

## Effect of Some Plants Powders in the Control of *Sitophilus zeamais* Motsch (Coleoptera: Curculionidae) Infestation on Maize Grains

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**Abstract:** Studies were carried out to determine the efficacy of three plant materials (*Nicotiana tabacum*, *Allium sativum* and *Zingiber officinale*) against *Sitophilus zeamais*, an insect infesting Maize (*Zea mays*) (L). Powders of *Nicotiana tabacum*, *Allium sativum* and *Zingiber officinale* from 0.5g-2.0g/50g of grains, were tested and compared to the synthetic conventional insecticide, Coopex (0.25g) against *S. zeamais* (Motsch.) under laboratory conditions (28-32°C and 65-70% r.h.). In all trials, percentage mortality among adult of *S. zeamais* reared on maize treated with the powders of *N. tabacum* was observed to be high (100%). The last two plant materials *Allium sativum* and *Zingiber officinale* recorded 85-95 % mortality within same period These percentage mortality among adults were significantly ( $p < 0.05$ ) different from the untreated (control). Thus, all the plant materials were found to significantly affect the survival of the *S. zeamais* at different concentration rates. Effect of plant powder on the emergence of adult *S. zeamais* was significantly ( $p < 0.05$ ) different and reduced the  $F_1$  progeny emergence. The objective of this research is to taste the efficacy of this plant powders in an area which has not been fully exploited.

**Key words:** Plant powders • Maize grains • *Sitophilus zeamais* • Mortality

### INTRODUCTION

Maize (*Zea mays* L) is an out-breeding, heterogeneous crop. It has come close to being a staple food crop in the drier parts of the forest zone, where it forms about 20 per cent of the total carbohydrate food grown [1,2]. Maize has the disadvantage of being harvested in the wet season and therefore susceptible to damage by microorganisms in addition to the problems of insect infestation. The insect pest associated with these losses is mainly maize weevil, *Sitophilus zeamais* (Motsch.) (Coleoptera: Curculionidae) along with scavengers, predators and parasitoids.

Field survey and modeling have shown that the densities of the maize weevil, *S. zeamais* and the larger grain borer, *Prostephanus truncatus* (Horn.) (Coleoptera: Bostrichidae) caused most grain damage and weight loss [3]. Effective control measures of maize weevil depend primarily on making the environment unfavourable for its survival and development. Various materials and methods are currently being tested for the control of *Sitophilus species* [4].

Prior to the advent of synthetic chemicals, man has been known to use plants and other local materials in an attempt to protect his grains from pest invasion. Lajide *et al.* [5] and Akinneye *et al.* [6] reported that plant materials and local traditional methods are much safer than chemical insecticides and suggested that their use needed exploitation. In many areas of Africa and Asia locally available plants and minerals are being widely used to protect stored products against damage by Insects infestations, as alternatives to chemical insecticides [7,8,9]. Objective of this research is to evaluate the insecticidal efficacy of these three plant materials in affecting the development of *S. zeamais* which if successful will serve as one of the control measures.

### MATERIALS AND METHODS

To raise the insect, insect were obtained from the infested maize in the Sokoto central market. Culture of *S. zeamais* was raised by adding 50g pairs of fresh emerged *S. zeamais* to 500g sterilized maize

grains in a large Kilner jar. The culture was maintained in the Entomology Laboratory of the Department of Zoology. After 49 days, newly emerged  $F_1$  generations were used to infest the maize samples used for the experiment.

Fresh leaves of *N.tabacum* (Tobacco) were obtained from Fadama in Usman Danfodiyo University of Sokoto while bulbs of *A. sativum* and rhizome of *Z. officinale* were purchased from Sokoto central market. All the materials were dried for ten days followed by grinding and sieved into powder, using 5mm mesh.

The maize (*Zea mays* L.) used, which had been previously sterilized with deep freezer at 0°C was weighed into petridishes. Each plant powder was applied at four levels or concentrations of 0.5, 1.0, 1.5 and 2.0g in to 50g of maize. Coopex (Permethrin 0.5%) at 0.25g concentration as standard. The control was tasted dry without treatment. The whole experiment was replicated three times. All the petridishes, except the control were vigorously shaken to ensure proper mixing of maize grains with plant powder or Coopex.

