

# FORAGING PATTERNS OF TERMITE SPECIES IN THE LIVING COMPLEXES OF BANGKANOON FOREST PLANTATION, PHUKET PROVINCE, SOUTHERN THAILAND

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## ABSTRACT

Studies on foraging patterns of termite species in the living complexes of Bankanoon Forest Plantation, Phuket Province, southern Thailand, gave result of 11 species of subterranean termites (*Coptotermes gestroi*, *Microtermes obesi*, *Macrotermes gilvus*, *Macrotermes carbonarius*, *Macrotermes anandalei*, *Odontotermes feae*, *Odontotermes proformosanus*, *Hypotermes makhamensis*, *Globitermes sulphureus*, *Microcerotermes crassus* and *Nasutitermes matangensiformis*) and 1 species of drywood termite (*Cryptotermes thailandis*). The foraging patterns at different season of the year in building construction on soil surface and at the depth of 15 cm., 30 cm., 45 cm., 60cm., and 90cm. under soil surface were discussed in details.

*Coptotermes gestroi* was the most destructive species attacking wooden components within the living complexes while, *Cryptotermes thailandis* and *Macrotermes gilvus* are minor house infestry termites in this area.

**KEYWORD:** subterranean termites, foraging patterns, living complexes, forest plantation, southern Thailand

## INTRODUCTION

Termites are known to be the most important pest of wooden structures and other wood products in tropical countries, including Thailand where wooden houses are still favorable and also in many components made of timber.

To date over 100 species of termites are reported distributing in Thailand (unpublished data). Subterranean termites are the most destructive species in building constructions; however, little is known about their foraging behavior or general activity patterns.

Previous studied dealing with the foraging activity and foraging territory of subterranean termite *Coptotermes gestroi* Wasmann, the most economically species attacking houses in urban area of Thailand, indicated that their foraging territories were mostly underground within the depth of 30 cm. The highest activity was reported at the depth of 15 cm. below soil surface and foraging distance was found to be extended up to 5 meters. The investigation also revealed the infestation of the other 11 subterranean termites species in rural area (Sornnuwat, 1996)

In order to determine the economic problems to which different termites give rise or caused a serious damaged in the living complexes or to enter a new era of termite control measure where the emphasis is more on integrated pest management. Therefore the ecology and foraging behavior or foraging patterns of the termite species found in the area should be clearly understand.

## **MATERIALS AND METHODS**

Following the procedure for monitoring stations described by Su & Scheffrahn (1986) 60 stakes of rubber wood *Heavea brasiliensis* measuring 5.0 cm x 30.0 cm x 2.5 cm were first installed for typical survey to detect the presence of termite species and activity in soil over a broad area of the living complexes (8.0 m x 25.0 m.).

The study was carried out from July 1999 – July 2000 at Bangkanoon forest plantation, Phuket Province, Southern Thailand. The area is characterized as a Mahokanee plantation where the mean annual rainfall 2,550.3 mm (1999) and 2,371 mm (2000), 78% relative humidity, mean annual temperature 27.8 °c (1999) and 22.3 °c (2000).

To study on foraging depth, 20 infested stakes were replaced by the deep monitoring stations that included a rubber wood stake (5.0 cm x 15-50 cm x 2.5 cm) surrounded by the collar of the PVC pipe measuring 15 cm in diameters by the length of 30 cm, 45 cm, 60 cm, 75 cm and 105 cm. 4 replications of each depth of monitoring stations were installed in ground at the depth of 15 cm, 30 cm, 45 cm, 60 cm and 90 cm, respectively.

40 states left were kept for monitoring soil surface foraging activity (5 cm.). Termite species and their foraging pattern both inground and above ground were inspected every 3 months. Every inspection period, wooden stakes have to be replaced.

For the seasonal trends in foraging activity were determined by summing the total numbers of stakes or monitoring stations that observed termite activity during each inspection period. (Tiben *et al.*, 1990; Pearce, 1999).

## **RESULTS**

The results obtained are shown in Table 1, 2 and Figure 1-3.

