Efficacy Of Leaf Powders Of Wild Lemon, (Afireagle paniculata) And African Rock Fig, (Ficus Congensis Engl.) On The Control Of The Groundnut Bruchid (Caryedon serratus Olivier)

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Abstract
The efficacy of the Wild Lemon (Afireague paniculata) and the African Rock Fig (Ficus congensis Engl.) leaf powder was tested on groundnut (Arachis hypogea) as an alternative source of control against the groundnut bruchid (Caryedon serratus), the experiment was conducted under room temperature at Kaltungo in Gombe State. The results obtained showed that, these plant materials in powdered forms had significant effect on all the parameters measured. There were 76.44% and 77.20% undamaged nuts recorded respectively, when groundnut nuts were stored with these plant material powdered leaves compared to the control, 7.60%. High mortality of 85.50% and 83.50% respectively, was obtained in these plant material powdered leaves and the least was in the control, 16.84%. Furthermore, there was only 9.65 and 7.00 number of adults that emerged while the control had 25.85. High number of eggs laid was recorded in the control, 710.00 and the least was in the two plant material powdered leaves, 268.00 and 159.00 respectively, at P ≤ 0.05 using the Student Newman-Keuls (SNK) test for variables. It was also found out that, these plant material powdered leaves are promising and effective for developing botanical, biodegradable and ecologically friendly insecticides which can be integrated with other pesticidal materials that could replace the use of synthetic insecticides on small farmers holding. Therefore, the leaf powders are recommended for storing groundnut for at least 16 weeks giving the perfect state of wholesomeness.

KEY WORDS: Wild Lemon, rock fig, bruchid, leaf powder, groundnut, efficacy, damage.

1. INTRODUCTION
Groundnut (Arachis hypogea Linn) belongs to the family Leguminosae and is one of the most important oil seed crop in the world (Brink and Belay, 2006; ICRISAT, 2009). The groundnut have been recognized around the world by an assortment of colorful names. Americans call it peanut, several other names such as African nut, Chinese nut, Manila nut, Kipper nut, Hawks nut, Jarnut, Earth chestnut, Monkey nut, Goobers pear, Ground pea, and Ground bean have been known (Johnson, et al., 1981). Locally in Nigeria especially in the north where it is cultivated it is known as ‘gyada' in Hausa, 'okpa' in Igbo, 'apa' in Yoruba (Wood and Ambridge, 1996) while it is

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also known as 'wada' in Kilba and Bura and the Yungur speaking people refer to it as 'shiyara' Samaila and Malgwi, (2012).

Although peanut have relatively gained importance recently, the origin of the crop dates back to 350 B C (Hammous, 1994). With a humble beginning, ground have gained prominence for their economic importance and nutritional value on a global scale and are now cultivated throughout the world (Shankarappa, et al., 2009). The main use of groundnut is as a source of edible oil, but it is an important food crop to man, however in spite of its importance to man, groundnut has a lot of pests in the field.

The groundnut bruchid (Carvedon serratus Olivier) is widely distributed in groundnut growing areas of the world from Myanmar through Hawaii, India, Indonesia, Iran, Israel, Jordan, Mexico, New Zealand, Nigeria, Pakistan, Sri Lanka, Sudan, Thailand and Uganda (King solver, 1970). Furthermore, it has also been reported to be found in Zambia, Senegal and West Africa (Feakin,1973), Central Africa (Delobel, 1989), and Australia (Cunningham and Walsh 2002). Subsequently, several workers reported its distribution in most groundnut producing areas of Northern Nigeria (Samaila and Malgwi, 2012 and Malgwi and Onu, 2004).

A large number of plant-derived substances exert various physiological and behavioural activities on stored product insects and notable among these plants are various spices and medicinal plants used traditionally for protecting foodstuffs against insect pests in store (Ho et al., 1995). Steam distillates and organic extracts of different aromatic medicinal plants have been reported to be effective against several insect species (Oaya, and Samaila, 2013, Adedire and Ajayi, 2003; Adedire and Lajide, 2003; Adedire et al., 2003; Boussaada et al., 2008; Ho et al., 1995; Rahman and Talukder, 2006). Oaya et al., (2011), reported that, the leaf powder of wild lemon Afracgle paniculata effectively reduced oviposition and drastically controlled the developmental stages of bruchid species in stored groundnut. The report also shows that, the African rock fig, Ficus congensis Engl. Leaf extract powder significantly reduces egg laying and larval development of the bruchid. There was also more than 50% mortality recorded Oaya, et al., 2011 and Oaya and Samaila, 2013).

This study therefore, examines the effect or the impact the Wild lemon, Afracgle paniculata and the African rock fig (Ficus congensis Engl.) exhibits on Carvedon serratus Olivier that may be present in stored groundnut in Kaltungo – Gombe State.

