

Studies on the Prevalence of *Sacculina* Spp. Infestation in *Portunus Sanguinolentus* (Herbst, 1783) from Parangipettai Coastal Waters, Southeast Coast of India

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Abstract

The presence of the external sacs on parasitic barnacles is the most unusual characteristic found in these genera. This barnacle belongs to genus *rhizocephala* that parasitizes crabs. Parasitization by *sacculinids* induces severe modifications in morphology, behavior and reproduction of their host (*Brachyuran crabs: Portunus sanguinolentus*). The present field study was carried out two landing center from Annankoil and Mudasalodai during January 2011–December 2011. It was found that total catch of infected crab was 12.4% from Annankoil and Mudasalodai landing center. The frequently infected male and female crab ratio was 66.3% and 33.7%. External parasites were found on crabs ranging from 56 mm to 88 mm in carapace width.

Keywords: *Portunus sanguinolentus*; *Sacculina granifera*

Introduction

Biological invasions and world-wide translocation of species pose great threat to the global environment and its after effects are creating severe havoc in marine ecosystems, often alters its biodiversity [1]. Introduction of exotic species or the abrupt proliferation of parasites in marine realm is a great menace the present day world is facing. Though the effects of some introductions are undetectable, but the introduction of some species may have dramatic ecological and economic impacts [2,3]. Parasitism is a biological trait that is defined predominantly in ecological terms [4]. Parasites constitutes nearly more than half of all biodiversity [5], but are least studied. Parasitic infestation and its associated diseases are the single most important factor threatening the fishery industry worldwide, particularly in the tropics [6]. *Brachyuran* crabs, especially those belongs to family *portunidae* forms an important constituent of marine fishery resources. Parasitic infestations caused by *sacculinids* in *Brachyuran* crabs is an havoc, that alters its morphology, physiology and reproductive pattern; which ultimately leads to population depletion of many crab species. *Sacculina* (*Rhizocephalan*) parasites are known to sterilize decapods hosts by altering their hormonal functions and generally cause abnormal host growth [7,8]. *Rhizocephals* cause castration, anecdyosis, stunting and increased mortality to their crab hosts, and thus, can have direct and indirect effects on crustaceans fisheries [9,10].

Indian marine ecosystem is extremely diverse blessed with an extensive coastline of 8,118 km, with an Exclusive Economic Zone (EEZ) of 2.02 mn sq. km and a continental shelf area of 468,000 sq km. India is bestowed with multispecies-multi sector marine fisheries resources, with total fish production of around 3.16 million tonnes [11]. Among the total marine fish production crustaceans occupies 16% which are represented by shrimps, lobster and crabs, in which crabs fishery shared nearly of 9.6%. It supports the sustenance fishery of appreciable importance, although it ranks third after shrimps and lobsters for their esteemed delicacy [12]. The marine crab fishery is supported mostly by the edible crabs belonging to the family *Portunidae*; represented mainly by *Portunus pelagicus*, *P. sanguinolentus*, *Charybdis* spp. etc. [13]. Among the *portunids*, three spotted crab, *Portunus sanguinolentus* is one of the commercially important species of crabs caught in moderate quantities all along the coast throughout the year and is generally caught as a bycatch in shrimp trawling.

Recent reports emphasized the shocking results of overwhelming predominance of *sacculinid* infestations in *portunid* crabs all along the southeast coast of India [14]. Pillai and Thirumilu [14] reported that the predominance was in the order of *P. sanguinolentus* followed by *P. argentatus*, *Charybdis lucifera*, *C. feriatius* and *Podophthalmus vigil*. *Sacculina* spp. is a typical crustacean parasite infested in shrimps and crabs. *Sacculina* belongs to the order, *Rhizocephala*, with special parasitic adaptations. They appear as a small tissue mass, projected out from the abdomen of crabs, which is termed as 'externa'. Parasitic barnacles (*Cirripedia: Rhizocephala*) are responsible for reducing the value of commercial crustaceans [9,10,15]. Larval *rhizocephalan* parasites infect mainly on decapods and the net effect is often a castration of both sexes of the host [16]. The *rhizocephalan Sacculina* has a marked effect on gonad development and growth; *Sacculina* infection may cause degeneration of the gonads in both male and female crabs and also modifies the secondary sexual characteristics in the male crab; resulting in the acquisition of female characteristics [17-19]. The wide prevalence of parasites noticed in a particular environment during a particular period of time might be attributed to change in the environmental parameters like water temperature, dissolved oxygen, salinity, pH etc., which may have an impact on the proliferation and survival of these parasites. The infection rates were seasonal for both sexes and were normally higher in the adult female population [20].

