

***Copidognathus fistulosus*, a new Halacarid mite (Acari: Halacaridae) from Korea**

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Abstract: 3A new species of halacarid mite belonging to the genus *Copidognathus* viz. *C. fistulosus* is described on the basis of specimens collected from an algal bed in Jeju Island, South Korea. *Copidognathus fistulosus* sp. nov. is closely related to *C. koreanus* Chatterjee & Chang and *C. laevisetosus* Chatterjee, Lee & Chang. Morphological similarities and dissimilarities among them are discussed.

Résumé : *Copidognathus fistulosus*, une nouvelle espèce d'acararien (Acari : Halacaridae) de Corée. Une nouvelle espèce d'acararien appartenant au genre *Copidognathus*, récoltée sur des algues de l'Isle de Jeju, Corée du Sud, est décrite. *Copidognathus fistulosus* sp. nov. est étroitement liée à *C. koreanus* Chatterjee & Chang et *C. laevisetosus* Chatterjee, Lee & Chang. Les ressemblances et dissemblances morphologiques entre ces espèces sont discutées.

Keywords: Marine Halacaridae, *Copidognathus*, New species, Korea

Introduction

Halacarid mite is one of the meiofaunal groups found among interstitial and phytal realms in the marine environment. Genus *Copidognathus* comprises maximum number of species among various genera in the family Halacaridae. The *Copidognathus* fauna has been studied in the northwestern Pacific, in Vietnam (Trouessart, 1896, 1899; André,

1937), Hong Kong and Southern China (Bartsch, 1990, 1991a, b, 1992, 1997), the Philippines (Bartsch, 1984a, b, 1985, 1986; Chatterjee & De Troch, 2003), the Kuril Islands (Makarova, 1972a, b, 1975, 1977), and the Russian coast of the Sea of Japan (Sokolov, 1952). The present authors have reported five *Copidognathus* species (*C. koreanus* Chatterjee & Chang, 2003, *C. laevisetosus* Chatterjee, Lee & Chang, 2004, *C. cerberoideus* Bartsch, 1991, *C. jejuensis* Chatterjee & Chang, 2004, and *C. polyporus* Bartsch, 1991) from Korea (Chatterjee & Chang, 2003, 2004; Chatterjee et al., 2004). In the present paper, a new species from Jeju Island, South Korea is described.

Reçu le 14 janvier 2005 ; accepté après révision le 24 juin 2005.

Received 14 January 2005; accepted in revised form 24 June 2005.

Materials and methods

Materials examined in the present study were collected from an algal bed at the intertidal rocky shore of Jeju Island, South Korea. Samples were filtered through a nylon net (64 μm in pore diameter) after anesthetization with 7% MgCl_2 solution for about 30 minutes, rinsed with freshwater for osmotic shock, and then fixed and stored in 80% ethanol.

Mites were cleared in lactic acid and mounted in glycerine jelly. They were examined under a differential interference contrast microscope (Olympus BX51) with Nomarski optics. Drawings were prepared using a camera lucida. Type specimens are deposited in the Department of Biology, Daegu University, Korea.

Abbreviations in the text and figure legends: AD, anterior dorsal plate; AE, anterior epimeral plate; ds_{1-6} , dorsal setae 1-6 on idiosoma; GA, genitoanal plate; GO, genital opening; mc, membranous cuticle between plates; OC, ocular plate; PAS, parambulacral seta; PD, posterior dorsal plate; PE, posterior epimeral plate; PGS, perigenital setae; P_{1-4} , first to fourth palpal segments; SGS, subgenital setae; VS, ventral seta.

Systematics

Family HALACARIDAE Murray, 1877
Subfamily Copidognathinae Bartsch, 1983
Genus *Copidognathus* Trouessart, 1888

Copidognathus fistulosus sp. nov.

Material examined

Holotype: female (DB00029), among coralline algae, Jocheon, Jeju Island, South Korea, 25 Jan. 2003 (C.Y. Chang & J.M. Lee).

