

## Research Note

### Notes on biological parameters of a new domiciliary pest, the smooth cockroach *Symploce pallens* (Stephens) (Dictyoptera: Blattellidae)

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**Abstract.** A preliminary study on several biological parameters of the smooth cockroach, *Symploce pallens* (Stephens) was undertaken in the laboratory. There were nine instars in nymphal development, spanning an average period of  $90.0 \pm 4.0$  days. Upon achieving adulthood, the insects showed an average preoviposition period of  $5.1 \pm 3.1$  days and oothecal incubation period of  $30.3 \pm 2.1$  days. Female fecundity was recorded at  $15.3 \pm 4.6$  oothecae per female, with an average of  $15.9 \pm 2.8$  nymphs per ootheca. Nymphal survivorship was relatively high (90%). Sex ratio of offsprings produced was 1: 1.07 (male: female). Male and female cockroaches showed a comparable longevity period at  $148.8 \pm 2.5$  and  $146.1 \pm 11.5$  days, respectively. A comparison of the biological parameters of the smooth cockroach with those of the German cockroach, *Blattella germanica* and Brown-banded cockroach, *Supella longipalpa* was done.

Cockroaches are an important group of insect pests in the urban environment (Lee *et al.*, 1999). In Malaysia, there are between 6 – 10 common domiciliary species of cockroaches which are considered as household pests by residents (Oothuman *et al.*, 1984; Yap *et al.*, 1991; Lee *et al.*, 1993, Yap *et al.*, 1997; Lee & Lee, 2000). Among these species, the smooth cockroach, *Symploce pallens* (Roth, 1984; Atkinson *et al.*, 1991), is a species that has only been recently reported as a domiciliary pest (Jeffery *et al.*, 1997; Lee & Lee, 2000). Roth (1984) clarified that *Symploce pallens* (Stephens, 1835) is the correct name for *Symploce lita* Hebard (1917), which was placed as a synonym of *Symploce hospes* (Perkins, 1899) by Hebard (1943).

Little is known of the biology of *S. pallens*. Since a good understanding of

pest biology is essential to better planning of control programmes, we conducted a preliminary study to provide some information on several biological parameters of this species. A comparison with published biological parameters of two other species within the family Blattellidae, i.e. the German cockroach, *Blattella germanica* (Lee *et al.*, 1996) and the Brown-banded cockroach, *Supella longipalpa* (Cornwell, 1968), was done. Here we report our findings.

The smooth cockroach used in this study was obtained from laboratory cultures established earlier from wild cockroaches collected from Sungai Batu and Kampung Melayu, Penang Island, Malaysia in June - December 1998. They were reared under environmental conditions of  $26 \pm 2^\circ\text{C}$ ,  $70 \pm 5\%$  relative humidity and 12 hours photoperiod. Dog

chow (Pedigree Crunchy Bites, manufactured by Kal Kan Foods, California, USA) and water were provided *ad libitum*.

Oothecae of *S. pallens* were collected from the rearing tanks and kept in plastic containers. Upon emergence of offsprings, the nymphs were separated and kept in plastic rearing cups (5.0 cm diam. x 10.0 cm height) (ZPC-225, model 19PP, ZPI), with four nymphs per group. Food and water were provided *ad libitum*, together with harbourages. A total of 20 replicates (= 80 nymphs) were done and the cockroaches were observed daily. Data were recorded for events in moulting and mortality.

Upon achieving adulthood, the cockroaches were paired at age 2 days in rearing cups and a total of 20 replicates were generated. Observation was made daily for events in reproduction according to methods described in Lee *et al.* (1996; 1998) and Lee & Heng (2000) until all the adult cockroaches died. Upon the release of an ootheca by a gravid female, the ootheca was isolated from the rearing cup and kept individually in a separate rearing container. Upon hatching of ootheca, the number of nymphs produced were

counted and a total of 200 nymphs were randomly separated and reared in a polyethylene container with food, water and harbourages provided until adulthood. Data were collected for the following parameters: preoviposition period (period between the release of an ootheca to the emergence of the next one), incubation period (time between the release to the hatch of an ootheca), no. nymphs per ootheca, no. oothecae produced per female, percentage of nymphal survivorship, nymphal sex ratio, male and female longevities.

