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New species of Paracalanidae along the west coast of India: *Paracalanus arabiensis*

KIRTI SURESHCHANDRA KESARKAR AND ARGA CHANDRASHEKAR ANIL
National Institute of Oceanography (Council of Scientific & Industrial Research), Dona Paula, Goa, 403-004, India

A new species of copepod, Paracalanus arabiensis *sp. nov. collected from Mandovi and Zuari estuaries, Goa, central west coast of India, is described. It differs from its congeners mainly in the structure of leg 5, with a row of six teeth along the edge of inner terminal spine resulting in a serrated margin and two small, stiff spines of equal length protrude in between the terminal spines.*

Keywords: copepod, Paracalanidae, *Paracalanus arabiensis*, new species, west coast of India

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INTRODUCTION

Paracalanids are dominant components amongst the subclass Copepoda and comprise about 20 species worldwide, sometimes consisting of 80% of marine copepod abundance. Most of the species are neritic and are abundant in coastal (Yoo & Lee, 1994) and oceanic surface waters throughout the tropical and temperate regions (Sewell, 1947). They are generally very small-sized copepods, mainly herbivorous (Arashkevich, 1969; Itoh, 1970; Paffenhöfer, 1984) belonging to the order Calanoida and vary in size from 0.5–1.5 mm. They play an important role as primary consumers in marine ecosystems (Yoo & Lee, 1994). There are six genera in this family: *Acrocalanus*, *Bestiolina*, *Calocalanus* (= *Leptocalanus*, *Ischnocalanus*), *Delius*, *Paracalanus* and *Parvocalanus* (Bradford-Grieve, 1994). The species of the genus *Paracalanus* Boeck, 1864 recorded from Indian waters include *P. aculeatus* Giesbrecht, 1888, *P. parvus* (Claus, 1863), *P. crassirostris* Dahl, 1894, *P. nanus* Sars, 1907, *P. denudatus* Sewell, 1929, *P. nudus* Sewell, 1929, *P. serratipes* Sewell, 1912, *P. dubia* Sewell, 1912, *P. indicus* Wolfenden, 1905 and *P. clevei* Carl, 1907. *Paracalanus indicus* was also recorded from New Zealand waters (Bradford-Grieve, 1994). *Paracalanus intermedius* Shen & Bai, 1956, *P. serrulus* Shen & Lee, 1963 and *P. brevispinatus* Shen & Lee, 1966 were reported from the Yellow Sea, China (Shen & Bai, 1956; Shen & Lee, 1963, 1966). *Paracalanus gracilis* Chen & Zhang, 1965 was recorded from Korean waters (Yoo & Lee, 1994). *Paracalanus tropicus* Andronov, 1977 was recorded from the south-east Atlantic Ocean (Andronov, 1977). *Paracalanus scotti* Fruchtl, 1923 was recorded from the Gulf of Guinea (Vervoort, 1963). *Paracalanus hibernicus* Brady & Robertson, 1873 was recorded from open seas off Ireland (Brady & Robertson, 1873). *Paracalanus mariae* Brady, 1918 was recorded as a new species during the Australasian Antarctic Expedition in 1918 (Brady, 1918). *Paracalanus quasimodo* Bowman, 1971 was recorded off the southern coast of Florida (Bowman, 1971). *Paracalanus campaneri* Bjornberg, 1980 was recorded off the coast of Brazil (Bjornberg, 1980).

In this paper, a new species of *Paracalanus* collected from the Mandovi and Zuari estuaries, Goa, west coast of India is described.

Corresponding author:
A.C. Anil
Email: acanil@nio.org

MATERIALS AND METHODS

Zooplankton samples were collected by horizontal hauls with a Heron–Tranter (HT) plankton net (100 μm mesh with a digital flow meter (Hydro-Bios, No. 438110)) from the Mandovi and Zuari estuaries (including Marmugao Port Trust (MPT) area), (15°25′N 73°48′E) during May 2005, December 2005 and September 2006. The same species was also observed in the samples collected from Jawaharlal Nehru Port Trust, Mumbai in the year 2001–2002 (Figure 1). The samples were fixed immediately after collection in 5% formaldehyde solution. Specimens of the new species were sorted, dissected and examined with the Olympus CX40 microscope. All drawings were made with the aid of camera lucida and the measurements with an ocular micrometer. The descriptive terminology employed follows Huys & Boxshall (1991).

SYSTEMATICS

Subclass COPEPODA Milne-Edwards, 1840
Order CALANOIDA Sars, 1903
Family PARACALANIDAE Giesbrecht, 1892
Genus *Paracalanus* Boeck, 1864
Paracalanus arabiensis sp. nov.
(Figures 2–4; Table 1)

TYPE MATERIAL

Holotype: adult female, 0.60 mm, Mandovi and Zuari estuary, Goa, specimen deposited in the National Institute of Oceanography (NIO), Goa, (GOMPC-1).

Paratypes: ten adult females, TL. 0.55–0.60 mm, mean 0.57 mm, SD ± 0.02, same locality, deposited in the NIO, Goa, (GOMPC-2).

