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INSECTICIDAL ACTIVITY OF *Secamone afzelii (*SCHULT*)* K. SCHUM POWDER IN THE CONTROL OF *Stiphilous zeamais* (MOTS) (COLEOPTERA: CURCULIONIDAE)

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ABSTRACT
Maize seeds are highly susceptible to beetles attack and every year this insect causes great loss in storage. This study investigated the efficacy of the insecticidal properties of *Secamone afzelii* plants powder against *Sitophilus zeamais*. Four application rates i.e. 0.5g/20g, 1.0g/20g, 1.5g/20g and 2.0g/20g of maize seeds were tested under ambient laboratory conditions. Mortality of adult insects at 48 hours and 15 days post treatment, adult emergence, adult exit holes and percentage weight loss in each treatment were compared with those of control. Amongst the various treatments tested application rate of 2.0g/20g seeds was observed to significantly ($P< 0.05$) suppress adult emergence and adult exit holes and percentage weight loss were significantly reduced at all levels of application.
KEYWORDS: adult emergence, application rates, efficacy, *Secamone afzelii, Sitophilus zeamais.*

INTRODUCTION

Maize seeds damaged in storage by *Sitophilus zeamais* are particularly important in Nigeria because they significantly reduce the availability of the produce as a good source of carbohydrate[1]. Maize damaged by *Sitophilus zeamais* eventually result in viability loss, caking and mould growth thereby making the maize to be unfit for consumption and reduce economic value[2].

The most effective method of controlling *Sitophilus zeamais* attack and damage in developing countries is currently the use of conventional synthetic insecticides[3]. Despite the effectiveness of these insecticides, their adoption and use at the peasant farmers and semi-commercial farmers' level under which maize is produced in Nigeria have been characterized by several problems, such as, appearance of resistant strain of pest[4], high cost of procurement[5], pest resurgence and secondary pest outbreaks[6]. In addition, non-selective insecticides kill beneficial insects and non-targeting organism thereby causing an imbalance in the ecosystem[7]. Public concerns over the toxicity of pesticides and their impact on the environmental damage and public health have necessitated research on alternative eco-friendly and sustainable methods of control[8]. This may proffer solution to problems emanating from the use of conventional insecticides. Therefore the objective of this study is to evaluate the insecticidal activity of *Secamone afzelii* powder in the control of *S. zeamais*

MATERIALS AND METHODS

S. zeamais Culture and Experimental Condition

The *S. zeamais* used for the experiment were derived from a colony originating from infested cowpea seeds collected from Ulede (Oja Oba) market in Owo, Ondo State, Nigeria (latitude 5^0 12' N and longitude 5^0 36' E). The emerge adults were sub-cultured in the Crop Protection Laboratory of Agricultural Technology Department of Rufus Giwa Polytechnic, Owo, Ondo State, and the sub-cultures were maintained in kilner jars in the laboratory under ambient conditions (28 ± 3^0C and 70 ± 5 % relative humidity) and emerging adult insects were recycled from generation to generation. *S. zeamais* was maintained on T-Swam yellow maize variety as substrate.

The clean maize seeds used for the experiment were obtained from the seed store of Ondo State Agricultural Development Project, Akure. The clean seeds showed no visible presence of adult insects or their exit holes, but were nevertheless disinfested by storing them in a deep freezer for two weeks and then acclimatized in the open laboratory for 24 hours to avoid mouldiness before use[9].

Preparation of *Secamone afzelii* powder

Fresh *Secamone afzelii* plants were collected from Laosuo Camp in Ondo West Local Government, Area of Ondo state, Nigeria (07^0 05' N, 04^0 55' N). The identity was confirmed at The Herbarium, Department of Forestry and Wood Technology of Federal University of Technology, Akure, Nigeria. The plants were shade dried and the leaves and vines were detached separately. Thereafter, the dried leaves and vines were grounded into powder using electric laboratory hammer mill[10]. The powders from leaves were stored separately in air tight plastic containers and placed in a wooden cupboard in the laboratory for future use.

