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# EFFECTS OF DAY TIME SAMPLING ON THE ACTIVITIES OF TERMITES IN OIL PALM PLANTATION AT MALAYSIA-INDONESIA

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## ABSTRACT

The activities and abundance of termites are highly affected by the environment. The objective of this study is to determine the activity of termites according to the different time of sampling event namely morning and evening session. The belt transects (100 metre length x 4 metre width) was set up in a line across the oil palm plantation. The sampling time was divided to the morning session (8:00 am to12:00 pm) and the evening session (2.00 pm to 6.00 pm). The presence of termites at each sampling time was recorded. A total of 12 belt transects with six replications for each sampling time at four different localities (MyFKT, MyLSK, IdFRGB, and IdCPSK) were placed. The results showed that the morning session recorded more species

(31 species) in comparison to the evening session (15 species), and there are significant differences between the two sessions ($\chi 2$=45,119, df=30, p<0.05). Based on the autocorrelation, there are also significant differences on the termite's activities between the two session. Overall, the termite activity is more active in the morning. The effect on the environment such as temperature and humidity in the morning and midday affect the abundance, diversity, and the presence of termites.

**Keywords:** day time sampling, activities, termites, oil palm plantation, Malaysia, Indonesia

## ABSTRAK

Aktiviti dan kelimpahan anai-anai sangat dipengaruhi oleh persekitaran. Objektif kajian ini dijalankan ialah untuk mengkaji aktiviti anai-anai mengikut waktu persampelan yang berbeza (waktu pagi dan petang). Transek sepanjang 100 meter dengan lebar 4 meter dipasang sepanjang barisan tanaman kelapa sawit. Waktu persampelan telah dibahagikan kepada dua iaitu waktu pagi (8.00 pagi hingga 12.00 tengah hari) dan juga petang (2.00 petang hingga 6.00 petang hari). Kehadiran anai-anai pada setiap waktu persampelan dicatatkan. Sebanyak 12 transek garis dengan enam replikasi pada setiap waktu persampelan di empat lokasi berbeza telah dipasang (MyFKT, MyLSK, IdFRGB, and Id CPSK). Hasil menunjukkan bahawa persampelan pada waktu pagi mencatatkan jumlah kehadiran spesies yang lebih tinggi iaitu sebanyak 31 spesies berbanding 15 spesies pada waktu petang. Terdapat perbezaan signifikan antara pensampelan pada waktu pagi dan petang ($\chi^2$=45.119, dk=30, p<0.05). Berdasarkan autokorelasi pula, terdapat perbezaan ketara pada persampelan yang dijalankan pada waktu pagi dan petang. Secara keseluruhannya, aktiviti anai-anai lebih aktif pada waktu pagi. Pengaruh terhadap persekitaran seperti suhu dan

kelembapan pada waktu pagi dan tengah hari mempengaruhi kelimpahan, kepelbagaian, serta kehadiran anai-anai.

**Kata kunci:** waktu persampelan, aktiviti, anai-anai, ladang kelapa sawit, Malaysia, Indonesia

## INTRODUCTION

The termite activity is caused by environmental factors especially micro climate including temperature, humidity and the availability of food. Previous research Lee and Wood (1971) indicated that distributions of termites are affected by the temperature and humidity. Termites are insects that have high water content in their bodies. Based on Nandika et al. (2003), a total of 80% water content is the main contributor to the body of termites. This proved that the termites need high percentage of humidity to survive with on varies the temperature. The temperature conditions will have influenced the level of water content in the termite body. For termites build mounds such as *Macrotermes* and *Odontotermes* recorded that the temperature of the mounds is 22 to 26 °C with high humidity up to 75% to 90%. However, termites have a very good defense mechanism for controlling the temperature and humidity without being affected by the changes in the environment. The ecology and social evolution of termites are poorly understood primarily because of the lack of knowledge regarding the nature of termites (Daheer & Vargo 2004). Thus, this study can provide the new findings and information of the termite activity in daytime this benefitting the Integrated Pest Management (IPM) in to controlling the termite pest.

