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Research Article

The preponderance of pod sucking bugs of cowpea and their control using botanical and synthetic insecticides in Samaru, Nigeria

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Abstract

The preponderance and effect of extra application of synthetic insecticide, lamda-cyhalothrin and botanical, neem seed extracts to control pod sucking bugs of cowpea were investigated in 2007 and 2008, respectively at Samaru, Zaria, Nigeria. The design used was Randomized Complete Block Design. The cowpea variety used was SAMPEA-7, which was sown on 4th and 6th August in 2007 and 2008, respectively. Six treatments were used which were designated as T1, for two sprays of Landa-cyhalothrin; T2 for three sprays of Lamda-cyhalothrim, T3 for four sprays of Lamda-cyhalothrin; T4 for five sprays of neem seed extract; T5 for six sprays of neem seed extract and T6 as a control where there was no spray of either of the insecticides. The treatments were replicated four times. The parameters assessed were number of sucking bugs per square metre, percentage of different species of sucking bugs, percentage of damaged pods per plant and yield per hectare. Five pod sucking bugs were found infesting cowpea pods in the following order of preponderance; *Clavigralla tomentosicollis* Stal. (66.3%), *Halydocoris ventralis* Dall. (15.7%), *Mirperus jaculus* Wstw. (9.0%), *Riptotus dentipes* Fab. (7.8%), and *Anoplocnemis curvipes* Fab. (1.2%). There was significant (P<0.05) decrease in the number of sucking bugs on the plots that were sprayed four times with lamda-cyhalothrin and those sprayed six neem seed extracts. There was significant yield increase in plots that had one extra spray of lamda-cyhalothrin, one extra spray of neem seed extract and two extra sprays of neem seed extract.

Keywords: synthetic insecticide, lamda-cyhalothrin, botanical, neem seed extracts, pod sucking bugs, cowpea

INTRODUCTION

Cowpea(*Vigna unguiculata* [L.] Walp), also known as croder pea, black-eyed pea and southern pea is the most economically important indigenous African grain legume and a major item in African trade within West and central Africa, where about 80 % of the world cowpea trade takes place (Lanyingtuo *et al*., 2003). It is the second most important pulse after groundnut, cultivated in Africa where Nigeria and Niger Republic predominates (Mbah and Silas, 2007). According to the Food and Agricultural Organization (F.A.O, 2008) of the United Nation, the total production for Nigeria and Niger in 2007, were 1,168,000 and 1,001,139 metric tons, respectively. Cowpea is an extremely valuable crop both as source of revenue and as important source of cheap dietary protein for the third world where meat is expensive (Lale, 1991). Different pests infest various cowpea plant parts, and in some cases, these pests overlap in their incidence and damage.

It is not unusual to find four or more pests on the crop at the same time (Jackai and Adalla, 1997).

In Nigeria, key field insect pests of cowpea include aphids (*Aphis craccivora* Koch.), thrips (*Megarulothrips sjostedti* Tryborn), legume pod borer (*Maruca vitrata*), spiny brown bug (*Clavigralla tomentosicollis* Stal.), flower beetle (*Mylabris species*), leaf footed plant bug (*Leptoglossus australis* F.), and foliage beetle (*Ootheca mutabilis* Saihib) (Malgwi and Onu, 2004).

The pod of cowpea is an important part that attracts an array of insects that cause reduction in yield of the crop. Aphids, Legume pod borer and a number of pod sucking bugs causes a devastating damage to the pods in the field. Some of the important pod sucking bugs, according to Singh and Jackai (1985), as well as Shuaibu et al. (2013) include *Clavigralla tomentosicollis, Riptortus dentipes, Anoplecnetnis curvipes, Mirperus jaculus* and *Nezera viridula*.

Application of insecticides once at flower budding, early podding and pod filling significantly reduced pod and seed damage, resulting in substantial increase in the number of pods, pod weight and seed weight per plant, and also number of seeds per pods (Dzemo *et al.*,2010). Cowpea pods were adequately protected from damage by the insect pests, and grain yields were significantly higher at 10 and 20% neem seed extract rates with four or six application schedules (Oparaeke, 2007). The objective of this study was to identify the different types of sucking bugs that damage cowpea pods and their preponderances in Samaru and the effect of extra field sprays in controlling them.

