

## ESTIMATING DETERIORATION RATES BY DRY-WOOD TERMITE *Cryptotermes cynocephalus* ON SOME SUBSTRATES

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### ABSTRACT

**ESTIMATING DETERIORATION RATES BY DRY-WOOD TERMITE *Cryptotermes cynocephalus* ON SOME SUBSTRATES. PAIMIN SUKARTANA.** A laboratory experiment was carried out to determine the deterioration rates caused by dry-wood termite *Cryptotermes cynocephalus* Light (Isoptera; Kalotermitidae) some types of substrate. Evaluation was based on the on the amount of the weight loss of the substrates due to the termite feeding activity during an exposure time.

The results showed that the feeding rate of the termite varied among the substrates. The sequence of deterioration rate among the substrates was different from the period to period. Merkus pine (*Pinus merkusii*) and rubber-wood (*Hevea brasiliensis*) could be consumed the most. The consecutive rate at the end of experiment, from the highest, is: merkus pine (*P. merkusii*) > rubber-wood (*H. brasiliensis*) > filter paper > sengon (*Paraserianthes falcataria*) > corrugated paper > duplicator paper. This is expressed with the amount of consumption by individual termite on each substrate as the following order: 2.41, 2.23, 1.61, 1.55, 1.12, and 0.73 mg after the five-week exposure.

**Key words:** Substrates , feeding amount, termite survival, individual consumption, deterioration rates

### ABSTRAK

**PENDUGAAN LAJU PERUSAKAN PADA BEBERAPA JENIS BAHAN OLEH RAYAP KAYU KERING *Cryptotermes cynocephalus*. PAIMIN SUKARTANA.** Suatu penelitian di laboratorium dilakukan untuk mengetahui laju perusakan oleh rayap kayu kering *Cryptotermes cynocephalus* (Isoptera: Kalotermitidae) pada beberapa jenis bahan. Penilaian perusakan dilakukan berdasarkan kehilangan berat bahan karena kegiatan makan dari rayap selama masa penelitian.

Hasil penelitian menunjukkan bahwa laju perusakan berbeda-beda di antara jenis-jenis media tersebut. Peringkat perusakan mungkin bervariasi dari waktu

ke waktu tetapi tampaknya kayu tusam (*Pinus merkusii*) dan kayu karet (*Hevea brasiliensis*) termasuk paling disenangi oleh rayap. Urutan peringkat laju perusakan pada akhir percobaan, setelah penelitian berlangsung selama lima minggu, dari yang paling tinggi adalah: tusam (*P. merkusii*) > karet (*H. brasiliensis*) > kertas saring > sengon (*Paraserianthes falcataria*) > kertas kardus ombak > kertas stensil duplikator. Hal ini dinyatakan dengan besarnya bahan yang dikonsumsi rayap pada akhir percobaan dengan urutan sebagai berikut: 2.41, 2.23, 1.61, 1.55, 1.12, dan 0.73 mg.

**Kata kunci :** Bahan, jumlah yang dimakan, rayap yang hidup, konsumsi tiap individu, waktu uji, laju perusakan.

## INTRODUCTION

It has been known that termites (Insecta; Isoptera) are the most voracious of all wood-feeding insects. Termites are cryptic insects, living in hidden area. These insects can be found throughout the tropics and in some temperate regions or even in northern parts of the world.

Dry-wood termites, those of inhabiting in seasoned wood without direct contact with ground, are the major destroying insects infesting wood in service such as furniture, housing (under the roof construction), and also any cellulosic materials kept in a house or building. Any valuable paper documents, for instance books, certificates, etc., are also amongst their target. The presence of granular materials scattering on floor is an evidence of this termite infestation. These materials are frass excreted by the insect from their concealment.

Dry-wood termite *Cryptotermes cynocephalus* (Isoptera; Kalotermitidae) is abundantly found in Bogor and its around. Martawijaya *et al.* (1973) observed the deterioration of numerous wood samples kept in storeroom of the research centre. This species had been employed to test the resistance of *Albizia falcataria* (now this species is named *Paraserianthes falcataria*) (Tarumingkeng and Martawijaya, 1975).

Natural durability of a number of Indonesian wood species against this species has been classified (Martawijaya and Sumarni, 1978). Deterioration evidence on various wood species that are being stored in this research centre had been determined (Sukartana, 1995) following the Martawijaya *et al.*'s observation in 1973. The storeroom of this centre due to having of the wood collection has also been a source of this termite specimen for experimental purposes for years.

