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SURVEY OF TERMITE DIVERSITY IN PANTAI ACHEH FOREST RESERVE, PENANG ISLAND, MALAYSIA

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Abstrak: Satu tinjauan awalan untuk menentukan diversiti spesies anai-anai di Hutan Simpanan Pantai Acheh (PAFR) telah dijalankan sempena satu ekspedisi saintifik (anjuran bersama Persatuan Pencinta Alam Malaysia, Universiti Sains Malaysia dengan kerjasama Jabatan Perhutanan Pulau Pinang, Jabatan Hidupan Liar Pulau Pinang dan Institut Penyelidikan Perikanan Pulau Pinang) yang berlangsung dari 15-23 April 2000. Serangga dikutip daripada kayu yang terjatuh daripada pokok, kumpulan daun gugur, tinggalan lumpur, dan lain-lain di beberapa lokasi di PAFR. Kami telah menjumpai sejumlah 24 spesies anai-anai tanah yang berada dalam 14 genus (*Coptotermes, Schedorhinotermes, Termes, Macrotermes, Microtermes, Odontotermes, Bulbitermes, Longipeditermes, Hospitalitermes, Subulioiditermes, Oriensubulitermes, Nasutitermes, Globitermes* dan *Microcerotermes*) dan 5 subfamili (Coptotermitinae, Rhinotermitinae, Termitinae, Macrotermitinae dan Nasutitermitinae). Tiga spesies yang dijumpai merupakan rekod baru di Semenanjung Malaysia, iaitu *Schedorhinotermes javanicus* Kemner, *Schedorhinotermes tarakensis* (Oshima), dan *Macrotermes latignathus* Thapa. Di samping itu, *Macrotermes ahmadi* Tho juga dijumpai buat kali pertama di kawasan tanah rendah di Semenanjung Malaysia.

Abstract: A preliminary survey to determine the diversity of termite species in Pantai Acheh Forest Reserve (PAFR) was initiated in conjunction with a scientific expedition (jointly organized by the Malaysian Nature Society, Universiti Sains Malaysia, in collaboration with Penang State Forestry Department, Penang State Wildlife Department and Fisheries Research Institute of Penang) from 15-23 April 2000. The insects were collected from fallen logs, leaf litters, mud trails, etc. in several locations in PAFR. We found a total of 24 species of subterranean termites which belong to 14 genera (*Coptotermes, Schedorhinotermes, Termes, Macrotermes, Microtermes, Odontotermes, Bulbitermes, Longipeditermes, Hospitalitermes, Subulioiditermes, Oriensubulitermes, Nasutitermes, Globitermes* and *Microcerotermes*) and 5 subfamilies (Coptotermitinae, Rhinotermitinae, Termitinae, Macrotermitinae and Nasutitermitinae). Of interest, 3 species were new records to Peninsular Malaysia, i.e. *Schedorhinotermes javanicus* Kemner, *Schedorhinotermes tarakensis* (Oshima), and *Macrotermes latignathus* Thapa. On the other hand, *Macrotermes ahmadi* Tho was found for the very first time in lowland area in Peninsular Malaysia.

Keywords: Termites, Malaysia, Species diversity

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INTRODUCTION

Termites are an important group of insects to the natural ecosystem (Sugimoto *et al.* 2000). Besides being pests to forest, agriculture and urban structures, termites also benefit mankind through nitrogen fixation by bacteria present in their gut, accumulation of minerals (in their mounds) and improvement of soil texture through their tunneling activities (Lee *et al.* 2003a). Tracing back to history, the study of termites in Malaysia was pioneered by Haviland (1898), followed by Bugnion (1913) who compiled a list of Indo-Malayan termites, and John (1925) on termites of Ceylon, Peninsular Malaysia, Sumatra and Java. Generally, compared to Myanmar, Thailand, Indonesia and other ASEAN countries, Malaysia has a richer termite fauna. Among 2,600 species of termites (Order Isoptera) that had been described (Kambhampati & Eggleton 2000), a total of 175 species were found in Peninsular Malaysia (Tho 1992). However, other than previous works of Thapa (1981) and Tho (1992), and the current research of Dr. Laurence Kirton of Forest Research Institute Malaysia (FRIM) (Kirton & Brown 2003), there has been extremely limited effort to enhance information on termite fauna in Malaysia. Earlier, in our efforts to lobby for the declaration of PAFR in Penang Island, Malaysia to become a state or national park, a scientific expedition had been organised to characterise and to determine the richness of fauna and flora of this area. This paper provides the first insight into the diversity of termite fauna in PAFR.

