

A MOST UNUSUAL ANIMAL DISTRIBUTION PATTERN:  
A NEW SIPHONOCRYPTID MILLIPEDE  
FROM TAIWAN (DIPLOPODA, SIPHONOCRYPTIDA)

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The millipede order Siphonocryptida previously consisted of three species. Its distribution demonstrates an unusual geographical pattern with one species in the Canary Islands and Madeira, one in Sumatra, and one in Malaya. A fourth species, *Hirudicryptus taiwanensis* sp. n., here described from Taiwan, complicates the pattern, and suggests an ancient, relictual trans-Palaeartic distribution. Connecting occurrences probably await discovery.

Key words: Siphonocryptida, millipedes, new species, Taiwan, zoogeography

## INTRODUCTION

The small millipede family Siphonocryptidae was revised by ENGHOFF and GOLOVATCH (1995). At that time it was classified in its own suborder, Siphonocryptidea (order Polyzoniida), but based on an unpublished cladistic analysis by W. A. SHEAR, SHELLEY (2003) formally elevated the taxon to full ordinal rank. Up to the present study, Siphonocryptida comprised only three species: *Siphonocryptus compactus* POCKOCK, 1894, from Sumatra, *S. latior* ENGHOFF et GOLOVATCH, 1995, from Malaya, and *Hirudicryptus canariensis* (LOKSA, 1967), from the Canary Islands and Madeira. The last species is common in forests on these islands, but those of *Siphonocryptus* are evidently rare, since they are only known from 4 (*S. compactus*) and 3 (*S. latior*) specimens.

Considering the general rarity of siphonocryptids it was surprising to find material in two major Taiwanese millipede collections – the National Museum of Natural Science, Taichung, and the Taiwan Forestry Research Institute, Taipei. We describe them here, discuss the species relationships to other siphonocryptids, and address the unusual ordinal distribution pattern.

## TAXONOMIC ACCOUNT

## Order Siphonocryptida

## Family Siphonocryptidae

Genus *Hirudicryptus* ENGHOFF et GOLOVATCH, 1995*Hirudicryptus taiwanensis* sp. n.

Holotype. ♂, TAIWAN, Taichung County, Heping township, Da-Hsueh-Shan, Anma-Shan, 2000 m a.s.l., soil sample (0–5 cm), 28 May 1996, R.-F. Chao leg. (NMNS)\*.

Paratypes. Same data as for holotype, 1 ♂, 1 ♀ (HNHM, slide prep.). Same locality, 1 ♀, 9 December 1995 (ZMUC); same locality, 1 ♀, 8 February 1996 (NMNS); same locality, 1 juv. f., 4 November 1996 (NMNS); all R.-F. Chao leg. – Ilan County, Chialo-hu, Shiji, N24°28' E121°28', 2200 m a.s.l., coniferous forest, 1 ♂, 20 June 2002 (HNHM, slide prep.); same locality, 1 ♂, 23 August 2002 (TFRI); same locality, 1 ♂, 4 June 2003 (TFRI); same locality, open grassland, bushes, 1 ♂, 23 July 2002 (TFRI); same locality, 2 ♂♂, 4 June 2003 (ZMUC, SEM prep. & TFRI); same locality and date, 2 ♀♀ (MNHN & TFRI); Taichung County, Lishan area, Shengwuan, near Wu-Lin, 1 ♀, 24 February–March 2003 (TFRI); all Y.-M. Chen & W.-C. Yeh leg. – Taichung County, Mt. Shiu-shan, Wuling township, Shiyuan-yako, logging road No. 710, 2050–2100 m a.s.l., 1 ♀, 21 August 2002, Ch.-Ch. Chen & Y.-H. Lin leg. (NSYSU).

Total material: 8 ♂♂, 8 ♀♀.

Etymology. The name refers to the occurrence of the species.

Diagnosis. Differing from *H. canariensis*, by having a small shoulder-like angle at the base of the posterior gonopod tibiotarsus (somewhat similar to that of *S. compactus*), a lower number (6–8, vs. 14–15 on each side) of tubercles on the posterior margins of paraterga, and a sinuous posterior margin of the last tergum (straight in *H. canariensis*).

Description. Size and shape. ♂♂ 31–46 terga, body length 10.5–16.8 mm, width 1.2–2 mm; ♀♀ slightly larger: 32–48 terga, body length 13.7–19.4 mm, width 1.3–2.5 mm. Body regularly rounded at both ends. Body shape, expressed as the relation between number of terga and body width, shown in Fig. 1.

