Estimating population size for Macrotermes gilvus Hagen (Blattodea: Termitidae) in Indonesia

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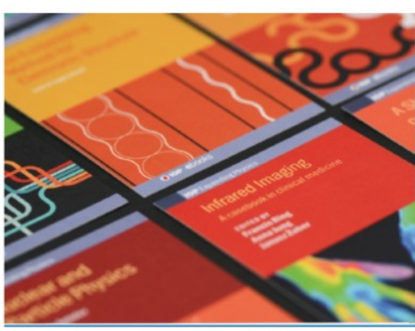

Estimating population size for *Macrotermes gilvus* Hagen (Blattodea: Termitidae) in Indonesia

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Abstract. *Macrotermes gilvus* Hagen (Blattodea: Termitidae) is a common mound-building termite species found in South East Asia regions, particularly in Indonesia, Malaysia, Singapore, Philippines and Thailand. However, scientific information on their demography and mound construction in Indonesian natural forests had not yet reported. This study aimed to investigate the demography and mound construction of *M. gilvus* Hagen in Yanlappa forest, which represents low-land natural forest in West Java, Indonesia. Termites mound distribution survey was conducted in strip transect, 50 m width interval, and supported by *Global Positioning System*. Termites population in each mound was determined after dismantled of the mounds, meanwhile mound construction were observed vertical as well as horizontal section. The mound of *M. gilvus* was distributed clusterly with density of 5 mound/Ha, density mainly located at elevation 3% - 5%, and under *Leaf Area Index* of 0-2. We concluded that *M. gilvus* is primary decomposers and contribute to litter fragmentation and the recycling of nutrient into the soil. *Macrotermes gilvus* plays an important role as a source of heterogeneity in this ecosystem, particularly in under stresses condition. The density and dynamic of *M. gilvus*, be taken into account in the global strategy of the forest resources management and conservation.

1. Introduction

Macrotermes gilvus Hagen (Blattodea: Termitidae) is a common mound-building termite species found in South East Asia regions, particularly in Indonesia, Malaysia, Singapore, Philippines and Thailand. However, scientific information on their demography and mound construction in Indonesian natural forests had not yet reported. A study was conducted to investigate distribution of mound subterranean termites *Macrotermes gilvus* Hagen (Blattodea: Termitidae) in Nature Reserved, Indonesia.

M. gilvus are recognized as ecosystem engineer because they promote soil transformations by disturbance processes. This species collects organic matter and mineral particles from different depths and deposit them in mounds, enhancing the content of organic C, clay and nutrient. Also, pH and microbial population are higher in termite mound than in adjacent soil. The material accumulated is redistributed by errosion, affecting soil microstructure and fertility. Termites also build galleries that increase soil porosity [1] and water infiltration and these galleries may be filled up with top soil material, with rainfall contributing to the process of formation of deep, uniform latosol [2]. The main factors for this trend are related to the scarcity and abnormal seasonal distribution of rains, to the increasing demographic pressure and to an overexploitation of natural resources [3].

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2. Methods

The study site was located in Yanlappa Sanctuary, Bogor, West Java, Indonesia. Field colony mound of *M. gilvus* Hagen on the natural forest of Indonesia, was selected for the object of this study. Termite mound distribution survey at least 32 Ha was conducted in strip transect, 50 m width interval, and supported by *Global Positioning System*/GPS [4]. These zonations were digitized and the mound termite data from the survey transects were overlaid using GIS prosedures. Leaf area index was done using a hemyphot method, vegetation analysis was transect, and elevation class was GPS facilities [5]. Data processing and analysis were conducted using ANOVA. In order to normalize the data, counts were transformed using the natural logarithm [6,7].

3. Results and Discussion

Yanlappa natural reserve is about 32 Ha and located between 6°40' S and 106°45' E, with rainfall was about 2399 mm/year. Mounds building by *Macrotermes gilvus* Hagen are quite common in the natural forests, especially in Yanlappa natural reserve. They are irregularly dome-shaped to sub conical structure of brownish earth, and are not infrequently found near base of trees and often with some grass and other bushy vegetation growing on them.

