

A Study on Copepod Parasites of Mangrove Fish *Polynemus Tetradactylus* (SHAW 1804) from Andhra Pradesh - East Coast of India

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Short title: "Copepod parasites of *Polynemus tetradactylus*"

Abstract: Anthropogenic activities in and around the estuaries are causing deterioration and depletion of fishes. In addition to this, fishes are prone to secondary infections by microbes and parasites. Three species of copepod parasites were recorded viz., *Lernanthropus polynemi*, *Caligus phipsoni* and *Parapetalus hirsutus*. The host parasite interaction, their prevalence and mean intensity of total and individual parasites was studied and recorded. Prevalence was found to be as high as 94.1% and the mean intensity is being 1.58 indicating that copepod infection is not intense. Usually they cause minor harm to their hosts when present in small numbers. However, in case of heavy infections severe damage to skin, muscles, and gill tissue accompanied with secondary infections, and resulting in decreased nutritive value of fish. Good environment management is crucial to avoid occurrence of parasites.

Keywords: polynemus tetradactylus, Lernanthropus polynemi, Caligus phipsoni, Parapetalus hirsutus, Andhra Pradesh, East Coast of India.

1. Introduction

Pallamkurru is the place on the banks of river Godavari, which flows eastward through the state of Andhra Pradesh and joins the Bay of Bengal. The river forms an estuary which is a source of livelihood for the rural fisherman folk in that area. This major source in recent times has been prone to pollution due to various anthropogenic activities, thus affecting the health of fishes, leading to their deterioration and mortality. Fish prone to pollution become vulnerable to infections from microbes and parasites, resulting in the decline of fish production, leads to poor economic condition of fishermen. Parasites and microbes are responsible for poor growth, low survival rate, decreased reproductive capacity and mortality of the fish. The parasites of estuarine fishes of Andhra Pradesh, east coast of India have been extensively studied.

Copepods are typically small and inconspicuous aquatic crustaceans, but they are extremely abundant (Boxshall, 2005). The copepods in general are small to microscopic with both free living and parasitic forms (Heckmann, 2003). More than 2000 species of copepods parasitize marine and freshwater fishes and most are ectoparasitic: they are found all over the external surface of the host body, as well as in more sheltered microhabitats that are permanently directly connected to the external environment, including the external nostrils, eyes, oral and branchial cavities, gills and cloaca (Boxshall and Halsey, 2004), which cause extensive damage to fishes. Copepods can be found as parasites across the entire range of cnidarian groups from the hard corals and sea anemones to the medusae and siphonophores (Humes 1985). Relatively few species of copepods make use of host groups such as the Nemertea, Platyhelminthes, Bryozoa, Phoronida, Echiura, Brachiopoda, Enteropneusta,

Hemichordata, Vestimentifera and Sipuncula (Boxshall and Halsey 2004).

Many fish parasites are known as causative agents for disease problems and outbreaks within mariculture facilities (Palm 2004; Ruckert *et al.* 2008, 2009). The occurrence of fish parasites is closely related to the distribution of their final and intermediate hosts (Collard 1970; Hine and Kennedy 1974). Their abundance is also influenced by further biotic and abiotic factors, such as the fish feeding ecology (Palm *et al.* 1998; Walter *et al.* 2002), water temperature (Rohde *et al.* 1995), salinity (Roubal 1997), water depth (Collard 1970; Palm 1999) and pollution (Galli *et al.* 2001). The close relationship of a highly diverse parasite fauna to its hosts and the environment opens up the opportunity to utilise these organisms as biological indicators. Therefore, fish parasites have already been applied to indicate the ecology of their hosts (e.g. feeding, (Palm 1999) migration and recruitment, (Williams *et al.* 1992; Moser 1991) or the conditions of the environment e.g. water quality, (MacKenzie *et al.* 1995; Galli *et al.* 2001;) pollution, (Sures and Reimann 2003;) environmental stress, (Khan and Thulin 1991;)(Landsberget *et al.* 1998). Thus, fish parasites are an important component of the aquatic biodiversity that can be utilised as biological indicators to describe not only the fish health but also the status of any aquatic environment.

No substantial work has been carried out on copepod parasites of *Polynemus tetradactylus* from Pallamkurru, Andhra Pradesh East Coast of India, in spite of their nutritive value and economic value. The current study is adjunct our information on fish parasites of fishes of Pallamkurru, Andhra Pradesh, East Coast of India. A prominence is given on brief diagnosis and infection levels of the ecto- and endo-

helminth fauna. The present work investigates the possibility to utilise the detected parasites as biological indicators.

2. Material and Methods

Polynemus tetradactylus samples were obtained freshly from local fishermen within the lagoon every month. The fish samples were observed for external parasites and dissected to collect internal parasites.