Colour. Dorsally yellowish, with a narrow dark brown middorsal band and brownish edges on each tergum which combine into additional longitudinal, marginal brown bands (Fig. 2). Head and rostrum are also brownish, gnathochilarium yellow (Fig. 3). Ventrally completely yellow. Smaller specimens with less conspicuous colour pattern.

Head completely hidden under collum in dorsal view. Gnathochilarium with 2–3 pairs of larger setae and several small apical setae. Antennae long and slender, with seven visible antennomeres, antennomeres 1–6 almost equally long, 7 much shorter. Two ocelli on each side, the posterior

\* Acronyms of collections where the material is deposited are HNHM = Hungarian Natural History Museum, Budapest, Hungary; MNHN = Muséum national d'Histoire naturelle, Paris, France; NMNS = National Museum of Natural Science, Taichung, Taiwan; NSYSU = National Sun Yat-Sen University, Kaohsiung, Taiwan; TFRI = Taiwan Forestry Research Institute, Taipei, Taiwan; ZMUC = Zoological Museum, Natural History Museum of Denmark, Copenhagen, Denmark.

one larger (Figs 4–5), each pair of ocelli in a blackish patch. A pair of long frontal setae. Rostrum somewhat curved downwards (Fig. 5), otherwise straightly tapering.

Collum crescent-shaped, with slightly developed antero-ventral “ears” (“e” in Fig. 4). (A similar structure occurs also in *H. canariensis* although it was not reported by ENGHOFF & GOLOVATCH 1995). Surface of collum smoother than in *H. canariensis*, posterior row of tubercles similar to following terga.

Body terga without setae, ca. 4× as broad as long, shallowly domed. A distinct mid-dorsal suture along entire body length (“s” in Fig. 2). A transverse ridge on each tergum at ca. 1/6 from anterior margin. Surface microtuberculate. Paraterga moderately developed, slightly bent caudad, more conspicuously so towards the posterior (Fig. 6), regularly overlying following paratergum from collum onwards. A transverse row of larger, dark tubercles on posterior margin of each paratergum. These tubercles less numerous and not as evenly distributed compared to *H. canariensis* (Figs 7–8). *H. canariensis*: 14–15 tubercles on each side of midbody terga; *H. taiwanensis*: only 6–8 tubercles on each side only, sometimes arranged pairwise. Suture between tergum and pleuron obliterated. Lateral margin with posterolateral corners acutangular, bent caudad (more than in *H. canariensis*) from fifth to last tergum with peritreme for ozopore. Peritreme situated in anterior 1/3 of margin on tergum 5, in posterior 1/3 in other terga (Figs 9–10). Last tergum large, subtrapezoid, with sinuous posterior margin (straight in *H. canariensis*) (Figs 11–12).

Sterna ca 2/3 as wide as coxa.

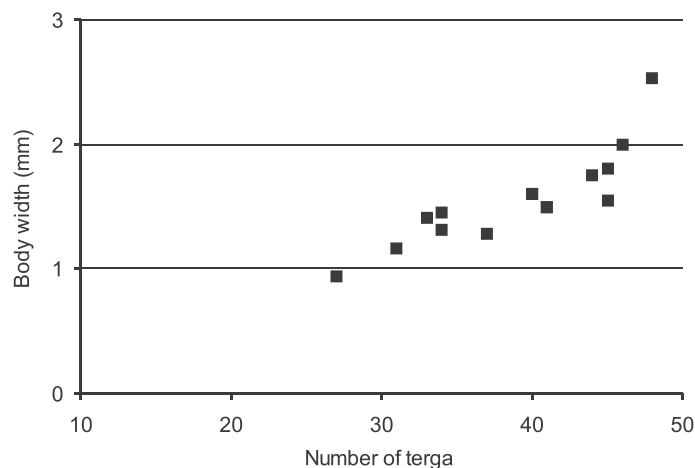
Telson small, hidden under last tergum in dorsal view; preanal ring completely surrounding anal valves, with a pair of long setae.

Legs almost reaching lateral body margin. No accessory claw.