Investigations pertain to the prevalence of *Sacculina* infestations are often restricted mainly to temperate species and very few are reported from tropical waters. Pioneering works about the prevalence and infestation of *Sacculina* spp. are by Day [18]; Boschma [21-24]; Philips

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and Cannon [25]; O'Brien and Wyk [26]; Johnson et al. [27]; Potter et al. [28]; Shields [29]; Galil and Lutzen [30]; Galil and Innoncenti [31]; Thresher et al. [32]; Werner [33]; Innocenti et al. [34,35]; Chan [36]; Galil [37-40]. Most studies on species diversity and biology of the *Sacculinidae* are based on temperate regions [41,42]. Research on *Sacculina* species in the Asian waters has been conducted mainly in Japan by Lutzen and Takahasi [43], in Taiwan by Huang and Lutzen [44].

In India, only few published reports were available for the prevalence and histopathological analysis of *Sacculina* spp. And the noted works among them were by Nair and Gurumani [45]; George [46]; Pillai and Thirumilu [14]. Comparative assessment on proximate composition and nutritional value of infected and non-infected crab of *P. sanguinolentus* were carried out by Ramar [47]. A comprehensive report focusing on the seasonal prevalence of *sacculinid* infestation in *Brachyuran* crabs along the southeast coast of India is found wanting. In this backdrop, an attempt has been made in the present study to understand the season wise prevalence of *Sacculina* spp. in *P. sanguinolentus* landed in Parangipettai fishing harbour.

Materials and Methods

The edible *Brachyuran* crabs, *P. sanguinolentus* (Figure 1) were procured from trawl heaps landed at Mudasalodai landing centre of Parangipettai coast, Tamilnadu (Lat. 11°29'N; Long. 79°46'E) and the data were pooled up seasonally for a period of one year (January 2011–December 2011). A total of 12,975 numbers of *P. sanguinolentus* were assessed among which 1,613 numbers were infested ones. Infested crabs were preserved in 10% formalin (tap water), formalin solution buffered with sodium borate (10 g/L solution) by Johnson et al. [27].

Systematic Position

Kingdom: Animalia

Phylum: Arthropoda

Class: Malacostraca

Order: Decapoda

Family: *Portunidae*

Genus: *Portunus*

Species: *P. sanguinolentus*

Results

A total of 12,975 specimens of *P. sanguinolentus* crabs were checked throughout the Study period of one year to find out the seasonal occurrence and host specificity of *Sacculina* infestation in Parangipettai coastal waters. Among the collected samples nearly, 12.4% of *P. sanguinolentus* crabs were infested by *Sacculina* castration. The infestation rate was varied among the seasons and also differs among the sexes of the host. The seasonal occurrence of *sacculinid* infestation was in the order that, Summer recorded the maximum (15.4%), followed by Premonsoon (13.3%), Postmonsoon (10.5%) and Monsoon (7.4%) respectively (Table1 and Figure 2). The rates of infestation were seasonal for both the sexes of *P. sanguinolentus*. The incidence of host specific prevalence were found more frequently on males (66.3%) than the female crabs (33.7%) (Table 2). Among the infected males, prevalence was maximum in Summer (67.4%) followed by Premonsoon (67.1%), Postmonsoon (64.7%) and Monsoon (60.8%)

