

MARINE WOOD-BORERS OF ANDAMAN-NICOBAR ISLANDS WITH NOTES ON CONTROL MEASURES AND ON THEIR DISTRIBUTION ALONG THE EAST COAST OF INDIA

L.N. SANTHAKUMARAN* AND V.V. SRINIVASAN

Forest Research Laboratory, Bangalore 560003

ABSTRACT

Marine wood-borers of Andaman-Nicobar islands, collected from destroyed timber structures, were: *Bankia campanellata*, *B. gracilis*, *B. rochi*, *Nausitora dunlopei*, *N. hedleyi*, *Nototeredo edax*, *Spathoteredo obtusa*, *Dicyathifer manni*, *Lyrodus pedicellatus*, *Teredo furcifera* and *Martesia striata*. Of these, *B. gracilis*, is a new record from Indian waters, and *S. obtusa* is reported for the first time since it was first recorded from Nicobar in 1945.

Faunal composition of marine wood-borers of Andaman-Nicobar islands and east coast of India are compared. Of the 25 species (i.e. 14 Teredinidae, 2 Pholadidae, 2 Sphaeromatidae and 7 Limnoriidae), so far reported from Andaman-Nicobar coasts, 18 species (12 Teredinidae and 2 each of Pholadidae, Sphaeromatidae and Limnoriidae) occur along the east coast of India. *B. campanellata*, *B. rochi*, *N. dunlopei*, *S. obtusa*, *D. manni*, *Bactronophorus thoracites*, *L. pedicellatus*, *T. furcifera*, *M. striata* and *Sphaeroma terebrans* constitute the predominant marine borers of Andaman-Nicobar islands. All these species (except *S. obtusa*), together with *Bankia carinata* and *Sphaeroma annandalei*, are important along the east coast of India. The distribution patterns of these borers in different habitats (test panels, timber structures, logs and mangroves) and methods for controlling biodegradation of timber in Andaman waters are discussed.

Key-words: Wood-borers, Andaman-Nicobar, east coast India.

INTRODUCTION

Wood-borers have been extensively investigated because they cause heavy damage to underwater timber structures, along the Indian coasts and adjoining islands resulting in huge economic loss (Santhakumaran, 1985). A perusal of the literature indicates that considerable systematic work has been done on borers collected from different habitats (i.e. test panels, waterfront structures, fishing boats, logs and mangroves) along the Indian coasts. However, work on the wood-borers of Andaman-Nicobar islands has been confined mostly to the species colonising mangrove vegetation (Das and Dev Roy, 1980, 1981, 1984; Dev Roy and Das, 1985; Tewari,

*Present address: Wood Preservation Centre (Marine), c/o National Institute of Oceanography, Dona Paula 403004, Goa.

Das, Dev Roy and Khan, 1980) and very little has been done with test panels (Karande, 1978) and submerged wooden logs (Ganapati and Rao, 1960; Rao and Ganapati, 1969). Some of the earlier studies on wood-borers of this area are those of Barnard (1936) on *Limnoria septima*, Heller (1868) on *Sphaeroma triste*, Smith (1904) who described *Xylophaga indica*, and Taki and Habe (1945) who recorded *Spathoteredo obtusa*. Rajagopal and Daniel (1972) reported *Nausitora dunlopei* from an almost freshwater environment in Great Nicobar island.

Recently, the authors had an opportunity to collect wood-borers from jetty piles and damaged timber logs stored in a timber-yard pond near Port Blair. Specimens were also collected from logs of *Terminalia* sp. imported from the Andamans by M/s Indian Plywood Manufacturing Company Ltd. at Dandeli in Karnataka. Teredinids from these habitats in Andaman-Nicobar islands have not been reported earlier. Consequently, a comparison of the wood-borer fauna of these areas with those occurring along the east coast of India are presented in this paper. A note on control measures against marine biodegradation is also included.

SYSTEMATICS

The wood-borers collected and identified are: *Bankia campanellata* Moll and Roch, *B. gracilis* Moll, *B. rochi* Moll, *Nausitora dunlopei* Wright, *N. hedleyi* Schepman, *Nototeredo edax* (Hedley), *Spathoteredo obtusa* (Sivickis), *Dicyathifer manni* (Wright), *Lyrodus pedicellatus* (Quatrefages), *Teredo furcifera* von Martens and *Martesia striata* (Linnaeus). Only one specimen of *B. gracilis* (Fig.1), reported for the first time from Indian waters, was found inside an infested log from Chatham timber pond. All the other species were present in various timber structures as well as in the logs stored in timber-yard ponds in the vicinity of Port Blair.

