



Redescription of poorly known neustonic calanoid copepod *Pontella andersoni* Sewell, 1912 (Family: Pontellidae) from the Bay of Bengal, Indian Ocean

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The neustonic calanoid copepod of family Pontellidae *Pontella andersoni* Sewell, 1912 was originally described from the Bay of Bengal based on a single male and a damaged female with a description of copepodid stage III. Later, this species was described from Gulf of Mannar (based on a male specimen) and from West Java (based on immature specimens). In the present study, adult female and male specimens were collected from the coastal waters of northern Bay of Bengal. The species was easily distinguished from its congeners by a barrel shaped first urosomal somite in female, and two subequal spines with two knot-like projections in the first exopodal segment of right fifth leg, serrated spine and three processes in the second exopodal segment of left leg in male. The present note is an updated illustrative description of *P. andersoni*, since the previous descriptions were lacking the taxonomic resolution.

[**Keywords:** Bay of Bengal, Copepoda, Pontellidae, Taxonomic description]

Introduction

Pontella andersoni Sewell, 1912, a neustonic calanoid copepod belonging to the family Pontellidae, was originally described based on a single male and damaged female obtained off Chittagong, Bay of Bengal¹. Though, the description was of copepodid stage III, it certainly added to our knowledge on the taxonomy of *P. andersoni*. The life history and the morphological changes observed at every copepodid stage up to the adult is certainly very significant in discerning the ecological role of the species. Subsequently, a male specimen of the species was described from Gulf of Mannar² and an immature female and male specimen was described from Labuan, West Java³. In the Indian Ocean, *P. andersoni* has been widely reported from the Bay of Bengal coast¹; Diamond Harbour, West Bengal⁴; Madras coast⁵; Lawsons Bay, Waltair⁶; Gulf of Mannar² and off Labuan, West Java³ (Fig. 1). In most of the collections, either male or female or immature specimens were reported. The lack of proper taxonomic description of both adult male and female specimen made it difficult to identify the organism from various coastal and marine environments. It is also mentioned that the original description of the species under the genus *Pontella* was poor and inadequate, leading to taxonomic ambiguities from Indian waters^{7,8}. During a taxonomic

study on the copepods along the coastal waters of Bay of Bengal, adult specimens of *P. andersoni* were collected from Sundarban mangrove region (West Bengal) and Gopalpur (along the Utkal coast of India, Odisha). This study describes *P. andersoni* on the basis of the present specimens with updated illustrations of both the sexes.

Materials and Methods

A winter monsoon survey was conducted from the Sundarban mangroves to northern Andhra Pradesh coastal waters of Bay of Bengal during 19th to 31st January 2018. Among the seven sampling transects perpendicular along the coast with 27 stations; one station in Sundarban mangroves (21°39'18" N, 88°28'13.9" E) and one station in Gopalpur (19°17'29.8" N, 84°57'56.9" E) recorded the occurrence of the copepod species *Pontella andersoni* (Fig. 1). The zooplankton samples were collected by Working Party (WP) net with mesh size 200 µm and mouth diameter of 60 cm, attached with a digital flow meter to record the amount of water filtered through the net. The WP net was towed at a speed of 1 knot (= 1.8 km/h) for 15 minutes and volume of water filtered was calculated. A Sea-Bird Electronics (SBE) portable Conductivity, Temperature, Depth (pressure) sensor (CTD) was used to record the profiles of temperature, salinity, Photosynthetic Active Radiation

(PAR) and fluorescence.

For morphological analysis, the samples were fixed in 4 % buffered formaldehyde. Mesozooplankton biomass of the stations was determined by displacement method (the ratio between displacement volumes to the volume of water filtered and expressed in ml/m³). The copepod specimens were photographed under a stereozoom microscope (Leica M125C), and subsequently identified to species level based on available literature. Specimens of *Pontella andersoni* were sorted from the original samples and oral parts and swimming legs were dissected in 50:50 solution of glycerine and distilled water. Line drawings were made using a drawing tube attached to a compound microscope.

