



A new species of the genus *Parastylodactylus* Figueira, 1971 (Crustacea: Decapoda: Caridea: Stylodactylidae) from off Kollam, southwest coast of India

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Abstract

A new species of the caridean genus *Parastylodactylus* Figueira, 1971 (Stylodactylidae), *P. sulcatus*, is described and illustrated on the basis of three male specimens from the Southern Arabian Sea, off the southwest coast of India, at a depth of 350 m. Morphologically, the new species appears closest to *P. bimaxillaris* (Bate, 1888) widely distributed in the Indo-West Pacific, but the much longer rostrum, the absence of a supraorbital tooth on the carapace, the deep hepatic groove on the carapace and the relatively longer and more slender third pereopod distinguish the new species from *P. bimaxillaris*. It is the first representative of the genus from Indian waters. An updated key to the species of *Parastylodactylus* is presented.

Key words: Crustacea, Decapoda, Caridea, Stylodactylidae, *Parastylodactylus*, new species, Arabian Sea, India

Introduction

The stylodactylid shrimp genus *Parastylodactylus* was established by Figueira (1971) to accommodate *Stylodactylus bimaxillaris* Bate, 1888. The genus is characterized by the absence of a palp on the mandible and the presence of arthrobranchs above the bases of the first to fourth pereopods in both males and females. The following seven species, all recorded from the sublittoral to the upper bathyal zone in the Indo-West Pacific region, are currently included in the genus: *P. bimaxillaris* (Bate, 1888), *P. hayashii* (Komai, 1997), *P. longidactylus* Cleva, 1990, *P. moluccensis* Cleva, 1997, *P. richeri* Cleva, 1990, *P. semblatae* Cleva, 1990, and *P. tranterae* Cleva, 1990 (Cleva 1990, 1997; Komai 2011). In addition, Hayashi (2007) indicated the existence of one undescribed species, previously referred to *P. semblatae* (cf. Hayashi 1991), from Japanese waters.

Three specimens of a stylodactylid shrimp were obtained by the second author from the by-catch of a deep-water shrimp trawler, operated off Kollam, southwest coast of India. On close examination, it was revealed that these specimens represent an undescribed species of *Parastylodactylus*, appearing closest to *P. bimaxillaris*. In this contribution, we thus describe a new species, *P. sulcatus*, on the basis of these three specimens.

The holotype and one paratype are deposited in the Natural History Museum and Institute, Chiba, Japan (CBM). One paratype is deposited in the Marine Biodiversity Referral Museum at the Central Marine Fisheries Research Institute (CMFRI), Cochin, India. Postorbital carapace length (cl) is used as the standard measurement indicating the size of the specimens. For comparison, the following material was examined.

Parastylodactylus bimaxillaris: 1 male (cl 5.1 mm), 1 female (cl 4.7 mm), off Tong Kong, southwestern Taiwan, depth unknown, 5 August 1996, commercial trawler, coll. T. Komai, CBM-ZC 2863; 4 ovigerous females (cl 5.3–6.6 mm), Dashi Fishing ground, off northeastern Taiwan, 300–400 m, 4 December 1997, commercial trawler, CBM-ZC 3878.

Taxonomic account

Family Stylodactylidae

Genus *Parastylodactylus* Figueira, 1971

Parastylodactylus sulcatus sp. n.

(Figs 1–4)

Material examined. Holotype: male (cl 9.3 mm), Southern Arabian Sea, offshore between Kollam and Cochin, south west coast of India, 09°04.5'N, 75°52.4'E, 350 m, 21 February 2010, coll. Rajool Shanis, CBM-ZC 10536. Paratypes: 1 male (cl 7.7 mm), same data as holotype, CBM-ZC 10537; 1 male (cl 7.9 mm), same data as holotype, CMFRI-E.D.1.7.1.1.

Description. Body (Figs 1, 2A, B) moderately slender for genus; integument moderately firm, glabrous on surfaces.



FIGURE 1. *Parastylodactylus sulcatus* sp. n., holotype, male (cl 9.3 mm), CBM-ZC 10536, entire animal in lateral view.