Paratypes: one male (DB00030) and one female (DB00031), collection data same as in holotype.

Description of holotype female

All dorsal plates separate. Idiosoma (Fig. 1) 438 μm long. Porose areolae of dorsal plates with porose panels consisting of modified rosette pores, *i.e.* numerous canaliculi opening into shallow, large pits; some parts of porose costae, particularly some portion in anterior parts, with 2 or 3 smaller pits instead of one large. AD 102 μm long and 122 μm wide. AD with 2 porose areolae (Figs. 1 & 6). Posterior areola transversely widened. Rest of AD containing panels. Paired ds_1 anterior to posterior areola on AD; pair of gland pores near anterolateral corner of posterior areola; ds_2 on mc between AD and OC.

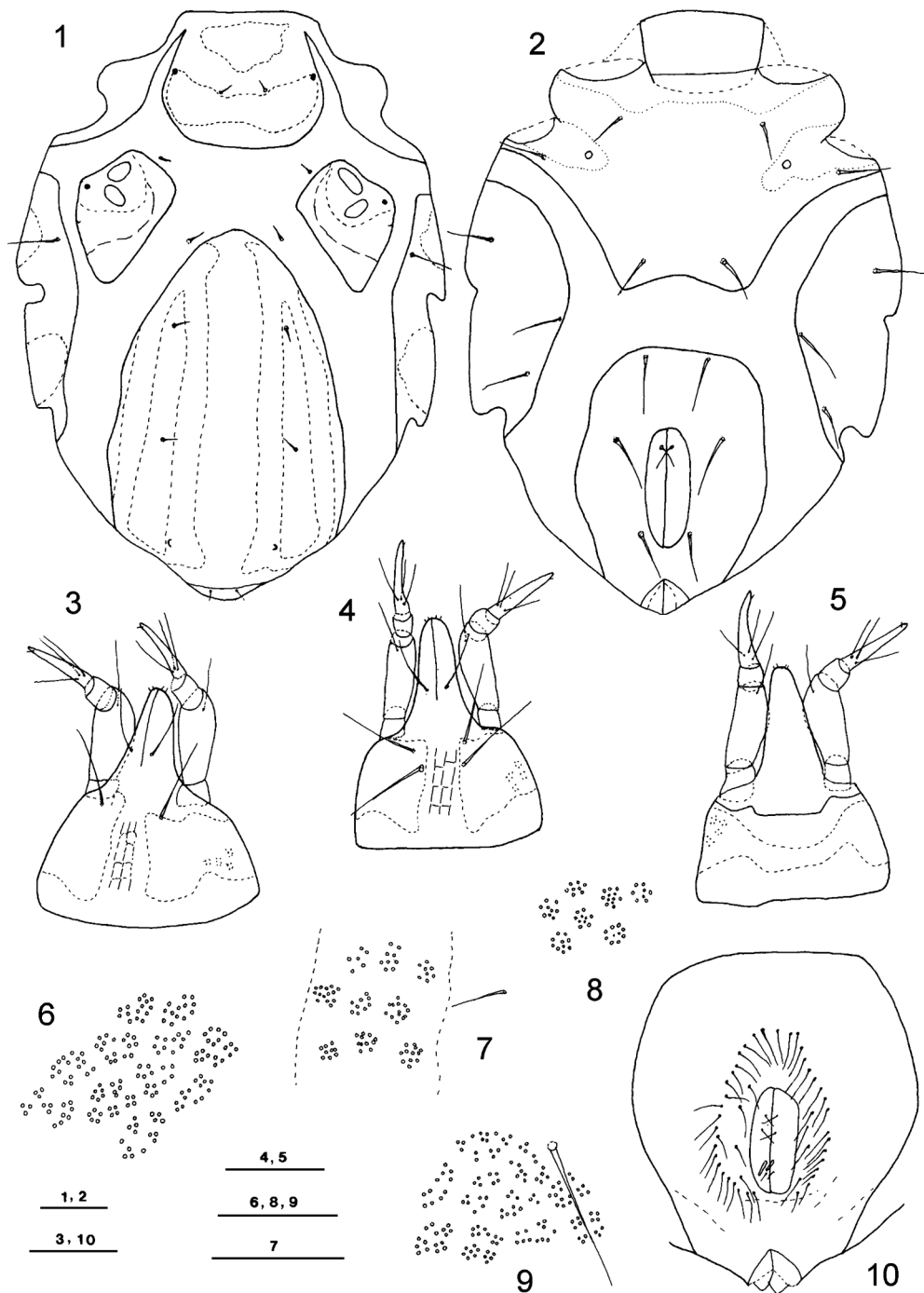
OC 102 μm long, 75 μm wide, length to width ratio of OC about 1.3; each with 2 corneae; porose areolae in corneal zone, medial and lateral to cornea; gland pore lateral to posterior cornea; pore canalicula present nearly on lateral margin of OC.

