# COMPARATIVE EFFICACIES OF KANE (*ANOGEISSUS LEIOCARPUS* GUILL AND PERR) AND NEEM (*AZADIRACHTA INDICA* A. JUSS) PLANTS ON THE CONTROL OF COWPEA POD BUG (*CLAVIGRALLA TOMENTOSICOLLIS* STAL.)

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## *Abstract*

Experiments were conducted during the 2014 cropping season in order to determine the comprative efficacies of Kane (*A. leiocarpus*) and Neem (*A.indica*) plants for the control of Cowpea spiny pod bug *Clavigralla tomentosicollis* Stal.) on cowpea. Extracts of fresh leaves stem and root barks of Kane plant were prepared. Similarly, the extracts of seeds, stem barks and leaf of Neem plants were also prepared. The results obtained in 2014 clearly indicated that the efficacies of Kane and Neem leave extracts at 1kg/3L of water were similar and significantly performed better than the untreated control in reducing the population of the *C. tomentosicollis*. The treatments also reduced the damage caused by the insect and increased the yield of cowpea. From the results obtained during the cropping season, it could be concluded that the Kane and Neem plants have a potential of being botanical insecticides that could be used for the control of *C. tomentosicollis.* This suggests that it can be used to substitute or compliment the use of synthetic insecticides which possess potential hazards to the user in particular and the environment in general. The phytochemicals used did not show any phytotoxicity on the cowpea plant.

**Key words:** Kane, Neem, Efficacy, Control, *Clavigralla tomentosicollis*

## INTRODUCTION

Cowpea (*Vigna unguiculata* (L) Walp.) is an important grain legume in the diet of many people in the third world countries as it provides not only high quality protein (25.4%) but also constitutes the cheapest source of dietary protein for low income

sectors of the population ((Stanton, 1966; Rachie, 1985). Besides providing the cheapest source of protein, it is also a good source of carbohydrate (56.8%), calcium, iron, vitamin B and carotene (Oyenuga, 1987). Although cultivated primarily for its edible seeds, direct consumption of cowpea leaves is widespread in Africa (Nelson *et al.*, 1997). In fresh form, the young leaves, immature pods and peas are used as vegetables, while snacks and main meal dishes are prepared from the dried grains (IITA, 2002). Beside its usefulness in human diet, cowpea serves as an important fodder crop in different parts of Africa (Quin, 1997). The haulm containing about 20% protein is highly valued feed and is sold for almost the same price as cowpea grain on dry weight basis (IITA, 1997). In order words, cowpea promotes crop livestock integration, thereby leading to a better nutrient cycling and enhanced income generation (Yusuf and Ahmed,, 2005). All these attributes, coupled with its ability to tolerate drought, shade, and its fast growth habit in warm climates as well as its contribution towards improving soil fertility (Carsky *et al.*, 2002)., have made cowpea to be a very important crop and an essential component of various farming systems in the marginal lands, and drier region of the tropics.

Although cowpea has high grain yield potentials ranging from 1.5 to 3.0 t/ha (Raheja and Hays, 1976; Alghali, 1993), actual yields in the traditional cropping systems in Africa are consistently low as the range is between 50 to 350 kg/ha (Emechebe and Singh, 1997). Tamo *et al.* (2003) reported that the reasons for this yield gap are numerous and direct, but most of the times it involves a combination of limiting factors such as low plant density, shading by cereal crops, biotic (e.g. drought, poor soil fertility) and biotic (e.g. arthropod pests, birds and rodents) factors. However, in most parts of West Africa, insect pests are the most important constraints to cowpea production (Karungi *et al.*, 2000). The major flowering and post-flowering insect pest of cowpea in tropical Africa are the flower bug thrips, *Megalurothrips sjostedti* Tryb., cowpea pod borer *Maruca vitrata* F. and a complex of pod sucking bugs out of which *Clavigralla tomentosicollis* Stal. is the dominant species (Jackai and Doust, 1986). Complete crop failure may occur especially in situation where control measures are not applied.

