



Insect Baits and Baiting:

Stand alone tools to control urban pests

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Introduction

Indoor pests have habituated themselves with human food and items around human vicinity, thus making use of insecticide baits have turned out to be most advantageous and effective. In fact, the singular reason for these pests to find harbourage in homes are for food and shelter. The concept of baiting has taken these two aspects and turned it into a practicable technique. A pest controller now provides a bait as food substitute, and bait stations as shelter to replicate both of the pest's needs. In addition, the reason for baiting becoming popular is its reduced risk and total safety aspect when used.

How Does Bait Reduces Risk?

Baits are safer as they make use of very little active ingredient in its formulation. The amount of active ingredient varies between 50mg to 2.0g per kg of bait. The application rates are also a few grams of formulated bait per square metre of the treatment area. This keeps both the application site and the applicator safe. In addition, most active ingredients used in insect baits are chosen to have low mammalian toxicity and are target specific. They are mostly not contact poisons and are mainly analogs and antagonists of insect growth regulators (IGR) such as juvenile hormone (JH), ecdysone, chitin synthesis inhibitors, and related compounds. Each of these

generation compounds have low toxicity to mammals, or selective toxicity towards insects, thus making baits safe to handle safe. But there are instances where toxic active ingredients are also used in baits to give a quick killing effect. In such cases, the percentage of active used in the formulation is kept at a level, which is many times lower than conventional spraying.

Baits are target specific; baits made for one pest species rarely attracts another pest species. This prevents affecting non-target organisms. This is achieved by using pest specific attractants and stimulants. In addition, baits are always applied or placed in selective areas, or inside concealed bait stations, which prevents non-target organisms coming into contact with the bait. Both these two aspects lower the risk of baits when applied.

Baits work by a single process of ingestion, a precise act on the part of the pest, while conventional spraying requires the pest to come in contact with the chemical. To ensure that the pests come into contact with the baits, the baits need to be selectively placed, whereas for spraying the entire area needs to be treated. Thus the amount of active ingredient used in baits can be very small compared to conventional spraying to achieve the desired result (Table 1).

Table 1. Comparative amount of active ingredient used in conventional spraying compared with gel baiting to eliminate German cockroaches, *Blattella germanica*, in a 250m² kitchen (Dhang 2018, unpublished work).

Treatment type	Total duration taken to totally eliminate of <i>Blattella germanica</i> population in a 250m ² kitchen	Amount of active ingredient used
Conventional spraying using a Deltamethrin SC formulation	90 days	12.0 g
Gel Baiting using a Fipronil based Gel bait	60 days	0.075 g

What Makes Bait Work?

Baits developed for insect pests are food based. They are not only effective in killing the insect directly through ingestion by the feeding individual but also show a killing effect on individuals that do not ingest the bait directly. The process termed “transfer effect or secondary effect” further enhances the efficacy of the bait against insects that are social or live in groups and exhibit trophallaxis (transfer food via mouth to mouth) or proctodeal (anus to mouth) feeding. Cockroaches are not social insects but live in groups thus baits work well with them. Cockroaches have shown horizontal transfer of insecticides contained in baits. There is considerable research to demonstrate this fact (Kopanic and Schal 1997; Buczkowski *et al.*, 2001). The process of secondary kill takes effect due the presence of unmetabolized slow acting insecticide in the bait formulation, in the feces, or oral secretions, or it may simply remains in the body of the dead cockroaches. By the process of coprophagy (eating faeces) and necrophagy (eating the dead), the left-over insecticide is then taken up by other individuals, which brings about the secondary kills. Transfer effects or secondary kills increases the overall control efficacy of the bait; however, the efficiency of the secondary kill can be dependent on the active ingredient and other influencing factors such as developmental stage of the pest, the strain, and

donor/recipient ratio (Wang *et al.*, 2008).

In one study, the researchers Bayer and colleagues (2012) showed that cockroaches in fact consumed more active ingredient than needed to cause mortality from a bait, proving no bait shyness. The same work also estimated that a 30g tube of gel bait potentially killed from 394 to 6,966 adult cockroaches, depending on the species. Mortality for all cockroach species was faster for adults (≥3 days), than for nymphs (≥7 days).

Similar successful bait transfer from one individual to other in the field has been shown in controlling all forms of social insect pests such as ants, termites, and feral wasps.

Are Baits Advantageous over Conventional Sprays?

It remains an unchallenged fact that conventional methods of pest control have eased the urban life of humans, but it has also brought enormous damage to our health and the environment. Conventional methods of pest control can cover a wide range of pests, provide quick and easy elimination, and have long field persistence as key benefits. Conventional methods depends on the use of pesticides as a single approach to pest control in which the chemical provides significant or acceptable reduction in pest population. It involves a single



action of chemical application following some regular, predetermined spray schedule. However, modern pest management is more than eliminating pests. It involves maintaining control over the pest, preventing re-infestations, and reducing chemical use as more important than mere killing (Dhang, 2011).

Baits have provided a rational solution to all the above, in addition to being able to control cryptic pests, and allows for the treatment of inaccessible and sensitive areas. In addition, baits offer no odour, no translocation, and no staining potential, which are common household concerns. Baits also leave lower or no residues. Furthermore, baiting is most suitable for treating sensitive locations such as high-density human populations, food preparation areas, inside hospitals and schools.

