DENSITY OF BORING MARINE BIVALVES IN PIECES OF WOOD INSIDE AND OUTSIDE PELABUHAN RATU HARBOUR, WEST JAVA, INDONESIA

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ABSTRACT

Six species of boring marine bivalves, *Teredo navalis* Spengler, *Teredo stutchburyi* "Leach" de Blainville, *Bankia syriaca* Roch, *Bankia minima* de Blainville, *Bankia zeteki* Bartsch and *Martesia striata* Linné, were found in wood pieces soaked in sea water for three months. The average density of boring organisms in four kinds of wood was higher in the harbour (232 individuals 150 cm^{-2}), than outside it (144 individuals 150 cm^{-2}). The same tendency is shown by attack intensity. The level is higher on wood soaked in the harbour than outside it. Most of the boring organisms prefer wood of Indonesian merbau (*Intsia bijuga*) and red mirabow (*Shorea leprosula*) to balau (*Shorea eliptica*) and Indonesia keruing (*Dipterocarpus confertus*).

INTRODUCTION

The harbour of Pelabuhan Ratu, West Java, Indonesia, is a fishing port with hundreds of wooden fishing boats. The boats are often damaged by boring organisms making holes in the wood. Most of the boring organisms are bivalves, mainly the genera *Teredo*, *Bankia* and *Martesia*.

Environmental conditions play an important role with respect to attack intensity of boring organisms. The harbour environment is influenced by human activities within the harbour, and freshwater from a small river reduces the salinity in the harbour basin. The water characteristics and low circulation in the harbour could therefore cause a stressful environment. Water outside the harbour is cleaner and circulates more. The present study aims at testing whether the two environments influence the occurrence and intensity of boring inside and outside of the harbour.

MATERIALS AND METHODS

The study was conducted in Pelabuhan Ratu on the south coast of West Java. Four types of wood pieces were used: Indonesian mirabow (*Intsia bijuga*), red meranti (*Shorea leprosula*), balau (*Shorea eliptica*) and Indonesian keruing (*Dipterocarpus confertus*), all measuring 2.5 x 5.0 x 30.0 cm. The wood pieces were soaked from 9 June to 26 August 1995. They were placed inside the harbour basin and outside, at the water surface and 1.5 m depth. The distance between the stations in the harbour and outside was about 500 m.

Density was counted as the total number of boring organisms forming holes on the surface of the wood, *i.e.*, the first attachment phase. Measurement of the intensity of attack was done by counting volume differences of the experimental woods before and after they were soaked. The environmental parameters counted were: temperature, current, salinity, pH, dissolved oxygen and BOD_5.

RESULTS

The environmental variables of water in the harbour basin and outside it were quite different. Only temperature and the salinity were found to be similar. Other variables showed considerable differences: pH, current speed, dissolved oxygen (DO) and BOD_5 (Tab. 1). The water characteristics inside the harbour tended to be less favourable to the fauna than the outside environment. In wood soaked for 2.5 months, 6 species of bor-

Table 1. Water characteristics inside and outside the harbour of Pelabuhan Ratu. L1D1: inside harbour, surface L2D1: outside harbour, surface. L1D2: inside harbour, below surface L2D2: outside harbour, below surface

	L1D1	L1D2	L2D1	L2D2
Temperature (°C)	31.0	30.4	30.0	29.9
Salinity (‰)	32.2	33.1	34.0	34.2
pH	7.8	7.8	8.3	8.3
water flow (m/sec)	0.031	0.031	0.072	0.072
DO (ppm)	3.39	3.47	6.31	6.47
BOD5 (ppm)	1.82	1.01	0.80	0.91

ing marine bivalves were found: *Teredo navalis* Spengler, *Teredo stutchburyi* "Leach" de Blainville, *Bankia syriaca* Roch, *Bankia minima* de Blainville, *Bankia zeteki* Bartsch and *Martesia striata* Linné.

Boring organisms were recorded at different densities (Fig. 1). The densities of boring organisms on all wood pieces ranged from 6 to 846 ind. 150 cm^{-2}. The highest density was in Indonesian mirabow, then in red meranti. The density of boring organisms as a function of depth did not show significant differences in wood soaked inside and outside the harbour. However, there was a ten-

