

Short Communication

Taxonomic description of the male *Tortanus (Atortus) murrayi* Scott A., 1909 (Copepoda, Calanoida, Tortanidae) from the Great Nicobar Island, Indian Ocean

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Tortanus (Atortus) murrayi Scott A., 1909 is classified within the species group named *murrayi*, under the species complex of *recticauda*. The species was originally described by A. Scott based on five female and two male specimens from St.118 (Celebes Strait), St.85 (Manipa Strait), and St.213 (Selayar Island), Indonesia. Later, the species was described from Phillipine waters. Recent studies have provided new distributional records and detailed taxonomic descriptions based on female specimens from the Great Nicobar Subdivision, India. However, for accurate species identification, descriptions of both male and female specimens are essential. The species closely resembles *T. (A.) scaphus* Bowman, 1971, as well as *T. (A.) sulawesiensis* Mulyadi, Nishida and Ohtsuka, 2017. This study illustrates the distinguishing characteristics of the male specimens from its congeners.

[**Keywords:** Copepoda, Northeastern Indian Ocean, Taxonomic description, *Tortanus*]

Introduction

Tortanus (Atortus) murrayi Scott A., 1909 is a calanoid copepod included within the genus *Tortanus* Giesbrecht, 1898 and subgenus *Atortus* Ohtsuka, 1992. It is primarily found along the coast of Indo-West Pacific and Northeastern Atlantic¹. Currently, the genus *Tortanus* comprises 49 species under five subgenera^{2,3}. The subgenus *Atortus* has been categorised into *tropicus* group as per sensu Othman, 1987, and the *murrayi* group as per sensu Othman, 1987^(refs. 1,4). Subsequently, Ohtsuka & Kimoto⁴ divided the *tropicus* group into the *longipes* as well as *rubidus* groups (along with one undesignated group). Simultaneously, they subdivided the *murrayi* group into *murrayi* and *recticauda* species groups, and redefined the *tropicus* and *murrayi* species groups

into *brevipes* and *recticauda* species complexes, respectively^{1,4}. The majority of species within the subgenus *Atortus* commonly inhabit oligotrophic and highly saline (34 – 40 PSU) clear waters, particularly in coral reef ecosystems and sea grass beds². The *recticauda* group is confined within the western part of the Indian Ocean; whereas, the *murrayi* group is generally found along the extreme west perimeter of the Pacific¹.

According to Wilson⁵, *T. (A.) murrayi* was initially observed by Sars⁶ and illustrated the appendages from Butaritari lagoon in the Pacific Ocean. Later, Scott⁷ illustrated and described the species from the Indonesian waters. Wilson⁵ described the species collected from six stations of Philippine waters during the Albatross expedition. However, Bowman⁸ observed some discrepancies in the descriptions of Wilson⁵ and re-described a closely similar species *T. (A.) scaphus* Bowman, 1971. Recently, a closely related species *T. (A.) sulawesiensis* Mulyadi, Nishida and Ohtsuka, 2017, has also been described from North Sulawesi, Indonesia¹. Furthermore, Anandavelu *et al.*⁹ have provided a new distributional information and detailed taxonomic description of the species *T. (A.) murrayi* (female specimen) reported from South Andaman, Northeast Indian Ocean. The precise description of both male and female specimens is crucial for unambiguous identification of the species, as closely related species (congeners) may also be present in the same area^{10,11}. The previously reported illustrations and descriptions of the male specimen of species^{5,7} lack good resolutions and clarity, which may lead to taxonomic ambiguities and misidentification of the species from various coastal and marine environments. In this context, the current study provides detailed descriptions and illustrations of the distinguishing features of male *Tortanus (Atortus) murrayi* specimens collected from the east coast of Great Nicobar Island, which will facilitate the unambiguous identification of the species from the Indian Ocean.

Materials and Methods

The sampling for zooplankton examination was carried out at Lakshman Beach on Great Nicobar Island (7°01'25.2" N, 93°55'23.0" E) on February 7th, 2021 (Fig. 1). Zooplankton specimens were collected utilizing a Working Party (WP) net of mesh size 200

