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NATURAL RESISTANCE OF TEN SPECIES OF CATAMARAN GRADE TIMBER TO MARINE WOOD BORER ATTACK AT VISAKHAPATNAM AND KOCHI HARBOURS

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ABSTRACT

The natural resistance of ten species of timber suitable for catamaran fabrication was evaluated at Visakhapatnam and Kochi harbours to suggest suitable substitutes to the conventional species as their availability is fast dwindling and prices are soaring up. The results showed that none of the ten species exhibited any remarkable resistance against marine organisms attack. The timbers lasted at the most for 9 months at Visakhapatnam and 7 months at Kochi. While the destruction of panels at Visakhapatnam was caused exclusively by teredinids, that at Kochi was brought about by both teredinids and pholadids. From the study, it is seen that preferred species did not offer any specific advantage over the underutilized species tested. Therefore, it is emphasized that any timber species used for catamaran fabrication be treated with suitable preservative chemicals so as to obtain long service life, saving of expenditure and conservation of forest wealth and its biodiversity.

INTRODUCTION

EVALUATION of bioresistance of timber under marine conditions is an essential prerequisite to determine the utilisation pattern of wood for different end uses. Screening of a large number of species have been carried out by a number of workers in Indian waters (Nair, 1956; Raveendran and Wagh, 1990; Cherian *et. al,* 1992; Santhakumaran, 1994 and 1997; Santhakumaran and Rao, 1994 and Satyanarayana Rao *et al,* 1994). In general, these works deal with the routine evaluation of common commercial timber of India rather than screening of species with focus on any end use except for the works of Balasubramanyam (1970) and Cherian *et al,* (1992) who have studied the aspect for boat building and for the construction of underwater structures related to fisheries, respectively. Lion's share of the timber used in marine sector goes to the fabrication of traditional fishing craft, the catamaran, which is extensively employed along the east coast by scores of poor fishermen. Since the availability of timber has become alarmingly low because of population explosion, irrational exploitation and unscientific utilisation, pressure is mounting up on alternatives. The situation in catamaran sector is no different from this general scenario. So far, the most depended and preferred species, namely, *Albizia molluccana, Albizia* spp., *Melia dubia, Paraserianthes falcataria (Albizia falcataria)* and *Tetrameles nudiflora* for making catamarans have almost disappeared even from the remote forest tracts of the country. Therefore, the need to evaluate more and more timber suitable for catamarans is felt highly essential and hence, the present effort.

Timber destruction is known to be location specific and general conclusions normally drawn based on data generated from a single place are misleading because of differences in

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environmental variables and divergent wood boring fauna (Kalyanasundaram and Ganti, 1975). Therefore, experiments at two important places, namely, Visakhapatnam (17°40′N and 83°16′ E) on the east coast and Kochi (9°57′N and 76°14′ E) on the west coast of India (Fig.-1) were taken up. The two stations not only represent distinctly different environmental conditions and diverse faunal assemblages but also pose extremely varying degrees of biological hazard to timber. Results of exposure tests carried out using 10 species of timber that meet most of the requirements for catamaran fabrication form the basis of this paper.

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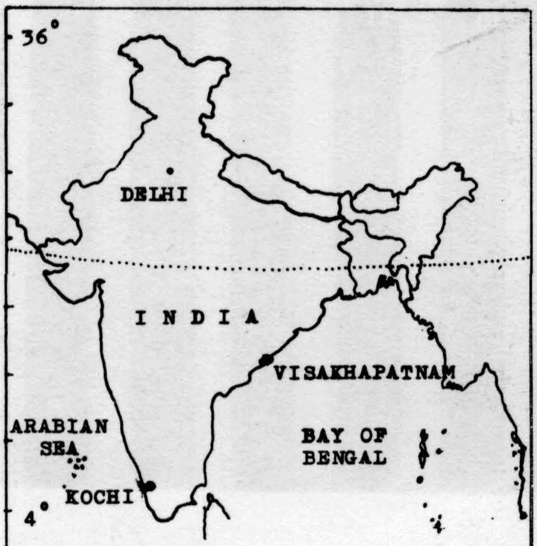

FIG. 1. *Test Stations on the East and West Coasts*

MATERIAL AND METHODS

Test panels of size 305 × 38 × 38 mm prepared from ten timber species, namely, *Ailanthus excelsa, Bombax ceiba, Euoida*