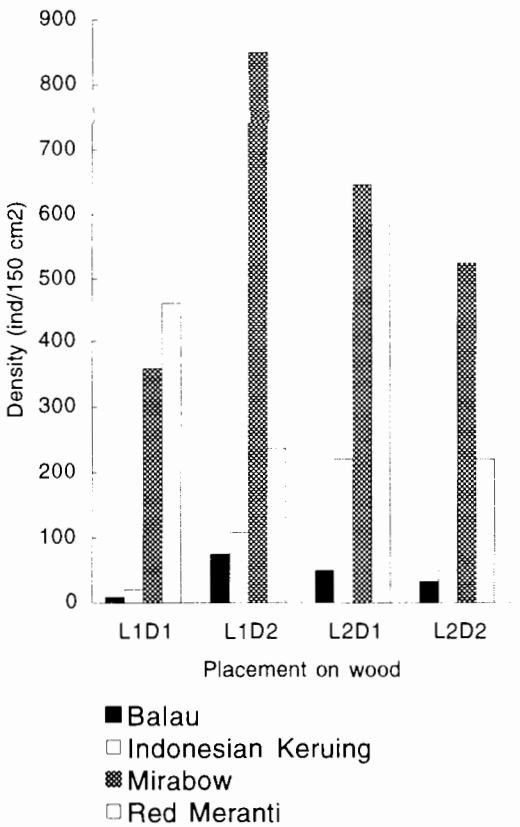

Figure 1. Density of boring marine bivalves on wood pieces soaked at different depth and location. L1D1: inside harbour, surface L2D1: outside harbour, surface. L1D2: inside harbour, below surface L2D2: outside harbour, below surface

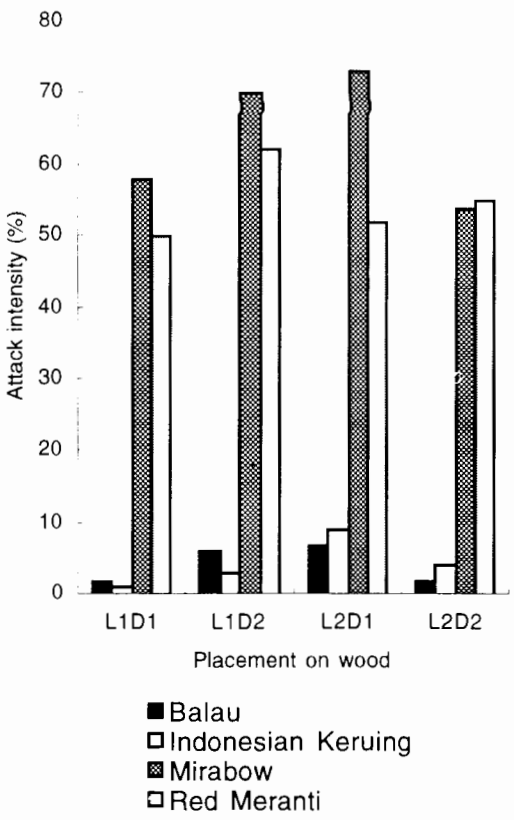

Figure 2. Attack intensity of boring marine bivalves on wood pieces soaked in different depth and location. L1D1: inside harbour, surface L2D1: outside harbour, surface. L1D2: inside harbour, below surface L2D2: outside harbour, below surface

dency that the density was higher in wood pieces soaked on the water surface except for mirabow. The average density of boring organism was higher in wood soaked outside the harbour.

The attack intensity ranged from 0.32 % to 73 % (Fig. 2). Highest intensity of attack was found in mirabow and red meranti. The intensity of attack was higher on wood soaked inside the harbour except for keruing. There was a tendency that the intensity was higher in wood pieces soaked in 1.5 m depth inside the harbour, while the attack intensity was higher in the water surface outside the harbour.

DISCUSSION

Wood, media for the boring organism to live in, attracts borers to a variable degree. The four types of wood used in this study exhibited different densities of boring marine bivalve. Mirabow and red meranti were the most favoured, based on their high density of boring organisms. Specific gravity and silica content of wood are other characteristics which influence boring organisms. Yulianda (1996) found that the correlation between the specific gravity and the attack intensity was negative, as it also was for silica content. Wood types with a higher density were not damaged so much by boring organisms. The density of mirabow and red meranti is lower than that of the other types of woods. Silica is a poison for boring marine organisms (Southwell & Bultman 1971), so a high silica content can reduce attacks.

Density of the boring organisms tended to be higher in wood pieces soaked in the water surface both inside and outside the harbour. This density was related to the larval attachment on the wood surface, probably because the larvae respond to light (Thorson 1964).

The attack intensity was different from the boring organism density. For instance, the attack intensity was higher on wood pieces soaked in 1.5 m depth inside the harbour. The water quality inside the harbour was bad, mainly at the surface. The attack intensity at the surface was higher outside the harbour than inside it, because of a better water quality. My results agree with Hoagland's (1986) conclusion, that the temperature, salinity and availability of suitable food are important factors that influence the activity of shipworms.

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