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Control of Pod-sucking bug *Riptortus dentipes* (Hemiptera: Alydidae) of Cowpea with aqueous Plant Extracts and Cymbush Super EC in Maiduguri, Nigeria

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Abstract
The cylindrical pod-sucking bug (*Riptortus dentipes* F.) is one of the dominant species of sap-sucking post-flowering insect pests (PFPs) in the Nigerian Savanna zone causing high yield losses by causing seed deformation, premature pod drying, seed abortion and pod shriveling. The present study assess the effects of neem seed oil (NSO), bitter melon (*Momordica balsamina*) and garlic (*Allium* sp) aqueous extracts and cymbush super EC for the control of this insect pest of cowpea in the Nigerian savanna zone. Field trials were carried out at the Teaching and Research Farm of the Faculty of Agriculture, University of Maiduguri, Nigeria in 2010 and 2011 wet seasons. Five treatments were each replicated four times in a randomized complete block design. Neem seed oil and garlic extracts significantly reduced the population of *Riptortus dentipes* on cowpea pods than bitter melon during the two wet seasons. Neem seed oil and garlic produced significantly higher undamaged pods, higher pod weights and higher grain weight in both years than bitter melon treated plots. Cymbush super (a combination of cypermethrin 30g + dimethoote 250g) insecticide produced the highest and best undamaged pods pod weights and grain yield in both seasons.
Keywords: Plant extracts, *Riptortus*, *dentipes*, cymbush super EC, threshed, unthreshed, Savanna zone

INTRODUCTION

Cowpea (*Vigna unguiculata* (L.) Walp.) is an important grain legume throughout the tropics and subtropics, covering Asia, Africa, Central and South America, as well as parts of Southern Europe (Dugje *et al*., 2009). Apart from being a major staple food and a cheap source of protein, it is a good source of fodder for cattle production as well as a rotational and a cover crop (FAO, 2006). Cowpea cultivation and yields in the Nigerian Savanna are known to be low and has continued to decline over the years because of a number of production constraints which include heavy insect pests infestation in the field resulting in colossal economic loss to the farmer (Singh *et al*., 2008, Asiwe, 2009, Egho, 2010, Degri, *et al*., 2012). Cowpea is vulnerable to insect pests during the reproductive stage more than seedling and vegetative stages (Degri and Chaudhary, 1998, Degri *et al.,* 2012). Several species of pod-sucking bugs (PSBs) like the spiny brown bug (*Clavigralla tomentosicollis*, Gaint pod bug (*Anoplocnemics curvipes*) and pod-sucking bug (*Riptortus dentipes*) are inportantinsect pests of cowpea in tropical Africa (FAO, 2006, Sharah and Ali, 2008 and Ahmed *et al*., 2009).

The pod-sucking bug (*Riptortus dentipes* F.) is a serious pest of cowpea in tropical Africa and Asia. The cylindrical nymphs and adults are usually seen resting on foliage or feeding on young shoots and green pods (Oparaeke *et al*., 2000). The nymphs and adults cause damage by sucking the sap from the developing young shoots and green pods causing seed deformation, premature seed drying seed abortion and pod shivelling with resulting economic loss of seed (Ogunwolu and Ameh, 2000, Degri and Hadi, 2000, Kamara *et al*., 2007, Dzemo *at al*., 2010, Egho, 2010 and Degri *et al*., 2012).

Although the use of a number of synthetic insecticides such as Lambda – cyhalothrin, Karate super, Sherpa plus, cypermethrin, dimethoate, deltamethrin, polytrinc, profenotos and monocrophos have been reported to give effective control and increase cowpea grain yields, the residual effect of such chemicals may cause environmental and human health hazards (Muthomi *et al*., 2007). Insecticides of plant origin as alternative to synthetics are being researched globally. Many researchers have found that the used of indigenous plant extracts are also good and effective for controlling cowpea insect pests of field and stored products (Ogunwolu and Amerh, 2000; Degri, 2011; Degri *et al*., 2012; Maina *et al*., 2012a and Maina *et al*., 2012b). This study therefore compare the effectiveness of Neem seed oil (NSO), garlic, bitter melon, with cymbush super EC for the control of cylindrical pod-sucking bug of cowpea in Maiduguri situated in the savanna zone of Nigeira.

