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INSECTICIDAL ACTIVITY OF NATIVE SOAP ON COWPEA (*VIGNA UNGUICULATA* (L) WALP) INSECT PESTS IN ASABA AND ABRAKA, DELTA STATE, NIGERIA

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ABSTRACT
The insecticidal activity of local native soap was tested on cowpea insect pests during the early cropping season of 2005 in two widely apart (135 kilometres) locations – Asaba and Abraka, Delta State of Nigeria. Four key insect pests of cowpea – the cowpea aphid, *Aphis craccivora* Koch, flower bud thrips, *Megalurothrips sjostedti* Tryb, legume pod borer, *Maruca vitrata* Fab and coreid bugs were studied. At Asaba, the trials took place in the Teaching and Research farm of the Agronomy Department, Asaba campus, Delta State University while at Abraka, on a plot of land 50 metres to Campus 2, Delta State University, Abraka. The experiments consisted of five treatments – 1, 2 and 3% soap concentrations, cypermethrin (as check) and a control, all organised into a randomised complete block design (RCBD) with three replications. The results indicated that more insect pests occurred at Asaba than Abraka. Three percent (3%) soap concentration significantly ($P<0.05$) reduced *A. craccivora* colonies and slightly prevented *M. sjostedti* damage. The present study provides the information that (i) grain yield was high at both locations (ii) yields were significantly ($P<0.05$) higher at Abraka (1102.40kgha^{-1}) compared to Asaba (599.40kgha^{-1}) and (iii) native soap is an effective insecticide for managing cowpea insect pests. The adoption of native soap in cowpea cultivation by farmers should be encouraged since it readily breaks down, safe and environmentally friendly.

KEYWORDS: Cowpea, insect pests, native soap, early season, Asaba/Abraka, Delta State.

INTRODUCTION

Among the leguminous crops in cultivation in the arid and semi-arid belts of the world is cowpea (*Vigna unguiculata* (L) Walp. Man cherishes it highly because of its value as protein source (IITA, 1984; Alabi *et al*., 2003) and because of its vitamins, mineral salts, fats and oil contents. Some African communities consume it as vegetable (Duke, 1981). It is equally important in erosion control (Okigbo, 1978), fibre production (Rachie, 1985), restoration of soil fertility and fodder for livestock (Job *et al*., 1983). Large scale cultivation takes place in the drier States – Northern states of Nigeria (Rachie, 1985). Recently however, cultivation extended to Southern Nigeria and the crop is thriving in the West and East (Ejega, 1979; FOS, 1995; Emosairue *et al*., 2004). Cowpea cultivation is met with a number of challenges which have significantly resulted in abysmally low yield at the farm level (Omongo *et al*., 1997) and in African countries. Activities of insect pests and diseases are some of the factors that have been clearly identified as production constraints (Taylor, 1964; Asiwe, 2005, 2009). Major insect pests such as the cowpea aphid (*Aphis craccivora*, Koch), foliage beetles (*Ootheca sp*, *Medythia spp*), the flower bud thrips, (*Megalurothrips sjostedti*, Trybom) the legume pod borer (*Maruca vitrata*, Fabricius) and the sucking bug complex, of which *Clavigralla spp*, *Anoplocnemis spp*, *Riptortus spp*, *Mirperus spp*, *Nezara viridula* and *Aspavia armigera* are most important and prevalent, attack and decimate the crop in the field at different growth period (Jackai and Singh, 1988). Apart from direct injury to the crop, some are vectors of certain cowpea diseases. Without their control, crop failure results and harvest is usually poor, hardly above 200 kg per hectare at the farm level (Omongo *et al.*, 1997). Application of synthetic chemical pesticides have been the main weapon of control and yield, several folds have been recorded (Jackai, 1993). However, excessive and unwise use of chemicals lead to serious problems such as danger to users, consumers, adverse effect on non-target organisms (predators, parasites and pollinators) and general environmental pollution. This is not however, to think of the abandonment of chemicals; this may worsen the food crisis (Stern, 1973). The recommendation is that, the use of synthetic chemical pesticides should be minimised, and should be carried out in consonance with other control measures. Consequently, control measures that are free from the dangers associated with synthetic chemicals are presently, the focus of cowpea farmers. Recently, plant derivatives (extracts/products) that are insecticidal in nature and environmentally friendly have been reported effective on a wide spectrum of insect pests on crops (Jackai, 1983; Emosairue and Ubana, 1998; Egho, 2011a). Native soap (black soap) which is prepared locally from plant materials (e.g. ashes of straw of millet, plantain husks and palm fruit shafts has curative property against skin infection such as eczema and rashes (Iliyasu, 2004). This study therefore evaluates the insecticidal property in native soap in the control of major insect pests and yields of cowpea and also makes comparison of soap effect on insect species and grain yield in two agro-ecological zones in Delta State.