PD 270 μm long and 180 μm wide. PD narrowing anteriorly, with 4 porose costae; lateral costa and middle costa joining anteriorly and posteriorly (posterior part faintly joining). Middle costa 3-porose-panels wide (Fig. 7), while lateral costa 2-porose-panels wide. Remainder of plate containing panels, each panel subdivided (Fig. 15). Pair of ds_3 situated just above anterior margin of PD on mc; ds_4 and ds_5 located on panelled area between middle and lateral costae; distance from ds_3 to ds_4 56 μm , 0.65 times of that (86 μm) between ds_4 and ds_5 . Gland pore present posteriorly on middle costa of PD.

All ventral plates separate and porose (Figs. 2, 8 & 9). AE 152 μm long and 281 μm wide. AE with 3 pairs of ventral setae and a pair of epimeral pores. Posterior margin of AE a little arched. Epimeral process not developed. PE with 3 ventral setae and 1 dorsal seta. GA 194 μm long, 137 μm wide. GO 89 μm long, 33 μm wide. Distance between anterior end of GO to that of GA 60 μm , about 0.7 times of GO length. Three pairs of PGS present; anterior pair near anterior margin of GA; middle pair almost at level of anterior margin of GO, 24-28 μm apart from lateral margin of GA; third pair near posterior side of GO (Fig. 2). Pair of SGS located at anterior one-sixth of GO. Distance between posterior end of GO and that of GA 55 μm .

Gnathosoma 135 μm long (Fig. 3). Palp consisting of 4 segments. Tip of rostrum extending just above middle of P_3 . P_1 and P_3 devoid of any seta. P_2 with 1 dorsal seta distally. P_4 with 3 long proximal setae and 1 minute distal seta. Proto- and deuterostrual setae situated at tip of rostrum; tritrostrual setae (long maxillary setae of rostrum) located below middle of rostrum (0.60 of rostrum length from tip of rostrum); gnathosomal base with a pair of setae (basistrostral setae). Distance between tritrostrual seta and tip of rostrum 36 μm ; distance between tritrostrual seta and basistrostral seta 34 μm . Rostral sulcus long, extending a little beyond tritrostrual setae. Ventrolateral and dorsolateral sides of gnathosomal base porose. Tectum truncate.

Chaetotaxy of legs (Figs. 11-14): trochanter 1-1-1-0; basifemur 2-2-2-2; telofemur 5-5-2-3; patella 4-4-3-3; tibia 7-7-5-5; tarsus (PAS excluded) 7-4-3-3. Small articulating lamellae present on tibiae I-IV. Length to width ratio of telofemora I-IV 1.9, 1.9, 2.1, 2.1, respectively. Telofemora and tibiae of all legs with coarse reticulation enclosing several modified rosette pores (similar modification as described above). Arrangement of pectinate setae on tibiae I-IV 0-1-1-0. Length to width ratio of tibiae I-IV: 1.9, 2.0, 2.4, 2.4, respectively. Tarsus I with 3 dorsal setae, 1 solenidion, 3 ven-

