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RESEARCH PAPER

Caligus cybii (Caligidae, Copepoda) Parasitising the Commercially Exploited Seer Fish, *Scomberomorus commerson*, from the Malabar Coast (India)- Occurrence and Adaptations

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Abstract

The paper presents a first time report on the host specific parasitic occurrence of copepod, *Caligus cybii,* on the barred seer fish, *Scomberomorus commerson* distributed along the Malabar Coast, India. Of 81 fish species belonging to 35 families examined during the period from Jan 2012 to Jan 2014, only *S. commerson* was parasitised by *C. cybii*. 361 individual host fish examined, 80 were found to be infested (P= 22) with a total of 162 sexually dimorphic male and female of *C. cybii* (I= 2.02). Significantly, high degree of disproportion in the sex ratio of the recovered members of *C. cybii* was found existed inasmuch as more than 91% (148 out of 162) of them were reproductively active females. Invariably, all of them were found attached the inner epithelial lining of the operculum of the host signifying the strict site specific parasitisation. Light and scanning electron microscopic study showed the presence of structurally and functionally specialised mouthparts and appendages suited for their parasitic existence was evidenced by the present light and scanning electron microscopic studies. The present paper also discusses the damage found in the epithelial tissue of the host fish likely due to parasitisation.

Keywords: Parasitic crustaceans, prevalence, intensity, host specificity, site specificity.

Introduction

Caligidae Burmeister, 1835 represents the most speciose family of parasitic copepods, comprising over 30 genera and 465 species including those species causing severe economic losses to fin-fish aquaculture (Boxshall & Defaye, 1993; Pike & Wadsworth, 1999; Ho & Lin, 2004; Boxshall & Halsey, 2004, Ho, Gómez, Ogawa, & Aritaki, 2004; Rosenberg, 2008; Maran, Ohtsuka, Takami, Okabe, & Boxshall, 2011). Among the caligids, *Caligus* Müller, 1785 reported to be the most species-rich genus comprising more than 371 species (Walter, 2005; Boxshall & El-Rashidy, 2009). Most of them are parasitic on teleosts; and only 17 species were reported from elasmobranchs, and of which 13 have also been common in teleosts (Tang & Newbound, 2004; Morgan, Tang, & Stirling, 2010).

With the vast development of marine aquaculture practices, the importance of caligids as disease-causing agents has become more evident inasmuch as 54% of copepod infestations in marine cultured fishes reported to be caused by them and their impacts range from mild skin damage to stress-induced mortality of the fish (Boxshall & Defaye, 1993; Costello, 2006; Maran, Seng, Ohtsuka, & Nagasawa, 2009; Maran, Oh, Soh, Choi, Myoung, & 2012). The deleterious effects of parasitisation by caligids, on their fish hosts have been studied in both farmed (Matumoto, 1980; Lin, Ho, & Chen, 1994; Lin, 1996; Pike & Wadsworth, 1999; Ho, 2000; Nagasawa, 2004; Johnson, Treasurer, Bravo, Nagasawa, & Kabata, 2004 for review) and aquarium fishes (Kik, Janse, & Benz, 2011). The sea louse, *Lepeophtheirus acutus* was reported as a pathogen of aquarium-held elasmobranchs (Kik *et al*., 2011). The epidermal tissues in several cases were found to be destroyed due to their infection, and the hemorrhaged wounds subsequently paved the way for bacterial invasion causing the death of the host fish (Lin *et al*., 1994; Lin & Ho, 1998; Ho, 2000). Occurrence of skin and head lesions among Atlantic salmon, Atlantic halibut, and the rabbit fish has been reported as a result of infestation with *Caligus* sp. (Lin, 1996; Bergh, Nilsen, & Samuelsen, 2001).

Reports, though scarce, are available on the infestation of caligids on fishes from different geographic regions. According to Raibaut, Combes, and Benoit (1998), 36 species of caligids are known to infest the fishes of the Mediterranean sea and 36 species recorded from Algerian marine fishes. More than 22 species of *Caligus* have been reported from the fishes of Australian waters (Morgan *et al*., 2010). Ninety species of *Caligus* and 33 species of *Lepeophtheirus* are so far reported from cultured and wild marine fishes (Ho, 2000; Ho *et al*., 2004; Ho, Lin, & Chang, 2007; Ho & Lin, 2004). Among them, 28 species of *Caligus* and 17 species of *Lepeophtheirus* are known as menace to cultured marine fishes in Japan (Ho, 2000). The fishes inhabiting coastal regions of Taiwan host about 50 species of *Caligus* (Ho *et al*., 2007). In Philippines, caligids are reported from both marine cultured and captive fishes (Maran, 2007).

