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EVALUATION OF BAIT GEL DOSAGES FOR *BLATTELLA GERMANICA* CONTROL

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Abstract *Blattella germanica* is a very important pest in homes, food service establishments and other structures in São Paulo city. The roach bait control is usually recommended. The aim this work was to evaluate the minimal dose of different active ingredients in bait commercial gel to *B. germanica* control. Mortality of different dosages of fipronil, imidacloprid, hydramethylnon and sulfluramide were evaluated on *B. germanica* adults. The doses were: 0.005; 0.007; 0.01; 0.03; 0.05; 0.07 and 0.1g of commercial gel bait. The insects were individually confined with respective gel dose, water and food; using 20 insects per bait active ingredient dosage. The mortality was assessed at 1, 2, 3, 4, 24, 48, 72, and 96 hours after bait introduction. Fipronil, imidacloprid and hydramethylnon bait gel showed 100% of efficiency in all dosages. Sulfluramide showed 100% of efficiency in dosages between 0.01 and 0.1g of bait gel.
Key Words Cockroach control

INTRODUCTION

Nowadays, more than 600 cockroach species are known in Brazil. The species *Blattella germanica* shows a general occurrence, from Rio Grande do Sul to Manaus (in Amazon region) (Pellens and Grandcolas, 2008). The high reproductive potential, adaptation in different conditions, cannibalistic and coprophageous behaviors are important characteristics to the success in the occupation of human habitats (Cornwell, 1976). Among the urban species, German cockroach has the greatest potential for becoming persistent and troublesome, due to its indoor location preference.

Cockroaches may become pests in homes, schools, food service establishments, restaurants, hospitals, warehouses, offices, storage areas and other structures in São Paulo city. They contaminate food and eating utensils and impart stains and unpleasant odors to surfaces they contact. The cockroaches were carrier pathogens that can remain viable in its digestive pipe, tegument and excrements, during days or weeks. The transmission of the pathogens can occur for regurgitate of foods, contact with its extremities (physicist) or for deposit of the excrements. The behavior of the domestic cockroaches to alternate habitats during the day and the night, transforms them into dangerous agents of contamination (Perez, 1989). In residences they contribute to the allergic processes as agents for induction and exacerbating of the asthma (Rosario et al., 1999). In the different types of establishments of manufacture or food manipulation they act as mechanical vectors, carrying pathogenic agents such as *Streptococcus* spp*., Endamoeba blattae, Aspergillus flavus, Escherichia coli, Serratia marcescen* e *Bacillus cereu, Staphylococcus* spp., hepatitis virus and coliform bacteria (Perez, 1989; Pai et al., 2003).

Diverse methods of control have been considered and searched inside of the philosophy of the integrated handling of cockroaches, being distinguished baits (Ross, 1998), in a very important to cockroaches integrated pest management (IPM). The use of baits results in less environmental contamination and reduced risk of intoxication. Bait is a substance which insecticide has incorporated in an attractive and palatable food (Cornwell, 1976) and to be efficient, gel formulations must be palatable and non-repellent (Appel, 1990). The German cockroach is repelled by most insecticides spraying application.

The aim of this work was to assess the minimal dose of professional gel baits containing different active ingredients.

MATERIAL AND METHODS

The laboratory bioassays were conducted from September until October 2010, at the Laboratory of Arthropods of Instituto Biológico in São Paulo, Brazil. The strain of *Blattella germanica* used in the experiments was collected

in kitchen in São Paulo city and reared in laboratory since 1998. Rearing and experimental conditions were 25-28ºC, relative humidity of 60-80% and photoperiod of 12:12. Mortality of different dosages fipronil, imidacloprid, hydramethylnon and sulfluramide were evaluated in *B. germanica* adults. The doses of 0.005; 0.007; 0.01; 0.03; 0.05; 0.07 and 0.1g of commercial gel bait were evaluated. The insects were individually confined with respective gel dose. Water and feline food were provided. The adult cockroaches were food disproved per 24 hours before the test. For each treatment, one adult cockroach was placed in each arena (250 ml). The experiment was replicated twenty times. Mortality was assessed 1, 2, 3, 4, 24, 48, 72 and 96 hours after bait introduction.

RESULTS

Fipronil, imidacloprid and hydramethylnon gel baits showed 100% of efficiency in all used dosages, 96 hours after the exposistion of the insects to the baits. Sulfluramide showed 100% of efficiency in dosages between 0.01 and 0.1g of gel bait. In terms of DL50, differences among the treatments were observed only during the first 72 hours after treatment, in which the highest values of DL50 were observed for hydramethylnon (Tabel 1).

Table 1. Toxicity (DL_{50}) (in g) of professional gel baits in *Blattella germanica*, in different periods after the exposition to the baits.

	48 hours	**72 hours**	**96 hours**
Fipronil	<0.005	<0.005	<0.005
Imidacloprid	<0.005	<0.005	<0.005
Hydramethylnon	>0.10	0.010	<0.005
Sulfluramide	0.002	0.0015	<0.005

Considering the time necessary to kill the insects, the longest values of LT_{50} were registered for hydramethylnon ($48 < TL_{50} < 72$ h at 0.1 g of bait) followed by fipronil ($4 < TL_{50} < 24$ h at 0.1 g of bait). The shortest values of LT_{50} were observed for imidacloprid (0.96 h of bait) (Table 2).

Table 2. Lethal time (LT_{50}) (hours) of professional gel baits in *Blattella germanica*, for different doses of baits.

	0.1 g gel bait	**0.005 g gel bait**
Fipronil	$4 < TL_{50} < 24$ h	$4 < TL_{50} < 24$
Imidacloprid	0.962 h	1.491 h
Hydramethylnon	$48 < TL_{50} < 72$ h	$72 < TL_{50} < 96$ h
Sulfluramide	2.432 h	3.999 h

DISCUSSION

The high values for median lethal time of hydramethylnon were already expected due to the mode of action of the chemical, which works as a metabolic inhibitor by blocking the biological process in the insect that makes Adenosine Triphosphate (ATP). ATP is a compound required by most biological processes to provide energy for life. Without ATP, the target pest becomes lethargic and stops eating. Hydramethylnon works gradually as a metabolic poison (U.S. EPA, 1998).

Imidacloprid acts inside the synapse of the insect to disrupt transmission of the nervous impulse. Imidacloprid binds to post-synaptic nicotinic receptor sites inside the synapse, essentially keeping the receptor in the open position thus hyperstimulating the cell. As this occurs throughout the nervous system, it leads to death of the insect (GreatVista Chemicals, 2011) in a short period of time.

Although slight differences in lethal times were observed for the different baits tested, the four chemicals (fipronil, imidacloprid, hydramethylnon, sulfluramide) proved to be promising options for the control of German

cockroach. Small doses, such as 0.005 g of gel bait for fipronil, imidacloprid and hydramethylnon, and 0.01 g of gel bait for sulfluramide, were enough to kill the cockroaches in less than 96 hours.

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