

Survey of Natural Parasitism of *Macrotermes gilvus* (Termitidae: Macrotermitinae) by *Misotermes mindeni* (Diptera: Phoridae) in Malaysia

by

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Abstract

A survey of *Macrotermes gilvus* (Hagen) (Termitidae: Macrotermitinae) mounds parasitized by *Misotermes mindeni* (Disney & Neoh) (Diptera: Phoridae) was conducted between September 2009 and September 2010 in Malaysia covering the states of Penang, Selangor, Kuala Lumpur, Terengganu, and Sarawak. Only 107 (13.5%) of 792 *M. gilvus* mounds were found parasitized by *M. mindeni*. No infected colony was reported in Selangor, Kuala Lumpur, Terengganu and Sarawak. The highest parasitism frequencies were recorded in Main Campus of USM (24.5%) followed by Bayan Lepas (21.1%) and Balik Pulau (12.0%), while the lowest frequency was recorded from Gelugor (4.0%). All the parasitized colonies in all study sites were classified as active, except in Main campus of USM, in which, 82.7% parasitized colonies were classified as active and the remaining 17.3% were classified as less active. Parasitized mound was significantly higher than unparasitized mound. There was no significant difference in mound diameter between parasitized and those of the unparasitized ones.

Key words: distribution, infestation levels, height, parasitism frequencies

Introduction

Macrotermes gilvus (Hagen) (Termitidae: Macrotermitinae) is a mound-building termite widely distributed in Southeast Asia, particularly in Thailand, Indonesia, Malaysia, and Philippines, (Roonwal 1970). Since 1930's, several species of phorid flies had been documented as endoparasitoids of *M. gilvus*. These include *Misotermes exenterans* Schmitz (Schmitz 1938, cited in Disney 1994) and *Palpiclavina kistneri* Disney (Disney and Kistner 1989, 1992, 1997). The larvae of *M. exenterans* were reported in the soldiers of *M. gilvus* (Disney 1986, Disney & Darlington 2000). In 2009, Neoh & Lee (2010) found a new species of phorid flies, *Misotermes mindeni* Disney & Neoh (Diptera: Phoridae) parasitizing the major soldier of the same host species. The morphological characteristics of the adult flies and the immature stages were first described by Disney et al. (2009) and Foo et al. (2011), respectively.

Host selection process is necessary for successful parasitism (Vinson 1976). The selection of hosts by adult parasitoids may be affected by the host factors such as nutritional status, size, and age (Vinson 1976). This study was conducted to show the distribution of parasitized mounds of *M*

gilvus, to determine the parasitism frequencies, and to investigate the effect of host colony condition in host colony selection.

Methods and materials

Study sites. Survey of parasitized mounds of *M. gilvus* was carried out in Malaysia, covering the states of Penang, Selangor, and Kuala Lumpur (West Coast of Peninsular Malaysia), Terengganu (East Coast of Peninsular Malaysia), and Sarawak (East Malaysia). Following locations were chosen as study sites:- In Penang: (1) Main Campus of Universiti Sains Malaysia (USM) (5° 21' N, 100° 18' E) (n = 343); (2) Gelugor (5° 22' N, 100° 18' E) (n = 50); (3) Bayan Lepas (5° 17' N, 100° 15' E) (n = 71); and (4) Balik Pulau (5° 22' N, 100° 12' E) (n = 50). In Selangor: (1) Serdang (2° 59' N, 101° 43' E) (n = 24); and (2) Kota Kemuning (2° 59' N, 101° 32' E) (n = 15). In Kuala Lumpur: (1) Kepong (3° 14' N, 101° 38' E) (n = 21). In Terengganu: (1) Kuala Berang (5° 04' N, 102° 59' E) (n = 50). In Sarawak: (1) Kuching (1° 32' N, 110° 20' E) (n = 28); (2) Samarahan (1° 27' N, 110° 30' E) (n = 28); (3) Sri Aman (1° 14' N, 111° 28' E) (n = 28); (4) Betong (1° 25' N, 111° 36' E) (n = 28); (5) Sarikei (2° 07' N, 111° 31' E) (n = 28); (6) Sibul (2° 19' N, 111° 50' E) (n = 28). The study was conducted between September 2009 and September 2010 and a total of 792 colonies were surveyed.

Parasitized mound categorization. To determine parasitism, we broke up the *M. gilvus* mound by digging a trench around the base of the nest. Sideways pressure was applied and the entire mound casing was removed. Termites were considered parasitized when major soldiers and presoldiers possessed a rounded head capsules with remarkably short mandibles or when there was a brown dot on the head capsules, thorax, or abdomen of fourth larval instars (L4s) (Neoh & Lee 2010). Two randomly chose parasitized termites were dissected and the larval parasitoid was identified based on Foo et al. (2011). The colonies were classified as active (mounds that were repaired by termites within 1–3 days) and less active (mounds that were not repaired by termites within 1–3 days and sometimes were seen overgrown with vegetation). The mound size (height and diameter) was measured before excavation.

