



Short Communication

Efficacy of Some Plant Species for the Control of Cowpea Weevil (*Callosobruchus maculatus*) and Maize Weevil (*Sitophilus zeamais*)

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ABSTRACT

The influence of leaf powders of *Vitex grandifolia* and *Dracaena arborea* incorporated into maize and cowpea flour on the survival of maize weevil (*Sitophilus zeamais*) and cowpea weevil (*Callosobruchus maculatus*), respectively was tested. Survival of adult beetles of maize and cowpea weevil was least on cowpea (10 g) and maize (10 g) flour treated with 3 g *V. grandifolia* (3.30–20%, 6.70–20%, respectively) and 3 g *D. arborea* (3.30–13.3%, 0.0–3.3%, respectively) compared to other treatments, which included different concentrations of the leaf powders. *V. grandifolia* was inhibitory to mean adult emergence of *C. maculatus* (7.00–9.33) and *S. zeamais* (8.00–9.67) compared with the control (15.00). However, *D. arborea* did not differ from the control. It is concluded that *V. grandifolia* has great potential for use as a plant-based biopesticide for controlling both weevil pests.

Key Words: *Vitex grandifolia*; *Dracaena arborea*; *Sitophilus zeamais*; *Callosobruchus maculatus*; Adult emergence

INTRODUCTION

Cowpea [*Vigna unguiculata* (L.) Walp] is attacked by pests both in the field and during storage. The major storage pest of cowpea is *Callosobruchus maculatus* Walp, while *Sitophilus zeamais* Motsch inflicts serious damage on maize (*Zea mays*) in the store. Pods of cowpea stored for 8 months could have as much as 50% of the grains damaged by *C. maculatus* (Caswell, 1984). Similarly, storage losses of maize due to *S. zeamais* may reach a level of 50% after six months (Taylor, 1977). Synthetic insecticides had been used and are still being employed for the control of these pests. However, the drawbacks associated with these are well known. Synthetic insecticides are noxious to man and livestock and can be pollutants to the environment. They may not be readily available and are un-affordable by the rural farmers. They may also be persistent in the produce (Deedant, 1994). Further, their application may require a degree of skill that the rural farmers who are the producers of the bulk of the nations' food supply do not have. Also, each generation of insects becomes more immune to chemical pesticides leading to the problem of resistance (Georgiou, 1991). In addition, non-selective insecticides kill beneficial insects thereby causing an imbalance in the ecosystem.

In recent years, attention has been focused on the use of plant materials for insect pest control. Such plant materials include powders from parts of the neem tree,

(*Azadirachta indica* A. Juss) (Ivbijaro, 1983), vegetable oils from groundnuts, palm kernel and coconut (Hall & Harman, 1991; Lale, 1995). Others are leaf extracts of *Toprosia vogelii* (Mallaya, 1985), oils from fresh garlic (Ho *et al.*, 1997) and basilum (Grainge & Ahmed, 1988). This list of plants is by no means exhaustive as the rainforest, for instance, contains several plant species with great insecticide potentials, many of which have not been identified. Furthermore, different insects react in varying ways to different plant products. In this study, powders of two plants viz., *Vitex grandifolia* and *Dracaena arborea* (dragon tree) were evaluated for their influence on the survival of *C. maculatus* and *S. zeamais*.

MATERIALS AND METHODS

The study was carried out in the Applied Biology Department of the Ebonyi State University Abakaliki.

Sources and preparation of plant materials. Leaves of *Vitex grandifolia* and *Dracaena arborea* were obtained from the rain forest, thoroughly washed in tap water, chopped and air-dried under room temperature for 7 days. When fully dried, these leaves were ground to powder.

Culturing of insects. Initial stock was obtained from infested maize and cowpea bought from the Abakaliki market. Adult *C. maculatus* and *S. zeamais* were introduced into cowpea and maize flour, respectively kept in jars into which 5% yeast (Park & Frank, 1984) had been

incorporated. They were removed 24 h later. The emerging adults, which were thus of uniform size and age were then used for the various experiments.

