Challenges to Subterranean Termite Management of Multi-Genera Faunas In Southeast Asia and Australia

by

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ABSTRACT

Termites are an important group of insect pests in the tropical Asia Pacific region. Due to the high diversity of termite species in this region, it is common to find several termite pest species co-existing and infesting buildings and structures. In Malaysia and Singapore, 12 species of subterranean termites from 7 genera (*Coptotermes*, *Macrotermes*, *Microtermes*, *Globitermes*, *Odontotermes*, *Schedorhinotermes* and *Microcerotermes*) can be readily found in and around buildings and structures, particularly in suburbia and rural settlements. Similar observations with species in the genera *Coptotermes*, *Microcerotermes*, *Macrotermes*, *Hypotermes* and *Odontotermes* are also recorded in urban and rural Thailand. Termites from 3 to 6 genera (*Mastotermes*, *Coptotermes*, *Schedorhinotermes*, *Heterotermes*, *Nasutitermes* and *Microcerotermes*) may be found co-existing as structural pests in Australia with the highest number of genera in the tropical north of the country. Since the introduction of baiting in Malaysia, secondary pest species are more frequently encountered. Following elimination of the principal pest species (*Coptotermes* spp.) with bait, it is not uncommon to find species from other genera such as *Macrotermes* and *Schedorhinotermes* infesting the same building or structure after several months. Most of these species, particularly those belonging to genera such as *Macrotermes*, *Globitermes* and *Odontotermes* from the higher termite (Termitidae), however, do not respond well to baits with paper-based matrices. Options for managing multiple genera termite pest faunas in the tropics are discussed.

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Key words: Termite management, multi-genera, control strategies, Malaysia, Singapore, Thailand, Australia.

INTRODUCTION

Termites are an important group of insect pests in the urban environment (Su & Scheffrahn 2000; Lee 2002a). In the Northern Hemisphere (eg. US, Europe and Japan), termite management often focuses on a few genera of termites which belong to the family Rhinotermitidae (Pearce 1997). These rhinotermitids include the genera *Reticulitermes*, *Coptotermes* and *Heterotermes*. It is normally rare to find more than one genus infesting a structure in this region. Among the various termite management systems used, baiting has been relatively successful against the rhinotermitids.

However, around the Equator and in the Southern Hemisphere there is a wider range of pest termite genera consisting of both rhinotermitids and non-rhinotermitids. In many instances, a structure can be attacked simultaneously by more than one species or in succession by different species (Lee 2002a). Newer technologies such as baiting have limited success against non-rhinotermitids in these regions. In addition, when baiting reduces/eliminates populations of rhinotermitids such as *Coptotermes*, other species which are normally considered secondary pest species or non-pest species, can become important and enter buildings (Lee 2002a; Lee 2002b; Kirton & Azmi 2005). This paper discusses termite management issues in countries with multi-pest genera based on the situation in Malaysia, Singapore, Thailand and Australia.

Table 1. Termite pest species found in infested premises in Northern Peninsular Malaysia (n = 132).

Species	Percentage (%)
Coptotermes spp.	84.1
Macrotermes gilvus	6.0
Schedorhinotermes medioobscurus	3.8
Microcerotermes crassus	2.3
Nasutitermes javanicus	2.2
Odontotermes sp.	0.8
Globitermes sulphureus	0.8

Common species and termite infestations in Malaysia and Singapore

In Malaysia and Singapore, termite genera that can be found in buildings and structures include *Coptotermes*, *Schedorhinotermes*, *Microcerotermes*, *Macrotermes*, *Nasutitermes*, *Globitermes* (Ngee & Lee 2002; Lee *et al.* 2003) and *Odontotermes*. Among

