Tropical Biomedicine 17: 45–48 (2000)

Research Note

Performance of hydramethylnon- and fipronil-based containerized baits against household ants in residential premises

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Abstract. A field study on the performance of two commercial containerized ant bait formulations, containing 1.0% hydramethylnon or 0.01% fipronil, against common household ants was conducted in a suburban residential slum on Penang Island, Malaysia. Three main species of household ants were found, namely, the pharaoh ant (*Monomorium pharaonis*), the odorous house ant (*Tapinoma sessile*) and the crazy ant (*Paratrechina longicornis*). Results indicated that both formulations performed well against common household ants, with more than 80% reduction in total ant count within one week post-baiting. However, no significant difference in bait effectiveness was found between the two ant baits throughout the eight weeks study period. About 60% of bait materials were consumed after 4 weeks post-treatment. The characteristics of a good ant bait are discussed.

Household ants are the most important household pests in Malaysia, after mosquitoes and cockroaches (Lee *et al.*, 1999). Several species had been reported to be potential mechanical vectors of human diseases, and have also been shown to penetrate dressed wounds and contaminate sterile equipments in hospitals (Beatson, 1972). Yap & Lee (1994) had conducted a survey on residential and food premises in Penang, Malaysia and reported on three main species of household ants, namely the pharaoh ant (*Monomorium pharaonis*), the odorous house ant (*Tapinoma sessile*) and the crazy ant (*Paratrechina longicornis*). A more recent study demonstrated 23 species of household ants covering 15 genera, that were found in and around Malaysian homes (Na & Lee, 2000).

Current control of household ants by pest control operators in Malaysia relies on residual insecticide treatment (Lee *et al.*, 1996; Chong *et al.*, 1998; Lee *et al.*, 1999). This method may be useful in acting as a barrier to prevent perimeter ant species from coming into the house (Hedges, 1999), but is not effective against several household ant species that reside within the house. Furthermore, some residual insecticides especially those from the pyrethroid group can cause insecticide repellency that will result in the budding of ant colonies (Chong & Lee, 1999). Heterogeniety of application surfaces may also cause unpredictable efficacy of residual insecticides (Knight & Rust, 1990). In addition, this treatment method does not affect the queen(s) and non-foraging individuals of an ant colony (Forschler & Evans, 1994).

Compared to residual insecticide treatment, toxicant ant baits have been shown to provide good control against many species of household ants (Knight & Rust, 1991; Reid & Klotz, 1992; Forschler & Evans, 1994; Vail *et al.*, 1996; Hooper *et al.*, 1998). The food bait is usually formulated with a slow-acting insecticide. Through trophallaxis (process of food exchange between members in a colony), insecticide-impregnated bait materials that were eaten by foraging workers will be transferred to other worker individuals, the brood and the queen, and thus subsequently suppress population growth, or even eliminate the population. However, bait acceptance and the amount of bait that are taken back to the colony are crucial to the success of this control method (Forschler & Evans, 1994).

To date, no study has been reported on the performance of commercial toxic baits against common household ants in Malaysia. This paper reports the performance of two commercial containerized ant bait formulations against common household ants in residential premises in Penang, Malaysia.

Two commercial containerized ant bait formulations were evaluated in this study: (1) Combat™ Ant Killer, containing 1.0% hydramethylnon, which is available in the Malaysian market. The test samples were purchased from a local supermarket. (2) Combat™ Quick Kill Formula, an established US ant bait product that contains 0.01% fipronil. The test samples were purchased from a supermarket in Indianapolis, Indiana, USA. Field evaluation was conducted in Sungai Batu, a suburban residential slum which is located at southwestern Penang Island, Malaysia. Prior to the trial, houses were screened to choose those with heavy ant infestation. About 3 g each of honey and peanut butter were placed onto an index card (6.5 x 7.5 cm) and left on surface areas where ant trails were sighted. Three index cards were placed inside the house. After 40 – 60 minutes, each index card was checked and the number of ants on each card was counted or estimated. Houses with more than 100 ants (total ants of three index cards) were chosen for the trial.

Prior to baiting, a sampling similar to the above was done again to determine the pre-treatment count. Baiting was done about an hour immediately after the pre-treatment sampling by placing three ant baits at locations as close as possible to visible ant trails. No bait was provided for control houses. A total of six houses were allocated for each bait treatment, and five untreated houses were reserved as control. Post-treatment samplings were conducted using the same method at 1, 2, 4 and 8 weeks post-baiting. At the 4th week post-baiting, one of the bait station was inspected to estimate the amount of remaining bait materials left in the station. Estimation was done as follows: 0% (completely consumed), 25%, 50%, 75% left. The total number of ants sighted in each house was compared with that of the pre-treatment count, and % reduction was calculated. Determination of the effect of the two bait formulations against individual species of ant was not possible, because test houses had varying number of ant species. Data were subjected to Kruskal-Wallis (KW) one-way analysis of variance and means were separated with KW multiple range test, using *Statistix® for Windows* software program.