## MATERIALS AND METHODS

The belt transect method was employed in this study. It was modified accordingly to the standard transect method that was introduce by Jones and Eggleton (2000). The standard transect method was about 100 x 2 m, while the modification that was done are 100 x 4 m. The belt transect was setting up parallel to the rows of palm tree planted. The modified method was initially proposed and tested by Rahim (2008); Rahim et al. (2011).

The sampling was conducted in the morning (08.00 am - 12.00 pm) and evening (02.00 - 06.00 pm). This particular session was selected to evaluate whether the time will influence the abundance of termites collected. In each session, a total of three replication at each transect was done. This study has been conducted in four localities namely Malaysia, Felda Kahang Timur- MyFKT. Malaysia, Ladang Sungai Kemelai - MyLSK. Indonesia, Frist Resources Group Bengkalis - IdFRGB and Indonesia, Central Plantation Services Kampar - IdCPSK.

The Chi-Square test was used to check whether the activity and abundance of termites was significantly differed between the session. The Autocorrelation whereby used to test the relationship of termite against the different time of sampling by looking on the pattern of the termite activity. The autocorrelation analysis is analyzed using PAST software.

## RESULTS AND DISCUSSION

A total of 31 species of termites were successfully recorded in the morning session while only 15 species in the evening session (Table 1). Thirteen species were recorded in both session, namely *Coptotermes curvignathus, C. kalshoveni, C. sepangensis, Parrhinotermes pygmaeus, Schedorhinotermes brevialatus, S. medioobscurus, S. sarawakensis, Globitermes*

*globosus, Macrotermes* sp. B, *Odontotermes* sp. B, *Nasutitermes proatripennis, N. longinasoides* and *N. roboratus.* The presence of these species in both session indicated that the adapatation of the species are ranging widely.

Table 1 List of species of termites which can be found in the morning and evening sampling

| Morning Samplig | Evening Sampling |
|---|---|
| *Coptotermes curvignathus* | *Coptotermes curvignathus* |
| *Coptotermes kalshoveni* | *Coptotermes kalshoveni* |
| *Coptotermes sepangensis* | *Coptotermes sepangensis* |
| *Parrhinotermes pygmaeus* | *Parrhinotermes pygmaeus* |
| *Schedorhinotermes brevialatus* | *Schedorhinotermes brevialatus* |
| *Schedorhinotermes medioobscurus* | *Schedorhinotermes javanicus* |
| *Schedorhinotermes malaccensis* | *Schedorhinotermes medioobscurus* |
| *Schedorhinotermes sarawakensis* | *Schedorhinotermes sarawakensis* |
| *Globitermes globosus* | *Globitermes globosus* |
| *Microcerotermes dubius* | *Pericaptiteremes latignathus* |
| *Microcerotermes havilandi* | *Macrotermes* sp. B |
| *Termes rostratus* | *Odontotermes* sp. B |
| *Procapritermes* sp. A | *Nasutitermes proatripennis* |
| *Pericapritermes mohri* | *Nasutitermes langinasoides* |
| *Macrotermes carbonarius* | *Nasutitermes roboratus* |
| *Macrotermes ahmadi* | |
| *Macrotermes malaccensis* | |
| *Macrotermes* sp. B | |
| *Odontotermes* sp. B | |
| *Odontotermes* sp. C | |
| *Odontotermes* sp. D | |
| *Odontotermes* sp. E | |
| *Odontotermes* sp. G | |
| *Nasutitermes havilandi* | |
| *Nasutitermes matangensis* | |
| *Nasutitermes neoparvus* | |
| *Nasutitermes proatripennis* | |
| *Nasutitermes longinasoides* | |
| *Nasutitermes roboratus* | |
| *Bulbitermes contrictoides* | |
| *Leucopitermes leucops* | |

Based on the Chi-Square test, there are significant differences ($\chi 2 = 45{,}119$, $df = 30$, $p < 0.05$) on the number of termites recorded in this two session. This could be due to the environmental factors such as differences on temperature and humidity between morning and the evening session. In the morning, temperature are slightly lower in comparison to the evening, where sun are at the peak hour during the time.