MATERIALS & METHODS

Study sites/locations

The study locations were Asaba and Abraka - two agro-ecological areas, widely apart, about 135 kilometres with distinct climatic conditions. Asaba occupies the northern part of Delta State and experiences drier weather, while Abraka located in the south has relatively humid weather with frequent rainfall.

Land preparation and seed planting

The experimental plots at both locations were marked out and cleared. At Asaba, the study took place in the research and teaching farm of the Agronomy Department. The land was harrowed and ploughed. At Abraka, the experiment was carried out on a plot of land about 50 metres to Campus 2, Delta State University. Here, the land was prepared with local implements – shovels and hoes. The experimental beds/plots at both locations measured each 3 x 5m with 1.5m as inter-plot. Seeds planted were Ife-brown, obtained from the International Institute of Tropical Agriculture (IITA), Ibadan Nigeria. Three seeds were planted per hole at planting space of 60 x 30cm (Remison, 1978e) and seeds that failed to sprout four days after planting were replaced. Thinning to two per stand was done ten days after plant emergence. Each experimental bed consisted of six rows of 36 stands.

Chemical preparation and application

The chemical for the experiment was native soap (local black soap). Three concentrations were used namely 1, 2 and 3 percent. They were made by weighing 10, 20 and 30 grams of soap with triple beam balance (Hous model). Each weight was dissolved in 1000ml of water. The mixture was left overnight and filtered with muslin cloth. At the age of 26 days of growth, the cowpeas were sprayed with the chemical solution.

Experimental design

The experiment consisted of five treatments and three replicates organised into a randomised complete block design (RCBD). The treatments were 1, 2 and 3 percent soap concentrations, cypermethrin (as check) and a control.

Insect observations and data collection

Four key insect pests of cowpea were observed as follows: *Aphis craccivora*: Infestation assessment was carried out between 8 and 10 a.m. when the plants were 27 days old. From the two middle rows of each plot, twenty stands were randomly tagged. Each was carefully inspected and the *A. craccivora* colony size on each stand was visually scored on a 10 point scale (Table 1). The mean score for the 20 stands was then calculated and recorded. Six observations at 7 days' intervals were made.

Megalurothrips sjostedti

Damage to cowpea by *M. sjostedti* was determined from the two middle rows of each plot between 8-10 a.m. at the growth age of thirty days. Twenty stands in the two middle rows were tagged randomly and damage to cowpea was rated visually on a scale of 1-9 points (Table 2). Rating was based on known symptoms of damage such as browning/drying of stipules, leaf or flower buds; and bud abscission. The mean score for the 20 stands was calculated and recorded. Five observations at 6 days' intervals were made.

Maruca vitrata

Damage to flowers by *M. vitrata* was carried out in the field between 3-5 p.m. at 45 days after planting. Twenty flowers in the two outer rows of each plot were selected randomly and each was carefully opened and examined on the spot. Flower damage was based on the presence of *Maruca* larva or hole(s) on flowers. The number of flower bud thrips (an insect which feeds on pollen) was also determined when each flower was opened. Five observations at 5 days' intervals were made and the mean score for the twenty flowers was calculated and recorded.

