

MYRIAPODOLOGICA



Virginia Museum of Natural History

Vol. 6, No. 2

ISSN 0163-5395

July 30, 1999

The milliped genus *Diplomaragna* confirmed for Taiwan, with the description of a new species (Diplopoda, Chordeumatida, Diplomaragnidae)

By William A. Shear

ABSTRACT

Syntelopodeuma formosanum was described by Verhoeff from the island of Tawiwan (Formosa) in 1936. Recent inspection of the type confirmed that this species is a member of the genus *Diplomaragna*. In addition, a second Tawiwane species, *Diplomaragna australis*, is described as new, strong evidence that the genus is native to Taiwan, some 1200 miles south of its nearest record in Shikoku, Japan.

INTRODUCTION

In 1990, I reviewed the milliped family Diplomaragnidae, giving a brief history of the study of the group, and synonymizing the family-level names Tokyosomatinae Verhoeff, Syntelopodeumatidae Golovatch, Ancestreumatidae Golovatch, and Sakhalineumatidae Golovatch under Diplomaragnidae Attems. Further, I argued that only a single genus, *Diplomaragna*, was required to accommodate all known species of the family.

One center of distribution of the family and genus is clearly central Asia, around Lake Baikal (Shear, 1990), with a western limit in the Urals, near Sverdlovsk. Additional work on diplomaragnids by Mikhaljova (19993, 1995, 1997) has revealed another focus of diversity in the Russian Far East and on Sakhalin Island, while numerous specimens I now have under study show that *Diplomaragna* is also unusually speciose in Japan, where a number of species on the southern islands are

troglobites (i.e., Murakami and Kawasawa, 1976).

Thus diplomaragnids would seem to be a primarily boreal faunal element. In view of this, I was skeptical about the species described as *Syntelopodeuma* (now *Diplomaragna*) *formosanum* by Verhoeff in 1936, with a locality given only as "Formosa". Verhoeff himself had reservations about the accuracy of the specimens' label, placing a member of the genus 1200 miles south of the next northerly record.

In 1958, Y. Wang reported *Syntelopodeuma* (now *Diplomaragna*) *gracilipes* Verhoeff 1914 from Taiwan¹, on the basis of a female. While Wang may indeed have correctly identified a diplomaragnid, it would not have been possible for him to establish its species identity, since the female genitalia of diplomaragnids were not illustrated until my 1990 review. Furthermore, the species *gracilipes* was described by Verhoeff from Hokkaido, in the northernmost part of Japan, and such a range for a single milliped species not a known synanthrope would be un-precedented, especially since it has never been found in the intervening territory.

In 1933, Verhoeff wrote that he had seen a chordeumatid from China, without naming or describing it.

Y. Wang & Chamberlin (1953) reported a species of *Craspedosoma* intercepted at quarantine in Ottawa, Canada, in a cargo from China. The identification of the heretofore strictly western European genus *Craspedosoma* from China is extremely dubious. Aside from these reports, the only chordeumatid species to be named from mainland China is *Vieteuma hubeiensis* Mauriès & Nguyen-Duy 1997, a troglobite from Hubei Province.

Recently, Dr. Rowland Shelley alerted me to the presence of chordeumatid milliped specimens from Taiwan in the Berenice Bishop Museum, Honolulu. I borrowed the material, thanks to Dr. Sabrina Swift, and it turned out to be a species of *Diplomaragna*, including males. Verhoeff's 1936 description of *D. formosana* did not, however, match these specimens, which were significantly smaller in body size and whose gonopods did not match the partial illustrations he gave. Therefore I borrowed the type specimens of *S. formosanum* from the Zoologisches Staatssammlung, München (with the kind cooperation of Dr. Hubert Fechter). These specimens confirmed my assignment of *formosana* to *Diplomaragna*, and also showed that the Bishop Museum specimens were not that species. The new species is described below.

The presence of the new species in Taiwan supports the hypothesis that the genus occurs on that island; if the locality data were more precise we could indeed be sure. Although the provenance of *D. formosana* remains in doubt, the discovery of a second species strengthens the case for it also being native to Taiwan.

