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41. SEASONAL VARIATION IN THE ABUNDANCE OF WOOD BORING MOLLUSCS IN VELLAR ESTUARY, SOUTHEAST COAST OF INDIA

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ABSTRACT

Woodan blocks of *MangHera indica,* each 30 x 5 x 5 cm in size and 650 cm^ surface area, were exposed in the tidal zone of the Vellar Estuary at various positions from January 1981 to December 1981. The season of the settlement of wood-boring molluscs was determined by exposing the blocks for 1 month at a time, and the rate of growth and the dominant borers were studied by exposing the blocks for 3 to 12 months.

***Martesia striata* Linne, *Teredo furcifera* von Martens, *Bankia carinata* (Gray), *Bank/a campanellata* Moll and Roch and *Lyrodus pedicellatus* Quatrefages were the common species encountered in the test blocks. Intensive settlement was seen during Summer (Aprii-June) and post Monsoon (January-March) periods.**

INTRODUCTION

Twenty nine species ofteredinids and four species of phoiadids are known to occur in Indian waters. The ability of these borers to attack, damage and eventually destory the wood in brackish water areas are well known, especially along the south east coast of India (Santhakumari and Nair 1975) Ecology of IVlarine Wood borers in Cochin Harbour was studied in detail by Nair (1965). Nair and Saraswathy (1971) have reported on the biology of wood-boring teredinid molluscs. Nair and Dharmaraj (1979) have dealt with aspects of vertical distribution and rate of attack. Very little infor-
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coast species. Only preliminary surveys have been made for wood borers at Godavary Estuary (Qanapathi and Rao 1959), Mahanadi estuary ^gubba Rao 1968), Krishna estuary (Rao et al 1957) and at Veliar-Colleroon estuarine system ^Nair and Dharmaraj 1980 b). The present g^udy was carried out for one annual cycle (January to December 1981) to determine the seasonal variation in the abundance of wood boring molluscs in the Vellar Estuary.

MATERIAL AND IVIETHODS

Study area

Vellar Estuary is situated on the east coast of India at 1l°29°Nand long 79°46°E. River Vellar originates from the Servarayan Hills of the Salem District (Tamil Nadu, India) and opens into Bay of Bengal at Portonovo. The river mouth is narrow and shifts to a considerable extent during monsoon, depending on the influx of fresh water. This estugrv is a main landing centre from where the indegeneous mechanised and non-mechanised crafts like plank built boats, catamarans and canoes are operated. Considering the wide use of different types of wooden crafts in this estuary it was selected as the experiment site to study the abundance of wood borers by exposing wooden blocks.

Settlement of the wood boring molluscs was determined by exposing untreated *Mangifera indica* blocks (5 x 5 x 30 cm) with a surface area of BBOcm^. These blocks were conditioned for a period of fifteen days by soaking in filtered estuarine water (Nair 1962). Subsequently, two series of experiments were conducted simultaneously. •

Under Series A, every month, one string with 2 blocks was tied vertically to rectangular frame, anchored with a stone at the bottom of the estuary. The wooden blocks were spaced at a distance of 1.5 m in such a way that the top most one was at the mid intertidal level and the other at the bottom of the estuary about 50 cm above the substratum.

In B series, three sets of blocks each with two units, were immersed at the same time and taken out one set by one during the post monsoon period (January-March). In the same way another 9 sets were employed during summer (April-June), premonsoon (July-September) and monsoon (October-December). This would give an idea of the settlement for the respective period of immersion from one month to three months during each season and also show the monthly settlement of the animals.

After removal of test blocks, surface debris and fouling organisms were scraped off so that the number of borer apertures on the wooden surfaces could be counted under a binocular microscope as followed by earlier workers (Nai 1965; Tsunado 1979). The blocks were cut into pieces randomly and the animals were collected for identification. Blocks which appeared free from attack were also cut into pices to confirm the complete absence of wood borers.

Scraped debris and fouling organisms were washed and the fouling complex were weighed in an electric balance to know the accurate biomass of fouling growth in a particular panel.

Water samples were collected twice a week, irrespective of tides. The bottom water was collected using Knudsens water sampler and the temperature was recorded with a standard thermometer, that was calibrated in advance. Salinity was estimated by Strickland and Parsons method (1968). Light penetration was measured in terms of the visibility with the sechi disc.