Despite India being known for the diversity of parasitic copepods (Pillai, 1985; Prabha & Pillai, 1986; Santhosh & Radhakrishnan, 2009; Helna, Aneesh, Arshad, & Sudha, 2013; Aneesh, 2014; Helna, 2016), information on the caligids and their parasitisation on Indian marine fishes has not been updated. At this juncture, this paper presents a first time report on the occurrence of *Caligus cybii* Bassett-Smith, 1898 (Caligidae) (Synonym: *Caligus brevisoris* Shen, 1957; *Caligus quinqueabdominalis* Heegaard, 1962) parasitizing the barred seer fish (narrow-barred Spanish mackerel), *S. commerson* (Synonyms: *Scomber commersonii* Shaw, 1803; *Cybium commersonii* Cuvier, 1829; *Cybium konam* Bleeker, 1851a; *Scomberomorus commersoni* Jordan & Seale, 1906; *Cybium multifasciatum* Kishinouye, 1915) which is of great global demand and showed distribution along the Malabar Coast of India; the study addresses the questions of host specificity, site specificity, host size related prevalence, intensity and seasonality in the parasitic infestation by *C. cybii* on the host fish (*S. commerson*). The present light and scanning electron microscopic studies attempt to define the morphological and structural adaptations of *C. cybii* for its parasitic life on the host fish. The present paper also discusses the damage on the epithelial tissue of the host fish likely due to the parasitic infestation by *C. cybii*.

Materials and Methods

All available marine fishes were collected from Ayyikkara (Lat. 11°51'N, Long. 75°22'E), the major fish landing centre of Malabar Coast (India) during the period from January 2012 to January 2014 with a view to assess the parasitic occurrence of *C. cybii*. The collection was made not less than twice a week during the study period. As soon as the fishes were collected and transferred to the laboratory, various body parts including body surface, lateral line region, and base of the pectoral fin, branchial cavity, gill filaments and inner epithelial lining of the operculum of the fish were carefully examined for the presence of the *C. cybii* using hand lens. Recovered parasites were immediately removed from the host and preserved in 70% ethanol for further detailed examination. The infestation site was further observed using the hand lens and dissection microscope (Leica-S6D) with a view to assess the sign of damage, if any, in the host tissue. The identification of the parasite at species level was done, according to the key characters described by Pillai (1985), Yamaguti (1985) and WoRMS (http://www.marinespecies.org/). The prevalence (P) and Mean Intensity (I) was calculated according to Margolis, Esch, Holmes, Kuris, and Schad (1982) and Bush, Lafferty, Lotz, and Shostak (1997).

$$\text{Prevalence (P)} = \frac{\text{Number of fishes infested}}{\text{Number of fishes observed}} \times 100$$

$$\text{Intensity (I)} = \frac{\text{Total number of parasites recovered}}{\text{Number of fishes infested}}$$

Host nomenclature and fish taxonomy are according to Fish Base (Froese & Pauly, 2015).

The length and width of the fishes infested with *C. cybii* were measured and according to their total length (TL), they were categorized into different size classes [Class I (15.0-35.9 cm), Class II (36.0-79.9 cm) and Class III (>80 cm)].

For assessing the level of statistical significance, the data were subjected to F-test (ANOVA) and/or Student’s t-test, using Graphpad InStat (Version 2.00, 2007) software. In all the instances, null hypothesis was rejected at 95% confidence interval ($P< 0.05$).

The recovered copepod (*C. cybii*) was further examined both under stereo microscope (Leica-S6D, Leica Microsystems Ltd., Milton Keynes, UK) and scanning electron microscope (Zeiss EVO 18 Cryo Scanning Electron Microscope (SEM), the facility available at CSIR-NIIST, Thiruvananthapuram, Kerala, India. Mouth parts and appendages were dissected out and observed under the compound research microscope (Leica DM-750). Photomicrography was done by using Leica ICC50 camera and microscopic image capturing and processing software, LAS EZ (Leica Application Suit - Version 1.7.0) attached the microscope.

Voucher specimens (PCM CC 01-12) of all parasites collected during the present study were deposited in the Parasitic Crustacean Museum, Sree Narayana College, Kannur, Kerala, India.

Results and Discussion

The taxonomical description and host fish of *Caligus cybii* have previously been reported years back by Basset Smith (1898), Kirtisinghe (1964) and Pillai (1965). It (*C. cybii*) shows more or less morphological resemblance to *Caligus kanagurta* infesting the scombrid fish *Rastrelliger kanagurta*. The present light and electron microscopic studies provide some additional significant information (Figures 1e and 6a); the cephalothorax of female *C. cybii* is broad with a breadth of 2.71 mm which is higher than its length (2.39 mm). The mouth parts comprise first and second antenna, maxilla I and II, and maxilliped (Figures 6b and 8a). Four legs provided with spines are also present (Figures 6b and 7a). Following the forth thoracic segment is the genital segment in which the major portion of the reproductive system is accommodated (Figure 8b). Two segmented abdomen is long as the thoracic or genital segment and attached to which are the caudal rami, provided with plumose setae (Figure 8b). The genital segment accommodates the long oviduct which runs forward and backward and coiled from the anterior region of its origin from the ovary and extends backward to the abdominal region (Figure 8b). The reproductively mature adult females possess paired egg sacs each with a length of 4.5-5 mm and bulged oviduct in the genital segment filled with oocytes, indicating high reproductive output of the parasitic females. The eggs in the egg sacs are arranged uniseriate and the fecundity ranges between 60-150 (Figure 8c). The egg with an average diameter of 363±1.2 µm (Mean ± SD) hatches out into nauplius larva (Figure 8d).