MATERIAL AND METHODS

Study area, experimental design and treatments

The experiment was carried out during the 2007 and 2008 cropping seasons. It was conducted at the Institute of Agricultural Research (I.A.R.) farm Samaru, Zaria, Nigeria. The total land area used was 525 m^2. The cowpea variety planted was SAMPEA-7, which was obtained from seed production unit of the I.A.R. Samaru, Zaria. The plot size used was 5 m by 5 ridges, with a clear border of 1 m between plots to minimized cross infestation. The experimental design used was Randomized Complete Block Design (RCBD). Six treatments, which were replicated four times, were used. The synthetic insecticide used was lamda cyhalothrin (Karate® EC 37.5 g a.i./ha) and the botanical was neem seed extract. The treatments were as follows; T1: Two sprays of lamda-cyhalothrin; T2: Three sprays of lamda- cyhalothrin; T3: Four sprays of lamda-cyhalothrin; T4: Five sprays of Neem Seed Extract; T5: Six sprays of Neem Seed Extract and T6: No spray (control).

Land preparation, sowing, crop management and application of treatments

The field was ploughed, harrowed and later ridged by the Estate Department of I.A.R. Cowpea seeds were sown on 4th August, 2007 and on 6th August, 2008. The seeds were treated with Apron star at the rate of 5 g/ l kg of seeds. Three seeds per hole were sown at the intra spacing of 25cm which was maintained constantly for all the treatments. This was later thinned to 2 plants per stand (two weeks after planting). A starter dose of NPK fertilizer was applied three weeks after planting at the rate of 20 kg/ha of N, 35 kg/ha of P_2O_5 and 15 kg/ha of K: Paraquat (Gramoxone 2.5 kg a.i./ha) was applied at the rate of four litres per hectare, three days after planting to control emerging weeds. Hoe weeding was conducted at three and six weeks after planting. Mancozeb (fungicide) was applied four weeks after planting, at 0.33 kg a.i./ha, to control fungal diseases.

Insecticidal spray was started at flower bud initiation stage (46 days after planting) of the crop. The spray of neem seed extract was conducted at weekly interval, while lamda-cyahalothrin was applied as targeted spray; at flower bud initiation, flowering and podding stage, lamda cyahalothrin was applied at 1 liter per hectare using a CP 3 knapsack sprayer.

Preparation of Neem seed extracts (NSE)

Mature Neem seeds were collected from Bayero University, Kano. The seeds were dried under the shade. The seeds were then pounded using mortar and pestle to separate the kernel from the shell. The inner kernels were further pounded to obtain the powder. Five hundred grams of the powder was then weighed and soaked in 5 litres of water. The mixture was vigorously shaken and allowed to stand overnight. In the morning the mixture was filtered using double layer of muslin cloth. The filtrate (neem seed extract) was then collected in small plastic jars and stored under cool condition before spray.

Insect sampling and identification of pod sucking bugs

Sampling of pod sucking bugs started at podding stage (59 days after planting) and was conducted at weekly interval. It was done within the one m2 of the inner three ridges. Plants in the selected area were gently examined by carefully turning the leaves, pods and fallen leaves for assessment. This was carried out between 7.30 m and 9.00 am, when the insects were relatively less active and would not readily take to flight when disturbed. The number of the sucking bugs was physically counted visually. The sucking bugs were identified in the insect museum of the Department of Crop Protection IAR ABU Samaru, Zaria.

Data collection

The following data were recorded during the experiment both in the field;

Number of sucking bugs per metre square

Total number of sucking bugs was taken per square metre from the plants in the inner three ridges of each treatment. The percentage of each species of the sucking bugs was later calculated using the following formula:

$$\text{Percentage of sucking bug} = \frac{\textbf{Number of the sucking bug species}}{\textbf{total number of sucking bug}} \times 100$$

= total number of sucking bugs X100

Percentage of damaged pods

Damaged pods were taken per plant. A pod was said to be damaged when it had one or more constrictions along its length, showed seed failure due to attack or when it was shriveled. The percentage of damaged pods was therefore calculated using the following formula:

$$\text{Percentage of damaged pods} = \frac{\textbf{Number of damaged pods per plant}}{\textbf{Total number of pods per plant}} \times 100$$

Grain yield of cowpea

After harvesting, the pods from each plot were threshed and then weighed to determine yield from each treatment. This was further converted to weight per hectare using the following formula;

$$\text{Weight per hectare (kg)} = \frac{10,000 m^2 \times \text{weight per treatment}}{\text{Area of treatment}}$$

Data analysis

Data obtained were subjected to Analysis of Variance (ANOVA) and means were separated using the technique of Student- Neuman -Keul Test (SNK) at 5% level of probability. The numbers of various species of sucking bugs were expressed in percentage.

