JOURNAL OF BIOPESTICIDES AND AGRICULTURE
2465-7115 (Online); 2465-7123 (Print)
http://www.biopjournal.com

EVALUATION OF PLANT EXTRACTS FOR THE CONTROL OF *Maruca vitrata* Fab. and *Clavigralla tomentosicollis* Stal ON COWPEA AT SAMARU KATAF, KADUNA STATE

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ABSTRACT

Field trial was conducted during 2016 cropping season at Samaru Kataf to evaluate the insecticidal potentials of two plant leaf extracts *Carica papaya* (pawpaw) and *Azadiracta indica* (neem) and Synthetic insecticide (Cypermethrin) against *Maruca vitrata* and *Clavigralla tomentosicollis*. The experiment was laid out in Randomized Complete Block Design with three replications. Four spray applications of cowpea at flower bud initiation stage, (50 % flowering, 50% podding and full podding) of *Carica papaya* and *Azadiracta indica* leaf extracts at 10, 20 and 30 % were used, respectively. Observations were taken on mean insect pest population mortality, number of pods damaged, grain yield and grain weight damaged by *Maruca* and *Clavigralla,* respectively. The result showed that neem *Azadiracta indica* leaf extract at 20 %, 30 % and Cypermethrin significantly ($p \leq 0.05$) reduced the infestation of the insect population and pods damaged. Grain weight was significantly higher ($p \leq 0.05$) in both experimental units treated to plant extracts and synthetic insecticide when compared with untreated control plots. Application of leaf extracts irrespective of concentration significantly suppressed insect pest populations compared with untreated control. Cypermethrin insecticide gave the overall best result which was comparative to neem extracts. Farmer could therefore adopt neem leaf extracts as alternative to synthetic insecticides for optimum cowpea production in study area.

Key words: *Maruca vitrata*, *Clavigralla tomentosicollis*, Cypermethrin , *Azadiracta indica*.

1. INTRODUCTION

Cowpea (*Vigna unguiculata* (L.) Walp) is an important grain legume in the tropics and subtropics. Cowpea can be regarded as vegetable meat due to the high amount (20-30 %) of protein in the grain. The percentage nutritional value of cowpea indicated its protein content to be 23%, fats 1.3%, fibre 1.8%, carbohydrate, 67% and water 8 – 9% (Owolabi *et al*., 2005).

Insects attack cowpea and cause economic damage at all stages of plant growth from seedlings to harvest and in storage (Amatobi *et al.,* 2005). Some of the major insect pests of cowpea in the tropics are aphids, *Aphis craccivora* Koch, foliage beetle, *Ootheca mutabilis*, the flower bud thrips, *Megaurothrips sjostedti* Trybom, the legume pod borer, *Maruca vitrata* Fab and sucking bug complex e.g. *Clavigralla spp, Nezeera viridula,* (Amatobi *et al.,* 2005). Yield losses associated with these pests have been reported in many parts of Africa where cowpea is grown in large scale. *M. vitrata* on the other hand, damage flower buds, flowers and developing pods. They also web inflorescences and the pods are malformed because of webbing. The caterpillars remain in the webbed mass and also feed upon the flowers and developing pods causing yield losses of 20–80% (Singh 2005).

Similarly, a loss from infestation by, *Clavigralla tomentosicollis* ranges from 70 - 100 % (Dabire-Binso, *et al*., 2007). Several control measures in Nigeria have been advocated such as the use of synthetic insecticides, biological controls, physical control and host plant resistance by many researchers to tackle post-flowering insect pests in cowpea production (Sharah and Ali, 2008). Results show that insecticides are the most effective control measure against these pests and majority of the farmers rely heavily on the use of synthetic insecticides in the management of their cowpea pests. Unfortunately, most farmers in the tropics are resource-poor and cannot afford the use of synthetic pesticides. Synthetic insecticides are costly, toxic to humans and when used inappropriately may be harmful to the environment humans and other non-target organism (Sharah and Ali 2008). Hence the need for alternative controls measures that will

minimize the use of synthetic insecticides for the management of cowpea pests. The use of some plant extracts are promising alternative control measures to synthetic chemicals (Oparaeke, 2007).

