A termite attack on rubber plantation on peat soil: Level of damage and identification of pest species

Y Indrayani*, D Setyawati, Y Maryani and B Simangunsong

Faculty of Forestry, Tanjungpura University, Jl. Daya Nasional Pontianak 78124, West Kalimantan, Indonesia.

*Corresponding author e-mail: mandaupermai@yahoo.com

Abstract. A study was carried out to evaluate the incidence of a termite attack on a rubber plantation at Kubu Raya Regency, West Kalimantan, Indonesia. The peat plantation area was surveyed to determine the level of damage and diversity of termite species attacks on the rubber tree. A total of 816 rubber trees were inspected for evidence of a termite attack. The level of damage caused by termite attack was done by looking at physical changes in the tree, mainly the presence of termite’s gallery/mud on the trunk that covers half of the trunk diameter or the entire trunk. Each tree is observed, and the value of damage (Score) is based on the condition of the trunk attacked by termites. For pest identification purposes, termite’s specimens were collected from the attacked- standing tree, fallen logs, and above ground. Seven species of termites were found from four sub-families: Termes laticornis, Schedorhinotermes sarawakensis, Schedorhinotermes malaccensis, Coptotermes curvignathus, Coptotermes havilandi, Lacessititermes laborator, and Prorhinotermes flavus. Approximately 13.97% of all rubber trees on the plantation at Kubu Raya Regency, West Kalimantan, were infested by termites.

Keywords: termite diversity; rubber plantation; peatland; level of damage.

1. Introduction

Rubber (Hevea brasiliensis) is an important plantation plan, both in improving society's economy or as a non-oil and gas foreign exchange earner of the country. Rubber plants easily grow in the tropical area, so that Indonesia is the second-largest producer of latex in the world. According to Damanik [1], Indonesia is the second world rubber producer after Thailand. The value of Indonesian rubber exports in 2008 reached 6,023,295,600 US$ with an export volume of 2,283,153.8 tons [2]. It is estimated that the growth rate of rubber production is 2.5% per year and world trade grows 2.6% [2], so it is estimated that in 2025, Indonesia can become a major world rubber producer with a rubber plantation area of 4.5 million ha, with its production can reach 3.3 million tons [1].

In Indonesia, rubber plants grow well in Sumatra, Kalimantan, and Java. According to Damanik [1], 24% of the rubber plantation area is located in Kalimantan, ranking second after Sumatra at 70%. The location of rubber plantations in West Kalimantan in 2020 was 391,700 ha from 3,681.30 ha of rubber plantations in Indonesia [3].

However, the management of rubber plantations in most tropical countries has many obstacles which affect their production levels, including plant pest organisms such as termites. Despite the fact that termites play an important role as decomposers in the ecosystem, termites are one of the most significant pests in agroforestry. The termites that mostly attack rubber plants are Coptotermes curvignathus (Holmgren) and Macrotermes gilvus [4]. The termites ate the whole rubber stems so that they could
cause death for rubber plants. It is because termites can burrow the branch until it penetrates the grafting eye on the rubber stem. Termites also attack rubber plant seeds that are newly planted by gnawing those whole seeds until they get severe damage, which does not allow them to grow properly again.

Generally, termites do not attack living trees or plants, except for most of the *Coptotermes* genus. The termite attacks trees or wood material by degrading cellulose with the help of enzymes produced from the termite intestine itself [5]. Termites digest cellulose into smaller molecules that maximize the degradation process of organic matter into soil constituent elements. Therefore, termites have an essential role in the decomposition process, the circulation of nutrients, and carbon release in the ecosystem [6][7]. Another important role of termites in the ecosystem is that it can improve soil chemical properties such as organic carbon content, nitrogen, phosphorus, and cations exchange capacity [8].