As a first time report, this paper also presents the detailed information on the parasitic occurrence of this copepod (*Caligus cybii*) on the barred seer fish, *Scomberomorus commerson* being distributed along the Malabar Coast, India. Though 81 species of marine fishes belonging to 35 families along the Malabar Coast were closely observed for the presence of *C. cybii* during the period from January 2012 to January 2014, it was recovered only from *S. commerson* (Figure 1a) signifying the oligoxenous host specificity of the parasite; the present observation appears to be significant as the parasitisation of the species (*C. cybii*) is limited to seer fish (*Scomberomorus* sp.) of family Scombridae, one of the fish groups with high global demand and commercially exploited. Host specificity, the tendency of parasite to occur on one or a few taxonomically related host species appears to be a product of co-existence between parasite and host lineages (Poulin, 2007). From the available literature, it is evident that most of the caligid species exhibit narrow host preference. For instance, *C. curtus* infests only gadid, merculid and salmonid fishes and *L. salmonis* is strictly restricted to salmonid fishes (Jones & Johnson, 2015). *Caligus gurnardi* has been recorded only from three triglid fish species (Kabata, 1979; Oines & Shram, 2008). *Pseudocaligus fugu* is reported as highly host specific caligid infesting only the toxic puffers belonging to the genus *Takifugu* (Maran *et al*., 2011). Our previous survey on other

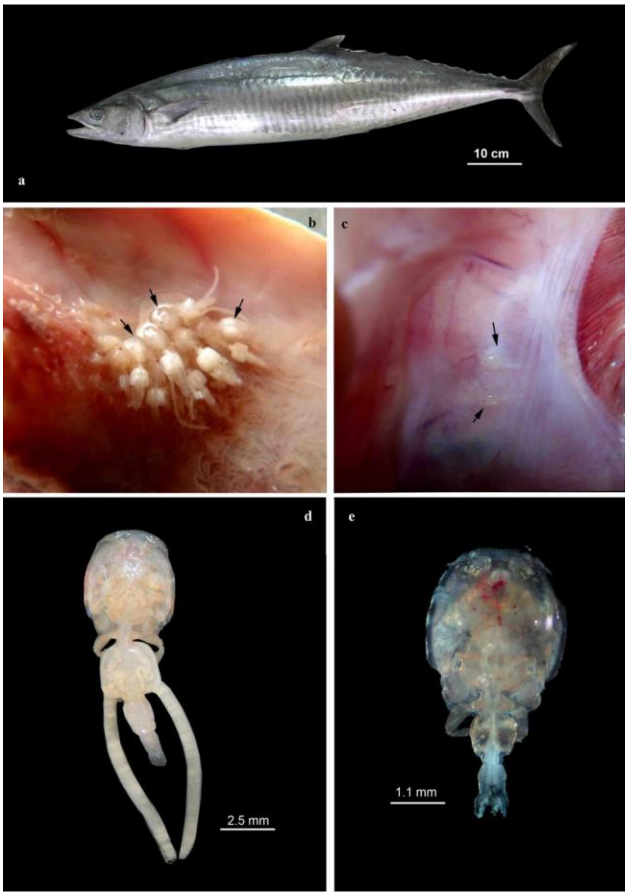

Figure 1. a).*Scomberomorus commerson*, host fish for *Caligus cybii*; **b**).infestation of *C. cybii* (arrow) on the operculum epithelial lining of *S. commerson;* **c**). *C. cybii* pre-adult male stages (arrow) on the opercular epithelial lining of *S. commerson;* **d**).*C. cybii*- female; **e**).*C. cybii*- male.