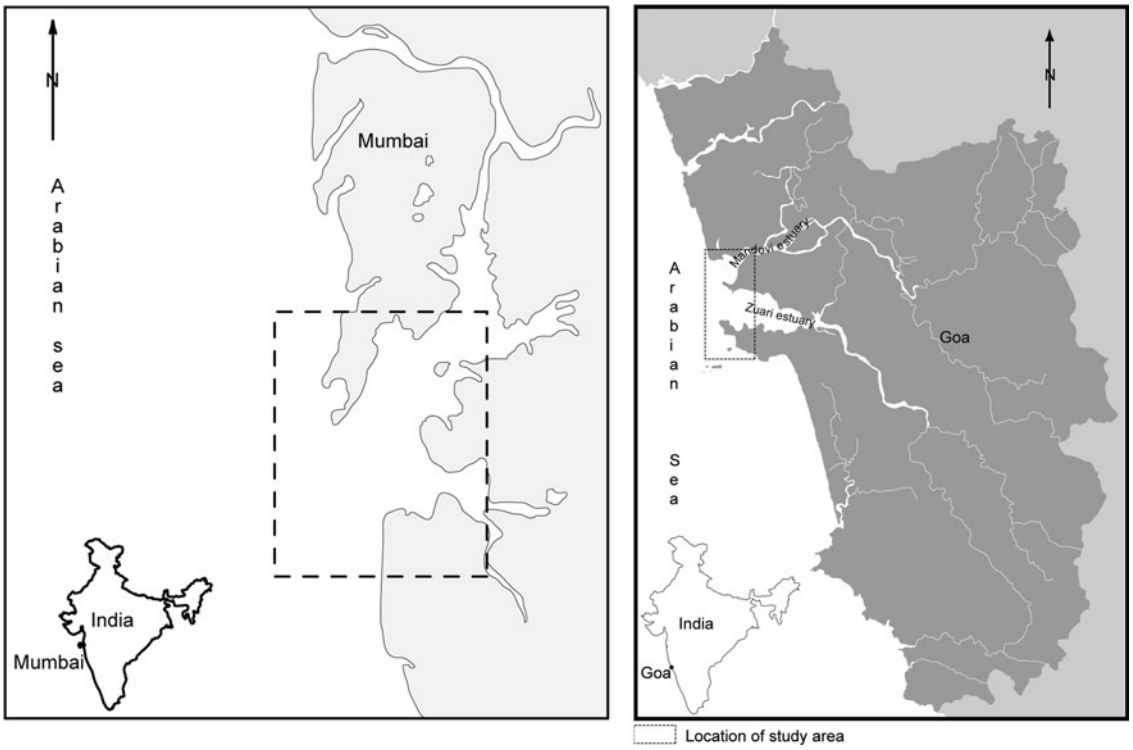

Fig. 1. Location of study area.

DESCRIPTION OF ADULT FEMALE

Total body length 0.60 mm, broad and short. Forehead uniformly rounded, rostrum short, solid, rounded at tip (Figure 2C & D). Cephalosome incorporating first pedigerous somite, slight demarcation between fourth and fifth pedigerous somites (Figure 2A & B). Urosome 4-segmented. Genital somite broad, rounded. Anal somite longer than second and third urosomites.

Antennule (Figure 3A): 25-segmented, extending to posterior margin of genital somite. Segments 1 (I) and 2 (II–IV) partially

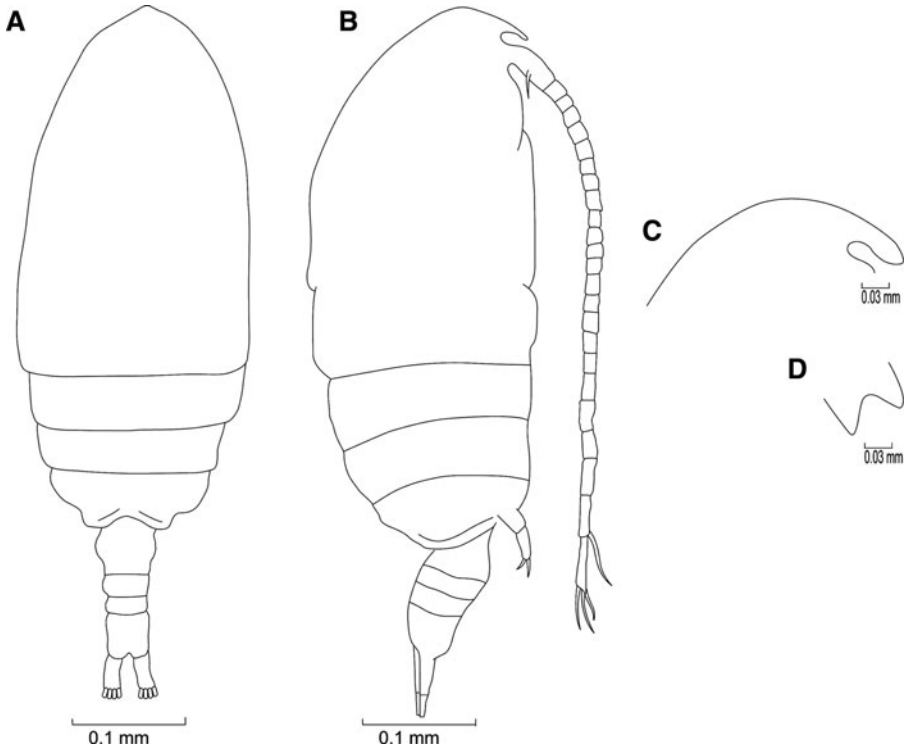

Fig. 2. *Paracalanus arabiensis* sp. nov. female (holotype). (A) Habitus, dorsal view; (B) habitus, lateral view; (C) rostrum, lateral view; (D) rostrum, dorsal view.