Effect of leaf powders of *D. arborea* and *V. grandifolia* on survival of *C. maculatus*. One, 2 and 3 g of *V. grandifolia* and *D. arborea* powders were thoroughly mixed with 10 g of cowpea flour in a petridish. Thereafter, 10 newly emerged adults of *C. maculatus* were introduced into each petridish. Control petridish contained 10 g of cowpea and 10 newly emerged adults. The experiment was replicated thrice. Observations were taken on adult survival.

Effect of leaf powders of *V. grandifolia* and *D. arborea* on the emergence of *C. maculatus*. This was similar to experiment 1 above except that the insects (*C. maculatus*) were removed 24 h after introduction. Thereafter, observations were taken on adult emergence over time.

Effect of leaf powders of *D. arborea* and *V. grandifolia* on survival of *S. zeamais*. One, 2 and 3 g of *V. grandifolia* and *D. arborea* were thoroughly mixed with 10 g of maize flour separately in a petridish. Thereafter, 10 newly emerged adults of *S. zeamais* were introduced into each petridish. The experiment was replicated three times. Observations were taken on survival of adults.

Effect of leaf powders of *V. grandifolia* and *D. arborea* on the emergence of *S. zeamais*. This was similar to experiment 3 above except that the insects (*S. zeamais*) were removed 24 h after introduction. Thereafter, observations were taken on adult emergence over time.

RESULTS

Effect of leaf powders of *D. arborea* and *V. grandifolia* on survival of *C. maculatus*. Percent survival of *C. maculatus* at 3 days post treatment was highest (90%) in the control but least in cowpea flour treated with 3 g of *V. grandifolia* (20%) and *D. arborea* (13.3%) (Table I) Survival rate amongst insects treated with 1 g of *V. grandifolia* did not differ from the control.

At 5 days post treatment survival rate remained lowest in cowpea flour treated with 3 g *V. grandifolia* (13.3%) and 3 g *D. arborea* (6.7%). It was highest in the control (83.3%) but followed by 1 g *V. grandifolia* and *D. arborea*. Observation taken at 7 days post treatment showed that *D. arborea* and *V. grandifolia* at 30% (w/w) flour were least (3.3%) in promoting survival of adult *C. maculatus*.

Effect of leaf powders of *V. grandifolia* and *D. arborea* on the emergence of *C. maculatus*. Table II shows that adult emergence was poorest in cowpea flour treated with ground leaves of *V. grandifolia* and highest in the control. The control was significantly higher than all three levels of *V. grandifolia*. *D. arborea* did not have as much influence as *V. grandifolia* on emergence of *C. maculatus*.

Effect of leaf powders of *D. arborea* and *V. grandifolia* on survival of *S. zeamais*. The control set indicated significantly higher survival of more *S. zeamais* (90%) than other treatments except 1 g of *V. grandifolia* at 3 days after

Table I. Survival of *C. maculatus* in cowpea flour incorporated with leaf powders of *V. grandifolia* and *D. arborea* at various days after treatment

Treatment	Days of treatment		
	3	5	7
Control	90.0	83.3	66.7
<i>V. grandifolia</i> (1g)	70.0	60.0	30.0
<i>V. grandifolia</i> (2g)	40.0	40.0	20.0
<i>V. grandifolia</i> (3g)	20.0	13.3	3.3
<i>D. arborea</i> (1g)	60.0	50.0	30.3
<i>D. arborea</i> (2g)	33.3	23.3	30.3
<i>D. arborea</i> (3g)	13.3	6.7	3.3
LSD	24.5	22.3	16.2

Table II. Adult emergence of *C. maculatus* in cowpea flour incorporated in the leaf powders of *V. grandifolia*

Treatments	Mean no. of emerging adults
Control	15.00
<i>V. grandifolia</i> (1 g)	9.00
<i>V. grandifolia</i> (2 g)	7.00
<i>V. grandifolia</i> (3 g)	9.33
<i>D. arborea</i> (1 g)	12.69
<i>D. arborea</i> (2 g)	12.00
<i>D. arborea</i> (3 g)	11.00
LSD	4.47

Table III. Survival of *Sitophilus zeamais* in maize flour incorporated with leaf powders of *D. arborea* and *V. grandifolia*