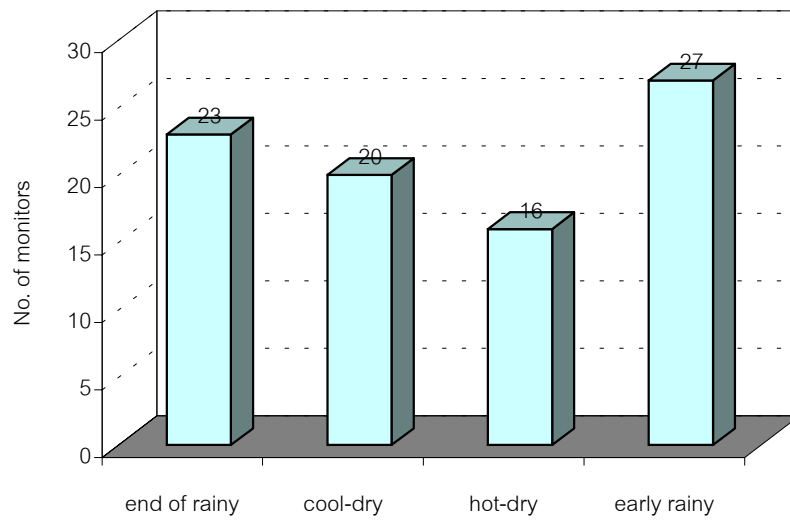


**Table 1** Foraging activity observed at soil surfaces (5 cm.) and in underground monitoring stations (15, 30, 45, 60, 90 cm.).

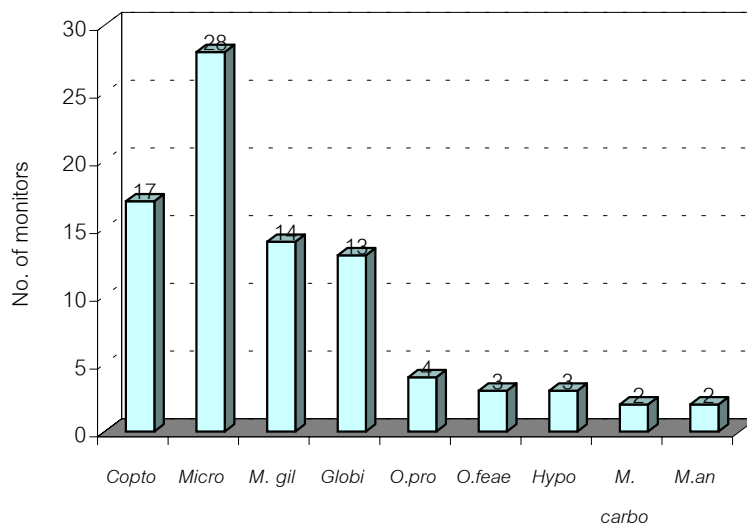
Termite species	First check							Second check							Third check							Fourth check							Total 1 year	
	Monitors infested/depth (cm.)							Monitors infested/depth (cm.)							Monitors infested/depth (cm.)							Monitors infested/depth (cm.)								
	5	15	30	45	60	90	Total	5	15	30	45	60	90	Total	5	15	30	45	60	90	Total	5	15	30	45	60	90	Total		
<i>Coptotermes gestroi</i>	1	-	1	-	1	-	3	1	2	-	-	-	2	5	-	-	-	-	-	-	-	-	4	1	1	1	-	2	9	17
<i>Microtermes obesi</i>	7	1	1	1	-	-	10	7	-	-	-	1	-	8	7	-	-	-	-	-	-	7	3	-	-	-	-	-	3	28
<i>Macrotermes gilvus</i>	3	-	-	-	-	-	3	2	-	-	-	1	1	4	-	1	-	-	-	-	1	4	1	-	-	1	-	6	14	
<i>Globitermes sulphureus</i>	2	-	-	-	-	-	2	1	1	-	-	-	-	2	2	-	1	1	-	-	4	4	-	1	-	-	-	5	13	
<i>Odontotermes proformosanus</i>	2	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	1	-	1	1	-	-	-	-	-	1	4	
<i>Odontotermes feae</i>	1	-	-	-	1	-	2	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	
<i>Hypotermes makhamensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	2	1	-	-	-	-	-	1	3	
<i>Macrotermes carbonarius</i>	1	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	2	2	
<i>Macrotermes annandalei</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	2	2	
	17	1	2	1	2	-	23	11	3	-	-	2	4	20	10	1	1	2	2	-	16	18	2	2	1	2	2	27		

