

Research Note

Diversity of cockroach species and effect of sanitation on level of cockroach infestation in residential premises

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Abstract: A field study on cockroach species diversity, and influence of sanitation on infestation level, was conducted on six different locations (four apartment settings [Tmas, Bmaung2, Relau and Kmelayu], a residential slum setting [Sg Batu] and a terrace houses setting [Bmaung1]) in Penang Island, Malaysia. A total number of 192 residential premises were sampled and 3,289 cockroaches, consisting of 10 species (*Periplaneta americana*, *Periplaneta brunnea*, *Periplaneta australasiae*, *Neostylopyga rhombifolia*, *Nauphoeta cinerea*, *Supella longipalpa*, *Blattella germanica*, *Blattella vaga*, *Symploce pallens* and *Pycnoscelus surinamensis*) were trapped. The American cockroach, *P. americana* was found to be the most dominant species in all locations, followed by *P. brunnea*. *P. australasiae* was found only in premises surrounded by heavy vegetation. A small number of *B. germanica* ($n = 2$) was trapped for the first time in an apartment building in Malaysia. No significant correlation ($P > 0.05$) between sanitation rate and level of infestation (no. cockroaches trapped) was found in this study.

Cockroaches are an important group of insect pests in the human environment. Although about 4000 species of cockroaches had been identified, only about 1% of them were considered as pests (Cochran 1999). Numerous reports have indicated that they are potential mechanical vectors of human diseases (Bajomi & Elek, 1979; Oothuman *et al.*, 1985; Anuar & Paran, 1976; Rampal *et al.*, 1981; Oothuman *et al.*, 1989; Lee, 1997). In addition, cockroaches have also been shown to cause household allergy and entomophobia (Lee, 1997).

In Malaysia, cockroach surveys have been earlier reported by several groups of researchers (Oothuman *et al.*, 1984; Yap *et al.*, 1991, Lee *et al.*, 1993; Yap *et al.*, 1997), where the American cockroach (*Periplaneta americana*) was found to be the most dominant species. Except for

Oothuman *et al.* (1984) which conducted their study in Selangor, all studies in Penang showed a lower diversity of cockroach species in residential premises (≤ 6 species). During the period between early 1998 – late 1999, we conducted a series of field surveys to determine the species diversity of domiciliary cockroaches in Penang Island, Malaysia and to determine the influence of sanitation on the level of cockroach infestation in residential premises.

We selected six locations in Penang Island which were representative of an urban apartment (Kmelayu), suburban apartments (Tmas, Bmaung2 and Relau), terrace houses (Bmaung1) and residential slums (Sg Batu). The total number of houses sampled per location varied because it was subject to consent by the premise owners. A total of five 0.45 L

glass jars, baited with white bread and moistened with a local beer, was left overnight in each house. Three glass jars were left inside kitchen cabinets, while the remaining ones were placed in locations suspected of harbouring cockroaches. Each house was rated for its sanitary condition: 1 = poor (lots of clutter, always with damp/wet floor, leaking pipe, food debris on the floor); 2 = moderate (less clutter, less food debris on floor, no leaking pipe, sometimes with damp/wet floor); 3 = good (practically no clutter, no visible food debris, floor always dry, no leaking pipe). Upon collection, the cockroaches were identified according to morphological descriptions in Cochran (1999) and Lee *et al.* (1999a). The number of cockroaches trapped in each house was plotted against its sanitary rate, and correlated with simple regression.

Out of the 192 residential premises sampled, 3,289 cockroaches were trapped. They consisted of 10 species (*Periplaneta americana*, *Periplaneta brunnea*, *Periplaneta australasiae*, *Neostylopyga rhombifolia*, *Nauphoeta cinerea*, *Supella longipalpa*, *Blattella germanica*, *Blattella vaga*, *Symploce pallens* and *Pycnoscelus surinamensis*) (Table 1). Sg Batu showed the highest diversity of cockroach species (8 species) followed by both Bmaung1 and Kmlayu (6 species). The American cockroach, *P. americana* was the most dominant species ($88.5 \pm 2.2\%$ of total cockroaches trapped) in all locations, followed by *P. brunnea* ($5.0 \pm 0.3\%$) (Table 1). This finding is similar to those reported earlier by Oothuman *et al.* (1984), Yap *et al.* (1991), Lee *et al.* (1993) and Yap *et al.* (1997).

