

## Distribution and growth of wood-borers in Bombay offshore waters

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The borer population comprised of 7 species of teredinid borers. Species composition varied with depth; *Bankia carinata* and *B. campanellata* were abundant at 2 m, *B. carinata* and *Lyrodus pedicellatus* at 22 m, *L. pedicellatus* at 42 m and *L. singaporeana* and *Teredo parksi* at 62 m depths. *Teredo indomalaiica* and *Teredora princesae* were of very rare occurrence. *B. campanellata* was the fastest growing species with a maximum growth-rate of 65 mm. month<sup>-1</sup>. Growth rate was faster during the monsoon period for all species except for *B. campanellata*.

In waters of Indian Ocean in general and Arabian Sea in particular, very little is known on marine wood-borers in offshore waters<sup>1-6</sup>. In this paper distribution and growth of wood-borers at a station in the area of the Bombay High region in the Arabian Sea, (approximately 160 km off Bombay, lat. 19° 20'N, long. 71° 21'E) are presented and discussed.

### Materials and Methods

Wooden panels (15 × 10 × 2.5 cm) of *Mangifera indica* were exposed at 2, 22, 42 and 62 m depths for varying durations ranging from 1-12 months to collect the boring organisms. This included 4-monthly panels, exposed for monsoon (June to September), postmonsoon (October to January) and premonsoon (February to May) seasons; 8-monthly panels corresponding to 2 consecutive seasons such as monsoon and postmonsoon (June to January), postmonsoon and premonsoon (October to May) and premonsoon and monsoon (February to September); 12-monthly panels (October 1983 to October 1984) and cumulative panels of exposure durations ranging from 1-12 months. All the panels, with the exception of the cumulative set, were exposed in vertical and angular (45°) orientations. On retrieval, fouling organisms on the panels were scraped and the panels were cut into halves. The burrow length which corresponds to the maximum length attained by the borer was measured using a flexible copper wire. Enumeration of the borers were done based on the number of pallets collected. To determine their relative abundance, maximum possible numbers of pallets were collected. They were preserved in alcohol-glycerine mixture and identified<sup>7</sup>.

### Results and Discussion

The borer population at this offshore station comprised 7 species of molluscan borers belonging to the family Teredinidae, viz. *Bankia carinata*, *B. campanellata*, *Lyrodus pedicellatus*, *L. singaporeana*, *Teredo parksi*, *T. indomalaiica* and *Teredora princesae*. Pholadids, sphaeromatids and limnoriids were completely absent in the test panels. Since the panels during the present investigation were exposed in the offshore waters and at about 14 m off the bottom, the horizontal and vertical distribution of the above borer groups might have imposed restrictions on their distribution on the test panels. Turner<sup>8</sup> noticed that the boards exposed during the Atlantic and Pacific deep water tests, installed just 1 m off the bottom, were only slightly attacked and the boards 7.5 to 15 m off the bottom were usually completely free of pholadid borer *Xylophaga*.

Based on the observations at Fort Lauderdale<sup>8</sup>, the shipworms of the genera *Lyrodus* and *Teredo* were found only on inshore boards, while they were completely absent on the offshore boards located approximately 4 km from the shore. Only the genus *Bankia* was present on all the boards<sup>8</sup>. Contrary to this, shipworms of all these 3 genera were observed in the present study area at Bombay High.

During the initial periods of study *B. carinata* and *B. campanellata* were the only borers encountered at all depths of panel exposure. At 2 m depth, *B. carinata* was the most dominant borer contributing > 50% to the total count of wood borers in majority of the panels, irrespective of their exposure duration (Fig. 1A). Their dominance was observed at 22 m depth also (Fig. 1B). At 2 and 22 m depths, their occurrences

