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EFFECT OF ACTELLIC ON OVIPOSITION IN *CALLOSOBRUCHUS CHINENSIS* (BRUCHIDAE : COLEOPTERA)

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Abstract: The toxic effect of Acetellic was tested against adults of *Callosobruchus chinensis*. LD_{50} for Acetellic was found to be 0.5559 ppm while 0.9 ppm caused 100% mortality after 48 hours. No treatment resulted in no mortality. There was a significant reduction in number of eggs between the treated and the control insects. The number of the eggs deposited decreased with the increase in the concentration of the insecticide.

INTRODUCTION

A great loss to world production of cereal grains, pulses and oil seeds is caused by insects, rodents and rot. If the crops could be protected from their ravages then it would not only be possible to store them for long periods without deterioration but also to meet the supply of most food needs of famine areas in the world (Cotton, 1963).

There are various types of contamination of stored grains and their sources. Many stored grain destructive pests reside inside the grain or pulses in their larval or grub stage. Inside the grain they devour the endosperm and leave their excreta inside them. These types of infested kernels or pulses are unfit for the human usage. Keeping this in view, the prevention of insect infestation of grain is of great importance, not only for the farmers but also for the users of these products (Cotton, 1963).

The most popular method to control these pests is the use of chemicals which ranges from chlorinated hydrocarbons, organophosphates and carbamates to pyrethroids. All insecticides have been used one after the other. Organophosphorus compounds contain one or more phosphorous atom chemically bound either directly to the carbon atoms of organic radical or indirectly through nitrogen, oxygen or sulfer (Gunther and Jeppson, 1960). They show a fast effect on the insects and their rate of accumulation in animals is comparatively less than chlorinated insecticides (Sun, 1968). The organophosphates are classified as stomach and systemic poisons, some as contact poisons, while others as fumigants (Hassall, 1983).

In the present study the toxic effect of Acetellic was assessed against *C. chinensis*.

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MATERIALS AND METHODS

Collection and maintenance of insects

To obtain the adults of *Callosobruchus chinensis* old infested grains were collected from local sources quality stores and shops selling provisions). These insects were separated and kept in sterilized glass jars (3" x 6") containing gram (*Cicer arietinum*), whole grain moong (*Vigna radiata*) and masoor (*Lence esculentum*) pulses at 28±20 and 65-70% relative humidity. The grains having unhatched eggs were daily separated and kept in fresh sterilized rearing jars. The newly emerged adults from these eggs were also transferred daily to fresh rearing bottles of similar dimension containing different pulses. The adults of the same age raised from this stock in the laboratory were used for experimental purposes.

Insecticide used and its treatment

In the present study Actellic which is an organophosphate and an ICI product was selected for use. It is marketed as liquid grain protectant and was obtained in commercial formulation of 50 EC from Grain Management Cell, Punjab Food Department.

Filter paper method

The bases of the Petri dishes (3" diameter) were fitted with filter paper and marked with a lead pencil for different doses. The dilutions (0.5 ml) were applied with the help of a pipette, starting from the periphery to the centre in a continuous circle for even distribution. The filter paper was placed on three common pins and was left to dry. Afterwards these were placed in Petri dishes to which 5 grams of grains were also added so that the eggs could be laid on them. Five pairs of newly emerged beetles were kept in each dish. Three replicates for each dose were set up. Mortality was noted after 48 hours and LD_{50} was determined by probit analysis (Finney, 1952; Busvine, 1971).

RESULTS

Effect of Actellic on mortality

The objective of the determination of LD_{50} was to measure the effectiveness of the insecticides against the adults of *C. chinensis* under laboratory conditions. The LD_{50} of Actellic in ppm determined by probit analysis was calculated to be 0.5559 ppm after 48 hours.

At 0.4 ppm, the mortality was 3.3%, 53.3% and 100% respectively after 2, 4 and 9 days, while 0.5 ppm caused 18.3%, 66.6% and 100% mortality after 2, 4 and 7 days, respectively. Treatment with 0.6 ppm resulted in 80% mortality after 2 days and 100% after 3 days. With 0.8 ppm, mortality was 86.6% after 2 days and 100% after 3 days, while with 0.9 ppm 100% mortality occurred within 2 days (Table I).