Each petridishes was infested with five pairs of newly emerged *S. zeamais*. The petridishes were labelled and covered These petridishes were arranged in complete randomized design (CRD) and were kept in the laboratory for seven days.

Observations were made at 24hrs, 48hrs and 72hrs to record the mortality among introduced adults. Dead insect were removed and live ones left. Until after 7 days, remaining insects were removed from all the petridishes and the grains were kept undisturbed for 7 weeks to allow the emergence of adults following any oviposition, which might have occurred during experimental period.

The data obtained were subjected to analysis of variance using statistical analysis system [10] and means found to be significant were separated using least significant difference (LSD).

## RESULTS

Table 1 shows the effect of various doses of plant powders on the mortality among the adults of *S. zeamais*. All the plant powders tested for their insecticidal efficacy were found effecting the mortality among *S. zeamais*, which was found directly proportional to the amount of powder used for treatment of grains. Most of the powders used were found to cause almost fifty percent mortality even at low doses. Powder of *Z. officinale* was least effective among all the powders used, while the powder of *A. indica* was observed to be most effective causing 100 per cent mortality even when used in low amount (Table1).

Higher mortality of 56.67 percent was observed among adults reared on maize treated with 0.5g of *A. indica* followed by *N. tabacum* 50 per cent within seven days of post infestation. Increasing the amount of plant powder resulted in significant ( $p<0.05$ ) effects on the mortality of adult *S. zeamais* (Table 1). Increase in concentration of the powders from 0.5 to 1.0 g resulted in an increase in the mortality to 96.67 per cent within 6-7 days of their introduction in to maize. Coopex took an average of 4.33 days to cause 100 cent mortality, while control had 13.33 per cent mortality within the same period.

## DISCUSSION

From the Table 1, it can be deduced that all plants powder used during the investigation have significant effects on the mortality of adults and the longevity of the weevils. The rate of mortality was also observed to be effected by the increase amount of powder. Thus, the effects of the various powders on survival of the weevil were found to be closely related. However, highly significant ( $p<0.05$ ) difference was observed between the test materials and control.

Table 1: Mortality among adult of *S. zeamais* reared on maize treated with different plant powders

Mean mortality among adults of <i>S. zeamais</i>				
Amount of powders applied/50g of grains				
Treatment	0.5g	1.0g	1.g5	2.0g
<i>A sativum</i>	43.33 <sup>a</sup> ± 2.96	86.67 <sup>b</sup> ± 2.96	90.00 <sup>b</sup> ± 3.24	96.67 <sup>a</sup> ± 2.96
<i>N. tabacum</i>	50.00 <sup>b</sup> ± 3.24	96.67 <sup>b</sup> ± 3.24	100.00 <sup>a</sup> ± 0.00	100.00 <sup>a</sup> ± 0.00
<i>Z. officinale</i>	33.33 <sup>d</sup> ± 2.96	76.67 <sup>c</sup> ± 2.96	86.67 <sup>c</sup> ± 2.96	90.00 <sup>b</sup> ± 3.24
Coopex (0.25g)	100.00 <sup>a</sup> ± 0.05	100.00 <sup>a</sup> ± 0.05	100.00 <sup>a</sup> ± 0.00	100.00 <sup>a</sup> ± 0.05
Control	20.00 <sup>d</sup> ± 1.42	13.33 <sup>d</sup> ± 2.96	16.67 <sup>d</sup> ± 2.96	20.00 <sup>d</sup> ± 0.00
LSD	4.381	4.753	4.716	4.753

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Table 2: Emergence of adults of *S. zeamais* reared on maize treated with varying amount of plant powders