Pod sucking bugs (PSBs): The number of pod sucking bugs was assessed between 8 and 10 a.m. when the cowpeas were 45 days old. From the two middle rows of each plot, the PSBs that rested on cowpeas were counted and recorded. All pod sucking bugs, from the nymphal stage were counted together since their damage are similar. Four observations were made at 7 days' intervals.

TABLE 1. Scale for rating aphid infestation on cowpea

Rating	Number of aphids	Appearance
0	0	no infestation
1	1-4	a few individual aphids
3	5-20	a few isolated colonies
5	21-100	several small colonies
7	101-500	large isolated colonies
9	>500	large continuous colonies

Source: Litsinger *et al*. (1977)

TABLE 2. Scale for rating flower bud thrips infestation on cowpea

Rating	Appearance
1	no browning/drying (i.e. scaling) of stipules, leaf or flower buds; no bud abscission
3	initiation of browning of stipules, leaf or flower buds; no bud abscission
5	distinct browning/drying of stipules and leaf or flower buds; some bud abscission
7	serious bud abscission accompanied by browning/drying of stipules and buds; non elongation of peduncles
9	very severe bud abscission, heavy browning, drying of stipules and buds; distinct non-elongation of (most or all) peduncles.

After Jackai and Singh (1988)

TABLE 3: Scale for rating *Maruca vitrata* damage to cowpea

	Pod load (PL)	Pod damage (PD)	
Rating	Degree of podding	Rating	%
1	most (<60% peduncles bare (i.e. no pods)	1	0-10
3	31-50% peduncles bare	2	11-20
		3	21-30
5	16-30% peduncles bare	4	31-40
		5	41-50
		6	51-60
7	Up to 15% peduncles bare	7	61-70
		8	71-80
9	Occasional bare peduncles	9	81-100

After Jackai and Singh (1988)

Yield and yield related components

Grain yield: Dry grain yield was determined from the two middle rows of each plot. At 65 to 70 days, pods were matured. They were then harvested with hands into black polythene bags, sundried for 7 days and then shelled with hands. Grains from the various treatments were then weighed with triple beam weighing balance (Haus model) and means calculated and recorded.

Seed weight

100 grains were hand-picked from each treatment and weighed with a weighing balance. Weights from the treatments were then recorded.

Number of pods/plant

At 60 days after planting (DAP), pods were fully filled and partially matured but still green. Two long sticks were used to mark out one metre long distance in the two middle rows of each plot. Cowpea pods and their stands which occupied this distance were counted. The number of pods was divided by the number of plant stands as shown below:

$$\text{Number of pods/plant} = \frac{\text{Number of pods}}{\text{Number of plant stands}}$$

Pod load (PL) and Pod damage (PD) by *M. vitrata*: These were assessed in the field when the plants were 60 days after planting (DAP). Both were visually scored on a scale of 1-9 points (Table 3). The *M. vitrata* damage index were holes and frass on pods and sticking together of pods.

Pod length: At 60 – 70 days after planting (DAP), pods were harvested from the two middle rows of each plot. According to plot/treatment, they were kept in labelled black polythene bags and were then sundried for 7 days. From each bag, twenty pods were randomly hand-picked and the length of each was determined with flexible thread. The mean value for the 20 pods was then calculated and recorded.

Pod evaluation index (Ipe): This was calculated following the formula below:

PL x (9 – PD) where PL is pod load and PD, pod damage (Jackai and Singh, 1988).

