Bioefficacy of *Senna Occidentalis* (L) Leaves Exract in the Management of *Sitophilus Zeamais* (Mots) (Maize Weevil) in Sudan Savannah Ecological Zone of Nigeria

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ABSTRACT

Ethanolic leaves extract of *Senna occidentalis* (L) at the rate of 1ml, 2ml and 3ml and a known weight of maize at 100g, 200g and 300g was used and tested for bioefficacy in the Laboratory for the management of *Sitophilus zeamais* Mots (maize weevil) on number of holes, oviposition response, antifeeding and germination percentage after maize storage for a diminutive period of six weeks in the Sudan Savannah Ecological Zone of Nigeria. A Complete randomized design (CRD) was used consisting of four treatments (including control) and repeated four times to determine the bioefficacy of *Senna occidentalis* L. in the management of the most destructive maize pest *Sitophilus zeamais* L. The result indicate that *Senna occidentalis* (L) leaves can serve as an antifeeding agent in managing the speed of infestation by *S. zeamais* in stored maize and positively affect the rate of oviposition of *Sitophilus zeamais* Mots. The result shows that *Senna occidentalis* L. has no effect on germination percentage observed during the maize seeds after the period of the storage. In conclusion, this research work suggested that the, management of *Sitophilus zeamais* (Mots) using *Senna occidentalis* (L) is promising and can be employed to store maize for a period of six weeks without disincentive to the quality of maize for consumption and for subsequent planting.

Keywords: *Senna occidentalis, Sitophilus zeamais, Antifeeding, Oviposition, Infestation, Bioefficacy, Sudan Savanna.*

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Highlights of this paper

- Much potentials exits in using green pesticide when exploited in storage of food crops than using synthetic crop pesticide.
- An existing gap and challenge exits in SSA predisposing farmers to lose income and dangers because of pesticide residues are above acceptable limits.
- There is much commonality and availability in green pesticide than synthetic pesticides as such farmers can exploits the usage of the available plant materials.

1. INTRODUCTION

Maize is an important cereal crop that provides stable food to large number of human population source of income to many farmers [1]. Agricultural yield is affected to a great extent by pest and diseases both at storage and at stand; crops are generally affected, hence, farmers try as much as possible to reduce pest and diseases attack in the farms. Crops pest of arthropods order are projected to cause post harvest losses of 8 to 25% in developed countries and 70 to 75% in developing countries. These losses are attributed to pest consumption and contamination. However, insect pest infestation is a major constraint to maize production which occurs not only in the field but continues during storage. *S. zeamais* is most important storage pest of maize causing heavy qualitative and quantitative loss of the crop, their feeding activity result in weight loss, contamination of produce with excrement and lowering of market value, nutrient conversion to inferior food materials, reduction in germination and reduced viguor of seedling [2, 3].

Maize weevils belong to the order of coleopteran and have adaptive mouths part for biting and boring. It reduces grains to powder and it can account for about 5 – 7% losses in grain. Anti feedents (behavior modifiers) are compounds that affect the behaviors, of insect. They are not poisons but prevent the target insects from feeding by evolving a general reaction on the food on which they have been applied e.g. Azadiratchin. Its estimated that post – harvest losses due to *S. zeamais* infestation are undoubtedly high resulting to about 45 – 50% loss [4]. The insects can destroy a large quantity of harvested maize within few months after harvest.

In Nigeria and many developing nations currently, the control of *S. zeamais* is highly dependent on synthetic insecticides, though effective but there has been various short coming associated with the use of synthetic insecticides [5-8].

Most recorded uses of *S. occidentalis* are use as traditional remedies for Malaria [9] Liver Complaint [10]. In Nigeria and other parts of the world, the use of plant in form of crude extract, decoction infusion or tincture to treat common infection and chronic condition are accepted. The information for *Senna occidentalis* is very scanty most especially the leaves properties on anti feedant action on insects. Adesina, et al. [11] used leaf power of *S. Occidentalis* to control *Collosobrochus maculatus* in stored cowpea grains. The insecticidal effect of the leaves extract can be attributed to one or more of the following: fumigants effect, repellency, stomach poison effect [12].

