Journal of Agriculture and Environment Vol. 15 No. 1, 2019: 119-125
ISSN: 1595-465X (Print) 2695-236X (Online)

EVALUATION OF SOME BOTANICALS ON *Clavigralla tomentosicollis* (SLAN) ATTACKING COWPEA (*Vigna unguiculata* [L.] WALP) IN SAMARU ZARIA, NIGERIA

U. Malik[1], A.I. Sadiq[1], A.Y. Mahmoud[2] and A.I. Ahmed[1]

[1]Department of Pest Management Technology, Ahmadu Bello University Zaria
[2]Chemistry Department, Ahmadu Bello University Zaria

ABSTRACT

Field experiment was carried out at Agricultural Engineering Department, Ahmadu Bello University, Samaru Zaria, Nigeria, Latitude 10° 1436N to compare three different biopesticides, Ginger rhizome (*Zingibe officinale*), Neem leaves (*Azadirachta indica*), Garlic bulb (*Allium sativa*) against *Clavigralla tomentosicollis* on Cowpea (*Vigna unguiculata* [L.] Walp.) at flowering stage. The experimental design was Randomized Complete Block Design (RCBD) with four (4) treatments, Neem leaf, Garlic Bulb, Ginger rhizome and Control (untreated). Neem leaf, Garlic Bulb, and Ginger rhizome were air dried at room temperature of (25°C), pound into powder form. 15 g of neem leaf, Garlic Bulb, ginger rhizome was soaked into 1 litre of water overnight prior to the application in the field, Muslim cloth was used to squeeze and to prevent foreign particles into the aqueous solution of neem leaves, ginger rhizome and garlic bulb. Insitu assessment was used to count the number of *Clavigralla tomentosicollis* per plant. Data were subjected to Analysis of Variance (ANOVA) and means were separated by LSD. The efficacy of neem leaf extract on mean population of *Clavigralla tomentosicollis* is highly significant as compared to ginger rhizome and Garlic Bulb. Neem leaf extract at 15g act as better alternative than ginger rhizome and garlic bulb on the control of *Clavigralla tomentosicollis* on cowpea, due to its environmental friendliness and non-hazardous nature to human health.

Keywords: Biopesticides; garlic bulb; ginger rhizome; insect; pest; cowpea

INTRODUCTION

Cowpea (*Vigna unguiculata* [L.] Walp.) is a leguminous crop, an indigenous African crop which originated from northern Nigeria and northern Cameroon (Prota, 2006). It is the most important grain legume of the world (Perrino, 1993). Cowpea is known as vegetable crop due to high amount of protein in the grain with better biological value on dry weight basis (Owolabi*et al.*, 2012). Cowpea grain, depending on varieties, for instance, IAR 48 (SAMPEA 7), SAMPEA 11 contains 26.6% protein, 3.99% lipid, 56.24% carbohydrate, 8.60% moisture, 3.84% ash, 1.38% crude fibre, 1.51% gross energy and 54.85% nitrogen free extract (Owolabi*et al.*, 2012). More than 11 million hectares are cultivated worldwide,

