

Research Note

Performance of mosquito coils containing transfluthrin against *Culex quinquefasciatus* (Say) in an urban squatter environment

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Abstract. Field performance of three formulations of mosquito coils containing transfluthrin (0.018, 0.027 & 0.046% w/w) were compared with that of another formulation (d-allethrin 0.18% w/w) in residential houses in an urban squatter environment in Penang, Malaysia. Results indicated that all formulations were able to provide protection against *Culex quinquefasciatus* (Say) mosquitoes with >90% reduction in mosquito landing/biting activity. However, no significant difference in the efficacy between the four formulations was observed.

Mosquito coil is the most widely used household insecticide product for personal protection in Asia (Yap *et al.*, 1996). Generally, coils provide a reliable and low-cost means of protection against vector or nuisance mosquitoes in many parts of Asia. Pyrethroid-based mosquito coil especially those containing d-allethrin and d-trans allethrin has been dominating the South East Asian market for more than two decades. Yap *et al.* (1990) evaluated four formulations of coil containing d-allethrin (0.19 and 0.28% w/w) and d-trans allethrin (0.12 and 0.16% w/w) in living premises in an urban squatter area and concluded that all formulations tested were able to reduce at least 70% in mosquito-man contact.

Recently, Bayer AG (Germany) introduced a new pyrethroid, transfluthrin which possesses low mammalian toxicity and is suitable for usage as a knockdown agent in household insecticide products (Mrusek *et al.*, 1995). This present study was conducted to evaluate some formulations of coil containing different concentration of transfluthrin, in comparison with a standard coil formulation containing d-allethrin (SIRIM, 1986) in residential houses in an urban squatter environment in Penang, Malaysia.

Four coil formulations each containing 0.018, 0.027 and 0.046% w/w transfluthrin [(1-R-Trans)-(2,3,5,6-tetrafluorophenyl)-methyl ester 3-(2,2-dichloroethenyl)-2,2-dimethyl-cyclopropane-carboxylic acid) and 0.18% w/w d-allethrin (d 1-3-allyl-2-methyl-4-

oxo-2-cyclopentenyl d-cis trans chrysanthemate), provided by Bayer AG, Germany were used. Active ingredient analyses on all coil samples were done using gas chromatography (Shimadzu GC 12A).

This study was conducted in Ujung Batu, an urban squatter area in Butterworth, situated at the northwestern coastal area of Peninsular Malaysia. Descriptions of the field site can be obtained from Yap *et al.* (1990). A total of 16 houses with living rooms areas of 37.9 - 68.4 m² were chosen for the trials. A set of four houses each with similar total living room areas (approximately 210 m²) were assigned for each formulation.

Prior to the treatment trials, pretreatment trials (control night) were done to determine the mosquito population in the area studied. The daily mortality and emergence of adult mosquitoes, and the emigration and immigration of mosquitoes from and to the study sites were assumed to be similar.

The sampling method followed essentially that of Yap *et al.* (1990). A human bait with both arms and legs bared was seated approximately 1.0 - 1.5 m away from the burning coils. All mosquitoes that landed on the bared legs and arms were collected using test tubes from 2100 - 0100 hours. The coils were burned half an hour earlier prior to the initiation of human bait collection. All mosquitoes collected were brought back to the laboratory for species identification. Three replicates were conducted at three differ-

Table 1. Field performance of four coil formulations tested in this study.

a.i. (conc. in % w/w)	Mean total no. mosquitoes landed (\pm S.E) ¹		% reduction ²
	control	treatment	
Transfluthrin (0.018)	123.0 \pm 8.1	12.3 \pm 1.2	90.0
Transfluthrin (0.027)	151.1 \pm 36.0	11.3 \pm 2.9	92.5
Transfluthrin (0.046)	169.7 \pm 32.8	4.0 \pm 0.6	97.6
D-allethrin (0.18)	136.7 \pm 8.7	6.3 \pm 3.8	95.4

¹ mean of three replicates.

² No significance difference in % reduction of mosquitoes for all formulations tested, based on analysis of variance ($P > 0.05$).

ent nights. Human bait catches in the 16 chosen houses were done 24 hours prior to the initiation of coil exposure (treatment night) to serve as control. Meteorological parameters were measured at each control and treatment night. Percentage reduction of total number of mosquitoes landed for each formulation were subjected to arc-sine transformation prior to analysis of variance (ANOVA).

Meteorological parameters during the experimental nights were recorded as 25 \pm 2°C, 61 \pm 3% R.H. and no rainfall. Results indicated that all coil formulations provided >90% reduction in numbers of mosquitoes which landed (Table 1). ANOVA test showed no significant difference ($P > 0.05$) in all formulations. This finding was similar to that of Yap *et al.* (1990) who reported no significant difference on the efficacy of coils containing d-allethrin (0.19 & 0.28% w/w) and d-trans allethrin (0.12 & 0.16% w/w) under the same environment. The lack of significant difference in % reduction of mosquitoes landed might be attributed to the lack of uniform room sizes and ventilation (number of windows and doors per room) in the houses used in

this study. This also reflects the actual situation of using coils indoors in living premises in the Asian region. However, under simulated or laboratory controlled conditions, the performances of the four formulations were distinctly different (H.H. Yap, unpublished data). In addition, the performance of all formulations was also consistent throughout the four-hour experimental period (Table 2).

Eight species of mosquitoes were collected at the three control nights ($n = 1742$) with *Cx. quinquefasciatus* being the predominant species (97.3%), followed by *Cx. sitiens* (1.2%), *Aedes albopictus* (0.6%), *Cx. gelidus* (0.2%), *Mansonia indiana* (0.2%), *Anopheles sinensis* (0.2%), *Armigeres subalbatus* (0.1%) and *Cx. tritaeniorhynchus* (0.1%). However, during the treatment nights, only *Cx. quinquefasciatus* (98.0%) and *Cx. sitiens* (2.0%) were collected ($n = 102$). The predominant species of *Culex* is the main vector for Bancroftian (urban) lymphatic filariasis throughout the tropical and subtropical regions (World Health Organization, 1989), although it is only a nuisance species in Malaysia. It is also the species that is most tol-

Table 2. Hourly percentage reduction of mosquitoes from 2100 to 0100 hours based on the performance of four coil formulations.

a.i. (conc. in % w/w)	% reduction at exposed time interval			
	2100-2200	2200-2300	2300-2400	2400-0100
Transfluthrin (0.018)	94.6	89.2	86.1	93.1
Transfluthrin (0.027)	98.7	84.3	95.2	91.3
Transfluthrin (0.046)	98.0	92.1	99.4	98.6
D-allethrin (0.18)	89.8	93.3	97.7	97.0

erant to pyrethroid-based mosquito coils among some common mosquito species from the genera of *Aedes*, *Anopheles*, *Culex* and *Mansonia* in Malaysia (Yap & Chung, 1987). Hence, it can be implied that coil formulations which proved effective against this species should also theoretically be effective against other species of mosquitoes.

In summary, coil formulations containing transfluthrin (0.018, 0.027 & 0.046% w/w) were as effective as those which contained d-allethrin (0.18% w/w) for personal protection against mosquitoes indoors. The choice of a particular concentration will depend very much on the cost effectiveness in their usage in different countries with diverse socio-economic backgrounds.

Acknowledgments. The authors are grateful to the Bayer AG, Germany (Drs. R. Sonneck & H. Rauen) for their interest and support; Malaysian Government (6th and 7th Malaysian Plan IRPA Grant) for research support and H.T. Tan, Samsuri Othman and S.Y. Lim for technical assistance.

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