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A new troglobitic milliped of the genus *Nepalella* from China (Diplopoda, Chordeumatida, Megalotylidae)

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ABSTRACT

Chordeumatid millipeds, undoubtedly very diverse in China, have only recently been discovered there, in the form of troglobites. *Nepalella caeca*, n. sp., (Megalotylidae) represents a new generic and familial record for China and is also the first troglobitic megalotylid to be discovered. The cave from which this species was collected evidently also hosts at least two more distinct species of troglobitic chordeumatids, but only female specimens were available for study.

INTRODUCTION

Chordeumatid millipeds have been found in abundance and variety in the Russian Far East, Nepal, Viet Nam, Thailand, Myanmar, Korea and Japan – all regions immediately adjacent to China. At least two species of the order have been found in Taiwan (Shear, 1999). But until 1998, no definitive record of a chordeumatid milliped from China had been published (D. Wang & Mauriès, 1996)¹. Mauriès & Nguyen Duy-Jaquemin (1997) have now described a new species of Vieteumatidae from a Chinese cave.

¹ Y. Wang & Chamberlin (1953) reported a specimen of the genus *Craspedosoma* intercepted at quarantine in Ottawa, Canada, in a cargo from China. This specimen could no longer be traced and is undoubtedly not a member of *Craspedosoma*, a genus known only from western Europe.

Through the kindness of my colleagues Sergei Golovatch (Moscow) and Alessandro Minelli (Padova), I was privileged to study a small collection of chordeumatid millipeds taken in Anjia Yan Cave, Shuicheng, Guizhou Province, China. These specimens were collected by the expedition "China Caves '94", led by Dr. Roberto Zorzin (Verona).

Three species were included, all highly adapted to a troglobitic existence, but unfortunately only one of them was represented by males. This species is described below as *Nepalella caeca*, n. sp.

Family Megalotylidae Golovatch

Megalotylidae Golovatch 1978 in Golovatch and Mikhajlova, Bull. Soc. Natural. Moscow 83:69; Shear 1987, Courier Forsch.-Inst. Senckenberg 93:237 (complete references).

The family Megalotylidae was erected by Golovatch in 1978 for the monotypic genus *Megalotyla* Golovatch & Mikhajlova, from the Russian Far East. In 1983, Golovatch argued for the inclusion of the subfamily Nepalellinae Shear (originally described under Conotylidae) in this family, largely because of the extreme reduction of the anterior gonopods to a sternal plate with two short lateral processes, and the retention in some species of coxal glands on legpair II of males (though the latter character is probably plesiomorphic). In 1987 I concurred with Golovatch's placement; the monobasic subfamily name Nepalellinae now seems superfluous in light of the evident close relationship between *Megalotyla* and *Nepalella*.

The affinities of the family are quite obviously with the North American-northeast Asian Conotylidae, with which they share many features of gonopod design. Indeed the megalotylids seem to represent the apex of a trend in the conotylids to the reduction of the anterior gonopods. *Conotyla atrolineata* (Bollman) and *C. albertana* (Chamberlin), both from western Canada, have much-reduced anterior gonopods, which may be at least partially fused to their sternum (Shear 1971)².

Genus *Nepalella* Shear

Nepalella Shear 1979, Senckenbergiana biol. 60:126 (type species, *N. khumbua* Shear, by original designation). Shear 1987, Courier Forsch.-Inst. Senckenberg

² Loomis & Schmitt (1971) described *Brunsonia complexipes* from Montana, a synonym of *Conotyla atrolineata* Bollman. Hoffman (1979, p. 128) has recognized the generic name *Brunsonia* for "two species, British Columbia, Alberta, Montana", obviously referring to *atrolineata* and *albertana* Chamberlin. In my opinion, these two species should remain in *Conotyla*.

93: 237. Golovatch 1984, Acta zool. Acad. Sci. Hungar. 19: 123. Mauriès 1988, Rev. suisse Zool. 95: 26.