¹ In the same paper, Wang also reported a female of the Japanese genus *Speophilosoma* (Speophilosomatidae) from Taiwan.

Unfortunately, I cannot add very much to the existing description of *formosana*, because only a single small fragment of the male gonopod has been preserved with the types.

TAXONOMY AND DISCUSSION

Order Chordeumatida

Family Diplomaragnidae Attems

Diplomaragninae Attems 1907:122.

Diplomaragnidae, Shear 1990:12 (complete references and synonymy to 1990; for further species descriptions see Mikhalova 1993, 1995, 1998).

Diplomaragnids are clearly related to Metopidiotrichidae, Megalotylidae, Conotylidae and the other families of the heterochordeumatoid complex. In 1990, I retained a superfamily Diplomaragnoidea, and suggested that the diplomaragnids were the plesiomorphic sister group of the other heterochoreumatoids. While their gonopods are highly specialized and in some ways unique, diplomaragnids retain the primitive chordeumatid-segment number of 32 (a few species have this reduced to 30, and one tiny, undescribed Japanese species has only 26). Most, but not all, diplomaragnids also retain coxal glands on both legpairs 10 and 11 of males, while in conotylids the glands on the eleventh legs are lost. Megalotylidae, however, includes some species in which the glands of the eleventh legs are merely reduced in size, while others have lost the glands entirely. Heterochordeumatids and metopidiotrichids have also lost the glands, and the tenth coxal glands have become hypertrophied.

Because only isolated species belonging to various subgeneric groups were described prior to 1990, many superfluous generic and even familial names were applied to what now appears to be just one genus, *Diplomaragna*. New species continue to be discovered in this genus, which may be in the midst of a bout of exuberant speciation in response to the alternation of glacial and interglacial periods in recent geological history.

At various times during the Pleistocene, Taiwan has been connected to mainland China (the Strait of Taiwan is now only 200 meters deep at the most), the Ryukyu Islands, and the main islands of Japan, though that connection was last severed about 2 million years ago. Because Taiwan is mountainous, with several peaks over 3000 meters, the survival of boreal faunal and floral elements in the highlands is not surprising.

I would further venture to predict that *Diplomaragna* extends far to the south in mainland China, particularly in highland environments; it should also be looked for in caves.

***Diplomaragna formosana* (Verhoeff)**

Fig. 1

Syntelopodeuma formosanum Verhoeff, 1936, p. 168.

Diplomaragna formosanum, Shear, 1990, p. 32.

The spelling of the species epithet has to be changed to agree with the gender (feminine) of the generic name; I neglected to do this in 1990.

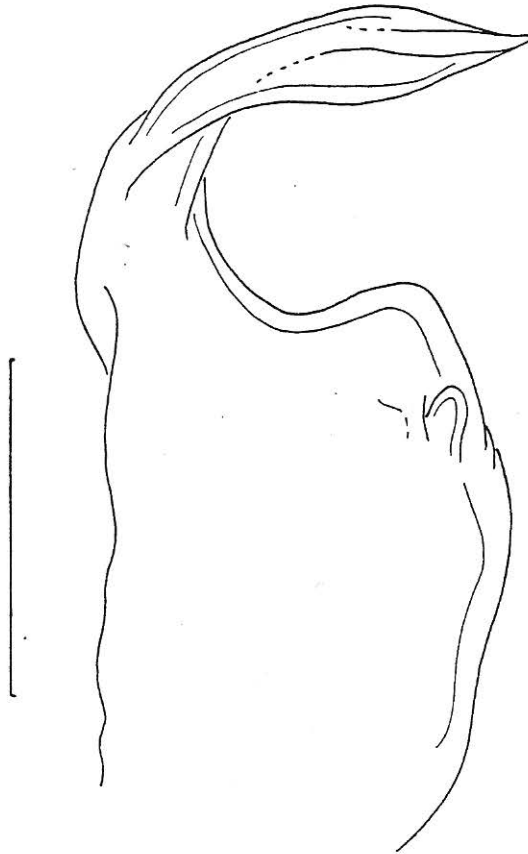


Fig. 1. Part of the angiocoxite of *Diplomaragna formosana* (Verhoeff), 200X. Scale line = 0.3 mm.