MATERIALS AND METHOD

Collections of worker and soldier termites were made on fallen logs, leaf litters, mud tubes, peel-off tree bark etc., at 3 different locations in the forest reserve: Pantai Mas, Pantai Kerachut and Teluk Kampi. The collected insects were kept in 70% ethanol, and brought back to the laboratory for identification. They were identified under a dissecting scope using soldier termite keys by Tho (1992) and Thapa (1981). Measurements were made using colour video camera (Sony CCD-IRIS, Tokyo, Japan), mounted onto a dissecting scope (Olympus model SZ-PT, Tokyo, Japan), and linked to a personal computer with an image analysing programme. The soldier identification features included (1) shape and characteristics of the head and mandibles, (2) antenna, (3) post-mentum, (4) pro-, meso- and meta-notum, (5) Size and colouration of termites, and (6) other individual characteristics. Unconfirmed species were sent to Dr. Laurence G. Kirton (FRIM) for identification and confirmation.

RESULTS AND DISCUSSION

A total of 24 species of termites from 5 subfamilies and 14 genera were collected from this study (Table 1). The termite diversity in PARF accounted for about 15% of the total species of termites in Peninsular Malaysia. The diversity is

considered high for a relatively small area such as PAFR. Furthermore, termites were only collected from 3 areas of the whole PAFR. Among the termite species collected, percentage of Coptotermitini, Macrotermitini and Rhinotermitini collected in PAFR represented between 17–29% of those species found in Peninsular Malaysia.

Table 1: Comparative total number of termite species (excluding Kalotermitid) collected from Pantai Acheh Forest Reserve (PAFR) with those of Peninsular Malaysia.

Subfamily	Total species recorded		%
	Pen. Malaysia[1]	PAFR	
Coptotermitinae	7	2	29
Rhinotermitinae	24	4	17
Heterotermitinae	1	0	0
Termitogetoninae	1	0	0
Termitinae	43	4	9
Apicotermitinae	2	0	0
Macrotermitinae	30	6	20
Nasutitermitinae	60	8	13
Total	159	24	15

[1]Based on Tho (1992).

Table 2 shows the list of termite species collected from PAFR, while the general characteristics of each genus of soldier termites are presented in Table 3. Among the 5 subfamilies, 8 species collected were from subfamily Nasutitermitinae, followed by 6 Macrotermitini, 4 each of Termitini and Rhinotermitini, and 2 species of Coptotermitinae. Two species of genus *Coptotermes* were found in this study. The *Coptotermes* is an important genus of subterranean termites in Malaysia with 5 species (*C. curvignathus* Holmgren, *C. travians* (Haviland), *C. kalshoveni* Kemner, *C. sepangensis* Krishna and *C. havilandi* Holmgren) being important structural pests (Lee 2002a, 2002b). On the other hand, *Globitermes sulphureus, Microtermes pakistanicus, Macrotermes gilvus* and *Microcerotermes crassus* were considered as peridomestic pests in the urban environment (Lee 2002b).

Table 2: List of termite species collected from PAFR.

Family	Subfamily	Species
Rhinotermitidae	Coptotermitinae	*Coptotermes sepangensis* Krishna
		Coptotermes kalshoveni Kemner
	Rhinotermitinae	*Schedorhinotermes javanicus* Kemner
		Schedorhinotermes medioobscurus (Holmgren)
		Schedorhinotermes malaccensisi (Holmgren)
		Schedorhinotermes tarakensis (Oshima)

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Table 2 - *Continued*

Family	Subfamily	Species
Termitidae	Termitinae	*Globitermes sulphureus* (Haviland)
		Termes propinquus (Holmgren)
		Microcerotermes serrula (Desneux)
		Microcerotermes crassus Snyder
	Macrotermitinae	*Macrotermes gilvus* (Hagen)
		Macrotermes ahmadi Tho
		Macrotermes latignathus
		Microtermes pakistanicus Ahmad
		Odontotermes sp. J Holmgren
		Odontotermes sp. I Holmgren
	Nasutitermitinae	*Hospitalitermes bicolor* (Haviland)
		Longipeditermes longipes Holmgren
		Nasutitermes havilandi (Desneux)
		Subulioiditermes sp. Ahmad
		Subulioiditermes sp. (close to *inanis*) Ahmad
		Oriensubulitermes sp. Emerson
		Bulbitermes sp. A Emerson
		Bulbitermes sp. C Emerson