TABLE-1. *Environmental factors affecting the settlement of wood boring Molluscs in Vellar Estuary for the period January 1981 - December 1981*

Month	Water T»mp (°C)		Salinlty (ppt)		Olssolveid Oxygen (ml 02/1)		Suspended Solids (mg/1)/		Rain fall (in mm)
	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	
Jan	30.1	29.6	26.51	27.01	5.10	3.78	23.03	22.2	67 5
Feb	30.6	30.0	26 81	27.51	3.06	2.27	20.73	14.4	NIL
Mar	32.0	30.2	30.51	32.01	362	2.83	25.7	19.8	0.2
Apr	32.2	30.7	33.51	34.01	4.42	3.51	6.8	4.9	0.1
May	33.0	31.2	34.01	34.80	5.10	4.64	11.7	7.9	77.8
Jun	33.2	32.0	34.51	35.01	272	2.26	8.1	5.2	22.5
Jul	29.5	28.0	31.51	32.51	3.17	3.06	27.1	22.9	199.6
Aug	29.1	27.0	28.51	29.50	5.90	5.78	25.7	21.8	140.3
Sep	28.5	26.0	28.0	28.51	4.76	4.53	15.5	11.7	44.1
Oct	25.0	24.5	0.529	1.029	4.52	4.31	51.6	44.2	536.5
Nov	26.5	25 2	10.520	13.020	3.62	3.44	29.1	27.6	153.7
Dec	24.5	24.0	9.02	11.200	4.20	4.01	57 08	41.4	276.1

RESULTS

Variations in salinity, temperature dissolved oxygen and suspended solids in surface and bottom waters are shown in Table 1. Salinity and temperature values were higher during summer and premonsoon seasons and lower during monsoon. Surface water temperature values were close to that of the atmospheric temperature. The differences between surface and bottom water temperature rarely exceeded 1°C. Higher light extinction co-efficient values were noticed during the monsoon season owing to the turbid nature of the water column. The suspended detritus matter varied in different seasons and was affected by upland run off, tidal currents, winds and boat traffic. The highest turbidity was attained in surface waters during October (51.6 mg/l) and December (57.8 mg/l). Particulate load decreased to a minimum of 8.1 mg/l during June and then rose to 27mg/1 during July. In the bottom waters the turbidity level decreased from 44.2 mg/l in October to 4.9 mg/l during April.

The fouling organisms like diatoms, barnacles, oysters, modiolids, crabs, annelids, alpheids, copepods, amphipods and isopods were found to occur on the blocks.

Five species of molluscs belonging to genera *Martesia*, *Teredo*, *Bankia* and *Lyrodus* were found to occur in the blocks. The monthwise number of these species recorded are shown in Fig 1.

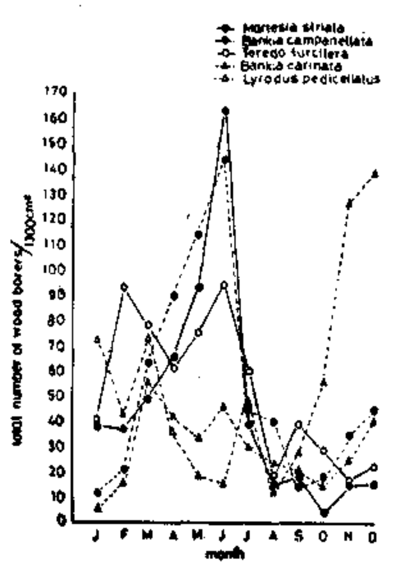

Fig. 1 Seasonal variation of different species of Marine wood borers at Vellar Estuary during January 1981 to December 1981.

Among the five species, the order of dominance was *Lyrodus pedicellatus*, *Bankia campanellata*, *Teredo furcifera*, *Martesia striata* and *Bankia carinata* repectively. *Martesia striata* has only one peak period of abundance during summer and the winter peak is not evident, where as *Lyrodus pedicellatus* has a highly pronounced winter peak of abundance and in summer the abundance of this species comparatively very poor. Among the rest of the three species *Bankia campanellata*, *Teredo furcifera* and *Bankia carinata* have a summer peak of abundance in the order in addition to a less pronounced winter peak

The monthly settlement of the five species in intertidal and bottom blocks are given in fig 2. The settlement of all the species in the bottom blocks are heavy uniformly with the seasonal variations among the species in different seasons.

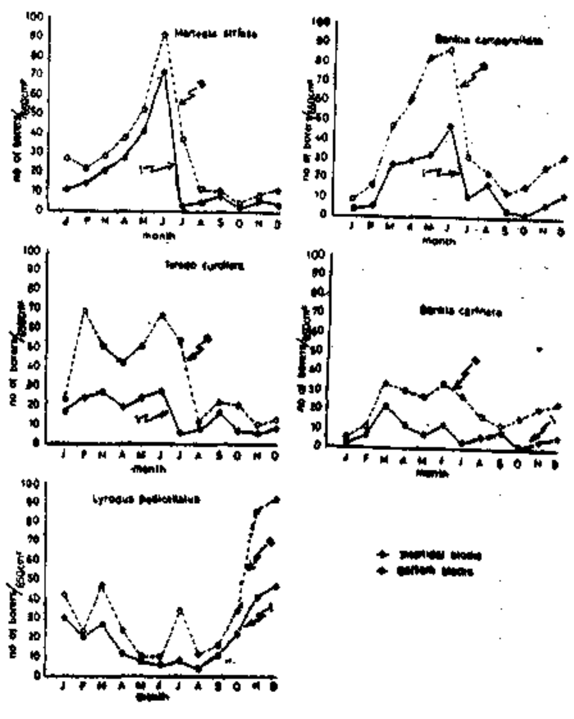

Fig. 2 Distribution of Marine wood borers in Intertidal and Bottom blocks in different seasons.