First check = end of rainy season July-October  
 Second check = cool-dry season October-January  
 Third check = hot-dry season January-April  
 Fourth check = rainy season April-July





**Figure 1** Overall number of underground monitors infested by termites at 4 inspection periods.



**Figure 2** Number of underground monitors infested by 9 termite species though out the study.

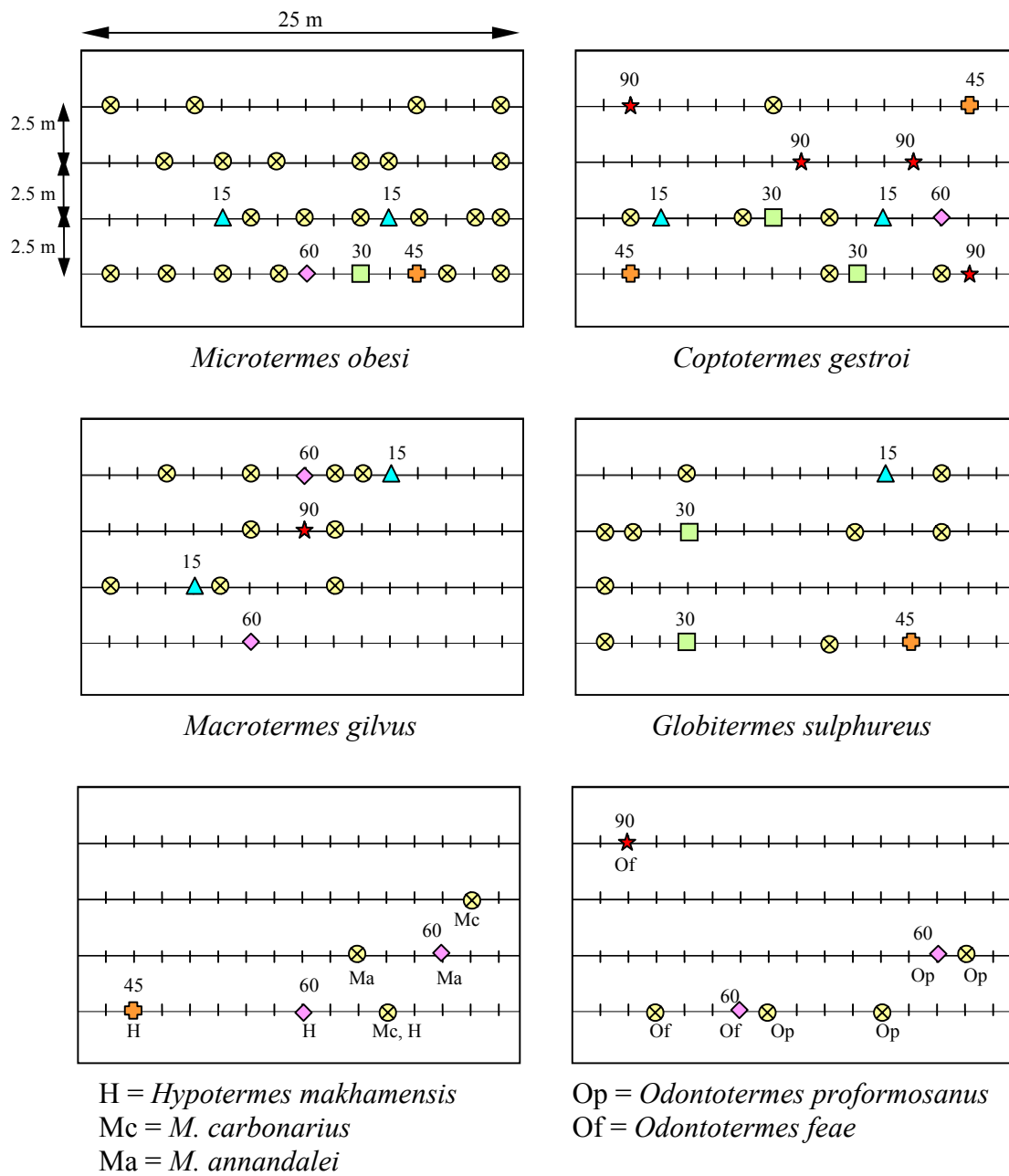
**Table 2** Termite species recorded in the area of the living complexes, Bangkanoon Forest Plantation and the vertical foraging patterns.

