

## **An Evaluation of Termite Attack Incidence on Araucaria Plantation Forest in Teluk Bahang, Penang**

by

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### **Abstract**

A study was carried out to evaluate the incidence of termite attack on an *Araucaria cunninghamii* plantation at Teluk Bahang Forest Park (TBFP), Penang. The hilly plantation area was surveyed to determine the composition of termite species that present in the area. Termite specimens were sampled on the standing *Araucaria* trees, underground monitoring stations, fallen logs, forest litters and termite mounds. There are 7 species of termites from 6 genera identified; *Coptotermes curvignathus*, *Schedorhinotermes medioobscurus*, *Schedorhinotermes malaccensis*, *Odontotermes sarawakensis*, *Parrhinotermes aequalis*, *Macrotermes malaccensis* and *Hospitalitermes hospitalis*. A total of 289 *Araucaria* trees were inspected for sign of termite attack. Termite infestation was mainly indicated by the present of mud trail on the tree trunk or an extensive soil cover at the base of the tree trunk. The most dominant termite species infesting the *Araucaria* trees is *Coptotermes curvignathus* accountable for 74 % of the overall infestation. *Schedorhinotermes medioobscurus* and *Odontotermes sarawakensis* were found infesting mainly on dead trees or tree stumps. The total incidence of infestation in the *Araucaria* plantation forest in Teluk Bahang is at approximately 21.5%.

**Key words:** Termite diversity, *Araucaria* plantation forest, *Coptotermes curvignathus*, Teluk Bahang

### **Introduction**

Termites in natural tropical ecosystem serve as an important decomposing agent of organic matter (Wood and Sand, 1978). Their feeding and tunneling activity improve soil porosity, aeration, stability and nutrient enrichment in the soil as they facilitate C mineralization and N fixation (Lee *et al.* 2003, Yamada *et al.* 2005, 2006, Gold *et al.* 1999). A total of 175 species from 42 genera of termites were recorded in Peninsular Malaysia (Tho 1992).

However, termites are generally known as an economically important pest. Su (2003) reported an estimation of more than USD 20 billion annually used for termite control and repair cost of termite damages around the world. In Malaysia, the cost for termite control in 2003 was at USD 10-12 million and the repair cost was estimated to be much higher (Lee 2004). The genus *Coptotermes* was listed as the most significant pest species that responsible for almost 85% of the total infestation in Malaysia (Lee *et al.* 2007).

Apart being known as structural pest, termites also found infesting and destroying crops and trees in plantation as well as in agro-forestry area. Within a disturbed ecosystem, natural enemy such as ants and competition from other termite species usually absent, causing specific species of termite to survive very

well. In a number of studies, the severity and high incidence of termite attack in Malaysian conifer plantations has been highlighted (e.g. Benedict 1971, Thapa and Shim 1971, Tho 1974, Abdul Hafiz and Abu Hassan 2008). The *Coptotermes curvignathus* Holmgren, a key pest species of plantation forest kills and damages trees of virtually any age (Tho 1974). Building structures within the area are also prone to termite infestation especially those made up of wooden material. A site survey was conducted to evaluate the severity of infestation on a conifer (*Araucaria cunninghamii*) plantation at Teluk Bahang Forest Park, Penang and gathering information related to the infestation.

### Materials and methods

This study was conducted in the Teluk Bahang Forest Park (TBFP) in Penang that covers an area of 32 hectares of recreational area, building structures, plantation forest of *Araucaria cunninghamii* as well as the natural tropical rainforest. Located at 5° 26' 47" N 100° 13' 06" E, TBFP is about 24 km away from the Georgetown. It was established in 1974 and is part of the Teluk Bahang Recreational Forest which covers about 873 hectares. The *Araucaria* plantation area however, only covers a small portion of the TBFP, approximately 5 acres.

Termite specimens were sampled on the standing *Araucaria* trees, underground monitoring stations, fallen logs, forest litters and termite mounds within the plantation area. Each *Araucaria* tree was inspected for the sign of termite infestations and observation the condition of the trees was carried out. The number of *Araucaria* trees and their condition were recorded. The sample of termite species found were collected and taken back to the laboratory for identification using key provided by Tho (1992) and Thapa (1981).

### Result and discussion

**Table 1.** Termite species and the location they were collected.

Termite Sp.		Locations				
		A	B	C	D	E
1.	<i>Coptotermes curvignathus</i>	X	X			
2.	<i>Schedorhinotermes medioobscurus</i>	X	X			X
3.	<i>Schedorhinotermes malaccensis</i>		X			
4.	<i>Parrhinotermes aequalis</i>		X			X
5.	<i>Macrotermes malaccensis</i>		X	X		
6.	<i>Hospitalitermes hospitalis</i>				X	
7.	<i>Odontotermes sarawakensis</i>	X	X			

Note: A= *Araucaria* tree; B= Underground Monitoring Stations; C= Mound; D= Open foraging; E= Plant residues

There are 7 species of termite from 6 genera found within the plantation area (Table 1). Three species were found infesting the *Araucaria* trees therefore considered as pest species. The dominant species are the *Coptotermes curvignathus*. About 46 of the infested trees were infested by the *Coptotermes curvignathus* while 13 trees were infested by *Schedorhinotermes medioobscurus*. There were also trees infested by *Odontotermes sarawakensis* (3 trees) (Table 2). There were 15 pre-installed underground

monitoring stations (UMS) were also utilized in this study. All of the termite species were found infesting the UMSs except for the *Hospitalitermes hospitalis*.

*Hospitalitermes hospitalis* were found foraging openly within the area. *Hospitalitermes* sp. is commonly found in tropical forest of Peninsular Malaysia foraging in long columns on the forest floor, tree trunks and canopies. They feed on lichen in which the workers roll the foods into small balls and carry them back to the nest (Chuah *et al.* 1986, Tho 1992). *Macrotermes malaccensis* mound was also found within the plantation area and was excavated for sample collection.