The type material of this species consists of two microscope slides and a vial containing parts of two specimens. They are labelled only as being from "Formosa". Unfortunately, only a fragment of one gonopod is present; this was illustrated by Verhoeff (1936, Pl. IV, fig. 26a and b). The fragment (fig. 1) consists of part of the angiocoxite of the posterior gonopod and the corresponding telopodite. The tip of the angiocoxite process is marked in the illustration by a line suggesting it is bifid, with the two branches closely appressed. The process is not bifid; that impression is given by a ridge on the tip, which can be resolved at high magnification. The fragment very closely resembles the same structure in two Hokkaido species, *D. gracilipes* (Verhoeff) and *tsurusakii* Shear, in that it is broad and distally spatulate. The lateral angle of the angiocoxite is pronounced, but less so than in *tsurusakii* and more so than in *gracilipes*. It bears no similarity to any part of the gonopod of the new species described below. The fragmentary bodies of the specimens of *formosanum* are from animals substantially larger than the specimens of the new species (Verhoeff [1936] gave the body length as 19-20 mm). The relative sizes of the gonopods of the two species can be compared by examining fig. 1 vs. figs. 2 and 3, all drawn to the same scale. The angiocoxal part of the *formosana* gonopod is nearly as bulky as the entire posterior gonopod pair of *australis*.

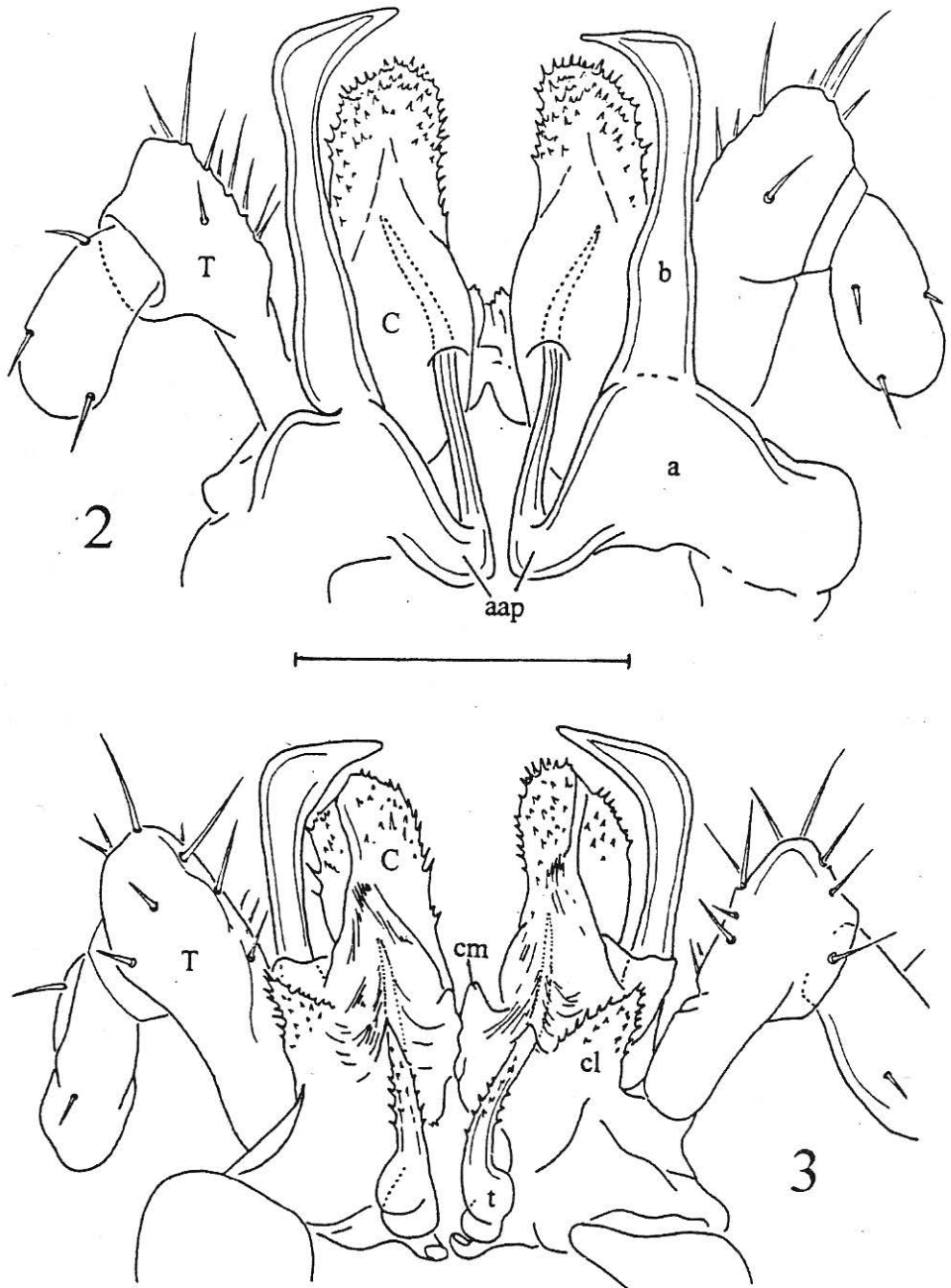
The similarities to the two Hokkaido species suggest that as Verhoeff suspected, the material of *formosana* may have been mislabelled as to locality. In light of this possibility, one is intrigued by Y. Wang's (1958) report of *gracilipes* from Taiwan (see above).