Caligus species infesting the fishes of Malabar Coast reveals that all recovered species such as *C. arii, C. kanagurta, C. triangularis, C. bonito, C. biseriodentatus, C. cordyla* are highly host specific, infesting the fishes, *Arius acutirostris, Rastrelliger kanagurta, Parajulis poecilepterus, Mugil curema, Auxis thazard thazard, Megalaspis cordyla* respectively (Aneesh, 2014). Reports on the *Caligus* sp. which lack host specificity are also available. For instance, *C. elongatus* has been recorded from more than 80 different fish species (Kabata, 1979) and Nagasawa (2004) reported *C. orientalis* as a least host specific species, recorded from 22 fish species. Many species of *Caligus*, however, seem to be restricted to a genus or family of fishes and it is found that though a parasite is present on several host species, it is consistently more common on some host species than others, which is interpreted as a trend towards specificity (Cressey, Collette, & Russo, 1983). In the course of evolution, different parasitic groups (for instance, copepods) developed diverse measures for host-parasite relationship like host specificity (Rohde, 1993). The factors determining host specificity of the most fish parasites in the marine realm are assumed to be ecological, host habitat and diet (Sukhdeo & Sukhdeo, 1994; Marcogliese, 2002). Most of the copepod infestive stages are pelagic free living stages and if the habitat of the fish is pelagic, then that fish will be more prone to infestation (Marcogliese, 2002).

Among the 361 members of host fish (*S. commerson*) examined during the study period, 80 showed infestation with a total of 162 male and female members of *C. cybii*; the average prevalence being 22% with highest degree (50%) in February 2012 (Table 1; Figure 2). The intensity of *C. cybii* in a single fish host showed wide range, between 1 and 16 and the highest intensity (16) was observed in June 2012 (Figure 3). Of the 162 *C. cybii* collected, 148 (>91%) were females and only 14 were males. Of the males, 11 were found associated with females seen either in colonies or single (Figure 1b); remaining 3 males (1 adult and 2 preadults) were found alone. Like females, all males were also in infestive stage clinging the epithelial lining of the inner operculum (Figure 1e).

Though the parasitic male and female of *C. cybii* are appeared in uniform colour (creamy white), they show remarkable size difference; males are small (3.8-4.0 mm) (Figure 1e) compared to females (6.0-7.0 mm) (Figure 1d) as reported in many species of parasitic copepods (Kabata, 1981). According to Raibaut, and Trilles (1993), such a female gigantism, generally found in parasitic crustaceans may be the result of selection for increased egg output in females.

Details of monthly collection of host fish and degree of parasitic infestation (prevalence) of *C. cybii* according to fish (*S. commerson*) size Class has been represented in table 2. The mean prevalence during the months (February-May) showed statistically significant high value compared to that of following months (June-October). However, it is statistically comparable to that of November-January (Figure 5). Of the three size classes of fish (Class I,II and III), Class II showed maximum prevalence and it is statistically significant (P<0.0001) compared to that of other two classes (Class I and III) of 162 individuals of *C. cybii* recovered, 160 were from size Class II. Only in a single instance, size Class I fish (15.0-35.9 cm) showed infestation with two pre-adult

Table 1 Parasitological index of *Caligus cybii* in *Scomberomorus commerson*

Parasite and Host fish	NFO	NFI	P (%)	I
Caliguscybii Bassett-Smith, 1898	361	80	22	2.02
Scomberomorus commerson (Lacepède, 1800)				

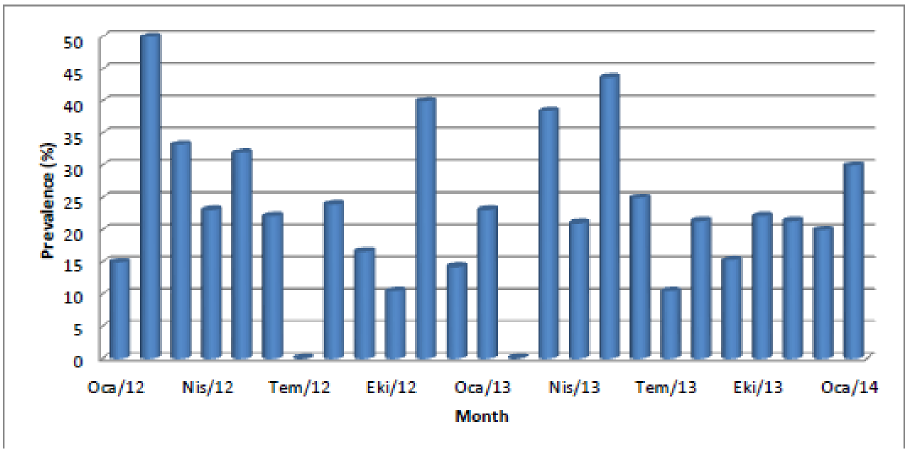

Figure 2. Prevalence of *Caligus cybii* infesting *Scomberomorus commerson* during the period from January 2012 to January 2014.