Previous study on termite diversity in TBFP by Aiman Hanis *et al.* (2010) reported 16 species of termite from 11 genera found. The study however covered area with human activity and disturbances within TBFP, a larger area which included the *Araucaria* plantation area. Having only to focus on the plantation area, this study were able to include 3 more species absent from the list provided by Aiman Hanis *et al.* (2010). They were *Schedorhinotermes malaccensis*, *Parrhinotermes aequalis* and *Macrotermes malaccensis*.

#### **Incidence of infestation**

The total number of *Araucaria cunninghamii* trees in the area were 289. This plantation area is believed to have more 400 trees planted during the early days. This assumption was based on the fallen tree trunks and the empty spaces between the remaining trees. However there are no record that can support this assumption. Heavy termite infestation in the area may have caused the trees to die. Tho (1974) reported that exotic trees are more susceptible to termite infestation and in Malaysia, most of the exotic conifer trees such as *Araucaria cunninghamii*, *Araucaria hunsteinii*, *Pinus caribaea* and *Pinus patula* are under threat of termite attack.

Of all the trees, only 210 are still living and assumed to be free of infestation except for 4 trees which were lightly infested by *Coptotermes curvignathus*. These infestation may be new or due to localized infestation. A tree was considered half-dead when the shoot of the tree is dead while dead tree is considered dead when it no longer bear green leaves or living branches. All the dead trees and tree stumps were actively infested by termites (Table 2).

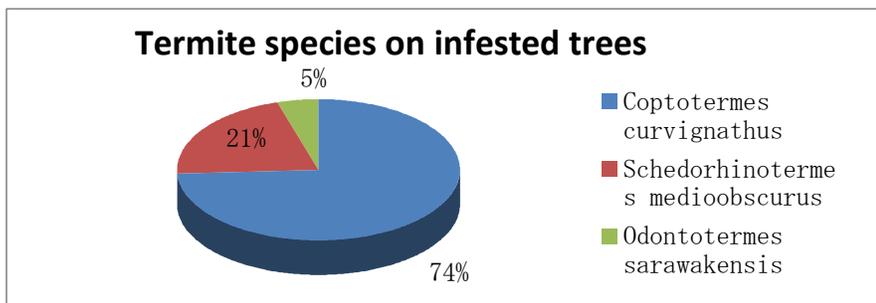
**Table 2.** The conditions of the *Araucaria* trees and termite species infesting the trees.

Tree conditions	Number of individual	Termite species
Living tree	210	No symptom (206) <i>Coptotermes curvignathus</i> (4)
Half – dead	34	No symptom (21) <i>Coptotermes curvignathus</i> (12) <i>Schedorhinotermes medioobscurus</i> (1)
Dead	15	<i>Coptotermes curvignathus</i> (11) <i>Schedorhinotermes medioobscurus</i> (4)
Tree stump	30	<i>Coptotermes curvignathus</i> (19) <i>Schedorhinotermes medioobscurus</i> (8) <i>Odontotermes sarawakensis</i> (3)

*Coptotermes curvignathus* was the most dominant pest species at this *Araucaria cunninghamii* plantation area found infesting about 74% of the total number of infested trees (Figure 1). This species

was found at all 4 stages of tree conditions (Table 2). They are able to cause fatality and damages on trees of any age (Tho 1974). *Coptotermes curvignathus* is a common and most important pest species of agriculture and plantation forest in Malaysia. A survey of termite attack in conifer plantation reported by Tho and Kirton (1998) stated that *C. curvignathus* as the only termite species attacking the trees. None of the living trees was infested by *Schedorhinotermes* and only one occurrence was observed on a half-dead tree indicating that this species may not infest living tree.

**Figure 1.** Percentage of infestation of three termite species showing dominancy of *C. curvignathus*.



At the time of this study, about 62 *Araucaria* trees were confirmed to be infested by termite by the presence of mud trails and soil covers on the tree trunks and in which the presence of termite on the trees were detected. The infestation is about 21.5% of the total trees in the area (Table 3). Extensive soil plastering on the base of the tree trunks is the common indication of severe *C. curvignathus* infestation (Tho and Kirton, 1998).

However 21 more of the half-dead trees were suspected to be infested although no common sign of infestation can be found. Half-dead tree is a possible sign that termite has damaged the vascular system of these trees, a mode of infestation describe by Kirton *et al.*(1999) as heartwood infestation. The only way to confirm this is by chopping down the trees. At least 5 of the half dead trees were cut down and all five were confirmed to be infested by *Coptotermes curvignathus*.

**Table 3.** Percentage of termite infestation.

No. of <i>Araucaria</i> trees and tree stumps	289
No. of confirmed infested trees	62
No. of tree suspected to be infested	21
Percentage of confirmed infestation	21.5%

This figure on percentage of infestation may be greater as it is possible that newly infested tree by mean of heartwood infestation may yet to show symptom of infestation in the presumably healthy living trees. In some exotic plantation of *Araucaria* and *Pinus* in Malaysia, up to 100% of trees can be attacked by *Coptotermes* species (Abdul Hafiz and Abu Hassan 2008).

### Conclusion

There were 7 species of termite found within the *Araucaria cunninghamii* plantation area in Teluk Bahang Forest Park (TBFP). At least 3 species in this study namely *Coptotermes curvignathus*,

*Schedorhinotermes medioobscurus* and *Odontotermes sarawakensis* were recognized as key pest species infesting *Araucaria* trees with *C. curvignathus* as the most dominant species. Degree of infestation incidence was at 21.5% of the total *Araucaria* trees present in the area.

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