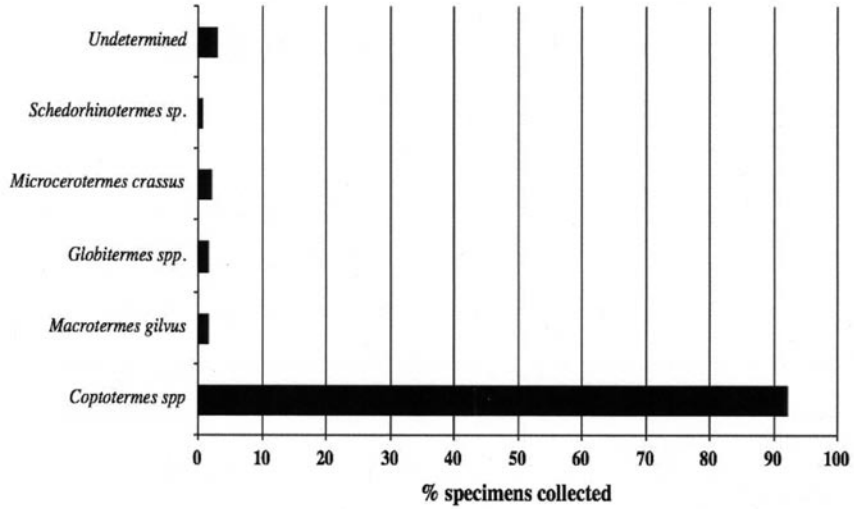

Fig. 1. Termite pest species found in infested premises in Singapore Island.

these genera, infestation caused by *Coptotermes* spp. is most prevalent and accounts for almost 85% (Table 1, Fig. 1) of the total. *Coptotermes gestroi* is the most common termite pest species in buildings and structures (Kirton & Brown 2003). Another species of *Coptotermes*, *C. curvignathus* may be found in premises built on ex-agricultural land or plantations, particularly rubber, oil palm and coconuts. In addition, it is also common to find several species of termite simultaneously infesting a building at any one time.

Table 2. Termite pest species found in infested houses in Thailand (n = 200) (Sornnuwat *et al.* 1996a).

Species	Urban	Rural
Coptotermes gestroi	90	22
Coptotermes kalshoveni	3	-
Coptotermes premrasmii	1	1
Coptotermes travians [havilandi]	4	-
Schedorhinotermes medioobscurus	2	1
Globitermes sulphureus	-	7
Macrotermes gilvus	-	4
Microtermes pakistanicus	-	2
Microtermes anandi	-	2
Microcerotermes crassus	-	42
Odontotermes proformosanus	-	8
Odontotermes longignathus	-	6

Common species and termite infestations in Thailand

In Thailand, a similar situation is commonly observed. Table 2 shows the termite species found in infested residential premises in rural and urban areas of Thailand. This study recorded a total of 13 species belonging to the families Rhinotermitidae (5 species) and Termitidae (8 species). The most common infestation in the

urban area was caused by *C. gestroi* (Sornnuwat *et al.* 1996a, 1996b, 1996c), while houses in the rural area were predominantly infested by *Microcerotermes crassus* (Sornnuwat *et al.* 1996a). Also in Thailand: termites of several species can infest a building or structure simultaneously (Figs. 2 & 3). The situation is more evident in rural areas with a higher diversity of termite species.

Common species and termite infestation in Australia

In Australia, a total of 7 genera of termites can be found in buildings and structures (Watson & Abbey 1990, Lenz 2002, Australian Standard 2000) (Table 3). The common ones, *Coptotermes* and *Schedorhinotermes*, are dis-