Deterioration rates are resulted from feeding activities on a substrate within a certain period. It is expressed as the amount of weight loss caused by feeding activities of the termites which is determined by measuring initial and final weight of a substrate before and after exposure to the insect. A laboratory experiment was carried out to identify the deterioration rates caused by the dry-wood termite *C. cynocephalus* on some substrates.

## MATERIALS AND METHODS

Dry-wood termite *C. cynocephalus* was collected from infested wood collections in the storeroom of the research centre. The materials used for this test consisted of three

wood species and three types of papers. The wood species were sengon or jeunjeing (*Paraserianthes falcataria*), rubber-wood (*Hevea brasiliensis*) and merkus pine (*Pinus merkusii*) and the papers were filter, duplicator, and corrugated paper (carton).

Wood blocks measuring of 2.5 by 2.5 by 0.5 cm (length, width and thickness) were applied for the test. The same size, except the thickness that depends on the original materials, of samples was prepared for the paper materials.

Each test sample was oven-dried weighed before and after exposure. The samples were tested in round plastic medicinal container of 3 cm diam and 3.5 cm high. Because these containers have concave base and convex cover, each test block and termite were put on the inside part of the cover to facilitate the termite for crawling to the test sample. (Putting on the container base that has concave form may cause difficulties in termite mobility to grasp the substrate so a better result probably would not be obtain).

The inside part of the covers was formerly slightly coarsened with sandpaper to facilitate the termite that will be put on to crawl. Four small holes were made on the container base to allow its chamber ventilated. Each sample, followed with 25 termites, was put in inside part of the cover

and the base was then installed on it. The container was installed reversely so the cover was in the bottom and the base on top position. The experiment was kept in a dark chamber at room temperature. Five replicates for each material and observation interval were prepared.

Observations were done weekly for five weeks. Each week a test unit consisting of the six substrates was terminated. Termite survivals were counted, and the test materials were oven-dried and weighed. The rates of deterioration were determined by substrate consumed. It is expressed by the difference between the initial oven-dried weight and the final oven-dried weight (weight loss) of each test material within a consecutive period of observation corresponding with the termite survival and individual feeding amount of the insect.

Data were analyzed by an analysis of variance recognized by computer program. Difference in feeding rates and termite survival means among the substrates within each period of observation were compared at the 0.05 level by Tukey's procedure. Prior to analyses, weight loss and individual feeding amount data were transformed to  $\sqrt{Y + 0.5}$  (Steel and Torrie, 1980).

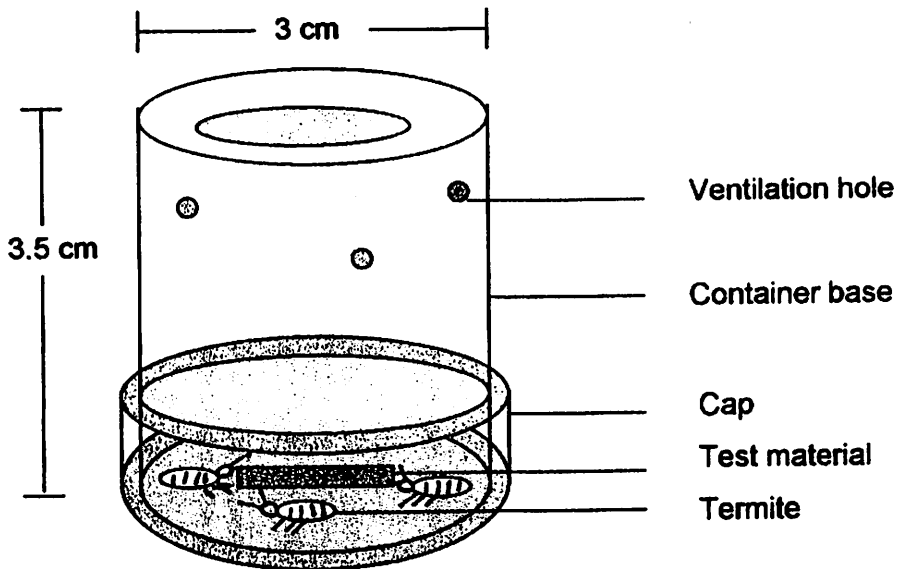


Fig 1. A cylindrical plastic for medicinal container used to test.