A total number of 102 specimens were examined for a period of 12 months i.e. from September 2015 to October 2016. Of these 96 fishes were infected with copepod parasites. Total length of each specimen was in the range of 18-28 cm. Gills were carefully removed and examined under microscope for parasites. Parasites collected were fixed in 10% Formalin. Lactic acid was used for clearing. Diagrams were drawn with the aid of camera Lucida. Measurements were given in mm unless otherwise mentioned.

Prevalence of parasites and their mean intensity was calculated individually and totally based on the equations

$$\text{Prevalance} = \frac{\text{number of fishes infected}}{\text{total number of fish examined}} \times 100$$

$$\text{Mean intensity} = \frac{\text{total number of parasites in host fish}}{\text{number of infected fish}}$$

3. Results

In the present study, three species of copepod parasites were reported from the fish *Polynemus tetradactylus*, they are *Lernanthropus polynemi* (Richiardi 1881), *Caligus phipsoni* (Bassett-Smith 1898), *Parapetalus hirsutus* (Bassett-Smith, 1898). During the present study, 102 fish examined (both male and female fish). Overall 96 specimens were found infected which show heavy infection of copepods and proved that *Polynemus tetradactylum* is a favorable host. One to three parasites were obtained from each host. The prevalence and mean intensity were studied individually and

collectively. Host infected with parasite species, prevalence and mean intensity was given in table 1 and graphically represented in graph 1.

Table 1: Prevalence (P in %), mean intensity (mI), No. of fish infected and parasites collected in parentheses for the copepod parasites of the dissected fish species

No. of fish infected	Name of the parasite	No. of parasites collected	Prevalence	Mean intensity
41	<i>Lernanthropus polynemi</i>	56	40.1%	1.3
32	<i>Caligus phipsoni</i>	44	31.3%	1.3
23	<i>Parapetalus hirsutus</i>	52	22.5%	2.2

The parasitic copepods obtained in the host *Polynemus tetradactylus* are described briefly.

Lernanthropus polynemi Richiardi (1881) (Figure a), they measure 4.86 – 5.1 mm in length. Cephalothorax longer than broad and anternnular lobe not projecting, anterolateral lobe well developed, margins of the cephalothorax hairy, anterior division of the trunk circular and demarcated from the dorsal plate by a distinct constriction. Dorsal plate large, longer than broad, narrower anteriorly and gradually widening posteriorly. Genital segment completely fused with the abdomen. Abdomen broader than long, caudal rami has long, proximally broad and narrowing toward the tip.

Caligus phipsoni Bassett-Smith, (1898) (Figure b), they measure 2.26 – 2.37 mm in length. Cephalothorax circular with projecting frontal plates, lunules large, posterior median lobe broad and overlaps on fourth thoracic segment. Posterior sinuses open. Fourth thoracic segment roughly triangular. Cephalothorax measures 0.97-1.8x0.92-1.13 mm. Genital segment is inverted 'U' shaped, longer than broad with a short anterior neck and round postero-lateral lobes. Genital segment measure 0.65-0.73x0.45-0.68mm Abdomen large and one segmented and measures 0.32 – 0.47mm, caudal rami rectangular, inner surface hairy with three long short plumose setae.

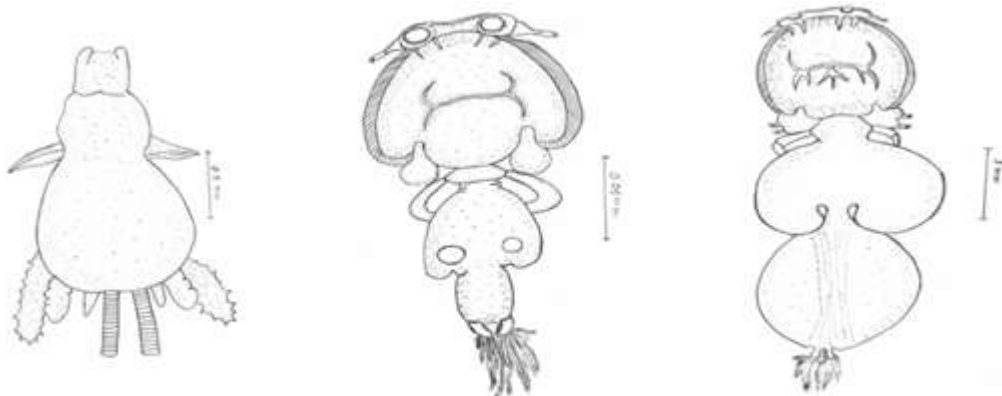
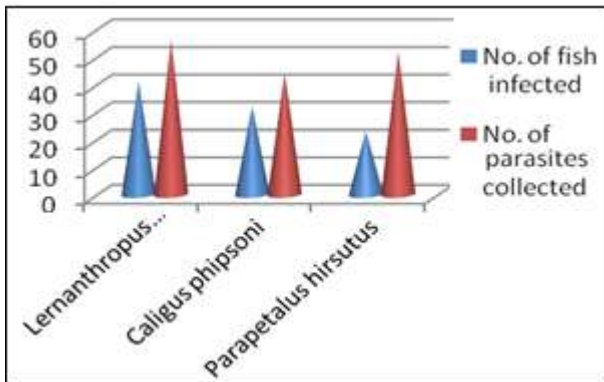