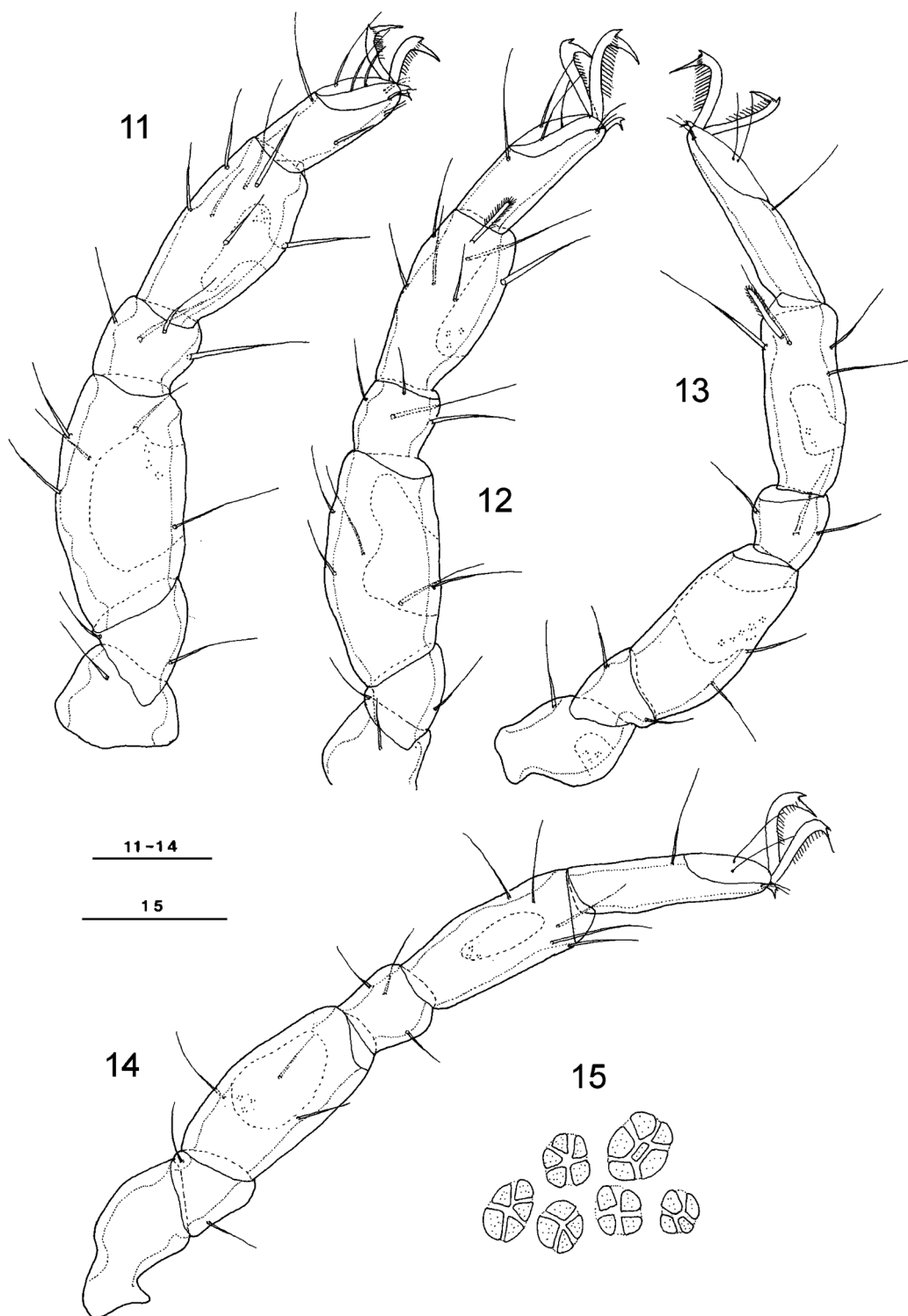


Figures 1-10. *Copidognathus fistulosus* sp. nov. (female: 1-3, 6-9; male: 4, 5, 10).

