

Efficacy Of Selected Plant Extracts On The Oviposition Deterrent And Adult Emergence Activity Of *Callosobruchus Maculatus* .F (Bruchidae; Coleoptera)

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Abstract- A study was undertaken to find out the effect of aqueous extracts of *Phyllanthus amarus*, *Ocimum tenuiflorum*, *Cynodon dactylon*, *Catharanthus roseus*, *Azadirachta indica*, *Tephrosia Purpurea*, *Morinda pubescens*, *Calotropis gigantea*, *Vitex negundo* and *Sesbania grandiflora* on oviposition deterrent and F₁ adult emergence were carried out at three different concentrations (1%, 3%, 5%) using black gram *Vigna munga* (L.) against *C. maculatus*. Maximum oviposition deterrent activity was observed in *C. dactylon* treatment (84.32%) which was par with *O. tenuiflorum* followed by *P. amarus* (83.83%) at higher concentration. All these plant extracts showed above 50% oviposition deterrent activity even at lower concentration. Reduction in F₁ adult emergence was also high after using these plant extracts.

Keywords: *Callosobruchus maculatus*, aqueous extracts, oviposition deterrent activity, adult emergence.

I. INTRODUCTION

The cowpea beetle, *Callosobruchus maculatus* is a cosmopolitan insect pest of cowpea. It is a field -to-store pest as its infestation of cowpea often begins in the field as the mature pods dry (Huignard *et al.*, 1985; Sathyaseelan *et al.*, 2008) and when such seeds are harvested and stored, the pest population increases rapidly and results in total destruction within a short duration of 3-4 months (Rahman and Talukder, 2006). It multiplies very rapidly in storage (Ouedraogo *et al.*, 1996) and reported 8.5% loss in pulses during post harvest handling and storage in India. Synthetic chemical insecticides have proved to be effective in the control of the beetle. Earlier, Petroleum ether extract of neem (Ranjana Saxena and Beenam Saxena 2000), dichloromethane and methanol extract of *Acorus calamus* and *Cassia siamiae* (Jayakumar *et al.*, 2005a), *Jatropha curcas* seed oil (Adebowale and Adedire, 2006), powdered leaves and extracts of *Vitex negundo* (Rahman and Talukder, 2006), plant lectins derived from *Cicer arietinum* (Sadeghi *et al.*, 2006) and powder of *Terminalia chebula* and *Cassia*

auriculata (Govindan and Jeyarajan Nelson, 2008) were reported to have significant oviposition deterrent and other biological activity against *C. maculatus*. In this context, based on the earlier literatures and easy availability of the plants, ten plants were screened viz *Phyllanthus amarus*, *Ocimum tenuiflorum*, *Cynodon dactylon*, *Catharanthus roseus*, *Azadirachta indica*, *Tephrosia purpurea*, *Morinda pubescens*, *Calotropis gigantea*, *Vitex negundo* and *Sesbania grandiflora* for their oviposition deterrent and adult emergence activity against *C. maculatus*

II. MATERIALS AND METHODS

1. Insect culture

Black gram seeds infested by the *C. maculatus* were collected from the grocery shop and brought to the laboratory. The infested seeds were set aside in a plastic container and covered with muslin cloth till the emergence of adult. Healthy adults emerged from the container were shifted to another plastic container and provided cleaned blackgram seed for oviposition and maintained at 28 ± 2°C and 70 ± 5% R.H. The container was undisturbed until the emergence of adults. Freshly emerged subsequent generations were used for further experiments.

2. Preparation of plant extracts

Fresh leaves of selected plants *Phyllanthus amarus*, *Ocimum tenuiflorum*, *Cynodon dactylon*, *Catharanthus roseus*, *Azadirachta indica*, *Tephrosia Purpurea*, *Morinda pubescens*, *Calotropis gigantea*, *Vitex negundo* and *Sesbania grandiflora* were collected at their respective places and brought to the laboratory. Each plant material was dried under shade and powdered by using electric grinder and pass through a 20 mesh sieve and kept in a 1 kg capacity polypropylene bag. 300 g of each powdered plant material were taken into 1 litre capacity conical flask and 1000 ml of distilled water was added to it and shaken for 8 h in a mechanical shaker and then kept it for 24 h. The extract was separated using fine muslin cloth and then filtered. The filtrate was collected in a 2 litre capacity conical flask and volume was made up to 1000 ml. This was considered as stock solution. Required concentrations (1%, 3%, 5%) were prepared from the stock solution.