DISCUSSION

One interesting outcome of the present study was the rediscovery of *Spathoteredo obtusa* (Fig.2) from Andamans. Taki and Habe (1945) reported this species for the first time from Great Nicobar along with *L. pedicellatus*. (Species they actually mentioned were: *Teredo obtusa* Sivickis, *T. variegata* Sivickis, *T. somoni* Moll, *T. bataviana* Moll and Roch and *T. murrayi* Moll – all synonyms of *T. obtusa* and *Teredo (Teredops) samoensis* Miller – a synonym of *L. pedicellatus*). *Spathoteredo obtusa* was not reported by subsequent investigators (Das and Dev Roy, 1980, 1981, 1984; Dev Roy and Das, 1985; Kalyanasundaram and Ganti, 1975; Karande, 1978; and Tewari, Das, Dev Roy and Khan, 1980), but our studies showed it to be a common species in the area. From the size of the pallets, it was evident that *S. obtusa* as well as *N. dunlopei* could grow to a very large size, and some of the burrows measured 20 mm in diameter (Fig.3). The damage caused by the borers to marine timber in the area was very extensive.

The occurrence of wood-borers in different habitats along the coast of Andaman-Nicobar islands, together with details on their distribution

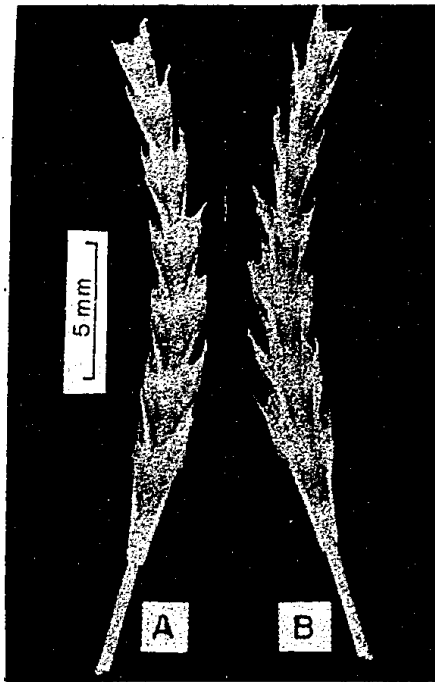


Fig.1. Pallet of *Bankia gracilis*, A : Outer face and B : Inner face.

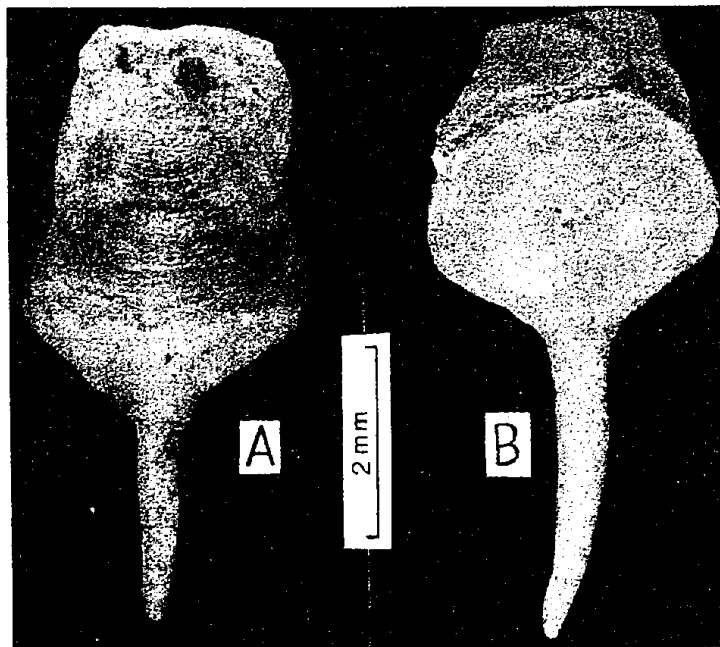


Fig.2. Pallet of *Spathoteredo obtusa*, A : Outer face and B : Inner face.