Rostrum (Figs 2A, 3A) elongate, slender, 2.2 times longer than carapace, slightly to somewhat curving dorsally in distal half; dorsal margin armed with 18–20 rather widely spaced, moderately small spines, including 6–7 on carapace, all but distalmost spine basally articulated, posteriormost spine arising at about 0.4 of carapace length; ventral margin with 6–8 moderately small spines, all basally articulated; lateral face without conspicuous carina. Carapace (Figs 2A, C, D, 3A) with low, but distinct postrostral ridge extending to midlength; dorsal margin in lateral view slightly sinuous; posterodorsal margin not particularly deeply notched; supraorbital tooth absent; infraorbital lobe prominent, far exceeding beyond antennal tooth, rounded distally, constricted at base, sharply buttressed on lateral face; antennal tooth moderately strong, directed forward; anterolateral margin between antennal and branchiostegal teeth strongly sinuous with deep concavity just inferior to antennal tooth; branchiostegal tooth relatively strong, overreaching antennal tooth; hepatic groove very deep, hepatic region inferior to hepatic groove noticeably inflated.

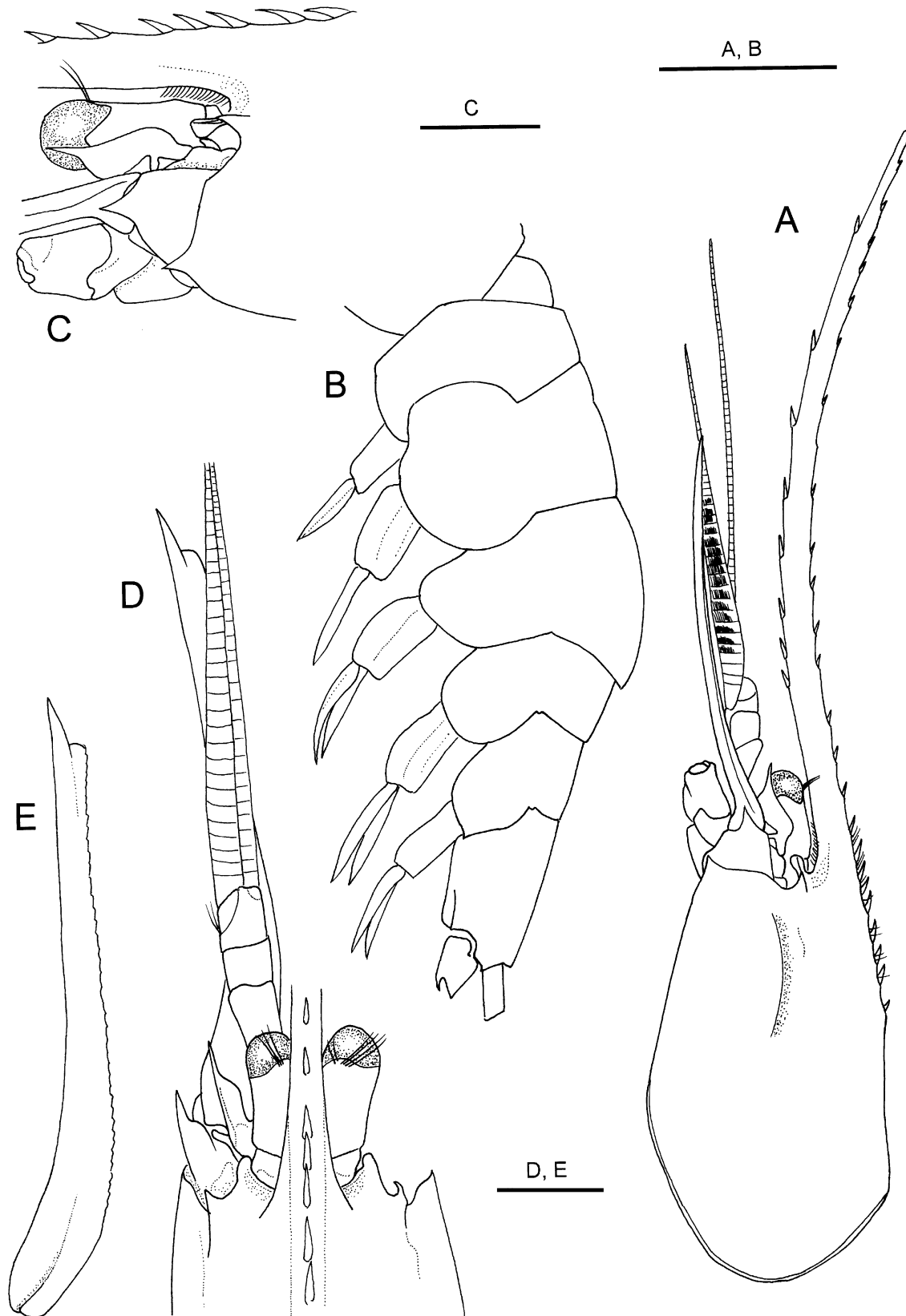


FIGURE 2. *Parastylodactylus sulcatus* **sp. n.**, holotype, male (cl 9.3 mm), CBM-ZC 10536. A, carapace and cephalic appendages, lateral view (left antennal flagellum missing); B, abdomen and pleopods, lateral view (telson and uropods broken off); C, anterior part of carapace, eye, and basal part of antennule and antennal peduncles, lateral view; D, anterior part of carapace and left cephalic appendages, dorsal view (setae omitted); E, left antennal scale, dorsal view (setae omitted). Scale bars: 5 mm for A; 2 mm for C–E.