The quarterwise cumulative abundance of wood boring molluscs obtained in the long term experiments are shown in Table 2. The rate of attack among the species in different quarters are very much evident and *Teredo furcifera* is the

TABLE 2. *The quarterwise cumulative abundance (Number of specimens) of Wood boring molluscs in long term wooden blocks in Vellar Estuary during 1981.*

Block No	Month	*Martesia striata*		*Teredo furcifera*		*Lyrodus pedicellatus*		*Bankia campanellata*		*Bankia carinata*	
		I	B	I	B	I	B	I	B	I	B
B1	Jan	11	27	17	23	30	42	4	3	2	4
B2	Jan - Feb	21	34	30	32	17	37	7	15	6	17
B3	Jan – Mar	56	92	62	182	34	67	52	162	7	49
B4	Apr	18	22	19	42	12	24	29	61	12	30
B5	Apr - May	62	77	32	123	16	21	54	132	21	47
B6	Apr - Jun	112	129	92	215	15	33	71	164	29	64
B7	Jul	2	37	6	54	8	34	11	31	2	28
B8	Jul - Aug	9	17	17	21	11	20	29	40	7	19
B9	Jul - Sep	16	29	41	72	21	38	31	52	11	21
B10	Oct	2	2	7	12	22	34	1	7	1	5
B11	Oct - Nov	8	14	14	21	64	121	9	32	13	27
B12	Oct - Dec	11	24	20	31	87	157	11	79	15	52
	Total	328	504	357	828	337	628	306	778	226	363

dominant species. As already pointed out *Teredo furcifera, Martesia striata, Bankia campanellata* and *Bankia carinata* have summer peak period of abundance in the order mentioned and *Lyrodus pedicellatus* has a highly pronounced peak period of abundance in winter. The differential settlement of *Teredo furcifera* in the bottom blocks is very high when compared to the other three species. Such a difference is very low in *Martesia striata*. The settlement of *Lyrodus pedicellatus* is very high in the bottom blocks during winter.

The effect of fouling growth over the wood boring molluscs in intertidal and bottom blocks are shown in Fig 3. The fouling growth was observed to be very high during January and this declines in subsequent months till December with an exception during July. The effect of the light intensity on the settlement of wood borers both in intertidal and bottom blocks are shown tn Fig 4. The moderate value of K (Light extinction co-efficient) during January tends to decline in February and April and

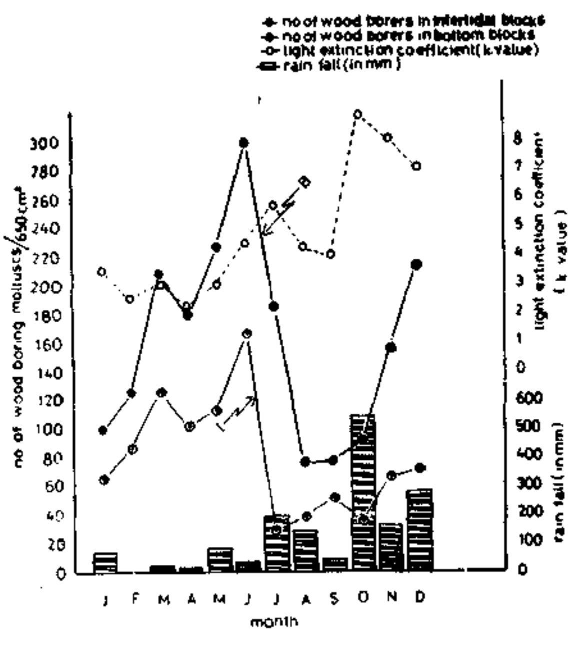

Fig. 3 Effect of Fouling growth over the settlement of molluscan larvae in intertidal and bottom blocks.