The aim of thi present study is to investigate bioefficacy of S*enna occidentalis* (L) leaves (extract) in the management of *Sitophilus zeamais* (maize weevil) on stored maize grain.

2. MATERIALS AND METHODS

The experiment was conducted at the Laboratory of Pest Management Technology, Federal College of Agricultural Produce Technology, Hotoro, Tarauni Local Governments area in Kano (11^0 39'N $8^0$27' E 427M above sea level) Tarauni local government area falls within Kano central as well as Sudan savanna agro-ecological zone of Nigeria. Completely randomize design (CRD) was used in conducting the experiment. Adults *S.zeamais* and Senna leaf were collected for identification at the Department of Biological Sciences, Bayero University Kano. The samples collected of Senna were dried at the room temperature and grinded and prepared with ethanol for extraction.

2.1. Sample Size

5 Adults Male and Female of *S. zeamais* were introduced into each treatment group and repeated four times.

2.2. Samples and Sample Size

The free infested maize seed variety (SAMMAIZ 17) was used for the experiment which was obtained from International Institute for Tropical Agriculture (IITA) sub-station Kano where 10g, 15g, 20g and control were measured to 1ml, 2ml and 3ml of senna extract and introduce into Kilners jar and kept in the Entomology laboratory and repeated 4 times. Data was taken and recorded at every 10 days interval on number of holes, oviposition response, antifeedant and germination percentage.

2.3. Interpretation of Data Analysis

Data collected and assessed from the following parameters on the experiments were number of holes, oviposition response, antifeedant and germination percentage were subjected to the analysis of variance as described by Snedecor and Cochran [13] using MiniTab 11 and the test among significant means were compared using Duncan's Multiple Range Test (DMRT) [14].

3. RESULTS

3.1. Phytochemical Screening

Table-1. Phytochemical composition of ethanolic leaf extracts of *S.occidentalis.*

Plant xtructs	Saponnins	Tannins	Alkaloid	Xantroprotein	Glycoside resin	Anthraquinone	Flavonoids	Phenol	Phlobotannin	Terpenes
S. occidentalis	+	+	-	-	+	+	+	+	-	+