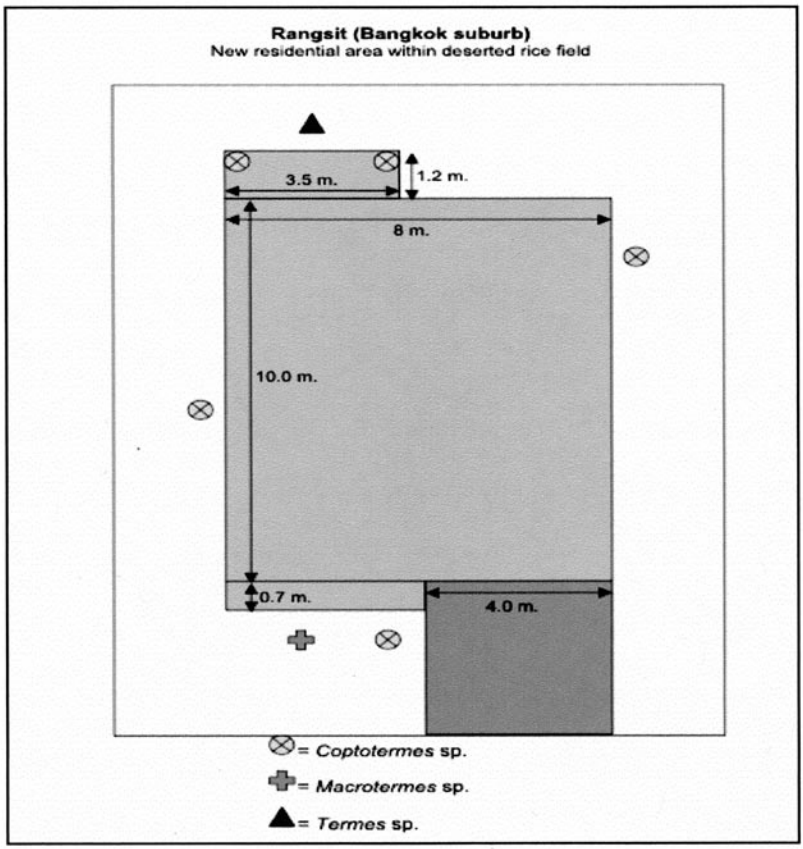

Fig. 2. Multi-genera termite infestation in a residential area in Rangsit, Bangkok, Thailand.

tributed over much of mainland Australia, while *Mastotermes* is important in the tropical region of Australia.

Challenges to management of multi-genera faunas

One major challenge in managing multi-genera termite faunas, especially with the use of termite baits, is re-infestation by higher termite species after the rhinotermitids have been eliminated or suppressed. As mentioned earlier, to date it is not possible to manage these non-rhinotermitids effectively with

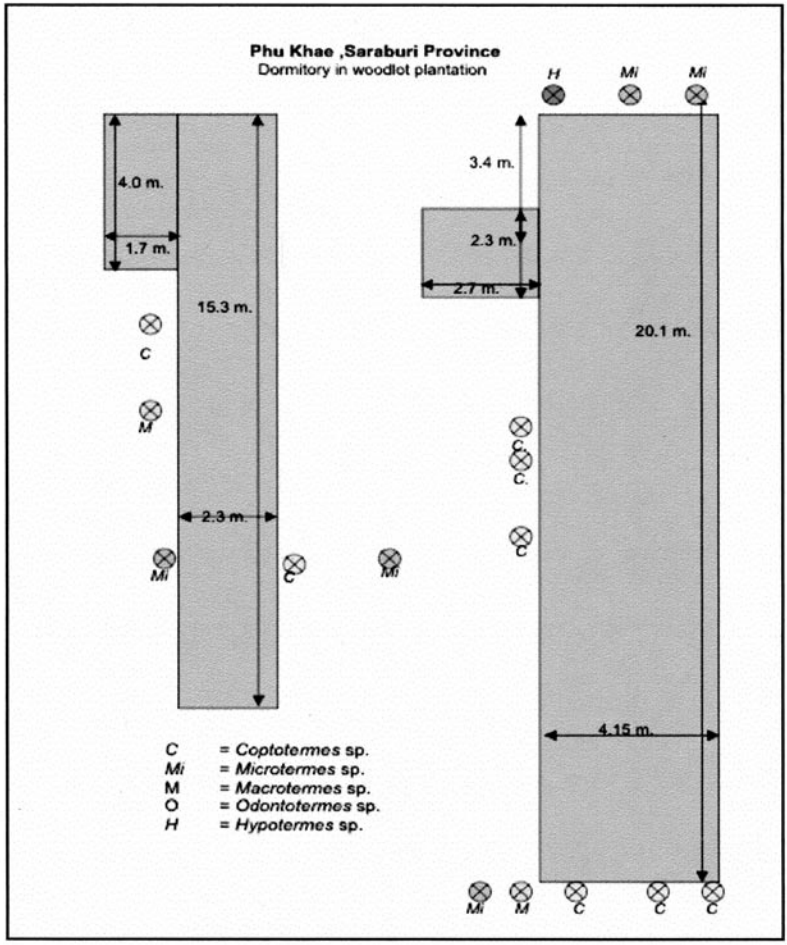

Fig. 3. Multi-genera termite infestation in Saraburi, Thailand.

Table 3. Australian termite pests in buildings and structures.

