World Journal of Fish and Marine Sciences 2 (4): 307-310, 2010
ISSN 2078-4589

Infestation of Barnacle (*Balanus amphitrite*) in the Mangrove Environment of Vellar Estuary, Tamilnadu

S. Sophia Rani, S. Bragadeeswaran, K. Prabhu and S. Priyadharshini

Centre of Advanced Study in Marine Biology, Annamalai University,
Parangipettai - 608 502, Tamilnadu, India

Abstract: Mangroves, a predominant coastal habitat in the tropics, are constantly threatened by various pressures deteriorating them to a great extent. The mangrove swamp harbours a complicated community of animals, which are not evident. The roots provide a rich substratum of variety of attached animals, especially barnacles, bivalves, worms and truncates. Fouling organisms were barnacles, mussels and oyster's species. Settlement pattern of fouling barnacles on mangrove ecosystem have been studied during the period of November 2008 to October 2009 in Vellar estuary, Parangipettai. *Balanus amphitrite* dominated community represents the climax fouling assemblages on most mangroves. In the present investigation the *Balanus amphitrite* preferred *Rhizophora apiculata* stem surfaces to those of *Avicenna marina* long with physico chemical parameters. Positive correlation was observed in salinity, pH and water temperature. Salinity was key factor for regulating the organism's settlement in mangrove roots.

Key words: *Balanus amphitrite* · *Rhizophora apiculata* · *Avicenna marina* · Infestation

INTRODUCTION

Mangroves are fragile ecosystem, extremely sensitive to some of the factors responsible in altering the prevailing biological, physico-chemical and physical properties of the ambiance. Settlement by marine fouling organisms - the sedentary animals such as barnacles, oysters and even gastropods and algae are also a serious menace with several undesirable effects on the fishing and shipping operations, on coastal industrial installations using sea water for cooling purposes and on mangrove seedlings. *Balanus amphitrite* and other fouling organisms, for instance, kill 42.5% of the mangrove seedlings in Goa, India [1]. Limpsaichol and Parnrongs [2] reported on the influence of tar on the settlings of *Balanus Amphitrite*. In the last few years, barnacles have destroyed *Rhizophora mucronata* seedlings in plantations in Nakron I Thammarat province Thailand [3]. Although some seedlings have been attacked by grapsid crabs and hermit crabs [4]. The phenomenon of barnacle damage constitutes new problems for mangrove forest plantations which have otherwise been successful.

The 2004 tsunami was a rare but devastating geophysical event, which affected many countries of the Indian Ocean. In its wake, the importance and wisdom of mangrove forest preservation, restoration and plantation gained a new urgency and relevance [5, 6]. Protection and restoration of mangroves, coastal forests and sand dunes would mitigate the impacts of not only tsunamis, but also storms and sea level rise. Coastal vegetation, such as mangroves, can provide coastal communities with many valuable goods and services and the protection of these ecosystems is an endeavor we wholeheartedly support, however, expecting these ecosystems to provide protection from large tsunamis appears, on the basis of our re-analysis of Kathiresan and Rajendran [7], unrealistic.

Findings from our recent study on the differential rates of infestation and establishment of the barnacle *Balanus amphitrite* on *Rhizophora apiculata* and *Avicenna marina*, two ecologically dominant mangroves in Vellar estuary, Tamilnadu, indicate that bark texture and to a lesser extent, mangrove tree or shrub morphology may play an important role in the success or otherwise of barnacle attachment and degree of harmful bio-fouling.

Corresponding Author: S. Bragadeeswaran, Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai- 608 502 E. mail: drpragathi@gmail.com

Investigation Protocols: Study indicated a clear gap in barnacle infestation of *Balanus amphitrite* on *Rhizophora apiculata* and *Avicenna marina*, two dominant mangroves in Vellar estuary, during (2008-2009). In the present study, eight trees of *Rhizophora apiculata* and *Avicenna marina* of Vellar estuary were selected for barnacle infestation quantification by direct observation [8]. The Vellar estuary has been demarcated into marine, gradient, tidal and freshwater zones [9] based on salinity characteristics. The aim of the study was to test the hypothesis that *Balanus amphitrite* preferred *Rhizophora apiculata* stem surfaces to those of *Avicenna marina* long with physico chemical parameters.

The present study was conducted by the method of Li [8] indicated a clear gap in barnacle *Balanus amphitrite* infestation on *Rhizophora apiculata* and *Avicenna marina.* The physico and chemical parameters such as temperature, pH and salinity were estimated by following standard methods. Temperature was measured in the field itself, using a standard centigrade thermometer. Salinity was estimated by Salinometer model E-2 and pH was measured using an Elico pH meter. The Rainfall data were collected from meteorological division, CAS in Marine biology, Parangipettai.