Results

One male specimen of *P. andersoni* was collected from the Sundarbans mangrove area (Station- WBS4) and one female specimen of *P. andersoni* was collected

from Gopalpur coastal water (Station- ODG2). WBS4 had a mesozooplankton biomass of 3.8597 ml/m³ and ODG2 recorded a mesozooplankton biomass of 0.9082 ml/m³. Copepod abundance at station WBS4 was 3588.78 (no./m³) and at station ODG2 it was 4392.617 (no./m³). The copepod species recorded along with *P. andersoni* were *Subeucalanus pileatus* Giesbrecht, 1888, *Labidocera acuta* Dana, 1849, *Labidocera pectinata* Thompson and Scott, 1903, *Acartia erythraea* Giesbrecht, 1889 and *Calanopia* sp. at WBS4, while *Centropages furcatus* Dana, 1849, *Temora discaudata* Giesbrecht, 1889 and *Undinula vulgaris* Dana, 1849 were present along with *P. andersoni* at ODG2. In WBS4, the temperature, salinity, dissolved oxygen (DO) and chlorophyll-*a* concentration were 21.472 °C, 24.696 psu, 5.419 ml/l and 0.09 µg/l, respectively. ODG2 recorded the values of temperature, salinity, dissolved oxygen (DO) and chlorophyll-*a* concentration as 23.561 °C, 28.418 psu, 5.871 ml/l and 0.09 µg/l, respectively.