Genus (no. pest species)	Distribution
Mastotermes (1)	In the tropics south to the Tropic of Capricorn, large populations
Coptotermes (4)	Almost all of mainland Australia.
Schedorhinotermes (5)	All of mainland Australia (mainly east coast and tropics), except the very souther parts. On the east coast, it is becoming more common, in some areas replacing *Coptermes* as the primary structural pest.
Heterotermes (10)	Widely distributed, 3 species in the tropics.
Microcerotermes (sev.)	Localized pest can appear in bait stations after *Coptotermes* is eliminated/ suppressed.
Nasutitermes (3)	2 arboreal nesters on the east coast, and 1 mound-builder across the South.
Porotermes (1)	Localized pest in South east, specific requirements.

Table 4. Succession of termite genera after suppression/elimination of *Coptotermes* spp. by baits in Malaysia (2001 - 2004) (n = 82 premises)

Species	Percentage (%)
Coptotermes	83.0
Schedorhinotermes	7.3
Macrotermes	4.9
Globitermes	1.2
Nasutitermes	1.2
Microcerotermes	2.4

baits. Earlier, Lee (2002b) reported the difficulty of managing *M. gilvus* that infested residential premises which had been previously baited for *Coptotermes* infestation. *M. gilvus* was found in the house as early as two months after the suppression or elimination of *Coptotermes*. Table 4 shows the succession of termite genera after suppression or elimination of *Coptotermes* spp. with baits. Although re-infestation by *Coptotermes* is relatively high (almost 85%), pest control operators find it difficult to explain to home owners that baits were only effective against *Coptotermes* and *Schedorhinotermes*. There have been many incidences in Malaysia where pest control operators had to resort to chemical spraying to repel these non-rhinotermitids. However, it is only seen as a temporary measure, as re-occurrence of these higher termites in other locations of the premises can be observed within a very short period of time.

Management strategies against multi-genera termite fauna

Current termite baits are most effective against *Coptotermes* and *Schedorhinotermes*. However, in Malaysia, for example, it takes a minimum of a month to suppress/eliminate a colony of *Coptotermes* and a minimum of 6 months for a colony of *Schedorhinotermes*. Baits are generally not effective against non-rhinotermitids (higher termite genera) such as *Macrotermes*, *Globitermes*,

Microtermes, etc. Because of this, Malaysian pest control operators normally sell baiting contracts only for control of *Coptotermes*. Whenever non-rhinotermitids are encountered, chemical soil treatment is carried out. In addition, where a structure is infested by higher termites following elimination of a previous *Coptotermes* infestation through baiting, pest control operators will embark on chemical soil treatment.

The most commonly used termiticides are: chlorpyrifos, fipronil and imidacloprid (Malaysia & Singapore); fipronil, imidacloprid, chlorfenapyr, fenoxycarb and fenvalerate (Thailand); and bifenthrin, fipronil, imidacloprid (Australia). For the management of *Mastotermes* in Australian tropics, standard chemical soil barriers require higher rates. All preventative termite management systems in tropical Australia have to be evaluated against *Coptotermes* and *Mastotermes* to gain official approval, but only against *Coptotermes* for the rest of the country (Lenz 2002).

For active infestations in tropical Australia, fipronil applications are replacing other methods; however, treatments also have to focus on surrounding areas targeting nest sites etc. due to the diverse pest species community (eg. vegetated area, tree trunks [for *Mastotermes*] and visible nests [*Microcerotermes*]). In Malaysia, Singapore and Thailand, it is essential to excavate the mounds of the higher termite species found along the perimeter of the baited homes to reduce the chance of these species infesting the premises upon suppression or elimination of *Coptotermes* species.

On the research front there is a serious need to determine the underlying reasons behind the lack of effectiveness of chitin synthesis inhibitors used in bait matrices against the higher termites. It has been found that some of these non-rhinotermitids feed on the baits without any visible detrimental effect to the colony (Ngee *et al.* 2004). In addition, the lack of palatability of paper-based bait matrices to *M. gilvus* is also a major issue to the pest control industry in South East Asia. These issues warrant urgent investigations.

SUMMARY & CONCLUSION

Multi-genera pest termite faunas are not uncommon in Malaysia, Singapore, Thailand and Australia. Suppression/ elimination of one species may quickly result in re-infestation by the same species or by a succession of different species/genera. This is particularly evident upon suppression/elimination

of *Coptotermes* with baits. Overall, managing multi-genera termite faunas in the tropical region can best be done by taking the biology of different target species into account, and by adopting several management strategies.

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