TERMITE SPECIES RICHNESS ON THE CAMPUS OF UNIVERSITAS INDONESIA, DEPOK

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Abstract

Termites are a group of invertebrates abundant in forested habitats. In this study, we conduct an inventory and spatial analysis of the termite fauna of the UI campus. The survey records the presence of six termite species (*Coptotermes curvignathus*, *Schedorhinotermes javanicus*, *Macrotermes gilvus*, *Microtermes insperatus*, *Odontotermes grandiceps*, and *Odontotermes javanicus*), most of which had been reported by previous studies. The spatial analysis of termite nest distribution suggests a random scattering of termite nests in the UI campus.

Keywords : *faunal inventory, termites, spatial distribution, UI campus*

1. Introduction

Termites (Insecta, Isoptera) are a dominant group of invertebrates in forested habitats. In their study of invertebrate communities in several habitats in Colombia, Decaens *et al*. [1] discovered that termites, in terms of individuals, outnumber other invertebrate groups, including ants and earthworms. Although usually regarded as pests that damaged houses or tree crops [2, 3], they have a significant ecological function. Termites are major decomposers of organic material, particularly wood. They harboured an anaerobic ecosystem of microorganisms in their hindgut, which acts as a bioreactor to break down cellulose and lignin [4]. Termites might also have some effect on soil quality. Soil samples taken from termite mounds and tunnels have a higher mineral and organic carbon content than its surroundings [5]. Termite structure-building activities accumulate organic carbon on the soil surface and probably influence the turnover of organic matter and minerals needed by plants [5].

Roonwal & Maiti [6] recorded the presence of about 200 termite species in Indonesia. Of these, about 30 species are known to inhabit Jawa [6, 7].

The campus of Universitas Indonesia, Depok ('UI campus') was formerly an rubber plantation, therefore offering a forested habitat preferable to termites. Its landscape is dominated by rubber, acacia, and grass patches. Earlier inventories of termite species in UI campus [8-11] found six termite species (*Coptotermes curvignathus*, *Macrotermes gilvus*, *Microtermes insperatus*, *Odontotermes javanicus*, *Pericapritermes* sp., & *Schedorhinotermes javanicus*; Table 1). However, all four studies were restricted to small areas.

Table 1. Termite species discovered by earlier studies in the UI campus, Depok

Species	Reference			
	[8]	[9]	[10]	[11]
Coptotermes curvignathus	O	X	X*	O
Macrotermes	X	O	X	X

gilvus				
Microtermes Insperatus	X	X	O	X
Odontotermes javanicus	X	X	X	X
Pericapritermes sp.	O	O	X	O
Schedorhinotermes javanicus	X	O	O	X

X = present; O = absent;
[8] Location: Rubber trees and *Pennisetum polystachyon* grass patches near FMIPA-UI.
[9] Location: Reforested areas around FMIPA-UI.
[10] Location: Roadside trees around FMIPA-UI, FKM-UI, Gedung BNI UI Depok and Balairung UI.
[11] Location: wooded area north of FE-UI.
* identified as *Coptotermes* sp.

This paper represents an attempt to do an exhaustive inventory of termite species coavering the entire area of UI campus. Also of interest is the pattern of distribution of termite nests on the UI campus.

2. Methods

Samples were collected from October to December 2002 in parts of UI campus, covering an area of 16.000m^2 (Figure 1). Sampling was conducted in a broad survey, by searching for termite nests on the ground, in live and dead trees, rotten wood, and wooden objects. Termite nests were opened and representative individuals were collected for identification. Sampled individuals were preserved in 70% alcohol. Termite species were identified by using worker caste characters, referring to several termite identification keys [2, 12-14].

Vandermeer [15] devises a method to distinguish between random and non-random spatial distribution of points in a two-dimensional space divided into quadrats by statistical test of similarity to the Poisson distribution. In a Poisson distribution, the probability of encountering a quadrat containing zero points is larger than the probability of encountering one containing one point, which in turn is larger than the probability of choosing one containing two points, and so on. The equation for probabilities in a Poisson distribution is:

$$P_r = \frac{\lambda^r e^{-\lambda}}{r!} \qquad (1)$$

r = number of points in a quadrat
P_r = probability of a quadrat containing r points
λ = mean number of points per quadrat
e = 2,71828...
[15]