The autocorrelation showed that there were significant differences in the termites activity between the morning and evening session. In Figure 1, the autocorrelation of termites activities between morning and evening session were presented. The blue line indicated the morning activities while red line indicated the evening activities. From the graph, it was seen that the activities of termites in morning session are actively going upward and downward, presenting the 3 peak of the graph. Towards the late morning, approaching the afternoon, the activities of termites are slightly declined. In the other hand, the activities of termites on evening session, showed that the pattern were shraply declined over the time. This particular pattern can be explained by the interaction of termites activity with temperature and humidity. Over the time (hour) in day time, temperature and humidity are increasing. There were some species of termites that can tolerate to a certain enviromental factors, thus increasing it activites or decreasing it activities accordingly. Termites will try to avoiding and hiding itself from the exposure to temperature and humidity. It will hide under the soil or in their mound, reasoning why so less termites can be sampled in the evening session.

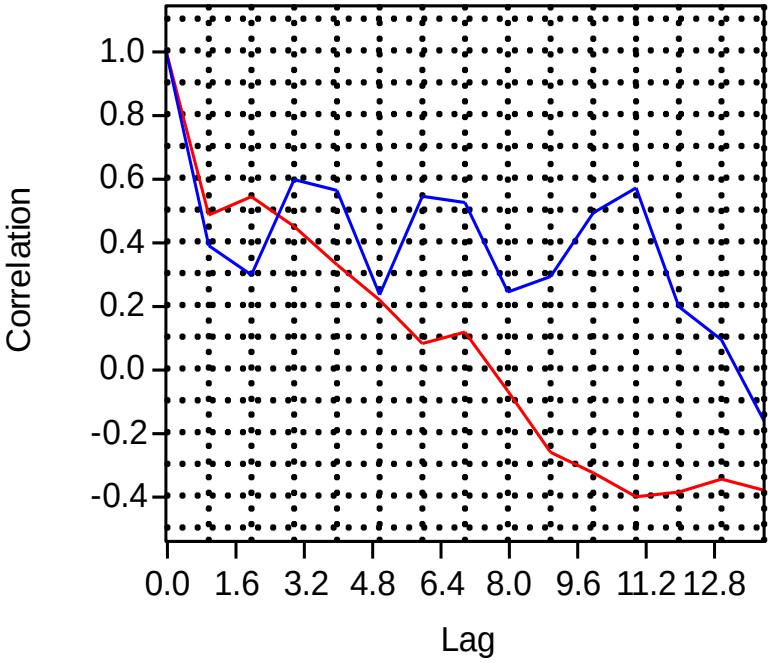


Figure 1. Autocorrelation between sampling in the morning (the blue line) and evening (the red line)

In the morning, the temperature and humidity of surroundings are favorable for termites to do the foraging activity. Meanwhile on evening, termites will return to the nest and try to protect themselves from temperature and humidity that are not favorable. Nandika et al. (2003) stated that termites body consists of 80% water. The activities in the evening will certainly affect the water contents in the body of termites. The drastic removal of water content in the body of termites can cause death and endangering the lives of their entire colonies.

Therefore, they had estimated in detail the conditions accordingly to the temperature so that the above matter can be avoided to happen. Previous study by Rahim (2008) reported that termites will be quite active for 10 hours and the next 10 hours will consume the time for resting. The activities are repeated when necessary. The results from this study suggested that the sampling of termites is best conducted in the morning session, as it will generate a proper collection and data on the abundance, composition and diversity of termites in oil palm plantation. This can help in a proper management of termites attack in the oil palm plantations (Alimin et al. 2011; Atiqah and Rahim 2015; Saputra et al. 2016; Saputra et al. 2016b; and Saputra 2017).

## CONCLUSION

The effective time sampling to study the diversity and abundace of termites is in the morning session (8.00 am to 12.00 pm). The activities of termites are highly adapated to the enviromental factors and is such in this study are temperature and humidity.

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