The mound of *M. gilvus* was distributed clusterly with density of 5 mound/Ha, density mainly located at elevation 3% - 5%, and under *Leaf Area Index* of 0-2. It was shown in the present study that a number of interrelated environmental factors influence termite distribution. Major parameters such as geology, terrain morphology and woody vegetation are reflected in land type. The land shaped by forces best described by local relief, slope class. Major parameter distribution mound termites *M. gilvus* can be seen in Table 1.

Tabel 1. Major parameter distribution mound termites *Macrotermes gilvus* in Yanlappa, nature reserve, Indonesia

Parameter Class elevation (m dpl)	Mound density	Area (m^2)
50-100	75	258.124
100-150	80	80.835
Leaf Area Index		
0-1	128	333.217
1-2	27	5.743
Slope class (%)		
3-5	155	288.026
6-17	0	16.707
18-20	0	34.228

According to the results, the Macrotermes mounds rest of subplot appeared as 3 different areas for tree species richness but still having the same site condition like parent soil and climatic factors. Compare the species diversity between the different areas mounds termite *M. gilvus* can be seen in Table 2.

Table 2. Comparison of the species diversity between the different areas in Yanlappa Nature Reserve, Indonesia

Higher density Tree		Low density		No density	
Artocarpus elastic	34.33	*Artocarpus elastica*	57.41	*Uncaria gambir*	37.21
Pentace polyantha	33.28	*Mallotus oblongifolius*	24.65	*Diospyros frutescens*	32.58
Knema intermedia	29.17	*Knema intermedia*	23.23	*Chrysophyllum roxburghii*	29.43
Vitex quinata	18.38	*Chrysophyllum roxburghii*	21.50	*Planchonia valida*	25.38
Euonymus javanicus	17.37	*Polyalthia lateriflora*	20.20	Kihuut	23.09
Ixora grandifolia	14.38	*Croton argyratus.*	20.12	*Artocarpus elastica*	22.33

A total of 226 spesies and 169 families were identified in the study subplot. These families, Myrtaceae 47.47%, Moraceae 34.33%, Tiliaceae 33.28%, Rubiaceae 21.34% and Verbenaceae 18.38% were the most represented families. To compare the species diversity between the different areas, the specific density was calculated as species richness at the unit of 100 m^2 of area for the mounds and surroundings. The mean density of tree community showed no significant difference by distribution mound termites in our study subplots ($P > 0.05$).

M. gilvus is primary decomposers and contribute to litter fragmentation and the recycling of nutrient into the soil. The important role that termites play as primary decomposer. Decomposing microbes are secondary receivers of carbon compounds fragmented by the termites. *Macrotermes gilvus* are less dependent on these factors because of mound architecture and fungal symbiosis. Termites are also able to patchily changes soil properties in the environment [8;9;10]. Research conducted before [11] found that nutrient concentration, organic carbon and clay-size particles in termite mounds were higher than in the surrounding soils. The interaction of passing on of nutrient rich particles across a decreasing size spectrum enables the movement of nutrients through the terrestrial ecosystem.

In modifying the distribution and availability of soil nutrients, soil engineer influence ecosystem services such as maintenance of biodiversity, stability and nutrient cycling. It is therefore necessary to study the links between their impact on ecosystem functioning and their ecological requirements, their ability to respond to their environment, as well as their relationships with other soil engineers in order to understand the structure of heterogeneity and then the functioning of ecosystem [12;13]. These result of data that can used to evaluate the role that a particular species of termite plays in an important natural ecosystem. This is major contribution to providing data on an invertebrate component of the ecosystem.

4. Conclusion

From the research on distribution of mound termites *Macrotermes gilvus* Hagen in natural forest ecosystem, there were some conclusions: The mound of *M. gilvus* was distributed clusterly with density of 5 mound/Ha, density mainly located at elevation 3% - 5%, and under *Leaf Area Index* of 0-2. *Macrotermes gilvus* is primary decomposers and contribute to litter fragmentation and the recycling of nutrient into the soil.

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