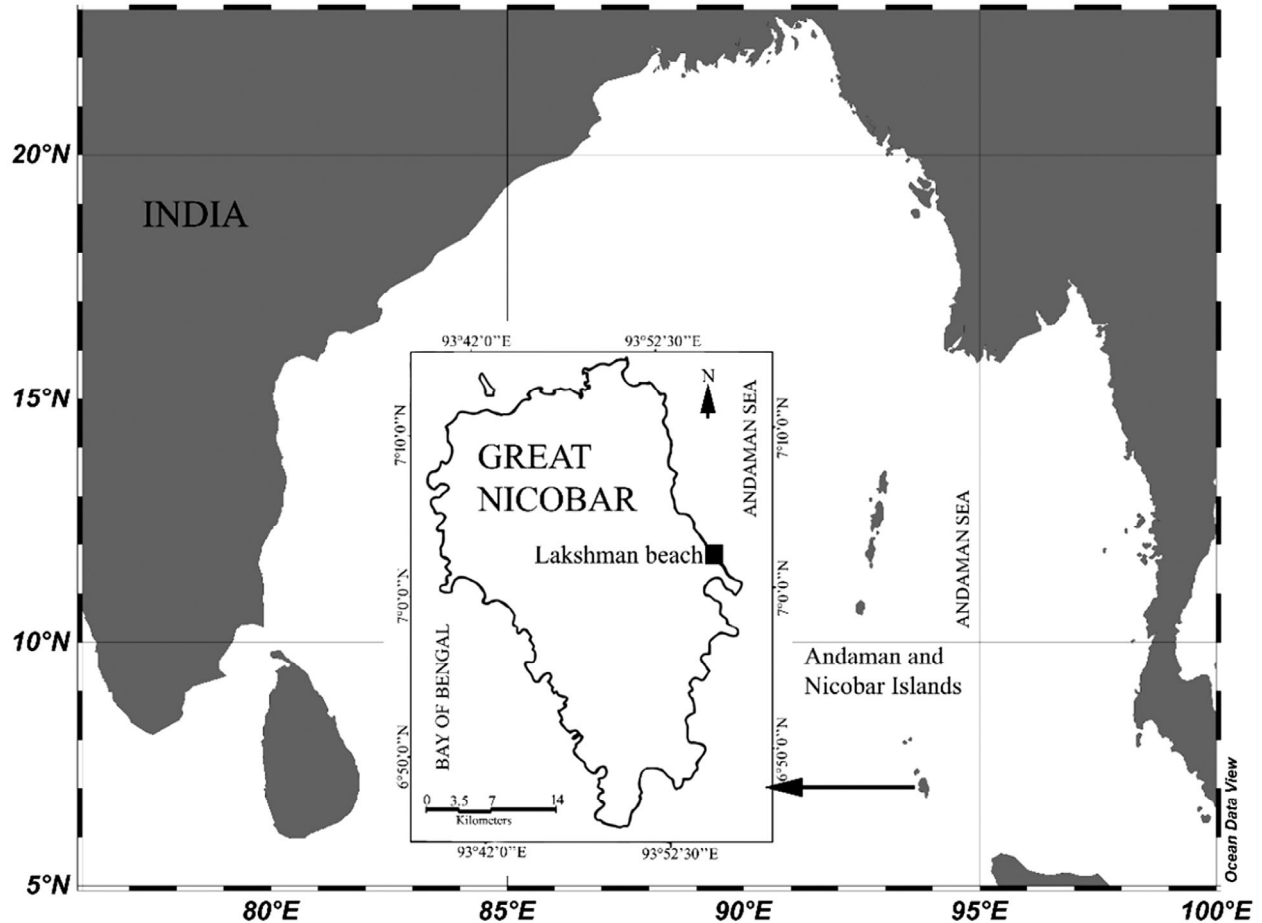


Fig. 1 — Map showing sampling location at Great Nicobar Island, Andaman & Nicobar archipelago

μm , mouth diameter of 60 cm, and equipped with a calibrated digital flow meter. The collected samples were preserved in 4 % buffered formaldehyde. Referring to the existing literature, specimens of copepods were examined carefully and meticulously identified to the species level using a stereo zoom microscope (Leica M125C). Specimens of *Tortanus (A.) murrayi* Scott A., 1909 were separated from the initial samples and dissected in a 1:1 glycerine and distilled water solution. Line drawings were created utilizing a drawing tube connected to a compound microscope with magnification capabilities ranging from 40 to 1000X. The specimens are deposited at the Zoological Survey of India (ZSI), Kolkata, under the accession number C-9209/2. The morphological terminologies used adheres to that of Huys & Boxshall¹² and Ohtsuka & Reid¹³. Abbreviations used in the description are Pr - Prosome; Ce - Cephalosome, A1 - Antennule; Pdg - Pedigerous somites; P1-P5 - Swimming legs 1-5; Ur - Urosome;

CR - Caudal Ramus/Rami; CO - Coxa, BA - Basis, Re - Exopod, Ri - Endopod; and TL - Total Length. The overall length of the specimen was gauged from the margin of the forehead to the caudal rami.