There is still little information about termite attacks on rubber trees and their control methods. Termite inventory studies and descriptions of termite damage to rubber seedlings have been reported [2][9][10]. There is very little data available on the level of tree damage caused by termites and the species of termites that attack the rubber plant. This research aimed to record the level of damage to rubber trees and identify the species of termites that attack them. The area chosen for conducting our study was a rubber plantation located in Kubu Raya Regency, West Kalimantan. The bioecological data of this pest can be used to determine the method of controlling termites in rubber plantations.

2. Study Site and Methods

2.1 Study site

This research was conducted in a rubber plantation in Kubu Raya Regency, West Kalimantan, owned by non-company farming communities with an altitude of 5 to 11 meters above sea level from July to September 2019. Geographically, the research location is located at 0013°40.83” to 100053.09” South Latitude and 109002°19.32” East Longitude to 109058°32.16” West Longitude. The average daily temperature is 30°C to 34°C, with rainfall in 2018 ranging from 118 mm to 404 mm. In 2019, the average rainy day was recorded at 14 days with an average rainfall intensity of 219.9 mm per month. The lowest rainfall was recorded in February, which was five days of rain, while the highest was in December, which was 23 days of rain or, in other words, almost an entire month of rain [3]. In general, the type of soil in study site is organosol or peat soil with varying thickness levels in each place ranging from 0 - 4 m. In the research area, the thickness of the peat soil ranges from 2-4 m [3].

2.2 Survey methods

A survey method by direct observation of the rubber plantation area was used as the survey method in this study. The rubber plantation area surveyed was approximately 1 ha with 816 trees, and it was divided into 22 planting lines. Observations were made on all trees by observing the symptoms and signs of termite attacks on trees. Each rubber tree was observed from the base of the tree to a height of 1.5 m. Termites responsible for tree damage are collected in glass bottles containing 70% alcohol for identification purposes.

2.3 Termites identification

Termites collected from infested rubber trees were identified at the Wood Technology Laboratory, Faculty of Forestry, Tanjungpura University. Termites were identified up to genus and species level using classification documents by seeing the shape and length of the head, head width, shape and size of the mandible, and the number of antennae segments of the soldier caste.

2.4 Termite attack intensity

Rubber plants attacked by termites were determined by the attack criteria based on the score used as a reference. Each rubber plant that showed symptoms of termite attack based on its physical condition was given a score from 0 to 6 with the criteria for damage as shown in Table 1 [11].
Table 1. Criteria for tree damage due to termite attacks

| Damage level  | Attack symptoms            | Score |
|---------------|----------------------------|-------|
| Healthy       | Broken trunk 0%            | 0     |
| Light         | Broken trunk range 1% - 20%| 1     |
| Moderate      | Broken trunk range 21% - 40%| 2     |
| Moderate severe| Broken trunk range 41% - 60%| 3     |
| Severe        | Broken trunk range 61% - 80%| 4     |
| Very severe   | Broken trunk above 80%     | 5     |
| Fail          | Fallen/broken/dead tree    | 6     |

3. Results and Discussion

The total number of rubber trees in the plantations as the survey area was 816. From all the trees in the plantations, approximately 13.97% of all rubber trees in the plantation were infested by termites with the following details: 702 trees were declared healthy and appeared free from termite attacks, while 105 trees were light to very severe and the rest (9 trees) were reported dead trees (Figure 1). Most of the dead trees were found in rubber plantation areas which were located near shrubbery. This is understandable because termites like such places, such as shrubs, to build nests. The percentage of trees infested by termites was thought to be higher because it was possible that some trees had not yet shown signs of infection.