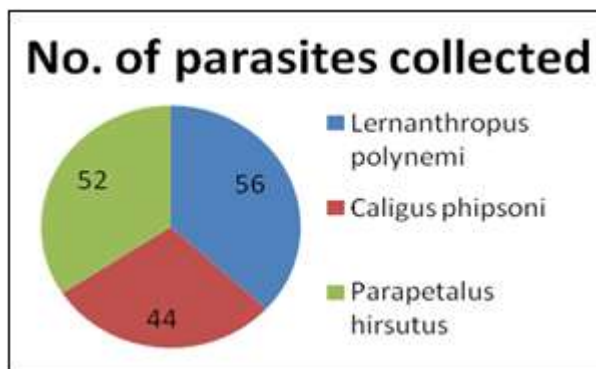
Figure a: *Lernanthropus polynemi* **Figure b:** *Caligus phipsoni* **Figure c:** *Parapetalus hirsutus*

Parapetalus hirsutus Bassett-Smith (1898) (Figure c), parasites measure 3.81-4.86mm in length. Cephalothorax longer than broad, lunules small, posterior median lobe is broader than the lateral lobe. Posterior sinuses slightly open, fourth thoracic segment broad, genital segment heart shaped, broader than cephalothorax and abdomen, Postero laterally

expands with lateral ends and overlaps the abdomen. Abdomen one segmented, circular and postero-laterally forms small lobes, caudal rami longer than broad with three short and three long plumose setae, inner margins hairy.



Graph 1 (a): Total no. of parasites collected and fish infected



Graph 1 (b): Total number of parasites collected

4. Discussion

The extraordinarily high biodiversity of the marine fauna in the Indonesian Archipelago is a result of its geographical location and geological history (Froese *et al.* 1996; Tomascik *et al.* 1997). Although, less than 10% of the Indonesian marine and brackish water fish species have yet been studied for parasites, this group of organisms appears to be highly diverse. The genus *Lernanthropus* was erected by de Blainville (1822) with *Lernanthropus munkas* type species. In 1881 *lernanthropus polynemi* was reported by Richiardi from *Eleutheronema tetradactylum*. It was also reported by Bassett-Smith (1898) as *lernanthropus trifoliatus* and *lernanthropus lappaceus* by Wilson (1912). Later Piasecki and Hayward (2002) synonymized these two species as *lernanthropus polynemi*. Yuniar *et al.*, (2007) reported this parasite from Indonesia in *Eleutheronema tetradactylum*. In this study 56 parasites were collected from host *Polynemus tetradactylus*. The genus *Caligus phipsoni* was first hoist by Bassett-Smith (1898) from India in *Cybiium guttatum*. Later Wilson (1912) reported it from *Polynemus tetradactylus*. Wilson (1923) from *Plectropoma cyanostigma*, Yamaguti (1963a), Margolis *et al.*, (1975), Yuniar *et al.*, (2007) has reported *Caligus phipsoni*. In the present study 44 parasites were collected from both male and female fish. It is a common parasite from east coast of India in *Polynemus tetradactylus*.

The genus *Parapetalus hirsutus* erected by Bassett-Smith (1898) as *Caligus phipsoni* from *polynemus tetradactylus* from India. These were reported by Wilson (1923) as *Parapetalus hirsutus*. Kitisinghe (1950) Shen (1957b), Pillai (1962), Yamaguti (1963a), Yuniar *et al.*, (2007) reported

from them *Polynemus plebius* and *Eleutheronema tetradactylum*. It is common parasite of this host from east coast of India as also reported by Wilson (1912). In the present study 23 parasites have been collected from *Polynemus tetradactylus*. Prevalence and mean intensity of parasite infection gives an overall view of host parasite relationship. Prevalence gives an idea of level of parasitization in host species i.e. *Polynemus tetradactylus*. The present finding states that the prevalence is less for *Parapetalus hirsutus* (22.5%) and *Caligus phipsoni* (31.3%) than *Lernanthropus polynemi* (40.1%). Overall prevalence of 94.1% is considered as high. Mean intensity is same for *Lernanthropus polynemi* and *Caligus phipsoni* i.e. 1.3, it is slightly higher for *Parapetalus hirsutus* of 2.2. The overall mean intensity is 1.58 which is less. This indicates though 96 fishes infected with copepod parasites are 94% the number of parasites occurring in each fish is less. It is a good sign because the health condition of host depends on the number of parasites present in it.

From the previous study, copepods feed by browsing on the fish gill epithelium or by ingesting blood from ruptured blood vessels (Nike, *et al.* 2014). High infection of these parasites may lead to the death of fish (Kabata, 1979). Study of these parasites is very important because parasites (copepod) can be as indicator the environment health (Nike *et al.*, 2014).

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