However, most findings on this aspect of crop protection were focused on stored pests control (Oparaeke, 2006). There is paucity of information on field application of extracts from plant sources for pests control on cowpeas. The study therefore aims to evaluate the effect of Neem (*Azadiracta indica*) and Pawpaw (*Carica papaya*) aqueous extracts for the management of cowpea flowering and post flowering insect pests in Samaru Kataf Area of Kaduna State.

2. MATERIALS AND METHODS

2.1 Research site

Field experiments were conducted at the School of Agricultural Technology Research Farm, Samaru Kataf Campus during 2016 cropping season. SAMPEA 7 (IAR- 48) variety obtained from Institute for Agricultural Research, Samaru Zaria was used. Fresh and clean leaves of neem and pawpaw were obtained from the School of Agricultural Technology, Research Farm, Samaru Kataf Campus.

2.2 Preparation of extracts

The leaves of each test plant were pounded separately into paste. Five hundred grams (500g) paste of each plant leaves were weighed and added to a 100 mls of sterile clean hot water in a 500 mls conical flask and mixed properly using a glass sterile. The mixture was allowed to stand for 24 hours before sieving through a sterile clean muslin cloth. Liquid soap at 0.1 % was added to the filtrate as emulsifier.

2.3 Experimental Layout

The fields were laid out in randomized complete block design consisting of eight treatments- two plant extracts Neem (*Azadiracta indica*) and Pawpaw (*Carica papaya*) at 10 %, 20 %, and 30 %, respectively, synthetic insecticide (Cypermethrin) and untreated control, replicated three times. Each plot measured 4.0 x 4.0 m. Seeds were sown at 3 seeds per stand at 2 – 3 cm depth within intra row spacing of 25 cm and inter row spacing of 75 cm apart. The cowpea seedlings were later thinned to two plants per stand at two weeks after sowing. Single super phosphate fertilizer was applied prior to planting at the rate of 175 kg ha^{-1} to boost the growth and proper root development. Manual weeding was done at 3 weeks interval after planting to ensure weed free set-up.

2.4 Effects of plant extracts on the test insects

The extracts were applied at 10 %, 20 % and 30 % concentration at weekly intervals using hand pump sprayer at the rate of 200l/ha beginning from flower bud initiation, 50 % flowering 50 % podding and full podding. Cypermethrin was applied twice, at flower bud initiation (36 days after planting) and at 50% flowering (46 days after planting at the rate of 1. 5 kg a. i/ha as standard check, while the control plots were sprayed with water.

Observations on the incidences of insect pests were recorded on five plant stands in the middle rows of each plot. The target insect pests were *M. vitrata* and *C. tomentosicollis*. The incidences of *M. vitrata* and *C. tomentosicollis* were assessed weekly from flower bud initiation to pod maturity stage. At each sampling period, the population of *M. vitrata* was counted by randomly picking 20 flowers and placing them in glass vials containing 30% ethanol solution and counted in the laboratory. Pod damage (shriveling, twisting, stunting, constriction) was assessed by examining 20 pods randomly selected from plants per plot. At harvest, data were collected on total grain yield from the tagged plants. Estimates of grain yield per unit area were done when the grains were dry using the tagged plants. The pods were threshed and winnowed. The results were extrapolated to kilogram per hectare. All data were analyzed using SAS 2003 and mean separation was carried out using the Student Newman's Keuls ($P \leq 0.05$) test.

3. RESULTS AND DISCUSSION

The use of plants, plant materials or crude plant extracts for the protection of crops and stored products from insect pests have been recorded as one of the oldest crop protection methods (Thacker, 2002). The findings of this study are supported by those of Dzemo *et al.* (2010), who reported that aqueous plant extracts significantly reduced the infestation of pod borers and pod sucking bugs (PSBs) on cowpea

thereby reducing pod and grain damage and increasing grain yield.

Effect of plant extract on mean number of *M. vitrata* is shown on table 1. The result showed that there were significant differences ($p \leq 0.05$) on the mean number of *M. vitrata* at the first weeks after spray. However, higher number of *M. vitrata* larvae was recorded from plots sprayed with water compared to synthetic insecticide but no significant difference was recorded among the plant extracts. On the other hand, no significant difference was observed at 2, 3, and 4 weeks after sprayed among the plant extracts and between the plants extracts and synthetic insecticide. Olaitan and Abiodun (2011) reported that effectiveness of plant extract depends on the level of extract concentration. Application of extracts at 20 and 30% were more effective, this likely because the response of insect to different level of concentration can be associated with the ability of each concentration to withstand photo – decomposition of the extracts.

