Comparative effect of the drugs, Amantadine hydrochloride and Hyoscine butylbromide on the German cockroach, *Blattella germanica* Linnaeus (Dictyoptera: Blattellidae)

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The effect of each of the drugs, Hyoscine butylbromide, an anti cholinergic agent with an antispasmodic effect, which has been compared with Amantadine hydrochloride as an anti-virus and anti-Parkinson's drug on the German cockroach was assessed herein. An experimental study was carried out using Bait method. The cockroaches, TEH susceptible strain were reared and kept in 25 to 27°C, 40 to 50% RH, and 14D: 10L photoperiod. The concentrations of 0.5, 1, 2, 4, and 8% used with pulverized dog food. Test results were analyzed with SPSS software. P-value of less than 0.05 was considered statistically significant between the different groups. The dose of 2% Amantadine hydrochloride, applied at a dose of 2%, caused 90% mortality rate of the adult stage German cockroach, while there were no significant differences between treatments when other doses (0.5, 1, 4 and 8%) of this drug or of the hyoscine (0.5, 1, 2, 4 and 8%) were used. It was observed that, the appropriate dose of Amantadine hydrochloride as a bait reduces irritability, lack of transfer of nerve impulses; weakening and eventual deaths of cockroaches. The dose of 2% Amantadine hydrochloride can be used as bait in laboratory studies. The use of drug to control of *Blattella germanica* in the laboratory should be investigated in the future.

Key words: Amantadine hydrochloride, hyoscine butylbromide, *Blattella germanica*, mortality.

INTRODUCTION

Infectious diseases are one of the most serious health problems that are caused by microorganisms, and are important to human health. The German cockroaches are the most important vectors that live in waste water wells and recycling.

They are considered as the vector of microorganisms such as fungi, protozoa, viruses, bacteria and one of the most important potential vectors of intestinal parasites to humans (Kinfu and Erko, 2008).

Recent studies have shown that levels of contamination with bacterial pathogens are not significantly influenced by the environmental contamination (Fu et al., 2009).

Its abundance and presence near the human settlements causes allergies and most serious health problem, and therefore the design of the control programmes is very important (Slater et al., 2007;
Improper and indiscriminate use of the insecticides against German cockroaches has led to resistance in different ways (Lee et al., 1999; Hemingway et al., 1993; Schal, 1988; Ladonni, 1993, 1997; Ladonni and Sadeghheyani, 1998; Nasirian et al., 2009; Shahi and Hanafi-bojd, 2008).

Poison bait has the advantage than liquid or dust formulations. Although, poison baits are expensive than liquid or dust formulation, but requires reduced environmental contamination, and increased efficacy. For example, when gravid female German cockroaches are exposed to insecticides lays their egg sacs (Mancock and Ross, 1993). Therefore, requires integrated management plans and new methods such as evaluate the new compound are developed for insect control and interrupt the growing resistance.

However, some drugs such as Warfarin (Coumadin) are an anticoagulant and rodenticide drug used in heart disease. Even low doses of this compound can be very dangerous for humans, especially children. Therefore, the use of human drugs as bait to control programs of the insects requires careful scientific laboratory and field studies. The important point about the use of human drugs as insecticide is the high price of some drugs such as antibiotics in many countries. Therefore, should be considered their cost effectiveness.

Until now, there are many studies about the effective used of drug on cockroaches (Abolghasemi et al., 2011a, b; Cochran, 1985; Derek, 1987; Bracke et al., 1978, Gammon, 2008; Nasirian, 2008; Lee, 2007).

Hyoscine butylbromide (Buscopan or Scopolamine HBr) is an anticholinergic drug, which used to relieve spasms, colic pain of digestive system, and pain of menstrual cycles (Martindale, 2008; Tytgat, 2007). Hyoscine was extracted from a plant source for the first time by German scientist Albert Ladenburg in 1880 (En.Wikipedia.org). This compound is a white or almost white, crystalline powder, soluble in water and dichloromethane; sparingly soluble in dehydrated alcohol. Amantadine Hydrochloride (Symmetrel) is an antiviral drug that is effective in the treatment of Parkinson's (Martindale, 2008; Crosby et al., 2003). Amantadine hydrochloride was considered as a prophylactic against adult influenza A by the U.S. Food and Drug Administration (FDA) in October 1966 (En.Wikipedia.org). This compound is a white or almost white crystalline powder, soluble in water and alcohol.

The aim of this study was to determine the effectiveness of Amantadine hydrochloride compared to Hyoscine butylbromide with different doses using as bait against the German cockroaches, Blattella germanica Linnaeus. There are scatter data due to the effectiveness of Amantadine Hydrochloride and Hyoscine butylbromide against the German cockroaches, B. germanica Linnaeus.

**MATERIALS AND METHODS**

This study was carried out in School of Public Health, Tehran University of Medical Sciences. New emerged cockroaches were placed inside the chamber (Cochran, 1983). The cockroaches reared at 25 to 27°C, 40 to 50% RH, 14D: 10L photoperiod. B. germanica had free access to food and water, without limitation, and were divided into 20 groups containing 30 samples. Two cockroach baits were studied. They were: 0.5, 1, 2, 4, and 8% of Hyoscine butylbromide, and the same concentrations of Amantadine Hydrochloride.