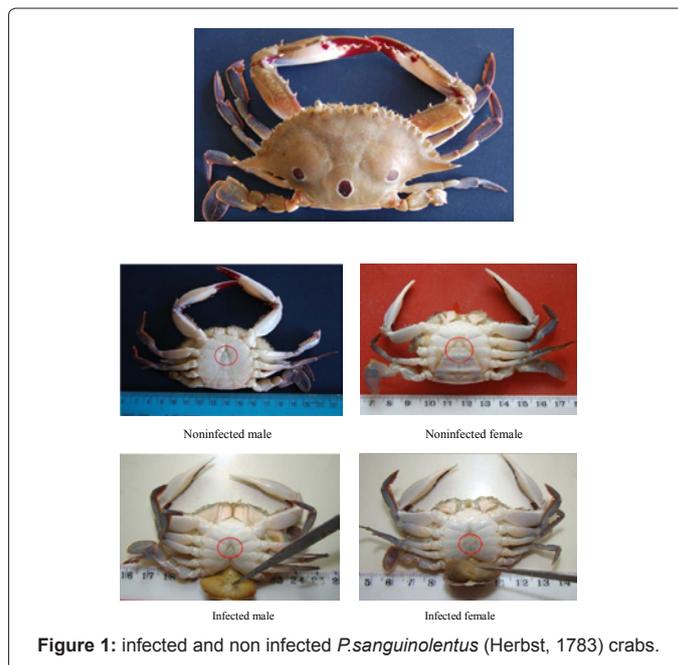


Figure 1: infected and non infected *P.sanguinolentus* (Herbst, 1783) crabs.

Infected crab	Postmonsoon		Summer		Premonsoon		Monsoon	
	Nos. of crabs	% of animal						
Male	220	64.7	290	67.4	500	67.1	59	60.8
Female	120	35.3	140	33.7	245	32.9	38	39.2
Total	340	---	430	---	745	---	97	---

Table 1: Seasonal infestation rate of *Sacculina* spp. in *P.sanguinolentus*.

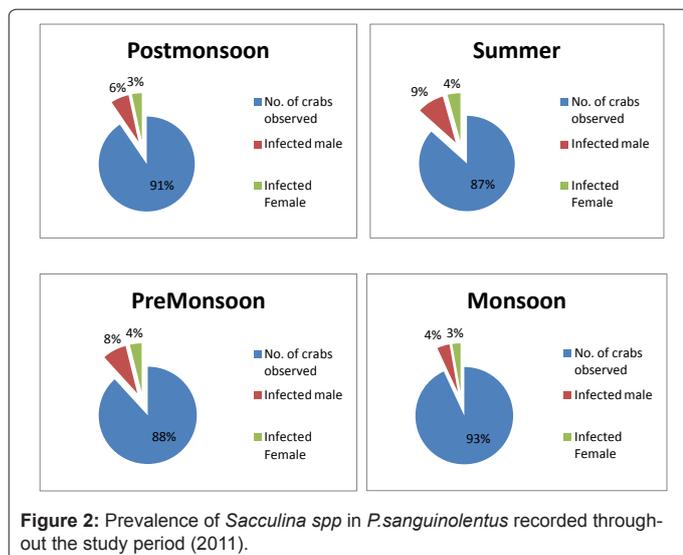
Crabs	Postmon- soon	Summer	Premon- soon	Monsoon	Total	%
No. of crabs observed	3250	2800	5600	1325	12975	---
Infected male	220	290	500	59	1069	66.30
Infected Female	120	140	245	39	544	33.70

Table 2: *Sacculina* spp. infestation rate in male and female crabs of *P.sanguinolentus*.

respectively. Among females, infestation rate lies from 32.9% to 39.2% among the seasons in such a fashion that; Monsoon season observed higher prevalence of 39.2% followed by Postmonsoon (35.3%), Summer (33.7%) and Premonsoon (32.9%).

