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First observation of *Alpheus soror* Bruce, 1999 (Caridea: Alpheidae) from Gulf of Mannar, Southern India with notes on *A. lottini* Guérin, 1830 [in Guérin, 1829-1830]

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Pistol shrimps *Alpheus* Fabricius, 1798 generally inhabit shallow depths of coral regions. A recent survey conducted at the Gulf of Mannar and Lakshadweep islands provided two species of *Alpheus* shrimps from the intertidal zone at 0.5 to 15 m depths. The study revealed that *Alpheus soror* Bruce, 1999 is a new report to the Gulf of Mannar and *A. lottini* Guérin, 1830 [in Guérin, 1829-1830] found in stony coral of genus *Pocillopora* sp. is a new report to Lakshadweep waters. The major intra and interspecific characters of these two species are described and discussed in detail.

[**Keywords**: Coral-associated shrimps, India, Lakshadweep, New report, Pistol shrimps, Morphology]

Introduction

Alpheids are popularly called pistol or snapping shrimps, which are commonly distributed from the intertidal zone to deep-water regions and occur in coastal and subtropical environments such as estuaries, mangroves, coral reefs, and deeper regions[1]. Alpheid shrimps display several peculiar behaviors and are frequently available in the marine aquarium industry[2]. These shrimps are primarily obligate or facultative symbionts with other marine organisms such as corals, sea anemones, bryozoans, polychaetes, echinoderms, echiuran worms, and fishes[3]. The most important and unique characteristics of alpheids are the snapping claw of major cheliped (First pereiopod) and the frontal structure of the carapace (Orbital hoods). The first pereiopods are remarkably asymmetrical; orbital hoods cover the eyes, and the projected frontal region of the carapace significantly varies among the species groups of alpheid shrimps[4].

Recently, four specimens of Bullseye snapping shrimp, *Alpheus soror* were collected from the coral regions of the Gulf of Mannar, at a depth of 13 – 15 m and three specimens of coral snapping shrimp, *Alpheus lottini* from *Pocillopora* sp. corals of Agatti island of Lakshadweep at depth range between 0.5 – 1.0 m. Further, these species were examined with the help of morphological and colour characteristics. The study revealed two new distributional records, *i.e. Alpheus soror* from the Gulf of Mannar and *Alpheus lottini* from Lakshadweep waters, along with detailed notes and live colourations.

Materials and Methods

Sampling and morphology

Three male and one female individual of Bullseye snapping shrimp were collected from shallow depths of coral regions of the Gulf of Mannar, India (8°48′ N, 78°20′ E) at a depth of 13 – 15 m, during February 2021. Similarly, three snapping shrimps were collected from the live coral of *Pocillopora* sp. at a depth of 0.5 – 1.0 m at Agatti Island, Lakshadweep, India (10°50′ N, 072°11′ E). The live colouration and small-scale habitat associated features of these species were captured with a digital camera (Nikon D90 & Nikon D3300, Thailand). The individuals of both species were captured using a small scoop net and preserved in 90 % ethanol for morphological examination. The specimens of both species could be characterized as an adult stages of *Alpheus soror* and *A. lottini* with the colour patterns and morphological features[5-7]. Carapace length (CL) was considered as standard length for the species (CL: anterior orbital margin to the posterior end of a carapace in lateral view). Subsequently, the specimens were preserved in ethanol and deposited in the national repository and fish museum of the ICAR-National Bureau of Fish Genetic Resources (NBFGR), Lucknow, India (NBFGR: ALPASOR.1, 2; NBFGR: ALPALOT.1, 2).

Results

Systematics

Order: Decapoda[8]
Infraorder: Caridea[9]
Superfamily: Alpheoidea[10]
Family: Alpheidae[10]

Genus: *Alpheus*[11]
Alpheus soror Bruce, 1999 (Fig. 1)

***Alpheus soror* Bruce, 1999**

Material examined

Two males, CL 14.0 mm (Accession Nos: ALPASOR.1, 2), ID No. NBFGR: TNG–16, 17; 1 male, CL 13.9 mm, ID No NBFGR: TNG–16a; 1 female, CL 13.7 mm, ID No NBFGR: TNG–16b, coral regions, Thoothukudi coast, Tamil Nadu, India, Gulf of Mannar (8°48′ N, 78°20 E), depth of 13 – 15 m, hand net, February 2021.

