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Survey on structure-infesting ants (Hymenoptera: Formicidae) in food preparative outlets

Lee C.Y., Lim C.Y. and Darah I.
School of Biological Sciences, Universiti Sains Malaysia, 11800 Penang, Malaysia.

Abstract. A survey on structure-infesting ants in food preparative outlets (university cafetarias, coffee shops, residential kitchens, and hotel kitchens) in Penang Island, Malaysia was conducted using index card methods. A total of 31 premises were surveyed and 13 species (*Anoplolepis longipes*, *Camponotus* sp., *Dolichoderus bituberculata*, *Monomorium destructor*, *Monomorium floricola*, *Monomorium pharaonis*, *Paratrechina longicornis*, *Pheidole* sp., *Prenolepis imparis*, *Solenopsis geminata*, *Tapinoma melanocephalum*, *Tapinoma indicum* and *Tetramorium* sp.) from three subfamilies (Dolichoderinae, Myrmicinae and Formicinae) were trapped. *M. destructor* is the most dominant species (27.8%), followed by *T. melanocephalum* (19.5%), *Pheidole* sp. (16.4%) and *M. floricola* (10.8%). Among the premises surveyed, the university cafetarias showed the highest diversity of ant species (n = 12).

INTRODUCTION

Structure-infesting ants are an important group of insect pests in living premises, food outlets and factories (Hedges, 1998; Lee & Yap, 1999; Lee & Robinson, 2001; Lee, 2002). An earlier questionnaire survey conducted on 814 houses in Penang, Malaysia in 1995 revealed ants as the most abundant household pests after mosquitoes and cockroaches (Lee *et al.*, 1999). Problems associated with ant infestations including food contamination (Lee, 2001), stings, bites and allergies (Goddard, 1993; Williams *et al.*, 2001), contamination of surgical instruments in hospitals (Beatson, 1972), as well as serving as mechanical vectors of human diseases (Aleksev *et al.*, 1972; Beatson, 1972; Edwards & Baker, 1981; Eichler, 1990; Bueno & Fowler, 1994).

Information on species composition and correct identification of structure-infesting ants are essential to better planning of an integrated control programme against these pests because different ant species often exhibit varying behavioural characteristics, as well as different feeding preferences (Hedges, 1998). Despite that, little is known on the species composition of structure-infesting ants in Malaysia. In a preliminary study, Yap & Lee (1994) reported a total of 13 ant species found in- and around living premises with *Monomorium pharaonis* being the pre-dominant species. More recently, Na & Lee (2001) reported in a more comprehensive study, an identification key for common household ants in Malaysia, where they found 23 species of ants infesting in- and around structures. This present paper summarises a survey of structure-infesting ants found in food preparative outlets in Penang Island, Malaysia.

MATERIALS AND METHODS

Ants were trapped from several types of

food preparative outlets in Penang Island, Malaysia, namely dining areas and kitchens of university cafetarias (n = 9), dining areas and kitchens of coffee shops (n = 9), kitchens of residential premises (n = 9), and kitchens of hotel restaurants (n = 4). All cafetarias were located in Universiti Sains Malaysia Minden campus, while the coffee shops were located in Jalan Sungai Dua, Air Itam and George Town. Nine residential premises were houses situated in Gelugor. Two hotels chosen were located in Tanjung Bunga, while the remaining two were hotels in George Town.

The index card method (Lee, 2000; Na & Lee, 2001; Lee & Lee, 2002; Lee *et al.*, 2003) was used in this study. It is essentially a 6 x 7 cm ruled card, baited with peanut butter (21.5% protein and 23.8% fat) and honey (75% carbohydrate). A total of five index cards were placed in locations within the premises where ant trails were sighted, or where ants were suspected to be nesting. About 40 minutes after placement, the ants found foraging onto the index cards were collected and brought back to the laboratory for identification. They were examined under a dissecting scope and identified according to descriptions provided in Na & Lee (2001), Bingham (1975), Bennett *et al.* (1997), Hedges (1998), Holldobler & Wilson (1990) and Bolton (1997).

RESULTS AND DISCUSSION

Results indicated that a total of 13 ants species were trapped in this study (Table 1), covering three subfamilies, i.e. Dolichoderinae (*Dolichoderus bituberculata*, *Tapinoma melanocephalum* and *Tapinoma indicum*), Formicinae (*Anoplolepis longipes*, *Camponotus* sp, *Paratrechina longicornis* and *Prenolepis imparis*), Myrmicinae (*Monomorium destructor*, *Monomorium floricola* and *Monomorium pharaonis*, *Solenopsis geminata* and *Tetramorium* sp.). The Singapore ant, *M. destructor* (27.8%) is the most dominant species, followed by ghost ants (*T. melanocephalum*) (19.5%), *Pheidole* sp. (16.4%), *M. floricola* (10.8%) and crazy ants (*P. longicornis*) (9.0%). The overall results obtained were different from those reported earlier by Yap & Lee (1994) who reported Pharaoh ants as the most abundant species. This is likely attributed to differences in sampling method, particularly the use of different food attractants, and locations of sampling where in the former survey, the authors concentrated mainly on residential premises. It is evident though, that the ant species profile trapped in residential kitchen concurs well with those reported by Yap & Lee (1994).