G. sulphureus colonies were characterized earlier by Ngee and Lee (2002) and Lee *et al.* (2003b). These 2 studies revealed foraging colony size of 0.51 - 4.02 x 10^6 and foraging territory size of 5.90–61.9 m^2. In addition, Lee *et al.* (2003c) found *M. pakistanicus* foragers to occupy foraging territory ranging from 30.5–54.2 m^2 with colony size estimated about 1.07 - 5.59 x 10^5. The information obtained is useful in establishing future management strategies against these pest species.

Table 3: General characteristics of soldier termites of each genus.

Genus	General characteristics
Coptotermes	Large and conspicuous fontanelle.
Schedorhinotermes	Both mandibles with prominent marginal teeth (2 at left and 1 at right mandible); dimorphic soldiers (minor soldier moves very fast).
Globitermes	Both mandibles with a single marginal tooth at the mid of mandibles; soldier's abdomen with bright yellow colouration.
Odontotermes	Inner margin of left mandible with one marginal tooth; dimorphic soldiers.

(Continued on next page)

Table 3 - *Continued*

Genus	General characteristics
Termes	Left and right mandible slightly asymmetrical and pointing downward.
Microcerotermes	Head rectangular; Inner margins of mandibles serrated.
Macrotermes	Labrum with hyaline tip.
Microtermes	Inner margins of mandibles entire.
Hospitalitermes	Head with nasus; legs very long; hind legs extending well beyond the abdomen; Monomorphic soldier.
Longipeditermes	Head with nasus; legs very long; hind legs extending well beyond the abdomen; pale coloured legs that contrast sharply with the dark coloured body.
Nasutitermes	Head with nasus; head not constricted behind antennal sockets; left mandible without a rudimentary tooth on apical portion.
Bulbitermes	Head with nasus; head constricted behind the antennal sockets.
Subulioiditermes	Head with nasus; Head somewhat pear-shaped.
Oriensubulitermes	Head with nasus; third antennal segment distinctly longer than second.

Macrotermes ahmadi Tho (Fig. 1) was found for the very first time in the lowland area in Malaysia. This species was previously described as a highland subterranean termite (above 1,200 m) (Tho 1992). On the other hand, *Termes propinquus* Holmgren (Fig. 2) which was first recorded by John (1925) and listed by Morimoto (1976) to be in Pasoh Forest Reserve, is a rare species. The specimen collected from this study confirmed the 1925's description of this species. We also found *Schedorhinotermes javanicus* Kemner (Fig. 3), *Schedorhinotermes tarakensis* (Oshima) (Fig. 4) and *Macrotermes latignathus* Thapa (Fig. 5) which were new records for Peninsular Malaysia.

This paper presents an insight into the diversity of subterranean termite species in PAFR, Penang Island, Malaysia. More detailed studies should be executed in future to further substantiate current findings as well as producing a checklist of termite species of this area.