2. MATERIALS AND METHODS

2.1 Insect culture

The insects used for the establishment of colony of Carvedon serratus came from a batch of infested groundnut nuts purchased at Legal Market in Shongom Local Government Area, Gombe State, Nigeria. Bruchids were reared subsequently by replacement of devourd and infested ground with fresh uninfected groundnut.
in 2-L Kliner jars covered with muslin cloth to allow air circulation. Insect rearing was carried out at an ambient temperature of 29-33°C and relative humidity of 54-56%. One day old adult bruchids were obtained by sifting the stock culture a day before the experiment as executed by Oaya and Samaila (2013).

2.2 Preparation of plant leaf powders

Relatively matured leaves of Wild lemon Afrleagle paniculata and the African Rock Fig Ficus congensis Engl. were sun dried and pulverized to powder using a local mortal and pestil. The leaf powders were kept in transparent polythene bags prepared for use.

2.3 Toxicity Tests

All tests were carried out in a secured store at Kalaring in Kaltungo Local Government Area of Gombe State. Four pairs of freshly emerged adults of Caryedon serratus were introduced into 100 g of clean groundnut of a local cultivar (kampala) to which the plant materials leaf powders and the chemical actellic dust were added in a 100 ml conical flask. The conical flasks were covered with muslin cloth to prevent the escape or the entry of other bruchids. The flasks were manually stirred with a glass rod to ensure uniform coating of nuts. The initial weight of the groundnut was taken and the moisture content of the groundnut was also derived (Kraszewski and Nelson, 1993).

Triplicate samples were prepared for each treatment and the control. The treatments were arranged on the table in the Laboratory at a room temperature of 36-38°C and relative humidity (RH) of 44-46%. The experimental design used was the Completely Randomized Design (CRD). Mean percentage of damaged nuts and undamaged nuts, mean number of eggs laid, mean percentage mortality and weight loss were taken and expressed as percentage. The Formulae

\[
\begin{align*}
\text{% of damaged nuts} &= \frac{\text{Number of damaged nuts}}{\text{Initial number of nuts}} \times 100 \quad (1) \\
\text{% of undamaged nuts} &= \frac{\text{Number of undamaged nuts}}{\text{Initial number of nuts}} \times 100 \quad (2) \\
\text{% Mortality} &= \frac{\text{Number of dead adult bruchids}}{\text{Total No. of bruchids alive and dead}} \times 100 \quad (3) \\
\text{% Weight loss} &= \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100 \quad (4)
\end{align*}
\]

2.4 Statistical Analysis

Data collected were subjected to analysis of variance appropriate to Completely Randomized Design according to Gomez and Gomez (1984). Means were separated using the Student Newman - Keuls (SNK) method of mean separation.

3.0 RESULTS AND DISCUSSION

Table 1, indicated that the highest mean percentage damaged nuts were observed in the control (92.40), followed by plant material powdered leaves, Afrleagle paniculata (23.56), Ficus congensis.
(22.80) and the least was found with the groundnut administered with chemical actellic dust (10.54). On the other hand, groundnut stored with the chemical actellic dust gave the highest mean percentage undamaged (89.46), followed by groundnut stored with the plant material leaf powders, *Afreagle paniculata* (77.20), *Ficus congestis* (77.20), *Afreagle paniculata* (76.44) and the least was observed in the control (7.68). Moreover, chemical means of control (actellic dust) also gave highest mean percentage mortality (96.87), followed by plant material leaf powders, *Afreagle paniculata* (85.50), *Ficus congestis* (83.50) and the least was obtained in the control(16.84) as seen in Table 1 at P ≤ 0.05 using the Student Newman – Keuls (SNK) test for variables.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Mean percentage damaged groundnut</th>
<th>Mean percentage undamaged groundnut</th>
<th>Mean percentage mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Afreagle paniculata</em></td>
<td>23.56&lt;sup&gt;b&lt;/sup&gt;</td>
<td>76.44&lt;sup&gt;b&lt;/sup&gt;</td>
<td>85.50&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Ficus congestis</em></td>
<td>22.80&lt;sup&gt;b&lt;/sup&gt;</td>
<td>77.20&lt;sup&gt;b&lt;/sup&gt;</td>
<td>83.50&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Chemical</td>
<td>10.54&lt;sup&gt;c&lt;/sup&gt;</td>
<td>89.46&lt;sup&gt;a&lt;/sup&gt;</td>
<td>96.87&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Control</td>
<td>92.40&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.60&lt;sup&gt;c&lt;/sup&gt;</td>
<td>16.84&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Mean</td>
<td>37.38</td>
<td>62.62</td>
<td>70.41</td>
</tr>
<tr>
<td>Coefficient of variability</td>
<td>7.58</td>
<td>6.43</td>
<td>5.94</td>
</tr>
<tr>
<td>Standard Error</td>
<td>1.61</td>
<td>0.98</td>
<td>0.87</td>
</tr>
</tbody>
</table>

Means followed by the same letter(s) in the same column are not significantly different at P=0.05 using the Student Newman – Keuls (SNK) method of mean separation.