Gambar 1. Silinder tabung obat dari plastik untuk percobaan.

## RESULTS AND DISCUSSION

The data presented in Table 1 weekly summarizes substrate consumption, termite survival and individual feeding amount for five weeks. Figures 1, 2 and 3, that are extracted from this table, show successively more distinctive substrate consumption, termite survival, and individual feeding amount.

The amount of termite feeding varied by among the substrate types. There was also no particular sequence in the feeding rate of the termite on those substrates during the observation periods.

Four substrates, i.e., rubber-wood, filter paper, sengon and merkus pine, were obviously eaten the most (Figure 1). The remains, particularly duplicator paper, are less consumed. Rubber-wood and merkus pine could be the most susceptible of all.

The deterioration rank of the substrates is consecutively; merkus pine > rubber-wood > filter paper > sengon > corrugated carton > duplicator paper which is expressed with the amount of substrate consumed by individual termite: 2.41, 2.23, 1.61, 1.55, 1.12, and 0.73 mg after five-week exposure.

**Table 1.** The average of weight loss of the substrates, number of termite survival, and individual consumption.

**Tabel 1.** Rataan kehilangan berat bahan, jumlah rayap hidup dan konsumsi per individu.

Week	Substrate	Substrate eaten (mg)	Termite survival (%)	Individual consumption (mg)
1	Sengon	9.45a	100a	0.38a
	Filter paper	9.72a	100a	0.39a
	Merkus pine	9.10a	100a	0.36a
	Rubber-wood	12.98b	100a	0.52b
	Corrugated carton	4.20c	99.2a	0.17c
	Duplicator paper	3.10c	100a	0.12c
2	Sengon	15.36a	88.8a	0.68a
	Filter paper	16.16a	98.4a	0.66a
	Merkus pine	23.82b	88.8a	1.07b
	Rubber-wood	21.30b	92.0a	0.92c
	Corrugated carton	5.40c	92.0a	0.24d
	Duplicator paper	5.68c	95.2a	0.24d
3	Sengon	21.30a	80.0a	1.07a
	Filter paper	23.68a	90.4a	1.05a
	Merkus pine	29.42a	80.8a	1.46b
	Rubber-wood	33.95b	84.8a	1.57b
	Corrugated carton	8.82c	76.0a	0.45c
	Duplicator paper	7.64c	84.8a	0.37c
4	Sengon	22.80a	80.0a	1.14a
	Filter paper	23.88a	81.6a	1.17a
	Merkus pine	34.14b	87.2a	1.57b
	Rubber-wood	36.48b	87.2a	1.67b
	Corrugated carton	13.42c	81.6a	0.65c
	Duplicator paper	10.32d	82.4a	0.50d
5	Sengon	28.16a	72.8a	1.55a
	Filter paper	32.22a	80.0a	1.61a
	Merkus pine	39.18b	64.8a	2.41b
	Rubber-wood	41.60b	75.2a	2.23b
	Corrugated carton	20.10c	72.0a	1.12c
	Duplicator paper	12.54d	69.6a	0.73d

<sup>1</sup> Numbers within a column of each period of week followed with the same letter indicate no significant difference at the 0.05 level of probability (Tukey's procedure).

