Crude Acquired Extracts of *Calotropis procera* (Desr) *Sodom apple* and K*haya senegalensis (Mahogany)* in the Management of Stored Cowpea Weevil (*C. maculatus)*.

***Ibrahim M.H., Martins B.O.,*Aigbavboa M.O., Gwaram M.Y.,*Barau B.,*Garba U.M.**
*Federal College of Agricultural Produce Technology,
Hotoro, Kano
Corresponding email: bashbarau2008@gmail.com

Abstract
Study was conducted to determine the ethanolic extracts of the leaves of Calotropis procera and Khaya senegalensis were screened for secondary metabolite constituents and insecticidal effect against cowpea weevils (Collosobruchus maculatus). The extracts of both plants at different concentration were also investigated for their insecticidal effect against C. maculatus. There was significant effect at P ≤0.05 on the extracts shown on mortality rate of C. maculatus on the insect pests. The findings indicated that the plant extracts was toxic proportionally to the concentration and higher concentration has stronger effects against C. maculatus of cowpea. The average oviposition of C. maculatus was observed during the research work which indicated that the extract has significant effect against oviposition in the storage period. The overall mean oviposition also increased with increase in time intervals after treatment, which revealed that the T1 and T2 has higher oviposition than that of T3 which is the best amongst preferred. Average number of holes indicated that the plant extracts has significant effect on weight reduction during the trial period in which the higher efficacy of the treatments ranged between 0.60 (0.00) to 0.08 (0.28) in T1 and 0.16 (0.38) to 0.16 (0.57) in T2 to 0.00 (0.57) in T3 which was considered less infested by C. maculatus when compared with control. Similarly in germination test, there was no significant effect on germination percentage between control and treatments. It could be concluded that, the plant extracts from C. procera and Khaya senegalensis leaf can effectively control C. maculatus in terms of mortality rate, oviposition, number of holes when admixture.

Keywords: *C. procera; K. senegalensis; C. maculatus; organoleptic; oviposition*

INTRODUCTION

Cowpea *(Vigna unguiculata)* is one of the annual leguminous food crops grown in many parts of the tropics and one of the important food crop especially in West Africa countries where it is a regarded as a cheap source of dietary protein (Ajayi and Adedire; 2003; Adedire *et al.*, 2011).

Majority of people in the developing countries including Nigeria are engaged in cowpea production and it has the potential to produce reasonable well under conditions that other crops become unproductive, but productivity has been very low, less than 200kg ha^{-1} (Opareaka *et al.*, 2005). This has been attributed to several biotic and a biotic factors (Singh 2005; Timko *et al.*, 2007). The biotic factors that cause yields reduction include insects pests, parasitic plant as well as viral, fungi and bacterial diseases (Emechebe and Laguke, 2002; and Amatobi *et al.*, 2005), while the abiotic factors include poor soil fertility, drought heat, acidity and stress due to inter cropping with cereals (Singh and Ajaigbe; 2002). Teroa *et al.*, (1997) reported that of all these factors, insect pests and plant diseases are the major

constraints to increased cowpea production which attacks the crop at different stages of growth and often leads to significant reduction in yield especially where little or no control measure is applied (Oparaeke, 2006).

Cowpea is a host to so many insects pests at all stages of its growth resulting in serious economic damage. Some of the insects pests of economic importance of cowpea in the tropics are aphids, *Aphis craccivora Koch*, foliage beetle, *Ootheca mutabills*, legume pod borer, M*aruca vitrata* fab and sucking bug complex C*lavigralla spp, Nezuera vindula, Aspavia Armigera* e.t.c. (Amatobi *et al*; 2005). Tremendous yield losses associated with these pests have been reported in many parts of Africa where cowpea is grown in large scale. Decreases in yield lead to several factors which may include sensitivity of *Vigna unguiculata* to diseases and pests (Parh, 1999).

C. maculatus is main storage insects pests of cowpea seeds, infestation starts in the field and spreads in the storage system, if no action is taken, this causes a drop in production or total post harvest losses of the crop (Ngamo and Hence, 2007); also severity of post harvest losses due to insect load is common especially in Africa (Lebayrio; 1992).