Seed damage: Seed damage by pod sucking bugs was carried out in the biology laboratory. At 65 days after planting (DAP), cowpea pods were matured and on the two central rows of each plot pods were harvested with hand into black polythene bag labelled according to plot number. The pods were sun-dried for one week. From each bag, twenty pods were hand-picked randomly. Each pod was then carefully opened and the number of seeds per pod was counted. The seeds were also classified into aborted seeds/pod, wrinkled seeds/pod and seeds with feeding lesions. Means for number of seeds/pod and the classified seeds were calculated and recorded for the various plots.

Data for insect observation yield and yield related components were subjected to analysis of variance (ANOVA) and significant means separated by Fisher's Least Significant Difference Test (LSD), at 5% level of significance.

RESULTS

During the early season experiment at Asaba, *A. craccivora* and pod sucking bugs (PSBs) were not observed; the other major insect pests occurred (Table 4). The various soap treatments slightly reduced *M. sjostedti* compared to control. There was no significant difference among the soap treatments. Similarly, no significant difference was observed for *M. vitrata* in the various treatments. On flower bud thrips population, the control recorded the least population, compared to soap protected plots. The key insect pests on cowpea (except PSBs) were observed in the early study at Abraka (Table 5). Soap concentration at 3 percent significantly ($P < 0.05$) reduced *A. craccivora* colonies and at 1 and 2 percent concentrations, the insect was slightly reduced when compared with the un-protected plots. For *M. sjostedti* damage, flower bud thrips population and *M. vitrata* damage, significant differences were not observed among the various treatments.

The data for the effect of locations on the major insect pests of cowpea under the application of native soap in the early season are presented in Table 6. *A. craccivora* was more at Abraka and significantly higher than Asaba. Conversely *M. sjostedti* damage to cowpea and flower bud thrip population, were significantly ($P<0.05$) higher at Asaba than Abraka. Pod borer damage was not significantly different at both locations. However, slightly more borers occurred at Asaba. For coreid bugs, the insect was not recorded at both locations.

Yield and yield related components

Grain yield in the early season at Asaba (Table 7) was moderately high; cypermethrin treated plots produced the highest grains. There was no significant differences among the protected plots and when compared with control. Yield related components such as 100 seeds weight, pod length, number of seeds/pod, pod damage, aborted seeds/pod, and wrinkled seeds/pods were not significantly different in values in all the treatments. Conversely, number of pods/plant, pod load, pod evaluation index and seeds with feeding lesions showed significant difference in values.

At Abraka, grain yield was high in all the treatments (Table 8). Cypermethrin had the highest grain yield. However, there were no significant difference among the various treatments and when compared with control. On yield related components, all treatments except 100 seeds weight were not significantly different in values among the treatments.

The results of the effect of locations on yield and yield related components in the early season are presented in Table 9.

The grain yield at Abraka was significantly (P<0.05) higher than Asaba. On number of pods per plant, pod load and pod evaluation index, mean values at Abraka location were significantly higher than Asaba. Pod damage, wrinkled seeds per pod and seeds with feeding lesions had values that were significantly higher at Asaba than Abraka. There were no significant differences between the two locations in terms of 100 seeds weight, pod length, number of seeds per pod and aborted seeds per pod.

TABLE 4: Effect of application of native soap on the major insect pests of cowpea in the early season at Asaba. (Egho and Emosairue, 2010)

Treatments	*Aphis craccivora* (rating)**	*Megalurothrips sjostedti* (rating)	Flower bud thrips* (actual counting)	*Maruca vitrata** (actual counting)	PSB** (actual counting)
CONTROL		1.52	0.04	0.14	0.00
1%		1.50	2.98	0.19	0.00
2%		1.50	2.42	0.09	0.00
3%		1.50	1.96	0.11	0.00
CPM		1.50	0.68	0.05	0.00
LSD(0.05)		NS	0.83	NS	NS

* Means of 20 flowers
** Number per 2-middle rows
CPM – Cypermethrin

TABLE 5: Effect of application of native soap on the major insect pests of cowpea in the early season at Abraka. (Egho, 2011b)

