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BIOPESTICIDAL EFFECT OF *NERIUM INDICUM* BARK EXTRACTS ON PULSE BEETLE, *CALLOSOBRUCHUS CHINENSIS* (LINN.)

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ABSTRACT
The insecticidal activity of *Nerium indicum* bark against *Callosobruchus chinensis*, a pest of pulses was studied. The bark extracts of *Nerium indicum* were tested for their effect on oviposition, adult emergence from grains and mortality of the pulse beetle, *Callosobruchus chinensis*. Observations were made on the number of eggs laid on seeds treated with extracts, adult emergence from seeds and mortality of adults exposed to treated seeds. The number of eggs laid and the adults emerged from seeds of *Phaseolus mungo* treated with ethanol extract of *Nerium indicum* bark were less than from seeds treated with methanol extract. In the present study the bark extract of *Nerium indicum* were effective as insecticidal property to control pulse beetle, *Callosobruchus chinensis*.

KEY WORDS: biopesticide, *Callosobruchus chinensis*, *Nerium indicum*

INTRODUCTION

The crop and store grain pest problems are nearly as old as the beginning of crop cultivation. With a greater awareness of hazards associated with the use of synthetic organic insecticides there has been an increased need to explore suitable alternative methods of pest control. This paper reports the results of research into the effects of extract of *Nerium indicum* plant on various stages in the life cycle of pulse beetle, *Callosobruchus chinensis*. Pande *et al.,* (1986), Islam (1987), Reddy *et al*. (1994), Kamal Mangala (1993), Dwivedi and Bhati (2006) have studied the effects of various plant extract against *Callosobruchus chinensis* and were found effective results against the control of pulse beetle. Singh (1998) studied the molluscicidal activity of *Nerium indicum* bark extract. The present study was directed to assess the bioprospectation of plant extract against pulse beetle, *Callosobruchus chinensis*.

MATERIALS AND METHODS

Nerium indicum bark was collected and were air dried and powdered was prepared with the help of electric grinder. 10gm of the powdered material was soaked, in the dark, in a solution of 10ml of distilled water and 40ml solvent (methanol and ethanol). After one day the solution were filtered and stored in the refrigerator prior to use.
The extracts were tested for their effects on three life cycle stages of *Callosobruchus chinensis*: oviposition (number of eggs laid), percent adult emergence and mortality. For screening two hundred seeds were shaken thoroughly with various extracts (0.5ml, 1ml, 1.5ml, 2ml and 2.5ml) in each jars. Control seeds were mixed with the same amount of methanol or ethanol extract. After mixing all seeds were allowed to dry leaving a film of extract. Into glass jars containing 200 seeds coated with each extract, five pairs of insects were released. Jars were closed by cheesecloth and sealed with rubber band. Four replication were used for each of the treatment. The mortality of adults was recorded in each of the treated and control jars. Egg number was counted weekly until the emergence of adults. After adult emergence, the numbers of adults were counted weekly. Newly emerged adults were removed from the jars.

RESULTS

Number of Eggs laid: The number of eggs laid on grains in each jar was counted over the nine week experimental period (Table-1). Overall the number of eggs laid on grains treated with plant extracts in ethanol was lower than methanol treatment. The mean number of eggs laid was the lowest for the treatment 2.5ml of bark extract being 8 and 3 from five pairs of adult beetles in methanol and ethanol extracts respectively. Grains treated with 0.5ml, 1ml,1.5ml and 2ml, the number of eggs were 92 and 85, 71 and 60, 36 and 30, 19 and 14 in methanol and ethanol extract respectively. The seeds treated with solvent only (control), the number of eggs laid on seeds were 121 (methanol) and 112 (ethanol).
Adult emergence: Adult emergence was counted in each jar at weekly interval until week nine, after which there was no more further adult emergence. The mean number of adults emergence shows in table-2 for the four replication of the extract treated seeds and the control. Overall, adult emergence was less in ethanol based plant extracts compared to methanol based extract. Seed treated with 0.5, 1.0, 1.5 and 2.0ml plant extract the mean number of adult emergence were 37 and 26, 22 and 14, 11 and 5, 3 and Zero in methanol and ethanol based extract respectively. No adult emergence found in the dose of 2.5ml extract of methanol and ethanol based bark extract. The percent adult emergence (per egg laid) was higher for the ethanol-based extract than methanol. This was probably due to fewer eggs laid on seeds treated with ethanol based extracts.
Insect Mortality: The cumulative percentage mortality of the adult insects released into the jars containing seeds treated with methanol and ethanol based plant extracts are shown in table-4. The mortality data show that all 40 beetles

had died within 10 days in the treatment using 2.5ml of methanol bark extract while in ethanol based extract the 100% mortality was recorded after 6 days of exposure in 2.0 ml and 2.5 ml of ethanol bark extract.