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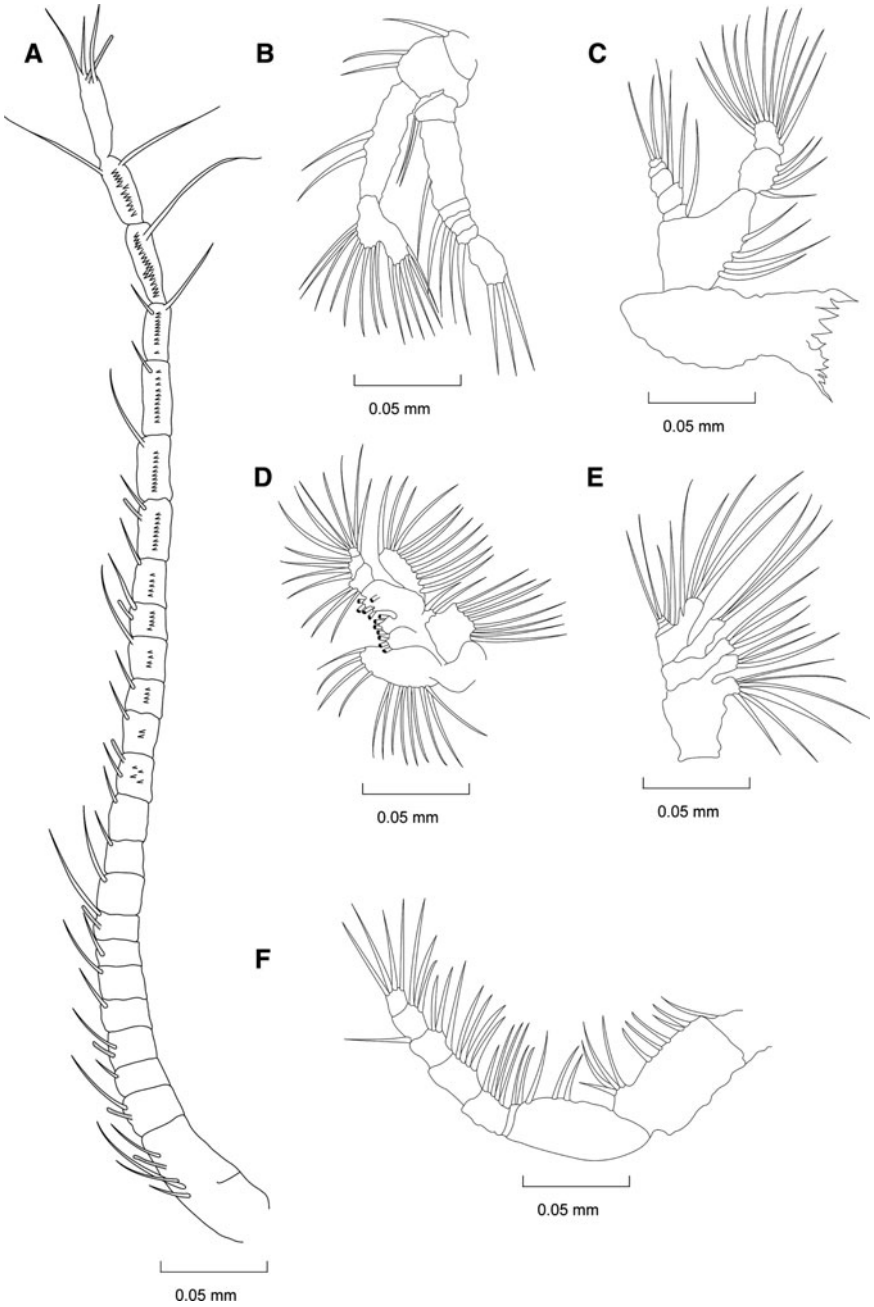

Fig. 3. *Paracalanus arabiensis* sp. nov., female (holotype). (A) Antennule; (B) antenna; (C) mandible; (D) maxillule; (E) maxilla; (F) maxilliped.

fused. Segments 3 (V) to 24 (XXVI) separate. Apical segment 25 (XXVII–XXVIII) double. Armature pattern as follows: segments 1 and 2 (I–IV) –4 + 1 aesthetasc, 3 (V) –1 + 1 aesthetasc, 4 (VI) –1, 5 (VII) –1 + 1 aesthetasc, 6 (VIII) –1, 7 (XI) –1, 8 (X) –1, 9 (XI) –1 + aesthetasc, 10 (XII) –1, 11 (XIII) –1, 12 (XIV) –1, 13 (XV) –1 + aesthetasc, 14 (XVI) –1, 15 (XVII) –1, 16 (XVIII) –1, 17 (XIX) –1 + aesthetasc, 18 (XX) –1, 19 (XXI) –1 + aesthetasc, 20 (XXII) –1, 21 (XXIII) –1, 22 (XXIV) –2, 23 (XXV) –1, 24 (XXVI) –2, 25 (XXVII–XXVIII) –3 + 1 aesthetasc. Segments 13–24 bear small spines. Number of spines 4, 2, 4, 4, 5, 5, 9, 10, 11, 10, 19 and 12 respectively.