Treatments	*Aphis craccivora* (rating)**	*Megalurothrips sjostedti* (rating)	Flower bud thrips* (actual counting)	*Maruca vitrata** (actual counting)	PSB** (actual counting)
CONTROL	3.33	1.00	0.09	0.05	0.00
1%	2.22	1.00	0.11	0.09	0.00
2%	2.11	1.00	0.09	0.06	0.00
3%	1.56	1.00	0.11	0.07	0.00
CPM	0.83	1.00	0.00	0.00	0.00
LSD(0.05)	1.24	NS	NS	NS	NS

* Means of 20 flowers,
** Number per 2-middle rows,
CPM – Cypermethrin

TABLE 6: The location effect of the application of native soap on the major insect pests of cowpea in the early season at Asaba and Abraka

Season	*Aphis craccivora* (rating)	*Megalurothrips sjostedti* (rating)	Flower bud thrips* (actual counting)	*Maruca vitrata** (actual counting)	PSB** (actual counting)
Asaba Early	0.00	1.50	2.02	0.12	0.00
Abraka Early	2.01	1.00	0.08	0.06	0.00
LSD (0.05)	0.17	0.13	0.57	NS	NS

* Means of 20 flowers
** Number per 2 middle rows
NS-Not significant

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TABLE 7: Effect of native soap and cypermethrin on yield and yield related components from cowpea in the early season at Asaba **(**Egho and Emosairue, 2010)

Treatments	Dry Grain yield (kg ha^{-1})	100 seeds wt(g)	Number of pods/ plant (approx)	Pod length (cm)	Number of seeds/pod	Pod load	Pod damage	Pod evaluation index	Aborted seeds/pod	Wrinkled seeds/pod	Seeds with feeding lesions
CONTROL	636.10	12.50	6.43	14.66	13.38	4.33	5.00	18.67	5.92	2.02	0.43
1%	547.90	12.63	6.46	14.49	13.93	5.00	5.00	22.67	3.18	1.82	0.27
2%	570.00	12.80	3.30	14.37	13.95	3.67	6.00	12.33	2.77	2.25	0.92
3%	384.70	12.50	3.48	14.77	14.17	4.33	5.00	18.67	2.88	1.67	0.75
CPM	858.50	12.60	7.11	14.01	13.60	7.00	3.00	42.00	4.27	0.77	0.21
LSD(0.05)	NS	NS	3.56	NS	NS	1.61	NS	15.06	NS	NS	0.65

CPM – Cypermethrin

TABLE 8: Effect of native soap and cypermethrin on yield and yield related components from cowpea in the early season at Abraka **(**Egho, 2011b)

Treatments	Dry Grain yield (kg ha^{-1})	100 seeds wt(g)	Number of pods/ plant (approx)	Pod length (cm)	Number of seeds/pod	Pod load	Pod damage	Pod evaluation index	Aborted seeds/pod	Wrinkled seeds/pod	Seeds with feeding lesions
CONTROL	1045.10	13.20	10.63	14.51	13.55	9.00	1.33	69.00	**2.07**	0.15	0.12
1%	919.80	12.23	8.81	13.34	12.07	9.00	1.00	72.00	**2.50**	0.70	0.10
2%	1105.20	12.37	10.39	14.06	11.75	9.00	1.00	72.00	**4.23**	0.55	0.18
3%	1355.90	12.37	11.62	13.55	12.83	9.00	1.00	69.00	**2.58**	0.12	0.07
CPM	1085.90	13.00	9.29	14.25	13.78	9.00	1.33	69.00	**2.37**	0.33	0.00
LSD(0.05)	NS	0.95	NS	NS	NS	NS	NS	NS	**NS**	NS	NS

CPM – Cypermethrin

TABLE 9: The location effect on cowpea yield and yield related components under the application of native soap in the early season at Asaba and Abraka