C. *maculatus* has caused enormous weight loss, reduced viability and reduced commercial value of cowpea seeds (Adedire and Akinneye, 2004). The storage weevil (C. *maculatus*) eats cowpea grain making distinctive round holes, damage is apparent about 2 to 3 months after harvest and virtually all of the grain may have holes by 6 months. Consumers have a strong aversion to grain that has been damaged by weevils, but it still can be effective as seed, although, germination percentage may have been reduced (Oparaeke, 2008). It has been reported that both qualitative and quantitative losses arising from physical, chemical and biological factors (e.g. Rodents, Fungi, Birds and Insects) occurs during storage of grains (Adedire and Akinneye, 2004). The use of agro chemicals is somehow discourage because of misuse, obsolete, sometimes persistent in crops and in the soil, very toxic (if mishandle) and expensive to purchase in the market. The use of plants materials (green pesticide) which are available in the local area and accessible in Nigeria is gaining pace most especially in cowpea production. In the recent years, several control measures have been advocated such as the use of biological controls, physical control and host plant resistance by many researchers to control post-flowering insect pests and stored weevil in cowpea production. However, unfortunately most farmers in the tropics are resource poor with low level of literacy and handling of those pesticides. Therefore, there is a need for an in depth research to be developed on botanical plants that have high efficacy in control and managing of pests from attacking stored beans using natural plants materials rather than used of synthetic insecticides to reduce exposure and health risk. The use of some plant extracts in control of insects are promising alternative measures to synthetic chemicals (Schmutterer, 1990). Those greener pesticide are economical, environmentally safe, and less hazardous to human and often less toxic to ecology, and toxic free to beneficial insects as well as no development of resistance by insect pests. The efficacy of plant extracts in the control of insect pests is based either on the insecticidal, larvacidal, repellent, antifeedant and/ or pungent characteristics they posses.

The mode of action of these biological plants may be insecticidal or anti- ovipositional as reported by (Adedire and Lajide, 1999).

This paper reports the use of acquired crude extract of *C. procera (Sodom apple)* and K. *Senegalensis (mahogany)* leaves in the management of stored cowpea weevil (*C. maculatus).*

MATERIALS AND METHODS

3.1 STUDY AREA

The research was conducted at Federal College of Agricultural Produce Technology, Hotoro, Tarauni Local Governments in Kano (11^0 39'N $8^0$27' E 427M above sea level) in the

department of Pest Management laboratory. Tarauni local government area falls within Kano central as well as Sudan savanna agro-ecological zone of Nigeria.

3.2 SAMPLES SIZE.

Cowpea seeds used for this research work were collected from International Institute for Tropical Agriculture (IITA), Kano substation. The certified free from infestation (ITK-277-1) was used in the experiment., and an extract of (C*alotropis procera*) Sodom apple leaf weighing 4ml and (K*haya senegalensis*) Mahogany Leaf weighing 4ml were introduce into 10g, 20g, 30g and a control in each of the treatment arranged and kept in kliners (jars) in a Complete Randomized Design. A well identified five (5) adults male and female of (C*allosobruchus maculatus*) cowpea weevil were inoculated in to each samples excluding (control) group.

3.3 MATERIALS

The Leaves of (*C. procera*) Sodom apple, (K. *senegalensis*) Mahogany, Adults' cowpea weevil (C. *maculatus*), Conical flask, Measuring cylinder, Solvent, Distilled water, 250ml plastic containers. Filter paper, Kliners jar. Stove/oven. Brush, Spatula, Mortar and pestle, Aluminum pot, Cowpea grains (Clean and free from infestation), Weighing scale.

3.4 COLLECTION AND IDENTIFICATION OF COWPEA WEEVIL

The *Callosobruchus maculatus* were collected from the innoculated infested cowpea seeds from Federal College of Agricultural Produce Technology Kano, Department of Pest Management Technology.