Statistical analysis. Mound size of the unparasitized and those that were parasitized was compared using Student *T*-test (SPSS version 12.0, Inc., Chicago, IL).

Results and discussion

Table 1 shows number of surveyed and parasitized colonies in each study sites. Only 107 (13.5%) of 792 *M. gilvus* mounds were found parasitized by *M. mindeni*. No infected colony was reported in Selangor, Kuala Lumpur, Terengganu, and Sarawak. The highest parasitism frequency was recorded in Main Campus of USM, 24.5% (84 of 343 surveyed mounds) (Fig. 1). The lowest parasitism frequency was recorded in Gelugor, 4.0% (2 of 50 surveyed mounds) (Fig. 1). Our present result was in contrast with the finding by Neoh & Lee (2010) as they reported that parasitism frequencies in Bayan Lepas were much higher than Main Campus of USM, 73% and 23%, respectively.

Table 1. Number of surveyed and parasitized colonies in each study sites.

	Study sites	Number of surveyed colonies	Number of parasitized colonies
Penang	Main Campus of USM	343	84
	Gelugor	50	2
	Bayan Lepas	71	15
	Balik Pulau	50	6
Selangor		39	0
Kuala Lumpur		21	0
Terengganu		50	0
Sarawak		168	0
	TOTAL	792	107

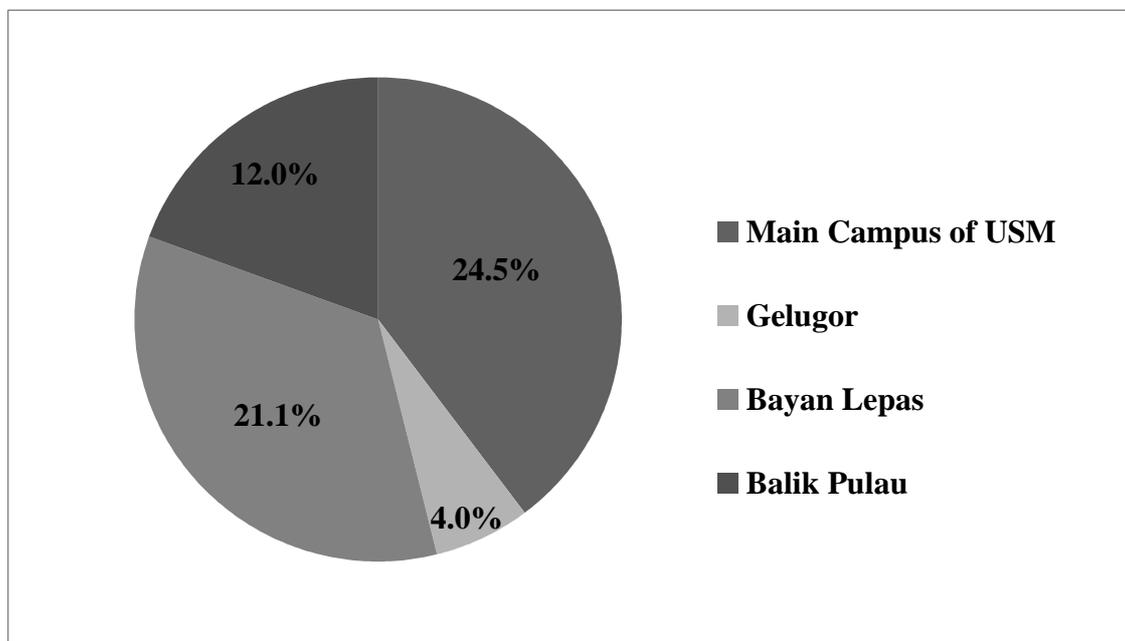


Fig. 1. Frequencies of parasitism (in percentage) in each study sites.

All the parasitized colonies in other study sites were classified as active, except in Main Campus of USM, in which, 67 of 81 (82.7%) parasitized colonies were classified as active and the remaining 14 (17.3%) were classified as less active. This shows that parasitoids were more attracted to the healthy colonies for better growth and development for their offspring.

Parasitized mounds were significantly higher than the unparasitized mounds ($t = 2.259$, d.f. = 341, $p < 0.05$), with an average of 42.20 cm ($n = 84$, range = 10–110 cm) for parasitized mounds and 35.78 cm ($n = 259$, range = 2–130 cm) for the unparasitized mounds. There was no significant difference in mound diameter between unparasitized and parasitized mounds. This indicates that mound size, particularly height may affect the selection of the host colony by the adult parasitoids.

Conclusion

In conclusion, this study provides information on the distribution of *M. gilvus* mounds infected by *M. mindeni*, parasitism frequencies, and the effect of host mound size on host colony selection by the adult parasitoids.

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