Antenna (Figure 3B): biramous; coxa and basis clearly separate, bearing 1 and 2 setae respectively. Exopod 7-segmented, slightly longer than endopod, segment 1 with 2 setae, segments 2–6 with 1 seta each, segment 7 bearing 3 setae apically. Endopod 2-segmented, first segment with 2 setae, second segment bilobed, with proximal and distal lobes bearing 8 and 6 setae respectively.

Mandible (Figure 3C): with cutting edge of gnathobase bearing 9 cuspidate teeth and 1 seta. Palp biramous; basis with 4 setae; exopod 5-segmented, segments 1–4 each with 1 seta, segment 5 bearing 2 apical setae. Endopod 2-segmented, bearing 4 setae on proximal segment and 11 setae on distal segment.

Maxillule (Figure 3D): praecoxal arthrite with 13 setae. Coxa with 3 setae on endite; epipodite with 8 setae. Basis with 4 setae on proximal endite and 5 setae on distal endite; basal exite with 2 setae. Exopod bearing 11 lateral setae. Endopod 3-segmented, first to third segments with 3, 4 and 7 setae respectively.

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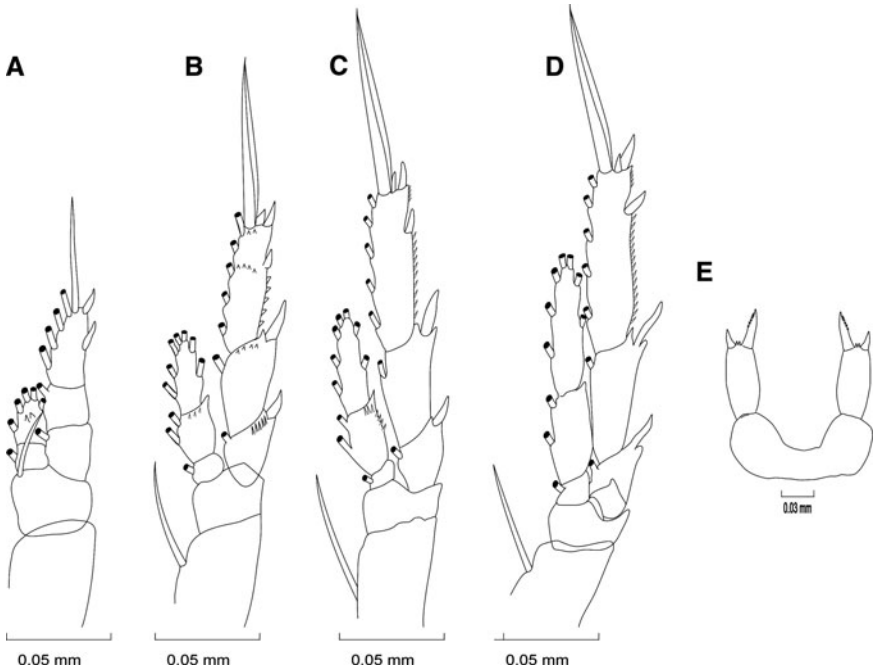

Fig. 4. *Paracalanus arabiensis* sp. nov., female. (holotype). (A) Leg 1; (B) leg 2; (C) leg 3; (D) leg 4; (E) leg 5.

Maxilla (Figure 3E): praecoxa bearing 2 endites; proximal endite with 6 setae, distal with 3 setae; coxa with 2 endites each armed with 3 setae; basis with a single endite bearing 4 setae and 1 seta laterally. Endopod 3-segmented with setal formula of 1, 1, 2.

Maxilliped (Figure 3F): praecoxa and coxa apparently separate; praecoxa with 1 seta; coxa bearing 2, 3 and 4 setae representing endites; basis bearing 3 setae. Endopod 6-segmented; first to sixth segments bearing 2, 4, 4, 3, 3 + 1 and 4 setae respectively.

Swimming legs with 3-segmented exopods; endopod 2-segmented in leg 1, 3-segmented in legs 2, 3 and 4 (Figure 4A–D). Spine and seta formula of swimming legs shown in Table 1. Leg 1 basis with inner edged seta, third exopodal segment of legs 3 and 4 with serrate distal margin.

Leg 5 (Figure 4E) 2-segmented, symmetrical. First segment slightly robust; second segment bearing 2 terminal spines of unequal length, inner spine twice the length of outer one with a row of six small teeth along its edge. Two small, stiff spines of equal length protrude in between the terminal spines.

MALE

Unknown.

Table 1. Spine and setal formula of legs 1–4 of *Paracalanus arabiensis* sp. nov.