Table I: **Percent mortality at differennt doses of Actellic against adults of *C. chinensis*.**

Dose	Actellic treatment (days)								
(ppm)	1	2	3	4	5	6	7	8	9
0.4	0	3.3	25	53.3	58.3	80	85	95	100
0.5	10	18.3	45	66.6	78.3	95	100		
0.6	15	80	100						
0.8	36.6	86.6	100						
0.9	38.3	100							

n = 100 in all cases.

Effect of Actellic on oviposition

The rate of egg laying was 25-30.6 eggs per female in the untreated controls. The acetone treated controls laid 26-30 eggs per female. The treatment with Actellic inhibited oviposition and the number of the eggs laid per female decreased with the increase in concentration of the insecticide.

The rate of egg-laying was 23.16, 20.9, 19, 16.8 and 14 eggs per female at 0.4, 0.5, 0.6, 0.8 and 0.9 ppm dose respectively. The rate of egg laying was reduced from 23 egg per female to 14 eggs per female, as the dose was increased from 0.4 ppm to 0.9 ppm. The total number of egg laid by five females is given in Table II.

Table II: **Oviposition of *C. chinensis* at different doses of Actellic.**

	0.4 ppm	0.5 ppm	0.6 ppm	0.8 ppm	0.9 ppm
Untreated control	150.33 ±20.60	128.00 ±3.348	134.00 ±5.74	125.30 ±10.76	139.66 ±3.604
Treated control	146.66 ±15.80	150.6 ±16.99	131.00 ±18.08	131.00 ±21.478	139.00 ±16.287
Treated	115.8 ±14.67	104.5 ±3.06	98.00 ±25.25	84.1 ±1.964	74.8 ±5.948

L.S.D. = 26.1215

DISCUSSION

As insects are the major cause of damage and loss to the stored products various forms of preventive measures are designed to keep the pest population below the economic level. All kinds of gram, pulses, etc., are devoured and rendered useless by these hungry weevils (Metcalf and Flint, 1967). Food grains are commonly protected by contact insecticides or fumigation. A simple method of killing the weevils and preventing the destruction caused by them is to treat them chemically with organophosphates or pyrethroids. The effectiveness of different insecticides varies with the pest species and their developmental stages (Yana, 1966; Champ *et al.*, 1969; Samson and Parker, 1989). Hence pesticides have specific mode of action and toxicity (Corbett, 1974; Matsumura, 1975).

In the present study Actellic which is an organophosphate and a fast acting insecticide with both a contact and a fumigant action was used (Worthington and Walker, 1987). During the present work exposure of the adults of *C. chinensis* to different doses of Actellic revealed the LD_{50} as 0.55 ppm, after 48 hours. By increasing the dose mortality also increased and at 0.9 ppm 100% mortality occurred after only 48 hours. This type of fast effect has been shown by other organophosphate compounds and reported by various workers like Worthington and Walker (1987).

Various workers have revealed that after topical application *in vivo*, the concentration of the insecticides at the primary site of action may be influenced by a large number of factors including penetration, distribution, selective accumulation in insect tissues, biotransformation and elimination (O'Brien, 1967; Narasashi, 1971; Brooks, 1976). During the present work the mode of application of the insecticide had a 2 fold action *i.e.*, penetration through the cuticle and via mouth, so it worked both as a contact and a stomach poison.

However, todate there is no generally accepted opinion on how the insecticides arrive at the target site. The conflicting view points are that on one hand, penetration through the cuticle and subsequent transport by the haemolymph occurs and on the other hand, that there is lateral transport in the cuticular wax layer and tracheal lining following by penetration through the glial cells into the central nervous system (Geroltt, 1970). All this finally results into the mortality and subsequent decrease in the population abundance of the pest under consideration.

Orr and Downer (1982) have reported that primary site of action of most of the insecticides is the nervous system, however, in addition, many physiological and biochemical effects of insecticides have been described in tissues outside the nervous system. These extraneuronal effects have been attributed to insecticide induced release of hormones or neurohormones from neuroendocrine tissues and consequent perturbation of normal physiological functions. When treated with Actellic ovipositional activity was found to be disturbed. There appeared a significant reduction in ovipositional activity as the dose was subsequently increased from 0.4 ppm to 0.9 ppm.

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