3.5 PHYTOCHEMICAL SCREENING.

The leaf part of *C. procera* and K. *senegalensis* were phytochemically analyses to determine both qualitative and quantitative characteristics using in vitro antioxidant properties of some various aqueous extracts of leaf parts. Thus, alkaloids, Saponins, Anthraquinone, Glycosides, Phlobotannins, Flavonoids, Tannins and Carbohydrate were determined using a similar method **described** by (Cannel, 2000); Xanthroprotein and Phenol were also determine using the procedure reported by (Lala, 1993).

3.6 MOISTURE CONTENT DETERMINATION OF THE COWPEA SEEDS

The fresh collected cowpea seeds were weighed to determine the initial moisture content using a sensitive weighing scale before putting the seeds in an oven. For dryness; the seeds were weighed and compared with the original weight recorded before drying in the oven to determine the moisture content of fresh seeds.

$$MCdb = \frac{\text{Weight of the dry sample}}{\text{Weight of the wet sample}} \times 100$$

Data collected were subjected to analysis of variance as described by Snedecor and Cochran (1967) using students newman –keul test (2010) software and the means were separated using LSD all-pair wise comparison

RESULTS

TABLE 1:

Identification of phytochemical composition of ethanolic leaf extracts of *C. Procera* and *K. Senegalensis*

Plant xtructs	Saponnins	Tannins	Alkaloid	Xantroprotein	Glycosins	Anthraquinone	Flavonoids	Phenols	Phlobaoacid tannin	CHO
C. procera	+	+	+	-	-	+	+	+	+	+
K. Senegalensis	+	+	+	+	-	-	+	-	+	+

+ Positive **- Negetive**

TABLE 2:

EFFECT OF *C.procera* and K.senegalensis ON OVIPOSITION of C. *maculatus*

Sample Code	R1	R2	R3
0	11.750[a]	11.330[a]	11.830[a]
T1	0.250[c]	0.000	0.160 [cd]
T2	0.580b	0.000	0.000
T3	0.000	0.080	0.000

Means in the same raw with different letters are significantly different (P<0.05).

TABLE 3

EFFECT OF *C.procera* AND *K.senegalensis* ON MORTALITY RATE

Sample Code	R1	R2	R3
0	0.160	0.080	0.160
T1	1.000	1.000	1.000
T2	1.000	1.000	1.000
T3	1.000	1.000	1.000

Means in the same raw with different letters are significantly different (P<0.05).

TABLE 4

EFFECT OF *C.procera* AND *K.senegalensis* ON NUMBER OF HOLES

Sample Code	R1	R2	R3
0	1.580	2.000	2.000
T1	0.000	0.080	0.000
T2	0.160	0.00	0.160
T3	0.000	0.000	0.160

Means in the same raw with different letters are significantly different (P<0.05).

TABLE 5
EFFECT OF *C.*procera AND K.senegalensis ON GERMINATION TEST

Sample Code	0	T1	T2	T3
10g	2.000	4.500	4.500	3.500
20g	3.000	3.000	4.500	5.000
30g	4.500	4.500	4.500	3.000

Means in the same raw with different letters are significantly different (P<0.05).

TABLE 6
EFFECT OF *C.procera* AND K.senegalensis ON ORGANOLEPTIC/SENSORY TEST

Sample Code	COLOUR	TEXTURE	ODOUR	GENERAL ACCEPTABILITY
CPB	3.080	2.250	*2.580*	*2.250*
KSM	*2.080*	*2.670*	*2.080*	*2.330*
CKS	*2.800*	*2.830*	*2.750*	*3.330*

Means in the same raw with different letters are significantly different (P<0.05).

TABLE 7
EFFECT OF *C.procera* AND *K.*senegalensis ON PROXIMATE ANALYSIS

Sample code / Attribute	Sample C	Sample K	Sample C+K
Moisture	11.500	11.750	8.750
Ash	4.750	5.000	3.750
Crude Fat	2.600	2.860	2.910
Crude Fibre	4.100	4.550	5.010
Crude Protein	22.300	21.650	19.950
Carbohydrate	55.250	55.140	59.640

Means in the same raw with different letters are significantly different (P<0.05).

DISCUSSION

PHYTOCHEMICAL SCREENING.