Three main species of household ants were commonly found at the test site, namely the pharaoh ant (*M. pharaonis*), the odorous house ant (*T. sessile*) and the crazy ant (*P. longicornis*). Other species found in small numbers included the fire ant (*Solenopsis germinata*) and the ghost ant (*Tapinoma melanocephalum*). Both the pharaoh and odorous house ants were commonly sighted in the food preparation table in the kitchen and dining room, while the crazy ants were found near the dish-washing area. Overall, there appeared to be no significant difference ($P > 0.05$) between both bait samples throughout the

two months study period. Both formulations provided more than 80% reduction in total ant count within one week post-treatment (Table 1). A slight increase in bait performance was seen at the second week post-treatment for both bait formulations. At 8th week post-treatment, a greater increase in ant counts was seen in premises treated with hydramethylnon, compared to those treated with fipronil baits, although no significant increase was recorded ($P > 0.05$) (Table 1). Both bait formulation were well-consumed by the ants with about 60% bait materials remaining after 4 weeks post-baiting (Table 1). One bait was completely consumed (hydramethylnon) and another three baits (one hydramethylnon, and two fipronil baits) with only about 25% bait materials left.

A substantial reduction of the pharaoh and crazy ants was observed in houses treated with either bait formulation, but decrease in odorous house and ghost ants was only seen in houses treated with fipronil-based baits. It is speculated that this could be due to the greater thickness of the container floor base of the hydramethylnon bait station (0.5 mm), compared to that of the fipronil bait station (0.3 mm). This could possibly deter easy access into thicker floor base of bait station by the smaller-sized odorous house and ghost ants. A preliminary laboratory study demonstrated that the hydramethylnon bait was only effective against workers of odorous house ants when it was exposed without the container, than when it was used in a containerized form (Lee, unpublished).

Two important characteristics are required for a good ant bait formulation (Knight & Rust, 1991). First, it must contain a toxicant that have delayed action, i.e. it will provide <15% mortality after 24 hours exposure, and >89% mortality after 20 days (Stringer *et al.*, 1964). Second, it must have a very attractive food base that will show high palatibility to the ants. Nonetheless, the physiological state of the colony and the general feeding preference of each species may affect the attractiveness of food bait (Chong & Lee, 1999). Several other factors that also contribute to the success of ant baiting included bait placement (preferably near to a foraging ant trail) and site sanitation. In the presence of food debris, the debris will serve as a competing factor to the bait. In addition, insecticide treatment that causes repellency will also affect foraging activities by household ants, thus reducing the chance of ants finding the bait (Hedges, 1998).

In summary, both bait formulations showed good performance against common household ants in residential premises. This study demonstrated the

Table 1: Comparative field performance of hydramethylnon versus fipronil ant baits against common household ants[1] in residential premises on Penang Island, Malaysia

Bait (% active ingredient)	n	mean pretreatment count ± SEM	% reduction in total ant count at nth week[2]				estimated % bait remaining after 4 weeks post-baiting
			1	2	4	8	
hydramethylnon (1.0%)	6	174.8 ± 25.2 a	82.1 ± 4.0 a	90.3 ± 5.8 a	83.7 ± 10.2 a	54.9 ± 12.4 a	37.5 ± 8.6 (n=6)
fipronil (0.01%)	6	178.5 ± 27.9 a	92.7 ± 6.3 a	95.8 ± 3.6 a	90.4 ± 6.9 a	79.3 ± 8.2 a	41.6 ± 5.2 (n=6)
control	5	169.6 ± 18.0 a	12.1 ± 2.5 b	–20.7 ± 7.5 b	10.2 ± 1.4 b	–32.8 ± 9.8 b	not applicable

[1]Three main species of ants were found: *Monomorium pharaonis*, *Tapinoma sessile* and *Paratrechina longicornis*.
[2]Mean values followed by same letter within the same column were not significantly different ($P > 0.05$; KW multiple range test).

potential of using containerized bait formulation containing small amount of toxicant, and placed in discrete and limited locations against common household ants, thus minimizing pesticide exposure to humans.

Acknowledgements: I thank N.L. Chong for proof-reading the draft manuscript, and A. Lazim and E. Bakar for technical assistance.

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