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3. Oviposition deterrent activity

Black gram seeds were cleaned and sterilized at 45° C for 6 h in order to kill the eggs and developing larvae. For each concentration, 25g blackgram seeds were taken in a conical flask and mixed with each concentration of aqueous extracts and seeds treated with water alone used as control. After thorough mixing the seeds were air dried and they were stored in plastic containers and 5 pairs of newly emerged adult *C. maculatus* were introduced in each container. Three replicates were maintained for each concentration and control. After 15 days, number of eggs laid on treated seeds (Ts) and control seeds (Cs) were recorded and the percentage of oviposition deterrence (POD) was calculated as $POD [(Ts-Cs)/Cs] \times 100$.

4. Adult Emergence activity

After the eggs were counted the experimental set up was kept undisturbed till the emergence of F_1 adults from the treated and untreated seeds. The number of F_1 adults emerged from the control seeds (Ac) and treated seeds (At) were recorded. The percentage reduction in F_1 adult (PRA) emergence (FI) was calculated as $PRA [(Ac-At)/Ac] \times 100$.

5. Data analysis

Mean number of eggs laid on treated and control seeds and F_1 adult emergence were calculated using the above said formula. The data obtained from the experiments were subjected to two-way analysis of variance (ANOVA).

III. RESULT AND DISCUSSION

Earlier literature indicate the importance of plant extract in protecting seeds by way of direct mixing of the dried leaves, plant powders, solvent extracts, vegetable/ essential oils on seeds during post harvest storage (Rajapakse, 1996; Ngamo *et al.*, 2007; Meera Srivastava and Lalitha Gupta, 2007; Zahra Sahaf and Moharramipour, 2008; Othira *et al.*, 2009). The reduction in oviposition was increased with the increase in dosage of each treatment. Earlier, Olaifa and Erhun (1998) found that higher concentration of the powder of *Piper guineense* significantly reduced the oviposition. These earlier findings are in conformation with the present study. Higher concentrations of plant extracts (5%) were found to be effective as compound to lower ones (1% and 3%) in bringing down the egg laying by the pest insect. Present study revealed that, maximum oviposition deterrent activity was observed in *O. tenuiflorum* and *C. dactylon* followed by *P. amarus* (Table 1). It is noteworthy that all these plant extracts showed more than 50% of deterrent activity even at lower concentration. It appears that these plant extracts might possess repellent and/or oviposition deterrent principles. Oviposition detergency may be due to the changes induced in physiology and behaviour in the adult of *C. maculatus* as reflected by their egg laying capacity. The data shown in Table 2 revealed the effect of leaf extracts on adult emergence of pulse beetle. A significant reduction in adult emergence was among the treatments. It is added that efficacy of these selected plant extracts was much stronger against F_1 than egg laying.

Jayakumar *et al.* (2003) reported that plant extracts have obvious effects on postembryonic survival of the insect and resulting reduction in adult emergence in all the concentrations of different plants. In the present study, maximum reduction in the adult emergence was observed in the seeds treated with *Azadirachta indica*. Adult emergence was reduced to 5.66 ± 0.66 at 1% 2.66 ± 0.33 at 3% and 1.66 ± 0.33 at 5% concentration of *Azadirachta indica*. It was followed by *T. purpureae* (82.11%) at 1% (88.62%) at 3% and (94.31%) at 5% concentrations. However *O. tenuiflorum* was found to be effective in reducing the adult emergence at a higher concentration. Annie Bright (2001) and Raja *et al.* (2001) reported that botanicals inhibited adult emergence in *C. maculatus* in cowpea. They further stated that, when the eggs were laid on treated seeds, the toxic substance present in the extract may enter in to the egg through chorion and suppressed their embryonic development. It is in agreement with the present study that adult emergence was greatly reduced in treated seeds than control seeds. Raja *et al.* (2001), Keita *et al.* (2001) and Sathyaseelan *et al.* (2008) reported that various plant products were effective in reducing oviposition and adult emergence of *C. maculatus* only, but the seed quality and germination were not affected. These results are in accordance with our findings. The present investigation has brought out the efficacy of *Phyllanthus amarus*, *Ocimum tenuiflorum*, *Cynodon dactylon*, *Catharanthus roseus*, *Azadirachta indica*, *Tephrosia purpureae*, *Morinda pubescens*, *Calotropis gigantea*, *Vitex negundo* and *Sesbania grandiflora*. Preparation of these aqueous extracts and application on the seeds are so easy and cheaper. Hence, effectual plant extract can be used as one of the component in Integrated Pest Management especially small godowns or shop retailer for short term storage.