Season	Dry Grain yield (kg ha^{-1})	100 seeds wt(g)	Number of pods/ plant (approx)	Pod load	Pod length	Pod damage	Pod evaluation index	No. of seeds/pod	Aborted seeds/pod	Wrinkled seeds/pod	Seeds with feeding lesions
Asaba Early	599.40	12.61	5.36	4.87	14.46	4.80	22.87	13.82	3.80	1.70	0.50
Abraka Early	1102.40	12.63	10.15	9.00	13.94	1.20	70.20	12.80	2.75	0.37	0.09
LSD(0.05)	211.91	NS	0.97	1.10	NS	0.91	7.82	NS	NS	0.66	0.13

NS= Not significant

DISCUSSION

A craccivora and pod sucking bugs were absent at Asaba in this study. Similarly, pod sucking bugs (PSBs) did not occur at Abraka. The absence of *A. craccivora* and PSBs in the study areas may be attributable to heavy rainfall at this period (April – July) which could have been unfavourable for the establishment of the two insects. Degri and Hadi (2000) reported from Bauchi, (Nigeria) the absence of *A. craccivora* on field cowpea under heavy rain-fed condition. Similar reports on low population of coreid bugs in early planting season of cowpea have also been documented by Dina (1982); Akinyemiju and Olaifa (1991) and Egho (2010). The use of soap in insect pest management is not a recent practice – well over 200 years and a number of minute insects such as aphids on some fruits and grasshouse have been reported susceptible to soap sprays. Others are mealybugs, psyllids and arachnids such as spiders and mites. IITA (2002) showed the beneficial effects of soap spray in the improved cowpea variety IT90K-277-2 and found yield of 516kg ha^{-1} compared to 361kgha^{-1} without insecticide. Under the application of native soap, the study indicated that native soap is a reliable natural insecticide; at 3 percent concentration, soap sprays significantly ($P < 0.05$) reduced *A. craccivora* colonies and slightly controlled *M. sjostedti*, both insects, among the major insect pests of cowpea reported earlier from the study areas (Egho, 2010). Results from this study have further indicated the efficacy of soap in insect pest management and agree with the report of IITA (2002).When the two locations were compared, Asaba recorded more insect pests than Abraka. Some years back, cowpeas were inconsistently cultivated at Asaba in the defunct Bendel State College of Agriculture. This, perhaps, could have led to a buildup of insect pests of cowpea in this agro-ecological zone compared to Abraka, where cowpea has never been grown. Insect pests from two agro-ecological regions, in terms of number, have been reported for some areas in Nigeria (Tobih, 2007). On grain yield, soap sprays produced grains that were significantly ($P<0.05$) higher at Abraka (1102.40 kg ha^{-1}) than Asaba (599.40 kg ha^{-1}). Yield differences due to locational effects for some other crops such as cassava (Akparobi *et al*., 2002); maize (Agbogidi, 2006) and yam (Tobih, 2007) have earlier been documented. The significant grain yield difference registered in the study areas may be due to soil factor (an area for investigation) since the insect load was light at both locations. Grain yield from the study areas were of high quantity and compare favorably with the grains from some of the major cowpea producing zones of Nigeria such as Bauchi (Degri and Hadi, 2000); Samaru, Kano and Ilora (IITA, 1986) and Bida and Mokwa (Afun *et al.,* 1991).The study here provides the evidence that planting cowpea at Asaba and Abraka during the early cropping season, under soap application is quite attractive, though cypermethrin (conventional chemical as check) proved superior. However, native soap was observed to cause delay and reduction in cowpea flowering. Moreover, Abraka agro-ecological zone is more productive in cowpea cultivation than Asaba, in Delta State, Nigeria.

CONCLUSION

Native soap at 3 percent concentration is an effective biopesticide in the management of cowpea insect pests, particularly *A. craccivora* and *M. sjostedti*. Grain yield is high during the early planting season at both locations. Abraka is however more suitable for cowpea cultivation compared to Asaba.

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