Insecticidal Activity Of Commonly Used Plants For The Control Of Stored Maize Weevil (Sitophilus zeamais) In Sokoto State

Nasiru, A. M 1Sambo, S. 2Sulaiman, B. 2Yalli, A.A. 2Liman, B. 2Nahantsi, M.S and 3Aliyu, L. S.
1Department of Forestry & Environment, Usmanu Danfodiyo University, Sokoto Nigeria
2Department of Biology, Shehu Shagari College of Education, Sokoto Nigeria
3Department of Agricultural Science, Shehu Shagari College of Education, Sokoto Nigeria
ibrahimasalau@gmail.com  Phone: +234(0)8053569551

ABSTRACT
The insecticidal activity of Tamarindus indica, Azadirachta indica and Jatropha curcas leaves powder were investigated for their efficacy in controlling maize weevil (Sitophilus zeamais). The methods used were mortality, oviposition and development of new offspring. The results shows that T. indica was found to be the most effective in the seeds treatment with 97%, while A. indica and J. curcas have 66% and 40% adult mortality at 1.0, 1.5 and 2.0g/20 maize seeds respectively. T. indica was also more effective in inhibiting oviposition and offspring emergence compare with other test plants. Efficacy of treatments increased with increased concentration of leaf powder used. There was a significant difference between the treatments at P=0.05. Observations made on the seed coat found it to be tainted; the texture was also rough and thickened. The study recommended the efficacy T. indica to be used in grain storage against insect pests especially Sitophilus zeamais.

Keywords: maize weevil, Botanical insecticides, stored maize, oviposition

INTRODUCTION
The protection of stored grain and seeds against insect pests has been a major problem from the development of agriculture. As a result of the huge losses suffered by farmers, over time various strategies have been employed to control the pest. These include various cultural practices such as sun drying, storing in air tight containers and so on. The most effective treatment in epidemics however has been the synthetic insecticides used on the field and in storage. Their cost has however been prohibitive to the peasants, who are the main producers. More so the technologies involved in their applications, and their toxicity to humans especially when manufacturers expiry dates are not adhered to. The need therefore arises to source for cheaper and safer control strategies that can be sourced locally and will require little skills.

Plant products have been successfully exploited as insecticides (Feng and Isman, 1995). Higher plants are a rich source of novel natural substances that can be used to develop environmental safe methods for insect control Arnason et al., (1989). Insecticidal activity of many plants against several insect pests has been demonstrated (Kim, 2003). The deleterious effects of plant extracts or pure compounds on insects can be manifested in several manners including toxicity, mortality, antifeedant growth inhibitor, suppression of reproductive behaviour and education of fecundity and fertility. Yang and Tang (1988) reviewed the plants used for pest insect control and found that there is a strong connection between medicinal and pesticidal plants.

To minimize use of synthetic pesticides and to avoid pollution of the environment, natural antifeedant, deterrent and repellent substances have been searched for pest control during recent times (Hidalgo et al. 1998). However, there is an urgent need to develop safe alternatives that are of low cost, convenient to use and environmentally friendly. Considerable efforts have been focused on plant derived materials, potentially useful as commercial insecticides.

Botanical insecticides compared to synthetic ones may be safer for the environment, are, generally, less expensive, easily processed and used by farmers and small industries (Arthur, 1996). Since these
insecticides are often active against a limited number of species, are often biodegradable to nontoxic products, and are potentially suitable for use in integrated pest management, they could lead to the development of new classes of safer insect control agents (Kim et al., 2003). The aim of our study is to evaluate the insecticidal activity of Tamarindus indica, Azadirachta indica, Jatropha Curcas leaves. They were studied for their effects on the mortality, oviposition, and emergence of the offspring of the pest in stored Maize seeds.

MATERIALS AND METHOD
Young shoots of Tamarindus indica, Azadirachta indica, Jatropha Curcas were collected, washed and then sun-dried for four days. This leaves were then removed and placed on a clean sheet of old newspaper and then weighed. The weighed leaves were then pounded separately in a mortar before being transferred to the blender to get fine powders. The powders were then sieved to get the fine and smooth powder. Their weights were taken and transferred to sterilized containers which are labelled. Non-infested maize seeds were selected by hand picking. Twenty non-infested grains were placed in each test tube. Some of the seeds were cultured with maize weevil (Sitophilus zeamais) eggs for one week to get adult Sitophilus zeamais. The treatment powders were applied to the non-infested cowpea seeds in the test tubes at the rate of 1.0g, 1.5g, 2.0g/20 seeds. Each treatment level was replicated thrice. The test tubes were thoroughly shaken to ensure the treatment powders were all mixed with the seeds. The treated seeds were then inoculated with day old 10 adult weevil with the aid of an insect pooter. Each of the test tubes were covered with muslin cloth and held with rubber bands. The set up were then placed in a cupboard at a temperature of 35°C for seven days. Assessment of adult mortality was done a week after infestation by direct count of dead insects after sieving. The oviposition was assessed by counting the number of eggs laid on a random sample of 10 grains after infestation. Five weeks after treatment the test tubes were examined and number of emerged offspring counted after sieving. At the end of the experiment five seeds were randomly selected from the bulky seeds of the three replicates of each treatment. They were placed in Petri-dishes with moist cotton wool. Observations were made on change in the seed coat texture, colour and seed viability.