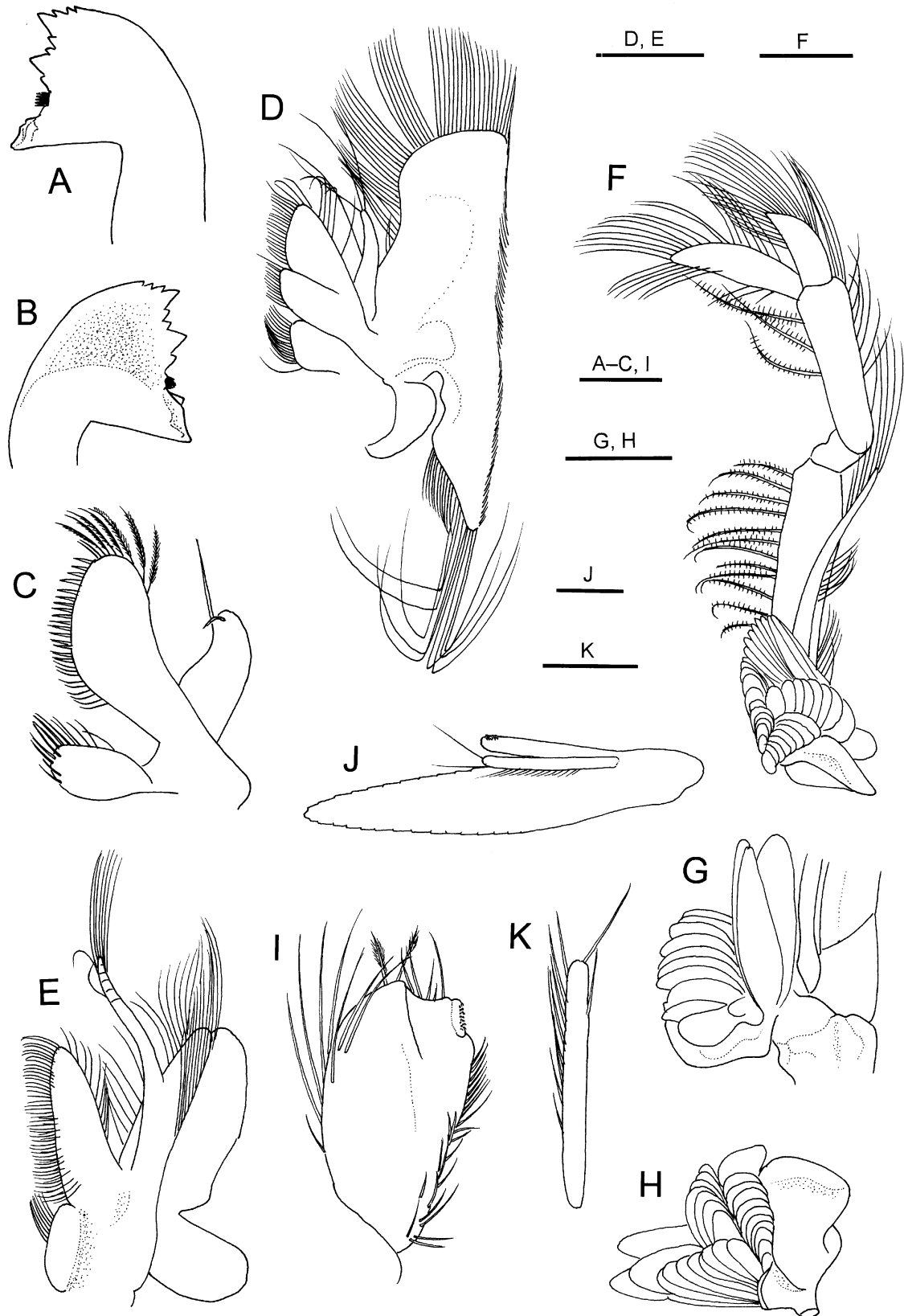


FIGURE 3. *Parastylodactylus sulcatus* sp. n. A–H, paratype, male (cl 7.7 mm), CBM-ZC 10537; I–K, holotype, male (cl 9.3 mm), CBM-ZC 10536. A, left mandible, outer view; B, same, inner view; C, left maxillule, outer view; D, left maxilla, outer view; E, left first maxilliped, outer view; F, left second maxilliped, lateral view; G, basal part of left second maxilliped, showing structure of epipod and podobranch, dorsal view; H, epipod and podobranch of left second maxilliped, ventral view; I, endopod of right first pleopod, ventral view; J, endopod of left second pleopod, ventral view; K, appendix masculina of left second pleopod, ventral view. Scale bars: 1 mm for D–F, G, H; 0.5 mm for A–C, I–K.

