

Evaluation of the Efficacy of Mixed Leaf Powders of *Vernonia amygdalina* L. and *Ocimum gratissimum* Del. Against *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae)

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Abstract: The possibility of controlling the cowpea bruchid, *Callosobruchus maculatus* (F.) with mixture controlling *Vernonia amygdalina* L. (Va) and *Ocimum gratissimum* Del. (Oc) leaf powders in the ratios of 0%:80%, 80%:0%, 50%:50%, 20%:80%, and 80%:20% was evaluated under ambient laboratory conditions ($30 \pm 3^\circ\text{C}$ and $70 \pm 5\%$ R.H). The mixtures of the leaf powders were applied at the rate of 5% per 30 g cowpea seeds. Mortality of adult *C. maculatus* at 24, 48 and 72h after treatment, number of eggs laid and adult emergence from each treatment were compared with the control (0%:0%). All mixtures recorded higher mortality, reduced number of eggs and suppressed adult emergence of *C. maculatus* than the control. The mixture (Va 50%: Oc50%) caused the highest mortality (33-80%), had the least egg count and least adult emergence during the exposure period. It was also significantly ($P < 0.05$) different from the control in all the parameters examined.

Key words: Evaluation • *Ocimum gratissimum* • *Vernonia amygdalina* • *Callosobruchus maculatus*

INTRODUCTION

Cowpea (*Vigna unguiculata* (L.) Walper is an important dietary protein in Africa where *Callosobruchus maculatus* (F.) has become a major storage insect pest of the seeds. Some people relish vegetable dishes of young cowpea leaves, immature pods, or immature seeds [1]. Mature dry cowpea seeds also provide several snacks and main meal dishes [2].

In Nigeria, cowpea is prone to pest infestation during pod and dry seed stages in the field and in storage. *C. maculatus* has caused enormous weight loss, reduced viability and reduced commercial value of cowpea seeds [3,4]. It has been reported that both quantitative and qualitative losses arising from physical, chemical and biological factors (e.g. fungi, rodents, birds and insects) occur during storage of grains [5]. The magnitude of competition between *C. maculatus* and human beings for this important crop necessitates its control to avoid food shortage and promote self-sufficiency. To protect the cowpea seeds from insect infestation, some farmers and traders use synthetic insecticides, which are applied as sprays or in powder form to reduce quality loss. However, insecticide residues are potentially harmful to humans as they have been linked with cases of food poisoning especially “killer foodstuff” in the country. The general

use of insecticides to protect stored grains has been limited by the interest in botanicals, which have been enhanced by the public suspicion of any chemical of a persistent nature, whether or not evidence is available of any adverse effects [6].

Although several workers have demonstrated the possible application of powder or extracts from plant materials to *C. maculatus* [7,8] limited information is available on the use of mixture of plant powders against insect pests. In response to dearth of information, this work is aimed at determining the action of mixed application of leaf powders of *Vernonia amygdalina* L. and *Ocimum gratissimum* Del. against *C. maculatus*.

MATERIALS AND METHODS

Insect Culture: *C. maculatus* was cultured in Kilner jars with meshed lids in the Crop Protection Laboratory of the University of Ilorin, Nigeria. The cultures were maintained at $30 \pm 3^\circ\text{C}$ and $70 \pm 5\%$ RH.

Test Plants: Leaves of *V. amygdalina* and *O. gratissimum* were obtained from Ilorin, Nigeria. Identity of each plant material was confirmed at the herbarium of Biological Sciences Department, University of Ilorin. The leaves were air-dried for 7 days before grinding in an electric mill.

The powder was passed through a sieve of 0.002 mm mesh size to obtain fine and uniform particles. Each plant powder was immediately put in separate brown envelopes and kept under ambient laboratory conditions.

Preparation of Cowpea Seeds: The cowpea variety used was Ife Brown supplied by the National Seed Service, Ilorin. The seeds were wrapped in polyethylene bag and then put in a deep freezer for 14 days to ward off any prior infestation. The seeds were then spread on the laboratory bench for 7 days for conditioning.

Experimental Protocol: Leaf powders of *V. amygdalina* and *O. gratissimum* were mixed in the proportions of 0:80, 80:0, 50:50, 20:80 and 80:20 and then admixed with 30 g cowpea seeds at 5% rate of application in plastic containers (12 cm in diameter) covered with muslin cloth to allow ventilation and exclude entry or escape of insects. Cowpea seeds not treated at all with plant material (0:0) were used as control.