Results

Order: Calanoida Sars, 1903

Superfamily: Diaptomoidea Baird, 1850

Family: Tortanidae Sars, 1902

Genus: *Tortanus* Giesbrecht & Schmeil, 1898

Tortanus (Atortus) murrayi Scott A., 1909 (Fig. 2)

Material examined: Two adult males, one dissected (TL: 2.34 mm) and mounted on a glass slide and the other intact male preserved in a vial (Fig. 2; TL: 2.26 mm)

Diagnosis: Pr around three times longer than Ur (Fig. 3a). Posterior edges of Pdg 5 produced into circular and symmetrical processes. Ur of 5 somites, genital somite without any lateral processes. CR symmetrical. Right A1 geniculate (Fig. 3b, c), 15-

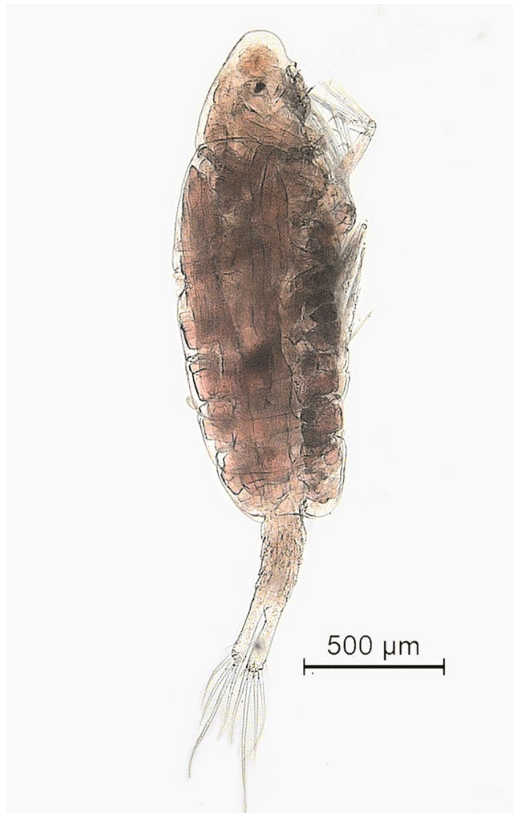


Fig. 2 — *Tortanus (Atortus) murrayi* Scott A., 1909, male dorsal view

segmented; ancestral segment I-VIII (segment 1), XXI-XXIII (segment 14) and XXIV-XXVIII (segment 15) totally or partially fused; segments XVI-XIX expanded. Armatures as stated: 1, (I-VIII) = 9+3ae; 2, (I) = 1; 3, (X) = 2+ae; 4, (XI) = 0; 5, (XII) = 0; 6, (XIII) = 1; 7, (XIV) = 1; 8, (XV) = 0; 9, (XVI) = 2+ae; 10, (XVII) = 1; 11, (XVIII) = 2+ae; 12, (XIX) = 1+ae+P; 13, (XX) = 1+P; 14, (XXI-XXIII) = 2; 15, (XXIV-XXVIII) = 1+7+ae. Segment XX anterior surface with a serrated ridge (Fig. 3d). Between segment XX and fused segments XXI-XXIII, a hinge junction is developed. Indent on anterior surface towards a proximal end of the latter segment. A lengthy spine-like process that spans nearly whole length of the fused segments XXIV-XXVIII located at the distal end. Antennule, antenna, mandible palp, mandible gnathobase, maxillule, maxilla and maxilliped (mouth appendages) similar to female specimens described from the South Andaman⁹. First to fourth swimming legs exhibit similarities to those observed in recently described congeners from the Indian Ocean^{9,14-16}. Right P5 (Fig. 3e) CO swollen, irregular pentagon-shaped with large triangular