Nepalella contains 13 species from the Nepal Himalaya, Vietnam, Thailand and Myanmar (Shear 1979, 1987; Golovatch 1983; Mauriès 1988). Undoubtedly many more remain to be discovered.

Males of *Nepalella* species have the anterior gonopods reduced to an oval or quadrangular coxosternal shield, with the sternal part largely relegated to the posterior surface; from the distoposterior edge extend two long, acute processes which pass laterally between the posterior gonopod colpocoxites and coxae or prefemora. Originally I called these telopodites but I am no longer at all sure of that homology and now think these processes are probably reduced coxites, true telopodites having been lost from conotyloid gonopods early on. The posterior gonopod telopodites are only somewhat reduced (quite large in a few species), and at least three species retain small (vestigial?) coxal glands on legpair 11; those on legpair 10 are large and obviously functional.

In *Megalotyta brevichaeta* Golovatch & Mikhaljova, the anterior gonopods are reduced to a simple, subrectangular coxosternal plate, slightly produced at the distolateral margins, the telopodites of the posterior gonopods are significantly reduced, and the posterior gonopod colpocoxites are rather simple. Coxal glands appear on both legpairs 10 and 11 of males, which have somewhat reduced telopodites.

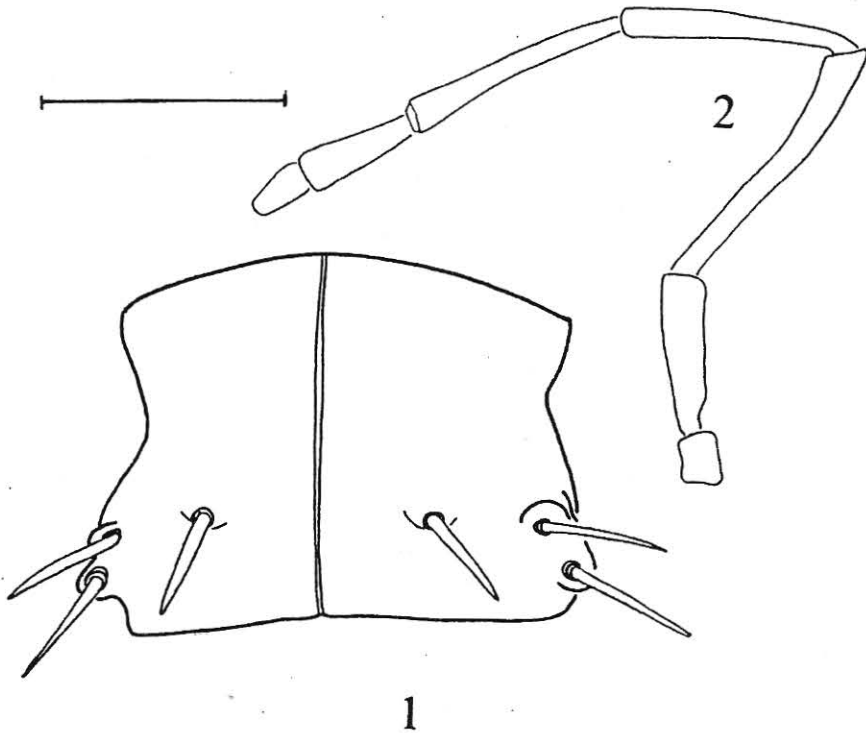
Mauriès (1988) described several species of *Nepalella* with strongly modified male tenth coxae and enlarged tenth coxal glands, remotely suggestive of the enlarged glands and coxae of males of the family Metopidiotrichidae (see Shear & Mesibov, 1997). However, I see this as a parallel development, since the telopodites of the tenth legs are not reduced in *Nepalella* as they are in metopidiotrichids, and the glands are clearly not sclerotic. The spermatophores they form are small and of a simple cap-like shape, not large, complex and species-specific in form as they are in at least some, if not all, metopidiotrichids. Nevertheless these observations add to the growing evidence for a coherent group of families including Heterochordeumatidae, Metopidiotrichidae, Eudigonidae, Megalotyliidae, Adritylidae and Conotylidae.