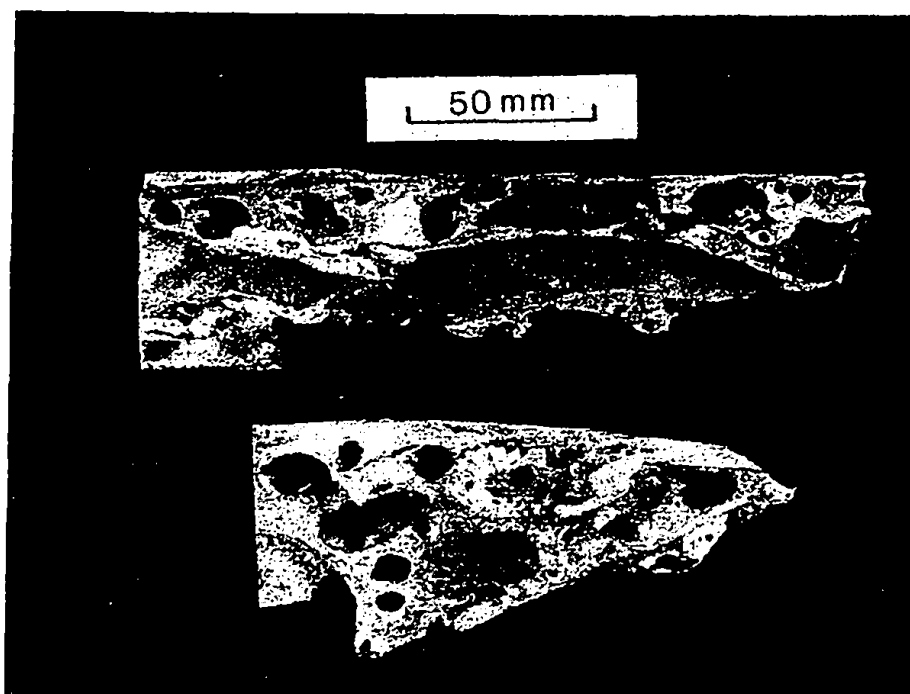


Fig.3. Small pieces from a log of *Terminalia* sp. showing large burrows of shipworms.

along the east coast of India is presented in Table I. So far, a total of 14 species of Teredinidae, 2 species of Pholadidae, 2 species of Sphaeromatidae and 7 species of Limnoriidae have been reported from Andaman and Nicobar islands. (This does not include *X. indica* reported from 185 fathoms off Andamans (Smith, 1904) and *Nototeredo* sp. from test panels (Karande, 1978) exposed near Port Blair). Of these, 12 species of Teredinidae and 2 species each of Pholadidae, Sphaeromatidae and Limnoriidae also occur along the east coast of India (Table I). Barring *S. obtusa*, species of teredinids in Andaman area, not recorded from the east coast of India, are very rare even in Andamans. This is also true of *Limnoria*; in fact *L. septima* has not been reported from Andamans, since it was first recorded by Barnard (1936). In general, there is great similarity in the faunal composition of the wood-borers (except *Limnoria*) of the two regions. *B. campanellata*, *B. rochi*, *N. dunlopei*, *S. obtusa*, *D. manni*, *Bactronophorus thoracites* (Gould), *L. pedicellatus*, *T. furcifera*, *M. striata* and *S. terebrans* Bate constitute the predominant borers of the Andaman-Nicobar islands. These species (excluding *S. obtusa*), together with *Bankia carinata* (Gray) and *Sphaeroma annandalei* Stebbing, are important along the east coast of India.

Since both *S. obtusa* and *B. gracilis* were present in logs transported to the east coast of mainland, it is possible that the species could become established along the mainland east coast. Incidentally, it may be mentioned here that there is a record of a single specimen of *S. obtusa* from Ashta-

Table I — Occurrence of marine wood-borers in different habitats in Andaman-Nicobar waters and their distribution pattern along the east coast of India.