Male sexual characters

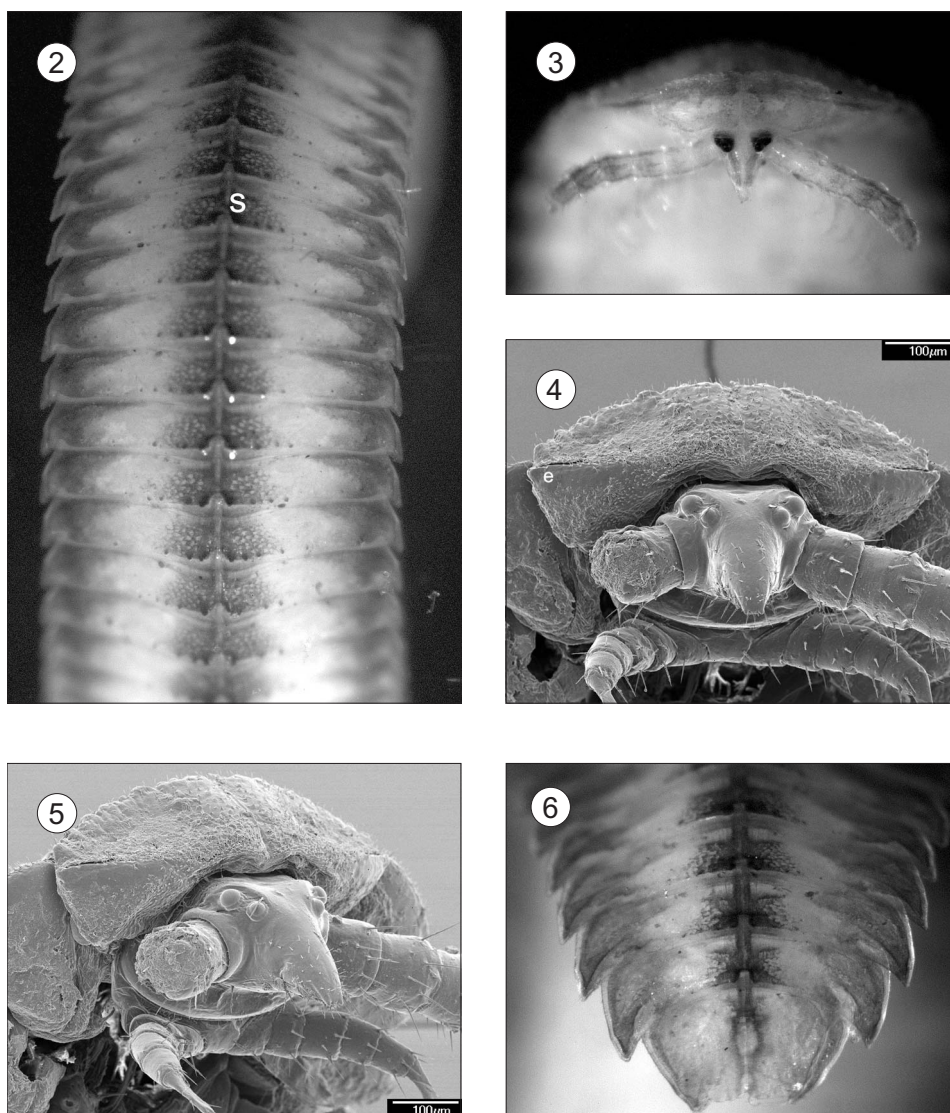
Second pair of legs as in Siphonocryptida in general. Penes bottleshaped, clearly delimited from coxae (Fig. 13) (autapomorphy for the genus *Hirudicryptus*, see Discussion).

Anterior gonopods (P9) leglike, incrassate, with six clearly separated podomeres. Terminal podomere drawn out into long, slightly twisted projection, similar to an open tube (t), probably for accommodation of the long terminal projection of the posterior gonopod (Figs 14–15). Three to four long setae situated dorsally to projection.



**Fig. 1.** Body shape, expressed as the relation between number of terga and body width of *Hirudicryptus taiwanensis* sp. n.

Posterior gonopods (P10) leglike, slenderer than P9, with five clearly separated podomeres. Terminal podomere drawn out into long, thin projection (p) showing a clearly visible, distinct shoulder (s) at its proximal third (Fig. 14).