***Nepalella caeca*, n. sp**

Figs. 1-7

Types: Male holotype, male and female paratypes from China, Guizhou Province, Shuicheng County, Cave Anjia Yan, collected July 1994 by R. Zorzin ("China

Caves 94"). Deposited in the Zoological Museum of the University of Moscow. The specific epithet, an adjective, means "partially blind."

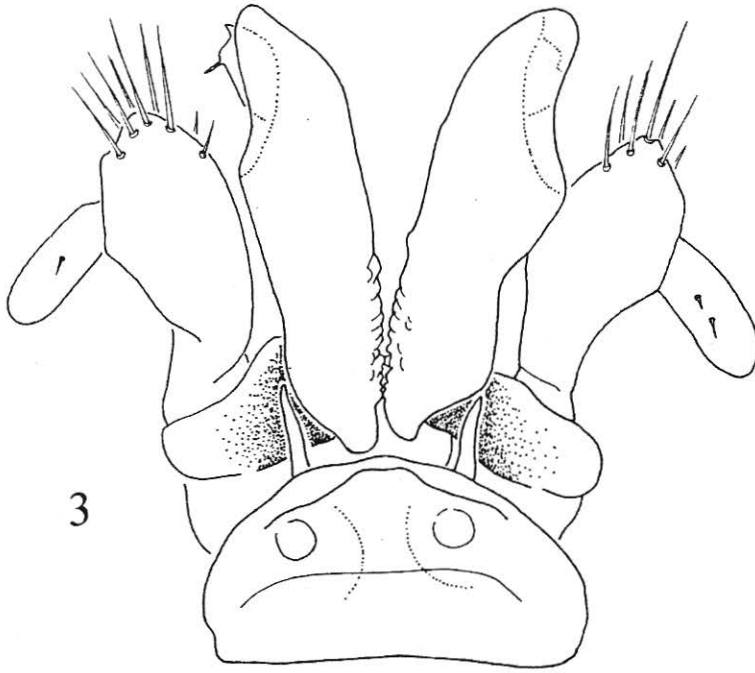


Figs. 1,2. *Nepalella caeca*, n. sp. 1, Midbody diplosegment, dorsal view. 2, Right antenna, anterior view. Scale line, 0.5 mm for both figures.

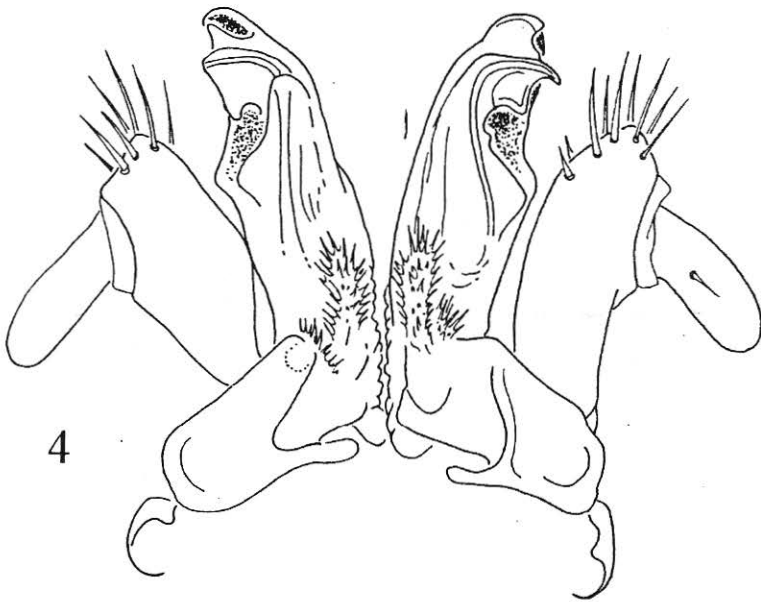
Diagnosis: Unlike most other known species of *Nepalella*, this form lacks a long process on the coxae of legpair 10 of males (see Notes, below), and unlike all species for which females are known, a long, projecting, cyphopod operculum process is also absent.