RESULTS AND DISCUSSION

The barnacle *Balanus amphitrite* showed distinct settlement preference for *Rhizophora apiculata* stem surfaces to those of *Avicenna marina.* The Physico chemical parameters were recorded during the study period from November, 2008 to October, 2009. The maximum temperature was recorded in during 37.5°C (June, 2009), Salinity (34psu, June, 2009), rainfall (356 mm, November, 2008), pH (8.13, June, 2009). The physico-chemical parameters were correlated with barnacle infestation of two mangrove species. Positive correlation was observed in salinity, pH and water temperature. When the salinity and pH have increased the barnacle settlement was high during present observation. Negative correlation was noticed between rainfall and mangrove plants (Table 1). During monsoon season the rainfall was high, it has been affect the salinity and pH. Barnacle infestation in *Rhizophora* species significantly correlated with water temperature at 0.05 % level. When the salinity and pH was low the barnacle settlement was also been very limited. In short of mangrove root fouling the pH and salinity was key factor for regulating the organism's settlement in mangrove roots. In the previous reports, salinity is one of the most important factors in tropical estuaries governing species composition, succession, functional physiology and reproductive activity of resident activity [10]. The horizontal and vertical distribution of fouling organisms is also controlled to a considerable extent by water salinity in the area. Nair [11, 12] and Nair and Nair [13] stated that fouling intensity extremely fluctuated due to salinity composed to other physico chemical factors. On the western (less saline) and eastern (more saline) seaboards of Hong Kong were selected for barnacle infestation quantification by direct observation [14]. This present study mangrove forests, were located at a distance ranging from 1 to 2.5 km away from the shoreline and also are in elevated places with steep topography [7].

The barnacle of *Balanus amphitrite* showed distinct settlement preference for Rhizophora *apiculata* stem bark which has a texture of shark skin whereas in the stem bark of *Avicen*na *marina* is silky smooth in texture (Fig. 1). The stem bark of *K. candel* is silky smooth in texture and tends to become powdery and shed in flakes [4, 15], presenting a surface, which appears to discourage cyprid settlement. Barnacle larvae find smooth substrata difficult to adhere and show a preference for rough surfaces [14, 16]. Similar behaviors were observed with post-settlement juveniles of the bivalve mollusk, *Macomona liliana*, which actively left fine ashed sediments [17].

Table 1: Simple Correlation of physico chemical parameters and macrofouling organisms in *A. marina* and *R. apiculata*

	Salinity	*pH*	*W. temp*	*Rainfall*	*A. Marina*	*R. apiculata*
Salinity	1					
pH	0.600*	1				
W. Temp	0.658*	1				
Rainfall	-0.713**	-0.570	-0.468			
Avicenna marina	0.301	0.344	0.516	-0.331		
Rhizophora apiculata	0.224	0.481	0.674*	-0.251	0.538	1

*Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

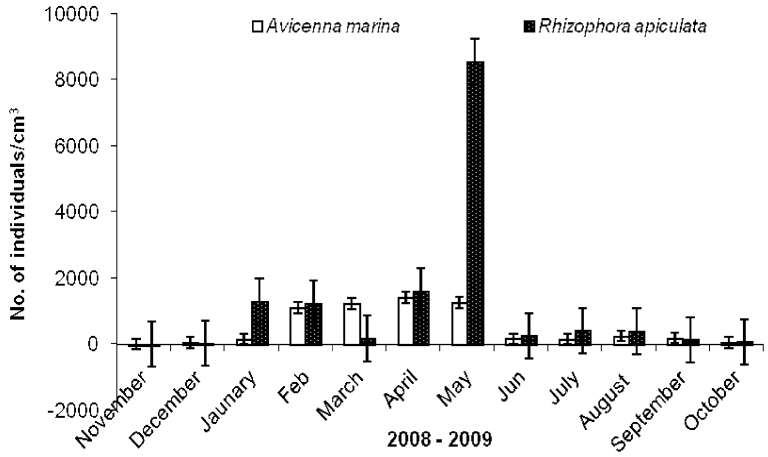

Fig. 1: Barnacle infestation in mangrove roots *A. marina* and *R. apiculata*

In contrast, densely packed conspicuous on the trunks of *Rhizophora apiculata* seem to encourage barnacle settlement. This preference for roughness and microcrevices by barnacles and the rejection of smooth surfaces (e.g. glass) were also noted by Faimli *et al.* [16] and Walter and Breckle [18]. Cyprids tend to avoid lethal height and dryness at the broad exploration phase [19] for permanent attachment.

The differences in bark texture between *Rhizophora apiculata* and *Avicen*na *marina* were highlighted in this paper but the concept has relevance beyond these species to many others of eco-economic importance. Recently, the adverse impacts of 'attached benthos' or bio-fouling mangrove fauna, especially barnacles and bivalves on mangroves was reported in Vietnam by Hoang and Nhuong, [20].

Data on fouling within different environments and on mangrove environment in Vellar estuary shows that the *Balanus amphitrite* is the predominant fouler. It is therefore suggested that a comprehensive account on systematic and distribution of mangrove vegetation, delineating true mangroves and associate species properly may be brought out to facilitate future research on mangroves and on their deterioration by marine organisms. We hope that more studies on bark and bio-fouling might be encouraged by these findings and that seedling age might be given more emphasis in the restore.

ACKNOWLEDGEMENT

Authors are gratefully acknowledging the Department of Biotechnology, Govt. of India, New Delhi for the financial assistance provided to carry out this research work.

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