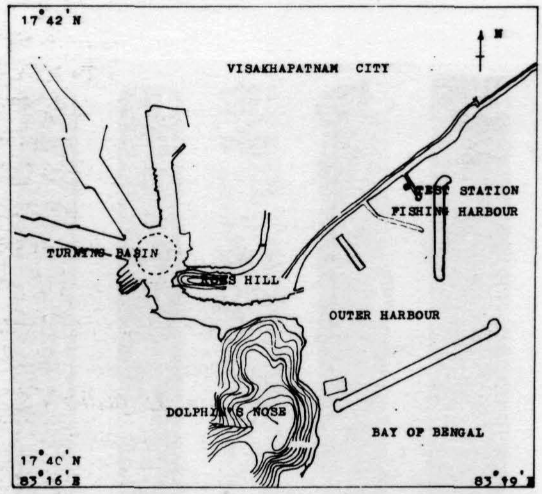

FIG. 2. *Test site at Visakhapatnam Harbour*

speciosa, Ficus aspirima, Ficus mysorensis, Lannea coromandelica, Melia dubia, Paraserianthes falcataria, Samanea saman and *Symplocos spicata* were arranged in the form of ladders with each ladder containing panels of all the ten species at random, using 3 mm nylon rope replicating it six times. Panels of *M. dubia* and *P. falcataria* were included in the test for comparison as control. All the ladders were suspended sufficiently below low tide mark at each of the test sites (a fishing vessel berth in the outer harbour at