Diagnosis

Alpheus soror Bruce, 1999: 453 – 463, Figs. 1 – 3; Nomura and Anker, 2005: 104 – 139, Fig. 14. Medium-sized species: generally, body glabrous and smooth. Carapace slightly compressed laterally, smooth with a minute hairy structure laterally. Rostrum laterally slender, horizontal, slightly overreaching mid of second antennular peduncle; dorsally depressed, broadly triangular, lateral carina start from base of orbital hoods. The orbital hoods are well-formed, with vertical anterior carina; frontal margin not rounded anteriorly, unarmed, feebly produced. Pterygostomial angle partly rounded. Antenna with strong basicerite and a lateral tooth; antennal scaphocerite reaching distal margin of antennular peduncle, about 1.8 – 1.9 times as long as wide, laterally concave with strong distolateral tooth exceeding distal margin of the lamella. Third maxillipeds slightly overreaching distal margin of scaphocerite with well-developed exopod. First pereiopods highly asymmetrical. Major pereiopod (left): merus about 0.4 times of CL with acute distodorsal tooth and a medial distoventral tooth, ventral margin with 3-minute spinulate tubercles medially; carpus very short; chela smooth, about 3.3 times wide; palm slightly compressed, with a transverse groove proximally on superior margin to dactylus; fixed finger with subacute tip and setae laterally, dactylus concave with a feeble molar process posteriorly. Minor pereopod (Right): chela slightly compressed, datylus with bilateral balaenicepssetal ridges and acute tip. Second pereiopods slender, exceeding the distal margin of scaphocerite by the length of distal two segments of carpus and chela; carpus segment ratio 1.3: 1.1: 1.0: 2.5: 2.7. Third pereiopod moderately slender, exceeding the distal margin of scaphocerite by half-length of propodus and chela, merus about 6.5 times as long as wide, propodus with 7 – 8 ventral spines and 4 ventrolateral spines. Abdominal segments are smooth

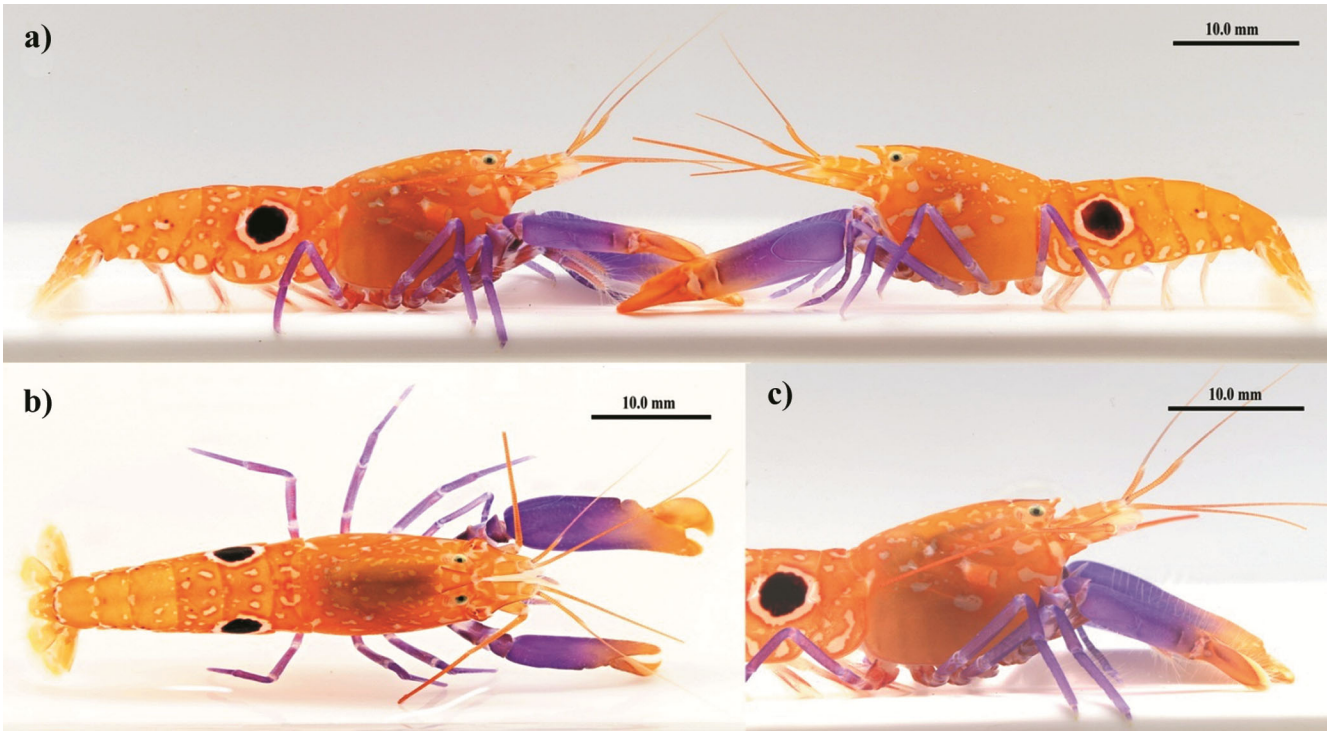

Fig. 1 — *Alpheus soror* Bruce, 1999 from Gulf of Mannar, India, Male, Carapace length - 14.0 mm: a) lateral view of male live specimens kept in photographic tank; b) dorsal view of a live animal; and c) closer view of carapace