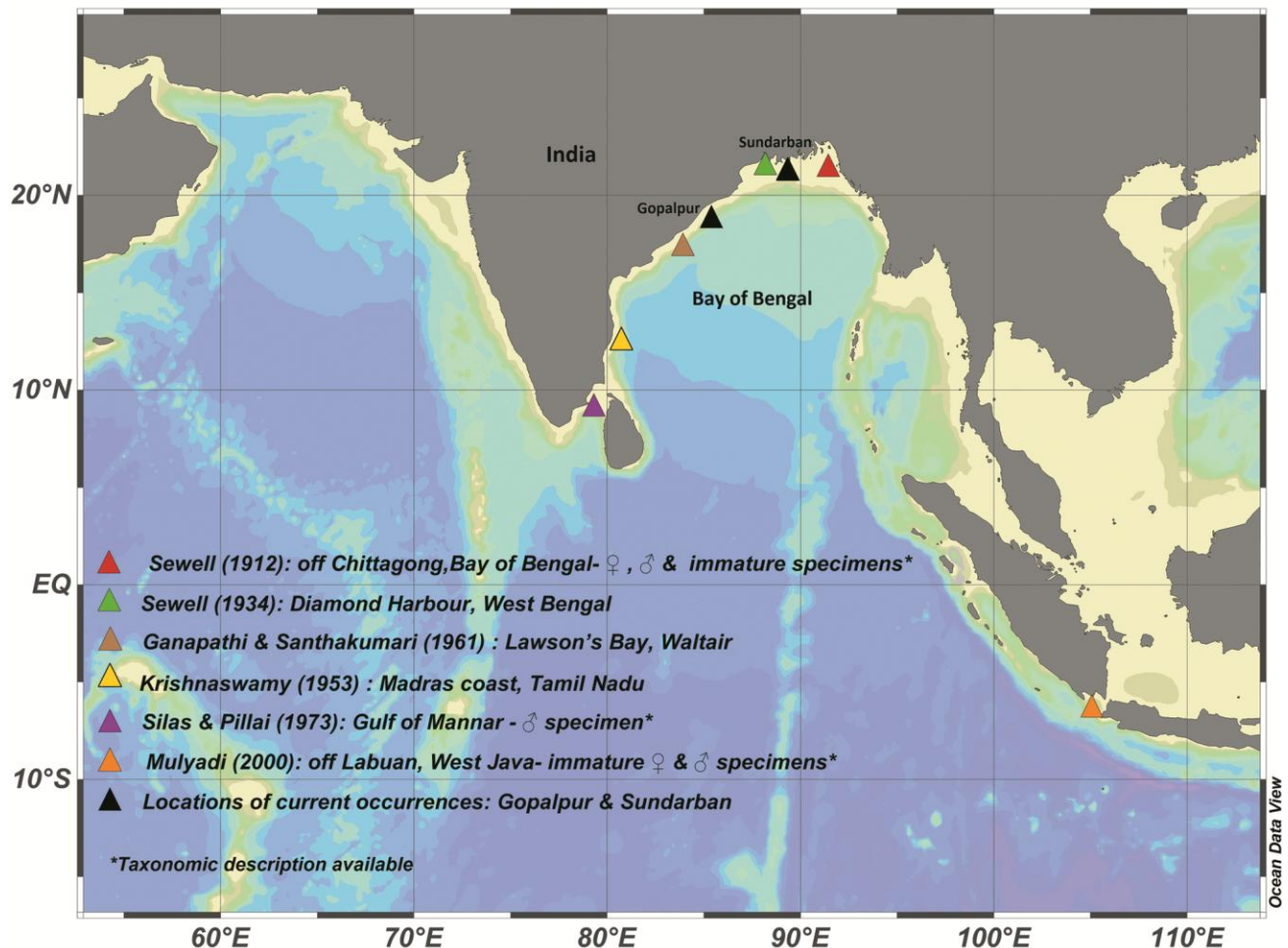


Fig. 1 — Map representing all the distributional records of *P. andersoni*

Systematics

Order: CALANOIDA Sars, 1903

Family: PONTELLIDAE Dana, 1852

Genus: *Pontella* Dana, 1846*Pontella andersoni* Sewell, 1912**Material examined**

One female and one male, deposited at the Zoological Survey of India, Kolkata (Accession number: C7957/2 for the female and C7958/2 for the male specimen).

Description

Female: Body length 3.24 mm (Fig. 2a). Triangular cephalosome with well-defined hooks. Cephalon along with first, fourth and fifth pedigers separate. Fifth pediger symmetrical, posterolateral ends produced into acuminate lobes and reaching middle of the first urosomal somite (Fig. 2e). Urosome symmetrical, with two somites. Antennule of

25 segments not reaching distal end of the last pedigerous somite. Segments III-IV and XI-XII partially fused. Armatures as follows I,2+2ae; II,2; III-IV,2; V,1; VI,1, VII,1; VIII,2; IX,1; X,1; XI-XII, 2; XIII,1+ae; XIV,1; XV,1+ae; XVI,2; XVII,2+ae; XVIII,2+ae; XIX,2; XX,2+ae; XXI,1; XXII,1; XXIII,1+1; XXIV,1+1+ae; XXV,4+2ae (Figs. 2b, c). Rostrum bifurcate; rostral lenses absent (Fig. 2d). First urosome somite barrel shaped and symmetrical; second somite small and terminates to symmetrical furca. Caudal rami are symmetrical containing five plumose setae and one small setae. Third pair of furcal setae is broader than the others (Fig. 2e). Antenna to maxilliped and first to fourth swimming legs similar to those of other species of the genus^{9,11,14,17}. Fifth leg; P5 symmetrical (Fig. 2f), basis with plumose seta; exopod and endopod one segmented. Endopod bifid apically. Exopod with five