Termite species	Frequency of termite activity observed in different foraging depth						
	5 cm.	15 cm.	30 cm.	45 cm.	60 cm.	90 cm.	Total 1 year
1. <i>Coptotermes gestroi</i>	6	2	2	2	1	4	17
2. <i>Microtermes obesi</i>	23	2	1	1	1	-	28
3. <i>Macrotermes gilvus</i>	9	2	-	-	2	1	14
4. <i>Macrotermes carbonarius</i>	2	-	-	-	-	-	2
5. <i>Macrotermes annandalei</i>	1	-	-	-	1	-	2
6. <i>Globitermes sulphureus</i>	9	1	2	1	-	-	13
7. <i>Odontotermes feae</i>	1	-	-	-	1	1	3
8. <i>Odontotermes proformosanus</i>	3	-	-	-	1	-	4
9. <i>Hypotermes makhamensis</i>	1	-	-	1	1	-	3

**Table 3** Foraging activity and degree of damage caused by 12 termite species in building in study area.

Termite species	Foraging activity		Degree of damage in building
	Underground	Aboveground	
1. <i>Microtermes obesi</i>	Very high	Non	-
2. <i>Coptotermes gestroi</i>	High	High	Heavily
3. <i>Macrotermes gilvus</i>	Moderate	Slightly	Slightly
4. <i>Globitermes sulphureus</i>	Moderate	Non	Slightly
5. <i>Odontotermes proformosanus</i>	Slightly	Non	-
6. <i>Odontotermes feae</i>	Slightly	Non	-
7. <i>Hypotermes makhamensis</i>	Slightly	Non	-
8. <i>Macrotermes carbonarius</i>	Slightly	Non	-
9. <i>Macrotermes annadalei</i>	Slightly	Non	-
10. <i>Microcerotermes crassus</i>	Non	Slightly (Arboreal nest)	Slightly
11. <i>Nasutitermes matangensiformis</i>	Non	Slightly (Arboreal nest)	Slightly
12. <i>Cryptotermes thailandis</i>	Non	Moderate	Moderately

Figure 3 Underground foraging patterns at depth of 9 subterranean termite species observed during July 1999- July 2000 in the area of the living complexes at Bangkanoon Forest Plantation.



- \* Foraging depth:
- ⊗ = 5 cm.
  - ▲ = 15 cm.
  - = 30 cm.
  - ⊕ = 45 cm.
  - ◇ = 60 cm.
  - ★ = 90 cm.