Contact Toxicity of *Secamone afzelii* powder to *S. zeamais*

The powders of *Secamone afzelii* leaves and vines were tested at 0.5g, 1.0g, 1.5g, and 2.0g per 20g of uninfested maize seeds in separate Petri-dish glass (9.0cm) plates. Each of the Petri-dishes was tumbled several times to ensure homogenous mixing of powder with grains. *S. zeamais* sex was determined using snout characteristic. Five male and five female (ten insects) of *S. zeamais* were introduced into each petri-dish glass[11,12]. Adult mortality was monitored and counted 48 hours after infestation; percentage mortality was calculated using the method adopted by Omotoso and Oso[13].

$$\% \text{ Mortality} = \frac{\text{No of dead insect}}{\text{Total no of insect}} \times 100$$

Adult weevils were removed 21 days after infestation and number of adult weevil emergence and that of exit holes were counted 45 days after infestation.

There was also a control treatment involving no addition of plant powder on to the seeds. At the end of the experiment, the final weight of each of the treatment was taken and used to calculate the percentage weight loss[13].

$$\% \text{ Weight loss} = \frac{\text{Initial weight - Final weight}}{\text{Initial weight}} \times 100$$

Experimental Design and Data Analysis

The experimental design adopted for the experiment was Complete Randomised Design (CRD) and each treatment was replicated three (3) times. Data collected were subjected to analysis of variance (ANOVA). While egg counts, exit holes were subjected to square root transformation, percentages were arcsine transformed, before analysis. Percentage efficacy was determined using Abott's formula[14]. Treatment means were separated using Least Significant Difference (LSD) statistics at $P < 0.05$.

RESULTS

Mortality of adults of *S. zeamais* 48 hours post treatment with different concentration of *S. afzelii* powder is presented in Table I. The leaf powder of *S. afzelii* applied at 2.0g inflicted significantly greater mortality to *S. zeamais* adults than when applied at other dosages except at 1.5g. The mortality in *S. zeamais* adults caused by the vine powder applied at 2.0g was also highest, but was not significantly different ($P > 0.05$) from mortality caused when applied at 1.5g and 1.0g.

Table II shows the mean mortality of *S. zeamais* 15 days post treatment with different concentration of *Secamone afzelii*. Both leaf and vine powders exercise significant kills of adult *S. zeamais* ($P < 0.05$) at all levels of application. The number of adults killed 15 days post treatment was highest at 2.0g concentration for both leaf (61.92) and vine powder (68.85) than other dosages.

Adult emergence of *S. zeamais* 45 days post treatment with different concentration of *S. afzelii* powder is summarized in table III. The vine powder recorded significant different ($P < 0.05$) compared to control and 0.5g dosage. The leaf powder recorded lowest *S. zeamais* adult emergence in 2.0g than other dosages and was significantly different ($P < 0.05$) compared to control and 0.5g dosage.

Table IV shows transformed mean number of adult exit hole on the grains treated with different concentration of *S. afzelii* powder. Adult exit holes in leaf and vine powder treatments exhibit significant difference ($P < 0.05$) when *S. afzelii* was applied at 2.0g compared to 0.5g and control.

Transformed percentage mean weight loss of grains treated with different concentration of *S. afzelii* powder is summarized in table V. The leaf powder treated on the grains is significantly different at 2.0g compared with 0.5g and control. Vine powder on maize seeds recorded the highest percentage of weight loss in control, and it's significantly different ($P <0.05$) when compared to 2.0g and 0.5g.

Figure 1 shows the percentage efficacy of grains treated with different concentration of *S. afzelii*. Maize treated with 2.0g of leaf powder of *S. afzelii* recorded highest efficacy and vine powder recorded the highest efficacy when treated at 0.5g compared to other dosages.

DISCUSSION

The significant mortality of *S. zeamais* when leaf and vine powders of *S. afzelii* were applied indicates the presence of insecticidal properties in this plant, which negatively impacted on survival of the adult beetles. This is consistent with the findings of other workers who have reported the effectiveness of various plant powders used as grain protectants against various insect pests of stored products[15].

The effectiveness of each of the treatment types against in suppressing the adult emergence revealed that the plants were effective against *S. zeamais*. For instance mean adult emergence at 2.0g for leaf powder and vine powder was 7.15 and 14. 53 compared to control 35.71 and 36.26 respectively. The result is in line with[16, 17] that mixing grains seeds with inert materials like wood-ash and sand can cause physical impediment to beetle movement thereby preventing mating and oviposition and in turn reduce adult emergence.