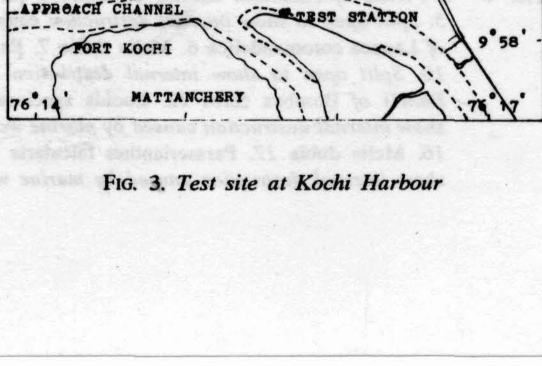

FIG. 3. *Test site at Kochi Harbour*

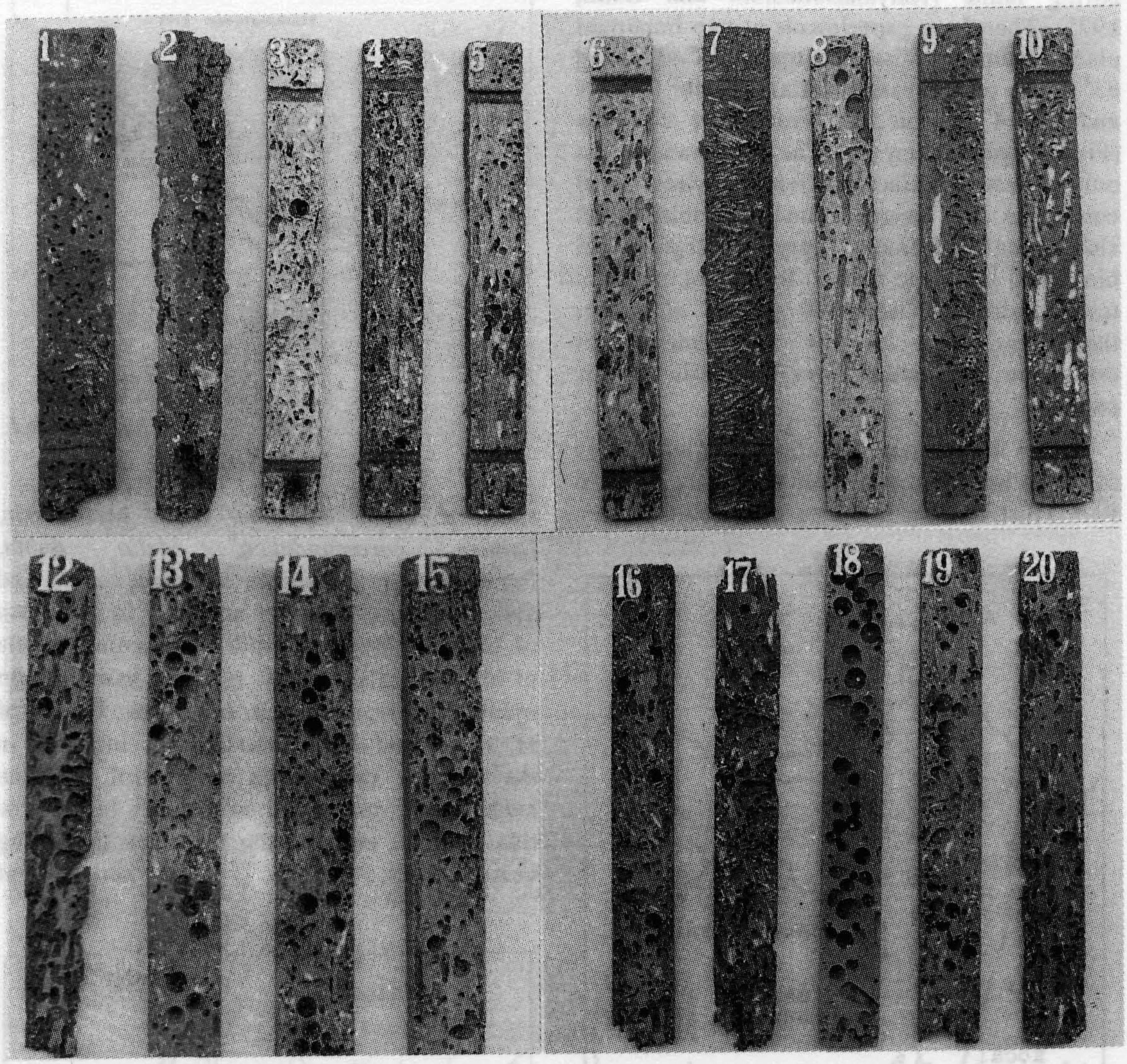

FIG. 4 *1. Panels of* Ailanthus excelsa *1.* Bombax ceiba *2.* Euoida speciosa *3.* Ficus aspirima *4.* Ficus mysorensis *5. Split open to show internal destruction caused by marine wood borers at Visakhapatnam Harbour. Panels of* Lannea coromandelica *6.* Melia dubia *7.* Paraserianthes falcataria *8.* Samanea saman *9.* Symplocos spicata *10. Split open to show internal destruction caused by marine wood borers at Visakhapatnam Harbour. Panels of* Bombax ceiba *12.* Euoida speciosa *13.* Ficus aspirima *14.* Ficus mysorensis *15. Split open to show internal destruction caused by marine wood borers at Kochi Harbour. Panels of* Lannea coromandelica *16.* Melia dubia *17.* Paraserianthes falcataria *18.* Samanea saman *19.* Symplocos spicata *20. Split open to show internal destruction caused by marine wood borers at Kochi Harbour.*

Visakhapatnam (Fig.-2) and the Embarkation jetty located in the Ernakulam channel of Cochin Port Trust at the Willingdon island, Kochi (Fig.-3). Procedure described by Santhakumaran and Rao (1994) was followed in design, conduct and data collection. The test lasted for 9 months at Visakhapatnam and 7 months at Kochi. After the final removal from the field, the panels were thoroughly examined for the intensity of borer attack, faunal composition and species identification. Subsequently, the panels were also split open for the visual assessment of the total internal destruction.

RESULTS

Near sea water conditions prevailed throughout the testing season at both the localities (Table-1).

Development of fouling complexes over the substrata of test material was very quick at both the localities. Irrespective of the species of timber exposed, the surface area of all the panels was encrusted to a large extent by the primary fouling assemblages (PFA) followed by the accumulation of secondary fouling assemblages (SFA) within one month. The PFA at Visakhapatnam consisted of *Laomedia bistriata* (coelenterata), *Serpula vermicularis, Hydroides norvegica* (annelida), *Balanus amphitrite* (arthropoda), *Membranipora tuberculata, Electra bengalensis, Alderina arabianensis, Bugula neritina* (bryozoa) and at Kochi it is comrised of *Bimeria franciscana* (coelenterata), *Membranipora savartii, Schizoporella unicornis* (bryozoa), *Ficopomatus macrodon, Mercierella enigmatica* (annelida) and *Balanus amphitrite* (arthropoda) besides several microfoulants like algae, diatoms, rotifers and nematodes. The dominant forms among them were *S. vermicularis, H. norvegica* and *B. amphitrite* at Visakhapatnam but only *B.amphitrite* dominated the fouling communities at Kochi throughout the testing season.