![Figure 1](https://example.com/figure1.png)

Figure 1. Number of trees infested by termites based on a score

A termite attack on trees was indicated by the presence of mud tubes on tree trunks. The presence of a mud tube around the tree's base was the most common characteristic of a tree attacked by *Coptotermes curvignathus* [12]. Meanwhile, dead rubber trees in the survey site were confirmed to be infested by termites. This finding was in accordance with a study conducted by Jasmi and Ahmad [13] in the Araucaria plantation. The fallen rubber trees directly showed damaged cambium tissue. Termite’s attack and damage tree can be seen in Figure 2.
Seven termite species were found in rubber plantations at the survey site (Table 2, Figure 3). These termites were grouped into four subfamilies. The species *Coptotermes curvignathus* was the most commonly found, and therefore, it was declared a pest insect. *C. curvignathus* is known to cause tree damage and death at any age [14]. The species found attacking the rubber tree were considered potentially dangerous because they attack the tree trunk, causing the growth of trees to be disrupted and could cause the tree's death. This species was a common and most important pest of Indonesian plantations. Several survey results indicated that most termites prefer peat soils, namely *Coptotermes* sp and *Schedorhinotermites* sp. Kon et al. [15] stated that the family of Rhinotermitidae would dominate peatlands and decrease in abundance and species richness on land with mineral soil types.

**Figure 2.** Termite’s attack and damage tree  
A: Mud tube on the trunk; B: Termite on the trunk; C: Dead tree

**Table 2.** Termite species found in rubber plantation in Kubu Raya Regency.

| Sub Family       | Species                                      |
|------------------|----------------------------------------------|
| Termitinae       | *Termes laticornis*                          |
| Coptotermitinae  | *Coptotermes curvignathus*                   |
|                  | *Coptotermes havilandi*                      |
| Nasutitermitinae | *Lacessititermes laborator*                  |
| Rhinotermitinae  | *Schedorhinotermites sarawakensis*           |
|                  | *Schedorhinotermites malacensis*             |
|                  | *Prorhinotermites flavus*                    |
Figure 3. Termite species in Rubber plantation in Kubu Raya Regency, West Kalimantan, Indonesia:
A. *Termes laticornis*; B. *Coptotermes curvignathus*; C. *Lacessititermes laborator*;
D. *Schedorhinotermes malaccensis*; E. S. *sarawakensis*; F. *Coptotermes havilandi*;
G. *Prorhinotermes flavus*

In the previous survey on termite attacks on rubber plants in North Bengkulu Regency, Helmiyetti et al. [16] found four species of termites consisting of 2 families, namely Rhinotermitidae and Termitidae. Species belonging to the family of Rhinotermitidae are only *Coptotermes curvignathus*, while the family of Termitidae consists of species *Microcerotermes* sp, *Microtermes inspiratus*, and *Nasutitermes* sp.). Another a termite survey conducted by Manap et al. [17] on a rubber plantation in Banjar Regency, South Kalimantan, it was found 11 termite species from four subfamilies, namely Termitinae, Macrotermitinae, Nasutitermitinae, and Rhinotermitinae, and the species are *Schedorhinotermes longirostris*, S. *tarakensis*, *Macrotermes gilvus*, *Microtermes insperatus*, *Capritermes mohri*, *Procapritermes setiger*, *Termes propinquus*, *Hospitalitermes hospitalis*, *Nasutitermes longinasoides*, *Nasutitermes proatripennis*, and *Parrhinotermes aequalis*. The difference in the species of termites found in each rubber plantation was predicted to be influenced by the location where termites were found in various habitats such as termite nests, above ground level, dead trees around rubber plantations, and
rubber trees. Another important species, _Schedorhinotermes_ spp., was observed because it attacked mildly infested rubber trees, indicating that it was not predicted to attack live trees.

Considering this issue, a termite control strategy should be implemented in the existing rubber plantations to stop further damage to the trees. It is also recommended to be considered at the time of the clearing of new plantation land to avoid possible economic losses due to termite attack.

4. Conclusion

Seven species of termites belong to four subfamilies were found in the rubber plantation of Kubu Raya Regency. These termites were responsible for 13.97% of the damage which occurred to rubber plants. The species _C. curvignathus_ and _Schedorhinotermes_ spp. were the main termite pests capable of infesting rubber trees. Species of _C. curvignathus_ was the dominant that was responsible for the total attack.

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