

Novel Potential of Effective Microorganisms as Bioattractant of Domestic Cockroaches in Malaysia

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Abstract: Objective: Bioattraction has been an essential aspect of pest control especially for insects. In this study, ExtremeBionic™, a mixture of effective microorganisms, was tested as microbial-based bait for its potential in attracting domestic cockroaches in Malaysia. **Materials and methods:** ExtremeBionic™ was activated for 5 days in 5% molasses to elicit production of volatile metabolites. The microbial culture and its metabolites was absorbed onto cotton pad and placed on a sticky trap. Several traps were placed strategically in infested residential halls to attract cockroaches. **Results:** To date, this is the first report on the use of microbial-based attractant consisting of effective microorganisms and their volatiles to attract cockroaches, thus addressing future application of biological baits as an alternative to domestic chemical based pest management.

Key words: Bioattraction, cockroach, pest control, microbial-based attractant

Cockroaches are unhygienic scavengers found in homes and settlements. These pests are night scavengers, lurking around kitchen cabinets, food storage spaces, rubbish bins and drains. The Malaysian cockroach of the *Periplaneta americana* species is commonly found in large numbers especially in urban areas. Other known cockroach species include *P. brunnea*, *Neostylopyga rhombifolia*, *Blattella germanica*, *Supella longipalpa*, *Nauphoeta citzerea*, *Lupparia notulata* and *Pycnoscelus surinamensis* (Zahedi and Jeffery, 1996). Cockroaches are smelly, filthy and can spread diseases by contaminating human food with germs which they pick up from latrines, garbage dumps, etc. A number of pathogenic bacteria have been isolated from the guts of domestic cockroaches, namely *Shigella flexneri*, *Salmonella typhi*, *Salmonella* spp., *Escherichia coli*, *Serratia marcescens* and *Pseudomonas aeruginosa* (Zahedi and Jeffery, 1996). Hence, cockroaches are carriers of intestinal diseases, such as diarrhoea, dysentery, typhoid fever and cholera. Besides that, cockroaches are always a nuisance as they spread filth, ruin food, fabrics, papers and book-bindings. They always disgorge portions of their partially digested food at intervals, drop feces, discharge nauseous secretion both from their mouths and from their body glands which give a long-lasting, offensive cockroach smell to areas or food visited by the pests (Rozendaal, 1997). Sensitivity to cockroaches was also

recognized as risk factor of asthma and allergic reactions (Leung and Ho, 1994). Therefore, significant effort has been undertaken to control cockroaches in human dwellings. Commercially available cockroach baits are normally chemical-based in nature. These chemical formulations of synthetic attractants had been used as cockroach baits for various commercially available sticky traps. Sugawara *et al.* (1975) reported on the synthesis of propyl cyclohexaneacetate and related derivatives which attracted German cockroach (*Blattella germanica*) (Sugawara *et al.*, 1975, 1976). Attempts to lure cockroaches by using pheromones and synthetic pheromones have been reported though not intensively used in pest management. This may be due to the amine compounds which are odour offensive, complex in structure or of gender- or stage-specific attractiveness (Karimifar *et al.*, 2011). Generally, cockroaches are considered as omnivores that feed on various foods containing all constituents of a balanced diet, including carbohydrates, proteins, lipids, fruits and vegetables. Cockroaches are also attracted to certain food-derived semiochemicals, particularly ethanol from beer (Karimifar *et al.*, 2011). Stale beer is well-known home recipe bait for cockroaches (Stauffer, 2007).

In this study, we attempted to explore biological based product, i.e., Effective Microorganisms (ExtremeBionic™ EM) as cockroach bioattractant.