Heading 1 Table: 1 Effect of plant extracts on Oviposition of pulse beetle, *C. maculatus*

Treatment	Total no. of Eggs laid		
	Conc % v/w		
	1%	3%	5%
Control	134.00±2.88		
<i>Phyllanthus amarus</i>	39.66±0.66 (70.4)	31.66±1.45 (76.37)	21.66±0.33 (83.83)
<i>Ocimum tenuiflorum</i>	38.66±5.23 (71.14)	27.33±3.38 (79.6)	21.00±0.00 (84.32)
<i>Cynodon dactylon</i>	41.33±3.28 (69.15)	28.33±2.33 (78.85)	21.00±1.15 (84.32)
<i>Catharanthus roseus</i>	49.66±1.85 (62.94)	39.66±4.25 (70.4)	30.33±1.76 (77.36)
<i>Azadirachta indica</i>	55.33±4.33 (58.7)	43.66±5.45 (67.41)	26.00±0.57 (80.59)
<i>Tephrosia Purpurea</i>	69.00±2.30 (48.5)	55.00±2.00 (58.95)	40.66±1.20 (69.65)
<i>Morinda pubescens</i>	65.33±2.33 (51.24)	49.66±1.66 (62.94)	44.00±1.00 (67.16)
<i>Calotropis gigantea</i>	63.33±1.20 (52.73)	52.33±0.88 (60.94)	41.66±1.45 (68.91)
<i>Vitex negundo</i>	70.33±5.60 (51)	53.33±1.76. (60.2)	44.00±2.51 (67.16)
<i>Sesbania grandiflora</i>	73.66±3.52 (45.02)	52.00±4.50 (61.19)	35.00±0.57 (73.88)

Within the column values was statistically significant ($P < 0.05$)

Heading 2 Table: 2 Effect of plant extracts on adult emergence of pulse beetle, *C. maculatus*

Treatment	Total no. of Eggs laid		
	Conc % v/w		
	1%	3%	5%
Control	41.00±0.57		
<i>Phyllanthus amarus</i>	27.00±3.00 (34.15)	15.66±0.33 (34.15)	14.33±0.33 (65.04)
<i>Ocimum tenuiflourum</i>	20.33±0.33 (50.41)	20.33±0.33 (50.41)	4.00±0.57 (90.24)
<i>Cynodon dactylon</i>	27.66±2.66 (32.52)	19.00±4.93 (53.66)	10.00±0.00 (75.61)
<i>Catharanthus roseus</i>	36.33±0.33 (11.38)	26.00±0.00 (36.59)	16.33±0.33 (60.16)
<i>Azadirachta indica</i>	5.66±0.66 (86.18)	2.66±0.33 (93.50)	1.66±0.33 (95.93)
<i>Tephrosia Purpureae</i>	7.33±0.33 (82.11)	4.66±0.33 (88.62)	2.33±0.33 (94.31)
<i>Morinda pubescens</i>	26.33±0.33 (35.77)	21.66±0.33 (47.15)	19.00±0.57 (53.66)
<i>Calotropis gigantea</i>	24.66±0.33 (39.84)	21.33±0.33 (47.97)	18.00±0.57 (56.10)
<i>Vitex negundo</i>	27.33±0.66 (33.33)	23.00±0.57 (43.90)	19.00±0.57 (53.66)
<i>Sesbania grandiflora</i>	27.33±0.66 (33.33)	23.00±0.57 (43.90)	19.00±0.57 (53.66)

Within the column values was statistically significant ($P < 0.05$)

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