Throughout the survey, termite nest locations were recorded and marked on a UI campus map [16] divided into quadrats representing 10x10m squares in the actual area. Each sampled termite nest was marked by one point on the map (Figure 2). The frequencies of quadrats containing zero points, one point, two points, etc. were calculated and subjected to a chi-square (χ^2) test against ideal frequencies derived from the Poisson distribution. Two hypotheses were tested:

Ho = No significant difference between the observed frequencies and the ideal (Poisson-derived) frequencies, spatial distribution of termite nests is random (observed χ^2 < expected χ^2).
Ha = Significant difference between the observed frequencies and the ideal (Poisson-derived) frequencies, spatial distribution of termite nests is nonrandom (observed χ^2 > expected χ^2).

A further test to distinguish between nonrandom distributions (clumped & even) is the test of variance. Variance is larger than the mean number of points per quadrat (λ) in a clumped distribution, while it is lower than λ in an even distribution [15].

3. Results and Discussion

Six species of termites have been identified from samples taken from UI campus (Table 2): *Coptotermes curvignathus* Holmgren, 1913 (Rhinotermitidae), *Schedorhinotermes javanicus* Kemner, 1934 (Rhinotermitidae), *Macrotermes gilvus* (Hagen), 1858 (Termitidae, Macrotermitinae), *Microtermes insperatus* Kemner, 1934 (Termitidae, Macrotermitinae), *Odontotermes grandiceps* Holmgren, 1912 (Termitidae, Macrotermitinae), and *Odontotermes javanicus* Holmgren, 1912 (Termitidae, Macrotermitinae). The presence of most of those species has been recorded by earlier studies [8-11], except *O. grandiceps*. *Odontotermes grandiceps* was found in three sites, one in Masjid UI and two near Balairung. An earlier study [10] already covered the area, but did not record the presence of *O. grandiceps.* The similarity of *O. grandiceps* to *O. javanicus* (both species only differ in head size) might have caused earlier observations to identify *O. grandiceps* specimens as *O. javanicus*. In addition, we did not discover *Pericapritermes* sp. (Termitidae, Termitinae) recorded earlier by Hidayati [10].

The two Rhinotermitidae species (*C. curvignathus* and *S. javanicus*) are damp-wood termites, nesting within dead tree trunks. The others (*Ma. gilvus*, *Mi. insperatus*, *O. grandiceps* and *O. javanicus*) are fungus-growing, soil-nesting termites. These four species build underground nests and tunnels on dead and live tree trunks. *Ma. gilvus* and *O. javanicus* sometimes build small mounds around tree bases. All six species are wood-feeders. The Macrotermitinae species cultivate fungus gardens within their nests for food. *Macrotermes gilvus* also feed on leaf litter

Table 2.
List of termite species collected in this study

Species	Number of sites
Rhinotermitidae	
Coptotermes curvignathus	9
Schedorhinotermes javanicus	2
Termitidae, Macrotermitinae	
Macrotermes gilvus	29
Microtermes insperatus	18
Odontotermes grandiceps	3
Odontotermes javanicus	11
Total	72

The taxonomic composition of termites (Rhinotermitidae and Macrotermitinae) discovered in this study is similar to those found by Intari [17] in a cajuput plantation in Tasikmalaya, and by Ismanto *et al*. [18] in Pasar Minggu and Pasar Rebo, Jakarta. In contrast, a study of termites in similar habitats (rubber plantation and grasslands) in Jambi [19], and another study of Krakatau, Ujung Kulon, and Pangandaran termites [7] discovered a different termite fauna composed of Rhinotermitidae, Macrotermitinae, Nasutitermitinae, and Termitinae. The presence of Nasutitermitinae and Termitinae species had never been recorded from UI campus, except for the record of *Pericapritermes* sp. by Hidayati [10].

The majority of termites encountered in this study (61 of 72 sites) are members of the fungus-growing Macrotermitinae. A study of termite fauna in various habitats in Danum Valley, Sabah [20] discovered that *Macrotermes gilvus* are mostly found in 'high-disturbance' sites, those with the highest amount of human activity. The abundance of Macrotermitinae in UI campus might reflect the high level of human activity in the UI campus environment, rendering it a 'high-disturbance' site.