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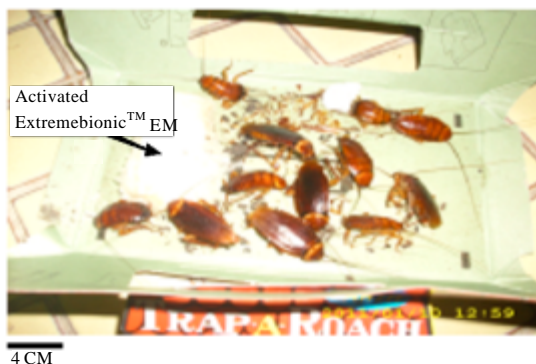


Fig. 1: Attraction of domestic cockroaches to activated Extremebionic™ EM in 48 h

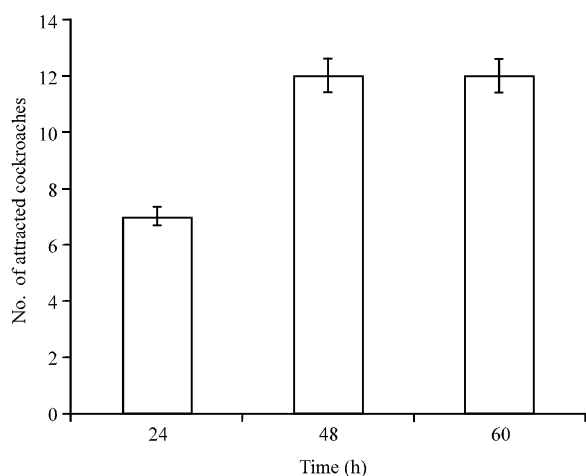


Fig. 2: Total numbers of domestic cockroach attracted to the activated Extremebionic™ EM

Extremebionic™ EM was prepared by activation of the cultured EM in molasses and distilled water at the ratio of 1:1:20. The mixture was activated for 5 days at room temperature in a tightly capped Schott bottle with intermittent loosening of the cap to release the internal pressure. The activated Extremebionic™ EM was soaked onto a cotton pad and placed on a sticky cockroach trap as bait. As control, molasses diluted in water soaked onto a cotton pad was prepared. The sticky traps were placed at various locations in undersink cabinets which were excellent cockroach hideouts. The experiments were carried out at a few selected residential halls in Universiti Teknologi Malaysia (UTM). Cockroach traps placed at the respective locations were observed after 24, 48 and 60 h for visual counts. It was found that domestic cockroaches could be attracted to the activated

Extremebionic™ EM and this is shown in Fig. 1. Figure 2 shows the total numbers of cockroaches attracted to the activated Extremebionic™ EM.

There has been no published report on the use of microbial strains as bioattractant of cockroaches. Generally, Effective Microorganisms (EM) denotes specific mixed culture of known and beneficial microorganisms that are being used effectively as microbial inoculants (Higa, 1991). EM may contain about 80 species of microorganisms, which can be divided into photosynthetic bacteria, lactic acid bacteria, yeasts, actinomycetes and fermenting fungi (Higa and Wididana, 1991). EM is mainly used as biofertilizer which enhances the photosynthetic capacity of plants, increases the efficacy of organic matter as fertilizers, thus improving the physical, chemical and biological environments of the soil. EM enhances the crop yields in organic systems in most of the environments. It also develops the soil, to improve its ability to sustain crops (Sangakkara, 1999).

Yeasts may formed a major component of EM, while all other mentioned microorganisms present only in very low concentrations (Van Vliet *et al.*, 2006). Yeasts are fermenting fungi that have been used in fermentation of food products and wines and in this process, yeasts produce various volatile metabolites which enhance its flavor, taste and aroma. Studies on the metabolites from yeasts are limited to volatile compounds used in food products (Huang *et al.*, 2010). Mugula and coworkers reported on volatile flavor compounds such as acetaldehyde, 2 methyl-propanal, 2-methyl-butanol, 3-methyl-butanol, ethanol, 2-methyl-1-propanol, 2-methyl-1-butanol, 3-methyl-1-butanol, diacetyl and acetoin which were produced by yeast co-cultures in the fermentation of togwa, a type of Tanzanian fermented food (Mugula *et al.*, 2003a, b). During their growth, the microbial strains from the Extremebionic™ EM may produce certain volatile metabolites which lured the cockroaches. Prior to future application of this biological bait, characterization of microbial strains in Extremebionic™ EM as well as their volatile metabolites is essential to elucidate the novel potential of this microbial attractant.

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