RESULTS

The results in Table 1 shows the effect of different spray schedules of synthetic (lamda-cyahalothrin) and botanical [neem seed extract (NSE)] insecticides on the population of pod sucking bugs. T1 (with 2 sprays of synthetic insecticides) and T6 (with no insecticidal spray) had the highest number of pod sucking bugs in 2007 and 2008, and there was no significant difference (P<0.05) between the two treatments in 2008. This is probably because the two sprays (at 46 and 58 days after sowing) were carried out early before the attack by the bugs. In both seasons the least number of sucking bugs were recorded in treatments 3 and 5 where there were extra sprays of lamda-cyhalothrin and neem seed extract. There was, however, no significant difference (P<O.05) between the two treatments.

The relative population incidence of each species of the sucking bugs is presented in Table 2. It shows that the spiny brown bug (*Clavigralla tomentosicollis* Stal.) was more preponderant in Samaru. It had the highest population, followed by Halydocoris ventralis Dall, *Mirperus jaculus* Wstw, *Riptotus dentipes* Fab., and *Anoplocnemis curvipes* Fab.

Pod damage on cowpea ranged from 13.3% in T3 to 78% in T6 in 2007, with a similar trend in 2008 (Table 3). The percentages were significantly lower in T3 (four sprays of lamda-cyhalothri) and T5 (six sprays of NSE) in both years, and there was no significant difference between the two treatments. However, T6 which was not sprayed with the insecticides had the highest percentage of damaged pods; followed by Ti (two sprays of lamda-cyhalothrin), 12 (three sprays of lamda-cygalothrin) and T4 (five sprays of NSE). The extra sprays of both lamda-cyhalthrin and the neem seed extract in T3 (four sprays of lamda-cyhalothrin) and T5 (six sprays of NSF) respectively, effectively reduced the percentage of pods that were damaged by the pod sucking bugs.

Grain yields were generally higher in 2007 than in 2008. This is partly due to early stoppage of rainfall in 2008, which seriously affected the crop at the later part of its growth period. Grain yields from T3 (four sprays of lamda-cyhalothrin) and T5 (six sprays of NSE) were significantly higher than the rest treatments in both years, and did not differ significantly (P<0.05) (Table 4) from one another. This was followed by T4 where there were five sprays of NSE, and it did not differ significantly from T3 and T5 in 2007. The control (T6), where neither of the two insecticides (lamda-cyhalothrin and NSE) was sprayed had lowest grain yield. However. TI (two sprays of lamda-cyhalothrin) and T2 (three sprays of lamda-cyhalothrin) were slightly better than the control, because at one time or the other some sprays that were carried out controlled some of the insect pests attacking the crop. Furthermore, T3 where lamda-cyhalothrin was sprayed four times (having one extra spray) had the highest grain yield in either year. This showed the superiority of the synthetic insecticide (lamda-cyahalothrin) over the botanical (neem seed extract) in the control of cowpea insect pests and consequently increasing grain yield.

Table 1. Mean number of pod sucking bugs/m^2 after using various Spray schedules of lamda-cyahalothrin and NSE insecticides

Treatment	2007	2008
T1	113.7b	119.8a
T2	65.0c	79.0b
T3	13.5e	15.8c
T4	51.3d	69.0b
T5	17.0e	19.8c
T6	130.8a	130.0a
SE±	6.9	11.9
CV (%)	10.7	16.6

Means in the column accompanied by the same letter(s) are not significantly different at (P<0.05%) using SNK (Student-Neuman-Keuls Test).

T1-two spray of lamda-cyhalothrin; T2-three sprays of larnda-cyhalothrin: T3-four sprays of lamda- cyhalothrin; T4- five sprays of NSE; T5- six sprays of NSE; T6 —no insecticide spray.

Table 2. Comparative incidence of pod sucking bugs infesting cowpea in 2007 and 2008 cropping seasons

Species of sucking bugs	2007	2008	Mean
Clavigralla tomentosicollis	65.1	67.7	66.3
Halydocoris ventralis	16.0	15.3	15.7
Mirperus jaculus	10.2	7.8	8.5
Riptortus dentipes	7.5	8.0	7.8
Anoplocnemis curvipes	1.3	1.2	1.2

Table 3. Percentage of damaged pods per plant after using different spray schedules of lamda-cyhalothrin and NSE

Treatment	2007	2008
T1	57.8b	62.0b
T2	39.3c	39.5c
T3	13.3d	9.3d
T4	43.3c	33.5c
T5	21.8d	15.8d
T6	78.0a	86.5a
SE±	7.8	6.2
CV (%)	18.9	15.0

Means in column accompanied by the same letter(s) are not significantly different at (P<0.05) using SNK (Student-Neuman-Keuls Test).