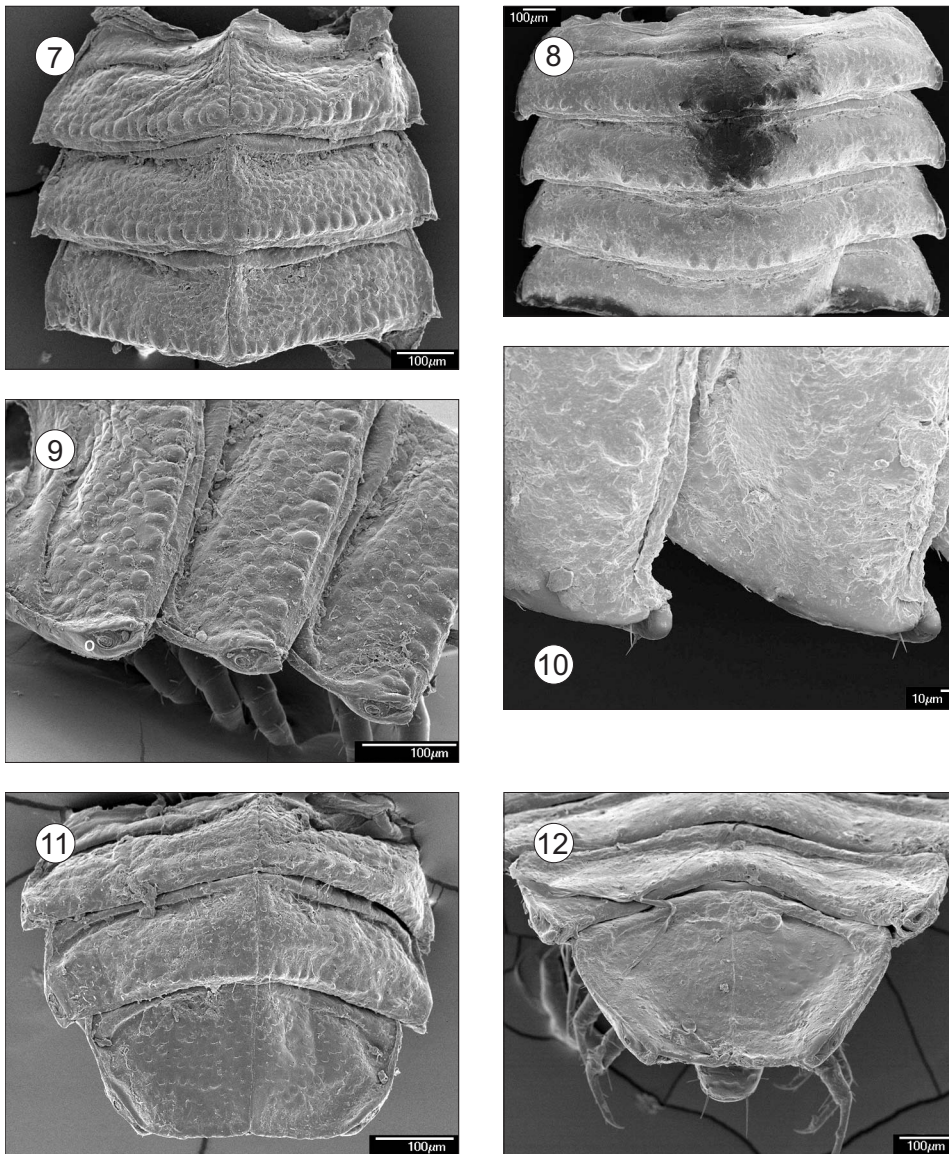


**Figs 2–6.** *Hirudicryptus taiwanensis* sp. n.: 2 = holotype body pattern, dorsal view, 3 = holotype head, frontal view, 4 = paratype from Shiji, head and collum in frontal view (right antenna broken), scanning electron micrograph, 5 = head, right fronto-lateral view, scanning electron micrograph, 6 = holotype, body end with paraterga bent caudad, dorsal view