Male: Length, about 18 mm, width, about 1.6 mm, 3rd antennomere 0.62 mm long (fig. 1). Ocelli 9, each reduced in size, lightly pigmented, widely separated. Head and collum typical. Diplosegments slightly constricted between prozonites and metazonites, with moderately developed metazonital shoulders bearing the lateral most two segmental setae (fig. 2). Segmental setae acute, relatively stout, about one-sixth as long as width of segment. Pregonopodal legs not modified.

Anterior gonopods in anterior view (fig. 3) with broad, suboval coxosternum bearing two short, acute processes inserted between colpocoxites and coxal bases of posterior gonopods. Posterior gonopods in posterior view (fig. 4) with large,

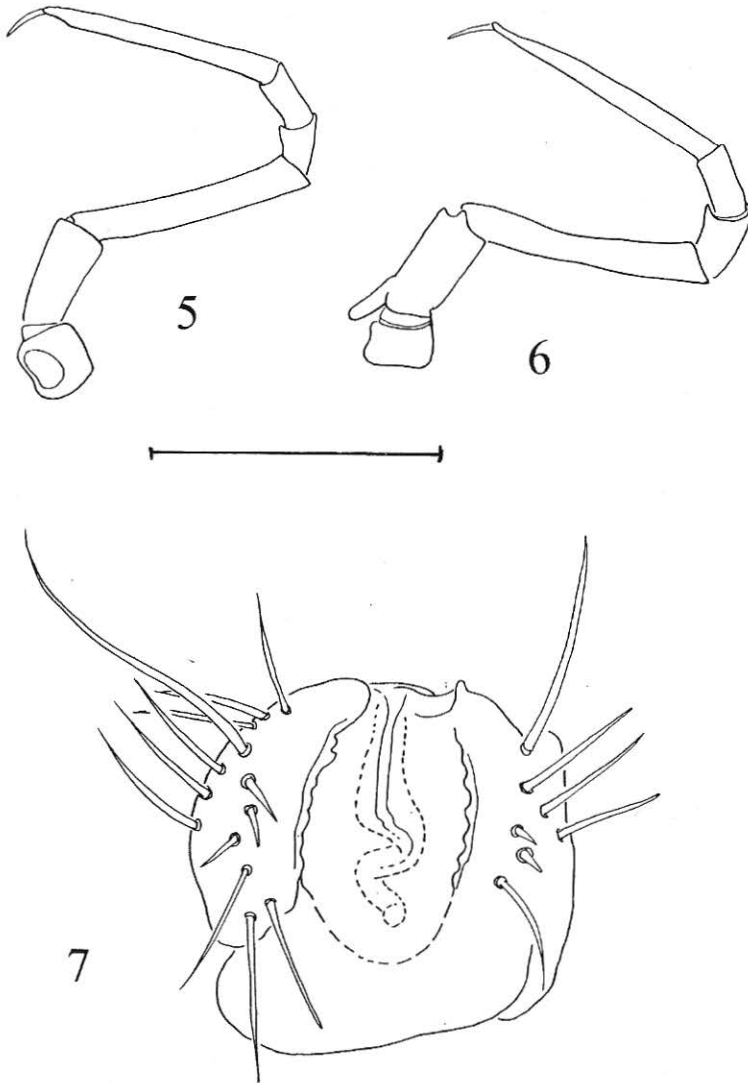


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Figs. 3,4. *Nepalella caeca*, n. sp. 3, Gonopods, anterior view. 4. Gonopods, posterior view. Scale line, 0.3 mm for both figures.