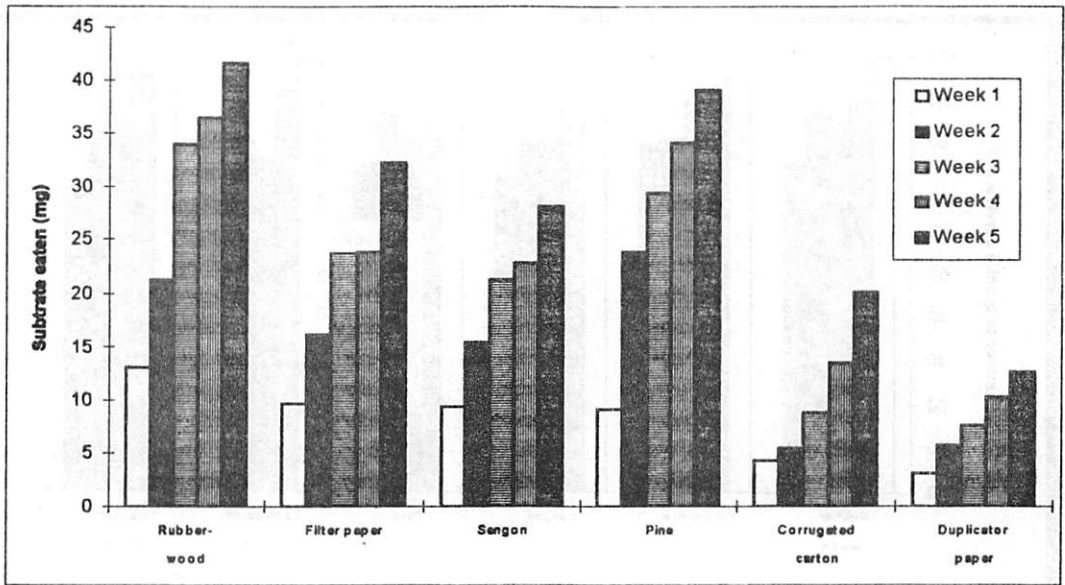


Figure 1. The amount of feeding by *C. cynocephalus* on six substrates. Calculation was based upon the termite survival.

Gambar 1. Jumlah pakan yang dikonsumsi oleh *C. cynocephalus* pada 6 jenis bahan. Kalkulasi berdasarkan rayap hidup.

The individual consumption of this termite, at least on certain kind of substrates, can be now estimated. The greediness of a termite colony should be also known if the colony size can be measured. Unfortunately, no method has been developed for dry-wood termite. It is different from subterranean termites, i.e. by using capture-mark-release-recapture technique (Essenther, 1980, Su, 1991, Su et al, 1983, Su et al., 1991). It seems this method can not be implemented on dry-wood termites due to the different behavior between dry-wood and subterranean termites.

There is no particular pattern on rank of the survival or mortality of number of termite influenced by the different

substrates (Table 1 and Figure 2). There is also no significant effect yet on termite mortality caused by the substrates. The higher preferable substrates did not give better survival than those of the lower. Hence until the trial was ended, the rank of susceptibility of substrates as mentioned above has no (yet) correlation with the termite survival. The termite can maintain its life even though it ate only smaller amount on particular substrates. The termite could have a little bit starvation during the period of experiment. Some death of termites that occurred at the second week or more could be caused by another factor instead of by starvation.

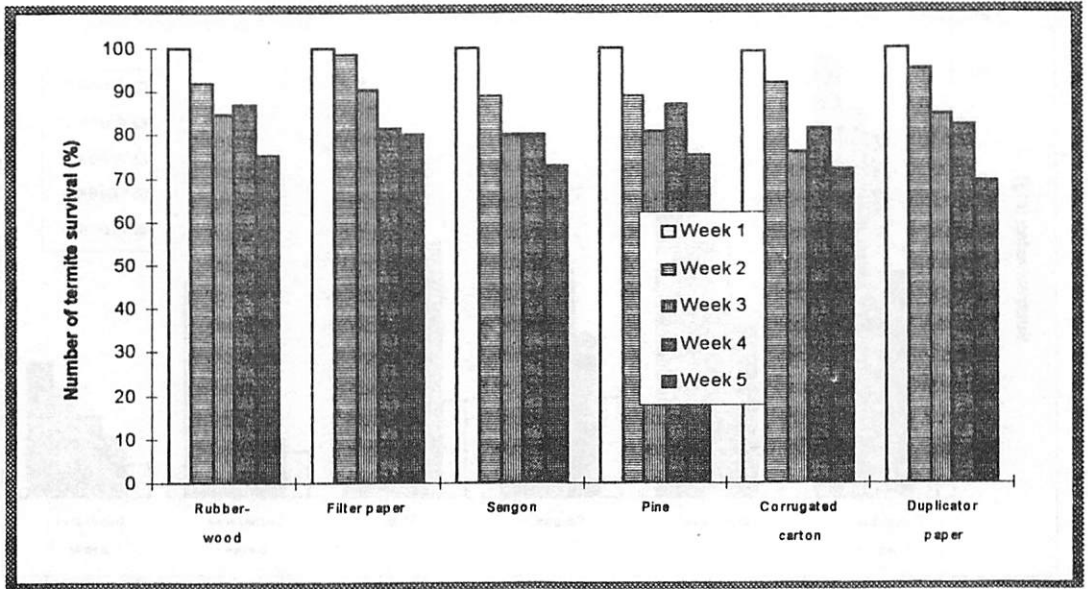


Figure 2. Average percentage of number of termite survival on each substrate sort and period of observation.