It is another aspect, such as the cost of

services and overall efficacy, which make baits advantageous over conventional sprays. A World Health Organization publication provide some insight into this (Rust, 2008). It was reported in one instance that the cost for a conventional service for cockroach control was USD\$8.57 per unit and IPM was USD\$7.49 per unit. In another study, the costs for IPM involving monitoring, baiting, cleaning and structural repairs, were USD\$46–69 per unit in the first year and USD\$24 per unit in the following year. In comparison, conventional chemical controls costed USD\$24–46 per unit, and involved no repairs or structural modifications to the apartments. In another study in public housing, the costs of conventional crack-and-crevice treatments with sprays and dusts were compared with vacuuming, baits and insect growth regulators (IGRs) for controlling German cockroaches. The average costs for IPM and conventional

treatments were USD\$4.06 and USD\$1.50 per unit, respectively. After eight months, cockroach populations decreased around 80% in IPM units, compared with a 300% increase with conventional treatments.

What are the Methodologies Involved in Baiting?

Compared to conventional spray treatments, baiting is inspection driven, kinder to the environment, and often more effective. Although the technology is restricted to a few pests, it has however made significant progress as a tool in urban pest management. However as discussed by Dhang (2011), the overall efficiency of baiting will depend on the bait applicators. Applicators' knowledge and skills are of paramount importance for baiting to be successful, as the concept of baiting is a dynamic field, constantly evolving, and adjusting to changes in insect behaviour and location. The human component involved in baiting is possibly the single factor against its popularity among pest control practitioners, which could be resolved through training.

The critical part of a typical baiting program depends on the following (Dhang, 2018):

- **Quality of the bait**

Commercial baits vary in attractability, nutritional quality, colour, texture, moisture, and many more factors that are critical determinants in acceptability and sustained feeding. Each bait needs to be tested before being used to ensure best performance.

- **Technical skills and knowledge of the bait applicator**

This is the second most important factor in bait performance. Good bait, with poor placement and the wrong dosage, can make bait ineffective. The greatest variant in any baiting program is the quantity of bait consumed. Knowledge on pest biology is usually required to overcome this issue.

- **Pest population**

It is never possible to determine the pest population based on a survey or inspection. Often the population of the pest determines the bait quantity, the number of visits, and ultimately the cost. This has to be taken note of before starting a baiting program.

- **Harbourage location**

Baits will only work if they are ingested, which is always a voluntary act. A pest will not walk the extra distance to seek a bait when food is around the harbourage. To



make baits competitive, it is thus important to either aggregate the pest in a specific location using a bait station or place the bait in the regular feeding zone near the harbourage.

- **Sanitation of the area**

Baits or a baiting program does not work well if the sanitation of the site is poor. Left over food or alternative food that is available in a site acts as direct competition to the bait. This results in a reduction of bait consumption and in turn turning ineffective in the elimination of the pest. Thus it is advisable to clean the site before baiting.

- **Follow up and monitoring**

One time bait application does not often work. Too much bait left may become dry or contaminated, and is not longer palatable to the pest. While too little bait will not kill all the individuals in the infestation. This makes a repeat visit or a monitoring trip a must. ■

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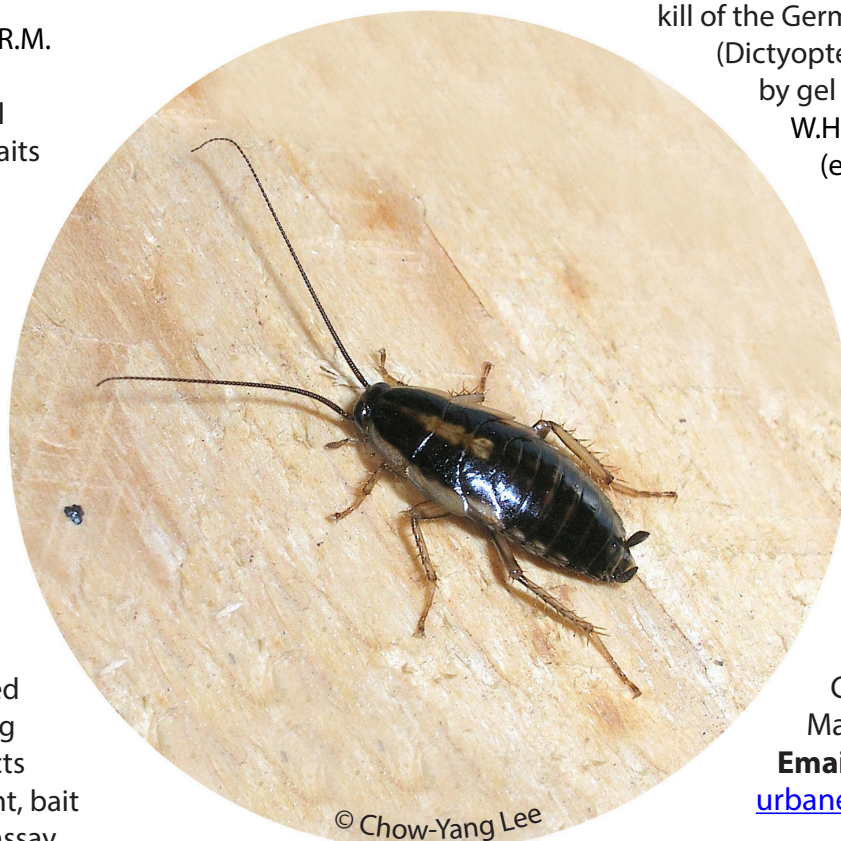
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