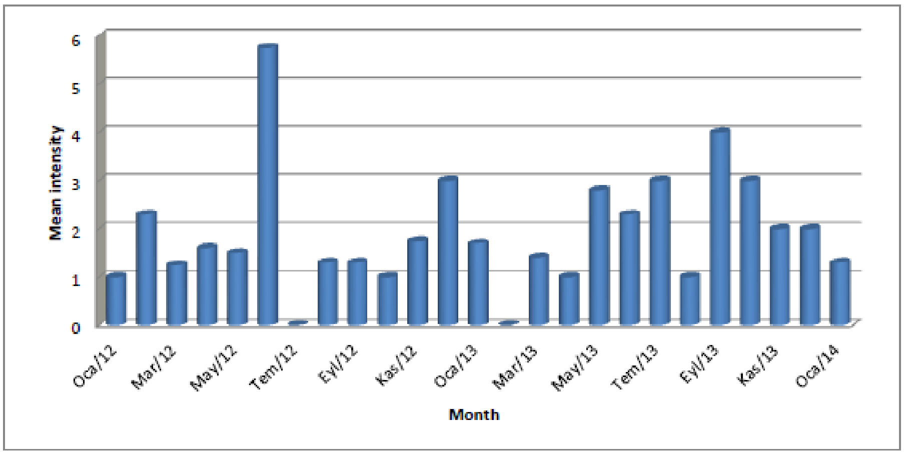

Figure 3. Intensity of *Caligus cybii* infesting *Scomberomorus commerson* during the period from January 2012 to January 2014.

Table 2 Month wise prevalence shown by *C. cybii* infesting *S. commerson* under different size classes

Sl No.	Month	Fish size Class			Prevalence (%)
		Class I (15.0-35.9 cm)	Class II (36.0-79.9 cm)	Class III (>80 cm)	
1.	January 2012	2	3	8	15
2.	February 2012	-	1	5	50
3.	March 2012	-	2	10	33.3
4.	April 2012	2	2	9	23.07
5.	May 2012	4	2	19	32
6.	June 2012	-	2	16	22.2
7.	July 2012	3	-	9	0
8.	August 2012	2	5	18	24
9.	September 2012	1	2	15	16.6
10	October 2012	-	2	15	10.52
11	November 2012	4	2	4	40
12	December 2012	3	1	3	14.3
13	January 2013	4	1	8	23.07
14	February 2013	2	3	12	0
15	March2013	-	2	11	38.5
16	April 2013	5	3	11	21.05
17	May 2013	6	3	7	43.7
18	June 2013	3	-	9	25
19	July 2013	2	1	16	10.52
20	August 2013	-	3	11	21.4
21	September 2013	3	1	9	15.3
22	October 2013	4	2	12	22.2
23	November 2013	1	-	13	21.4
24	December 2013	-	-	5	20
25	January 2014	2	3	5	30

males (Figure 4). And Class III fish (>80 cm) were found totally free from infestation with *C. cybii*, indicating the existence of partial negative correlation between the parasitic abundance of *C. cybii* and size of its host. This observation is akin to our recent report on the prevalence of *Cybicola armatus*, another parasitic copepod, infesting the same host (*S. commerson*); the highest rate of infection (Prevalence - 99.2%) was found in medium sized fish with size range 36.0-79.9 cm (Helna, Sudha, Aneesh, Piasecki, & Anilkumar, 2016). The remarkable level of negative correlation has also been reported between the parasitic abundance of *Hatschekia pagellibogneravei* and size of the host fish (*Pagellus bogaraveo*) by Hermida, Cruz, and Saraiva (2012). According to them, this is related to the ontogenic changes of habitat, the juvenile fish prefer shallow coastal waters whereas adult one inhabits deeper waters. In the case of *S. commerson*, however, such a habitat difference is not known according to the size/age increase as both juveniles and adults are reported to be epipelagic (Claereboudt, McIlwain, Al-Oufi, & Ambu-Ali, 2005; Kaymaram, Hossainy, Darvishi, Talebzadeh, & Sadeghi, 2010) and they undertake only a spawning migration after attaining the sexual maturity at the size > 60 cm (Claereboudt *et al*., 2005; Helna *et al*., 2016). It is not known, the migration from warm water (where the diversity of parasites are relatively higher) to low temperate waters, has any effect on making the fish less prone to

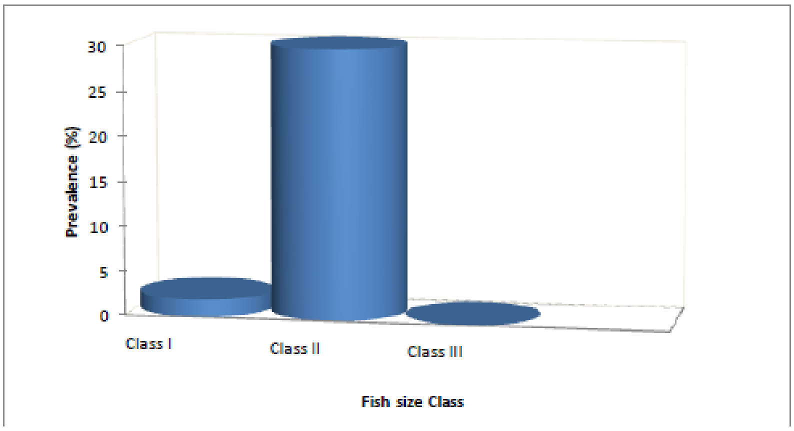

Figure 4. Relative prevalence of *C. cybii* in Class I (15.0-35.9 cm), Class II (36.0-79.9 cm), Class I III (> 80 cm) fish groups of *S. commerson* during the period from January 2012 to January 2014.