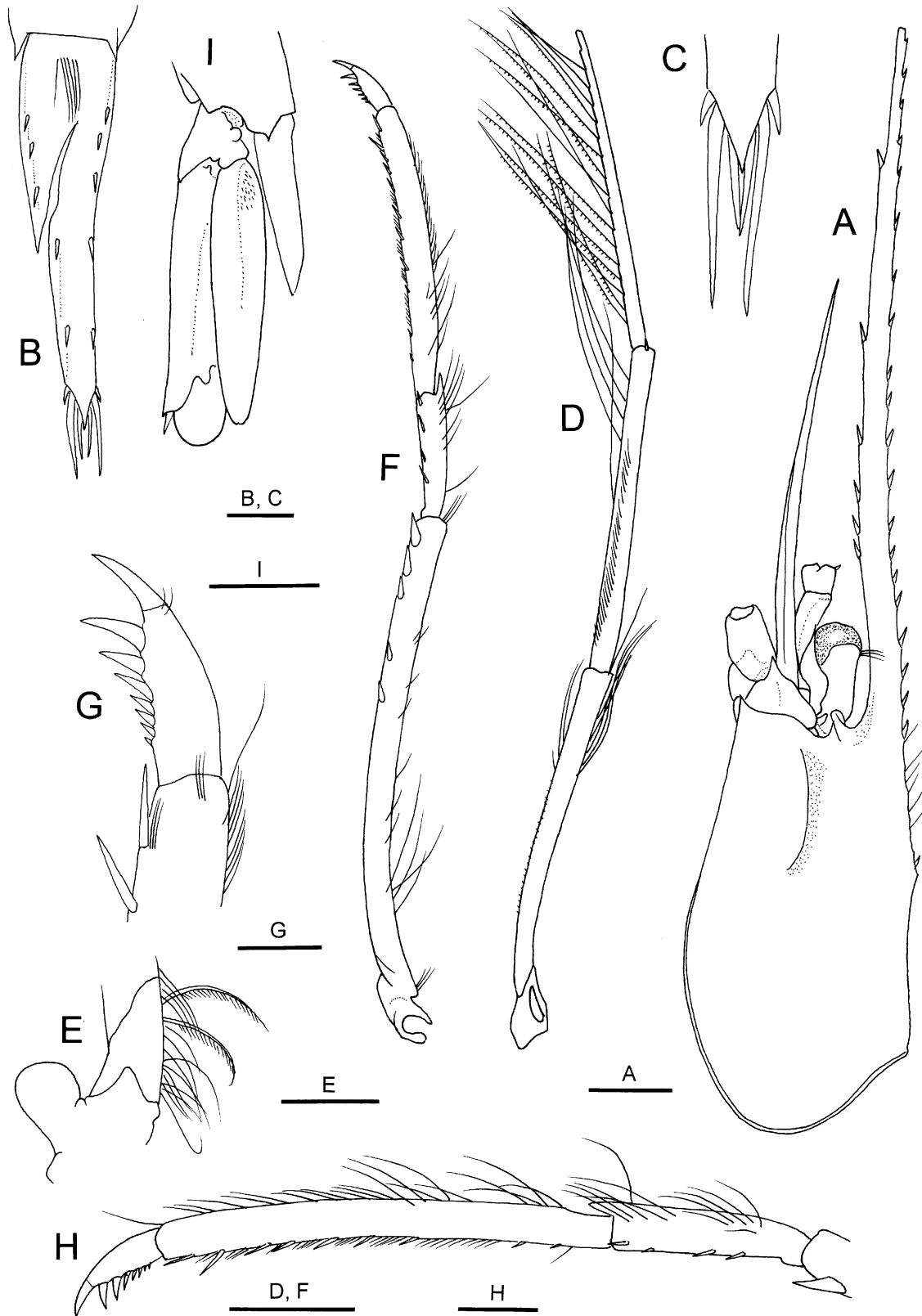


FIGURE 4. *Parastylodactylus sulcatus* sp. n. A–C, I, paratype, male (cl 7.7 mm), CBM-ZC 10537; D–H, holotype, male (cl 9.3 mm), CBM-ZC 10536. A, carapace and cephalic appendages, lateral view (antennule damaged, left antennal flagellum missing); B, telson, dorsal view (damaged); C, posterior part of telson, dorsal view; D, left third maxilliped, lateral view; E, same, basis and coxa, dorsal view; F, left third pereopod, lateral view; G, same, dactylus, lateral view; H, same, dactylus to carpus, lateral view; I, posterior part of sixth abdominal somite, telson and left uropod, lateral view. Scale bars: 2 mm for A, D, F, I; 1 mm for B, E, H; 0.5 mm for C, G.

Abdomen (Fig. 2B) dorsally rounded on every somite; posterodorsal margin of third somite somewhat produced posteriorly. First to fourth pleura rounded, fifth pleuron with small posteroventral tooth. Sixth somite 1.6 times longer than high and 1.9 times longer than fifth somite, posteroventral angle bluntly pointed, posterolateral process moderately strong, terminating in acute tooth. Telson (Fig. 3B, C) tapering posteriorly to acute tip, bearing 5 pairs of dorsolateral spines (distance between spines becoming wide posteriorly) and 3 pairs of terminal spines (second pair elongate, about 5 times as long as first pair and about twice length of third pair).

Eye (Fig. 2C) subpyliform; cornea relatively small, distinctly shorter than and slightly wider than eyestalk; ocellus absent; eyestalk bearing prominent setal tuft on dorsodistal extension.

Antennular peduncle (Fig. 2A, D) moderately stout, not reaching midlength of antennal scale. First segment longer than distal two segments combined; stylocerite strongly compressed laterally, reaching distal one-fourth of first segment, abruptly tapering to slender spiniform tooth; small, forwardly directed process proximal to base of stylocerite. Second and third segments unarmed. Outer flagellum with thickened aesthetasc-bearing portion reaching distal lamella of antennal scale; inner flagellum falling short of tip of rostrum.