\+ Positive =Presence
\- Negative. = Absent

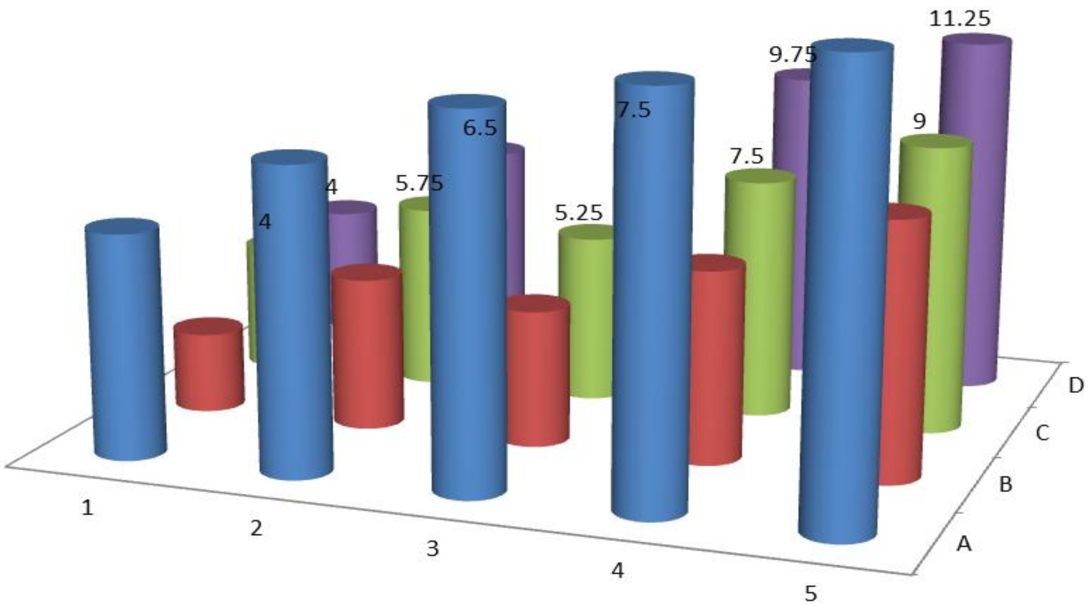

Figure-1. Mean Bioefficacy effect of *Senna occidentalist* L. on *Sitophilus zeameas* Mots on number of holes.

3.2.Treatments

A- Blue= Control, B=Red=10g/1ml, C=Green=15g/2ml, D=Purple =20g/3ml

Table-2. Mean Bio efficacy effect of *Senna occidentalist* on *Sitophilus zeamais* on the number of holes.

Treatments	10DAT	20DAT	30DAT	40DAT	50DAT
TA	7.000	9.500a	11.500a	12.500a	13.750a
TB	2.500	4.750ab	4.250b	6.000c	8.000c
TC	4.000	5.750b	5.250b	7.500bc	9.000bc
TD	4.000	6.500b	7.500ab	9.750ab	11.250ab
CD(0.05)	NS	3.123	4.256	2.901	2.863

Means followed by the same letter(s) in the vertical column are not statistically different at 5% level of probability.

Table-3. Mean antifeedant Bio efficacy effect of *Senna occidentalis* on adults *S. zeameas* Mots.

Treatments	10DAT	20DAT	30DAT	40DAT	50DAT
TA	3.075	5.225a	5.575	6.375	8.725a
TB	3.325	4.725bc	6.450	6.875	8.075b
TC	2.800	4.750bc	6.075	6.950	8.300ab
TD	3.450	4.325c	6.175	7.150	7.425c
CD(0.05)	NS	*	NS	NS	*

Means followed by the same letter(s) in the vertical column are not statistically different at 5% level of probability.

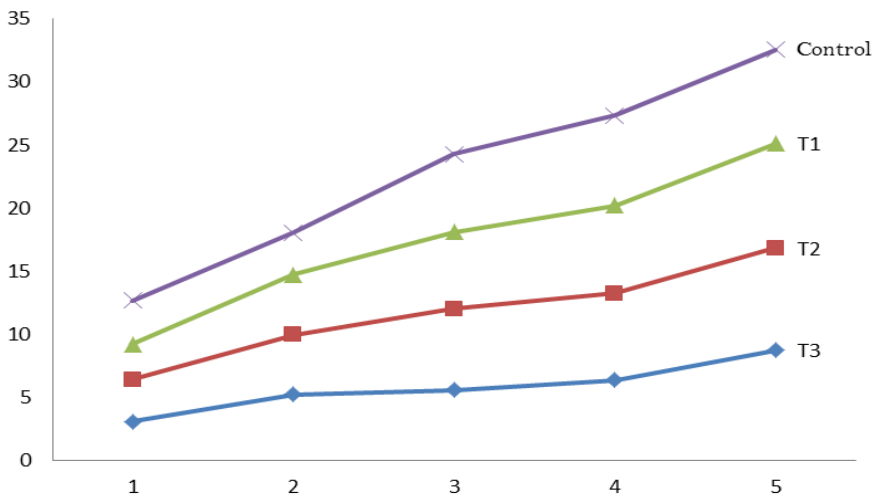

Figure-2. Mean Bio efficacy effect of *Senna occidentalis* on adults *S. zeameas* Mots on oviposition.

A- Blue (Treatment 3), B=Red (Treatment 2), C=Green (Treatment 1), D=Purple (Control)

Table-4. Mean Bio efficacy effect of *Senna occidentalis* on adults *S. zea meas* Mots on oviposition.