1. Idiosoma, dorsal. 2. Idiosoma, ventral. 3. Gnathosoma, ventral. 4. Gnathosoma, ventral. 5. Gnathosoma, dorsal. 6. Part of anterior areola on AD. 7. Middle costa near ds₅. 8. Canaliculi in the middle of AE. 9. AE near VS₃. 10. GA of male. Scale bars: 1-5 & 10 = 50 µm; 6-9 = 20 µm

Figures 1-10. *Copidognathus fistulosus* sp. nov. (femelle: 1-3, 6-9; mâle: 4, 5, 10).

1. Idiosome, dorsal. 2. Idiosome, ventral. 3. Gnathosome, ventral. 4. Gnathosome, ventral. 5. Gnathosome, dorsal. 6. Portion de l'aréole antérieure sur AD. 7. Côte médiane près de ds₅. 8. Canalicules au milieu de AE. 9. AE près du VS₃. 10. GA. Échelles: 1-5 & 10 = 50 µm; 6-9 = 20 µm.

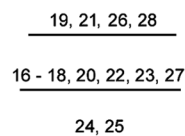


Figures 11-15. *Copidognathus fistulosus* sp. nov., female.

11-14. Legs I-IV. **15.** Panels between middle costae on PD. Scale bars: 11-14 = 50 μ m; 15 = 20 μ m.

Figures 11-15. *Copidognathus fistulosus*. sp. nov., femelle.

11-14. Pattes I-IV. **15.** Plaques entre les côtes médianes sur PD. Échelles: 11-14 = 50 μ m, 15 = 20 μ m.



22-28. *Copidognathus laevisetosus* Chatterjee, Lee & Chang, femelle. **22.** Partie des aréoles postérieures sur AD. **23.** Côte centrale près de ds₄. **24.** Plaques entre deux côtes médianes **25.** Plaques entre les côtes centrale et laterale. **26.** AE près de VS₁. **27.** AE près de VS₃. **28.** Partie des aréoles sur le côté ventrolateral du gnathosome. Échelles = 20 µm.

tral setae and 2 doublets eupathid PAS. Tarsus II with 3 dorsal setae, 1 solenidion and 2 doublets eupathid PAS. Tarsi III and IV with 3 dorsal setae and 2 PAS. All legs with 2 lateral claws and a bidentate median claw. Lateral claws with accessory process dorsally and pectinate ventrally. Pectens long.

Male (paratype)

Idiosoma 423 μm long. GA 191 μm long, 177 μm wide (Fig. 10). GO 59 μm long, 29 μm wide; distance between anterior end of GO to that of GA 77 μm , about 1.3 times of GO length. Forty-seven PGS present around GO. Four pairs of SGS present; first, second and fourth pairs thin, while third pair thick and spur-like. Distance between posterior end of GO to that of GA 55 μm , subequal to length of GO. Gnathosoma 118 μm long, 97 μm wide. Gnathosomal base with two pairs of setae (basirostral setae) (Fig. 4). Distance between tritrostral setae and tip of rostrum 37 μm ; distance between tritrostral setae and first pair of basirostral setae 30 μm . Tectum truncate (Fig. 5).

Variability

Middle costa was 3-porose-panels-wide in holotype, while 3 (or 4)-porose-panels wide in paratype female; in female paratype, each porose panel on costae of PD contained more canaliculi than in the holotype; the position of tritrostral setae ranged from 0.57 to 0.62 of rostrum length from the tip of rostrum. Among three type specimens examined, two paratypes (one male and one female) showed the lateral areola continuing to the posterior part of OC, while holotype female showed the lateral areola restricted to the anterior half of OC.