Many ant species trapped in this study are tramp species that are of cosmopolitan distribution. These included *Monomorium* spp., *P. longicornis*, *Tapinoma* spp., *P. megacephala* and *A. longipes*, Tramp ants are defined as ants that are polygynous, unicolonial, reproduce by budding, largely dispersed worldwide through human commerce and live with close association with humans (Holldobler & Wilson, 1990; Passera, 1994). Although a number of ant species demonstrate anthropophilic tendency (Pisarski, 1982, Prins *et al.*, 1990, Thompson, 1990), only tramp species are truly domestic with great ability for nest changes. Nesting in unstable habitat in the human environment requires frequent migration, and thus this becomes a unique characteristic of tramp ant species (Passera, 1994). In addition, they are also frequently observed as the first ant species to succeed in a newly constructed building or structure (eg. *P. longicornis*) (C.Y. Lee, unpublished data). Another characteristic of tramp ant species is its ability to displace other native ant species once it becomes established. Wetterer *et al.* (1999) reported the displacement of several ant species and other insects by *P. longicornis* in Biosphere 2, a 1.28-hectare closed greenhouse structure built in the

Table 1. Survey of structure-infesting ants in food preparative outlets in Penang Island, Malaysia

Species	Location (No. ants trapped)						
	Cafetaria Dining areas (n = 9)	Cafetaria kitchen (n = 9)	Coffee shop dining areas (n = 9)	Coffee shop kitchens (n = 9)	Residential kitchens (n = 9)	Hotel kitchens (n = 4)	Total (%)
Anoplolepis longipes	74	17	–	3	–	–	94 (1.7)
Camponotus sp.	2	3	–	–	–	–	5 (0.1)
Dolichoderus bituberculata	65	–	–	–	–	–	65 (1.2)
Monomorium destructor	1037	306	184	11	11	–	1538 (27.8)
Monomorium floricola	163	24	404	–	8	–	599 (10.8)
Monomorium pharaonis	–	–	170	–	20	–	190 (3.4)
Paratrechina longicornis	154	103	114	65	64	–	500 (9.0)
Pheidole sp.	278	38	407	179	3	–	905 (16.4)
Prenolepis imparis	16	–	1	–	–	–	17 (0.3)
Solenopsis geminata	146	–	–	–	57	–	203 (3.7)
Tapinoma melanocephalum	32	192	–	–	807	47	1078 (19.5)
Tapinoma indicum	2	5	1	168	55	–	231 (4.2)
Tetramorium sp.	4	–	6	89	7	–	106 (1.9)
Total no. ants per location (%)	1973 (35.7)	688 (12.4)	1287 (23.3)	515 (9.3)	1021 (18.5)	47 (0.8)	5531 (100)

Arizona desert, U.S.A., as a microcosm to study ecosystem dynamics and global change.

In this study, the dining areas of the university cafetarias showed the highest diversity of ant species (12 species), followed by residential kitchens (Table 1). As the university cafetarias were mainly surrounded by shrubs and vegetations which were suitable nesting habitats for many peridomestic ant species (eg. *Camponotus* sp., *Paratrechina longicornis*, *Pheidole* sp., and *Solenopsis geminata*), the likelihood of these species to be introduced into the premises was higher than those locations surrounded mainly by concrete floors and buildings (eg. hotels, urban shops).

The Singapore ants, *M. destructor* is the most dominant species trapped in this study (Table 1). It is sometimes misidentified as the pharaoh ant, although this species is generally larger (1.8 – 3.0 mm) than the latter (1.5 – 2.0 mm). Both species are relatively bigger in size than *M. floricola* (1.4 – 1.8 mm). Nesting habitats for *M. destructor* are generally outdoors particularly in soil with vegetations and shrubs, while the other two *Monomorium* spp. prefers to nest indoors (Na & Lee,

2001). The large numbers of *M. destructor* trapped in the dining areas of university cafetarias are likely to have been introduced into the cafetarias from outdoors.

Only ghost ants, *T. melanocephalum* were trapped in hotel kitchens (Table 1). This is a tiny ant species (1.2 – 1.7 mm) which emits a bad odour when crushed, thrives well in moist and warm kitchen environment. Although they were trapped in small numbers in hotels, they are the most dominant species in kitchen of residential houses (Table 1). This undoubtedly demonstrated the ability of this species to establish its colony in a man-made structure upon being introduced. Naturally, ghost ant's primary habitat is outdoors; however, it is highly opportunistic in nesting habitats which include in soil, in dead tree limbs, under and inside logs, under stones and in soil of potted plants (Hedges, 1998).

This study demonstrated the abundance and prevalence of structure-infesting ants in food handling premises in Penang Island, Malaysia. It is of paramount importance to be able to manage them well because ants are a potential group of mechanical vector of pathogenic microorganisms. A total of 31 bacterial, 8 fungal and 2 yeast species which are pathogenic or potentially pathogenic, were isolated from the external bodies of the ant species trapped in this study (Lim, 2001). These findings will be reported in the near future.

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