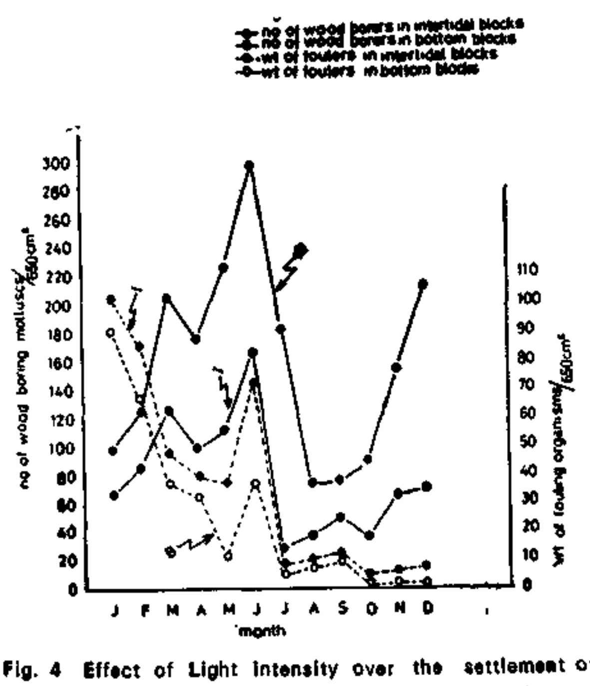

Fig. 4 Effect of Light Intensity over the settlement of wood borers in intertidal and bottom blocks.

increases up to October with slight decline in August and September.

DISCUSSION

Generally wood boring molluscs are seen to attack during high saline conditions. The greater settlement of *Teredo furcifera, Martesia striata* and *Bankia camjpanellata* during summer in B series (Table 2) may be due to the intrinsic interspecific compatibility of the species in subsequent months, and also availability of 'Micro flora' as food which is known to be an essential prerequisite for speedy borer infestation (Becker and Kohlmeyer 1958). Further, as time advances the activity of marine fungi and bacteria would have converted the cellulose of the timber blocks into cellubiose, thus rendering the wooden blocks feasible for easy attack (George 1963).

Studies on the life history of shipworms also revealed that the rate of settlement and growth varies with temperature, salinity and availabilty of food (Turner and Johnson 1971). in the present observations the influence of temperature and salinity over the abundance of the wood boring molluscs is evident from the analysis of variance as both surface and bottom water temperature and salinity have very high significant correlation. The reason for the lower settlement of the mollusc wood borers during premonsoon and monsoon seasons may be due to the change in temperature, rapid currents due to heavy rain, sudden decrease in salinity, and also the accumulation of silt over the blocks. The experiment on the salinity tolerance of larvae of *Teredo furcifera* had shown this species iseuryhaline as it tolerate salinity from 0.2 ppt to 34 ppt (Nagabushanam 1963). However, as observed in the present study and in other estuarine regions of Kerala coast also the *Teredo* species settled well on the test panel during the hot saline coditions (Santhakumari and Nair 1975).

Martesia striata appeared on the test blocks throughout the year, with a peak in the summer months (Fig 2). During this period (April, May, June) the lower settlement of other molluscan borers might be due to the feeding of this species on the veligers of other molluscan borers, as reported by Ganapati and Nagabhushanam (1955) the presence of veligers in the gut content of *Martesia striata.*

The difference in the intensity of attack of *Martesia striata* in the intertidal and bottom blocks are very minimum. Better survival of this species may be due to its ability to tolerate wide range of salinity and high temperature as seen from the studies on the larvae of *Martesia striata* (Boyle and Turner 1976) and on adults of *Martesia striata by* Nagabhushanam (1955).

Teredo, Lyrodus and *Bankia* activity in Vellar estuary is as severe as that *of Martesia* sp. *Teredo furcifera* and *Bankia* spp have been observed to settle intensively in the bottom blocks during summer and *L. pedicellatus* during winter. Walden et al (1967) observed that the *Bankia* larvae were abundant mainly at the bottom and spread to the surface in declining numbers. The higher abundance of the wood boring molluscs in the bottom blocks may be due to the influence of different environmental factors specially the light intensity and suspended solids, as the less intensive light has been found to favour the settlement of these wood borers as observed by Isham et al (1951) in *Teredo pedlceliata {- T. bartscfii)* and Owen (1953) in *Teredo norvegica.*

As the fouling growth is concerned, except in summer during other seasons it is observed that the settlement of wood borers is negatively correlated with the fouling growth. Nair (1962) observed that the dense fouling growth, retarded the settlement of larvae of wood borers. The high fouling rate on the wood surface reduced the available area for the subsequent settlement of the shipworm larvae on wooden blocks (Radhakrishnan et al 1983). Extensive accumulation of barnacles was observed to affect the settlement of veligers of the wood borers adversely in the intertidal block. Johnson et al [1936] have reported that the fouling organisms like barnacles, bryozoans, tunicates and mussels feed extensively on the shipworm larvae and specially the basal plates of barnacles prevent the penetration of shipworm larvae into the wooden blocks.

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