Borer species	Andaman-Nicobar coast*				East Coast of India §
	Test panel (2)	Timber structures (3)	Timber logs (4)	Mangroves (5)	
(1)	(2)	(3)	(4)	(5)	(6)
<i>B. bipalmulata</i>	+	-	-	-	Madras, Pondicherry, Pamban.
	(1)				
<i>B. bipennata</i>	-	-	-	+	Visakhapatnam, Madras, Pamban.
				(2,3,6)	
<i>B. campanellata</i>	+	+	+	-	Calcutta, Sundarbans, Mahanadi estuary, Visakhapatnam, Godavary estuary, Pulicat lake, Madras, Porto Novo, Muthupet, Pamban
	(1)	(4)	(4)		
<i>B. gracilis</i>	-	-	+	-	Not yet recorded.
			(4)		
<i>B. rochi</i>	-	+	+	+	Sundarbans, Mahanadi estuary, Visakhapatnam.
		(4)	(4)	(3,6)	
<i>N. dunlopei</i>	-	+	+	+	Calcutta, Sundarbans, Mahanadi estuary, Visakhapatnam, Madras, Pamban
		(4)	(4)	(3,5,7)	
<i>N. hedleyi</i>	-	+	+	+	Mahanadi estuary, Pulicat lake, Madras, Porto Novo.
		(4)	(4)	(2,3,5,6)	
<i>N. edax</i>	+	+	+	+	Visakhapatnam, Godavary estuary, Madras, Tondi.
	(1)	(4)	(4)	(2,3,6)	
<i>S. obtusa</i>	-	+	+	-	Not yet recorded.
		(4)	(4)		
<i>B. thoracites</i>	-	-	-	+	Sundarbans, Mahanadi estuary, Visakhapatnam, Porto Novo.
				(2,3,5,6,8)	
<i>D. manni</i>	-	+	+	+	Sundarbans, Mahanadi estuary, Visakhapatnam, Pulicat lake, Madras, Ramnad.
		(4)	(4)	(2,3,6,7,8)	
<i>L. pedicellatus</i>	-	+	+	+	Mahanadi estuary, Visakhapatnam, Pulicat lake, Madras, Porto Novo, Muthupet, Adirampatnam, Tondi, Ramnad, Pamban, Tuticorin.
		(4)	(4)	(2,3,5,6,7,8)	

Table I (continued)

1	2	3	4	5	6
<i>T. furcifera</i>	+	+	+	+	Visakhapatnam, Godavary estuary, Pulicat lake, Madras, Porto Novo, Muthupet, Tondi, Pamban, Tuticorin.
	(1)	(4)	(4)	(6)	Madras, Raminad, Pamban.
<i>U. rehderi</i>	-	-	-	+	Visakhapatnam, Madras, Porto Novo, Ramnad, Pamban.
	(1)	-	-	(2,3)	Cosmopolitan.
<i>M. striata</i>	+	+	+	+	Off Puri, Visakhapatnam, Godavary estuary, Madras, Porto Novo, Pamban.
	(1)	(4)	(4)	(2,3,7)	Pamban, Tuticorin.
<i>S. terebrans</i>	-	-	-	+	Not yet recorded.
	-	-	-	(3,5,6,7)	Not yet recorded.
<i>S. triste</i>	-	-	-	+	Madras, Ramnad, Mandapam.
	-	-	-	(9)?	Not yet recorded.
<i>L. andamanensis</i>	-	-	+	-	Not yet recorded.
	-	-	(10)	-	Not yet recorded.
<i>L. indica</i>	+	-	+	-	Madras, Ramnad, Mandapam.
	(1)	-	(11)	-	Not yet recorded.
<i>L. insulæ</i>	-	-	+	-	Not yet recorded.
	-	-	(11)	-	Not yet recorded.
<i>L. pfefferi</i>	-	-	+	-	Madras
	-	-	(11)	-	Not yet recorded.
<i>L. platicauda</i>	-	-	+	-	Not yet recorded.
	-	-	(11)	-	Not yet recorded.
<i>L. septima</i>	-	-	+	-	Not yet recorded.
	-	-	(12)?	-	Not yet recorded.
<i>L. unicornis</i>	-	-	+	-	Not yet recorded.
	-	-	-	-	Not yet recorded.

§ For literature on locality records, see Santhakumaran, Udaya Bhaskar and Srinivasan, 1985.