Data Analysis
Data analysis was done using the two way ANOVA

RESULTS
Mortality rates were highest observed in the T. indica and A. indica leaf powder treatments (Table 1) which gave 97 and 66% mortality respectively. The lowest mortality rates were observed in the J. curcas leaf powder treatments which gave 40% mortality at 2.0g/20 maize seeds. Oviposition was highest in the A. indica leaf powder treatments (Table 2) with gave 31.3, 26.3 and 27.0 eggs at 1.0, 1.5 and 2.0g/20 maize seeds and least in the T. indica leaf treatments (Table 2) which gave 11.3, 6.7, 5.7 eggs at 1.0, 1.5 and 2.0g/20 maize seeds. The efficacy increased with an increase in the amount/weight of leaf powder used.

The emergence of offspring at five weeks post leaf powder treatment was highest in the J. curcas treated seeds (Table 3) which gave 23, 27 and 23 at 1.0, 1.5 and 2.0g/20 maize seeds respectively. Lowest values were recorded in the T. indica treated seeds (Table 3) with 4.7, 3.0 and 1.0 at 1.0, 1.5 and 2.0g/20 maize seeds respectively. It was also observed that the emergence number decreased with an increased in the weight of the leaf powder treatments used. Although the seeds were tainted and their seed coats became rough, their viability was however not affected.

Mortality of adult Sitophilus zeamais per 20g cowpea seeds one week post leaf powder treatment (Table 1). This shows a high rate of the pest when treated with T. indica the effect of the treatment is slightly independent of the change in concentrations. This is statistically true of P=0.05. There is no significant difference in the treatment means A. indica shows a lower mortality when compared with T. indica and the effect of the treatment. The least effective treatment on adult mortality was J. curcas. The effect of the powdered treatment is almost insignificant compared to those of T. indica and A. indica. This effect is
independent of the increase in amount of treatment used. There is no significant difference due to the treatment.

Table 1: Effect of the Leaf powders on adult mortality of *Sitophilus zeamais* at one week treatment

<table>
<thead>
<tr>
<th>Treatment (g) Per 20 maize Seeds.</th>
<th>T. indica</th>
<th>A. indica</th>
<th>J. curcas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replications</td>
<td>1.0</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Total number</td>
<td>22</td>
<td>27</td>
<td>29</td>
</tr>
<tr>
<td>Percentage (%)</td>
<td>73%</td>
<td>90%</td>
<td>97%</td>
</tr>
</tbody>
</table>

Table 2: Effect of the Leaf powders on eggs of *Sitophilus zeamais* at three weeks treatment

<table>
<thead>
<tr>
<th>Treatment (g) Per 20 maize Seeds.</th>
<th>T. indica</th>
<th>A. indica</th>
<th>J. curcas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replications</td>
<td>1.0</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>13</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Total number</td>
<td>34</td>
<td>20</td>
<td>17</td>
</tr>
<tr>
<td>Average</td>
<td>11.3</td>
<td>6.7</td>
<td>5.7</td>
</tr>
</tbody>
</table>

Table 3: Effect of the Leaf powders on offspring of *Sitophilus zeamais* at five weeks

<table>
<thead>
<tr>
<th>Treatment (g) Per 20 maize Seeds.</th>
<th>T. indica</th>
<th>A. indica</th>
<th>J. curcas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replications</td>
<td>1.0</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Total number</td>
<td>14</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Average</td>
<td>4.7</td>
<td>3.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

DISCUSSION

In recent years, interest in screening plants for novel insecticides has increased significantly (Weinzierl, 1998). Searching for plant-derived that have potential use as crop protectants (insecticides, antifeedants, growth inhibitors) often begins with the screening of plant extracts (Akhtar and Isman, 2004).

The plants used in this study are widely known for their medicinal properties. *Tamarine indica* were found effective in the control of *Sitophilus zeamais* which goes with the findings of Chariandy et al. (1999) screened 29 species used in traditional medicine in Trinidad for insecticidal properties using *Aedes aegypti*. Liu et al. (2007) screened 40 species of Chinese medicinal herb from 32 different botanical families for contact, fumigant and feeding deterrent activities against two stored-grain insects *Sitophilus zeamais* and *Tribolium castaneum*. Several investigators have reported activity in extracts of species related to our study. The results from our study revealed that some of the plants extracts tested had insecticidal activity against *Sitophilus zeamais*. Therefore, this activity may be attributed to the presence of the high concentration of some sesquiterpene lactones which were found to be extremely sour and it is likely that this sour taste acts as a deterrent to herbivores (Cravotto et al., 2005).

Therefore, the study of the effects of plant materials extracts upon pests can lead to the discovery of alternative insecticides. However, systematic studies of medicinal plants against insects were very
scarcity (Chiu, 1985). In this paper, we report our findings on contact and antifeedant bioassay activity of insecticidal plants on *S. zeamais*.

**CONCLUSION**

The different plants powder in our present study revealed the toxicity against store insect may be due to the presence of different classes of bioactive compounds. From the insecticidal activity results, it is observed that different powder extracts of three plants would be more or less effective for controlling maize weevil. The powder extract of *T. indica* showed the highest toxic effect followed by the powder extract of *A. indica*. *T. indica* and *A. indica* are available throughout the country and the farmers may use this plant in their storehouses for the management of stored grain pests. Further investigation on the identification of active ingredient from the powder extracts, which is more effective than other extracts, is utmost needed.

**REFERENCES**


