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Full Length Research Papers

Effects of Pre-harvest application of Lamda-cyhalothrin and Neem Seed Extracts in the management of Cowpea bruchid, *Callosobruchus maculatus* Fab.(Coleoptera:Bruchidae) on stored cowpea.

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Field and Laboratory experiment was conducted to investigate the effect of pre-harvest application of synthetic insecticide, lamda-cyhalothrin and botanical, neem seed extract on cowpea bruchid, *Callosobruchus maculatus* Fab. Samaru, Zaria, Nigeria. The designs used were Randomized Complete Block Design and Completely Randomized Design for field and laboratory experiments respectively. 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,T2 and T3 for 2,3 and 4 sprays of Landa-cyhalothrin; T4 and T5 for 5 and 6 sprays of neem seed extract; and T6 as a control where there was no spray of either of insecticides. The treatments were replicated four times. The parameters assessed were number of bruchids per treatments, percentage of seeds damaged and percentage germination of the seeds. The lowest number of *C. maculatus* and lowest percentage of seeds damaged were recorded in the seeds from those plots that have one pre-harvest sprays of lamda-cyhalothrin and neem seed extract. At the end of the storage period of six months highest germination percentage was recorded in the seeds from the plots that were sprayed four times with lamda-cyhalothrin and from those sprayed six times with neem seed extract. Germination percentages were highest in the seeds from the plots that were sprayed four times with lamda-cyhalothrin and six times with neem seed extract. And their last sprays were carried out eighty-two days after sowing (82 DAS) as pre-harvest spray which had significantly reduce the initial initial infestation of the cowpea seeds by *C.maculatus*

Keywords: cowpea, *Callosobruchus*, insecticides, lamda-cyhalothrin, neem, pre-harvest,

INTRODUCTION

The bruchid, *Callobruchus maculatus* is th major is the major storage insect pest of cowpea (*Vigna unguiculata* L. Walp) in the tropics.Infestation by this bruchid usually starts from the field. Parr (1994) reported that store

infestation of cowpea is frequently derived from the harvested field-infested pods or seeds. Another work by Ezueh (1995) confirmed that the attack by bruchid beetles, *Callosobruchus* spp., on cowpea begins at about pod drying time and damage of between 2-11 % may occur at this stage.

Under storage condition, bruchids (Coleoptera: Bruchidae) especially those belonging to the genus *Callosobruchus* are pestiferous to cowpea seeds (Ofuya and Bamigbola, 1991). The various species which have been recorded in different stored seeds of cowpea in Nigeria include *C. maculatus, C. rhodesianus* and *C. subnotatus*. Haines (1991) also reported *C. chinensis* on cowpea seeds in the tropical Africa. Another bruchid, *Bruchidius atrolineatus* was reported by Kabeh and Lale (2004) to infest cowpea seeds in the store. In Nigeria and other West African countries *C. maculatus* out competes other species of *Callosobruchus* and *B. atrolineatus* in storage and it has therefore been ranked as the principal post-harvest pest of cowpeas particularly in the West African Sub-region (Jackai and Daoust, 1986).

Many conventional insecticides have been demonstrated to be effective against storage bruchids either as dusts or fumigants (Rahman, 1990; Singh and Singh, 1990; Daglish *et al.,* 1993). Fumigants are especially useful for bruchid control in large scale storage of grain legumes. Cowpea seeds can be fumigated in woven-plastic or multi-wall paper bags. After fumigation, the seeds should be protected from re-infestation (Ofuya and Lale, 2001).

However, the trend towards safer environment, different kinds of botanicals such as neem products,were used to control the bruchids. Neem seed oil (NSO) was shown to suppress the development of *C. maculatus* in store, brought about by reduced oviposition and increased mortality of eggs and first instar larvae on the surface of the seeds before they are able to penetrate the cowpea cotyledons (Maina and Lale, 2005). It has been confirmed that plant materials that control *C. maculatus* will generally control other *Callosobruchus* species.

These botanicals according to Ivbijaro (1983) are used to protect cowpea seeds, because they are cheap, effective, less toxic to animals, easy to adopt and environmentally friendly.

The objective of this study was to find out whether pre-harvest sprays of the botanical, neem seed extract and the synthetic insecticide lamda-cyahalothrin would have a significant effect on initial field infestation by *Callosobruchus maculatus* on cowpea seeds.