Treatments	10DAT	20DAT	30DAT	40DAT	50DAT
TA	3.075	5.225a	5.575	6.375	8.725a
TB	3.325	4.725bc	6.450	6.875	8.075b
TC	2.800	4.750bc	6.075	6.950	8.300ab
TD	3.450	4.325c	6.175	7.150	7.425c
CD(0.05)	NS	6.556	NS	NS	0.630

Means followed by the same letter(s) in the vertical column are not statistically different at 5% level of probability.

Table-3. Mean bio efficacy effect of senna occidentalis extract on adults s. zea meas mots on germination.

Treatments	50DAT
TA	21.267c
TB	22.833b
TC	25.500a
TD	23.333b
CD (0.05)	2.0778

Means followed by the same letter(s) in the vertical column are not statistically different at 5% level of probability.

4. DISCUSSION

Result from Table 1 shows the phytochemical metabolites found on *Senna occidentalist* that can be responsible for the management of *Sitophilus zeamais* on number of holes, antifeedant, oviposition response and germination percentage. However, in Table 2; the effect of number of holes at 10DAT (Days after application of the treatment) shows no significant differences observed among the treatments and the control. However, at 20DAT, highest number of holes were observed at the control and was significantly the same with the application of 1ml of *senna occidentalis*; whereas application of *senna ocidentalis* of 2ml and 3ml were statistically at par. At 30DAT, control has higher number of holes. Application of 1ml and 2ml of ethanolic Senna leaves extract yield the same statistical results and were having lower number of holes compared to the other treatments. However, at 40DAT, control and application of 1ml was statistically the same with control and has higher number of holes in *S. zeamais*. Application of 2ml and 3ml yield the same statistical result and were having lower number of holes compared to the others treatments.(Same explanation with Figure 1).

The mean effect of antifeedant was presented in Table 3, at 10 DAT there were no significant differences among the treatment during the sampling period. However, at 20 DAT, significant differences was shown on control where the insect feeding activities was high compared to application of 1ml and 2ml of *Senna occidentalis* with lower *Sitophilus zeamais* antifeeding activities. At 30 and 40 DAT, there were no significant differences between control and treatments. At 50 DAT, there was a significant difference among the treatment where control has the highest antifeeding activities which cause lower grain weight compared to application of 1ml and 2ml of *Senna occidentalis.* However, a lower antifeeding activity was observed when ethanolic extract of *Senna occidentalis* was applied at 3ml which causes deter feeding of *Sitophilus zeamais.*

Result from Table 4 shows that, at 20DAT shows, highest mean number of oviposition on *S.zeamais* was noticeable at the control. However, the application of *senna occidentalis* at 2ml and 3ml were statistically at par. At 50DAT, control produce highest mean oviposition compared to all other treatments and was statistically at par with application of 2ml of *Senna occidentalis.* Least significant oviposition was found by the application of 3ml of *Senna occidentalis* compared to all other treatments. (Same explanation with Figure 2).

The effect of *Senna occidentalis* on germination of maize at table 5 shows that, application of 2ml of ethanolic extract of *Senna occidentalis* has higher germination compared to all other treatment. This might be that one of the metabolites might act as a growth promoter/regulator. Least germination during the trail was shown in control than all other treatments. This might attribute to the metabolites found in the *Senna occidentalis* which can influence germination of the seeds among the treatments and for control might attribute to number of holes which causes low germination percentage.

5. CONCLUSION

Based from the results shown in this study, its pertinent to conclude that the *Senna occidentalist* extract can be used to manage oviposition, anti feeding and reduce infestation of maize by maize weevil *Sitophilus zeamais* in the Northern Sudan Savanna Ecological Zone of Nigeria. Further studies need to be carried out to find the exact metabolite and then isolate them to find out which one is responsible for the management of number of holes, antifeedant effect, oviposition and germination.

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