+ = present; - = not yet recorded; ? = habitat not certain.

* Key to numbers in parenthesis: 1=Karande, 1978; 2=Das and Dev Roy, 1980; 3=Tewari, Das, Dev Roy and Khan, 1980; 4 = present study; 5=Das and Dev Roy; 1984a; 6=Das and Dev Roy, 1984b; 7=Dev Roy and Das, 1985; 8=Das and Dev Roy, 1981; 9=Heller, 1868; 10=Rao and Ganapati, 1969; 11=Ganapati and Rao, 1960; 12=Barnard, 1936.

mudi backwaters in Kerala on the south-west coast of India (Dharmaraj and Nair, 1981).

Destruction of timber logs held in ponds for export as well as various underwater structures along the Andaman-Nicobar coast by marine wood-borers is so enormous that it is extremely important to evolve means of protecting them. Permanent structures can be effectively protected from biodeterioration by pressure impregnation of a creosote-coal tar mixture (1:1) at a retention of 320 kg per cubic metre or Copper-chrome-arsenic (CCA) at a dosage of 32 kg per cubic metre prior to exposure in the sea. It is neither practical nor possible to totally prevent decay of logs stored underwater. Degradation of these logs during storage and transit can only be minimised and controlled to some extent and this may check the wide dispersal of boring organisms. This can be achieved by poisoning with toxic materials applied to waters surrounding the infested surfaces or by treating the timber prophylactically with an inert material or with a toxic composition that prevents the borers from gaining access to the wood. A few such methods are given below:

1. Sodium arsenite (as Arsenic trioxide) is highly effective for poisoning the water even at 25 ppm. Its main advantages are: (i) High toxicity to both teredinids and limnoriids; (ii) its presence not detected by the borers so that they get killed before plugging the entry holes; (iii) it is inexpensive enough (also due to the low concentration required) to make feasible treatment of large volume of water surrounding the infested wood. Its main disadvantage is its toxicity to a wide range of animal life other than borers. However, this hazard may not be important in a timber yard pond.
2. Wrapping the timber logs with good quality plastic sheets or plastering with an extremely thin layer of cement or providing a layer of CCA-treated thin coir rope wound closely on the logs from end to end may also protect the logs from infestation during storage in the sea. Since the protection needed is for a short duration, the plastic sheets and treated coir ropes can be re-used. If coir ropes are used, the ends of the logs will have to be covered with plastic sheets or with thin cement.
3. A bituminous compound, containing high and low boiling asphalt, creosote-coal tar mixture and Arsenic trioxide may be effective (Purusotham, Sebastian and Grover, 1959).
4. If possible, the logs should be stored in the timber yard pond with the bark intact (without debarking). This will not only give an effective barrier to borer attack, but also, due to its decay and leaching out of chemical constituents, will pollute the water in the surrounding areas creating anaerobic conditions. The lack of oxygen will kill the borer larvae and settlement will not occur, as is the case in the coconut husk retting ground areas in Kerala backwaters. Bark protection against marine borers may be the cheapest method for logs stored in sea water.
5. The following precautions may also be taken: (i) The procurement and transportation of logs may be so adjusted that the duration of storage

in sea water and exposure to borer hazard is reduced as much as possible. (ii) Infested blocks and other trash wood lying in and around the storage pond are ideal breeding grounds for borers and are sources of larvae for fresh attack. Hence, these should be removed from the vicinity of the storage pond. (iii) Erection of suitable embankments for the pond will minimise mixing and preventing frequent replenishment of water in the pond, thereby facilitating the creation of a local anaerobic conditions with its adverse effect on borer population.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. S.N. Rai, Head, Utilisation Research, Forest Research Laboratory, Bangalore, and to Dr. B.N. Desai, Director and Dr. A.H. Parulekar, Head, Biological Oceanography Division, National Institute of Oceanography, Goa, for their keen interest in this work and for providing laboratory facilities; and to Prof. Ruth D. Turner, Harvard University, U.S.A., for confirming the identification of *B. gracilis* and *S. obtusa*. Thanks are also due to Dr. A. Purushotham, M/s Indian Plywood Manufacturing Co. Ltd., Dandeli, for making available samples of damaged logs imported from Andamans; and to Mr. V.M. Date, Mr. U.S. Shirsat and Mr. S.A. Karim, N.I.O., for the photographic work connected with this paper.