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MATERIALS AND METHODS

Preparation of neem seed extracts (NSE)

Mature neem seeds were collected from 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.

Field experimentation

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 m². 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 (Figs 1 and 2). 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; T6: No spray (control).The sprays of the insecticides were started at 46 days after sowing (DAS).

Laboratory experiment:

The laboratory experiment was conducted in the Department of Crop Protection, A.B.U., Zaria. After harvesting, the pods were immediately hand threshed. One hundred grams of the seeds were counted and weighed from each of the six treatments (T1, T2, T3, T4, T5 and T6) and separately put in Kilner jars. The jars were covered with muslin cloth.

The experimental design used was Complete Randomised Design (CRD). The six treatments; T1, T2, T3, T4, T5 and T6 were replicated four times. Therefore, twenty-four Kilner Jars were used.

In the Laboratory, sampling was conducted at monthly interval for six months. The content of each Kilner jar was

emptied into a tray and the bruchids were counted (both dead and live). The bruchids were also identified in the Insect Museum of the Department of Crop Protection IAR/ ABU, Zaria.

At the end of the storage period of six months in the Laboratory, germination tests were carried out on the seeds.

Data recorded:

The following data were recorded during the experiment in the laboratory

Number of *C. maculatus*:

The threshed cowpea was stored in kilner jars for the period of six months. The number of *C. maculatus* were recorded at three and six months of storage.

Percentage of seed damaged:

Twenty seeds of cowpea were taken randomly from each kilner jar. Damaged seeds were identified and recorded. A seed was considered damaged when it had one or more emerging hole of bruchids. The percentage of damaged seeds was taken using the following formula by Oparaeke and Daria (2005).

$$\text{Percentage of damaged seeds} = \frac{\text{Number of bored grains}}{\text{Total number of grain counted}} \times 100$$

Germination percentage of seeds

Ten seeds were taken randomly from each petri dish at the end of the storage period of six months. They were soaked in water for seven days. The number of seeds germinated from each petri dish was obtained. Germination percentage of the seeds was calculated as follows;

$$\text{Germination percentage} = \frac{\text{Number of germinated seeds}}{\text{Total number of seeds}} \times 100$$

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

RESULTS

The result in Table 1 shows the number of *C.maculatus* found infesting cowpea after three and six months of storage. In 2007, lowest number of the bruchids was found in T3 (four sprays of lamda-cyhalothrin), which had one extra field spray of the synthetic insecticide; and was not significantly different from T5 (six sprays of NSE). However, there was no significant difference ($P<0.05$) among the three treatments (T3, T4 and T5) at six months of storage period in both years. The number of bruchids was highest in T6 (untreated control) and was not significantl different from T1 (Two sprays of Lamda-cyhalothrin). The number of the bruchids in T6 had increased considerably during the storage period from three months to six months of storage period respectively in both years. In 2007, the increase was from 37.3 to 90.0, whereas in 2008, it was from 37.1 to 95.0.

Significant attack by *C. maculatus* and consequently, highest percentage of seeds damaged was found in T6 (untreated control), However it was not significantly different from T1 and T2 at six months of storage in both years. T3 (four sprays of lamda-cyhalothrin) and T5 (six sprays of NSE) had the least percentage of damaged seeds. Although, the percentage of the damaged seeds was lower in T3 than T5 at three and six months after storage, there was no significant difference ($P<0.05$) between them in both 2007 and 2008 cropping seasons. Furthermore, at three month of storage in 2007, T4 which had five sprays of NSE, did not differ significantly from T3 and T5. The result showed that the highest percentage of seeds damaged by *C. maculatus* was from the unsprayed plots.

The viability of the seeds was tested at the end of the storage period using germination count. The figures presented in Table 3 shows that most of the seeds from the unsprayed plots (T6) failed to germinate, which may have been as a result of the attack by the bruchids; the percentage germination was 6.3% and 5.5% in 2007 and 2008 respectively. However, highest and significant germination percentage was found in T3 (four sprays of lamda-cyhalothrin), which was not significantly different from T5 (six sprays of NSE). There was no significant difference in the germination percentages between T3, which had four sprays of lamda-cyhalothrin and T5, which had six sprays of NSE, in both years.

