

PROTECTANT EFFICACY OF DENNETIA TRIPETALA BAK. (F) (ANNONACEAE) EXTRACTS AND DELTAMETHRIN AGAINST SITOPHILUS ZEAMAI MOTSCH (COLEOPTERA: CURCULIONIDAE) IN STORED MAIZE



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ABSTRACT

The use of plant products has shown great potentials as alternatives to synthetic insecticides. The present studies investigated the efficacy of *Dennetia tripetala* and Deltamethrin as grain protectants against adult *Sitophilus zeamais* in stored maize. Acetone extracts of *D. tripetala* and Deltamethrin 12.5EC were evaluated in the laboratory based on insect mortality, progeny production and grain damage. Five concentration levels of each toxicant were prepared including 20mls, 15mls, 10mls, 5mls and 1ml for *D. tripetala* and 1ml, 0.5ml, 0.25ml, 0.1ml and 0.01ml for Deltamethrin. Controls with no toxicants were included. The design of the experiment was a CRD and each repeated 4 times. Twenty grams of insect-free maize were measured into each replicate vial and infested with ten, 1-5-days old adult insects. Mortality was recorded at 12, 24, 48- and 72-hours post-treatment. After 35 days, progeny production and number of damaged grains were recorded. Data obtained were statistically analyzed using SPSS version 13. The results indicated that Deltamethrin was more toxic than *Dennetia tripetala*, however, at 10mls-20mls, *D. tripetala* showed moderate toxicity against *S. zeamais*. Comparative mortalities of the two toxicants indicated that Deltamethrin was significantly ($P < 0.05$) more toxic than *D. tripetala* at all levels. The studies however, revealed that the application of *D. tripetala* in controlling *S. zeamais* could be effective at higher concentrations. Therefore, it was suggested that *D. tripetala* should be applied at higher concentrations for effective control of maize weevil.

1. INTRODUCTION

Maize belongs to the Family Poaceae. It is an important cereal crop in Nigeria, where it serves as major staple food component of their diet. The harvested crop is attacked by a wide range of insect pests including, beetles and moths (Ogungbite and Oyeniyi, 2014). The weevil, *Sitophilus zeamais* Motsch (Coleoptera: Curculionidae) is a major

insect pest of maize grain in Nigeria and other parts of the world, causing severe losses incurred in stored maize annually (Nwana, 1993). In recent years, controlling many of these destructive insects has profoundly relied on the use of synthetic chemical (Akinkurolere, 2007) which have been reported to have many consequence that impede their widespread use nowadays. Public awareness of adverse side effects of the synthetic insecticide has called for an urgent need to look for safer alternative that could comparably contend with chemical insecticide in action. In order to limit the use of these synthetic chemical insecticide, research studies have been focused on plant kingdom as a new tool of controlling insect pest of stored products (Ogungbite and Oyeniya, 2014).

2. METHODOLOGY

Adult *Sitophilus zeamais* were obtained from the infested stocks of maize purchased from Nise market, Awka, Anambra State, Nigeria. The weevils were introduced into 2 different containers each containing 700 g of clean maize grains var. Yellow Jos Mangu. The weevils were allowed to oviposit and multiply for 2 months until required for experiment. Matured adult weevils were removed and the culture returned to the container for further outbreeding. Adults that were 1-5 days old were used for the experiment.

Fresh fruits of *Dennetia tripetala* weighing 600g were obtained from Eke Awka Market Anambra State, Nigeria. The seeds were extracted and sun-dried for 4 days, after which they were pulverized with an electric Blender. One hundred grams of the pulverized sample was added to 250mls of Acetone (Analar grade) and shaken at intervals. It was allowed to stand for 3 days during which time it was shaken periodically. The final extract was filtered using No 1 Whatman filter paper.

The crude extract was regarded as 100% concentration and thereafter diluted serially into 20mls, 15mls, 10mls, 5mls and 1ml using acetone to obtain 100%, 75%, 50%, 25% and 5% of *Dennetia tripetala*, respectively. Deltamethrin (synthetic pyrethroid) 12.5 EC equivalent of 15.5g/l of active ingredient was used for the experiment. The serial dilutions of the synthetic pyrethroid were prepared to include 1ml, 0.5ml, 0.25ml, 0.1ml and 0.01ml using Acetone as solvent giving 5%, 2.5%, 1.25%, 0.5% and 0.05% of Deltamethrin active ingredient respectively.