The laboratory analysis of phytochemical screening shown in table 1 reveals that, Flavanoids, phlobo acid tannins, saponnins, alkaloid, and carbohydrate were positives in all ethanolic extracts of *C. procera* and *K. senegalensis* while glycosine, was detected negative in both

plant extracts, anthraquinone, and phenols were found positive only in *C. procera* whereas; while xanthroprotein was found present in only *K. senegalensis* plant extract.

Those phytochemicals may be responsible for their insecticidal properties (Kabaru and Guchia, 2001). The presence of tannins shows that the plants can be used as purgative.

The results of the Oviposition of the samples in R1 (10g of *C. Procera*) as shown in table 2 reveals that the sample treated with *C.procera* and *K.senegalensis* were highly significant ($P<0.05$) compared to C+K and the control. This reveals that in treatment T1 and T2, the oviposition is higher than that of T3 which is the best and most preferred, in R2 it was also shown that the treatment T1 and T2 are significant and most effective against oviposition unlike T3 which have a higher oviposition rate when compared with R3 treatment. On general terms among the treatment T3 is most preferred with least oviposition compared to the other treatments.

In table 3, the results of the mortality rate shows that, there was no significance difference among all the treatments compared to the control sample, but the T3 is the most preferred sample with slightly higher rate of mortality in contrast to control sample.

Table 4 revealed that the results of number of holes of the cowpea seeds samples which shows the high efficacy of the treatments ranges between 0.600 to 0.080 in T1 and 0.160 to 0.160 in T2 and 0.000 to 0.570 are less infested by *C. maculatus* when compared with the control sample which ranged between1.580 to 2.000 which indicates high level of infestation.

As shown in table 5 the result of the germination test reveals that there was no significant difference among the treatment compared to the control sample throughout the sampling period. This means that *C. procera* and *K. senegalensis* treatment have no any negative e effect against germination of the cowpea seeds.

Table 6 shows the results of organoleptic test, the mean scores where compared with the rating used in the test which ranged from one (1) for like and extremely to nine (9) dislike extremely. There was no significant difference ($p>0.05$) among the treatment of cowpea seeds in color of the product in the entire samples. The result also shows that there was no significant difference in texture and odor among all the treatment when compared with the control sample.

The proximate composition results for treatment *C. procera, K. senegalensis* and *K.senegalensis* and *C.procera* are presented in the table 7. For ash content, there was an increase from 4.75 (0.08) for *C. procera* to 5.00 (0.06) for *K. senegalensis*. The results of the moisture for *C.procera* and *K. senegalensis* are higher at 11.50 (0.20) to 11.75 (0.15) than that admixture of *C.procera* and *K. senegalensis* which has moisture content of 8.75 (0.09) The crude extracts of fat is less in the cowpea seeds which ranged between 2.60 (0.10), for *C.procera* 2.86 (0.09) for *K. senegalensis* and 2.91 (0.10) for the admixture of *C.procera* and *K. senegalensis* respectively. This is so simply because, cowpea is a *leguminous* crops. The results of the fibre ranged between 4.10 (0.05) to 5.01 (0.10) for all the treatment, for *C. procera, K. senegalensis* and admixture of *C.procera* and *K. senegalensis* which indicates that the cowpea seeds are highly digestible owing to its rich in fibre content. This research proves that cowpea seeds treated with *C. procera, K. senegalensis* and admixture of the two samples has no adverse effect on it nutritional compositions, which shows that the protein content of the samples ranged within 19.95 (0.20) to 22.30 (0.21) respectively. The carbohydrate content of the sample was taken by difference, which reveals that the cowpea treated with *C. procera, K. senegalensis* and admixture *C. procera* and *K. senegalensis* has a carbohydrate content ranged from within 55.14 (0.07) to 59.64 (0.01) respectively.

CONCLUSION

Based from the observed study, it can be concluded that *C. procera* and *K. senegalensis* if extracted industrially can replaced some synthetics agro chemicals in management of

Oviposition, Numbers of holes, Mortality rate of *C. maculatus.* Equally no phytochemical effects on the Germination test, Organoleptic test of the seeds samples during the trail period of the storage was found traceable.

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