DISCUSSION

The pre- harvest sprays, which were conducted at 82 days after planting, in this experiment had significantly reduced the number of *C. maculatus* recorded during the 3 and 6 periods of storage. This was, probably, as a result of significant reduction in the number of eggs of the bruchids. Kabeh and Lale (2004) found similar trend, when they combined the extra spray of synthetic insecticides and the botanicals, on one hand, and early harvesting of the cowpea, on the other. Lower number of the bruchids found in the plots where the extra sprays were applied, was as a

Table 1. Effect of different spray schedules of lamda-cyhalothrin and Neem seed extract on mean number of *C. maculatus* at 3 and 6 months of storage of cowpea seeds.

	2007		2008	
	months		months	
Treatment	3	6	3	6
T1	34.5a	97.3a	35.7a	98.8a
T2	38.2a	86.7a	39.2a	85.9a
T3	4.3c	10.0b	4.7c	9.7b
T4	15.9b	26.0b	16.9b	17.0b
T5	5.1c	8.0b	6.0b	8.4b
T6	37.3a	90.0a	37.1a	95.0.0a
SE ±	5.1	15.5	6.3	16.6

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

Table 2. Effect of different spray schedules of lamda-cyhalothrin and Neem seeds extracton percentage of damaged cowpea seeds by *C. maculatus*. after 3 and 6 months of storage.

	2007		2008	
	months		months	
Treatment	3	6	3	6
T1	48.8b	83.8a	47.0a	93.0a
T2	60.0a	82.0a	55.5a	83.3ab
T3	13.8b	15.3c	12.8b	17.3c
T4	36.3ab	49.5b	37.0a	63.0b
T5	16.3b	22.8bc	7.0b	15.3c
T6	64.5a	94.0a	61.5a	96.5a
SE±	19.6	18.7	14.3	13.6

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- six sprays of NSE; T6-no spray of insecticide

Table 3. Effect of different spray schedules of lamda-cyhalothrin and Neem seed extract on germination percentage of cowpea seeds after 6 months of storage.

Treatment	2007	2008
T1	11.8bc	4.0c
T2	15.0bc	9.8c
T3	90.0a	91.5a
T4	29.0b	32.5b
T5	93.0a	86.3a
T6	6.3c	5.5c
SE±	9.8	8.0

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- six sprays of NSE; T6 –no spray of insecticide

result of less number of eggs already laid in the field. Dick and Credland (1986) reported that the number of *C. maculatus,* which can emerge from cowpea seeds, depends among other things on the number of eggs initially present. However, there was no significant increase of *C. maculatus* between the two conditions of non spray (control) of the insecticides and early sprays (46 and 58 days after sowing) of the insecticides, without the extra sprays as shown by this study. The result, therefore, indicated that field infestation of cowpea grains by the *C. maculatus* usually occurs towards the pod ripening stage. Ezueh (1995) had reported that the attack by the bruchid beetles *C. maculatus* on cowpea begins at about pod drying time and damage of 2-11 percent may begin at this stage.

Almost all the seeds obtained from the untreated plots were destroyed at 6 months of storage period. However, no significant difference was recorded when four regimes of Lamda-cyhalothrin and five and six regimes of neem seed extract were used.

Since no significant difference was found among four sprays of lamda-cyhalothrin, five sprays of neem seed extract and six sprays of neem seed extract during three months storage of cowpea, it will be more economical to use five spray regimes using neem seed extract if the intended period for storing the cowpea seeds is three months. This will also save farmers time required for applying another regime of the insecticide.

The response of cowpea seed viability to treatment with extra insecticide spray was significant. Most of the seeds that were protected in the field just before harvesting germinated. This is expected since these seeds were least damaged by the bruchids in the store. This indicates that the embryos of the seeds were not damaged significantly. Okonkwo and Okoye (2002) had reported that reduction in germination of damaged seeds was attributed to damage to the embryo. Bruchid-damaged cowpea seed suffered a decline in germination related to each emergence hole on the seeds. Farmers may plant seeds damaged with up to two bruchid emergence holes with only a small reduction in germination. Seed with more than four emergence holes are not recommended for planting (Ezueh, 1995).

In conclusion, pre-harvest synthetic insecticide (Lamda-cyhalothrin) and the botanical (neem seed extract) as shown by this study can be used to reduce field infestation of cowpea by *C. maculatus.* 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 (Neem seed extract) is readily available, cheap, 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 bruchids (*Callosobruchus* spp.) on cowpea.

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