Table 2 shows the effect of plant extracts on the mean number of *C. tomentosicollis* on cowpea. Plots sprayed with water had higher ($p \leq 0.05$) number of *C. tomentosicollis* compared to plots sprayed with synthetic insecticides and plant extracts except that at car 30% had the same number of *C. tomentosicollis* as synthetic insecticide at 4th week after spray. Both the synthetic and biopesticides (extracts) have been reported to have controlled insect infestation and increase the yield of cowpea to reasonable levels (Olaitan and Abiodun, 2011).

The present study indicates the effectiveness of plant extracts at different concentrations 10, 20 and 30%. However application of neem extracts at 20 and 30% and *Carica papaya* at 30% proved to be more effective against the two observed insect pests when compared with other concentrations, but the efficacy was low compared with synthetic insecticide. This is in line with the report of Olaitan and Abiodun (2011) who stated that synthetic insecticides are more effective than botanicals insecticide when both were applied under field conditions. The synthetic insecticide (Cypermethrin) and neem leaf extract had the least number of pod damaged by *maruca* compared with other extracts. At 3rd week after spraying plots sprayed with water and *Carica papaya* at 10%, 20% had higher pods damaged by *C. tomentosicollis* compared with other plant extracts and the test synthetic insecticide (Table 3 & 4).

The impressive performance of the test plant extracts could be attributed to insecticidal properties they contain that are lethal to a wide range of insects including thrips and *maruca* (Oparaeke, 2007). Similarly, the significant reduction in the incidences of these pests observed with neem extract may be attributed to the high level of secondary metabolites that produced the enhanced insecticidal efficacy when compared to *Carica papaya* plant extracts. However, in another experiment, Oparaeke (2004) found that the stem bark extracts of *A. indica* and *E. citriodora* were effective against some cowpea pests.

Table 5 shows the effect of plant extracts on weight of damaged grains by test insects, weight of undamaged grains and grains yield. The result of this study shows that the test synthetic insecticide, neem leaves extracts at 20%, 30% and papaya at 30% had least weight of damaged grain compared to untreated plots and other extract concentrations. Grain weight was high in all the plots treated with synthetic insecticide and plant leaf extracts at levels beyond 10%. There were significant yield increases in experimental units treated to the test chemical and plant extracts when compared with untreated plots. This corroborates the work of Panhwar (2002) who reported that plant extracts applied on cowpea plants protect them from insects and resulted in yield increases. The pest reduction efficacy by some plant extracts leadinf to yield increases in cowpea have also been reported in separate trials by Jackai *et al.* (1992) and Oparaeke (2005).

Pod borers and Pod – sucking Insect pests like *Maruca vitrata, Clavigralla spp, Anoplocnemics sp, Riptortus sp, Mirperus sp Neizara sp* and other post flowering pests of the reproductive structures of cowpea with early feeding leading to flower abortion, pod shriveling and seed damage are important and hence poor grain yield observed when not managed (Dzemo *et al.*, 2010). Panhwar (2002) also reported that good aqueous solution of neem, garlic and ginger will effectively control

worms, beetles and thrips in cowpea. Plant extracts have been reported to possess toxic organic compounds that are effective in reducing insect pest populations including pod borer (Ogah, 2013). The ability of the test plant extracts to protect cowpea from severe insect attack is probably anchored on their antifeedant and repellent properties.

4. CONCLUSION

The experiment showed that though the application of these bio-pesticides did not eradicate the target insect pests completely, all the tested plant extracts were effective against the major flowering and post flowering insect pests of cowpea resulting in reasonable grain yield. The study also showed that neem and *Carica papaya* at 30% have the potentials to serve as effective alternatives synthetic insecticides in the management of insect pests of cowpea.

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Table 1**:** Effect of plant extracts on the mean number of *M. vitrata* after weekly sprays

Treatments	Varying concentrations of extracts sprayed in Weeks			
	1	2	3	4
Car 10%	2.000ab	2.000	1.000	1.250
Car 20%	1.500ab	1.250	1.500	1.000
Car 30%	1.500ab	1.250	1.000	3.500
Neem 10%	1.500ab	1.250	2.000	1.250
Neem20%	2.500ab	1.250	1.000	1.000
Neem 30%	2.500ab	1.500	1.250	1.000
Cypermethin	1.000b	1.75	1.000	1.500
Water	3.000a	2.500	2.000	2.000
Means	1.938	1.594	1.344	1.563
SE±	0.52	0.322	0.175	0.631

Means within the same column followed by different letter(s) are significantly different at P≤0.05 of Student Newman's Keuls (SNK) test.