DISCUSSION

Several workers have reported growth and development inhibition properties of plant extracts on pulse beetle, *C. chinensis*. Much of this literature refers to the effects of neem oil. Ketkar (1986) reviewed the effect of neem oil along with three other non-edible oils against *C. chinensis*. It was found that the growth index with neem was the lowest; neem also had the greatest ovicidal effect. Pandey *et al.,* (1986) reported that a petroleum ether extract of neem leaves and twigs mixed with green gram seeds inhibited the oviposition of *C. chinensis*. Das (1989) studied the effects of chickpea storage duration on oviposition of *C. chinensis* when the seeds were treated with neem oil. Khaire *et al.,* (1993) studied the effect of 10 vegetable oils, including neem, on ovipositional preference and egg hatching of *C. chinensis*. They reported that all treatments affected ovipositional preference. Kachare *et al.,* (1994) found that no hatching of eggs of *C. chinensis* took place during the storage of pigeonpea for 33 days when the seeds had been treated with neem oil. Reddy (1994) reported that mungbean seeds treated with neem oil halted the embryonic development of *C. chinensis*, protecting stored seed for a period of 12 months. Studies conducted by Chiranjeevi and Sudhakar (1996) revealed that neem seed powder, mixed with mungbean seed, completely prevented the development of *C. chinensis*. Rouf *et al.,* (1996) reported that mixing of neem leaf powder with lentil seeds resulted in reduced oviposition and adult emergence in the same beetle. Studies reported by Rajapakse and Senanayake (1997) showed that seeds treated with neem oil significantly reduced oviposition of *C. chinensis*.

Babu *et al.,* (1989), who reported a mixture of oils of *Ricinus communis* and *Pongamia glabra* as an effective seed protectant. Gupta *et al.,* (1991) also reported that oil of *Ricinus communis* gave complete protection to cowpea from bruchid damage. Dwivedi and Garg (2001) have also recorded larvicidal properties of *Tagetes indica* and *Ricinus communis* against *Corcyra cephalonica*. Antifeedent properties of *Nicotiana spp.* And *Lantena camera* were observed by Kumari and Kumar (1998) and Saxena *et al.,* (1992), respectively which also support the results of present study.
In the present study clearly indicates that the bark of *Nerium indicum* is an important source of a botanical insecticide. The toxicity study revealed that the toxic component of *Nerium indicum* bark is soluble in ethanol. Guzman and Ambros (1992) and Singh (1998) observed that the aqueous and ethanolic extract of *Nerium indicum* bark is an effective biopesticide against *Blatta orientalis* and Lymnaea *acuminata* respectively. Siddiqui S. *et al.,* (1990) reported that glycosides, steroids and termenoids have been isolated from different parts of *Nerium indicum*. Chander and Ahmed (1986) stated that reduction in oviposition on treated grains was mainly because of insect mortality and repellent effect of plant extracts, which are responsible for seed protection. The findings of the present investigation revealed that the bark extract of *Nerium indicum* possess remarkable bioprospectation of natural insecticide against *Callosobruchus chinensis.* The study needs further investigation to find out active ingredients responsible for insecticidal properties against wide range of store grain pest and to reach any final recommendations.

Table-1. Number of eggs laid on seeds coated with methanol and ethanol extract of the bark *Nerium indicum*.

Dose level	No. of eggs laid on seed treated with methanol extract.	No. of eggs laid on seed treated with ethanol extract.
Control	121 ±0.237	112 ±0.314
0.5ml	092 ±0.302	085 ±0.135
1.0ml	071 ±0.235	060 ±0.116
1.5ml	036 ±0.119	030 ±0.213
2.0ml	019 ±0.235	014 ±0.078
2.5ml	008 ±0.104	003 ±0.145

Mean number of eggs laid in four replication.