Table 2, indicated the highest mean number of adults alive and mean number of eggs laid was recorded in the controls (25.80 and 710.00) respectively. This was followed by the plant material leaf powders of *Afreagle paniculata* (9.65 and 268.00), *Ficus congestis* (7.00 and 159.00) and the least was recorded in the groundnut stored with the chemical actellic dust (2.67 and 96.33). Likewise, the mean percentage weight loss was higher in the control (65.00) significantly followed by the plant material powdered leaves *Afreagle paniculata* (21.40), *Ficus congestis* (18.50) and the least was observed in the groundnut nuts stored with the chemical actellic dust at P≤0.05 using the Student Newman – Keuls (SNK) test for variables.
### Table 2: Mean number of adults alive, number of eggs laid and percentage weight loss

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Mean Number of Adults alive</th>
<th>Mean Number of Eggs Laid</th>
<th>Mean Percentage Weight Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afreagie paniculata</td>
<td>9.65&lt;sup&gt;b&lt;/sup&gt;</td>
<td>268.00&lt;sup&gt;b&lt;/sup&gt;</td>
<td>21.40&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Ficus congensis</td>
<td>7.00&lt;sup&gt;b&lt;/sup&gt;</td>
<td>159.00&lt;sup&gt;b&lt;/sup&gt;</td>
<td>18.50&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Chemical</td>
<td>2.67&lt;sup&gt;c&lt;/sup&gt;</td>
<td>96.33&lt;sup&gt;c&lt;/sup&gt;</td>
<td>7.01&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Control</td>
<td>25.85&lt;sup&gt;d&lt;/sup&gt;</td>
<td>710.00&lt;sup&gt;d&lt;/sup&gt;</td>
<td>65.00&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Mean</td>
<td>12.05</td>
<td>258.33</td>
<td>28.03</td>
</tr>
<tr>
<td>Coefficient of variability</td>
<td>8.54</td>
<td>7.80&lt;sup&gt;e&lt;/sup&gt;</td>
<td>5.84</td>
</tr>
<tr>
<td>Standard Error</td>
<td>1.41</td>
<td>0.98</td>
<td>1.09</td>
</tr>
</tbody>
</table>

Mean followed by the same letter (s) in the same column is not significantly different at P=0.05 using the Student Newman – Keuls (SNK) method of mean separation.

A number of studies by Adedire, et al., (2003); Oaya, et al., (2011); Oaya and Samaila, (2013) have demonstrated significant impact on the pesticidal efficacy of the Wild Lemon, Afreagie paniculata and African Rock Fig, Ficus congensis Engl. However, synthetic insecticide (actellic dust) was seen to be the most toxic to the bruchid in all the parameters measured, especially in this study. This is because, chemical control is still the most effective method of insect pests control despite the serious hazard they cause to humans, wildlife and the environment, in addition to the development of resistant insect pests strains (Daglish, et al., (1993). Oaya and Samaila (2013); Oaya, et al., (2011); reported that, chemicals have oviposition deterrence which inactivates the insect pests by their toxic effects leading to mortality prior to oviposition and also prevents egg and larval development.

Meanwhile, the Wild Lemon, Afreagie paniculata and the African Rock Fig, Ficus congensis Engl. gave significant control of the groundnut bruchid, Caryedon serratus in store. These plant material leaf powders significantly reduced the egg laying ability and clearly suppressed adult emergence. This agrees with findings by Ofuya and Lale, (2001), Oaya and Samaila, (2013) that, plant material powdered leaves with toxic constituents are effective in suppressing egg laying ability and the observed result could have direct consequences of reduction in egg production or inhibition of egg laying or both. This study has further proved that, the plant materials used are capable of inhibiting egg laying and hatching which agrees with Oaya, et al., (2011) and Oaya and Samaila, (2013), who stated that, the repellent and the pungent odour produced by the plant material powdered leaves inactivates the bruchids. As a result, their ability to bore into the nuts was significantly minimized.

Therefore, the number of eggs laid
and mean percentage damaged was less compared to the control. Also, less weight loss was recorded in plant material powder treated. This reinforces the earlier report by Lale (2002) that, the presence of the protective powder around the stored groundnut reduces the weight loss by 14%.

4.0 CONCLUSION

Even though, a number of studies have addressed the toxicity potential of protectants of plant origin with special focus on the leaf powders of the Wild Lemon (Afreagle paniculata) and the African Rock Fig (Ficus congensis Engl.), this study has consolidated the findings of these plant materials proving that they are promising candidates for developing botanical, biodegradable and ecologically friendly insecticides, which could be used by small holder or subsistence farmers against the groundnut bruchid, Caryedon serratus Olivier on stored groundnut. These plant material leaf powders are therefore recommended for groundnut storage for at least 16 weeks given the perfect state of wholesomeness of the groundnut.

Recommendation

The results obtained from this research work reveals that, the Wild Lemon (Afreagle paniculata) and the African Rock Fig (Ficus congensis Engl.) gave significant control of the groundnut bruchid, Caryedon serratus Olivier on stored groundnut. These plant material leaf powders are therefore recommended for groundnut storage for at least 16 weeks given the perfect state of wholesomeness of the groundnut.
References


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against the Cowpea Seed Bruchid (Callosobruchus maculatus Fab.)


