SUBTERRANEAN TERMITE FAUNA ON A PEATLAND: A PRELIMINARY ASSESSMENT OF THE SPECIES DIVERSITY AND BIOMASS UNDER DIFFERENT LAND USE TYPES

Ahmad Muhammad[1*], Febri Ayu[1], Andi Saputra[1], Yusnarti Yus[1], Treshandila Purnasari[1], Desita Salbiah[2]

[1] Dept. Biology, Fac. Mathematics & Natural Sciences, Riau University, Pekanbaru, Indonesia
[2] Dept. Agrotechnology, Fac. Agriculture, Riau University, Pekanbaru, Indonesia
[*]Email: biodiversity_riau@yahoo.com

ABSTRACT

Owing to their wet nature, peatlands in their original conditions may not be favorable habitats for most ground-dwelling organisms. Apart from being acidic, peat is water saturated most of the times, making it unlikely habitatble for such organisms. After the construction of drainage system, however, substantial amount of water can be drawn out from the peat, resulting the drop of water table. We hypothesized that the alteration of this fundamental feature of peatlands might promote the proliferation ground-dwelling organisms in peatland habitats and/or colonization by non-native ones. We tested our hypothesis by surveying termite species richness and biomass under different land use systems that reflected a gradient of water table alteration (from shallower than 20 cm to deeper than 100 cm below the surface). The study has been carried out under peat swamp forest, rubber jungle, rubber plantation, oil palm plantation, homegarden, and acacia plantation forest in Bukit Batu area, Riau, Sumatra. We encountered a total 18 spp of subterranean termites with the average of only 6.2 spp found under each land use type. The average subterranean termite biomass was 0.29 gr/m^2. Our data did not support our hypothesis in a way that subterranean termites were even most diverse (9 spp) and demonstrated largest biomass (0.53 gr/m^2) under peat swamp forest, where the water table was never deeper than 20 cm and the peat was almost always water-saturated. However, the striking differences in species composition between peat swamp forest assemblage and those under other land use types suggest that the conversion of peatland might have significantly reduced the number of species native to this ecosystem, while inviting non-native ones.

Key word: peatland, Riau, Sumatra, land use, subterranean termites, species richness, biomass, Coptotermes curvignathus

INTRODUCTION

Tropical peatlands are unique environments that are increasingly drawing the attention of international communities. They demonstrate in the first place sinks of huge amount of carbon on earth's surface. Secondly, they are also increasingly becoming new frontiers of agro-silcultural development. The alteration of the natural condition of these carbon sinks raises concerns, since it may stimulate processes that enhance the release of carbon to the atmosphere. Such release of belowground carbon as greenhouse gases (CO_2 and/or CH_4) in considerable quantity can agravate climatic changes at global scale.

Owing to their wet nature, peatlands in their original conditions may not be favorable habitats for most ground-dwelling organisms. Apart from being acidic, peat is water saturated most of the times, a feature that creates anexic or hypoxic condition and therefore makes it unlikely habitatble for such organisms. After the construction of drainage system, however, substantial amount of water can be drawn out from the peat, resulting in the drop of water table and thus creating more porous and oxygenated surface peat layer.

We hypothesized that the alteration of that fundamental feature of peatlands might promote the proliferation of certain native ground-dweeling organisms in peatland habitats and/or colonization by non-native ones. To test this hypothesis, we have carried out a survey of subterranean termites under different land use types that somewhat also reflected a gradient of water table alterations. The specific objectives of this study have been to assess the species richness and abundanceof subterranean termite fauna.

Subterranean termites are of special interest in this regard, since these organisms are among the most important decomposition agents in terrestrial ecosystems. These insects are not only influencing nutrient cycling and distribution in such ecosystems, but also capable of shaping the physical structure of soil through their nest- or mound-building activities, for which they are dubbed as ecosystem engineers. A few species of them are known as notorious pests for many crops as well. Changes the assemblages and abundance of subterranean termite fauna are therefore often be associated with significant changes in an ecosystems, even when these may proceed only gradually and slowly.

METHODS

Our study has been carried out in Bukit Batu area, Bengkalis District, Riau Province, Indonesia (Figure 1). Much of the peatland in this area has been deforested and converted for agro-silvocultural development. Rubber has been cultivated by smallholders in this area possibly since 1940, but significant development possibly has taken place only after the end of 1950s. Large-scale and rapid deforestation has occurred especially after 2000, followed by a rapid development of acacia plantation forest. Oil palm planting by smallholders has also begun to spread after 2000.