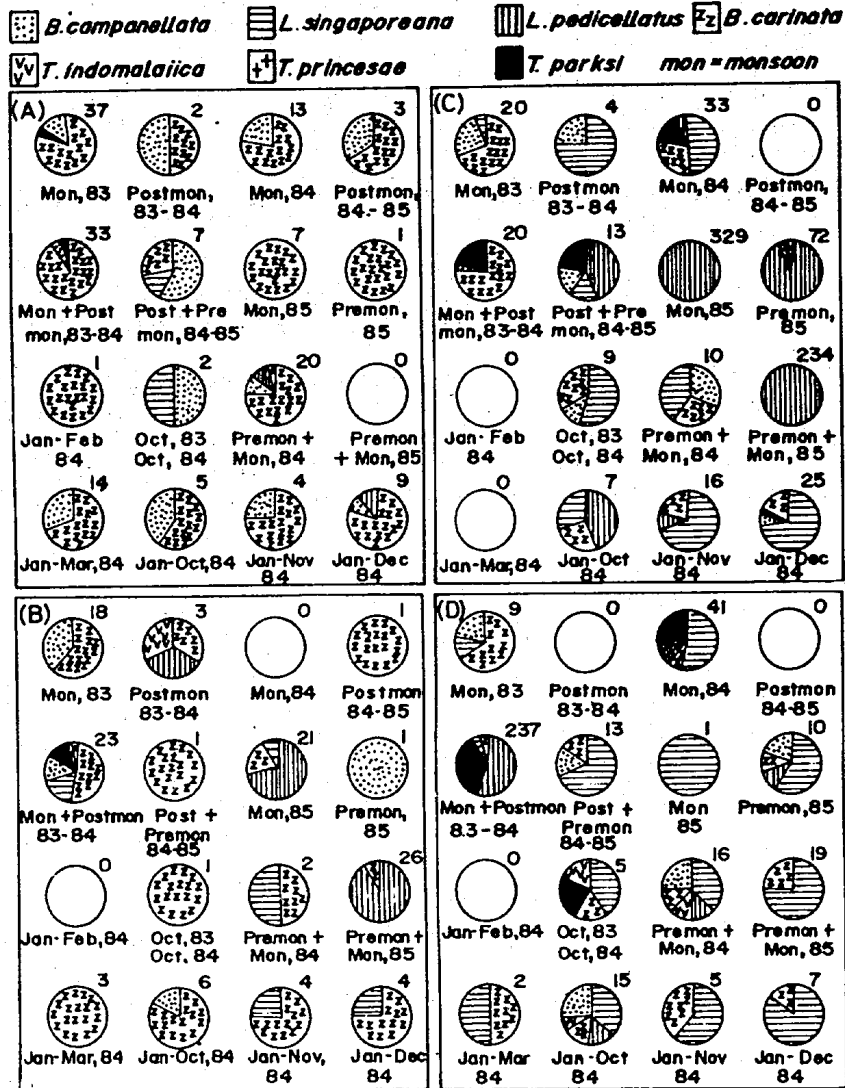


Fig. 1—Species composition of wood-borers collected from panels of different exposure periods at 2 (A), 22 (B), 42 (C) and 62 m (D) depths. (Numbers on the right hand top indicate the number of borers collected from the panel exposed for that particular duration)

continued almost throughout the period of study. However, during the course of time, at 42 m *L. pedicellatus* (Fig. 1C) and at 62 m *L. singaporeana* (Fig. 1D) replaced them. Other species such as *Teredo indomalaiica* and *Teredora princesae* were of very rare occurrence at this station.

*B. carinata* and *B. campanellata* were reported to be active all along the coastal waters of India<sup>9,10</sup>. Nair<sup>9</sup>, assumed these 2 species to be the major destructive ones in offshore waters. Present study supports this observation. According to Turner<sup>11</sup>, oviparous species are generally confined to the large ocean basins. However, the genus *Bankia* was reported to be an exception. Despite their oviparous nature, they showed a world-wide distribution in tropical and subtropical waters<sup>7</sup>.

*L. pedicellatus* enjoys wide distribution along the coastal waters of India and has been reported to be particularly destructive in the coastal waters of Bombay<sup>10</sup>. Some of the panels exposed at 42 m depth had undergone extensive damage due to heavy attack by this species thereby indicating their dominance in offshore waters. Majority of them were very small in size (40 mm length). However, inspite of being a well established species in this offshore locality, *L. singaporeana* was completely absent in the coastal waters of India.

The only earlier record of *Teredo indomalaiica* from the east coast of India was based on collections from drift wood<sup>12</sup>. *T. parksi* showed a very patchy distribution along the coastal waters of India<sup>1</sup>. Along the west coast it was recorded only from Bombay:

Nair<sup>13</sup> has reported its occurrence in drift woods, which probably indicated their presence in the open sea.

The vertical distribution revealed differential depth preferences shown by the individual species of borers. For example, in the present study, *B. carinata* and *B. campanellata* were abundant at 2 m, *B. carinata* and *L. pedicellatus* at 22 m, *L. pedicellatus* at 42 m and

*L. singaporeana* and *T. parksi* at 62 m depths (Fig. 2). This concentration of individual species at different depths may be an ecological adjustment shown by the borers to avoid interspecific competition<sup>13,14</sup>

*B. campanellata* was the fastest growing species in Bombay High offshore waters (Table 1). It is notable that this species had attained a length of 259 mm in 4-months during the premonsoon season. In the case of *B. carinata*, maximum growth-rate recorded was 48 mm. month<sup>-1</sup>. Growth was found to be faster during the initial periods. For example an increase in length of 32 mm was recorded during 1 month period between 2nd and 3rd months whereas, it was only 13 mm during the same period between 10th and 11th months. Maximum growth-rates recorded in the case of *L. pedicellatus*, *L. singaporeana* and *Teredo parksi* were 35.3, 22.0 and 23.3 mm.month<sup>-1</sup>.

In general, the pattern of distribution of borers was in agreement with that of the earlier reports from the coastal waters where maximum attack was observed on panels exposed at or near bottom<sup>15,16</sup>. Growth-rate in all species was faster during monsoon compared to postmonsoon and premonsoon seasons. However, *B. campanellata* was an exception.