	Coxa	Basis	Exopod			Endopod		
			1	2	3	1	2	3
Leg 1	0–0	0–1	0–1	0–1	II, I, 4	0–1	1, 2, 2	–
Leg 2	0–1	0–0	I–1	I–1	II, I, 5	0–1	0–2	2, 2, 3
Leg 3	0–1	0–0	I–1	I–1	II, I, 5	0–1	0–2	2, 2, 3
Leg 4	0–1	0–0	I–1	I–1	II, I, 5	0–1	0–2	2, 2, 3

ETYMOLOGY

The species name refers to the locality 'Arabian sea' where the specimens of the new species were collected.

REMARKS

The new species is readily distinguished from other *Paracalanus* species by the following characteristics: size, appearance of rostrum, antennule extension, and total number of spines present on the dorsal surface of exopodal and endopodal segments 1–3 (Table 2). This comparison is mainly based on the structure of leg 5. The new species has a row of six teeth along the edge of inner terminal spine and two small, stiff spines of equal length protrude in between the terminal spines. Inner terminal spine of *P. brevispinatus* is serrated with four teeth (Figure 5A) and it is armed with seven or eight teeth in *P. scotti* (Figure 5C). *Paracalanus crassirostris* bears a row of two or three teeth along its inner terminal spine (Figure 5M). In *P. aculeatus*, *P. nudus*, *P. serratipes*, *P. dubia* and *P. quasimodo* the edge of inner terminal spine is armed with small spinules (Figure 5B, K, N, L and Q, respectively). A comparison of total number of spines present in between the terminal spines is also made from the available literature. *Paracalanus scotti* has four to five stiff spines (Figure 5C), *P. serrulus* has only one spine protruding in between terminal spines (Figure 5D). *Paracalanus serratipes* (Figure 5N) has three spines near its terminal spines and in *P. dubia* five spines are present (Figure 5L). The structure of leg 5 in *P. hibernicus* (Figure 5O) is different from the other species, it is cylindrical, one branched, three jointed of nearly equal length terminated by two or three fine short setae (Brady & Robertson, 1873).

Morphologically, the genera *Paracalanus* and *Parvocalanus* Andronov, 1970 show a considerable resemblance especially in the structure of leg 5 (Figure 5). Andronov (1970) revised some species of *Paracalanus* and placed them in the genus *Parvocalanus*. These were *P. crassirostris, P. scotti, P. serratipes* and *P. dubia*. In addition to this, two new species,

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Table 2. Comparison of the genera *Paracalanus* and *Parvocalanus* (female specimens).

Species of *Paracalanus* and *Parvocalanus*	Geographical distribution	Total length (mm)	Body shape	Rostrum	Fusion line between fourth and fifth pedigerous somites	Antennule extension	No. of spines on the dorsal surface of exopodal segments 1–3	No. of spines on the dorsal surface of endopodal segments 1–3	Structure of leg 5	References
Paracalanus arabiensis. sp. nov.	Arabian Sea (Goa and Mumbai coast)	0.55–0.60 (mean 0.57) (SD ± 0.02)	Broader and shorter	Short, solid, slightly round at tip	Visible	Extends approximately to posterior margin of genital somite	Leg 2 → 5, 4, 6 Leg 3 → 0, 0, 0 Leg 4 → 0, 0, 0	Leg 2 → 0, 3, 0 Leg 3 → 0, 7, 0 Leg 4 → 0, 0, 0	(i) Inner terminal spine twice the length of outer terminal spine. Its edge serrated with six teeth (ii) Two small spines of equal length protrude in between the terminal spines	This study
P. brevispinatus Shen & Lee, 1966	Chaikiang river, China	0.45–0.55	Broader and shorter	X	Visible	X	Leg 2 → 5, 0, 0 Leg 3 → 4, 0, 0 Leg 4 → 4, 0, 0	Leg 2 → 0, 0, 0 Leg 3 → 0, 4, 0 Leg 4 → 0, 4, 0	(i) Inner terminal spine four times the length of outer terminal spine. Its edge serrated with four teeth (ii) No spines observed between the terminal spines.	Figure 6 (Shen & Lee, 1966)
P. tropicus Andronov, 1977	South-east Atlantic Ocean	0.74–0.90	Narrower and longer	Pointed	Visible	Extends to posterior margin of third urosomite	X	X	X	РИС 1 (Andronov, 1977)
P. aculeatus Giesbrecht, 1888	Atlantic, Indian and Pacific Oceans, Arabian Sea, Red Sea, Gulf of Aden	0.80–1.36	Narrower and longer	Pointed	Visible	Extends the caudal rami by last segment	Leg 2 → 6, 5, 3 Leg 3 → 3, 7, 0 Leg 4 → 0, 4, 0	Leg 2 → 0, 8, 0 Leg 3 → 0, 8, 2 Leg 4 → 0, 14, 10	(i) Inner terminal spine more than five times the length of outer terminal spine. Small spinules present at its edge (ii) No spines observed between the terminal spines	Figure 36 (H) (Bradford-Grieve, 1994)
P. scotti Fruchtl 1923 (=*Parvocalanus scotti* (Fruchtl, 1923))	West Africa, Gulf of Guinea, Portuguese Guinea	0.64–0.67	Broader and shorter	Short, pointed	Visible	Extends until posterior end of caudal rami	Leg 2 → 0, 5, 5 Leg 3 → 0, 7, 7 Leg 4 → 0, 7, 0	Leg 2 → 0, 4, 0 Leg 3 → 0, 6, 3 Leg 4 → 0, 4, 3	(i) Inner terminal spine more than twice the length of outer terminal spine. Its edge serrated with seven or eight teeth (ii) Near the terminal spines, four to five stiff spines present	Figure 12 (e) (Vervoort, 1946)