Much earlier however, valuable recommendations had been made for the control of these insects using insecticides ( Jackai and Doust, 1986; Alghali, 1992)

but these have been adopted only by few farmers (Alghali, 1991). This is because most of the farmers are resource-poor with small holdings, and have little or no access to capital with which to purchase any form of Agricultural input. Some attempts made in the past to reduce insect pest pressure on crops using botanical preparations have only been in favour of storage pest control (Oparaeke, 2005). Few trials conducted so far using plant extracts on arable crops were screen house studies, which may not represent the actual situation on the field, and they were mostly based on the use of sole plant extracts in pest controls (Oparaeke *et al.*, 2003). Thus, it is imperative to determine the response of the plant extracts as sole plant extract and in mixtures in controlling the flowering and post-flowering insect pests of cowpea under field condition. Presently, considerable interest has been focused on the development of more benign strategies for controlling insect pests using plant extracts (Oparaeke *et al.*, 2003 and Rahman *et al.*, 2007).

The aims of the present study was therefore to compare the efficacies Kane and Neem plant extracts on the control of cowpea pod sucking bug, *C. tomentosicollis.*

## MATERIALS AND METHODS

The experiments were carried out at the Teaching and Research Farms of the Abubakar Tafawa Balewa University Bauchi, $10^{0}22^{1}$N, $9^{0}47^{1}$E from 2007 to 2011 cropping seasons. The area is representative of Northern Guinea Savanna Ecological Zone (Kowal and Knabe, 1964). The land was disc harrowed and ridged at inter-row distance of 75 m. Cowpea variety SAMPEA 7 (IAR 48) which is an erect and highly susceptible to post flowering insect pests of cowpea was sown at an intra-row spacing of 25 cm.

### Collection and preparation of Kane extract

Fresh leaves, stem bark and root bark of Kane were collected from Kane trees around the Abubakar Tafawa Balewa University, Bauchi using hoe, cutlass and digger. Each part was transferred separately in a polythene bag and was taken to the laboratory. The collected plant materials were air-dried adequately under the shade and ground to fine powder

An electric weighing balance was used to weigh lots of 500 g, 1000 g and 1500 g of each of the various parts of Kane collected. These were thereafter pounded separately using mortar and pestle. Each of the nine treatments was then soaked in 3 l of water for 24 hours. They were then filtered into plastic buckets using a clean muslin cloth. The contents of each of the plastic buckets were vigorously stirred to give a thorough mixture. The crude aqueous extracts were then ready for spray. The procedure was repeated each week the spray operation was carried out. A knapsack sprayer CP15 (Copper Pegler) was used in all cases to spray the extracts on the cowpea plots. In each of the replicates, one plot was left as untreated control; this was sprayed with water only without the extracts. Ridomil gold (Fungicide) was applied at the rate of 1litre per hectares to control fungal diseases on cowpea.

During the 2011 cropping season, three parts ( Leaves, stem bark and root bark ) of Kane plant (*A. leiocarpus*) each at three concentrations of 500g, 1000g and 1500g per 3 litres of water were screened for the control of these post flowering insect pests of *C. tomentosicollis.* Each of the concentrations was placed in plastic and bucket properly labeled.

**Preparation of Neem extracts**

**Neem Seed extract**

I. Ripe Neem seeds especially those that have naturally fallen from the trees growing around the Abubakar Tafawa Balewa University, Bauchi were collected and prepared as follows:

II. The pulps were removed and the seeds were dried under the shade. The shed-dried neem product was then stored in gummy bags.

III. The required quantity of the seeds was transferred into mortar and the kernels pounded properly to form a paste.

IV. Fifty grammes of ground seeds was soaked in 1litre of water for use in 5 litre sprayer.

V. The paste mixed with water was left overnight.

VI. In the morning, the Neem/water mixture was filtered through a clean piece of fine cloth. This was then diluted in 1:2 ratio and was used to spray the cowpea crops using a knapsack sprayer as recommended by Youdeowei (2004).

**Stem bark extract**

I. One kilogram of neem stem bark was pounded in a mortar with a pestle.

II. The paste was soaked into a bucket containing three litres of water and was allowed to stand for 24 hours.

III. The mixture was vigorously stirred to form a thorough mixture. This was then filtered with 1.5 litres of water using a clean muslin cloth as recommended by Oparaeke (2005).

**Leaf extract**

I. Neem leaves were collected before the trees started to flower.

II. One kilogram of the leaves was pounded and mixed with 100 g of chilly pepper in a mortar.

III. The neem leaves were soaked 1.5 litres of water and allowed to stay overnight.

IV. The mixture was then filtered through a clean piece of fine cloth and 1litre of liquid soap was added to act as adhesive.