Figs. 5-7. *Nepalella caeca*, n. sp. 5, Right leg 10 of legs, anterior view. 6, Right leg 11 of male, anterior view. 7, Right cyphopod, ventral view. Scale line 0.5 mm for figures 5 and 6, 0.15 mm for figure 7.

oblong coxae. Colpocoxites erect, slightly curved laterally, with posterior ridge sharply curving laterally, terminating in small, acute process. Short, stout, single fimbriate branches arise at base of each coxite. Telopodites with large, erect prefemur, femur reduced in size.

Legpair 10 of normal size, coxae slightly enlarged, coxal gland present (fig. 5). Legs 11 without coxal glands, prefemora with blunt, retrorse processes (fig. 6).

Color uniform golden brown without darker markings.

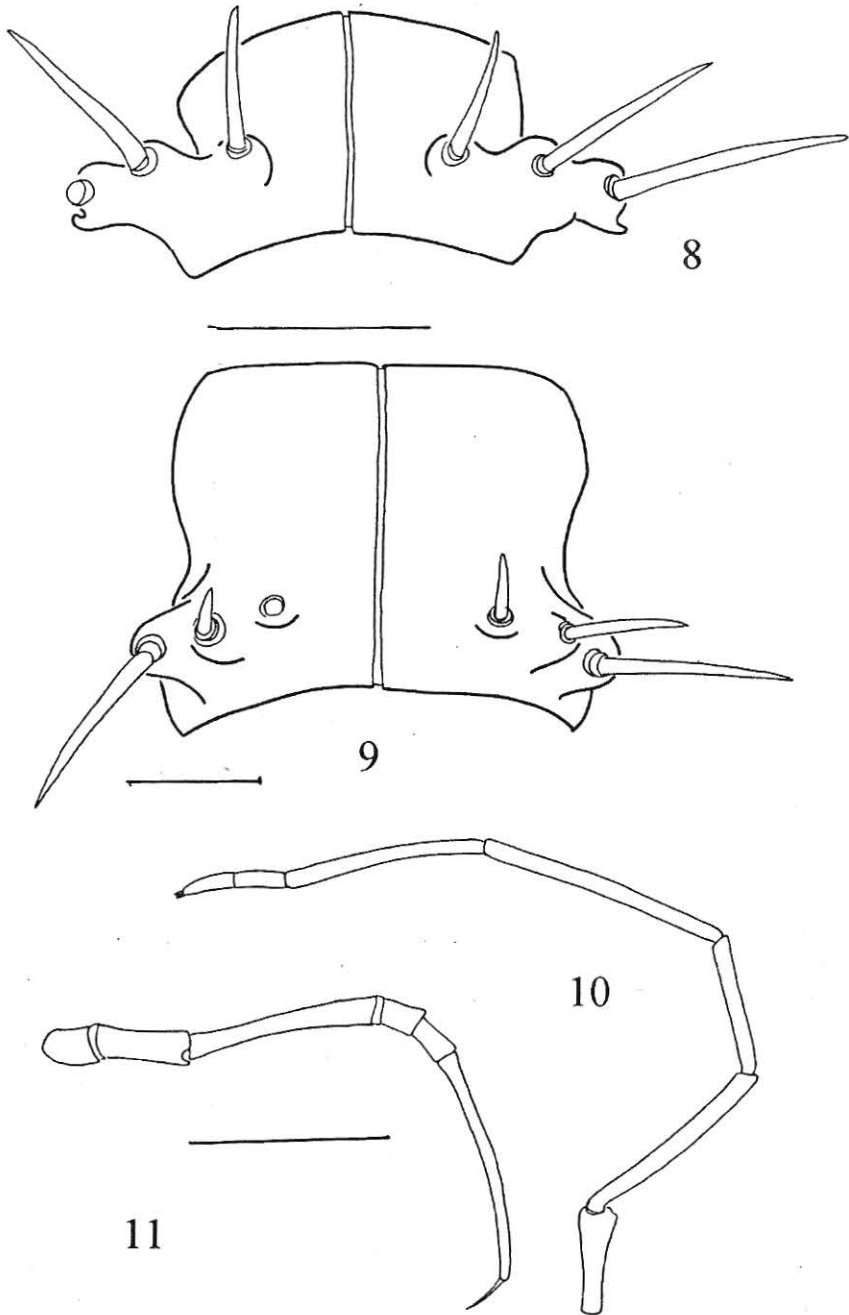
Female: Total length about 22 mm, width about 2.4 mm. Antennal segment three 0.66 mm long. Ocelli 13, individual ocelli larger and more darkly pigmented than in male.