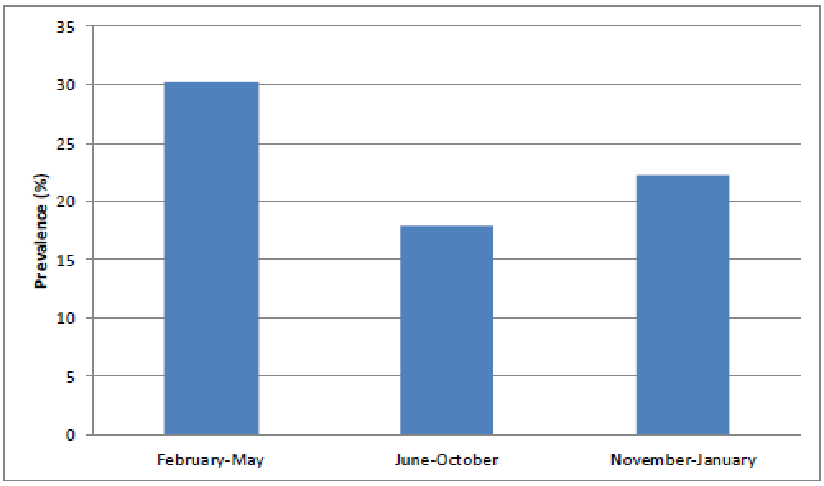

Figure 5. Average prevalence of *C. cybii* during the period from January 2012 to January 2014.

infestation and this aspect needs further investigation. deMeeus, Morand, Magnan, Do Chi, and Renaud (1995), suggested that parasitism and aggregation usually increase with age of hosts; larger microhabitats able to support more parasites and increased food intake or increased water volume flushing over the skin and gills in older host may be responsible for parasite loads increasing with age.

Apart from host specificity, *C. cybii* also exhibits strict site specificity, preferring the epithelial tissue lining of the inner operculum of its host (*S. commerson*) (Figure 1b). In most cases, the site specificity of the parasites is attributed to their feeding habit. Caligids are typically surface grazing ectoparasites, feeding mainly on blood, mucous, and epithelial tissue of their hosts (Boxshall & Halsey, 2004) and specifically, the species of *Caligus* are generally tissue feeders, taking blood less frequently (Johnson, 2004). The major factors that lead a parasitic species to a specific site or niche include intra and interspecific competition, reinforcement of reproductive barriers, a suitable substrate for attachment and feeding and enhancement of the chance to mate (Rohde, 1979; 1993; 1994; Ramasamy, Ramalingam, Hanna, & Halton, 1985; Koskivaara, Valtonen, & Vuori, 1992; Lo & Morand, 2001; Scott-Holland, Bennett, & Bennett, 2006; Cavaleiro & Santos, 2011). Morphological factors are at least partly responsible for site specificity of some species (Rohde, 1993). During the present study, *C. cybii* were recovered from both (left and right) opercular chambers and invariably they found remained in the chamber in an upright position.

The highly modified mouthparts and appendages of *C. cybii* facilitate their parasitic clinging to the inner operculum of the host fish. The broad, cup shaped cephalothorax fringed with a fine membrane functions as suction cup to hold firmly the opercular tissue (Figures 6-7 and 8a). Suction cup, formed by the cephalothorax and one more pairs of swimming legs which form the rim appears to be the one of the parasitic adaptations of all *Caligus* species and other 15 caligid genera (including *Pseudocaligus*, *Tuxophorus*, and *Metacaligus*) and also other parasitic copepod families such as Bomolochidae and Taeniacanthidae (Boxshall & Halsey, 2004; Boxshall,

