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EVALUATION OF DUST FORMULATIONS OF ACTELLIC AND PHOSTOXIN FOR INSECTICIDAL ACTIVITY.

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ABSTRACT

Controlled release dust formulation of actellic was prepared by mixing together commercial dust formulation with melted paraffin wax. The dust formulation of phostoxin was prepared by grinding the commercial phostoxin tablets. The insecticidal activity of the formulations was investigated by weighing known amounts of each formulation into the petri dish to which some bean weevils (*Callosobruchus maculatus*) were later introduced. The release rate of actellic formulation was assessed by the measurement of actellic residue of the formulation at 3 days intervals. The results showed that the insecticidal activity of actellic formulation with wax lasted longer than that of formulation without wax or commercial phostoxin tablets. The results of residue analysis indicated that formulation with wax showed a longer period of activity due to reduced rate of release of the active ingredient.

Key words: Actellic, phostoxin, formulation, dust, wax.

INTRODUCTION

Actellic (Pirimiphos-methyl) is an organophosphorus insecticide with a wide margin of safety in mammals and a broad spectrum of insecticidal activity at low rates of application (Adesuyi, 1977; Redlinger, 1976). Phostoxin (aluminium phosphide) is an insecticide commonly used for fumigation of stored products (Mejule, 1977). Phostoxin is formulated as 3g or 0.6g pellets. The commercial dust formulation of actellic is more effective for the storage of grains at temperate temperatures because the active ingredient is lost faster by vaporization at tropical temperatures (Tun, 1979; Sowumi, 1981; 1982). The problems of instability of insecticides, the short term effectiveness and the increased expense of several applications have led to the research on how to extend the period of effectiveness of insecticides (Neogi and Allan, 1974). Previous efforts were made to develop a slow release formulation of insecticides. These include the introduction of the Shell-NO-Pest strip and microencapsulation of insecticides (Bakan, 1975). The latter involves the incorporation of the insecticide in a permeable covering that permits its escape at a reduced but effective rate. Coating materials can be selected from a variety of natural or synthetic films forming long chain compounds. The amount of coating can be varied from 1 to 70% by weight (Oladimeji et al, 1986). Encapsulated materials may be isolated as dry, free-flowing powder. The insecticide disappearance may be measured by residue determination (Freeman et al, 1975; Oladimeji 1987) while the recovery of insecticide from formulations can be achieved by solvent extraction (Bertsch et al, 1974; Oladimeji, 1999).

Coating materials of low softening points are desired to prevent thermal degradation of the biologically active ingredient (Neogi and Allan, 1974).

There is the need to improve the effectiveness of actellic dust formulation to be used under the tropical environment. The present work therefore involves the modification of the commercial dust formulation of actellic. This is an attempt at reducing the rate of vapourisation of actellic so as to prolong the effectiveness of the formulation. The insecticidal activity of the modified formulation is assessed by comparing its activity with that of phostoxin which is a well known insecticide for stored products.

MATERIALS AND METHOD

Actellic dust formulation and phostoxin tablets were obtained from Chemical and Allied Products, Ltd., Apapa, Lagos. Candle wax was purchased from Oja-Oba market, Akure.

PREPARATION OF THE DUST FORMULATIONS

Actellic commercial dust formulation (51g) was weighed into a 97g screw-capped

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Table1: Percentage kill of bean weevilss placed in petri dish for 48hr after application of the insecticide formulation previously exposed to the atmosphere.

Exposure period (days)	Percentage kill of bean weevils		
	Actellic formulation		Phostoxin formulation
	Without wax	With wax	
0	100.00±0.00	100.00±0.00	100.00±0.00
3	100.00±0.00	100.00±0.00	100.00±0.00
6	40.50± 1.50	100.00±0.00	100.00±0.00
9	0.00±0.00	100.00±0.00	0.00±0.00
12	0.00±0.00	100.00±0.00	0.00±0.00
15	0.00±0.00	70.76±2.04	0.00±0.00

All data given as means of three replicates.

glass jar. Candle wax (9g) was melted and added to the actellic dust in the jar and the components thoroughly mixed together. Phostoxin tablets were ground to obtain the dust formulation.

ASSESSMENT OF INSECITICIDAL ACTIVITY OF THE DUST FORMULATIONS.

Each formulation (3g) was weighed into a petri-dish to which 10 bean weevilss (Callosobruchus maculatus) were later introduced. The petri dish was loosely covered and mortality of the bean weevils observed after 48hr. Each treatment was carried out in triplicate.

ANALYSIS OF ACTELLIC FORMULATIONS

Each of the actellic formulations (60g) was transferred into a cardboard box of dimensions 24mm x 18mm x 14mm and spread on the floor of the box. The loosely covered cardboard boxes were kept in a well-ventilated room. The analysis of each formulation was carried out by extracting 3g sample using $25cm^3$ ethyl acetate in each case in a chromatographic column (14cm long x 1.5cm inner diameter). The wax additive had earlier been found to be held onto the column on eluting with ethyl acetate. The amount of actellic present was determined using a UV spectrophotometer with absorbance measured at 400nm. Pure actellic used for the standard solution was obtained by eluting 10g actellic commercial dust formulation with $100cm^3$ diethyl ether. The ether was distilled away to leave behind light brown coloured liquid actellic. This process was repeated to get the required amount of actellic with 0.1g of it weighed out to prepare $100cm^3$ standard solution with ethyl acetate.

Table2:

Residue amount of actellic formulation as percentage of the initial amount at 3 days interval.

Days	Percentage residue amounts of actellic formulation	
	Without wax	With wax
0	100.00±0.00	100.00±0.00
3	84.24±2.30	96.47±3.05
6	52.50±3.12	86.36±4.13
9	33.75±1.24	84.76±2.24
12	19.15±4.35	74.53±3.16
15	16.33±2.26	64.23±4.41

All data given as means of three replicates

RESULTS AND DISCUSSION

The insecticidal activity of actellic formulation without wax has activity which is less than that of phostoxin (Table 1). After 6 days application the activity of actellic formulation without wax was found to be reduced while phostoxin formulation still maintained undiminished activity. After 9 days, phostoxin formulation was no more effective in controlling the bean weevils while modified formulation of actellic containing wax was still effective in controlling the insects. The modified formulation exhibited a longer period of effectiveness due to reduced rate of release of actellic (Table 2). After 15 days 83.67% actellic had evaporated away from the formulation without wax while 35.77% actellic was lost from that with wax.

This shows that wax is an effective coating agent which promotes the reduction of release rate of actellic thereby leading to improved insecticidal activity of the dust formulation.

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