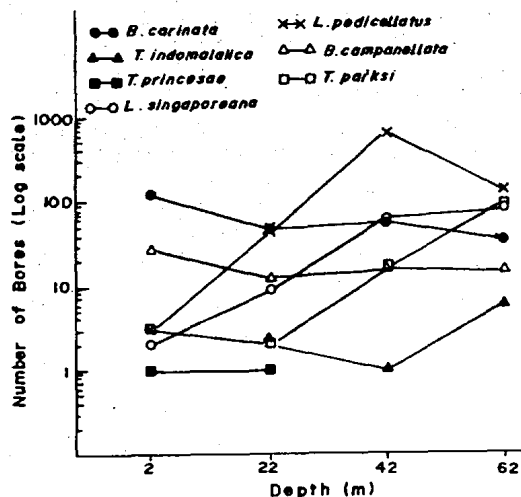


Fig. 2—Vertical distribution of wood-borers

Table 1—Maximum length attained and growth-rate of wood borers in waters of Bombay High

Duration of Exposure	<i>B. carinata</i>		<i>B. campanellata</i>		<i>L. singaporeana</i>		<i>L. pedicellatus</i>		<i>T. parksi</i>	
	ML	GR	ML	GR	ML	GR	ML	GR	ML	GR
<b>Seasonal</b>										
June 83-Sept. 83	191	47.8	175	43.8	51	12.8	—	—	—	—
Oct. 83-Jan. 84	87	21.8	66	16.5	65	16.3	110	27.5	—	—
June 84-Sept. 84	152	38.0	165	41.3	194	48.5	141	35.3	93	23.3
Oct. 84-Jan. 85	70	17.5	67	16.8	—	—	—	—	—	—
Feb. 85-May 85	42	10.5	259	64.8	173	43.3	78	19.5	50	12.5
June 85-Sept. 85	98	24.5	—	—	112	28.0	41	10.3	—	—
<b>Eight-monthly</b>										
June 83-Jan. 84	189	23.6	192	24.0	181	22.6	205	25.7	75	9.4
Feb. 84-Sept. 84	108	13.5	360	45.0	238	29.8	82	10.3	—	—
Oct. 84-May 85	124	15.5	208	26.1	242	30.3	—	—	—	—
Feb. 85-Sept. 85	188	23.5	—	—	150	18.8	22	2.8	—	—
<b>12 Monthly</b>										
Oct. 83-Oct. 84	171	14.3	280	23.3	265	22.1	—	—	30	2.5
<b>Cumulative</b>										
Jan. 84-Feb. 84	45	45.0	—	—	—	—	—	—	—	—
Jan. 84-March 84	77	38.5	99	49.5	10	5.0	43	21.5	—	—
Jan. 84-Oct. 84	166	18.4	164	18.2	210	23.3	65	7.2	—	—
Jan. 84-Nov. 84	179	17.9	160	16.0	230	23.0	70	7.0	—	—
Jan. 84-Dec. 84	116	10.6	127	11.6	235	21.4	185	16.8	31	2.8

ML = maximum length, GR = growth rate

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**References**

- 1 Raveendran T V & Wagh A B, *Mahasagar - Bull Natn Inst Oceanogr*, 19 (1986) 209.
- 2 Wagh A B & Raveendran T V, in *Advances in Aquatic Biology and Fisheries, Prof N Balakrishnan Nair felicitation volume*, edited by P Natarajan, (Kerala University, Trivandrum) 1987, 405.
- 3 Raveendran T V & Wagh A B, in *Marine biodeterioration: advanced techniques applicable to the Indian Ocean*, edited by M F Thompson, R Sarojini and R Nagabhushanam (IBH & Oxford Publishing Co, New Delhi) 1988, 575.
- 4 Raveendran T V, *Studies on marine organisms affecting timber*, Ph D thesis, University of Bombay, 1989.
- 5 Raveendran T V & Wagh A B, *J Indian Acad Wood Sci*, 21 (1990) 53.
- 6 Raveendran TV, Jayalakshmi K V & Wagh A B, *Internatl Biodeterior Bull* (Communicated).
- 7 Turner R D (editor), *A survey and illustrated catalogue of teredinidae (Mollusca: Bivalvia)*, (Harvard University, Cambridge) 1966, pp 265.
- 8 Turner R D, in *Holz und organismen*, edited by G Becker and W Liese, (Dahlem, Berlin) 1966, 437.
- 9 Nair N B, *Proc Indian Acad Sci (Anim Sci)*, 93 (1984) 203.
- 10 Santhakumaran L N, Udaya Bhaskar S & Srinivasan V V, *J Indian Acad Wood Sci*, 16 (1985) 40.
- 11 Turner R D, *Austr Nat Hist*, 17 (1971) 139.
- 12 Nair N B, *J Bombay Nat Hist Soc*, 62 (1965) 120.
- 13 Nair N B, in *Proceedings of the 2nd International Congress on Marine Corrosion and Fouling*, (Athens, Technical Chamber of Greece) 1968, 365.
- 14 Santhakumaran L N, *Gunneria*, 47 (1984) 7.
- 15 Nair N B, *Hydrobiologia*, 27 (1966) 248.
- 16 Cheriyan P V, *J Timb Dry Preserv Ass India*, 10 (1964) 26.