Antennal peduncle (Fig. 2A, C, D) moderately stout. Basicerite with moderately strong distolateral tooth. Carapocerite short, slightly falling short of first segment of antennular peduncle. Antennal scale (Fig. 2E) 1.1 times longer than carapace, very narrow (8.7 times longer than wide), curving laterally in proximal half; lateral margin concave, unarmed; distolateral tooth strong, wider than distal lamella at base, far overreaching distal lamella; distal lamella clearly defined, narrowly rounded.

Mandible (Fig. 4A, B) without palp; incisor and molar processes not clearly separated, incisor process bearing 8 acute, unequal teeth on mesial margin; molar process with uneven mesial face; cluster of numerous minute spinules on mesial margin between incisor and molar processes. Maxillule (Fig. 4C) with subovate coxal endite; basal endite subovate, somewhat narrowing basally, mesial margin with double row of slender spines and stiff setae; endopod with subtruncate terminal margin bearing 1 long spiniform seta at mesial angle and 1 short, curved submarginal seta. Maxilla (Fig. 4D) with coxal endite consisting of single lobe; basal endite divided in 2 lobes, proximal lobe subrectangular, distal lobe subtriangular; endopod slightly curved mesially, reaching nearly to distal margin of basal endite, bearing 1 seta on mesial margin and 3 apical setae; scaphognathite moderately broad, posterior lobe subtriangular, bearing long, flexed setae terminally. First maxilliped (Fig. 4E) with thickened coxal endite; basal endite narrowly subovate; endopod falling short of distal margin of basal endite; exopod moderately narrow, flagellum arising at midlength of mesial margin of caridean lobe; epipods large, distinctly bilobed. Second maxilliped (Fig. 4F) with 2 terminal segments articulated at distal margin of propodus, ventral segment (= dactylus) longer than dorsal segment; propodus elongate, slightly widened distally; carpus very short, cup-shaped; merus and ischium fused, subequal in length to propodus, bearing row of stiff setulose setae on ventral margin; basis short, obliquely articulated to ischium-merus; exopod flagellum-like, slightly overreaching distal margin of merus; coxa with rounded, membranous epipod and large podobranch consisting of lamellae of various size (Fig. 4G, H).