Continued

Table 2. Continued

Species of *Paracalanus* and *Parvocalanus*	Geographical distribution	Total length (mm)	Body shape	Rostrum	Fusion line between fourth and fifth pedigerous somites	Antennule extension	No. of spines on the dorsal surface of exopodal segments 1–3	No. of spines on the dorsal surface of endopodal segments 1–3	Structure of leg 5	References
P. serrulus Shen & Lee, 1963	China	–	X	X	Visible	X	X	X	(i) Inner terminal spine more than three times the length of outer terminal spine. Edge of this spine is smooth (ii) In between the terminal spines, one small spine protrudes	Figure 3 (Shen & Lee, 1963)
P. indicus Wolfenden, 1905	South-west Pacific, Mid-Tasman Sea, New Zealand	0.85–0.95	Broader and shorter	Pointed	Slightly visible dorsally	Extends beyond third urosomite	Leg 2 → 0, 0, 0 Leg 3 → 0, 6, 0 Leg 4 → 0, 0, 0	Leg 2 → 0, 4, 0 Leg 3 → 0, 4, 2 Leg 4 → 0, 6, 0	(i) Inner terminal spine seven times the length of outer terminal spine. Edge of this spine is smooth (ii) No spines observed between the terminal spines	Figure 19 (N) (Bradford-Grieve, 1994)
P. intermedius Shen & Bai, 1956	China	0.88	Broader and shorter	X	Visible	X	X	X	(i) Inner terminal spine four times the length of outer terminal spine. Edge of this spine is smooth (ii) No spines observed between the terminal spines	Figure 13, plate II (Shen & Bai, 1956)
P. nanus Sars, 1907	Atlantic, Indian and Pacific Oceans	0.60–0.62	Narrower and longer	Pointed	Not visible	Extends to last abdominal somite	Leg 2 → 4, 0, 0 Leg 3 → 0, 4, 1 Leg 4 → 0, 0, 0	Leg 2 → 0, 4, 0 Leg 3 → 0 Leg 4 → 0, 2, 2	(i) Inner terminal spine more than five times the length of outer terminal spine. Edge of this spine is smooth (ii) No spines observed between the terminal spines	Figure f (Sewell, 1929)
P. gracilis Chen & Zhang, 1965	East China Sea, Korean peninsula	0.80–0.90	Narrower and longer	Pointed	Not visible	Extends beyond the caudal ramus by last segment	Leg 2 → 3, 3, 0 Leg 3 → 0, 3, 0 Leg 4 → 0, 0, 0	Leg 2 → 0, 3, 0 Leg 3 → 0, 3, 0 Leg 4 → 0, 5, 0	(i) Inner terminal spine four times the length of outer terminal spine. Edge of this spine is smooth (ii) No spines observed between the terminal spines	Figure 3 (d) (Yoo & Lee, 1994)

P. parvus (Claus, 1863)	Atlantic, Indian and Pacific Oceans, Mediterranean Sea, Red, Black and Adriatic Seas	0.70–1.20	Narrower and longer	Pointed	Not visible	Extends approximately to third urosomite	Leg 2 → 5, 3, 0 Leg 3 → 0, 2, 0 Leg 4 → 0, 0, 0	Leg 2 → 0, 6, 0 Leg 3 → 0, 3, 2 Leg 4 → 0, 5, 0	(i) Inner terminal spine four times the length of outer terminal spine. It has a tiny internal spine. Edge is smooth (ii) No spines observed between the terminal spines	Figure B (Conway *et al.*, 2003)
P. denudatus Sewell, 1929	Meditteranean Sea, Indian Sea and Great Barrier Reef	0.74–0.81	Narrower and longer	Pointed	Visible	Extends beyond the caudal rami by last segment	Leg 2 to 4 without spines	Leg 2 → 0, 7, 0 Leg 3 → 0, 5, 0 Leg 4 → 0, 6, 3	(i) Inner terminal spine more than five times the length of outer terminal spine. Edge of this spine is smooth (ii) Near the terminal spines, two small spines present	Figure 10 (e) (Vervoort, 1946)
P. nudus Sewell, 1929	Indian Ocean	0.45–0.48	Narrower and longer	Pointed	Not visible	Extends until the last abdominal somite	Leg 2 → 1, 1, 0 Leg 3 → 2, 0, 0 Leg 4 → 0, 0, 0	Leg 2 → 0, 2, 0 Leg 3 → 0, 3, 0 Leg 4 → 0, 1, 0	(i) Inner terminal spine more than ten times the length of outer terminal spine, stout and is armed throughout the distal three fourths with a row of spinules giving it a serrated margin (ii) No spines observed between the terminal spines	Figure 30 (i) (Sewell, 1929)
P. crassirostris Dahl, 1894 (=*Parvocalanus crassirostris* (Dahl, 1894))	Bay of Bengal, south-west Atlantic, Indo-Malesia, North-east Australia	0.42–0.5	Narrower and longer	Pointed	Not visible	Extends approximately to second urosomite	Leg 2 → 0, 4, 4 Leg 3 → 0, 3, 1 Leg 4 → 0, 0, 0	Leg 2 → 0, 5, 0 Leg 3 → 0, 3, 2 Leg 4 → 0, 0, 2	(i) Inner terminal spine more than twice the length of outer terminal spine. Edge serrated with a row of two or three small teeth (ii) No spines observed between the terminal spines	Figure 27 (b) (Sewell, 1929)
P. serratipes Sewell, 1912 (=*Parvocalanus serratipes* (Sewell, 1912))	Indian Ocean	1.1	X	X	X	X	Leg 2 → 0, 4, 5 Leg 3 → 0, 4,5 Leg 4 → X	Leg 2 → 0, 6, 0 Leg 3 → 0, 4, 0 Leg 4 → X	(i) Inner terminal spine more than twice the length of outer terminal spine. Its edge is armed with a row of spinules (ii) Near the terminal spines, three small, stiff spines present	Figure 22 (b) (Sewell, 1929)
P. hibernicus Brady & Robertson, 1873	West of Ireland	1.6	X	X	X	X	X	X	Cylindrical, one branched, three jointed, with joints of nearly equal length terminated by two or three fine short setae	Figure 3, plate VIII (Brady & Robertson, 1873)