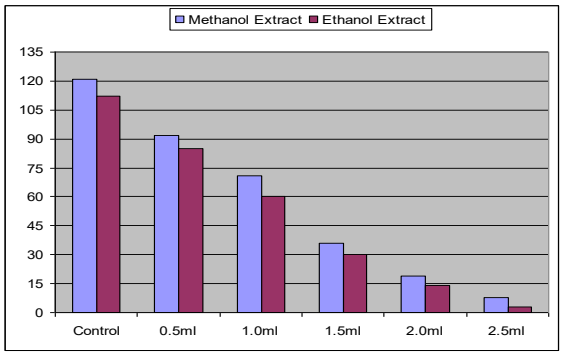

Figure 1. Number of eggs laid on seeds coated with methanol and ethanol extract of the bark *Nerium indicum*.

Table-2. Number of adult emergence from seeds treated with methanol and ethanol based plant extract of *Nerium indicum*.

Treatment / dose level	No. of Adult Emergence from Methanol based plant extract.	No. of Adult Emergence from Ethanol based plant extract.
Control	103	91
0.5ml	037	26
1.0ml	022	14
1.5ml	011	05
2.0ml	003	---
2.5ml	----	---

Mean number of adult emergence in four replication.

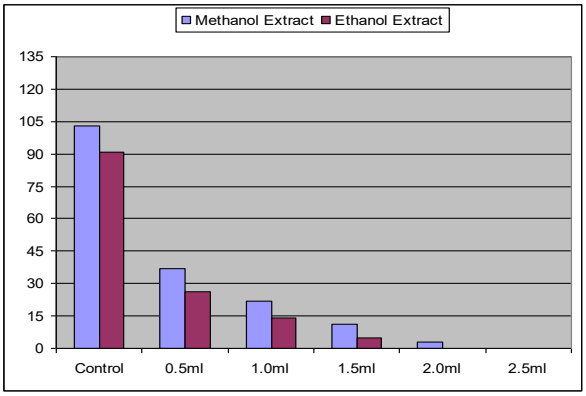

Figure 2. Number of adult emergence from seeds treated with methanol and ethanol based plant extract of *Nerium indicum*.

Table-3. Percent adult emergence (per number of eggs laid) from seeds treated with methanol and ethanol based extracts of *Nerium indicum.*

Treatment / dose level	**Methanol based Extract**	**Ethanol based Extract**
Control	85.12	81.25
0.5ml	40.21	30.58
1.0ml	30.98	23.33
1.5ml	30.55	16.66
2.0ml	15.78	------
2.5ml	------	------

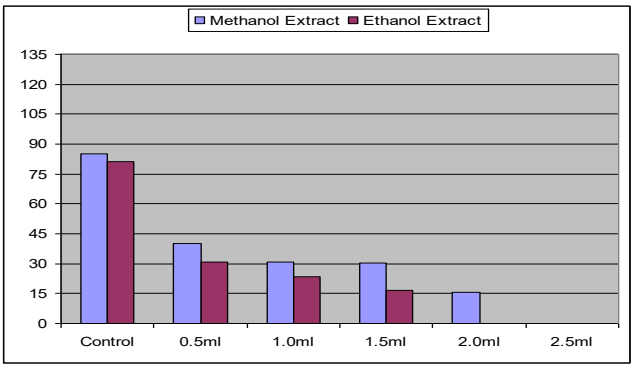

Figure 3. Percent adult emergence (per number of eggs laid) from seeds treated with methanol and ethanol based extracts of *Nerium indicum.*

Table-4. Cumulative mortality of *Callosobruchus chinensis* in the presence of seed treated with methanol and ethanol based extract of *Nerium indicum*.

Treatment / dose level	Intervals Days after release (%)													
	2 days		4 days		6 days		8 days		10 days		12 days		14 days	
	M	E	M	E	M	E	M	E	M	E	M	E	M	E
Control	----	---	---	---	---	---	---	---	---	---	---	2.5	2.5	---
0.5 ml	05	7.5	12.5	15	17.5	22.5	25	32.5	37.5	47.5	65	75	72.5	100
1.0 ml	17.5	17.5	35	42.5	42.5	62.5	52.5	82.5	70	100	87.5	---	100	---
1.5 ml	22.5	27.5	37.5	52.5	55	77.5	67.5	100	85	---	100	---	---	---
2.0 ml	27.5	32.5	42.5	65	57.5	100	72.5	---	87.5	---	100	---	---	---
2.5 ml	32.5	42.5	47.5	70	62.5	100	77.5	---	100	---	---	---	---	---

Total of four replication.

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