V. The filtrate was diluted in 1:2 ratios for spraying directly on cowpea crops.

**Layout**

An area measuring 735 $m^2$ was marked out for the experiment. There were three replications (blocks) and each of the replications consisted of eight plots measuring 3m by 3.75m =18.75 $m^2$. Each of the blocks was separated from the next by a distance of 2m while the distance between each plot was 1m.

**Data collection**

**Insect pests' population**

Insect pests sampling was conducted 24 hours after each spray on weekly basis from 06:30- 08:30 hours.

*C. tomentosicollis* was sampled 24 hours after each spray for four weeks.

*C. tomentosicollis* was sampled by counting the number of the bugs on five stands from

each plot randomly selected. Insects found were counted and recorded.

**Damage assessment**

The damage was assessed based on the following:

- Number of shriveled pods caused by *C. tomentosicollis* per plot

Each of the above parameters was assessed by sampling the number from five stands in each plot randomly at10 WAP.

**Yield assessment**

Harvesting of matured cowpea pods commenced when more than 50% of the pods are fully matured. Subsequent harvestings were also carried out to ensure that the cowpea was fully harvested. Pods harvested from each plot were placed in separate polythene bag, labeled and taken to the laboratory where the pods were weighed and seed weights were measured using Blancauni 2000 (an electric weighing balance). The pods and seed weights were calculated using the following formula recommended by Raheja, (1976)

Seed/pod weight (kg/ha) $= \frac{ax10,000}{bx1000}$

Where a = plot yield in gram (g)

b = Net plot size

**Data analysis**

All the data generated were subjected to the analysis of variance (ANOVA). F-test was used to test for the significances among treatment means while significant treatment means were separated using Student Newman Keuls (SNK) test. (SAS Institute, 1990).

## RESULTS

Results presented in Table 1 show the comparative efficacy of *A. leiocarpus, A. indica* and karate on the populaton control of *C. tomentosicollis* on cowpea in 2014.

At 9, 11 and 13 WAP, there was non-significant difference in *C. tomentosicollis* population between *A. leiocarpus*, *A. indica* and karate treated plots but all the three treatments were significantly better than the untreated control in reducing the population of the insect. However, at 10 WAP, *A. leiocarpus* supported the lowest population of the bug. *A. leiocarpus* treated plots performed significantly better than the synthetic chemical (Karate) treated plots. There was no significant difference in the population of *C. tomentosicollis* between *A. leiocarpus* and *A. indica* treated plots. All the three treatments however, performed significantly better than the untreated plots in the population of the bug (*C. tomentosicollis*) on cowpea. The

efficacy of the plant products was comparable and even better than the synthetic chemical (karate) at 10 WAP in the control of the insect.

Table 1: Comparative efficacy of *A. leiocarpus* and *A. indica* extracts on the population C. *tomentosicollis* on cowpea at Bauchi in 2011.

| | | | | |
|---|---|---|---|---|
| *A. indica*(5g/l) | 3.44[b] | 4.11[b] | 5.11[b] | 4.44[b] |
| *A. leiocarpus*(1kg/3l) | .00[b] | 1.78[c] | 5.11[b] | 4.56[b] |
| karate(1l/ha) | 3.66[b] | 5.33[b] | 4.33[b] | 2.67[b] |
| Untreated (Control) | 9.67[a] | 10 .67[a] | 15 .33[a] | 15.00[a] |
| L S. | *** | *** | *** | *** |
| S.E. (±) | 0.88 | 0.93 | 1.2 | 1.09 |

Means within a subset in the same column followed by same letter(s) are not significantly different at $p \leq 0.001$=*** by Student-Newman-Keuls (SNK) multiple range test. L.S.= Level of significance.