Treatment	Average number of adults emerged			
	0.5g	1.0g	1.5g	2.0g
<i>A. sativum</i>	16.33 <sup>c</sup> ±0.88 (69.02)	12.33 <sup>c</sup> ± 0.54 (68.50)	7.00 <sup>c</sup> ± 0.58 (75.03)	4.33 <sup>c</sup> ± 0.54 (76.37)
<i>N. tabacum</i>	13.00 <sup>b</sup> ± 0.58 (70.92)	9.67 <sup>b</sup> ± 0.54 (66.23)	4.67 <sup>a</sup> ± 0.54 (82.36)	0.67 <sup>a</sup> ± 0.54 (100)
<i>Z. officinale</i>	22.67 <sup>b</sup> ±1.10 (70.09)	18.00 <sup>a</sup> ±0.92 (69.23)	12.67 <sup>d</sup> ± 0.88 (67.86)	8.33 <sup>c</sup> ± 0.54 (65.75)
Coopex (0.25g)	0.00 <sup>a</sup> ± 0.00 (0.00)	0.00 <sup>a</sup> ± 0.00 (0.00)	0.00 <sup>a</sup> ± 0.00 (0.00)	0.00 <sup>a</sup> ± 0.00 (0.00)
Control	39.33 <sup>d</sup> ± 0.54 (74.21)	42.00 <sup>e</sup> ±1.30 (78.75)	41.67 <sup>e</sup> ± 0.88 (79.63)	41.33 <sup>d</sup> ±1.22 (80.52)
LSD	1.415	1.510	1.141	1.339

Mean in the column followed by a common letter are not significantly different

The high mortality rate observed among adults of *S. zeamais*, reared on *N. tabacum* treated maize indicated that tobacco is a promising control agent against *S. zeamais*. The same effect of natural extracts from tobacco against insect infestation was reported by Liu, [11] Golob *et al.* [8] also reported that application of *N. tabacum* powder provided protection of maize grains against *S. zeamais* and *Sitotroga cerealella* during storage.

The powders of *A. sativum* affected the survival of the adult weevils in all trials with a mortality rate ranging from 43.33 - 96.67 per cent within seven days. Although, *A. sativum* species have not been much in use for its killing effects, the high mortality rates observed using their powders indicates the possibility of using them in the control of storage pest. *Z. officinale* is constituent of many local medicinal recipes and its use in the control of weevil is not a common practice in most of the world. The result obtained from this study has shown that the treatment of maize with *Z. officinale* powder significantly affected the survival of the adult of *S. zeamais* at higher concentrations resulting in 90 per cent mortality among adults. This result is in agreement with the findings of Lajide *et al.* [5] who admixed 1g/100g of maize and record 50 percent mortality among *S. zeamais* within seven days.

The emergence of adults from the maize treated with various amount of different plant powders and coopex is presented in Table 2. It showed that the different powders used negatively affecting the emergence of adults. Same table also showed that, there were significant effects on the emergence of adult reared on the treated and untreated grains. *N. tabacum* powder was found to be most effective in affecting the emergence than any other powder, while *Z. officinale* was observed as least effective powder (Table 2). It is clear from Table 2, that fewer (13.00) adults emerged from the grains treated with 0.5g of *N. tabacum* powder. This infers that *N. tabacum* is most effective in affecting the emergence while *Z. officinale* had least effect. Significant difference has also been observed among all plant powders tested and also when they are compared with coopex and untreated control.

Maize treated with 2.0 g of various plant powders showed significant decrease in the number of emergence of adults (Table 2). Only 0.67 adult emerged on maize treated with *N. tabacum* while no adult emergence on maize treated with coopex. These results revealed that the varying concentrations of different powders had significant effects on the emergence of adult. It was also observed that among the test materials *Z. officinale* was least effective, even applied in higher amounts.

The marked differences on mortality and emergence of *S. zeamais* reared on treated and untreated maize indicate that the powders of different plants tested had marked effects on developmental stages which in turned affected emergence. The effectiveness of the plant powders was observed to be directly proportional to their concentration. From the results obtained, it can be inferred that, the high mortality obtained within seven days of introduction of adults unto grains treated with various plants products was caused by these powders and not merely by nature.

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