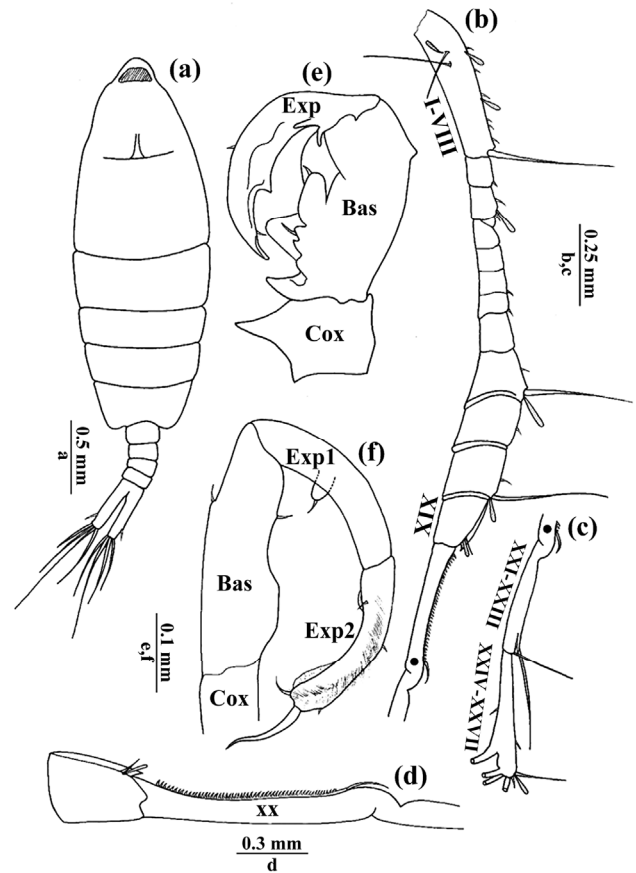


Fig. 3 — *Tortanus (Atortus) murrayi* Scott A., 1909, male (a) habitus dorsal view; (b – d) antennule; (e) right leg anterior view; and (f) left leg 5 anterior view

process; BA swollen, curves medially; small triangular process anteriorly; large, sharply pointed process emerges near inner proximal end; medial margin with three lamellae - proximal with three rounded processes; middle lamella triangular with rounded process proximally and seta at the base; distal lamella digitiform with rounded tip and subterminal seta. Claw-like Re; primary curve at 1/3rd proximally; two finger-like processes on medio-proximal margin; subdistal spinule on lateral margin; medial margin with subdistal triangular process short of distal end; segment terminates in a pointed tip; features one minute seta on mid-anterior. Left leg (Fig. 3f) CO devoid of processes; BA medial margin swollen near proximal and distal ends, one seta each near distal 1/3rd of lateral and medial margins; Re-1 exhibits a digitiform process, terminal seta near proximal 1/3rd of medial margin; Re-2 displays a rounded process on proximomedial margin with seta at its base, hirsute lateral margin, medial margin

features lamellae at distal end and subterminal spine, apex possesses a long sinuate spine.

Remarks

The *murrayi* group of subgenus *Atortus* currently accommodates nine species (*T. (A.) murrayi*, *T. (A.) scaphus*, *T. (A.) lophus* Bowman, 1971, *T. (A.) sinicus* Chen, 1983, *T. (A.) bonjol* Othman, 1987, *T. (A.) erabuensis* Ohtsuka, Fukuura & Go, 1987, *T. (A.) tumidus* Chen, Hwang and Yin, 2004, *T. (A.) sulawesiensis*, and *T. (A.) manadoensis* Mulyadi, Nishida & Ohtsuka, 2017), among them, the male *Tortanus (A.) murrayi* Scott A., 1909 closely resembles *T. (A.) scaphus* and *T. (A.) sulawesiensis*. These species share many similar morphological features hence making hard to distinguish them. The male *T. (A.) murrayi* can be distinguished from the congeners by (1) right leg 5 basis swollen, curved medially with a small triangular process anteriorly, and medial margin containing rounded process proximally with small seta at the base. The small seta is absent in *T. (A.) scaphus* and *T. (A.) sulawesiensis*. (2) exopod claw-shaped, main curvature at proximal 1/3rd with two finger/tooth-like process on medio-proximal margin and medial margin is with subdistal triangular process reaching toward and stopping just before the distal end, the segment ends in a sharp tip. The original description mentioned the presence of two tooth-like processes, but only one process was illustrated in plate LVI, figure 6^(ref. 7). In *T. (A.) scaphus*, one tooth-like process was represented in Figure 2(f, g & h)⁸ and is similar to those of *T. (A.) murrayi* but is not mentioned in the description. The processes are completely absent in *T. (A.) sulawesiensis* (Fig. 3e^(ref. 1)).

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Conflict of Interest

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

Ethical Statement

We adhered to relevant international, national, and institutional guidelines for the ethical treatment and use of animals. No live animals were subjected to experimentation in the course of this study.

Author Contributions

SVF: Conceived and initiated the presented idea, species identification, preparation of figures 1 and 3, and drafting of the initial manuscript. JP: Coordinated and led the survey, sample collection, contributed to manuscript writing and preparation of final version of the manuscript. AS, AB & HP: Participated in the survey, sample collection, and contributed to the preparation of final version of the manuscript. All authors were engaged in result discussions and collaborated in crafting this manuscript.

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