The wood boring fauna mainly responsible for the deterioration of test panels were identified as *Bankia campanellata, Lyrodus bipartita, L. pedicellatus, Teredo furcifera, T. parksi* (teredinids) and *Martesia striata* (pholadids) at Visakhapatnam and *Nausitora hedleyi* (teredinids) and *Sphaeroma terebrans* (sphaeromatids) in addition to the above borers except *L. bipartita* and *T. parksi,* at Kochi. Among these forms, *B. campanellata* and *L. pedicellatus* were predominant at Visakhapatnam and *L. pedicellatus* and *M. striata* at Kochi.

Between Visakhapatnam and Kochi harbours not much variation was found in the per cent destruction of timber panels (Fig.-4, 1-10; 11-20) *F. mysorensis, E. speciosa* and *S. spicata* which were destroyed beyond 80% in 5 months at Visakhapatnam showed a damage

TABLE 1: *Hydrographical conditions at the test sites in Visakhapatnam and Kochi harbours*

Harbour	Surface Temperature °C		Salinity %		Dissolved oxygen ml/L		pH	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Visakhapatnam	26.0	31.0	24.0	34.0	4.48	7.00	7.2	8.1
Kochi	28.1	33.4	27.5	33.6	3.50	4.20	7.9	8.2

of 93%, 72% and 92% respectively in just 3 months time at Kochi. Panels of *L. coromandelica* and *F. aspirima* also were destroyed in 5 months at Visakhapatnam but in 7 and 6 months at Kochi; undergoing above 83% destruction in all instances. *B. ceiba* was destroyed at both the harbours almost to the same extent (above 90%) in about 6 months period. *M.dubia* and *S. saman* were destroyed beyond 85% at both the harbours but in 9 months at Visakhapatnam and 6 months at Kochi *A. excelsa* has undergone 90% damage in 9 months at Visakhapatnam. *P. falcataria* was destroyed in 9 months at Visakhapatnam but in just 3 months at Kochi; with 75% and 65% destruction respectively (Table-2).

At Visakhapatnam, the destruction of panels of all the ten species was mostly brought about by teredinids, though a few pholadids have also infested them. At Kochi, pholadids caused major damage to the panels of *B. ceiba* and *P. falcataria* though numerous teredinid holes were observed on the panels of the former and not the latter. *E. speciosa, F. mysorensis, M.dubia, S. saman* and *S. spicata* on the other hand were mainly destroyed by teredinid borers. In the case of *F. aspirima* and *L.coromandelica*, both pholadids and teredinids equally contributed to their destruction. The role of sphaeromatids in the destruction of panels was almost negligible in all the ten species although their attack was observed to some extent in *B. ceiba, P. falcataria* and *L. coromandelica*.

The average size of the animals encountered in the timber panels destroyed at Visakhapatnam and Kochi harbours ranged from 13.4 to 19.0 mm and 1.4 to 28.4 in the case of pholadids and 3.3 to 88.5 mm and 1.0 to 84.8 mm, in the case of teredinids, respectively while the size of sphaeromatids varied between 3.7 to 11.0 mm, at Kochi, depending upon the intensity of colonisation and competition for space. Surprisingly, individuals of each of these groups of organisms attained the maximum size when mixed populations occurred rather than isolated or dominant populations.

DISCUSSION

The varying faunistic composition in the damaged panels of different species and the disproportionate degree of destruction inflicted to the panels noticed during the present tests coincides with similar observations made by Kalyanasundaram and Ganti (1975). Such intricacies, although common in the attack and destruction of timber seem to arise out of variations in the a) size, structure and orientation of wood elements, b) chemical composition of wood substances, c) quantity and quality of wood extractives, and d) incidence and precariousness of borer larvae during settlement besides e) interrelations of various organisms in the community, f) survival laws of life, and g) environmental processes and parameters that govern or influence all the above factors.

Of the ten species of timbers screened at the two localities,none of the species including *M. dubia* and *P. falcataria*, which are highly preferred for catamarans either exhibited any remarkable bioresistance against marine organisms attack or depicted any marked superiority in durability. However, the above two species along with *A. excelsa* and *S. saman* performed comparatively better at Visakhapatnam while only *B. ceiba* and *L. coromandelica* fared relatively better at Kochi. Also more number of species lasted longer at Visakhapatnam than at Kochi. Results of similar nature were also reported by Kalyanasundaram and Ganti (1975). Obviously, such inequalities occurred because of the differences in faunistic composition and borer predominance between the two localities in addition to the variable interference from foulers.