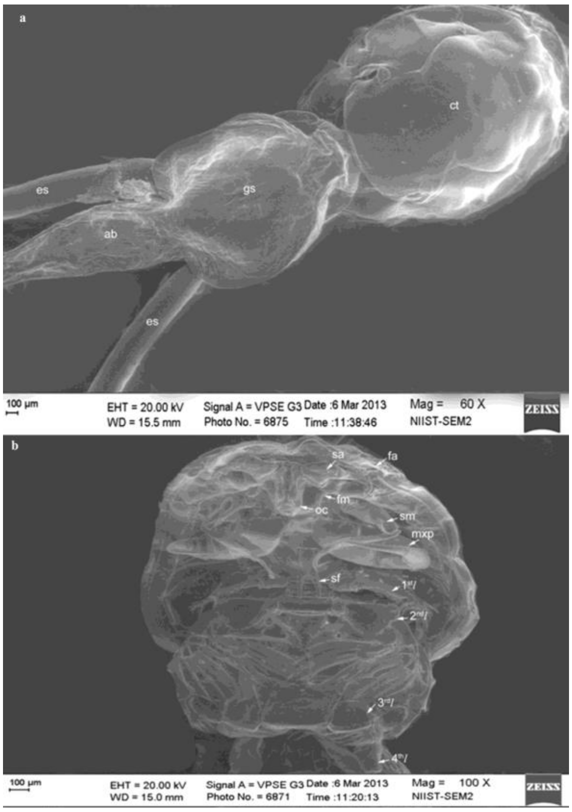

Figure 6. Scanning electron microscopic view of *Caligus cybii* **a**) Dorsal view (ct-cephalothorax, gs-genital complex, ab-abdomen, es-egg sac); **b**). Ventral view of cephalothorax (oc-oral cone, fa-first antenna, sa-second antenna, fm-first maxilla, sm-second maxilla, mxp-maxilliped, sf-sternal fork, 1st*l*-1st leg, 2nd*l*-2nd leg,3rd*l*-3rd leg, 4th*l*-4th leg).

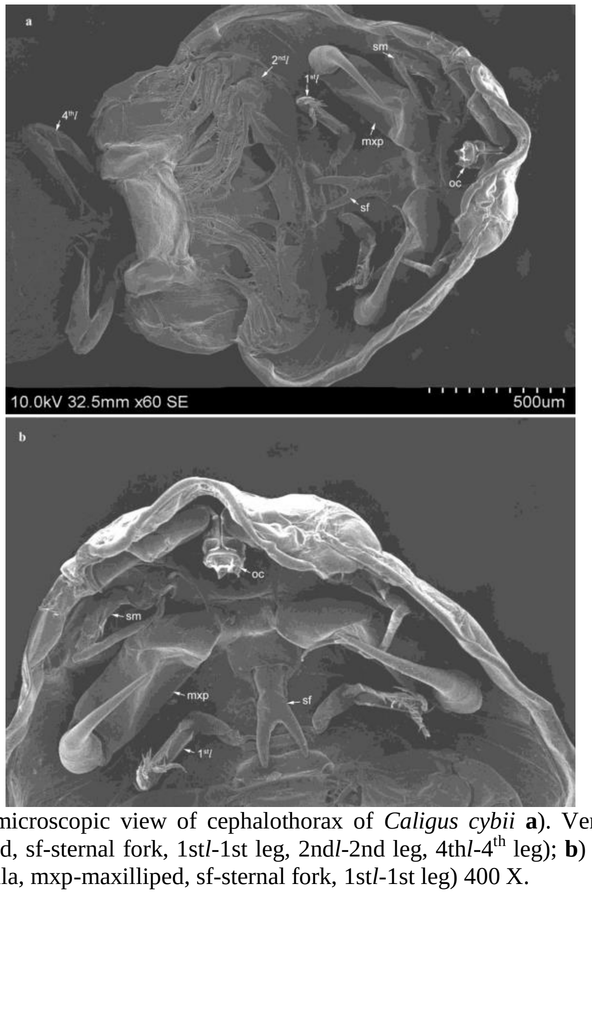

Figure 7. Scanning electron microscopic view of cephalothorax of *Caligus cybii* **a**). Ventral view (oc-oral cone, sm-second maxilla, mxp-maxilliped, sf-sternal fork, 1st*l*-1st leg, 2nd*l*-2nd leg, 4th*l*-4th leg); **b**) ventral view enlarged version (oc-oral cone, sm-second maxilla, mxp-maxilliped, sf-sternal fork, 1st*l*-1st leg) 400 X.

2005; Ho & Lin, 2004; Huys, Fatih, Ohtsuka, & Llewellyn-Hughes, 2012). However, in *Lepeophtheirus* sp. (salmon louse), cephalothaorax does not meet this function; the modified second antennae and oral appendages like sternal fork are used for attaching themselves on their host tissue and oral cone or siphon acts as the feeding organ (Johnson, 2004). In *C. cybii*, accessory structures including first and second pair of antenna and stout maxilliped are also found to be effective for the permanent attachment to the host tissue as evidenced from the present study (Figs 6b, 7a, b and 8a). *C. cybii* possesses “lunule” (Figure 8a) and according to Boxshall (2005), this additional paired structure possessed only by few caligids, helping them to hook into the skin of the fish, and it is placed as an evolutionary novel structure. Though most caligid adults are reported to be freely motile over the surface of their hosts (Boxshall, 2005), in the present study, more than 93% instances, *C. cybii* was found firmly attached the opercular tissue using the lunule, antennae and maxilliped.