Etymology

The proposed specific name, *fistulosus* (the Latin meaning "with many pitfalls" or "porous"), refers to the "porose" panels on areolae of dorsal plates, which makes this species easily separated from the related congeners.

Remarks

The new species is similar to *C. koreanus* Chatterjee & Chang and *C. laevisetosus* Chatterjee, Lee & Chang, both recorded from Youngdeok, eastern coast of Korea (Chatterjee & Chang, 2003; Chatterjee et al., 2004), in many aspects of morphological characteristics (Table 1). The three species have two areolae on AD, the posterior one of which is transversely widened; ds_2 and ds_3 on mc; PD with four costae (middle costa and lateral costa joining anteriorly); about 50 PGS around GO in male; all telofemora with porose area; two pairs of basirostral setae in male, a pair of basirostral setae in female; 0:1 ventral seta each on

telofemora III and IV; tibia I with three smooth ventral setae and tarsi III and IV with three dorsal setae.

However, *C. koreanus* and *C. laevisetosus* have rosette pores on areolae and costae of dorsal plates (Figs. 16, 17, 22 & 23), while *C. fistulosus*, sp. nov. has porose panels (Figs. 6 & 7). Nature of areolae and arrangement of canaliculi on ventrolateral surface of gnathosomal base are different between *C. fistulosus* (Figs. 3 & 4) and the other two species above (Figs. 21, 28). The porosity of ventral plates is also different between *C. fistulosus* (Figs. 8 & 9) and the other two species (Figs. 19, 20, 26 & 27).

Moreover, *C. fistulosus* is distinguished from them due to the following points. The distance from ds_3 to ds_4 is about 1.1-1.2 times farther than that of ds_4 to ds_5 in *C. laevisetosus*, and 0.9-1.0 in *C. koreanus*, while 0.65 in *C. fistulosus*. Panels on dorsal plates are subdivided in *C. fistulosus* (Fig. 15), while panels are not subdivided in *C. koreanus* (Fig. 18) and *C. laevisetosus* (Figs. 24 & 25).

Tibia III is equipped with a ventral pectinate seta in *C. fistulosus* (Fig. 13), while all setae on the segment are smooth in *C. koreanus*. Dorsal side of gnathosomal base is furnished with canaliculi in *C. fistulosus* (Fig. 5), while only panelled in *C. koreanus*. The second pair of PGS in female are closer to lateral margin of GA in *C. koreanus*, while away from the lateral margin in *C. fistulosus* (Fig. 2). The tectum is truncate in *C. fistulosus* (Fig. 5), while a little protruded in *C. laevisetosus*. The tip of rostrum extends beyond the middle of P_3 in *C. fistulosus*, while only up to the end of P_2 in *C. laevisetosus*. The ventral sides of tibiae I and II are relatively more swollen in *C. laevisetosus* than in *C. fistulosus*. One of the ventral setae on tibia II is pectinate in *C. fistulosus*, while all ventral setae on the segment are smooth in *C. laevisetosus*.

Considering ds_2 and ds_3 on mc, AD with two areolae, PD with four costae, about 30- 50 PGS around GO in male, two pairs of basirostral setae in male, a pair of basirostral setae in female, 0:1 ventral seta each on telofemora III and IV, tarsi III and IV with three dorsal setae, *C. fistulosus* also resembles *C. curtus* Hall, 1912 from California and Chile (Hall, 1912; Newell, 1951a, 1984; Macquitty, 1984), *C. granulatus* (Hodge, 1863) from United Kingdom (Hodge, 1863; Green & Macquitty, 1987; Bartsch, 1991c), *C. richardi* (Trouessart, 1902) from the North Atlantic (Trouessart, 1902; Bartsch, 1991c), and *C. unalaskensis* Newell, 1951 from Unalaska Island, Alaska (Newell, 1951b). However, in having the porose panels with modified rosette pores on dorsal plates, *C. fistulosus* is different from all the above species which possess typical rosette pores. Furthermore, *C. curtus*, *C. granulatus* and *C. unalaskensis* possess tibia I with a pectinate seta ventrally and tibia II with two pectinate setae ventrally, while *C. fistulosus* has tibia I with smooth ventral setae only and tibia II with a pectinate ventral seta.