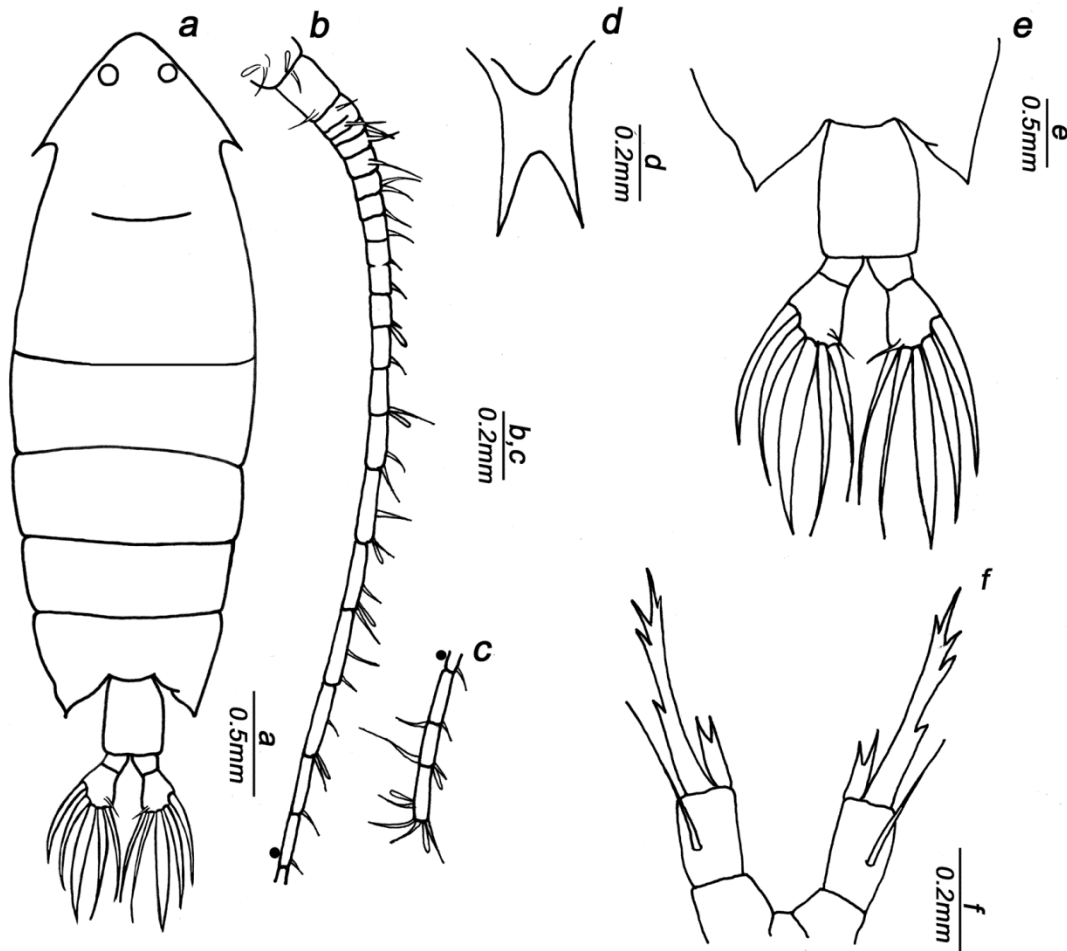


Fig. 2 — *Pontella andersoni* Sewell, 1912 female: a) habitus, dorsal view; b, c) right antennule; d) rostrum anterior view; e) urosome dorsal view; and f) 5th leg, posterior view

processes, one near the middle of the outer margin and four together at the distal end.

Male: Body length 2.72 mm (Fig. 3a). Cephalon separate from first pedigerous somite. Urosome comprising five somites, of which the third somite is the longest. Caudal rami symmetrical, second pair of furcal setae longer than the rest. Right antennule geniculate (Fig. 3b). Antennule of 25 segments. Ancestral segments I–II, V–VII, VIII–X, XII–XIII totally or partially fused. Elongated spine present on segment XIV. Fused segments XIX–XX with a denticulated plate, extending to three-fourth of its dorsal margin. Fused segment XXI–XXII with two dorsal toothed plates, armed with fine spinous teeth; distal margin with a falcate spine. Segments XXIII–XXV completely fused. Armatures as follows I–II,1;

III,2; IV,1; V–VII,3; VIII–X, 5; XI,4; XII–XIII,3; XIV,1; XV,1+ae; XVI,3; XVII,1+ae; XVIII,1; XIX–XX,1; XXI–XXII,1; XXIII–XXV,10. Left antennule similar to female. Rostrum with anterior and posterior lower frontal lenses (Fig. 3c). Diameter of posterior lower frontal lens 1.3 times those of anterior lower frontal lens (Fig. 3d). Fifth leg (Fig. 3e), right coxa and basis longer than the left; each basis with plumose seta. Right leg chelate, first exopodal segment with two sub equal spines and two knot-like projections proximal to the spines. Second exopodal segment club-shaped distally with four spinous setae along inner margin. Left leg, first exopodal segment elongate with a conspicuous spine at outer distal margin. Second exopodal segment slender and elongate with one spine and two processes distally; an additional serrated