Treatments	Days of treatment		
	3	5	7
Control	90.00	86.7	60.0
<i>V. grandifolia</i> (1 g)	73.3	66.7	40.0
<i>V. grandifolia</i> (2 g)	46.7	36.7	10.0
<i>V. grandifolia</i> (3 g)	20.0	16.7	6.7
<i>D. arborea</i> (1 g)	56.7	50.0	33.3
<i>D. arborea</i> (2 g)	30.0	16.7	3.3
<i>D. arborea</i> (3 g)	3.3	3.3	0.0
LSD	21.3	23.9	17.5

Table IV. Adult emergence of *S. zeamais* in maize flour incorporated with leaf powders of *V. grandifolia* and *D. arborea*.

Treatments	Mean no. of emerging adults
Control	15.00
<i>V. grandifolia</i> (1 g)	8.00
<i>V. grandifolia</i> (2 g)	9.67
<i>V. grandifolia</i> (3 g)	8.00
<i>D. arborea</i> (1 g)	12.67
<i>D. arborea</i> (2 g)	10.00
<i>D. arborea</i> (3 g)	11.00
LSD	5.60

treatment. *D. arborea* at 3 g caused the lowest survival of adult *S. zeamais*, followed by 3 g *V. grandifolia* (Table III). At 5 days after treatment, the trend remained the same, while at 7 days after treatment survival was least when insects were subjected to 2 and 3 g of *V. grandifolia* and *D. arborea* at various days after treatment.

Effect of leaf powders of *V. grandifolia* and *D. arborea* on emergence of *S. zeamais*. Adult emergence was highest

in the control but lowest in maize flour treated with 3 g of *V. grandifolia*. Emergence of *S. zeamais* was not affected by *D. arborea* (Table IV)

DISCUSSION

Whole-wheat flour + 5% brewer's yeast (w/w) has been shown to be a good medium for rearing insects (Park & Frank, 1984). Incorporation of the leaf powders of the two plants into maize and cowpea flour and introduction of adult *S. zeamais* and *C. maculatus*, respectively provided a rapid bioassay of the plant materials. Leaf powders of *V. grandifolia* and *D. arborea* were also very effective in suppressing the survival of *S. zeamais* when applied at 2 and 3 g. This indicates that the plants have some toxic factors, which negatively impacted on survival of adult *S. zeamais*.

Three levels of *V. grandifolia* (1, 2 & 3 g) used in this study were significantly better than the control in suppressing emergence of adult *C. maculatus*. This is again an indication that *V. grandifolia* is toxic to *C. maculatus*. However, it is not clear why *D. arborea* did not affect adult emergence. It would seem that larvae of *C. maculatus* are more susceptible to leaf powder of *V. grandifolia* than that of *D. arborea*. This needs to be further investigated. Emergence of adult *S. zeamais* was poorest in maize flour treated with 3 g of *V. grandifolia*. Obviously, a toxic factor, which inhibits adult emergence, exists in this plant. Like *C. maculatus*, *D. arborea* did not affect emergence of *S. zeamais*. There is need for further research in this area.

Although the toxic factors in *D. arborea* and *V. grandifolia* are not yet known, this study demonstrates that they are insecticidal to *C. maculatus* and *S. zeamais*. Of the two plants, *V. grandifolia* was more potent on *C. maculatus* and *S. zeamais*. Still both plants can serve as protectants against the two insects. Apart from being toxic, the plant factors they possess may have antifeedant and repellent properties. The work of Bekele *et al.* (1996) showed that ground leaves of *Ocimum suave* was a source of repellents and toxicants against the maize weevil *S. zeamais*, the lesser grain borer *Rhyzopertha dominica* and the angoumois grain moth *Sitotroga cerealella*.

CONCLUSION

This finding is of great value for further research on the use of these plants for the control of *S. zeamais* and *C. maculatus*. *V. grandifolia* in particular and *D. arborea* have great potential for development of plant-based biopesticides for the control of the above stored product pests. Furthermore, there is need to evaluate the mammalian toxicity of these plants since information in this area is lacking.

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