97% of which is in Africa, Nigeria alone cultivates 4.5 million hectares annually representing over 60% of total production (FAO STAT, 2011). The major areas of production in central and West Africa, which account for about 89% of the total area of world production, are Nigeria, Niger, Mali, Burkina Faso, Senegal, Cameroon and Democratic Republic of Congo (FAO, 2008). Modest amounts also emanate from Mozambique, Tanzania, Uganda, Sudan, Kenya and Somalia. Other producers are Myanmar, Haiti, Serbia, Sri Lanka and Egypt (FAO, 2008). The main producing areas in Nigeria are within the Guinea and Sudan Savannas (Mongo, 1996). However, some appreciable quantities are grown in the rain forest, particularly in the south west, which has two (2) growing seasons, namely early (March – July) and late (August – November) (Ebong, 1965). The major producing states in Nigeria include: Kaduna, Katsina, Zamfara, Bauchi, Sokoto, Kebbi, Plateau, Borno, Yobe, Jigawa, Niger, Benue, Nasarawa and Kano states, where most cowpea are traditionally grown as intercrops with cereals such as millet, maize, rice, sorghum (Chemeda, 1997). The grain yield of cowpea in Nigeria is 700 kg/ha (FAO STAT, 2011). Cowpea provides plant protein for human and animals (Dike *et al.*, 2002). It serves as a raw material for industries (Onwueme *et al.*, 1991). It has ability to fix atmospheric Nitrogen through its root noddle and grow well in poor soil (Blade, 1997). It is shade tolerant and compatible with intercrops such as maize, millet, sorghum and sugarcane (Blade, 1997). The leaves of cowpea have the highest percentage of calories from protein among vegetable crops (Shew and Monica, 2007). Another importance of cowpea is provision of income for small holding farmers (Fatokun, 2002). With all the importance of sole crops in Nigeria, cowpea has limiting factors in production due to insect pests and diseases. The feeding activities of insect pests have caused a great loss or damages to cowpea production. Some of these notorious insect pests which affect cowpea are leaf miners, white flies (*Bemisia tabacci*), leafhoppers (*empoasca sp.*) mites (*tetranychus sp.*), thrips (*Megalurothrips sjostedtistal*), Oothaca sp., maruca sp., and aphids (*Aphis craccivora*), grasshopper *(Zenocerus verigatus).* Out of which *Clavigralla tomentosicollis* is the dominant specie which affect the cowpea yield loss (Olabode, 2011). Other species of *Clavigralla* are as follows: *Clavigralla aculeata* , *Clavigralla alpica* (Bergroth, 1927), *Clavigralla andersoni*, *Clavigralla angolensis* , *Clavigralla annectans*, *Clavigralla annulipes* (Signoret, 1860), *Clavigralla asterix* Dolling, 1979*Clavigrallatuberculicollis* (Reuter, 1887), *Clavigralla uelensis* (Schouteden 1938), *Clavigralla wittei* (Schouteden, 1938), *Clavigralla zambiae* (Dolling, 1979), *Clavigralla tomentosicollis* (Stål, 1855).

The infestation of cowpea by these pests has caused a lot of damages to cowpea production, if this continues the resultant effect may lead to high economic lost on yield of cowpea and this may have a negative effect on majority of population in Nigeria. Some trials had been conducted to curb the activities of these pests, on cowpea, such trials includes breeding resistance varieties, cultural management practices, the use of natural plant materials against these pests on cowpea, some scholars also advocated the use of chemical or synthetic insecticides because of their broad spectrum and quick action, but they leave residues in the cowpea seeds. The only option left to manage the population of *Clavigralla tomentosicollis* is possibly the use of some botanical insecticides which are environmentally friendly to both farmers and consumers. Hence, this study focuses on the evaluation of the insecticidal efficacy of some botanicals on *Clavigralla tomentosicollis* a pest of cowpea.

MATERIALS AND METHODS

Study Area

Field trials were conducted at Department of Agricultural Engineering, Samaru College of Agriculture, Division of Agricultural Colleges, Ahmadu Bello University, Samaru Zaria, Nigeria, Latitude 10^{o} 1436N (IAR, 2012), with mean annual rainfall between 1,150 to 1,350 mm and a mean temperature of 25.32 ^{o}C in the dry harmattan and harvest period (November – December). The soil types at Samaru is clay-loam with organic matter content less than 0.02 % and sandy loam at were the colour of the top soil varies from a slight-brown to dark-brown and the pH range from 6.5 – 8.5 (IAR, 2012).

Experimental Design and Field Trial

The trial comprised four treatments. they are ginger rhizome extract, garlic bulb extract, neem extract and untreated (control). The treatments were laid in a Randomized Complete Block Design (RCBD) with six replicates giving a total of 24 plots. The size of the plots was 3m x 4m.