The reduction in seed damage as reflected by the mean number of adult exit holes and percentage weight loss in the grains is in tandem with the mean number of adult emergence from the treated grains The lower the percentage adult emergence from the treated grains, the lower the adult exit holes and damage weight loss or vice versa. This result confirmed earlier findings of[18] that ash of some bioactive plant species cause oviposition deterrence and or ovicidal action resulting in reduced progeny production of stored product insects, thus reduce seed damage.

CONCLUSION

It could be concluded from the observation of this study that application of *S. afzelii* powder has cumulative effect on reduction in the weevil adult emergence of treated seeds and thus could be used as storage protectant to complement conventional synthetic insecticides.

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Table I: Percentage mean mortality of *S. zeamais* 48 hours after treatment of infested product with *Secmone afzelii* at different dosages

	***S. zeamais* mortality in:**	
g powder/20g of grain	**Leaf powder**	**Vine powder**
0.0g	0.00	0.00
0.5g	24.20	26.07
1.0g	26.07	28.08
1.5g	30.99	33.00
2.0g	37.14	41.07
LSD (0.05%)	8.25	14.36

NB Value were arcsine transformed

Table II. Percentage mean mortality of S. zeamais 15 days after treatment of infested product with S. afzelii at different dosages

S. zeamais mortality in:		
g powder/20g of grain	**Leaf powder**	**Vine powder**
0.0g	17.37	26.07
0.5g	45.00	59.71
1.0g	54.99	61.92
1.5g	59.01	63.93
2.0g	61.92	68.85
LSD (0.05%)	13.45	12.13

NB Value were arcsine transformed

Table III: Mean adult emergence of *S. zeamais* when treated with different dosages of *Secamone afzelii*

S. zeamais mortality in:		
g powder/20g of grain	**Leaf powder**	**Vine powder**
0.0g	35.71	36.26
0.5g	24.58	20.79
1.0g	14.51	15.60
1.5g	11.24	15.09
2.0g	7.15	14.53
LSD (0.05%)	7.40	4.45

NB Values were square root transformed

Table IV: Mean number of adult exit holes on maize seeds treated with different dosage rates of *S. afzelii*

S. zeamais mortality in:		
g powder/20g of grain	**Leaf powder**	**Vine powder**
0.0g	6.07	6.41
0.5g	4.74	4.05
1.0g	3.17	3.19
1.5g	2.64	3.10
2.0g	2.49	3.01
LSD (0.05%)	3.04	0.74

NB Value were square root transformed

Table V: Percentage weight loss of maize seeds treated with different dosages of *S. afzelii*

S. zeamais mortality in:		
g powder/20g of grain	**Leaf powder**	**Vine powder**
0.0g	21.88	21.26
0.5g	21.27	15.43
1.0g	9.84	10.25
1.5g	8.57	10.17
2.0g	7.66	10.08
LSD (0.05%)	6.19	4.89

NB Value were arcsine transformed

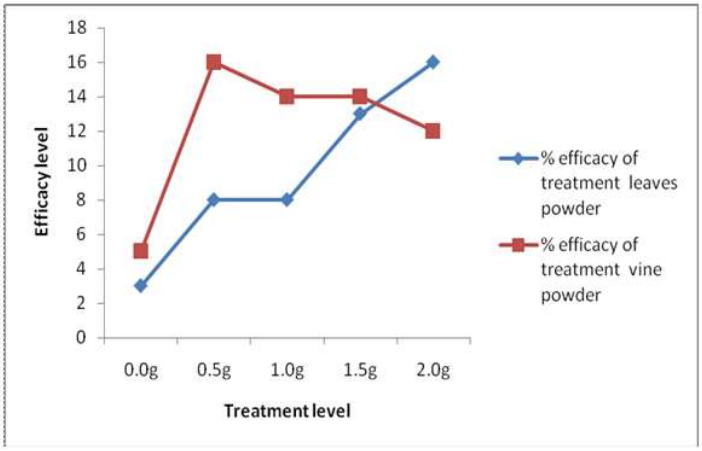

Figure 1: Percentage efficacy of Maize seeds treated with different doses of *Secamone afzelii*.

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