Discussion

The overall prevalence of *Sacculina* infestation in *P. sanguinolentus* found in this study is compared with works done elsewhere. Nearly, 12.4% of *sacculinid*'s infestation was reported among the population of *P. sanguinolentus* which were checked for a period of one year. Among males, infestation prevalence was more in Summer; whereas as in the case of infected female crabs the prevalence was more in Monsoon. This clearly shows that infestations of *sacculinid* is irrespective of the seasons and are found throughout the year. The data were pooled up season wise that shows that infestation in males (66.3%) are higher than the female crabs (33.7%). Shrimp trawl activities reach its peak in all days of Premonsoon and part of days in Summer (due to trawl ban period) along the Parangipettai coast, so the availability of landed crabs were also on the higher end. This might be the reason for the higher prevalence of infested crabs during Summer and Premonsoon.



Many reasons have been attributed to the temporal and spatial prevalence of *sacculinid* castration in marine crabs. George [48] observed that 20% of the examined crabs from Madras coast were infested by *rhizocephalan* parasite. According to Nair et al. [45], 169 out of 193 specimens of *Portunus sanguinolentus* had parasites of *Sacculina*. Grothers [49] suggested that infected hosts are more sluggish and are easily caught, and that passive fishing methods under estimate the true prevalence of parasites. Phang [50] accounted a prevalence range between 24% and 68% of *Thompsonia* sp. in *P. pelagicus* from Singapore and Perry (1984) pointed out that over 50% of blue crabs from a single population in the Gulf of Mexico were infected with *rhizocephalan* parasite. Hawkes et al. [51] reported nearly 76% prevalence of the *rhizocephalans* in blue king crabs from Glacier Bay. Potter et al. [28] documented the higher occurrence of *Sacculina granifera* in the warmer months in Western Australia. Host density may affect prevalence of parasites and it was found that the locality with the highest abundance of hosts naturally had more parasitic infestation [52,53]. Hoeg [16] revealed that *rhizocephalans* are parasitic sterilizers and at high prevalences they must therefore exert a strong selection pressure on the host.

Pillai and Thirumilu [14] observed that more specimens of *P. sanguinolentus* were infected with *Sacculina* spp. when compared to other crabs in Chennai coast. They reported that *Sacculina* were first observed in crabs in the month of June, and later it was found to be prevalent in almost all the months. Only few authors investigated and discussed the parasitic infested rates and its host specificity of marine crabs. Pillai and Thomas (1972) observed that 12.2% of the total population of *Portunus pelagicus* was infested with the *rhizocephalan* parasite in the Gulf of Mannar. They suggested that infested parasite showed perfect female host specificity and nearly 28.1% of the female crabs were infested. Johnson et al. [27] analyzed that 50% of the population of blue king crab, *Paralithodes platypus* were infected with *rhizocephalan* parasite. They revealed that both males and females were infected, but parasitic infection was strongly related to ovarian abnormalities.

Sumpton et al. [20] reported that the infection rates in Moreton Bay, Australia were seasonal for both sexes of *P. pelagicus* with higher prevalence in the adult female population in such a way that nearly 20% of adult females carried externa during the summer months. Werner

[33] explained that higher incidences of infestation were found more frequently on males than the females. Galil [40] suggested among the parasitic infected crabs, the percentage of males were found higher and with an increase in the prevalence of infestation. Based on the present investigation, it is evinced that *Sacculina* infestation exhibits no clear specificity on sex wise and seasonal wise, we found in considerable quantities round the year with slight increase in warmer months. From the present investigation, the higher prevalence of *Sacculina* spp. in *P. sanguinolentus* in Parangipettai coast pose an alarming situation and also put forth the query about the sustenance of crab fishery and its future stock; as this will pave way to the occurrence of parasitic castration that indeed negatively affects its reproductive capacity and future recruitment. This study will serve as a baseline platform for a detailed and thorough investigation aiming to understand the rate of *sacculinid* infestation in *Brachyuran* crabs and its effect in future stock of crab population.

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