and glabrous. Telson broad, concave, about 0.4 times to CL with two pairs of dorsal spines and a pair of asymmetrical spines, each on distolateral margin.

Colouration in life

The general body and antennal regions are bright orange with small white patches; all pereopods with purple except chela of the first pereiopod is orange in colour. Abdomen bright orange with white patches; second segment with a large conspicuous ocellus, found laterally with a round red spot surrounded by a transparent ring (Fig. 1).

Habitat and distribution

During the exploration, it is noted that the shrimp is free-living and distributed near to coral reefs and few associated with fishes at a shallow depth of the Gulf of Mannar, India. This species is initially described and reported from off Trincomalee, Sri Lanka[6]. The present reports provide an extension of species distribution from Sri Lanka to the Gulf of Mannar.

Remarks

This species is a member of the diadema group with the characteristics of rostrum base broad, flattened; without orbital tooth; major chela with palm oval in cross-section and balaeniceps in minor chela[5]. The present Indian specimens closely agree with the type specimens of *A. soror* by the morphological and colour patterns[6]. However, the observed morphological features on the present Indian material are slightly different with a specimen of *A. soror* from Sri Lanka[6,7]. The antennal scaphocerite is 1.8 – 1.9 times wide (vs 2.0 times), second pereiopod merus bear with 3 to 4 ventral medial minute spinulates (vs 2-minute spinulate) and the second pereiopod of carpus segments ratio is 1.3: 1.1: 1.0: 2.5: 2.7 (vs 2: 1.5: 1: 2.8: 4.2), which might be an intraspecific variation on this species[6,7].

Further, it was observed in captivity that the male individuals are more aggressive and produce loud sounds frequently. During frequent explorations in the Gulf of Mannar regions, this species is recorded in a single observation only, which reveals the least diversity and rarity of the species in the region. Hence, it is suggested that the development of captive breeding technology is needed for this colourful ornamental shrimp, which could help its conservation and sustainable supply of this shrimp to the aquarium trade.

***Alpheus lottini* Guérin, 1830 [in Guérin, 1829-1830]**

Material examined

1 male, CL 7.0 mm (NBFGR: ALPALOT.1), ID No. NBFGR: DBTAL–01; 1 female, CL 8.0 mm (NBFGR: ALPALOT.2), ID No DBTAL–02; 1 male, CL 7.2 mm, ID No NBFGR: DBTAL–01A, corals of *Pocillopora* sp, Agatti Island, Lakshadweep, India, (10°50′ N, 072°11′ E), depth of 0.5 – 1 m, hand net, February 2021.

Diagnosis

Body glabrous, smooth, and laterally compressed. Carapace smooth without any tooth. Rostrum broad, flattened dorsally, slightly horizontal laterally, a deep sulcus on each side of the lateral base, reaching distal margin of first antennular peduncle. Orbital hoods well-formed with acute teeth on the lateral margin of the hood. Pterygostomial region broadly rounded. Antennal scaphocerite long, overreaching distal margin of antennular peduncle. Third maxilliped stout, three-segmented with ratio 2.8: 1.0: 2.3. Inferior margin of antepenultimate segment with 17-18 movable spines, penultimate segment short with 6 inferior marginal spines. First pereiopods asymmetrical. Major pereiopod (Right): merus broad, inferointernal margin with 5 movable spines and without superior tooth; carpus short; chela laterally compressed and about 2.3 – 2.4 times as long as broad, palm smooth with faint sulcus at proximal margin to adhesive plaque and without any crest and groove, dactylus with a somewhat rounded tip and strong molar process posteriorly. Minor pereopod (Left) similar length to major one: merus broad with 5 – 6 inferointernal spines, chela slightly compressed, about 3.0 times as long as broad, palm smooth with a faint sulcus at proximal margin to adhesive plaque, dactylus strongly curved with acute tip. Second pereiopod slender and exceeds the distal margin of scaphocerite by chela; carpus five segmented, ratio 2.8: 1.7: 1.2: 1.0: 2.0. Third pereiopod short and stout; merus about 2.7 times as long as wide, without any spine; carpus with strong projection in both sides of distal margin; propodus broad with 6-7 ventral spines; dactylus broad, flattened, with a blunt tip. Abdominal segments are smooth and glabrous. Uropodal exopod broad posteriorly rounded with strong movable tooth and a fixed spine. Telson broad with two pairs of dorsolateral spines and two pairs of postero-lateral spines.