## DISCUSSION

### Seasonal trends of the foraging activity underground:

1. First inspections during the end of rainy season (July-October 1999).  
23 of 60 monitoring stations were infested by 7 species of subterranean termites. *Microtermes obesi* showed highest activity (10 hits) followed by *Coptotermes gestroi* and *Macrotermes gilvus* (3 hits), *Globitermes sulphureus*, *Odontotermes feae* and *Odontotermes proformosanus* and the lowest activity were observed in *Macrotermes carbonarius*.
2. Second inspection during cool-dry season (October-January 2000).  
20 of 60 monitoring stations were infested by 5 species of subterranean termites or the over all termite activities were slightly lower than the first inspection. *Microtermes obesi* showed the highest in foraging activity followed by *Coptotermes gestroi* *Macrotermes gilvus*, *Globitermes sulphureus* and *Odontotermes feae*.
3. Third inspection during hot-dry season (January-April 2000).  
16 of 60 monitoring stations were infested by 6 species of subterranean termites or the over all termite activities further decreased. *Microtermes obesi* still showed the highest in foraging activity followed by, *Globitermes sulphureus*, *Hypotermes makhamensis* and the lowest activity recored in *Macrotermes gilvus*, *Macrotermes carbonarius* and *Odontotermes proformosanus*.
4. Fourth inspection during rainy season (April-July 2000).  
27 of 60 monitoring stations were infested by 7 species of subterranean termites or the over all termite activities were highest compared to earlier inspection. *Coptotermes gestroi* showed highest activity followed by *Macrotermes gilvus*, *Globitermes sulphureus*, *Microtermes obesi*, *Macrotermes annandalei* and *Odontotermes proformosanus* as well as *Hypotermes makhamensis*.

Results indicated that the foraging activities of subterranean termites in rainy season was the highest and slightly decreased at the end of rainy season, in cool-dry season the activity further decreased while, the lowest activities were observed in hot-dry season. Climatic factors especially rain fall that declined soil temperature and increase soil moisture and relative humidity might influenced the foraging patterns and increasing foraging activity of subterranean termites (Collin *et al.*, 1973, La Fage *et al.*, 1976 and Black and Wood, 1989).

Comparing the foraging activities through out the year between different termite species found in the living complexes at Bangkanoon Forest Plantation (Table 1 and Figure 2) revealed that *Microtermes obesi* showed the highest in foraging activity followed by *Coptotermes gestroi*, *Macrotermes gilvus*, *Globitermes sulphureus*, *Odontotermes proformosanus*, *Odontotermes feae* and *Hypotermes makhamensis*, the lowest activity was observed in *Macrotermes carbonarius* and *Macrotermes annandalei*.

### Depth of foraging patterns

Results in Table 2 and Figure 3 indicated that foraging pattern of all termite species in the living complexes at Bangkanoon Forest Plantation higher foraging at soil surface than underground. Maximum depth of foraging activity of *Coptotermes gestroi*, *Macrotermes*

*gilvus* and *Odontotermes feae* could reach the depth of 90 cm. which *Microtermes obesi*, *Hypotermes makhamsensis* and *Odontotermes proformosanus* can reached the maximum depth of 60 cm. and *Globitermes sulphureus* can foraged to the depth of 45 cm. under soil surface. The variation on depth of foraging activity might due to the availability of food source and soil moisture requirement of the particular species.

Results from Table 3 should be further explained that although no infestation by *Microtermes obesi* was found within the building studied, random surveyed of the area always revealed slightly infestation by this species in wood or branches left on ground the same as *Globitermes sulphureus* which caused severe damage to tree stumps, fence post and outdoor wooden materials on ground in the study area.

*Cryptotermes thailandis* is the dry-wood termites usually found attacking timber and dead branches along the coastal area and also wooden house made by lumber from durian tree in swamp forest in Narathiwat.

## CONCLUSION

1. Totally 11 species of subterranean termites (*Coptotermes gestroi*, *Microtermes obesi*, *Macrotermes gilvus*, *Macrotermes carbonarius*, *Macrotermes anandalei*, *Odontotermes feae*, *Odontotermes proformosanus*, *Hypotermes makhamsensis*, *Globitermes sulphureus* and *Microcerotermes crassus* and *Nasutitermes matangensiformis* and 1 species of drywood termite (*Cryptotermes thailandis*) were found distributed underground and aboveground in the complexes of Bangkanoon Forest Plantation, Southern Thailand.
2. *Coptotermes gestroi* is by far the most destructive subterranean species attacking building constructions followed by Dry wood termite; *Cryptotermes thailandis* and *Macrotermes gilvus* is a minor house-infesting termite in this area.
3. *Microtermes obesi* showed highest foraging activity followed by *Coptotermes gestroi* *Macrotermes gilvus* and *Globitermes sulphureus*.
4. Underground foraging activity of subterranean termites increased in rainy season and declined in hot-dry season.

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