## Female sexual characters

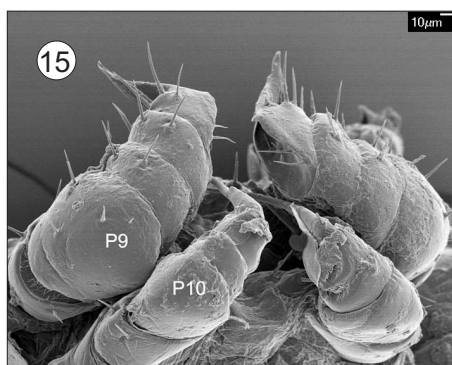
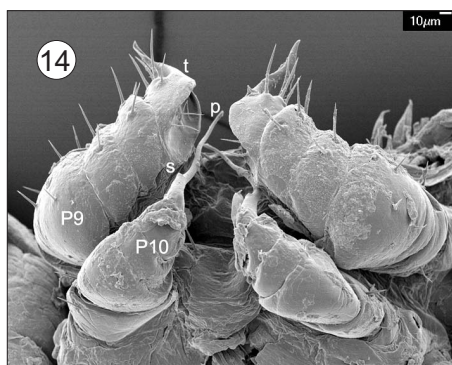
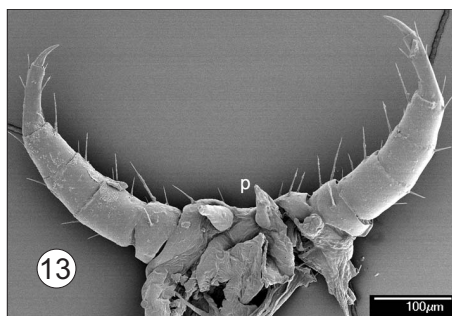
Second pair of legs with separate coxae. Vulvae large, embedded in coxae.



**Figs 7–12.** Scanning electron micrographs of *Hirudicryptus* spp.: 7–8 = caudal edge of midbody terga with pattern of tubercles: 7 = *H. canariensis* (LOKSA, 1967), 8 = *H. taiwanensis* sp. n.; 9–10 = left lateral edge of midbody segments with peritreme: 9 = *H. canariensis* (LOKSA, 1967) with ozopores (o), 10 = *H. taiwanensis* sp. n.; 11–12: caudal margin of last tergum: 11 = *H. canariensis* (LOKSA, 1967), 12 = *H. taiwanensis* sp. n.

## DISCUSSION

According to ENGHOFF and GOLOVATCH (1995) monophyly of the Siphonocryptidae is demonstrated by tergal tubercles, tergal-pleural fusion, and lateral ozopores in the peritremata. The taxon may be the sister-group to other Polyzoniida, although the foundation for this hypothesis is weak. Based on an unpublished cladistic analysis by W. A. SHEAR, in which siphonocryptids are more closely aligned with Platydesmida than Polyzoniida (SHEAR in litt.), SHELLEY (2003) elevated Siphonocryptidea to full ordinal status.



**Figs 13–15.** *Hirudicryptus taiwanensis* sp. n., scanning electron micrographs: 13 = second pair of legs, with pair of penes (p), 14 = gonopods, ventral view, 15 = gonopods, right ventro-lateral view

*Hirudicryptus taiwanensis* does not alter the hypotheses about of monophyly and external relationships of the order. However, when comparing the two genera, ENGHOFF and GOLOVATCH (1995) found *Siphonocryptus* to be derived with respect to *Hirudicryptus*, in all but one trait, the condition of the penes: in *Hirudicryptus* they are set in distinct sockets, probably the autapomorphic state. The Taiwanese species shares this condition, so “penes set in distinct sockets” is an autapomorphy, although not a very convincing one, for *Hirudicryptus*. A sister-group relationship between *canariensis* and *taiwanensis* is the best supported hypothesis. We interpret the gonopod “shoulder” shared by *H. taiwanensis* and *S. compactus* as homoplastic, although few morphological characters support this contention cladistically.

Assuming monophyly of *Hirudicryptus*, we are left with an unlikely biogeographical disjunction: Macaronesia and Taiwan, while *Siphonocryptus* is

known from the Malaccan Peninsula and Sumatra. ENGHOFF and GOLOVATCH (1995) commented on the Macaronesian–SE Asian pattern but found no parallels, although they listed several strange disjunctions involving Macaronesian taxa. We too know of no other examples of the “amphi-Palaeartic” insular distribution pattern shown by *Hirudicryptus*, and believe the only possible explanation is a strongly relictual, trans-Palaeartic distribution with all continental representatives being extinct (or undiscovered). The Julidae also shows a trans-Palaeartic distribution (ENGHOFF 1993), occurring from Macaronesia in the west to Japan and Taiwan in the east. There are no common julid genera between the extreme western and eastern Palaeartic, but as noted by ENGHOFF (1992) the mostly Macaronesian genus *Dolichoilulus* and the Japanese genus *Japanoilulus* are similar. The distribution pattern of *Hirudicryptus* may correspond to a strongly relictual version of the julid pattern.

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