Diplomaragna australis, new species

Figs. 2, 3

Types: Male holotype, male and partial female paratypes from Taiwan, "Chito, experimental forest, Nanto hsienip", 1000 meters, collected September, 1957, by T. Maa. Deposited in Berenice P. Bishop Museum, Honolulu.

The geographical data given above in quotation marks is exactly as it appears on the typed label. This label was probably transcribed from a hand-written collection label, perhaps in Chinese, and evidently errors of transcription or transliteration crept in. "Nanto hsienip" undoubtedly refers to Nan-tou Hsien (province), located in the mountainous central region of Taiwan. I was unable to find any record of a place-name "Chito" or Chi-to" in Taiwan, searching the World-Wide Web database of 3.3 million names maintained by the United States Board on Geographic Names (<http://164.214.2.59/gns/html/index.html>). However, there is a mountain in Nan-tou Hsien named Chün-ta Shan. It is located at 23°33'N, 120°58'E, in the southern sector and has a peak elevation of 3292 M. Given that the specimens were collected at an elevation of 1000 M, I suspect that this is the locality referred to.



Figs. 2,3. *Diplomaragna australis*, new species. 2, Posterior gonopods, anterior view. 3, Posterior gonopods and anterior gonopod telopodites, posterior view. Both figures 200X, scale line = 0.3 mm.

Name: The specific epithet is a noun in apposition, referring to the southerly distribution of the species.

Male: Length, about 11 mm, maximum width, 1.0 mm. Antennal segment three 0.6 mm long. Trunk segments smooth, shining, segmental shoulders weakly developed on anterior segments only, posterior segments smoothly cylindrical. Segmental setae relatively long, acute. Legpairs 3-7 enlarged, crassate. Ocelli 27, in triangular eyepatch.

