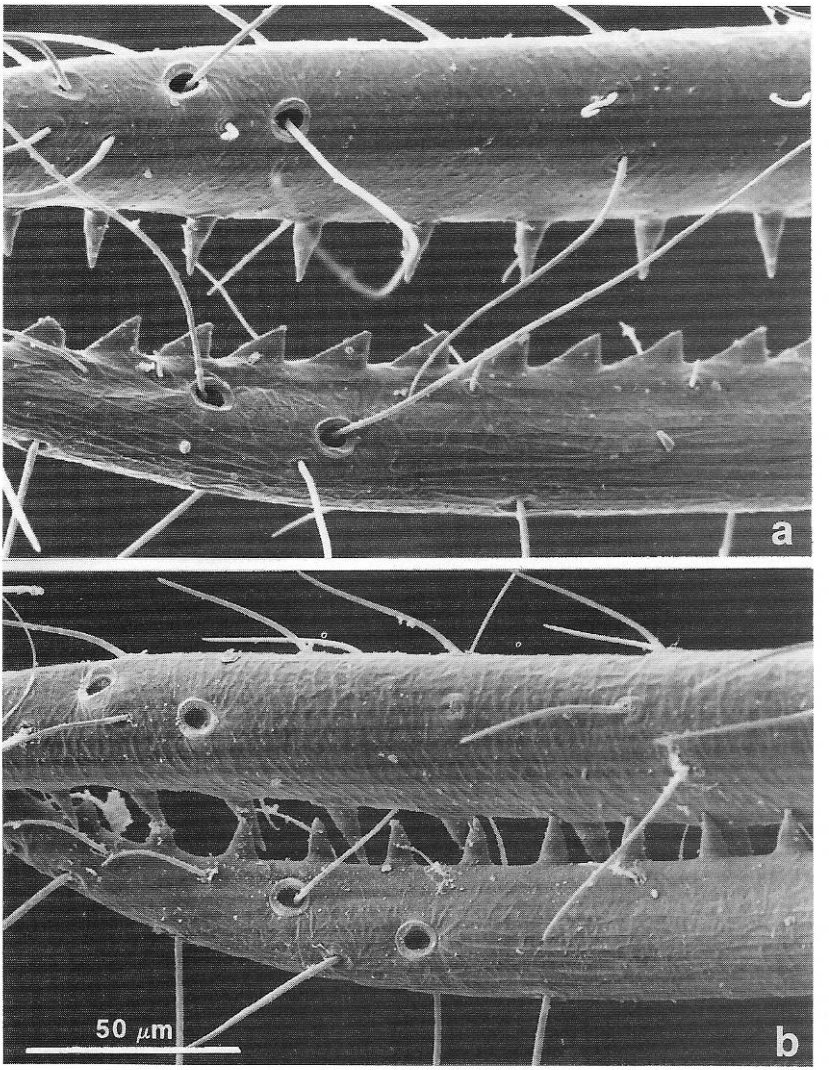

Fig. 5: Dentition on movable and fixed finger; a. *Chthonius* (*C.*) *herbarii* Mahnert, 1980 (Crete, Aghios Ioannis Cave, 8.VII.1996); b. *Chthonius* (*C.*) *minotaurus* **sp. n.**, holotype ♂ (Crete, Koumas Cave, 7.VII.1996).

In comparison with the epigean *Chthonius* species *C.* (*C.*) *minotaurus* **sp. n.** shows strong adaptations to cave life. Most striking are the loss of eyes and pigmentation and the increase in pedipalp length. These morphological changes must be considered as the result of an evolutionary process.

The mechanisms behind this process have been discussed in different theories. Now, intensive studies of all kinds of troglobitics are revealing parts of it. The factors behind eye atrophy in blind mole rats (*Spalax* sp.) have been illuminated by Eviatar Nevo and colleagues (Diamond 1996). Without most of the brains visual structures, *Spalax ehrenbergi* saves at least 2% of its energy budget, and the free brain space is used for the exquisite development of other sensory modalities. The drastic reduction or complete loss of eyes in some troglobitic pseudoscorpions in combination with the expansion of sensory capabilities might be explained in this way. In a completely dark environment with only a scarce food supply, predators need the maximum of their sensory modalities to find prey.

Biology and ecology

In spite of intensive search only one specimen could be found. Such rare occurrence is not unusual in cave environments, where the lack of food necessarily leads to populations of low density. The specimen was found in a small crevice between the cave wall and a stalagmite, under small pieces of stone. Some decaying organic detritus had fallen into the crevice and was used as food by Collembola and small Coleoptera, that are probably elements in a small ecosystem. Since there was no presence of Chiroptera in the cave, the pseudoscorpion and some spiders appear to be on top of this ecosystem.

The discovery of *C.* (*C.*) *minotaurus* **sp. n.** together with some other discoveries made in the Kournas cave, should contribute to a revalidation of this cave, which seems to contain an ancient ecosystem of important biological value.

Acknowledgements

The author is very grateful to Ilias Kaniadakis, keeper of the Kournas cave, who allowed to study the caves fauna. He is also indebted to Pavlos Lydakis for his generous hospitality. Fruitful discussions about troglobitic animals with Dr. Narcisse Leleup, Gijs Verkerk and Jan Bosselaers are also gratefully acknowledged. Thanks are also due to Anna Petrochilou for her kind advices concerning the caves, to the Laboratoire Souterrain du C.N.R.S. in Moulis and to Aline Raeymakers who spent long hours with the author in the caves.

References

Diamond, J., 1996. Competition for brain space. — *Nature* **382**: 756–757.

Mahnert, V., 1980. Pseudoscorpione (Arachnida) aus Höhlen Griechenlands, insbesondere Kretas. — *Archives des Sciences, Genève* **32**: 213–233.