The location of termite nests discovered during the inventory is shown in Figure 2. Quadrats marked with a cross (X) in the map were not explored in the inventory, due to limited time, and therefore excluded from the analysis. Chi-square (χ^2) value obtained from the observed distribution (χ^2=1.6907) is smaller than expected χ^2 value (11.071; degree of freedom (d.f.)=5, confidence level (α)=0.05). This result suggests that the distribution of termite nests is not significantly different ($p>0.05$) from the Poisson distribution. Therefore, we infer that the termite nest distribution in UI campus is random.

The random distribution of termite nests can be interpreted as the result of a uniform distribution of resources. Wood is the most important resource for termites, being a source of food and dwelling. Uniform distribution of resources is seldom encountered in nature [21]. However, the UI campus is an artificially planted area. Trees are rather evenly distributed there, thus providing a uniform distribution of resources to be exploited by termites.

4. Conclusions

The UI campus has a termite fauna of six species, which is similar in taxonomic composition to other termite fauna in regions with high human activity. The fungus-growing, soil-nesting subfamily Macrotermitinae dominates the termite fauna. Analysis of termite nest spatial pattern suggests a random distribution, which might be the result of a uniform distribution of trees, the main resource required by termites, in the UI campus.

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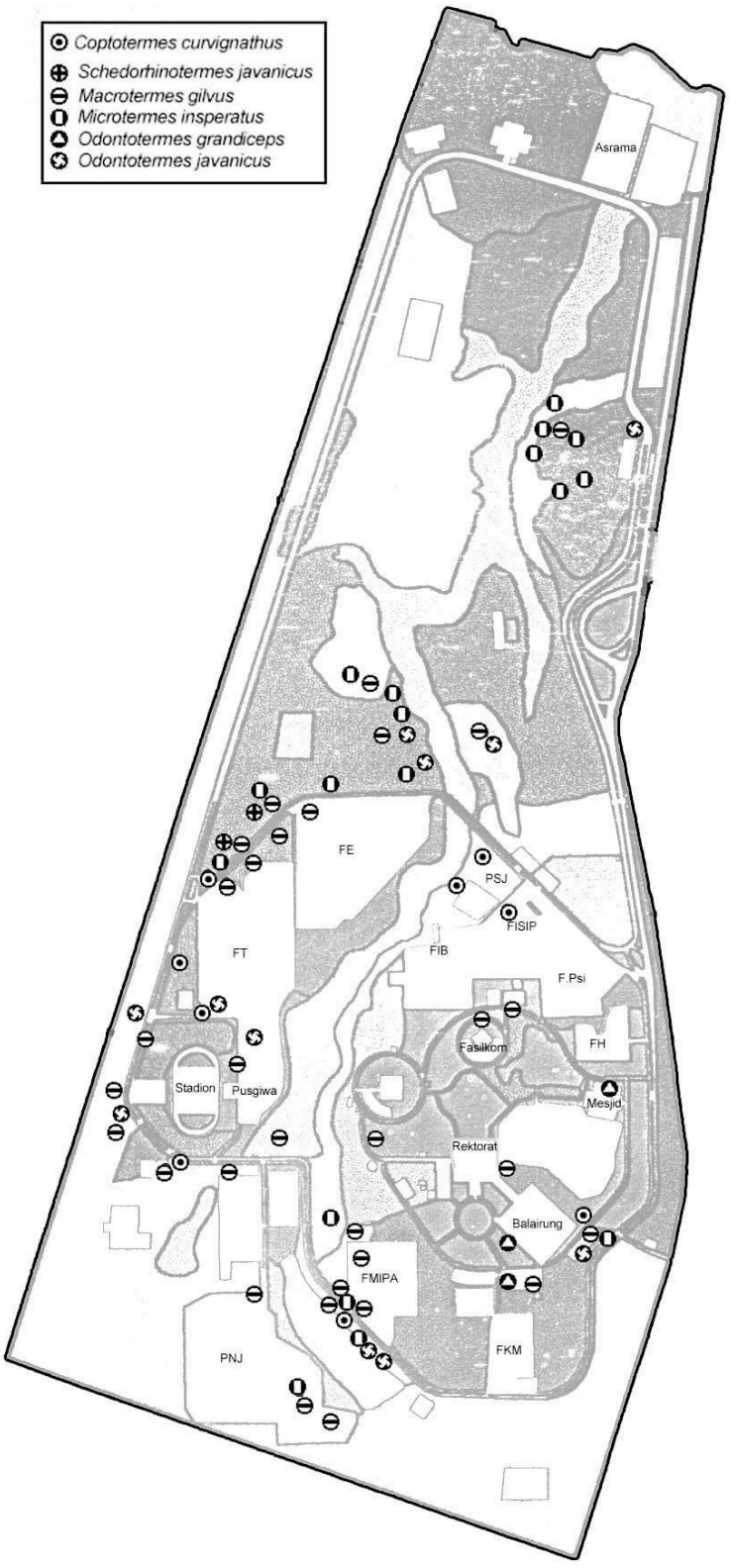