B. germanica (German cockroach) was trapped for the first time in an apartment building (Relau) (Table 1). Although this species is prevalent in food outlets in Malaysia (Lee *et al.*, 1993; Lee, 1998), they have never been reported in residential premises in this country prior to this study. Despite the small number trapped ($n = 2$), more surveys need to be

done to further substantiate current findings. Infestation by German cockroach in residential premises has serious implication, as this species has a high reproductive capability and is capable of establishing a sizable population within a short period of time (Lee *et al.*, 1996a). Furthermore, selection from insecticide treatment can cause development of insecticide resistance in this species, which in turn can further dampen control efforts (Lee *et al.*, 1996b; Lee *et al.*, 1999b).

The Australian cockroach (*P. australasiae*) was only found in the rural slums (Sg Batu) where heavy vegetation was in abundance (Table 1). This confirmed earlier reports by Yap *et al.* (1991) and Lee *et al.* (1993) that *P. australasiae* is an outdoor species (Cochran, 1999). It was most likely introduced into residential premises due to its attractance to light at night. Another species commonly attracted to light that was trapped in small numbers is the field cockroach (*Blattella vaga*). This is a small cockroach which resembles the German cockroach, but can be distinguished by a blackish area on the front of the head, extending from the mouthparts to between the eyes (Bennett *et al.*, 1997).

The Harlequin cockroach (*Neostylopyga rhombifolia*) was found in all locations. It is the only species found in this study which is wingless at the adult stage; it is believed to be of Indo-Malayan origin (Cornwell, 1968). From our experience, this species usually harbours inside abandoned old kitchen cabinets. *Supella longipalpa* (Brown-banded cockroach) which prefers to harbour in drier areas, was also trapped in all locations (Table 1). It is usually found in bedrooms, old clothes cabinets, and in dining room areas. *Symploce pallens*, which was found earlier in abundance in Kuala Lumpur, Selangor and Kelantan (Jeffery *et al.* 1997) was also trapped in three locations (Sg Batu, Bmaung1 and

Table 1: Diversity of cockroach species in residential premises in Penang Island, Malaysia

Species	Locations (no. premises surveyed) (% of total no. cockroaches trapped)					
	Sg Batu (43)	Tmas (40)	Bmaung1 (29)	Bmaung2 (14)	Relau (25)	Kmelayu (41)
<i>Periplaneta americana</i>	80.5	92.0	87.2	90.1	95.5	85.4
<i>Periplaneta brunnea</i>	4.0	5.6	5.5	4.5	-	5.5
<i>Periplaneta australasiae</i>	6.5	-	-	-	-	-
<i>Neostylopyga rhombifolia</i>	2.6	0.3	1.8	3.4	1.3	1.2
<i>Nauphoeta cinerea</i>	-	-	-	-	-	1.4
<i>Supella longipalpa</i>	4.9	2.1	4.7	2.2	2.0	3.3
<i>Blattella germanica</i>	-	-	-	-	1.3	-
<i>Blattella vaga</i>	0.5	< 0.1	0.4	-	-	-
<i>Symptloce pallens</i>	0.9	-	0.7	-	-	3.2
<i>Pycnoscelus surinamensis</i>	0.1	-	-	-	-	-
Total no. cockroaches trapped	816	1172	274	178	152	697
Mean no. cockroaches/ house/jar/night	3.8	5.9	1.9	2.5	1.2	3.4

Kmelayu) in this study.

In this study, we found no significant relationship between the number of cockroaches trapped with the sanitary rate ($P > 0.05$; $r^2 = 0.108$). This indicated that bad sanitation does not necessary result in higher cockroach infestation, or vice-versa. Earlier, Owens (1980) and Bertholf (1983) reported that improved sanitary condition does not reduce German cockroach population. It was believed that once a cockroach population is established, the adaptability of the insect makes it almost impossible for improved sanitation to reach a level that will reduce the population (Marsh & Bertholf, 1986). Nevertheless, we found that better sanitation increases field performance of insecticidal baits against American cockroaches (Lee & Lee, unpub. data).

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