T1-two spray of lamda-cyhalothrin; T2-three sprays of lamda-cyhalothrin; T3-four sprays of lamda-cyhalothrin; T4- five sprays of NSE; T5- sprays of NSE; T6 -no spray of insecticide.

Table 4. Effect of different spray schedules of lamda-cyhalothrin and NSE on grain yield (kg/ha) of cowpea

Treatment	2007 kg/ha	2008 kg/ha
T1	163.3c	153.4c
T2	233.3b	220.3b
T3	300.0a	299.9a
T4	256.7ab	240.5b
T5	283.4a	286.7a
T6	55.0d	43.3d
SE±	26.9	27.9
CV (%)	12.5	13.5

Means in column accompanied by the same letter (s) are not significantly different at (P<0.05) using Student-Neuman-Keul Test (SNK).
T1-two spray of lamda-cyhalothrin; T2-three sprays of lamda-cyhalothrin; T3-four sprays of lamda-cyhalothrin; T4- five sprays of NSE; T5- six sprays of NSE; T6-no spray of insecticide.

DISCUSSION

This study identified five sucking bugs associated with cowpea pods in the field. These were *Clavigralla tomentosicollis, Halydocoris ventralis, Mirperus jaculus, Riptortus dentipes* and *Anoplocnemis curvipes*. The study therefore confirmed the findings of Singh and Jackai (1985) that had identified C. *tomentosicollis, Riportus spp*., *Anoplocnemis spp*., and *Mirperus spp*. infesting cowpea pods. The preponderance of these pod sucking bugs as established by this study showed that C. tomentosicollis is the most predominant in Samaru area, followed by *Halydocoris spp*. Amatobi (1995) suggested three spray regimes for SAMPEA 7 to control heavy infestation by pod sucking bugs. However, the extra sprays of this study, where lamda-cyhalothrin (karate®) was sprayed four times and neem seed extract (NSE) was sprayed five and six times, effectively reduced the population of pod sucking bugs. Although the extra application of the NSE was less effective than that of the synthetic insecticide, lamba-cyhalothrin, a finding already confirmed by Dike (1998), there was no significant difference between the two. Therefore, neem seed extract should be preferred over the use of the synthetic insecticide for the following reasons; it is cheaper, readily available, environmentally friendly and non toxic to man and livestock. Neem seed extract was also known to have less harmful effects on natural enemies of the insect pests.

The botanical can be used together with other non chemical methods such as manipulation of cultural practices to control the sucking bugs. For instance, Pitan and Odebiyi (2002) found that close spacing of cowpea increased chances of damage by the pod sucking bugs. It was discovered that the thick foliage resulting from the closeness of the plants sheltered the pests and encouraged reproductive activities and thereby attracted more insects to the microenvironment. Therefore, they suggested that average spacing of 30 cm between stands should be part of the integrated pest management of pod sucking bugs of cowpea. This study had confirmed the earlier finding by Dzemi *et al.* (2010), where there was highest percentage of undamaged pods from the plots that had extra sprays of the insecticides and which occurred at pod ripening and drying (70 and 82 days after sowing) stage. In addition, this finding can be used along with the natural enemies to control pod sucking bugs. Jackai et al. (1985) suggested the use of natural enemies as well

as cultural methods in controlling the sucking bugs.

The results of this study have also indicated the effect of the extra sprays of the insecticides on the yield of cowpea. Grain yields increased significantly with extra sprays of the insecticides. Sucking bugs are among the major field pests that determine the yield of cowpea. So controlling the bugs would help increase the yield of the crop. Olufemi and Odebiyi (2002) showed that control of the sucking bugs helped in increasing the yield of cowpea. It has also shown that five sprays of neem seed extract is enough to get significant yield of cowpea grains. Similar results were obtained by Shuaibu et al. (2013)

CONCLUSION

The study has identified the preponderance of pod sucking bugs in Samaru, Nigeria. Also the extra field sprays of the synthetic insecticide (lamda-cyhalothrin) and the botanical (neem seed extract) as shown by this study can be used to reduce the population of pod sucking bugs. The synthetic insecticide was found to be more effective than the botanical as shown in this study. However, there was no significant difference between them. Therefore, the botanical insecticide should be preferred as it (the neem seed extract) is readily available, cheap, and friendly to the environment, not toxic to the farmer and livestock, and ease of application. The study can therefore be used as part of the strategy in the management of store infestation of bruchids (*Callosobruchus spp*.) on cowpea.

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