Continued

Table 2. Continued

Species of *Paracalanus* and *Parvocalanus*	Geographical distribution	Total length (mm)	Body shape	Rostrum	Fusion line between fourth and fifth pedigerous somites	Antennule extension	No. of spines on the dorsal surface of exopodal segments 1–3	No. of spines on the dorsal surface of endopodal segments 1–3	Structure of leg 5	References
P. mariae Brady, 1918	Maria Island, Tasmania	–	X	X	X	X	X	X	(i) Inner terminal spine more than twice the length of outer terminal spine. Edge of this spine is smooth (ii) No spines observed between the terminal spines	Figure 14, plate I (Brady, 1918)
P. dubia Sewell, 1912. (=*Parvocalanus dubia* (Sewell, 1912))	Indian Ocean	0.74	Broader and shorter	Pointed	Slightly visible	Extends to second urosomite	Leg 2 → 3, 0, 4 Leg 3 → X Leg 4 → X	Leg 2 → 0, 4, 0 Leg 3 → X Leg 4 → X	(i) Inner terminal spine about three times the length of outer terminal spine. Its edge serrated with row of ten to twelve spinules (ii) Near the terminal spines, five spines present	Figure 29 (b) (Sewell, 1929)
P. quasimodo Bowman, 1971	Off southern Florida	1.00	Broader and shorter	Pointed	Visible	Extends to posterior margin of anal somite	Leg 2 → 3, 6, 0 Leg 3 → 0, 6, 0 Leg 4 → 0, 0, 0	Leg 2 → 0, 8, 0 Leg 3 → 0, 11, 4 Leg 4 → 0, 2, 9	(i) Inner terminal spine more than three times the length of outer terminal spine. Edge is serrated with small spinules (ii) No spine observed between the terminal spines	Figure 20 (l) (Bowman, 1971)
Parvocalanus latus# Andronov, 1972	Indian Ocean	0.42–0.47	Broader and shorter	Short	Visible	Extends slightly beyond the caudal rami	Leg 2 → 2, 7, 15 Leg 3 → 0, 9, 7 Leg 4 → 0, 8, 0	Leg 2 → 0, 6, 0 Leg 3 → 0, 8, 3 Leg 4 → 0, 4, 3	(i) Inner terminal spine more than three times the length of outer terminal spine. Edge of this spine is smooth (ii) No spines observed between the terminal spines	РИС 1 (10) (Andronov, 1972)
P. elegans# Andronov, 1972	Indian Ocean	0.48–0.50	Narrower and longer	Short	Visible	Extends almost to end of the anal somite	Leg 2→ 0, 0, 0 Leg 3 → 0, 6, 0 Leg 4 → 0, 0, 0	Leg 2 → 0, 3, 0 Leg 3 → 0, 4, 2 Leg 4 → 0, 3, 2	(i) Inner terminal spine three times the length of outer terminal spine. Edge of this spine is smooth (ii) No spines observed between the terminal spines	РИС 2 (7) (Andronov, 1972)

–, data not available; X, figure not available; #, different genus.

