

BIOPESTICIDES TO CONTROL THE GROWTH OF A STORAGE PEST *SITOPHILUS ORYZAE* (L.)

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KEY WORDS

Black pepper
Cinnamon bark
Sitophilus oryzae

Received on :
17.11.2010

Accepted on :
07.02.2011

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ABSTRACT

Sitophilus oryzae L., a storage pest of wheat grains is normally managed by the application of DDT which, however, remains in the wheat grain, even after cleaning, and affects human health. The present study has used to biopesticides, viz., extracts of black peppercorns and of cinnamon bark, to control the growth of this pest. These were extracted in diethyl ether and alcohol, and then after wheat grains were soaked in the extract for 30 minutes before the adults of *Sitophilus oryzae* were introduced into the treated grains. It was found that the biopesticide were able to effectively control the pests. Surprisingly the mortality rate of the pest was found to be higher at low concentration and lower at higher concentration of the extracts. This was due to the fact that the adult pests were able to escape the pesticidal effect by adhering to the sides and lids of the jar and not feeding treated grains. The extracts made in alcohol found to be more effective.

INTRODUCTION

Many plant extracts have been used for their insecticidal and fungicidal properties (Obeng-Ofori *et al.*, 1998). Black pepper, also known as "King of Indian spices" has also been in use for this purpose (Lale and Alaga, 1998; Pessu and Williams, 1998). Similarly, cinnamon has also been studied (Ho *et al.*, 1997) for its insect repellent properties. Every house holder will testify to the fact that several insects infest the stored grains of rice, wheat, pulses etc., and render them unfit for human consumption. The present study attempt to scientifically analyse the efficacy of black peppercorn and cinnamon bark in reducing these infestation by *Sitophilus oryzae* L.

MATERIALS AND METHODS

The materials used were (a) Black peppercorns (*Piper nigrum* L.); (b) Cinnamon bark (*Cinnamomum zylanicum* L.); (c) Insect pest *Sitophilus oryzae* L.; (d) Grains of wheat (*Triticum aestivum* L.).

Experimental details

The black peppercorn extract was prepared in two different ways, viz., in diethyl ether and in ethanol. To prepare the extract in diethyl ether, five gram of black peppercorns were crushed in 20 mL diethyl ether and allowed to remain for 45 minutes. This extract mixture was then filtered through Whatman's number 1 filter paper. To prepare 1 per cent concentration of this extract, one ml. of the extract was added to 99 mL distilled water. Similarly, 2%, 5% and 10% solutions were prepared. A similar procedure was adopted for preparing ethanol extracts of black peppercorn.

Cinnamon bark extract was prepared crushing five gram cinnamon bark in diethyl ether and ethanol in the same way and again 1%, 2%, 5% and 10% concentrations were

prepared in distilled water.

Insect culture

A fresh culture of *Sitophilus oryzae* was obtained from the CSA University of Agriculture and Technology, Kanpur. They were then reared in the laboratory of botany department of the college at a temperature of $29 \pm 3^\circ\text{C}$ and RH 84 – 85%, in the month of October. A mass culture of these insects was maintained for experimentation.

Twenty mL of each of the extract of black peppercorn and cinnamon bark were mixed thoroughly with 20 g of wheat grains and allowed it to dry. Each of these was placed in a 250 mL specimen jars and 20 adults of *Sitophilus oryzae* were introduced in to it. The mouth of each jar was covered with cotton cloth and tied tightly. These jars were maintained for four weeks.

A control experiment was also maintained in which twenty gram wheat grains were mixed with 20 mL distilled water into which 20 insects had been introduced.

Observations were taken each week for four weeks on the mortality of test insects and also to determine if any abnormality and juvenomimetic effect could be seen.

RESULTS AND DISCUSSION

The observations on the mortality percentage are given in Table 1. It can be clearly seen from these observations that both cinnamon bark and black peppercorn extracts are more effective in controlling the insects at lower concentrations, i.e., at 1% concentration. The highest mortality rate was found to be 85% in 1% cinnamon bark extract. At this concentration of black peppercorn extract, the insect mortality rate was found to be 75%. An unusual observation was that the mortality

Table 1: Effect of black peppercorn and cinnamon bark extract made in diethyl ether and ethanol on mortality percentage of *Sitophilus oryzae* L.

Extraction solution Percentage concentration	Diethyl ether		Ethanol					
	1	2	5	10	1	2	5	10
Plant extract Black peppercorn (%)	13/20(65)	9/20(45)	8/20(40)	9/20(45)	15/20(75)	13/20(65)	12/20(60)	12/20(60)
Cinnamon bark (%)	14/20 (70)	14/20 (70)	9/20 (45)	8/20 (40)	17/20(85)	15/20(75)	14/20(70)	8/20(40)

decreased progressively with increase in the concentration of extract. In other words, the mortality of insects was inversely proportional to the concentration of plant extract.

It was seen that the adult insects were able to escape from the wheat grains, treated with plant extract, by climbing up the walls of the specimen jars and attaching themselves to the cotton cloth used as lids for the jars. At lower concentrations, the signals were probably, not strong enough for them to attempt to escape, and hence were killed. At progressively higher concentrations, these signals also most likely, became progressively stronger so that the insects were prompted to escape.

The workers have determined the effect of different plant extracts in controlling the insects. Villalobos *et al.*, (2003) observed the insecticidal effect of a group of plant essential oils (Caraway, coriander, sweet basil, garlic and chrysanthemum) against *Callosobruchus maculatus* and *Sitophilus granaries*. They found that only the bruchid was affected and that caraway oils the most effective by causing 60% - 100% mortality. Bourarach and Hannin (1999) studied the insecticidal activity of some plant products (*Smyrrium olusatrum*, *Nigella sativa* and *Piper nigrum*) against the storage pest, *Rhizopertha dominica* and *Sitophilus oryzae* and found significant effects that can be correlated to the present work. In the present study, 60% - 75% mortality was observed with black peppercorn in ethanol but in diethyl ether extract the mortality was little lower that is 45% - 65%. The mortality percentage was higher when cinnamon bark was used, it was 40% - 85% when extract was made in ethanol and 40% - 70% when extract was made in diethyl ether.

CONCLUSION

At a time when non-biodegradable chemical insecticides like DDT are being used to control storage pests, the proven efficacy of plant extract can become a boon to the environment as well as to the health of the consumers.

ACKNOWLEDGEMENT

The author would like to express the gratitude to the Principal and to the Head for providing the necessary facilities. Thanks are also due to Dr. Veena Tewari, Associate Professor for her help and encouragement.

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