Kanannado cowpea (SAMPEA 11) weight was measured before sowing and was exactly 0.5kg using electric weighing balance. The cowpea was sown on the 1st August, 2016. Each ridge had four (4) stands, while each plot had 12 stands, while each block had 72 stands and the total cowpea stands in all the experimental plot were 288.

Extraction of Plant Materials

Ginger rhizome, neem leaves and garlic bulb were air dried at room temperature of (25 ^{o}C) for two weeks, crushed with pestle and mortar and pounded into a powdery form. Muslim cloth (sieve) was used to separate the fine powder from the chaff, furthermore, 15g of each extraction materials were measured using the electric weighing balance (Sartorius 2355 160g maximum) (ginger, garlic bulb and neem extract), with this, 15g of each was separately poured into labelled kegs containing one litre of water and kept overnight. Then after each of the content in each were thoroughly squeezed inside Muslim cloth to separate metabolite ready for field application.

Application of Treatment

Fifteen grams of ginger rhizome, neem leaves, garlic bulb extract were measured separately and poured into a 16 litre capacity jacto sprayer and then 3 litres of water was added into the same sprayer and then mounted at back for treatment. The plots were already labelled for spray. The spray was done 4 times fortnightly.

Insect Count

The method of whole plant count by insitu was used to count the population. In each plot, a one outer rows from each side was discarded. The observation was carried out early in the morning at zigzag pattern and observed for presence of *Clavigralla tomentosicollis.* This selection was done at different angle of the plot after getting rid of discard rows from

each side (Green, *et al.,* 2013). The mean number of *Clavigralla tomentosicollis* was calculated per plant and average was computed by summing the number of *Clavigralla tomentosicollis* on each plant and dividing it by the number of plants in each plot. On-spot Visual count was adopted as outlined by (Nattowick *et al.,* 2005).

Yield Assessment

The harvest was done progressively when the cowpea pod dried, it was harvested according to the plot and the harvested cowpea pods were put into polythene bag for laboratory assessment. The weight of the cowpea pods in the polythene bag was recorded according to the treatment and, the mean weight computed which was later subjected to statistical analysis.

Data Analysis

The mean population of insects were subjected to analysis of variance (ANOVA) at 5% level of significance.

RESULTS

Effect of ginger rhizome, neem leaves, garlic bulb extract on mean population of *Clavigralla tomentosicollis* on cowpea at Samaru during the 2016 wet season. The results of the trial conducted to evaluate the different botanicals on *Clavigralla tomentosicollis* on cowpea are presented in tables 1-4. The result showed that there were significantly higher *Clavigralla tomentosicollis* populations on cowpea of the untreated plots than those of the treated plots. At two weeks after treatment there was significant difference among the three aqueous extract of botanicals in which neem extract recorded the lowest number of insect count.

Table 1: Effect of ginger rhizome extract, neem leaves extract, garlic bulb extract on population of *Clavigralla tomentosicollis* on Cowpea during the 2016 wet season at 2 weeks before and after spray

Treatments	Insect Count Before Spray (ICBS) at 2weeks	Insect Count After Spray (ICAS) at 2weeks
Control	136.700[a]	175.700[a]
Garlic Bulb	135.000[a]	118.00[b]
Ginger rhizome	127.700[b]	73.300[c]
Neem leaves	107.700[c]	53.00[d]
LSD	2.867	2.7016

ICBS=Insect count before spray, ICAS=Insect count after spray, LSD=Least Significant Difference

Table 2: Effect of ginger rhizome extract, neem leaves extract, garlic bulb extract on population of *Clavigralla tomentosicollis* on Cowpea during the 2016 wet season at 4 weeks before and after spray

Treatments	Insect Count Before Spray (ICBS) at 4weeks	Insect Count After Spray (ICAS) at 4weeks
Control	175.700[a]	197.000[a]
Garlic Bulb	118.000[b]	86.300[b]
Ginger rhizome	73.300[c]	70.300[c]
Neem	53.00[d]	65.300[d]
LSD	2.1587	2.2771