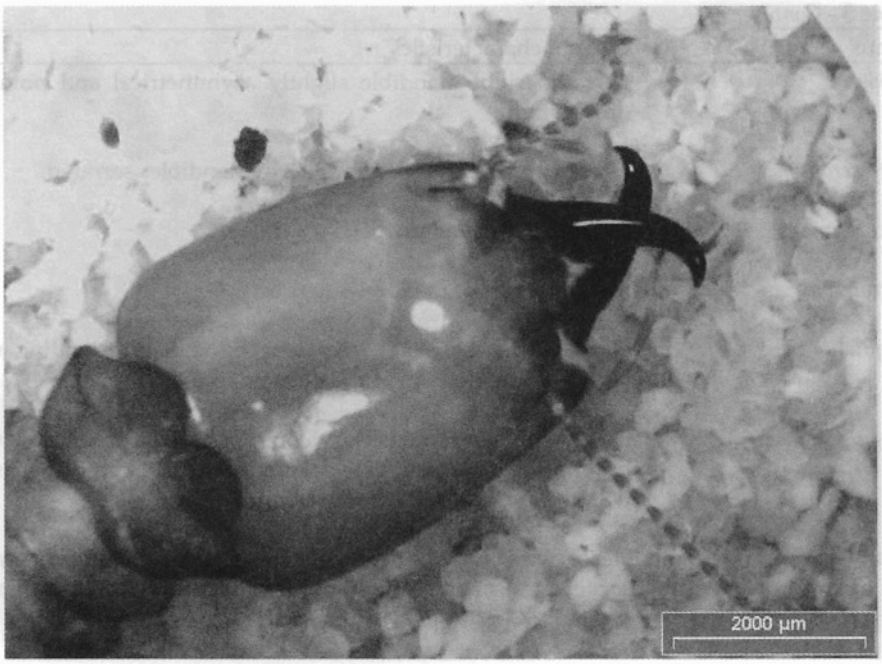

Figure 1: Soldier head of *Macrotermes ahmadi*.