The maize grains (Bende white) used for the experiment were sorted to remove damaged and broken ones. The sample was sterilized in the refrigerator at 18 degrees Celsius for 3 days to kill off any hidden infestations. Thereafter it was allowed to condition at ambient laboratory conditions. Twenty grams weight of the grains were placed in each of the transparent plastic cups and each treated with 2mls of 100%, 75%, 50%, 25% and 5% of *D. tripetala* extract, respectively using a disposable syringe. Ten adults of *S. zeamais* of mixed sexes were introduced into each of the cups. The contents were covered with muslin cloth and held in place with rubber bands. The control treatments had no *D. tripetala* extract added and each treatment was repeated 4 times. The insect mortality was recorded from 12 hours of treatment and up to 72 hours. Insects were assumed dead on failure to respond to gentle probing with a blunt dissecting needle. The same procedure was adopted with 5%, 2.5%, 1.25%, 0.5% and 0.05% of Deltamethrin treatments. The layout plan was CRD with four repetitions displayed on the laboratory work bench.

After 5 weeks of infestation, samples of 20 maize grains were drawn from each replicate sample and number of damaged grains were counted and recorded. The sample was returned to the container and shaken, the process was repeated 2 more times and the mean values were recorded.

Data obtained were analyzed using SPSS version 13 package.

3. RESULTS

Table 1: Damaged Grains

Treatments	Damaged grains (%)
Deltamethrin (0.01)	0
Deltamethrin (0.1)	0
Deltamethrin (0.25)	0
Deltamethrin (0.5)	0
Deltamethrin (1.0)	0
<i>D. tripetala</i> (1.0)	46
<i>D. tripetala</i> (5.0)	21

<i>D. tripetala</i> (10.0)	32
<i>D. tripetala</i> (15.0)	17
<i>D. tripetala</i> (20.0)	15
Control (0).	86
LSD (0.05)	11.98

The LSD value showed that there were significant differences ($p < 0.05$) in damaged grains between the maize treated with *Dennetia tripetala* and the ones treated with Deltamethrin. The grains treated with Deltamethrin showed no damage. The LSD also indicated that there was a significant difference ($p < 0.05$) in the control and 1ml, but no significant differences between 10mls, 5mls, 15mls and 20mls.

Table 2: Progeny Production

Concentration of the Pesticide (ml)	Progeny production
Deltamethrin (0.01)	0
Deltamethrin (0.1)	0
Deltamethrin (0.25)	0
Deltamethrin (0.5)	0
Deltamethrin (1)	0
<i>D. tripetala</i> (1)	11
<i>D. tripetala</i> (5)	7
<i>D. tripetala</i> (10)	8
<i>D. tripetala</i> (15)	7
<i>D. tripetala</i> (20)	3
Control (0)	19
LSD (0.05)	2.36

The LSD value indicated that there were significant differences ($p < 0.05$) in progeny production between the maize treated with *Dennetia tripetala* and the ones treated with Deltamethrin. There was no significant difference ($p > 0.05$) among the different concentrations of Deltamethrin with respect to progeny production. There was no significant difference ($p > 0.05$) between 10mls, 5mls and 15mls of *Dennetia tripetala* with respect to progeny production. There were significant differences ($p < 0.05$) between 1ml, 20mls and the treatments

Table 3: Mortality Assesment

Concentration (mls)	% Mortality at hourly intervals			
	12hr	24hr	48hr	72hr
Deltamethrin (0.01)	10.0	65.0	97.5	100
Deltamethrin (0.1)	17.5	80.0	100	100
Deltamethrin (0.25)	52.5	95.0	100	100
Deltamethrin (0.5)	55.0	95.0	100	100
Deltamethrin (1)	99.0	97.5	100	100
<i>D. tripetala</i> (1)	7.5	15.0	20.0	20.0
<i>D. tripetala</i> (5)	12.5	22.5	30.0	30.0
<i>D. tripetala</i> (10)	12.5	25.0	50.0	50.0
<i>D. tripetala</i> (15)	15.0	30.0	52.5	55.0
<i>D. tripetala</i> (20)	37.5	47.5	55.0	60.0
Control (0)	0.0	0.0	0.0	0.0
LSD (0.05)	14.9	18.27	9.063	17.48

