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Redescription of *Ryukyua circularis* (Pillai, 1954) (Isopoda, Cymothoidae), parasite of the Bleeker smoothbelly sardinella *Amblygaster clupeoides* Bleeker, 1849 from India

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Abstract

Ryukyua circularis (Pillai, 1954) is recorded here for the first time on the host *Amblygaster clupeoides* Bleeker, 1849 from Indian waters. The species is redescribed with illustrations of the gravid female, adult male and manca from its type locality, and the known hosts and geographical records of the species are reviewed. *Ryukyua circularis* is readily identified from the oval to rounded body shape, widest at pereonite 3–5; cephalon deeply immersed in pereonite 1; mandible palp with the spiny surface, article 3 with a long terminal setae; pleonite 1–3 partially overlapped by a posterolateral margin of pereonite 7; pleotelson anterior lateral margins weakly convex, posterior margin evenly rounded, without median point.

Key words: *Ryukyua*, fish parasite, *Amblygaster*, branchial cavity, India

Introduction

The species of *Ryukyua* Williams & Bunkley-Williams, 1994 inhabit the branchial cavity of fish hosts and are commonly recorded from pelagic fishes (Bunkley-Williams & Williams 1986; Williams & Bunkley-Williams 1994; Aneesh *et al*. 2016; Praveenraj *et al*. 2017). The genus was erected to hold two species, *Ryukyua globosa* Williams & Bunkley-Williams, 1994 and *Ryukyua circularis* (Pillai, 1954). *Ryukyua globosa* was originally described from Japan from the blue sardine, *Amblygaster leiogaster* (Valenciennes, 1847) and spotted sardinella *Amblygaster sirm* (Walbaum, 1972). Williams & Bunkley-Williams (1994) reported that the host *A. sirm* had a greater infection rate (83% collectively) rather than the one unexamined isopod reported from *A. leiogaster*, making the latter host questionable until more isopods from *Ryukyua globosa* have been reported. More recently, Rameshkumar *et al*. (2016) reported *R. globosa* from Parangipettai's coastal waters on the south-east coast of India, from the goldstripe sardinella, *Sardinella gibbosa* Bleeker, 1849; bringing confirmed host records for this isopod species to two.

Ryukyua circularis (Pillai, 1954) was originally described by Pillai (1954) as *Livoneca circularis* from the host *A. leiogaster* (without record of its type material), and Bunkley-Williams & Williams (1986), Williams & Bunkley-Williams (1994) and Praveenraj *et al*. (2017) have only reported of the cymothoid's occurrence on *A. sirm*. Williams & Bunkley-Williams (1994) provided a brief description and illustration of female specimens from Phuket, Thailand and transferred it to the genus *Ryukyua*. Nonetheless, many aspects of this species has not been addressed in detailed as its species counterpart, which include: 1) description of the species for different life stages, 2) brood pouch morphology, 3) listed host association and 4) updated list of known geographical occurrences.

As part of a larger project of the Indian cymothoids diversity, *R. circularis* specimens were collected from *Amblygaster clupeoides*, which further provided the opportunity to complete a redescription for this species.

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Males differ from females in having an elongated body, with a few chromatophores scattered towards the middle posterior margins of pereonite except pereonite 4; anterior margin of cephalon almost triangular, posterior margin not immersed in pereonite 1. The manca has eyes that cover nearly 90% of the whole cephalon, and has distinct chromatophores scattered on the pereonites and pleotelson, and appearing mahogany brown in colouration, in comparison to its adult female and male juvenile counterparts.

Ryukyua circularis and *R. globosa* have a near identical morphology of the cephalon deeply immersed in pereonite 1; body widest at pereonite 3–6; pereopods with rather a broad basis, elongate ischium and short propodus; and all pleopods are laminar. *R. globosa* can be distinguished from *R. circularis* by being greatly having a broader and rounded body shape; the posterolateral margin of pereonite 7 produced and overlap all pleonites (*vs* pleonite 1–3 partially overlapped by pereonite 7), pleotelson a slightly wider than long and having a rectangular (*vs* evenly rounded, without median point); a lobe present between bases of antenna 1, and antennae not extending beyond the posterior margin of the cephalon.

Host usage in the Cymothoidae is not random, and species of tropical Cymothoidae generally exhibit a narrow range of host use (see Bruce 1986; Trilles *et al*. 2011; Martin *et al.* 2015), often restricted to a family or related group of genera. The two species of *Ryukyua* are genus specific to the host *Amblygaster*, a small group of sardinellas from the family Clupeidae containing three valid species worldwide (Eschmeyer *et al*. 2018): *Amblygaster clupeoides* (Bleeker's smoothbelly sardinella), *Amblygaster leiogaster* (Smoothbelly sardinella) and *Amblygaster sirm* (Spotted sardinella). Including this present study, *R. circularis* is present on all hosts, whereas *R. globosa* is commonly reported from *A. sirm*. Although it may not come as a surprise to find *R. globosa* on *A. leiogaster*, more reports are needed to clarify the host specificity and infection rate of this parasitic relationship.

With regards to geographical occurrence of this parasite (in relation to the availability of the host), both *Ryukyua* sp. have a Indo-West Pacific distribution, with both species reported from India (Rameshkumar *et al*. 2016, Praveenraj *et al.* 2017, current study); Japan for *R. globosa* and Thailand for *R. circularis* (Williams & Bunkley-Williams 1994).

Ryukyua circularis attaches to the ventral part of the host branchial cavity, with reports of the species' cephalon facing the anterior end of the host and the abdomen outwards toward the operculum in a lateral position (Pillai 1954, Williams & Bunkley-Williams 1994). Four of the currently collected specimens were also dorsally positioned, although two were positioned with the ventral surface facing towards the operculum.

Since records of *R. circularis* from the Indian sub–continent were made possible due to the collection of its fish host for subsistence and commercial use by local fisherman, it was an opportunity not to be missed to re-describe the species. Other reports that have further aided the ecological knowledge of the parasite include feeding behaviour (Rameshkumar *et al*. 2013), molecular identification (Praveenraj *et al*. 2017) and prevalence, mean intensity and abundance (Aneesh *et al*. 2016). We hope clarity of its taxonomy and ecology (particularly host-specificity) creates awareness on parasitic cymothoids and their potential harm towards the aquaculture and fisheries industry should an outbreak occur.

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