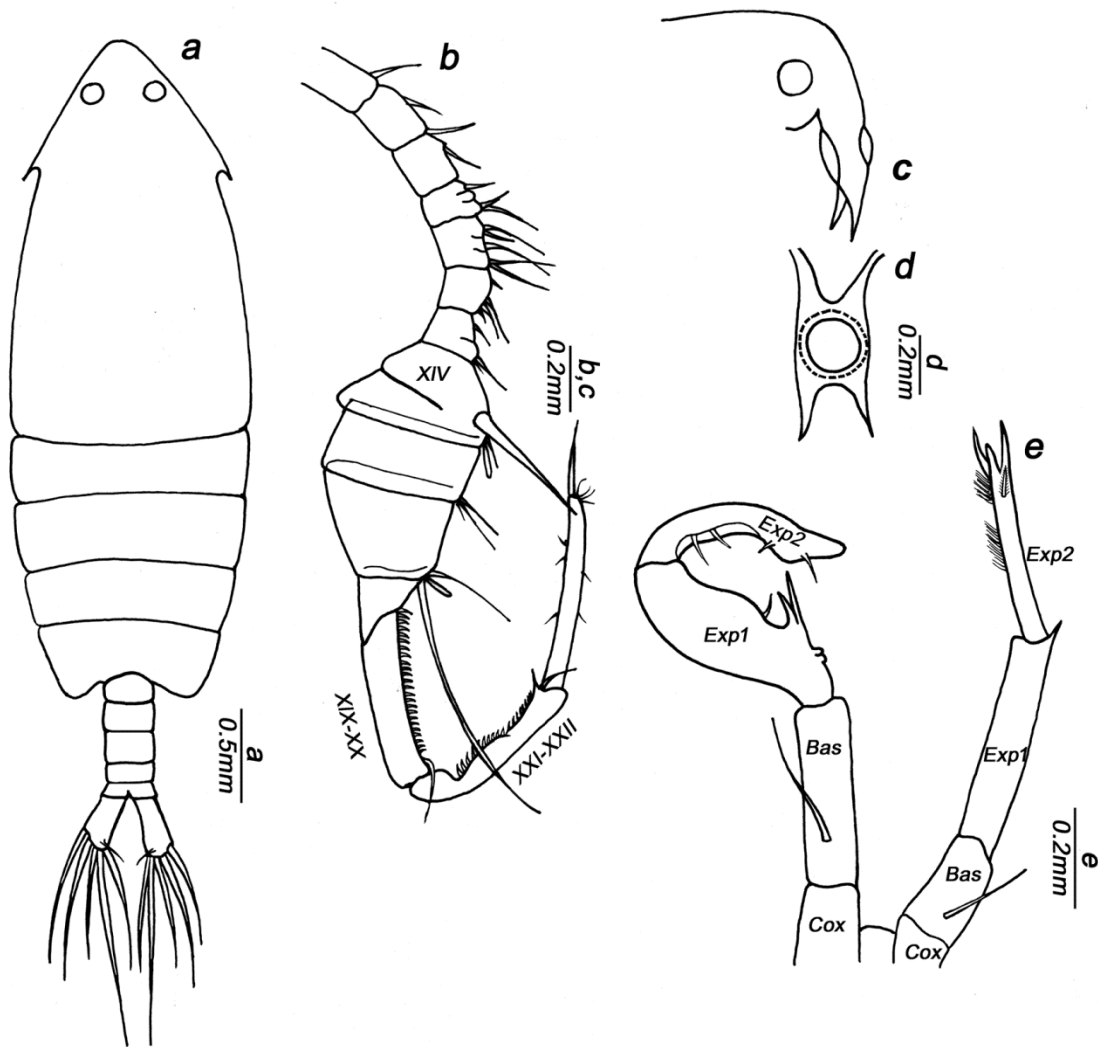


Fig. 3 — *Pontella andersoni* Sewell, 1912 male: a) habitus, dorsal view; b) right antennule; c) head, right lateral view; d) rostrum, anterior view showing anterior and posterior lower frontal lenses in solid and dotted lines, respectively; and e) 5th leg, posterior view

spine present at about two-third of distance along its outer margin. A tuft of small hairs present along the exopodal segment's inner margin.