Third maxilliped (Fig. 3D) slender, overreaching distal end of antennal scale by about 0.7 length of ultimate segment; ultimate segment gradually tapering distally, subequal in length to penultimate segment, bearing 2 rows of long setulose setae on ventral (flexor) margin; ultimate segment with 1 minute spine distolaterally and with 2 row of long setulose setae on ventral (flexor) margin; antepenultimate segment subequal in length to ultimate segment; articulation between ischium and basis clearly delimited; coxa (Fig. 3E) with flattened, subcircular epipod on lateral face, without strap-like process; exopod absent.

Pereopods moderately long and slender (Fig. 1), only left third pereopod of holotype preserved. Third pereopod (Fig. 3F–H) slightly falling short of tip of antennal scale; dactylus 0.27 times as long as propodus, terminating in strong, clearly demarcated unguis, armed with 7 accessory spinules noticeably increasing in length, distalmost spinule arising somewhat proximal to base of unguis, only slightly shorter than unguis; propodus about 12.0 times longer than wide, with 2 rows of slender spinules and tufts of short stiff setae on flexor margin; carpus 0.4 times as long as propodus, bearing 3 slender spines on lateral face ventrally; merus and ischium completely fused, bearing 5 spines in distal half, these spines increasing in size distally.

Gill formula summarized in Table 1.

First pleopod with exopod distinctly longer than endopod; endopod (Fig. 4I) strongly modified, tapering distally, mesial part folded ventrally, bearing thick covering of stiff setae and prominent slender spur arising at midlength of dorsomesial margin, lateral margin sinuous with sparse long stiff setae, appendix interna very short, located subterminally, bearing cluster of adhesive hooks. Second pleopod with appendix masculina subequal in

length to appendix interna (Fig. 4J, K), bearing row of stiff setae on almost over entire length of mesial margin and 1 subterminal seta on lateral margin, both appendices arising at proximal 0.2 of endopod and reaching to midlength of endopod. Uropod (Fig. 3I) with moderately stout protopod terminating posterolaterally in acute tooth; endopod slightly shorter than exopod, gradually tapering distally; exopod with slightly sinuous lateral margin, bearing 1 stout spine just mesial to minute posterolateral tooth.

TABLE 1. *Parastylodactylus sulcatus* n. sp. Gill formula.

	1	2	3	4	5	6	7	8
	Maxillipeds			Pereopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	0	0	0	1	1	1	1	1
Arthrobranchs	0	0	1	1	1	1	1	0
Podobranchs	0	1	0	0	0	0	0	0
Epipods	1	1	1	0	0	0	0	0
Exopods	1	1	0	0	0	0	0	0

Coloration. Body and appendages generally orange-red; pleopods paler; cornea darkly pigmented.

Distribution. Known only from the type locality in the southern Arabian Sea, off Kollam, southwestern India, 350 m.

Remarks. Some comments about the generic assignment of this new species seem warranted. In Stylodactyliidae, *Parastylodactylus* and *Neostylodactylus* Hayashi & Miyake, 1968 are characterized by the absence of a mandibular palp, and the former genus is primarily distinguished from the latter by the presence of arthrobranchs above the bases of the first to fourth pereopods in both sexes. In *Neostylodactylus*, there are no arthrobranchs above the bases of the first to fourth pereopods in females (Chace 1983). With regard to the present new species, only three male specimens are available for study, and consequently it cannot be assessed if the gill formula is sexually dimorphic. Nevertheless, the present new species differs from most known species of *Neostylodactylus*, except *N. investigatoris* (Kemp, 1925), in the unarmed lateral margin of the antennal scale. As Cleva (1990) mentioned, species of *Parastylodactylus* are generally much larger in body size than species of *Neostylodactylus* (cl greater than 4.0 mm in *Parastylodactylus* versus less than 3.5 mm in *Neostylodactylus*). The larger specimen (holotype) of the present new species is 9.3 mm in cl. Consequently the present new species is confidently assigned to *Parastylodactylus*.