Gambar 2. Ratan persentasi jumlah rayap yang hidup pada setiap jenis bahan dan periode pengamatan.

The amount of consumption on each substrate always increases accordingly to the increasing duration (Table 1 and Figure 3). A linear correlation might be drawn even though the feeding activity was seemingly inconsistent from the period to period. Percentage of termite survival might has no significant effect yet to this situation.

The samples utilized in this experiment are sound, no any contamination by fungus. Rubber-wood could be the hardest of the all, but it was better chosen. Meanwhile sengon (*Paraserianthes falcataria*) even though it is softer than the two other wood samples, was less preferred. To the dry-wood termite *C. cynocephalus*, this wood species is classified in to moderate resistance, much

better than that of merkus pine (Martawijaya and Sumarn, 1978). Therefore, the different preference of *C. cynocephalus* Substrate hardness affects the termite feeding, even though other factors, for example fungal contamination, may also involve in (Behr *et al.*, 1972). Certain fungi that grow on a substrate may repel termite attack, but various fungi may promote the termite to the substrates used in this experiment could be caused by another factor instead of by thos mentioned above. The paper substrates, except filter paper, gave no better host for the wood destroying insect. Any different chemical constituent resulted from processing could be the major reason.

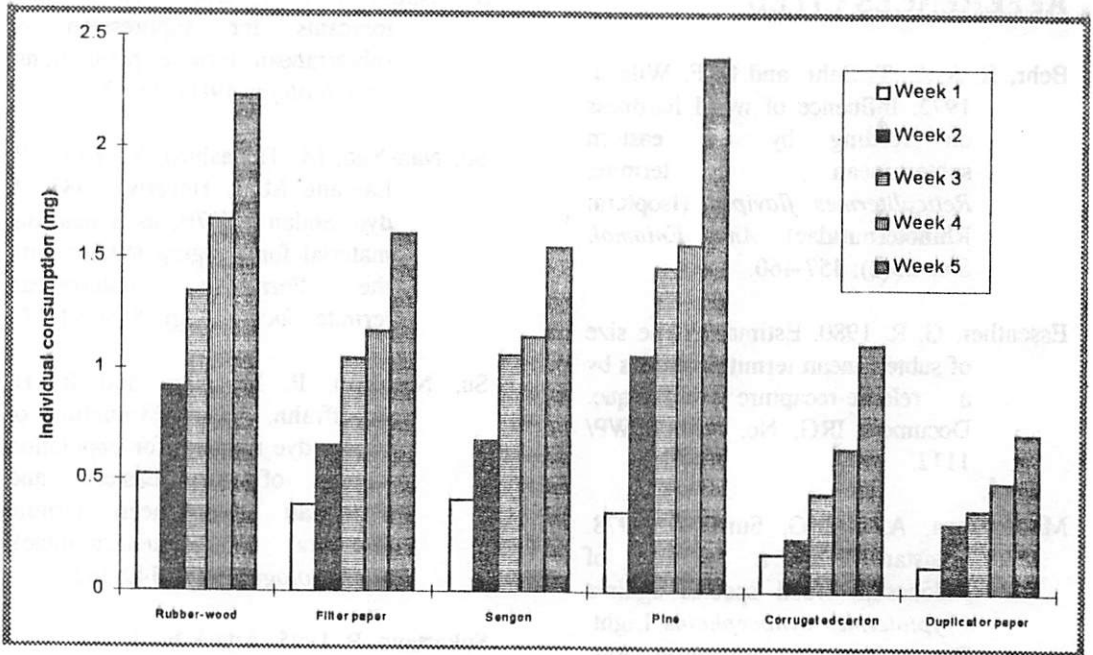


Figure 3. The amount of individual consumption, calculated from the termite survival feeding (Watanabe and Casida 1961, Smythe *et al.*, 1971).

Gambar 3. Jumlah konsumsi per individu dihitung berdasarkan kegiatan makan dari rayap hidup. (Watanabe dan Casida 1961, Smythe *et al.*, 1971)

### CONCLUSION

There are various rate in deterioration caused by dry-wood termite *C. cynocephalus* of six substrates consisting of three wood species and three kind of papers. Merkus pine, rubber-wood, filter paper and

sengon could be consecutively categorized the most preferred substrates than the corrugated and duplicator paper. The feeding capacity of the termite on that materials was successively about; 2.41, 2.23, 1.61, 1.55, 1.12 and 0.73 mg during a five-week exposure.



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