Anterior gonopods typical, with T-shaped sternum and flagelliform telopodites inserting in sheaths on posterior surfaces of posterior gonopod colpocoxites. Telopodites (fig. 3) heavily set with cuticular fimbriae. Posterior gonopods in anterior view (fig. 2) with robust angiocoxite (**a**), drawn out distally into long, apically sharply curved branch (**b**) paralleling colpocoxites; anterior angiocoxite process (**aap**) thin, sheathed by colpocoxites on anterior side. Colpocoxites (**C**) in anterior view flattened, curving posteriorly, distal third densely set with cuticular spinules. Telopodites (**T**) reduced in size, 2-segmented. In posterior view (fig. 3), angiocoxites lacking movable processes but meeting in midline, partially fused. Colpocoxites (**c**) sheathing anterior gonopod telopodites (**T**); sheaths with blunt, medially contiguous, median processes (**cm**). Lateral sheath processes (**cl**) subtriangular, densely set with spinules.

Tenth leg coxae with glands, slightly enlarged. Eleventh coxae not modified, lacking glands.

Female: Known only from a fragmentary specimen consisting of segments 14-32. This specimen is regarded as female because it is more robust than the two males.

Distribution: Known only from the type specimens, the collecting locality of which is not entirely certain.

Notes: The gonopods of *D. australis* resemble those of some Japanese species, particularly those once placed in the genera *Tokyosoma* and *Pterygostegia*, in that the large lateral process seen in anterior view does not represent a division of the colpocoxite, as seen in *D. ronkayi* (Shear, 1990), but is an extreme development of the lateral angle of the angiocoxite (Murakami & Kawasawa, 1976). The blunt median sheath processes, at least partially fused in the midline, and the accommodation of the anterior angiocoxal process in a colpocoxal sheath place this species in the *Inflata* group (Shear, 1990), where several other species have also lost the coxal glands on the eleventh pair of legs of males. Species of this group have heretofore been recorded from Korea, Japan, and the Russian Far East.

LITERATURE CITED

- Chamberlin, R. V., and Y. M. Wang. 1953. Records of millipeds from Japan and other oriental areas, with descriptions of new genera and species. *Amer. Mus. Novitates* 1621: 1-13.

- Mauriès, J.-P., and M. Nguyen-Duy. 1997. Nouveaux craspedosomides et glyphilulides cavericoles de Chine. *Mem. Biospeleol.* 24: 49-62.
- Mikhailjova, E. V. 1993. The millipeds (Diplopoda) of Siberia and the Far East of Russia. *Arthropoda Selecta* 2: 3-36.
- Mikhailjova, E. V. 1995. The millipede genus *Diplomaragna* Attems 1907, on the Sakhalin and Kurile Islands (Diplopoda Chordeumatida Diplomaragnidae). *Arthropoda Selecta* 2: 79-87.
- Mikhailjova, E. V. 1997. New data on the millipede genus *Diplomaragna* Attems 1907, in the Far East of Russia (Diplopoda Chordeumatida Diplomaragnidae). *Arthropoda Selecta* 6: 123-130.
- Mikhailjova, E.V. 1998. The millipedes of the Russian Far East (Diplopoda). *Arthropoda Selecta* 7: 1-77.
- Murakami, Y., and T. Kawasaki. 1976. The cave millipeds of the genus *Pterygostegia* (Diplopoda, Diplomaragnidae). *Bull. Nat. Sci. Mus. (Tokyo)* 14: 311-332.
- Shear, W. A. 1990. On the central and east Asian milliped family Diplomaragnidae (Diplopoda, Chordeumatida, Diplomaragnoidea). *Amer. Mus. Novitates* 2977: 1-40.
- Verhoeff, K. W. 1936. Ueber Diplopoden aus Japan, gesammelt von Herrn Y. Takakuwa. *Trans. Sapporo Nat. Hist. Soc.* 14: 148-172.
- Wang, D., and J.-P. Mauriès. 1996. Review and perspective of study on myriapodology of China. *Mém. Mus. natn. Hist. nat.* 169: 81-99.
- Wang, Y. M. 1958. *Serica* 1i: On Diplopoda from Taiwan with a new strongylosomid. *Quart. J. Taiwan Mus.* 11: 340-344.

Address of the author:

Dr. William A. Shear
Department of Biology
Hampden-Sydney College
Hampden-Sydney, VA 23943