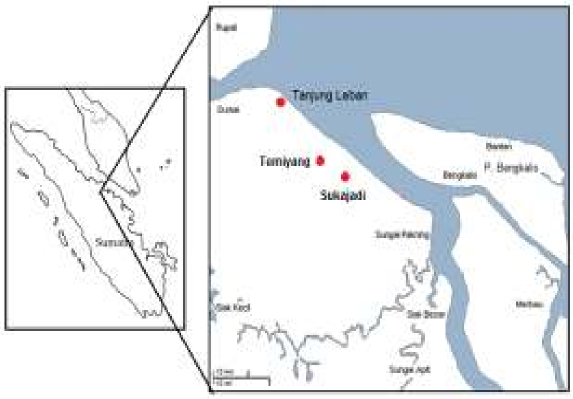

Figure 1. Sampling locations in Bukit Batu area, Riau

In this study, we focused on six different land use types, namely peat swamp forest, rubber jungle, rubber plantation, oil palm plantation, homegarden, and acacia plantation forest. We selected four sampling locations representing each land use type and establish one 100 m-long, or two parallel 50 m-long transect lines on each location, depending on the field condition. Ten 10 sampling plots of 1 m x 1 m were laid on the line(s) with a regular distance of 10 m from one to the next. Each plot was divided into 16 equal sections of 25 cm x 25 cm which dug out one by one systematically to a depth of 10 cm. Termites were carefully extracted from each section and weighed alive. Specimens were collected and sorted out after morphospecies in the lab, before they were identified after some references, such as Tho (1992). One-way ANOVA has been used to test the difference of species richness and biomass between land use types. Sorensen's Index of Similarity has been used to measure the similarity between two land use types.

RESULTS AND DISCUSSION

Species richness and composition

We found a total of 18 subterranean termite species (Table 1). The species found in sampling locations under peat swamp forest comprised nine species (50%) of the assemblage, while those found under oil palm plantation contrastingly consisted of only three species (30%). The average number of species in one particular land use was 6.2 species, of which the largest species number was found under peat swamp forest and the smallest one under oil palm plantation. The differences in species number between peat swamp forest and other land use types were significant ($P<0.05$).

As Table 2 shows, the similarity in species composition was averagely 0.37 and the highest (0.50) was between rubber jungle and rubber plantation and between rubber plantation and oil palm plantation. The lowest similarity was observed between peat swamp forest and rubber plantation, oil palm plantation and homegarden, which was invariably 0.00.

Table 1. Subterranean termite species found under different landuse types

No.	Species	Land Use Type*					
		PSF	RJ	RP	APF	OPP	HG
1	*Bulbitermes constrictiformis*		●				
2	*Bulbitermes flavicans*	●					
3	*Bulbitermes* sp.	●	●				
4	*Capritermes latignathus*		●	●			●
5	*Capritermes mohri*	●	●		●		
6	*Capritermes semarangi*	●			●		
7	*Ceylonitermes indicola*	●					
8	*Coptotermes calshoveni*						●
9	*Coptotermes curvignathus*		●	●	●	●	●
10	*Coptotermes havilandi*			●			
11	*Microcerotermes dubius*	●					
12	*Nasutitermes proatripennis*	●					
13	*Parrhinotermes aequalis*	●			●		
14	*Parrhinotermes inaequalis*					●	●
15	*Parrhinotermes* sp.			●			●
16	*Schedorhinotermes malaccensis*	●					
17	*Schedorhinotermes sarawakensis*		●	●		●	●
18	*Termes rostratus*		●				
	Total	9	7	5	4	3	6

*Land use types: PSF (Peat Swamp Forest); RJ (Rubber Jungle); RP (Rubber Plantation); APF (Acacia Plantation Forest); OPP (Oil Palm Plantation); and HG (Homegarden).

Table 2. Similarities in species composition between different land use types*

	PSF	RJ	RP	APF	OPP	HG
PSF	-	0.25	0.00	0.19	0.00	0.00
RJ		-	0.50	0.18	0.40	0.46
RP			-	0.31	0.50	0.54
APF				-	0.29	0.20
OPP					-	0.67
HG						-

*Abbreviations refer to Table 1

The average subterranean termite biomass was 0.29 gr/m^2. The largest biomass was found under peat swamp forest (0.53 gr/m^2) and the smallest under oil palm plantation (0.09 gr/m^2). The differences between the biomass under the former and other land use types were significant ($P<0.05$).

Our data did not support our hypothesis in a way that subterranean termites were even most diverse (9 spp) and demonstrated largest biomass under peat swamp forest, where the water table was never deeper than 20 cm and the peat was almost always water-saturated (>80%). However, the striking differences in species composition between peat swamp forest assemblage and those under other land use types suggest that the conversion of peatland might have significantly reduced the number of species native to this ecosystem, while inviting non-native ones.

CONCLUSIONS

Peat swamp forests in their natural conditions appear to support subterranean termite fauna that is more diverse and has larger biomass than that after undergoing deforestation and conversion to other land use types. The striking differences in species composition of the termite assemblage under such natural habitat if compared with altered habitats suggest that native species may not persist after the conversion and that non-native ones may come to replace them.

ACKNOWLEDGEMENTS

This study has been supported by a grant from GCOE Project (Initiative 3), Kyoto University.

REFERENCES

Tho, Y.P. 1992. *Termites of Peninsular Malaysia*. Forest Research Institute of Malaysia.