Results indicated that the nymphal developmental period of *S. pallens* is about two times longer than that of *B. germanica* (Table 1) due to the fact that the nymphs of smooth cockroach moulted 3 – 4 times more than the nymphs of the German cockroach. Each instar of *S. pallens* took an average of  $10.0 \pm 1.1$  days to develop to the next stage, which was comparable to that in *B. germanica* ( $8.1 \pm 1.1$  days) (Lee, 1995). On the other hand, *S. longipalpa* nymphs took about 35 days less than those of the smooth cockroach to become adults, after undergoing 6 – 8 moults.

Table 1: Information on some biological parameters of the smooth cockroach, *Symphloe pallens* (Stephens) (Dictyoptera: Blattellidae), in comparison with those of *Blattella germanica* and *Supella longipalpa*

Biological parameter	<i>Symphloe pallens</i>		<i>Blattella germanica</i> <sup>1</sup>	<i>Supella longipalpa</i> <sup>2</sup>
	n	Mean $\pm$ S.E.M. /range	Mean $\pm$ S.E.M./range	Mean $\pm$ S.E.M. /range <sup>2</sup>
Nymphal development (days)	65	90.0 $\pm$ 4.0	45.6 $\pm$ 0.3	54 – 56
Total number of moults	65	9 – 10	5 – 7	6 – 8
Preoviposition period (days)	170	5.1 $\pm$ 3.1	9.2 $\pm$ 0.1	6
Incubation period (days)	276	30.3 $\pm$ 2.1	25.0 $\pm$ 0.2	40
No. nymphs per ootheca	17	15.9 $\pm$ 2.8	30.0 $\pm$ 1.3	12
No. oothecae per female	17	15.3 $\pm$ 4.6	4.8 $\pm$ 0.3	5 – 18
Nymphal sex ratio (M:F)	180	1 : 1.07	0.90 : 1	–
Nymphal survivorship (%)	200	90%	90.9 $\pm$ 0.3	85
Male longevity (days)	5	148.8 $\pm$ 2.5	115.1 $\pm$ 7.4	115
Female longevity (days)	10	146.1 $\pm$ 11.5	165.8 $\pm$ 10.3	90

<sup>1</sup>data obtained from Lee *et al.* (1996).

<sup>2</sup>data obtained from Cornwell (1968).

Both preoviposition and incubation periods of the smooth cockroach were also relatively similar to those reported earlier for the German cockroach (Table 1). The total period combined for both parameters was about 35 days for both species, compared to *S. longipalpa* which took about 10 days longer to complete a preoviposition and incubation cycle. Smooth cockroach females produced an average of 15.9 oothecae with  $15.3 \pm 4.6$  nymphs per ootheca, which is comparable to that produced by the Brown-banded cockroach (Table 1). The German cockroach produced a lesser number of oothecae; however, each ootheca had a higher number of nymphs. When compared in terms of nymphal survivorship, all three species showed a relatively similar percentage number of nymphs that achieved adulthood (90%) (Table 1).

In terms of adult male longevity, the smooth cockroach showed the longest life-span, followed by both German and Brown-banded cockroaches (Table 1). There appeared to be no significant difference between the female longevity periods of both the smooth and German cockroaches.

The smooth cockroach demonstrated fecundity parameters relatively similar to those of *Supella longipalpa*. One of the main reasons may be due to the fact that both species deposit their eggs upon emergence, while the *B. germanica* will carry its ootheca until it is about to hatch (Lee *et al.* 1999). The German cockroach also showed a higher biotic potential when compared to the smooth cockroach. Thus, the likelihood of the smooth cockroach establishing itself as the dominant pest in the presence of the German cockroach is very unlikely. It would be interesting to study interspecific competition between the three species. In summary, this study has provided an insight into some important biological parameters of the smooth cockroach. More studies are currently undertaken to further substantiate current findings.