ICBS=Insect count before spray, ICAS=Insect count after spray, LSD=Least Significant Difference

Table 3: Effect of ginger rhizome extract, neem leaves extract, garlic bulb extract on population of *Clavigralla tomentosicollis* on Cowpea during the 2016 wet season at 6 weeks before and after spray

Treatments	Insect Count Before Spray (ICBS) at 6weeks	Insect Count After Spray (ICAS) at 6weeks
Control	180.000[a]	207.0000[a]
Garlic Bulb	28.300[b]	0.0000[b]
Ginger rhizome	21.000[c]	0.0000[b]
Neem	12.000[d]	0.0000[b]
LSD	1.475	0.7256

ICBS=Insect count before spray, ICAS=Insect count after spray, LSD=Least Significant Difference

Table 4: Effect of ginger rhizome extract, neem leaves extract, garlic bulb extract on population of *Clavigralla tomentosicollis* on Cowpea during the 2016 wet season at 8 weeks before and after spray

Treatments	Insect Count Before Spray (ICBS) at 8weeks	Insect Count After Spray (ICAS) at 8weeks
Control	205.3000[a]	205.00[a]
Garlic Bulb	0.0000[b]	22.50[b]
Ginger rhizome	0.0000[b]	0.00[c]
Neem	0.0000[b]	0.00[c]
LSD	33.212	29.046

ICBS=Insect count before spray, ICAS=Insect count after spray, LSD=Least Significant Difference

Table 5: Effect of treatments on cowpea yield

Treatments	Yield
Control	0.51[c]
Garlic Bulb	1.48[b]
Ginger rhizome	1.52[b]
Neem leafs extract	2.02[a]
LSD	<0.0001

LSD=Least Significant Difference.

DISCUSSION

Table 1 to 5 shows the effect of three aqueous plant extracts (neem leaves extract, ginger rhizome and garlic bulb extract) on population of *Clavigralla tomentosicollis* on Cowpea from the 15th October to 30th November, 2016) and Cowpea Yield. The results showed that neem leaves extract, ginger rhizome and garlic bulb extract possessed insecticidal property which is effective on the control of *Clavigralla tomentosicollis* (slan) on cowpea.

The highest yield was recorded by neem leaf extract (2.02kg/ha), followed by ginger rhizome (1.52kg/ha), then garlic bulb with (1.48kg/ha), and finally the control recorded the lowest yield 0.51kg, which gives a clear indication that all the botanicals used in this study have the insecticidal property effective enough to manage the insect pest under study.

The aqueous neem leaves extract was found to be the most effective in reducing the population of *C. tomentosicollis* due to its lowest insect count and also the recorded yield was significantly higher than that recorded by cowpea treated with either garlic bulb or Ginger rhizome extracts. Also, the controlling of the cowpea storage pests with neem powder was reported by Ivbijaro (1983). Jackai 1993, reported the control of grasshoppers in Northern Nigeria, using the aqueous solution of *Azadirachta inidca*. Furthermore, the use of neem products as insecticides is a common practice in Nigeria and some other countries (Jackai, 1993).

The lowest yields were recorded by the control plots. These values again give support to the finding of Afun *et al*. (1991). The untreated plots recorded poor performance in most of the yield related components. This is probably because the cowpeas plants in these plots were exposed to severe insect pest infestation and the subsequent yield loss during the period.

CONCLUSION

The results from the present study has shown that Neem leaves extract at 15g mixed with 3 litres of water is a potential insecticide against *C. tomentosicollis* on cowpea, since the efficacy and the concentrations were conducted under field condition. This therefore recommended to growers of cowpea where C. *tomentosicollis* constitutes a serious pest problem.

REFERENCES

Afun, J.V.K., L.E.N. Jackai and Hodgson, C.J. (1991). Calendar and monitored insecticide against cowpea aphids and their deleterious effect on predating coccinelidae. *Journal of Applied Entomology*, 125(9-10): 571-575. application for the control of cowpea pests. Crop Protection, 10: 363-370.