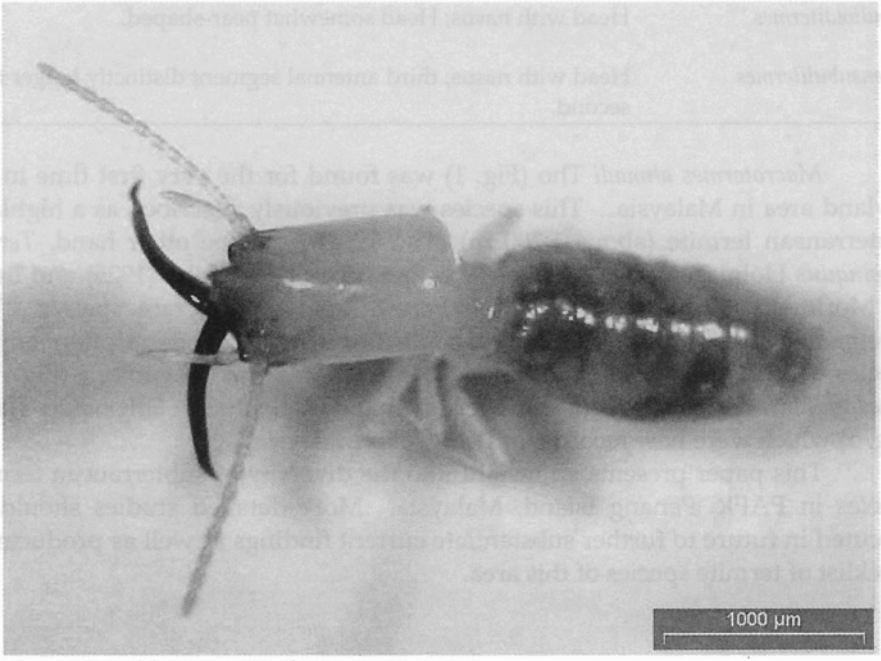

Figure 2: Soldier termite of *Termes propinquus*

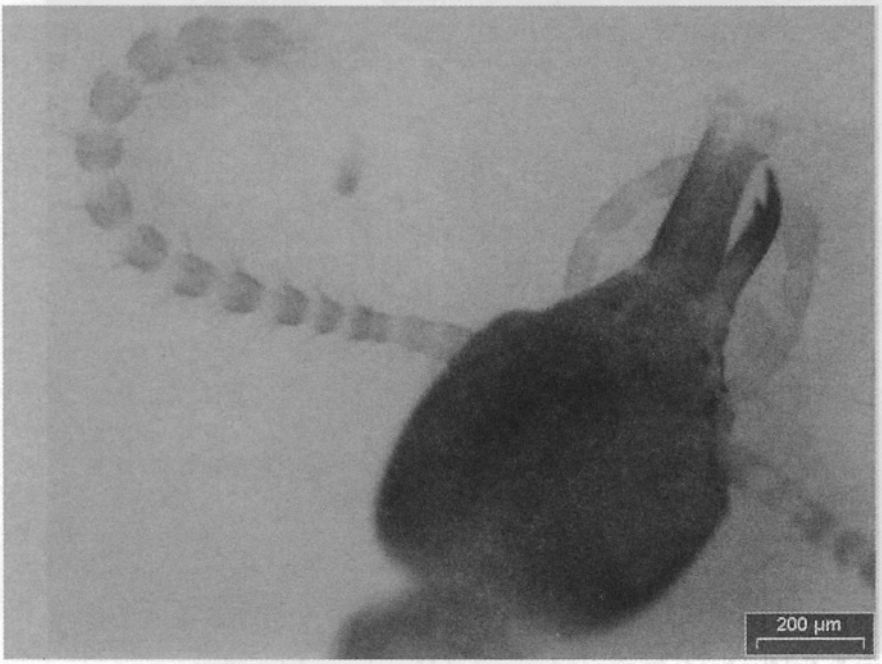

Figure 3: Soldier head of *Schedorhinotermes javanicus*

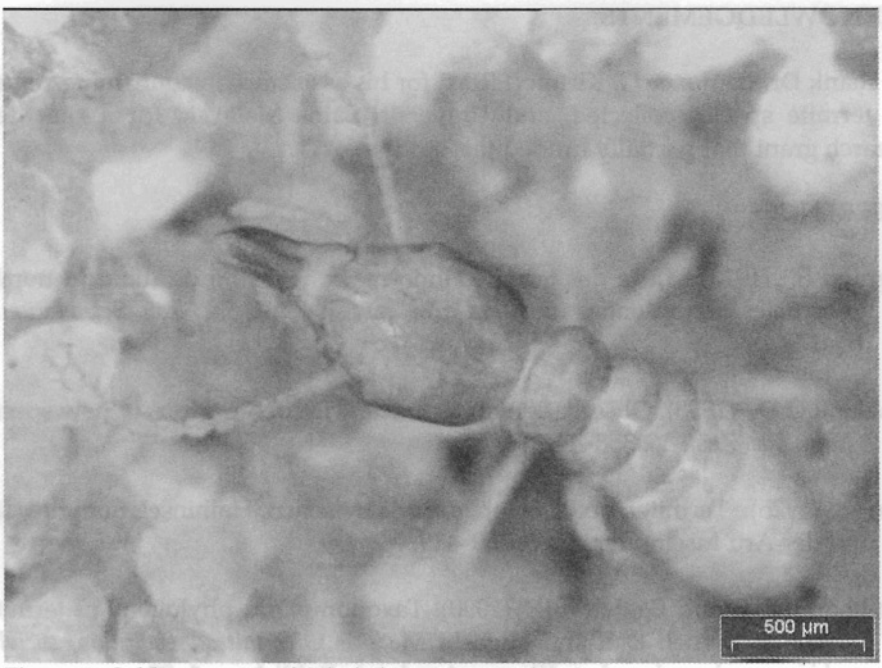

Figure 4: Soldier termite of *Schedorhinotermes tarakensis*

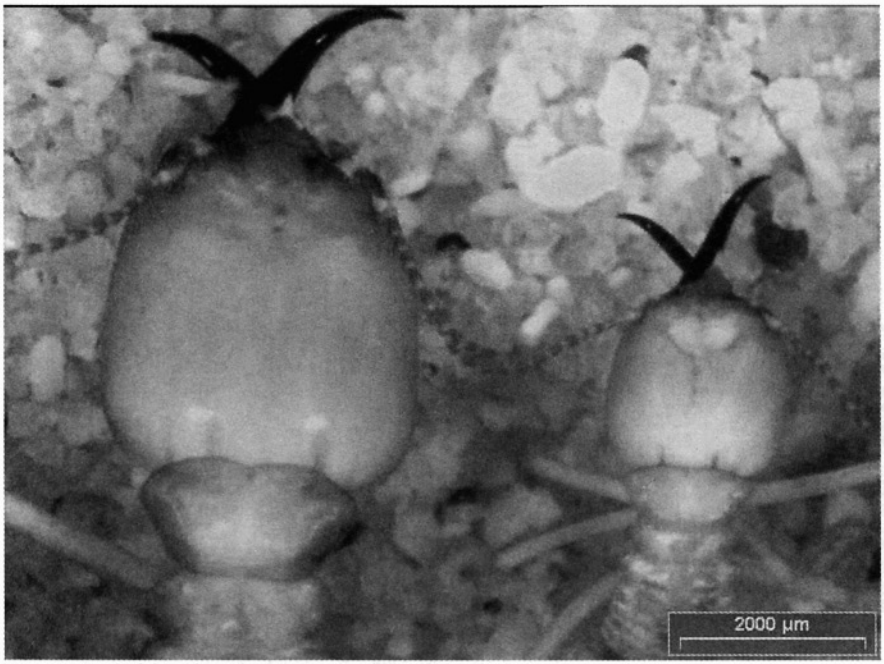

Figure 5: Soldier heads (major and minor) of *Macrotermes latignathus*.

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