Apart from the structural adaptations to attach the host tissue, *C. cybii* also possesses highly specialized reproductive system enabled them for efficient dissemination. Invariably, all the recovered females (148) were found with both paired oviduct and egg sac filled with growing yolky oocytes and oviposited eggs (undergoing embryogenesis) respectively (Figures 1d and 8b) indicating their prolific continuous breeding. Large genital complex, making up the major portion of body mass and continuous prolific breeding, both appear as the significant adaptations for the parasitic life of copepods (Johnson, 2004).

Vast reports are available on the adverse effect of caligid infestation on fishes. According to Wagner, McKinley, Bjørn, and Finstad (2004), caligids cause reduced swimming and cardiac performance in Atlantic salmon (*Salmo salar*). High levels of caligid infection result in chronic stress, osmoregulatory problems, reduction in macrophage respiratory burst and phagocytic activity in the host fish (Johnson, 2004). Infestation with *Lepeophtheirus salmonis* results in visibly obvious skin erosion and lesions (Revie, Dill, Finstad, & Todd, 2009). Infestation by *Caligus elongatus* on lump fish leads subsequent infections on several types of co-inhabiting farmed fishes (Johnson *et al*., 2004 for review). Further, caligids are thought to act as reservoirs of infection and vectors of transmission for various viral (Nylund, Hovland, Hodneland, Nilsen, & Lovik, 1994), bacterial (Cusack & Cone, 1986), and other parasitic (Nowak, Bryan, & Jones, 2010) diseases. The attachment and feeding activity of the caligid, *C. orientalis* causes the destruction of skin epidermal

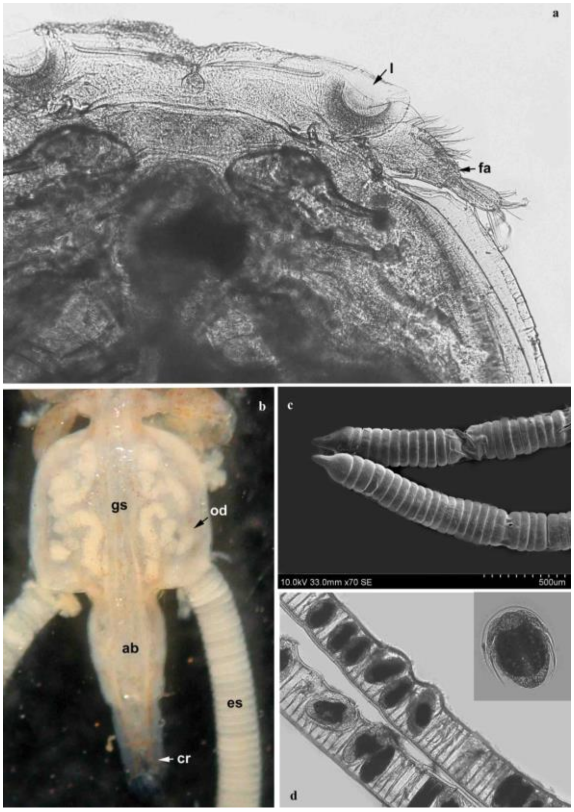

Figure 8. a). Light microscopic view of Cephalothorax of *Caligus cybii* showing lunule (l-lunule, fa-first antenna) 400 X; b) genital complex of *C. cybii* (female) accommodating the reproductive system (gs-genital complex, od-oviduct, ab-abdomen, cr-caudal rami, es-egg sac) 40 X; **c**). Scanning electron micrograph of *C. cybii* egg sac; **d**). Egg sac of *C. cybii* -releasing the nauplius larva (Inset) 400 X.

tissues of the host fish (Suzumoto, 1974). The infection also causes reduced appetite and subsequent death of the fish (Urawa & Kato, 1991). In the present study, the host fish (*S. commerson*) infested with *C. cybii* (Figure 1b) showed the presence of severe lesions on the opercular epithelial tissues apparently due to its clinging (through its extremely modified mouthparts) and feeding. During the mass infestation (Figure 1b), copious exudation of mucous from the infested site was frequently noticed indicating the tissue response against the infestation. The lesions in the host (*S. commerson*), due to the parasitic clinging and feeding of *C. cybii*, may provide the sites for secondary bacterial or fungal infection as reported by Revie *et al*. (2009).

Conclusion

The host specific parasitic occurrence of *C. cybii* on *S. commerson*, one of the commercially important seer fishes world over was noticed first time along the Malabar Coast, India with moderate level of prevalence and intensity. The mouth parts and appendages of this caligid species undergo extensive modifications suitable for their site specific parasitization targeting the opercular epithelial tissue of the host fish. Since majority of the caligids recovered from the marine food fishes of Malabar Coast is represented by *Caligus*, comprising more than 15 species and they appear as a serious threat to the marine and cultured food fishes of Malabar, a comprehensive study on them is highly warranted to optimize aquaculture practices in this coastal region.

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