Five freshly emerged adult *C. maculatus* (2 males and 3 females) were introduced into each container and replicated three times including the control. Treatments were arranged in completely randomized design. Mortality of adult *C. maculatus* was recorded at 24, 48 and 72h after treatment. Live and dead bruchids were removed and discarded 7 days after treatment. Counts of the eggs were determined using the procedure described by Emeasor *et al.*, [1]. Adult *C. maculatus* emergence commenced 26 days after treatment and cumulative emergence on the 30 days after treatment was recorded.

Statistical Procedure: Data were subjected to analysis of variance (ANOVA) and significantly different means were partitioned using Duncan's new multiple range test (DNMRT).

RESULTS

Table 1 shows that the difference in *C. maculatus* adult mortality was not significant ($P>0.05$) 24h after treatment with leaf powders of *V. amygdalina* and *O. gratissimum* alone as well as in cowpea seeds treated with mixed proportions of the two leaf powders and the control. However, there was significant difference ($P<0.05$) in *C. maculatus* adult mortality 48 and 72h after treatment with leaf powder of *V. amygdalina* and *O. gratissimum* applied alone or in combination compared to the control. Leaf powders of the two plants applied at equal proportions (Va50: Oc50) caused the highest mortality 24, 48 and 72h after treatment. The mixed powders did not show contact toxicity to adult *C. maculatus* because 100% mortality was not achieved during the exposure period. There was increase in adult mortality with period of exposure.

Table 1 also shows significant difference in the number of eggs laid in cowpea seeds treated with *V. amygdalina* and *O. gratissimum* alone or mixed proportions of the plants compared to the control. Treatments resulted in significantly ($P<0.05$) lower number of eggs than the control. Treatments show significant difference in adult emergence compared to the untreated control. Leaf powders of *V. amygdalina* and *O. gratissimum* admixed at equal proportions gave the least adult emergence (Table 1).

DISCUSSION

This investigation shows that mixing leaf powders of *V. amygdalina* and *O. gratissimum* at equal proportions (50:50) caused 60.0% mortality of adult bruchids, reduced oviposition and suppressed adult emergence. Emeasor *et al.* [1] reported that mixture of the seed powders of *Piper guineense*

Table 1: Effects of mixtures of *V. amygdalina* and *O. gratissimum* leaf powders on adult mortality, oviposition and adult emergence of *C. maculatus*

Treatment	% Mortality (hr)			Mean No. of Eggs per 20 seeds	% Adult emergence
	24	48	72		
Va0 ± Oc80	13.0a	40.0a	53.3a	2.67 b	78.6b
Va80± Oc0	20.0a	20.0a	26.7ab	4.67c	50.0c
Va50 ± Oc50	33.0a	46.7a	60.0a	3.33bc	40.0c
Va20 ± Oc80	13.0a	33.3a	46.7ab	4.00bc	41.7c
Va80 ± Oc20	13.0a	26.7a	40.0ab	6.00c	55.6b
Va0 ± Oc0	0.0a	0.0b	0.0c	8.67a	80.8a
SE±	0.36	0.41	0.33	0.64	0.38

Values show proportions of *V. amygdalina* and *O. gratissimum* in the mixtures applied at 5% of seed weight (30 g)

Values in the same column followed by same letter(s) are not significantly different at 5% level of probability (DNMRT)

and *Thevetia peruviana* (in different proportions significantly achieved adult mortality and reduced oviposition and adult emergence of *C. maculatus*. Results show additional effects on *C. maculatus* adult mortality when equal proportions of *V. amygdalina* and *O. gratissimum* were applied. The efficacy of two plants when applied alone has been reported. Ofuya [9] observed that *O. gratissimum* leaf powder admixed with 500 cowpea seeds at 2 g (w/w) had few eggs laid by *C. Maculatus*. Lajide *et al.* [10] reported that *V. amygdalina* admixed with maize at 1% (w/w) was not effective in causing mortality in adult *Sitophilus zeamais* within 7 days. There were significant differences with the varying proportions of the mixed leaf powders consistently having higher efficacy than the untreated control. The lower adult emergence could result from death of immature stages as a result of treatment. The active components of the two plants might be responsible for this.

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