Cyphopod (fig. 7) lacking opercular process, operculum and median valve evidently fused. Intersternal cuticle of segment not modified, cyphopod process absent.

Notes: Of all species so far described, *Nepalella caeca* seems closest to *N. pallida* Mauriès 1988, which was collected in 1954 in Kambaiti, northern Myanmar (then called Burma) at an altitude of 2270 m. Like *caeca*, *pallida* is only lightly pigmented, but has a larger number of pigmented, well-formed ocelli. The simple coxites of the posterior gonopods are similar in form to those of *caeca* (Mauriès, 1988), and the tenth leg coxae lack a large process. Females of *pallida* are unknown.

Shuicheng is in western Guizhou (Kwei'chow) Province near the Yunnan border. Here the foothills of the great ranges that arc sharply southward from the Tibetan Plateau along the Myanmar border rise to altitudes of two to three thousand meters. The cave of Anjia Yan is itself at 2160 m altitude. Two hundred and eighty meters long, the cave features a modest flow of water in a deep central channel and is rich in dripstone pools and calcitic formations. Abundant breakdown litters the floor. There are signs of human use, including a dry stone wall just inside the entrance. In July, the air temperature was 10.8° C at a time when the outside temperature was 18.6° C (R. Zorzin, pers. comm. to A. Minelli). I have no information about other life forms in the cave.

However, the collection sent to me included two additional chordeumatid milliped specimens that do not conform to *Nepalella caeca* as described above. Both are females and both are highly adapted troglobites, depigmented, with very long antennae and legs, and completely eyeless. The smaller of the two females is a partial specimen with only 25 segments present, so the full segment count is unknown. Its total length was probably about 20-25 mm, with a width of 2.3 mm. The metazonites have extraordinarily developed, nodular shoulders projecting far out from the body outline (fig. 8; even more extreme than Mauriès [1988] illustrates for *Nepalella pallida*). The segmental setae are very long and stout. On the posterior side of the lateralmost setal tubercle is a small, but prominent, tooth.



Figs. 8-11. Indeterminate chordemoids collected with *Nepalella caeca*. 8, Smaller species, midbody diplosegment, dorsal view. 9, Larger species, midbody diplosegment, dorsal view. 10, The same, antenna. 11, Midbody leg. Scale lines, 1.0 mm for figures 8 and 9, 0.75 mm for figures 10 and 11.

The larger of the two females is a complete specimen of only 28 segments but is about 32 mm long, with a width of 3.5 mm. The third segment of the very elongate antenna (fig. 10) is just under a millimeter long; like the antennae, the legs are extremely long and thin (fig. 11) and the whole animal has an almost centiped-like appearance as a result. The segmental shoulders are less well developed (fig. 9) but prominent. It is not possible at this time to assign either of these females to a family.

Clearly three distinct species of chordeumatid millipeds occupy this relatively small cave. Because of the evidently different levels of troglobitic adaptation of each of them, it is even possible that they represent three distinct invasions of the cave by *Nepalella* itself.

I thank Alessandro Minelli and Sergei Golovatch for allowing me to study the specimens, and Roberto Zorzin for information on the cave (through Minelli). Jean-Paul Mauriès kindly provided information on other Chinese chordeumatid millipeds.

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