Table 2: Effect of plant extracts on the mean number of *C. tomentosicollis* after weekly sprayed

Treatments	Varying concentrations of extracts sprayed in Weeks			
	1	2	3	4
Car 10%	4.750b	4.500b	4.250ab	3.250ab
Car 20%	4.250b	4.250b	3.000ab	2.500ab
Car 30%	3.250b	2.500b	2.000b	1.750ab
Neem 10%	4.250b	3.750b	3.250ab	2.500ab
Neem20%	3.500b	2.750b	2.500ab	2.00ab
Neem 30%	3.000b	2.500b	2.500ab	1.750ab
Cypermethin	3.000b	2.000b	1.500b	1.000b
Water	9.000a	9.000a	6.500a	4.000a
Means	4.375	3.963	3.188	2.347
SE±	0.849	0.712	0.646	0.359

Means within the same column followed by different letter(s) are significantly different at P≤0.05 of Student Newman's Keuls (SNK) test.

Table 3: Effect of plant extracts on the number of pods damaged by *M. vitrata* after weekly sprayed

Treatments	Varying concentrations of extracts sprayed in Weeks			
	1	2	3	4
Car 10%	5.750	3.500ab	3.000	1.750ab
Car 20%	3.500	2.750ab	2.500	2.250ab
Car 30%	3.750	3.000ab	2.000	1.750ab
Neem 10%	4.250	3.250ab	2.750	2.250ab
Neem20%	4.500	3.250ab	2.250	1.750ab
Neem 30%	3.000	2.500ab	2.000	1.250b
Cypermethin	1.500	1.500ab	1.250	1.250b
Water	6.250	4.750a	4.250	4.750a
Means	4.063	3.063	2.500	2.125
SE±	0.912	0.418	0.525	0.483

Means within the same column followed by different letter(s) are significantly different at P≤0.05 of Student Newman's Keuls (SNK) test.

Table 4: Effect of plant extracts on the number of pods damaged by *C. tomentosicollis* after weekly sprayed

Treatments	Varying concentrations of extracts sprayed in Weeks			
	1	2	3	4
Car 10%	3.250	2.750	2.250ab	1.750
Car 20%	3.500	3.000	2.500ab	2.250
Car 30%	2.500	2.000	2.000b	1.500
Neem 10%	2.250	2.500	1.750b	1.500
Neem20%	3.250	2.250	1.500b	2.500
Neem 30%	1.750	1.500	1.500b	1.000
Cypermethin	2.000	1.500	1.250b	1.000
Water	5.00	4.000	3.750a	2.500
Means	2.938	2.436	2.063	1.750
SE±	0.761	0.459	0.298	0.347

Means within the same column followed by different letter(s) are significantly different at P≤0.05 of Student Newman's Keuls (SNK) test.

Table 5: Effect of plant extracts on the Weight of damaged grains by *M. vitrata*, *C. tomentosicollis*, undamaged grain and grain yield kg/ha

Treatments	Damaged and undamaged grains (Kg)			
	Grains damaged by *M. vitrata*	Grain damaged by *C. tomentosicollis*	undamaged grains	Grain weight kg/ha
Car 10%	4.125abc	2.018b	6.143bc	223.32ab
Car 20%	3.035bc	2.225b	5.263bc	172.46ab
Car 30%	2.925bc	1.458b	5.175bc	274.64ab
Neem 10%	5.648ab	2.480b	8.778ab	85.32b
Neem20%	5.125abc	2.268b	6.643bc	194.01ab
Neem 30%	3.250bc	1.545b	4.798bc	265.36ab
Cypermethin	1.475c	1.425b	3.700c	368.78a
Water	7.540c	3.840a	11.378a	80.86b
Means	4.084	2.157	6.484	208.085
SE±	0.614	0.251	0.695	42.347

Means within the same column followed by different letter(s) are significantly different at P≤0.05 of Student Newman's Keuls (SNK) test.

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