TABLE 2: *Natural resistance of catamaran grade timber at Visakhapatnam and Kochi harbours*

Sl. No.	Timber Species	Specific Gravity	Visakhapatnam						Kochi					
			Durability	Destruction	Borers	Borer count	Borer Size in mm	Dominant Group	Durability	Destruction	Borers	Borer count	Borer Size in mm	Dominant Group
1.	*Ailanthus excelsa*	0.356	9 m	90%	P	2	16-18	T	—	—	P	—	—	—
					S	—	—				S	—	—	
					T	α	2-25				T	—	—	
2.	*Bombax ceiba*	0.365	6 m	95%	P	5	15-21	T	7 m	90%	P	α	1-25	P
					S	—	—				S	35	2-15	
					T	α	4-120				T	α	1-110	
3.	*Euoida speicosa*	0.485	5 m	85%	P	4	15-26	T	3 m	72%	P	51	1-35	T
					S	—	—				S	—	—	
					T	α	1-85				T	α	1-70	
4.	*Ficus aspirima*	0.350	5 m	90%	P	2	16-17	T	6 m	90%	P	α	1-30	P&T Equal
					S	α	—				S	—	—	
					T	α	3-125				T	α	1-70	
5.	*Ficus mysorensis*	0.350	5 m	80%	P	5	10-13	T	3 m	93%	P	α	1-30	T
					S	α	—				S	—	—	
					T	α	1-90				T	α	1-40	
6.	*Lannea coromandelica*	0.497	5 m	85%	P	4	15-20	T	7 m	83%	P	73	1-27	P&T Equal
					S	—	—				S	4	6-9	
					T	α	5-90				T	α	1-103	
7.	*Melia dubia*	0.394	9 m	90%	P	—	—	T	6 m	92%	P	α	1-25	T
					S	—	—				S	—	—	
					T	α	2-25				T	α	1-100	
8.	*Paraserianthes falcataria*	0.328	9 m	75%	P	10	15-28	T	3 m	65%	P	144	5-29	P
					S	—	—				S	12	3-9	
					T	α	4-150				T	—	—	
9.	*Samanea saman*	0.491	9 m	85%	P	—	—	T	6 m	90%	P	α	1-27	T
					S	—	—				S	—	—	
					T	α	5-75				T	S	1-90	
10.	*Symplocos spicata*	—	5 m	85%	P	3	5-9	T	3 m	92%	P	56	1-28	T
					S	—	—				S	—	—	
					T	α	6-100				T	α	1-95	

m-Months; P-Pholadids; S-Sphaeromatids; T-Teredinids; α-above 200; LNS (1971)-Santhakumaran, L.N. (1971); LNS (1997)-Santhakumaran, L.N. (1997); RN (1960)-Nagabhushanam, R (1960); KSR (1994)-Satyanarayana Rao K. *et. al.* (1994)

(Table continued...)

Some of the timber species used in the present study were also screened for their durability by some earlier workers (Nair, 1956; Nagabhushanam, 1960; Santhakumaran, 1971 and 1977 and Satyanarayana Rao *et al*, 1994). The comparative performance of these species is presented in Table-2. The data show that *A. excelsa, M.dubia* and *S. saman* performed equally better at Goa and Visakhapatnam than at Kochi, *B. ceiba* and *L. coromandelica* lasted better at Bombay than at Kochi or Visakhapatnam and *P. falcataria* fared better at Visakhapatnam than at Kayamkulam or Kochi.

From the foregoing account it is clear that none of the ten timber species including the ones in current demand for catamaran fabrication, in their unprotected form possesses any specific advantage and really serve the desired purpose of the poor traditional fishermen for long. It is therefore very important that any timber used for such specified end use like catamarans is adequately protected and used to avoid the drain on our forest wealth and biodiversity of the country.

TABLE 2. *Continued....*

Sl. No of Species	Bombay		Goa		Visakhapatnam			
	LNS (1971)		LNS (1997)		RN (1960)		KSR (1994)	
	Durability	Destruction	Durability	Destruction	Durability	Destruction	Durability	Destruction
1.	—	—	6 m	75%	—	—	9 m	R
2.	9m	65%	—	—	4m	VH	9 m	R
3.	—	—	—	—	—	—	—	—
4.	—	—	—	—	—	—	—	—
5.	—	—	—	—	—	—	—	—
6.	9m	18%	—	—	—	—	12 m	35%
7.	—	—	6 m	70%	—	—	—	—
8.	—	—	—	—	—	—	—	—
9.	—	—	6 m	85%	—	—	7 m	R
10.	—	—	—	—	—	—	—	—

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