Table 1. *Copidognathus fistulosus* nov. sp. Comparison of characteristics between *Copidognathus fistulosus* and its related congeners.
Tableau 1. *Copidognathus fistulosus* nov. sp. Comparaison des caractéristiques entre *Copidognathus fistulosus* et les espèces proches.

	<i>C. curtus</i>	<i>C. granulatus</i>	<i>C. koreanus</i>	<i>C. laevisetosus</i>	<i>C. richardi</i>	<i>C. unalaskensis</i>	<i>C. fistulosus</i>
Idiosoma length: (µm)	♂, 350-428; ♀, 421	425-460	♂, 360-374; ♀, 392-432	♂, 360-384; ♀, 412-437	♂, 558	♂, 492-536; ♀, 518-551	♂, 423; ♀ 438
Nature of porose areolae on AD and PD	Rosette pores	Rosette pores	Rosette pores	Rosette pores	Rosette pores	Rosette pores	Porose panel with modified rosette pores
Panel between costae on PD	Not subdivided	Not subdivided	Not subdivided	Not subdivided	Not - subdivided	-	Subdivided
Relative distance between ds ₃ to ds ₄ and ds ₄ to ds ₅	~ 2	Subequal	0.9-1.0	1.1-1.2	1.4-1.6	~ 2	0.65
Middle and lateral costae	Joining anteriorly	Not joining	Joining anteriorly	Joining anteriorly	Not joining	Joining anteriorly	Joining anteriorly
Distance between anterior ends of GA and GO in female	Less than GO length	Subequal to GO length	Half of GO length	Little less than GO length	Subequal to GO length	A little more than GO length	0.7 times of GO length
Distance between anterior ends of GA and GO in male	More than GO length	More than GO length	1.5 X GO length	1.7 X GO length	More than GO length	2.0 X GO length	1.3 X GO length
Position of tritrostral setae	Posterior half of rostrum	Posterior half of rostrum	Posterior half of rostrum	Anterior half of rostrum	Posterior half of rostrum	Posterior half of rostrum	Below middle of rostrum
Tectum	-	-	Truncate	A little protruded	-	-	Truncate
Dorsal side of gnathosoma	-	-	Panelled	Panelled	-	-	Porose
Pectinate seta on tibia I	1	1	0	0	0	1	0
Pectinate seta on tibia II	2	2	1	0	1+1 (faint)	2	1
Pectinate seta on tibia III	1	1	0	1	1	1	1
Areolae on telofemora I and II	Rosette - pores		Rosette pores	Rosette pores	Pitted, canaliculi	Porose panels	Porose panels with modified rosette pores
Locality	USA, Chile	UK	Korea	Korea	North Atlantic	Alaska	Korea

Acknowledgements

A special thank is due to Dr. Ilse Bartsch, Forschungsinstitut Senckenberg, Germany, for her helpful suggestions after checking the slides to determine the exact

areolar nature of dorsal plates. Thanks are also due to Dr. Ji Min Lee, Daegu University, Korea for her support in collecting samples. We are grateful to Dr. Ivano Morselli, Università di Modena e Reggio Emilia, Italy; Dr. G. W. Krantz, Oregon State University, USA; Dr. Hiroshi Abé,

Nihon University, Japan and Dr. Marleen De Troch, University of Ghent, Belgium, for their moral support. We appreciate two anonymous reviewers for their helpful comments that greatly improved the manuscript. The first author (TC) is indebted to the Brain Pool Program, Korea. This work was supported by a Daegu University Research Grant, 2004.

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