Parastylodactylus sulcatus n. sp. appears closest to *P. bimaxillaris*, sharing the following diagnostic characters: carapace with eight or fewer postrostral spines; fifth abdominal pleuron at least occasionally with posteroven-tral tooth; sixth abdominal somite 1.6–2.0 times longer than high; telson with five pairs of dorsolateral spines; dactylus of third pereopod with strong distal accessory spinule, making dactylus clearly biunguiculate; and merus-ischium of third pereopod lacking proximoventral spine. However, the new species can be readily distinguished from *P. bimaxillaris* by the longer rostrum exceeding twice the carapace length (versus usually less than 1.8 times as long), the absence of a supraorbital tooth, and the very deep hepatic groove and the markedly inflated hepatic region inferior to the hepatic groove on the carapace (cf. Figs 2A, 3A). In *P. bimaxillaris*, the supraorbital tooth is present near the rostral base, although it is minute; the hepatic groove is shallow and the hepatic region is not particularly inflated (Fig. 5A). Furthermore, in *P. sulcatus*, the branchiostegal tooth overreaches the antennal tooth, while in *P. bimaxillaris*, it extends as far as the antennal tooth. The third pereopod is relatively longer and more slender in *P. sulcatus* than in *P. bimaxillaris* (the propodus is about 12.0 times longer than wide versus about 7.0–9.0 times) (cf. Fig. 3H and Fig 5B).

As discussed by Cleva (1990), the size and shape of the ocellus on the eyestalk differs between species of *Parastylodactylus*. As far as we could determine, there is no trace of an ocellus on the eyestalk in the present new species. Nevertheless, our observation may not be definitive, as the condition of the three type specimens is less than satisfactory. In order to confirm the presence or absence of the ocellus, examination of better-preserved material is required.

As far as we aware, there are no previous records of species of *Parastylodactylus* from waters around India, with the present record thus constituting the first of the genus for Indian waters.

Etymology. From the Latin *sulcatus* (grooved), in reference to the characteristic very deep hepatic groove seen in this new species.