Figure 1. Location of termite nests in UI campus

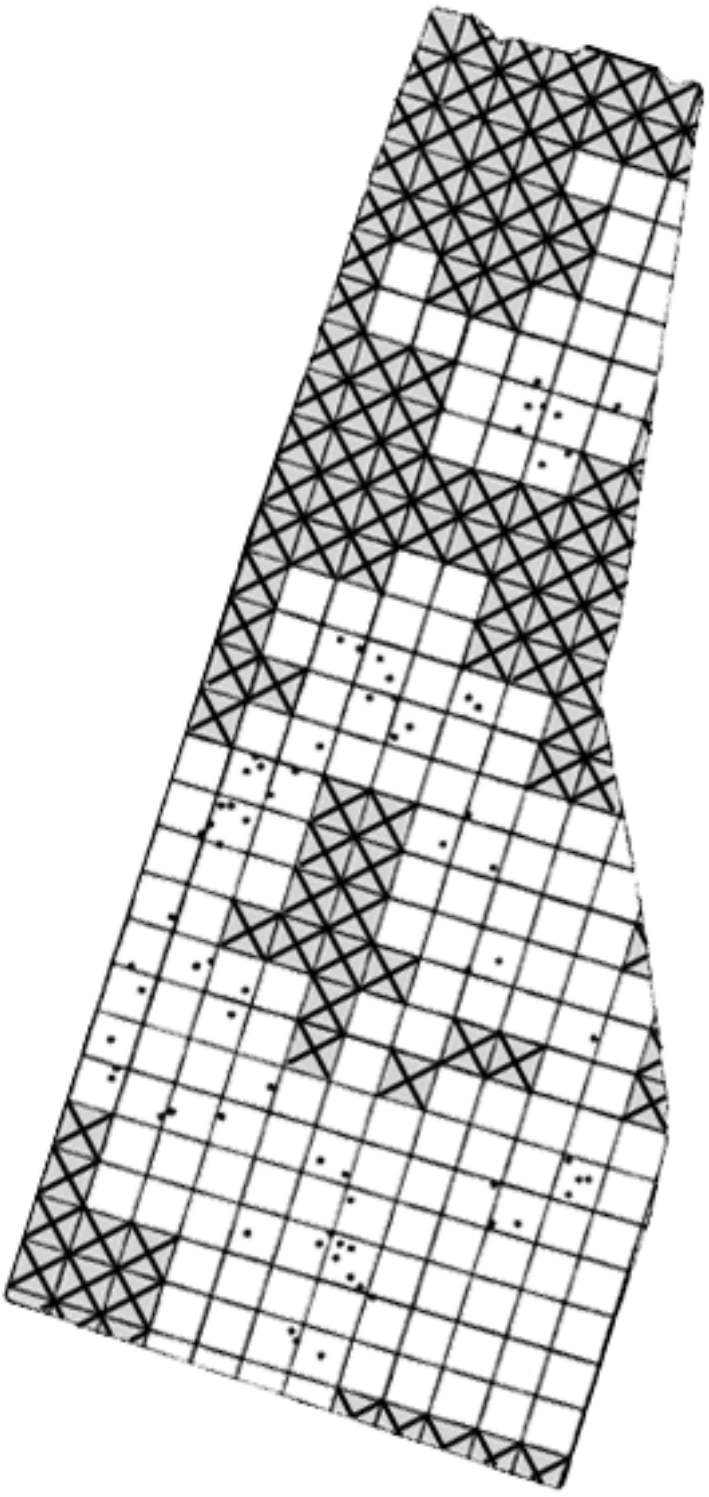

Figure 2. Termite nests plotted on quadrats. Each quadrat represents an area of 10 x 10 m. Quadrats not sampled are marked with a cross (X).