Colouration in life

Generally, body reddish with two broad longitudinal black to brownish bands dorsally, which

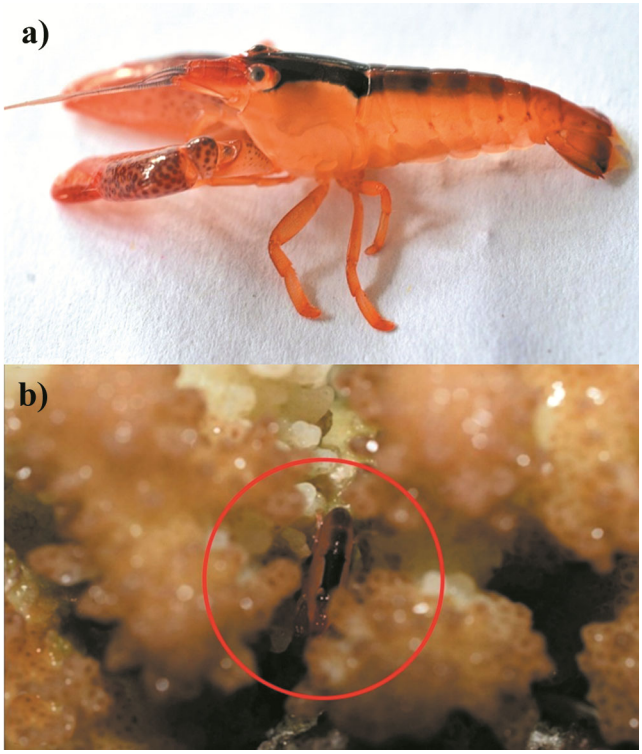

Fig. 2 — *Alpheus lottini* Guérin, 1830 [in Guérin, 1829-1830] from Agatti Island, Lakshadweep, India: a) Male specimen, CL 7 m; and b) *A. lottini* associated with stony coral of the genus *Pocillopora*

start from the base of the eye to the entire abdomens. Antenna, antennular flagellum, and rostrum reddish. Carpus and chela of first pereiopods reddish with dark small spots (Fig. 2).

Habitat and distribution

Alpheus lottini is widely distributed in Indo-Pacific regions: from the Red Sea to Hawai through South Africa, Andaman Sea, Philippines, Indonesia, Australia, California, and Colombia, with a depth of sublittoral to 50 m. In the present study, three specimens were collected from the intertidal region of Agatti Island with a depth of 0.5 – 1.0 m; associated with stony coral of genus *Pocillopora* sp. and two trapezia crabs.

Remarks

The specimens of *Alpheus lottini* collected from the shallow depth of Lakshadweep is the first report to this region. As mentioned by Banner & Banner[12] and Rouzé *et al*.[13], *A. lottini* generally inhabits shallow water depth and exhibit exosymbiotic relationship with pocilloporid corals. The present Indian material also generally agreed well with the descriptions of *A. lottini* by Banner and Banner[12] and Chace[5]. Previously, the present species was reported in the North Reef and Rutland Island areas of the Andaman Islands, India with shallow depth[14]. Few morphological variations showed in the specimens of present study are third maxilliped ratio of 2.8: 1.0: 2.3 [vs 3.3: 1.0: 2.7(ref. 12)], major chela about 2.3 – 2.4 times as long as broad (vs 2.5 times[5]), carpus segments ratio is 2.8: 1.7: 1.2: 1.0: 2.0 [vs 1.7: 1.0: 1.0: 1.0: 0.8(ref. 12)] which may be due to the ecological variations between the populations. *Alpheus bicostatus* and *A. socialis* are close to *Alpheus lottini*, but these are not reported in India. These two species differ from *A. lottini* by the presence of major chela with sculpture and dactylus of ambulatory legs simple and with acute tips[12].

Acknowledgments

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Conflict of Interest

All authors declare that there is no conflict of interest.

Ethical Statement

The organisms under the study are not under scheduled list/protection categories, thus ethical clearance is not applicable.

Author Contributions

MM: Specimen collection and manuscript preparation; PP: Identification and manuscript preparation; DSDD: Specimen collection; and TTA: Manuscript editing and review.

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