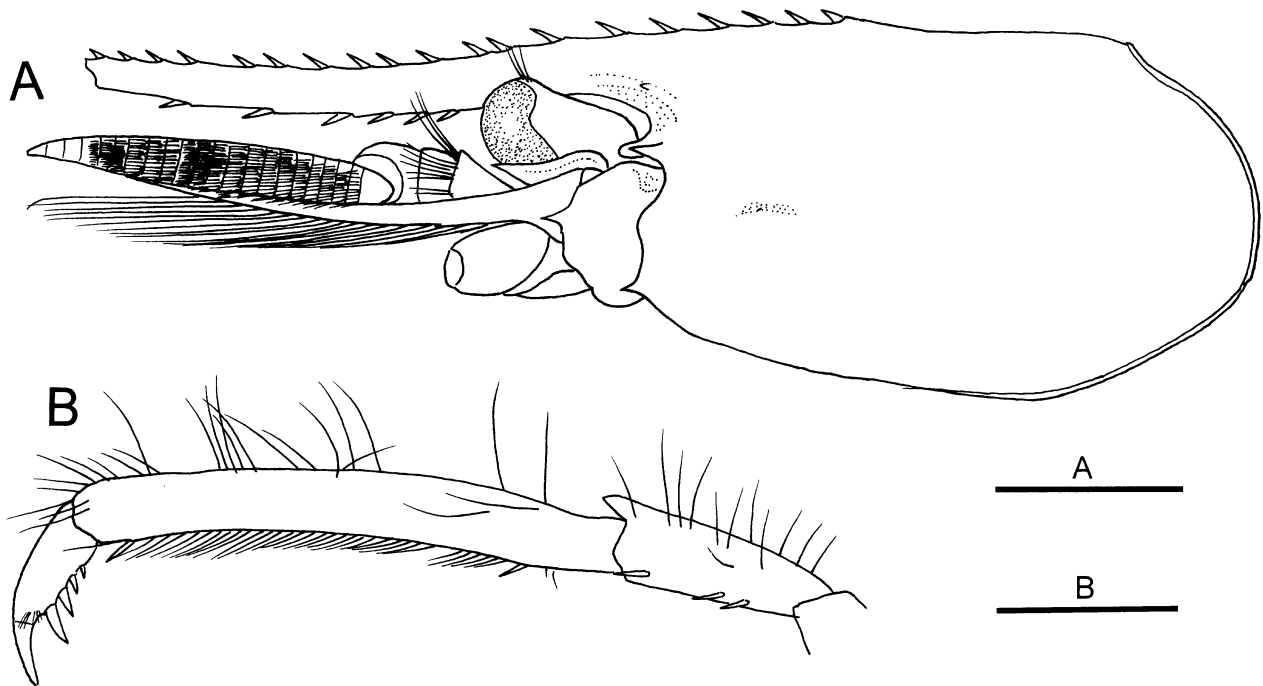


FIGURE 5. *Parastylodactylus bimaxillaris* (Bate, 1888), male (cl 5.1 mm), CBM-ZC 2863. A, carapace and left cephalic appendages, lateral view (distal part of rostrum broken off); C, dactylus and propodus of left third pereopod, lateral view. Scale bars: 2 mm for A; 1 mm for B.

Key to species of *Parastylodactylus*

1. Fifth abdominal pleuron armed with posteroventral or posterolateral tooth. 2
- Fifth abdominal pleuron unarmed. 6
2. Carapace with 5–8 postrostral spines; sixth abdominal somite less than 2.0 times as long as fifth somite; telson armed with 4 or 5 pairs of dorsolateral spines. 3
- Carapace with 11–16 postrostral spines; sixth abdominal somite 2.2–3.0 times as long as fifth somite; telson armed with 3 pairs of dorsolateral spines (merus-ischium of third pereopod with proximoventral spine) *P. tranterae* Cleva, 1990
3. Fifth abdominal pleuron with posterolateral tooth; merus-ischium of third pereopod with proximoventral spine (carapace with supraorbital tooth) 4
- Fifth abdominal pleuron with posteroventral tooth; merus-ischium of third pereopod without proximoventral spine 5
4. Ventral rostral spines moderately long, subequal or only slightly longer than dorsal spines; telson with 5 pairs of dorsolateral spines; meri of third to fifth pereopods without dorsodistal spinule. *P. hayashii* (Komai, 1997)
- ventral rostral spines elongate, distinctly longer than dorsal spines; telson with 4 pairs of dorsolateral spines; meri of third to fifth pereopods each with dorsodistal spinule. *P. moluccensis* Cleva, 1997
5. Rostrum less than 2.0 times as long as carapace; minute supraorbital tooth present near rostral base; hepatic groove shallow; branchiostegal tooth extending as far as antennal tooth *P. bimaxillaris* (Bate, 1888)
- Rostrum more than 2.0 times as long as carapace; carapace lacking supraorbital tooth; hepatic groove deep; branchiostegal tooth overreaching antennal tooth. *P. sulcatus* **sp. n.**
6. Carapace with 12 postrostral spines (supraorbital tooth present) *P. semblatae* Cleva, 1990
- Carapace with 5–8 postrostral spines 7
7. Rostrum with 5–9 ventral spines; minute supraorbital tooth present; dactyli of third and fourth pereopods appearing biunguiculate; merus-ischium of third pereopod without proximoventral spine *P. bimaxillaris* (Bate, 1888)
- Rostrum with less than 5 ventral spines; supraorbital tooth absent; dactyli of third and fourth pereopods not biunguiculate; merus-ischium of third pereopod with strong proximoventral spine 8
8. Dactyli of third and fourth pereopods elongate, over half length of propodi, unarmed on flexor margin *P. longidactylus* Cleva, 1990
- Dactyli of third and fourth pereopods shorter than half length of propodi, armed with accessory spinules on flexor margins *P. richeri* Cleva, 1990

Acknowledgements

The guidance and support of Dr. G. Syda Rao (Director of the CMFRI), Dr. N. G. K. Pillai, Dr. E. V. Radakrishnan, Dr. U. Ganga (CMFRI) and MoES/CMLRE, Government of India are gratefully acknowledged. We thank Drs. Sammy De Grave (Oxford University Museum of Natural History) and Tin-Yam Chan (Institute of Marine Biology, National Taiwan Ocean University) for reviewing the manuscript.

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