At 12hours, the LSD value showed that there was no significant difference ($p > 0.05$) between 1ml, 5ml, 10mls, 15mls of *D. tripetala* and 0.01ml, 0.1ml of Deltamethrin. There was no significant difference ($p > 0.05$) between 0.01ml

and 0.1ml. There was no significant difference ($p>0.05$) between 0.25ml and 0.5ml. 0.25ml and 0.5ml differed significantly from 0.1ml and 0.01ml with the former having a higher level of mortality. There was also a significant difference ($p<0.05$) at 1ml which presented the highest level of mortality. The control had no mortality. There was no significant difference ($p>0.05$) between 10mls, 15mls, 5mls and 1ml. There was a significant difference ($p<0.05$) at 20mls and control

At 24hrs, the LSD value showed that there was no significant difference ($p>0.05$) between 20mls of *D. tripetala* 0.01ml of Deltamethrin. There was no significant difference ($p>0.05$) between 1ml, 0.05ml, 0.25 and 0.1ml. There was a significant difference ($p<0.05$) at 0.01ml and it presented a lower level of mortality. Similarly, there was no significant difference ($p>0.05$) between 1ml, 5ml, 10ml and 15mls. However, there were significant differences ($p<0.05$) at 20mls and control.

At 48hrs, the LSD value showed that there was a significant difference ($p<0.05$) between Deltamethrin and *Dennetia tripetala*. There was no significant difference ($p>0.05$) between all the different concentrations of Deltamethrin. There was no significant difference ($p>0.05$) between 20mls, 15mls and 10mls with respect to mortality at 48hrs. There was no significant difference ($p>0.05$) at 1ml and 5mls but they ($p<0.05$) differed from 20mls, 15mls and 10mls. There was a significant difference ($p<0.05$) between the control and all the treatment concentration

At 72hrs, the LSD value indicated that there was a significant difference ($p<0.05$) between Deltamethrin and *Dennetia tripetala*. There was no further mortality in Deltamethrin, all the insects were dead after 3 days of treatment. There was no significant difference ($p>0.05$) between 20mls, 15mls and 10mls. There was no significant difference ($p>0.05$) between 1ml and 5mls but they differed significantly from 20mls, 15mls and 10mls with a lower level of mortality. There were significant differences ($p<0.05$) between the control and all the treatment concentration.

4. DISCUSSION

In Table 1, no damaged grain was recorded in Deltamethrin irrespective of the treatment level. In *Dennetia tripetala* damaged grains were found to be decreasing with increasing concentration. The results of the present studies were in agreement with those of Udo (2015) where the number of damaged grains decreased with an increasing concentration of *Dennetia tripetala*.

In Table, 2 progeny was found to be decreasing with increasing concentration In *D. tripetala* treatment. The findings of the present studies similarly agreed with the result of Udo (2015) where progeny decreased with increasing concentration of *Dennetia tripetala*

The same level of mortality was observed after 48hrs irrespective of the treatment levels as shown in Table 3. The present studies also agrees with the result of Rajanish and Rohit (2014) where Deltamethrin was effectively used in the control of *S. oryzae* in wheat. The result was also similar to those of Frank (1994), where Deltamethrin was effectively used in the control of *R. dominica*

Mortality was found to increase with increasing concentration of *D. tripetala*. 10mls, 15mls and 20mls gave the same level of mortality from 48 hours. The observations of the present studies further strengthen the results of Udo (2015) where mortality increased with increasing concentration of *Dennetia tripetala*. The present findings agree with the result of Olayinka (2014), where the mortality of *Dermestes marculatus* increased with increased concentration of *Dennetia tripetala*.

5. CONCLUSION AND RECOMMENDATION

Since Deltamethrin was able to kill the insects within 3 days irrespective of the concentration. It could be suggested that it should be used at very low concentration in order to minimize cost and its residual effect.

D. tripetala was able to control the insects moderately at 20mls. Therefore, for effective control of the pest, it could be applied at higher dose with repeated application. Unlike Deltamethrin, the plant product will take longer time to give 100% mortality while it does not have a residual products and not toxic to human being.

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CONFLICT OF INTEREST

None.

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