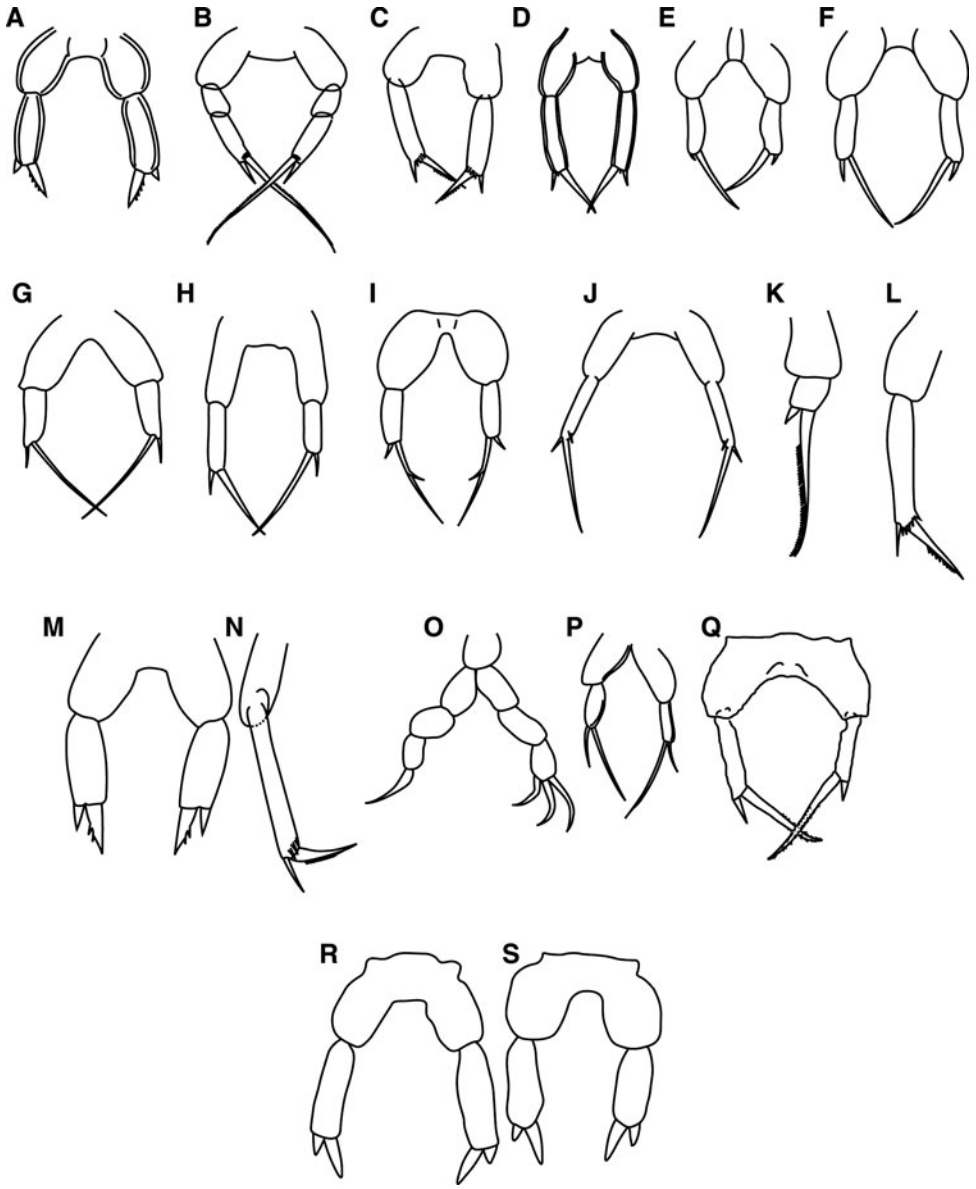

Fig. 5. Comparative morphology of female leg 5 among the genera *Paracalanus* and *Parvocalanus*. (A) *Paracalanus brevispinatus*; (B) *P. aculeatus*; (C) *P. scotti*; (D) *P. serrulus*; (E) *P. indicus*; (F) *P. intermedius*; (G) *P. nanus*; (H) *P. gracilis*; (I) *P. parvus*; (J) *P. denudatus*; (K) *P. nudus*; (L) *P. dubia*; (M) *P. crassirostris*; (N) *P. serratipes*; (O) *P. hibernicus*; (P) *P. mariae*; (Q) *P. quasimodo*; (R) *Parvocalanus latus*; (S) *P. elegans*.

Parvocalanus latus Andronov 1972 and *Parvocalanus elegans* Andronov 1972 were described by Andronov (1972). In these two species, edge of the inner terminal spine of leg 5 is smooth and no spines observed in between the terminal spines (Figure 5R & S).

A comparison is also made on the basis of leg 1 between the two genera *Paracalanus* and *Parvocalanus* and the following are the differences:

PARACALANUS	***PARVOCALANUS***
(1) Basis 2 usually with inner edge seta.	(1) Basis 2 without inner edge seta.
(2) Endopod 2-segmented.	(2) Endopod 1 or 2-segmented.
(3) Endopod segment 2 with 5 setae.	(3) Endopod segment 2 with 6 setae.

Paracalanus clevei Carl, 1907 has not been included in the comparison because Sewell (1914) in his description of the male *P. aculeatus*, showed that *P. clevei* is a developmental stage of this male. *Paracalanus campaneri* Bjornberg, 1980 and *P. pygmaeus* (Claus, 1863) are also not included in the description as they could possibly be synonyms of *P. aculeatus* Bjornberg, 1963 and *P. denudatus* respectively.

Our comparative table based on distribution, morphology (Table 2), differences in leg 5 (Figure 5) among the female *Paracalanus* species and differentiating characters with respect to leg 1 among the genera *Paracalanus* and *Parvocalanus* gives credence for the newly reported species to be a new inclusion in the genus *Paracalanus*.

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Correspondence should be addressed to:
A.C. Anil
Marine Corrosion and Material Research Division (MCMRD)
National Institute of Oceanography (NIO)
Dona Paula
Goa 403004
email: acanil@nio.org

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