Discussion

The present specimens of *Pontella andersoni* agree with the earlier descriptions of the species^{1,2}. This agreement concerns the morphology of the cephalosome, the abdominal somites and the fifth legs of both the sexes and the right antennule of male, as described above. As for the eye lenses in the species, there is no information regarding the presence or absence of the eye lenses^{1,2}. In the present description, it is evident that females are without any rostral lenses and in males, posterior lower frontal lens 1.3 times those of anterior lower frontal lenses. On account of the furcal setae, the caudal furca might have been overlooked or not mentioned in previous descriptions due to the unavailability of specimens¹. As for the caudal furca in female, the third pair of furcal setae is broader than the others in the present observation which was not mentioned in the original description. The species could be easily distinguished from its congeners by the barrel shaped first urosomal somite in female, and two subequal spines with two knot-like projections in the first exopodal segment of right fifth leg, serrated spine and three process in the second exopodal segment of left leg in male. In the northern Indian Ocean, particularly Bay of Bengal, only a few species (9 species) of *Pontella* have been recorded. The species recorded under the Genus *Pontella* from Indian Ocean^{10,11} are *Pontella andersoni* Sewell, 1912; *P. atlantica* (Milne Edwards, 1840); *P. danae* Giesbrecht, 1889; *P. diagonalis* Wilson C.B., 1950; *P. fera* Dana, 1849; *P. investigatoris* Sewell, 1912; *P. princeps* Dana, 1849; *P. securifer* Brady, 1883; and *P. spinipes* Giesbrecht, 1889. Additional records of this genus *i.e.* *P. aculeata* Heinrich, 2006 are found from the eastern Indian Ocean¹², *P. karachiensis* Rahman, 1973 from western Indian Ocean^{13,14} and *P. valida* Dana, 1852 from equatorial Indian Ocean¹⁵. So far, only 12 out of 56 valid species of the genus have been recorded in the Indian Ocean.

Presence of *P. andersoni* was observed when the water temperature was 24 °C and salinity ranged between 23 – 28 psu during the month of January in the coastal waters of Odisha (Bay of Bengal)¹⁶. *P. securifer* and *P. sinica* Chen and Zhang, 1965 were also observed in the South Sea of Korea¹⁷ where the temperature was 24 °C and salinity was 31 psu. This result is comparable to the temperature (21.472 –

23.561 °C) and salinity (24.696 – 28.418 psu) recorded during present study. Furthermore, dissolved oxygen value obtained in present study ranged from 5.419 – 5.871 ml/l which compiles well with the range (4.8 – 5 ml/l) observed in the month of January¹⁶. Family Pontellidae mostly occurred from January to April, with a peak in the month of February¹⁸. Hence, the presence of the species of this family in this study is not preposterous.

Along with *Pontella valida* Dana, 1852 both congeneric and noncongeneric species were found in the sampling stations of equatorial Indian Ocean¹⁵. *Labidocera acutifrons* Dana, 1849, *L. minuta* Giesbrecht, 1889 and *L. acuta* Dana, 1849 were the noncongeneric species. A similar observation was witnessed in the present study where along with *P. andersoni* some noncongeneric species like *L. acuta*, *L. pectinata* and *Calanopia* sp. were observed. Earlier, *Pontella* sp. and *L. acuta* were also found in the same sample¹⁹. This might imply that *P. andersoni* is having an optimal level of euryhaline and eurythermal endurance and the common association with some of the non-congeneric species such as *L. acuta*, *L. acutifrons*, and *L. minuta*. The species may presumably be distributed more in the coastal waters of Bay of Bengal, but this might be overlooked due to less taxonomic exploration of copepods in the recent years.

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Conflict of Interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

Author Contributions

SVF: conceived the idea presented herein, identified the copepod species, developed figures 2 and 3 and wrote a part of the manuscript. JP: participated in the survey and collected the samples, manuscript writing, and contributed to the final version of the manuscript, supervised the findings of this work and in charge of

overall direction and planning. AS: participated in the survey and collected the samples, calculated biomass and abundance of the samples, manuscript writing and contributed to the final version of the manuscript. AB: participated in the survey and collected the samples, developed figure 1, manuscript writing, and contributed to the final version of the manuscript. SBN: supervised the findings of this work and provided critical feedbacks. All authors discussed the results and have contributed in making of this manuscript.

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