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## REFERENCES

- Atkinson, T.H., Koehler, P.G. & Patterson, R.S. (1991). Catalog and atlas of the cockroaches (Dictyoptera) of North America North of Mexico. *Miscellaneous Publications of the Entomological Society of America* **78**: 1 – 85.
- Cornwell, P.B. (1968). *The Cockroach*. Volume 1. Hutchinson Company, London. 391 pp.
- Hebard, M. (1917). The Blattidae of North America north of the Mexican boundary. *Memoirs of the American Entomological Society* **2**.
- Hebard, M. (1943). The Dermaptera and orthopterous families Blattidae, Mantidae, and Phasmidae of Texas. *Transactions of American Entomological Society* **68**: 239 – 311.
- Jeffery, J., Zahedi, M., Oothuman, P., Sallehudin, S., Vythilingam, I. & Abdullah, S. (1997). *Symploce pallens* (Stephens) (Dictyoptera: Blattellidae) – a new pest cockroach from Peninsular Malaysia. *Tropical Biomedicine* **14**: 137 – 139.
- Lee, C.Y. (1995). *Toxicity, resistance and sublethal effects of selected insecticides on German cockroaches, Blattella germanica (L.) (Dictyoptera: Blattellidae) in Malaysia*. Ph.D. thesis. Universiti Sains Malaysia.
- Lee, C.Y. & Heng, C.Y. (2000). Effects of food and water deprivation on nymphal development, adult fecundity and insecticide susceptibility in German cockroaches, *Blattella germanica* (L.). *Tropical Biomedicine* **17**: 27–34.
- Lee, C.Y. & Lee, L.C. (2000). Diversity of cockroach species and effects of sanitation on level of cockroach infestation in residential premises.

- Tropical Biomedicine* **17**: 39–43.
- Lee, C.Y., Chong, N.L. & Yap, H.H. (1993). A study on domiciliary cockroach infestation in Penang, Malaysia. *Journal of Bioscience* **2**: 95 – 98.
- Lee, C.Y., Yap, H.H. & Chong, N.L. (1996). Comparison of selected biological parameters of laboratory susceptible and field collected strains of the German cockroach, *Blattella germanica* (L.) (Dictyoptera: Blattellidae). *Malaysian Journal of Science* **17A**: 37 – 48.
- Lee, C.Y., Yap, H.H. & Chong, N.L. (1998). Sublethal effects of deltamethrin and propoxur on longevity and reproduction of German cockroaches, *Blattella germanica*. *Entomologia Experimentalis et Applicata* **89**: 137 – 145.
- Lee, C.Y., Yap, H.H. Chong, N.L. & Jaal, Z. (1999). *Urban Pest Control – A Malaysian Perspective*. Universiti Sains Malaysia. 134 pp.
- Oothuman, P., Jeffery, J., Daud, M.Z., Rampal, L. & Shekhar, C. (1984). Distribution of different species of cockroaches in the district of Kelang, Selangor. *Journal of Malaysian Society of Health* **4**: 52 – 56.
- Perkins, R.C.L. (1899). Orthoptera. *Fauna Hawaii* **2**: 1.
- Roth, L.M. (1984). The genus *Symptloce* Hebard. 1. Species from the West Indies (Dictyoptera: Blattaria: Blattellidae). *Entomology of Scandinavian* **16**: 113 – 139.
- Stephens, J.F. 1835. *Illustrations of British Entomology*. 6.
- Yap, H.H., Chong, N.L., Loh, P.Y., Baba, R. & Yahaya, A.M. (1991). Survey of domiciliary cockroaches in Penang, Malaysia. *Journal of Bioscience* **2**: 71-75.
- Yap, H.H., Ong, C.H., Chong, N.L., Yahaya, A.M., Rahim, A.R., Awang, A.H. & Samsuri, O. (1997). Cockroach infestation in different household settlements in rural, suburban and urban areas on Penang Island, Malaysia. *Journal of Bioscience* **8**: 182 – 186.