Five groups considered as Hyoscine butylbromide, five groups Amantadine Hydrochloride, and the rest as control. Pulverized dog food with different dosage 0.5, 1, 2, 4, and 8% of the drug were combined and used as treatment groups. The capsules of Amantadine Hydrochloride were 100 mg and tablets of Hyoscine butylbromide consists of 10 mg prepared and the concentrations determined after their mill. In the control group, dog food was used as 0.5, 1, 2, 4, and 8%. Mortality of cockroaches was calculated seven day post feeding. In addition, type of mating, numbers of ootheca were investigated. The test accepted when the mortality of control group was less than 5%, and reject when more than 20%. When the mortality of control group was between 5 to 20% the result as corrected using Abbot Formula (Abbott, 1952).

**Statistical analysis**

SPSS ver. 11.5, stata 80, and one way ANOVA test were used to compare the mortality of B. germanica (L.) between two groups. A P-value less than 0.05 were considered statistically significant.

**RESULTS**

Mortality of Hyoscine butylbromide as the concentrations of 0.5, 1, 2, 4 and 8% calculated as 0, 10, 6.7, 16.7 and 26.7%, respectively. The mortality rate found as 3.34%, in control group of dosage of 4 and 8% (Table 1).

Mortality of Amantadine hydrochloride was found as 13.34, 46.7, 90, 36.7 and 33.34% after post feeding of 0.5, 1, 2, 4 and 8% bait, respectively. Mortality in control group of 8% concentration was found as 3.34% (Table 2). There are significant differences among the effectiveness of Hyoscine butylbromide and Amantadine hydrochloride (P<0.05). Significant difference found due to mortality of B. germanica Linnaeus post feeding of Amantadine hydrochloride as dose of 2% of bait (P<0.05).

**DISCUSSION**

In this study, the effectiveness of the Amantadine hydrochloride and Hyoscine butylbromide were investigated against the German cockroach, B. germanica in the world. Hyoscine is absorbed through the gastrointestinal truck. This drug is used for treatment of gastrointestinal spasm, bile, kidney, and menstrual problems (Martindale, 2008). No significant effects of the
drug as a various dose was found on B. germanica Linnaeus.

Amantadine capsules are absorbed through the digestive system. Its half-life is between 2 to 4 h, and identified the preventive effects to entrance of the virus in to the cell body. It also causes the release of dopamine in the base node of the brain and is used to treat the Parkinson's (Martindale, 2008).

Ree et al. (2006) reported the fipronil bait cause the mortality of 90.9% on B. germanica Linnaeus at Korean restaurants, 96.4% at Chinese restaurants, and 89.4% in beer hall kitchens after 4 weeks of the treatment, while 11.5% in control group.

In contrast, the evaluation of hydramethylon baits against German cockroaches, showed a 100% reduction rate in laboratory strain (MacDonald et al., 1987), 94% in the wild strain of apartments (Patterson and Koehler, 1989), 84.4% reduction in private premises, 99.2% in lab animal rooms, and 88.8% in apartments (Ree et al., 1995), whereas in our study calculated as 90% one week post feeding of Amantadine hydrochloride as a dose of 2% bait. It seems that the killing effects of hydramethylon bait are more than the fipronil, and Amantadine Hydrochloride bait.

In previous study, we reported that Insulin N with a dose of 20 µ caused more than 70% mortality of susceptible strain of B. germanica. In fact, there was a significant difference between 20 µ of insulin N with other doses of 5, 10, 15 and 25 µ (Abolghasemi et al., 2011a).

Lee et al. (1996a) stated that lambda-cyhalothrin was the most, while propoxur and bendiocarb were found to be the least toxic against B. germanica. Experimental 2.15% imidacloprid gel bait containing 44% water was evaluated in laboratory and field studies against the German cockroach, Blattella germanica (L.). When applied at 15-45 g per kitchen, the bait significantly reduced German cockroach trap catch in infested homes during a 4-week period. There was a 50% reduction after 1 week and 80% reduction 4 week of post feeding (Appel and Tanley, 2000). Cochran (1985) stated the ingested boric acid destroys the cellular lining of the forcut of German cockroaches, Blattella germanica (L.) and finally death occurred due to starvation.

The killing effects of the Amantadine Hydrochloride is considered as the reduce irritability and mobility, imbalance, lack of transmission of nerve messages and eventually weakness, disability and death of cockroaches. In our study, Amantadine Hydrochloride at a dose 2% was found to have the most killing effects against B. germanica Linnaeus (Table 1).

There are many reports due to emergence of various chemical resistances of cockroaches and results indicate the defeat of the control plan (Lee et al., 1996b; Cochran, 1997; Ladonni, 2001; Schott et al., 1990; Atkinson et al., 1991; Valles and Yu, 1996; Valles, 1999; Valles et al., 2000; Wei et al., 2001). It seems to be the bait of Amantadine Hydrochloride as a dose of 2% can be used as a candidate bait to control of German cockroaches.

### Table 1. Effect of different doses of the drug Hyosine Butylbromide on the German cockroaches. The dose of 2% Amantadine Hydrochloride.

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<th>Total sample</th>
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<td>Mortality rate ±SE</td>
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### Table 2. The results of different doses of Amantadine HCL drug on German cockroaches (B. germanica).

<table>
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<th>Total sample</th>
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<td>Mortality rate ±SE</td>
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Also, since the lower dose of this drug can not cause poisoning and serious problems for humans and infant.

In conclusion, results of our study showed that doses of 2% of Amantadine hydrochloride as bait cause 90% mortality among the B. germanica Linnaeus. The risk of toxicity is negligible in human communication especially in children after exposure of the dose of 2%. The use of the effective dose of the Amantadine hydrochloride as bait is recommendation in field studies in the future.

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REFERENCES