REFERENCES

- Barnard, K.H., 1936. Isopods collected by the R.I.M.S. "Investigator". *Records of the Indian Museum (Calcutta)*, **38**: 147-191.
- Das, A.K. and M.K. Dev Roy, 1980. On the wood-boring molluscs of South Andaman, India. *Records of the Zoological Survey of India*, **77**: 179-187.
- Das, A.K. and M.K. Dev Roy, 1981. On the teredinid borers of mangroves of Camorta Island, Nicobar, India. *Bulletin of the Zoological Survey of India*, **4**: 391-393.
- Das, A.K. and M.K. Dev Roy, 1948a. A note on the marine borers of Little Andaman, India. *Bulletin of the Zoological Survey of India*, **6**: 95-98.
- Das, A.K. and M.K. Dev Roy, 1984b. Report on the marine wood-borers from the mangroves of Neil, Havelock and Peel Island, Ritchie's Archipelago, Andaman, India. *Bulletin of the Zoological Survey of India*, **6**: 327-329.
- Dev Roy, M.K. and A.K. Das, 1985. Marine wood-borers from the mangrove ecosystem of Great Nicobar Island, India. *Bulletin of the Zoological Survey of India*, **7**: 251-254.
- Dharmaraj, K. and N.B. Nair, 1981. Occurrence of *Spathoteredo* Moll (Bivalvia: Teredinidae) in India. *Current Science (Bangalore)*, **50**: 1084-1085.
- Ganapati, P.N. and M.V.L. Rao, 1960. On some crustacean wood-borers from Andamans. *Current Science (Bangalore)*, **29**: 275-276.

- Heller, C., 1868. Crustaceen (Crustaceans). In: Reise der osterreichischen Fregatte Novara um die Erde in den Jahren 1857, 1858 and 1859. *Zoologischer Theil*, 2: 1-280. Wien, 1868.
- Kalyanasundaram, N. and S.S. Ganti, 1975. Investigations on the natural durability of indigenous timbers for use in marine constructions. *Journal of the Timber Development Association of India*, 21(1): 13-18; 21(2): 15-26; 21(3): 11-20.
- Karande, A.A., 1978. Marine fouling and timber deterioration in sub-oceanic islands of Andamans. *Indian Journal of Marine Science*, 7: 39-43.
- Purushotham, A., V.O. Sebastian and P.N. Grover, 1959. A preliminary note on the protection of timber logs from splitting and deterioration by insects, termites, marine borers and fungi for short periods during transit and storage. *Journal of the Timber Dryers' and Preservers' Association of India*, 5: 15-19.
- Rajagopal, A.S. and A. Daniel, 1972. Boring organisms of the Great Nicobar Island. Mollusca: Teredinidae. *Journal of the Bombay Natural History Society*, 69: 676-678.
- Rao, M.V.L. and P.N. Ganapati, 1969. A new species of *Limnoria* from the Andaman Islands. (Isopoda, Flabellifera). *Crustaceana*, 17: 225-230.
- Santhakumaran, L.N., 1985. *Marine wood-borers of India, An annotated bibliography*. Wood Preservation Centre (Marine), National Institute of Oceanography, Dona Paula, Goa-403004, India. 147 pp.
- Santhakumaran, L.N., S. Udaya Bhaskar and V.V. Srinivasan, 1985. Occurrence and distribution of marine wood-borers of India. *Journal of the Indian Academy of Wood Science*, 16: 40-60.
- Smith, E.A., 1904. Natural history notes from H.M. Indian Marine Survey Steamer, "Investigator"... Series III, No.1. On Mollusca from the Bay of Bengal and the Arabian Sea. *Annals and Magazines of Natural History*, 14: 1-14.
- Taki, I. and T. Habe, 1945. On the teredinid species of Ambon and Nicobar. *Kairuigaku Zasshi (Oshima)*, 14: 118-123.
- Tewari, K.K., A.K. Das, M.K. Dev Roy and T.N. Khan, 1980. On the wood-borers of mangroves of Andaman and Nicobar Island, India, with notes on the gallery pattern of some insect borers. *Records of the Zoological Survey of India*, 77: 357-362.