Blade, S. F., Shetty, S. R. R., Terao, and Singh, B. B. (1997). Recent developments in cowpea cropping systems research. *In*: Singh, B.B., Mohan Raj, D. R., Dashiell, K. E. and Jackai, L. E. N. (Eds.) *Advances in Cowpea Research.* International Institute of Tropical Agriculture and Japan International Research Center for Agricultural Sciences.

CABI. Crop Protection Compendium (2000). *Global Module,* 2nd edition CABI publishing, Wallingford, UK. 76pp.

Chemeda, F. (1997). Effects of Planting Pattern, relative planting date and intra-row spacing on a haricots bean\maize intercrop. *African Crop Science Journal,* 5(1) 15 – 22.

Dike, M.C., Oparaeke, A.M. and Muhammadu, N.J (2002). Integrated pest management of major insect pests of cowpea. *Nigerian Journal of Plant Protection* 20:87-92.

Nattowick, E. T., Garrett, J. H. Haward (2005). Farm supply, grass valley, C. A. Azman Frinchen and Mishra.

Ebong, U. U. (1965). Cowpea Production in Nigeria *Memorandum* No. 8, pp. 9. Federal Department of Agricultural Research, Ibadan.

Fatokun, C. A., Tarawali, S. A., Singh, B. B., Kormawa, P. M. &Tamo, M. (Eds.) (2002). Challenges and Opportunities for enhancing sustainable Cowpea production. *International Institute of Tropical Agriculture*.

Food and Agricultural Organization (FAO) (2000). Protection of stored bean seeds against *Callosobruchusmaculatus* (F.) (*Coleoptera:Bruchidae*). Edited by Van Rhecnen. H. A., Pere, W. M. and Magoya J. K. p. 23.

Food and Agricultural Organization (FAO) (2008). Agricultural Production Status Worldwide. http//www.icrisat.org/faosat accessed July, 2012.

Food and Agricultural Organization (FAO). STAT (2011). Bulletin of Tropical Legumes. http//www.icrisat.org/faosat accessed September, 2012.

Green, Sujay P., B. Singh (2013). Effect of botanical chemicals and bio-insecticides for the management of thrips in onion. *Indian Journal of Agricultural Research.*

Ivbijaro, M.E. (1983). Preservation of cowpea, Vigna unguiculata (L.) Walp, with the neem seed,

Jackai, L.E.N. (1993). The use of neem in controlling cowpea pests. IITA Research, 7: 511.

Mongo, C.M. (1996). Biology and Epidemiology of *Sphaceloma*sp. The pathogen of cowpea scab. Department of Crop Protection, Ahmadu Bello University, Zaria. *Ph.D Thesis.*(unpublished) 86p.

Olabode, O. S., Adeshina, G. O. and Olapeju, T. R. (2011) A Survey of agricultural chemicals available to farmers in South Western Nigeria, *International Journal of Agricultural Economic and Rural Development*, 4(1).

Onwueme I. C. and Sinha T. D. (1991). Field Crop Production in Tropical Africa. Michael Health Ltd. England, 479 pages.

Owolabi, A. O., Ndidi, U. S., James, B. D., Amune, F. A. (2012). Proximate, antinutrient and mineral composition of five varieties (improved and local) of cowpea (*Vigna unguiculata*), commonly consumed in Samaru community, Zaria – Nigeira. *Asian Journal of Food Science and Technology* 4(2):70 – 72.

Perrino, P., G.Laghetti, P. L. Sagnoletti.Zeuli and L. M. Monti, (1993).Diversification of Cowpea in the Mediterranean and other centres of cultivation. *Genetic Resources and Crop Evaluation*, (40)3: 121 – 132.

PROTA (2006). Plant Resources of of Tropical Africa 1: Cereals and Pulses. Editors: M. Brinks and G. Belay, 2006. pp. 213 – 218.

Shew, Monica (2007). 100 most protein Rich Vegetarian Foods. Smarter Fitter Blog. Retrieved 2008-04-06.