Results presented in Table 2 compare the efficacy of *A. leiocarpus*, *A. indica* and karate treated plots on the damaged caused by *C. otomentosicollis* On cowpea. There was a significant difference ($P<0.001$) in the percentage of aborted flowers, twisted or shriveled pods between the treatments and the untreated control. Among the three treatments, karate had the lowest percentage of aborted flowers (15.67) and twisted or shriveled pods (6.00) followed by *A. leiocarpus* (29.00). *A. indica* treatment had higher percentage of aborted flowers (32.11) and twisted or shriveled pods (12.11) than that of *A. leiocarpus* but the two were not significantly different

Table 2: Comparative efficacies of *A. leiocarpus* and *A. indica* on the damage caused by *C. tomentosicollis* on cowpea at Bauchi in 2014.

| Treatments pods | % of aborted flowers shrivel | % of twisted or |
|---|---|---|
| *A. indica*(5 g/l) | $32.11^{b}$ | $12.11^{b}$ |
| karate(1 l/ha) | $15.67^{c}$ | $6.00^{c}$ |
| Control | $41.33^{a}$ | $16.67^{a}$ |
| L.S. | *** | *** |
| S.E. (±) | 1.76 | 0.88 |

Means within a subset in the same column followed by same letter(s) are not significantly different at p<0.001=*** by Student-Newman-Keuls (SNK) multiple range test. L.S.= Level of significance.

Results in Table 3 shows the result of the comparative efficacies of *A. indica, A. leiocarpus* and karate (Lamdacyhalothrin) on the yield of cowpea in 2011. The result revealed that highest yield was obtained from karate (Lamdacyhalothrin) treated plots (340.93 kg/ha) and it differred significantly with the yields obtained from *A. indica* (206.67 kg/ha) and *A. leiocarpus* (246.67 kg/ha) treated plots. Yields obtained from *A. indica* and *A. leiocarpus* treated plots were not significantly different from each other. All the yields obtained from the two plants extracts and karate treated plots differed significantly with the untreated control (123.37).

Table 3: omparative efficacies of *A. leiocarpus* and *A. indica* on the yield of cowpea AT Bauchi Nigeria in 2014.

| Treatments | Grain yield (Kg/ha) |
|---|---|
| *A. indica* | $206.67^{b}$ |
| *A. leiocarpus* | $246.67^{b}$ |
| karate | $340.93^{a}$ |
| Control | $123.37^{c}$ |
| L.S. | *** |
| S.E. (±) | 24.58 |

Means within a subset in the same column followed by same letter(s) are not significantly different at p<0.001=*** by Student-Newman-Keuls (SNK) multiple range test. L.S.= Level of significance

## DISCUSSION

The results show that both plant extracts (kane and neem) had greater potentiality in suppressing the population of the insects, although they were not as effective as the synthetic insecticide (karate). Several authors had earlier reported on the potentials of neem as biopesticide. Neem contains two major triterpenoids (Azadirachtin and Salannin), which has anti-feedant, repellant and growth regulatory properties (Vietmeyer, 1992). So, the efficacy of neem extracts in mixtures with extracts of other plant species could not be attributed to the potency of the former but due to the complementary or synergistic activities of the latter. These plants extracts could provide a suitable alternative for integrated management of the three post-flowering insect pests of cowpea in smallholder, limited resource farm enterprises commonly found in developing countries such as Nigeria.

All the tested plant extracts had potentials value to substitute synthetic insecticides in pest management, since they were found to be promising in controlling *C. tomentosicollis*). Both extracts of neem and kane were similar in their effectiveness in reducing the percentage of aborted flowers and twisted or shrived pods although; they were not as effective as the karate. Application of the two extracts resulted in increased in yield of cowpea plant when compared with the untreated control. This is in agreement with the findings of Panhar (2002) and Fuglie (1998) who reported that plant extracts applied on cowpea plants increased flower production and yield per plant. Panhar (2002) reported that plant extracts application at flowering and pod formation stages reduced the level of infestation of insect pests and increased the yield of plants. This result indicated the potentials of the two plant products especially *A. leiocarpus* for use to bring about increase in yield of cowpea plant.

## CONCLUSION

From the results obtained during the cropping season, it could be concluded that the kane (*A. leiocarpus*) and Neem plants have potentials of being botanical insecticides that could be used for the control *C. tomentosicollis* on cowpea. The efficacy of the kane plant was comparable with that of Neem plant that has been

used widely for the control of insect pests of various crops. Therefore, the plant extracts can easily be used to substitute the synthetic insecticides, which are less desirable in present day Agriculture. The biodegradable properties of these plant materials will also reduce any potential hazard to the farmer in particular and the environment in general.

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