MATERIALS AND METHOD

Field experiment were carried out at the Teaching and Research farm of Faculty of Agriculture, University of Maiduguri situated at the Sudan Savanna of North eastern Nigeria during 2010 and 2011 cropping seasons. The aim of the study was to assess the efficacy of three plant materials namely, neem seed oil (*Azadirachta indica*), bitter melon (*Momordica balsamina*), garlic bulb (*Allium* sp) in the control of pod-sucking bug (*Riptortus dentipes* F.) and compared with a synthetic insecticide cymbush super EC (a combination of cypermethrin 30g + dimethoate 250g). The basis for the choice of these plant materials was due to their

availability, ease of preparation and application by the poor-resource farmers in the savanna region. Another reason for choosing these plants was also to get indigenous plants that have insecticidal potentials for controlling cowpea pod-sucking bug as alternative to synthetic insecticides in the zone. Five treatments including control (check) each replicated three times in a randomized complete block design (RCBD) were used.

The experimental field was cleared, harrowed, ridged and borders raised manually. The net plot size was 4.0m x 3.0m with 1.0m interspaced between plots and alley of 2.0m wide. A cowpea variety IT89KD-288 which has a late maturing, semi-erect, photosensitive and large seed size was sown on 10th August, 2010 and 14th August 2011 at the rate of two seeds per hole, 30cm intra row and 75cm inter-row spacing (Onyibe *et al*., 2006 and Dugje, *et al*., 2009). Gap filling was done at two weeks after germination to maintain the optimum plant population per plot. Weeding was done manually with a hoe at 3, 6 and 9 weeks after sowing.

Fresh bitter melon shrubs and garlic bulb were obtained from the University farm botanical garden and Monday market while the neem seed oil (NSO) was purchased from local processing shop at Baga road, Maiduguri. The fresh bitter melon shrubs, and garlic bulbs were washed with clean water and then pounded using mortar and pestle into paste. The paste from each plant was weighed 100g and poured into 5000ml conical flask containing one litre of water (weight/volume). The paste and the water in the conical flask were manually stirred thoroughly for five minutes and was left for two hours and thereafter sieved using 1.0mm sieve to get the 10% suspension (Ogunwolu and Ameh, 2000 and Degri, *et al*., 2012).

The neem seed oil was purchased from recognized neem seed oil commercial markets in Baga road, Maiduguri, while the synthetic cymbush super EC insecticide was purchased from an agrochemical marketer in Maiduguri. The application of the aqueous plant extracts was done by using CP 15 knapsack sprayer at the rate of 100g/litre of water, neem seed oil was mixed with soap solution and applied at the rate of 50ml/litre of water and cymbush super EC was applied at 30g + 250g a.i/litre. The treatments application were done at an interval of 7 days. After the application of each product, the sprayer was washed thoroughly with clean water and triple rinsed before introducing the next product into the spraying container. The first application started from flower bud initiation when the cylindrical pod-sucking bugs were seen feeding on the developing young shoots, peduncles and green pods. Treatment applications stopped when most of the shoots, peduncles and pods were matured and turned brown ready for harvest.

Pod-sucking bug (*Riptortus dentipes*) population count was done by direct count method done of the conspicuous nymphs and adults from the beginning of podding till pod physiological maturity early in the morning (6.00am – 8.00am) on randomly selected five plants per plot and tagged at 24 hours before and after spraying. Mean number of damaged and undamaged pods were obtained at pod harvest. The pods were harvested when most of them reached physiological maturity. Harvested pods were kept in a well labeled polythene bags then weighed separately using sensitive weighing metler balance model P.E 2000 and recorded. Mean number of pods per plant and pod weight per plant were also obtained at pod harvest. The matured pods were counted on five randomly selected plants per plot and recorded. Pod weights per plant were taken at harvest. The matured pods counted from five randomly selected plants per plot were then weighed separately using sensitive weighing metler balance and recorded. Mean seed number per pod and 100 seed weight per plot were taken at harvest. Ten matured pods at larvest were randomly selected from each plot. These pods were opened and their seeds counted and recorded. Also, 100 seeds from each plot were kept in a well labeled separate polythene bags and the weighed using Furi electronic scale model FEJ: 5000 and recorded. Mean cowpea grain yield were taken at harvest. The total cowpea grain yields were obtained from harvested physiologically matured pods. Harvested matured pods from each plot were kept in a well labeled separate bags, then threshed, winnowed and weighed using metler balance (PE 2000 model).

Data collected from the various parameters were subjected to analysis of variance (ANOVA) using statistix version 8.1 and the means were compared using least significant difference (LSD) at 5% level of probability.

RESULTS AND DISCUSSION

The result presented in Table 1 showed that there were significantly different among the five treatments. Cymbush super reduced the population of the cylindrical pod-sucking bug much better than the three aqueous plant extracts while untreated check did not reduce the pod-sucking bug population during the two years trials.

The infestation of the cowpea by pod-sucking bug *Riptortus dentipes* was significantly reduced by cymbush super, neem seed oil and garlic because of their effectiveness, deterrent and suppressant activity of their individual active ingredients on the pests. The combining effects of cypermethrin and dimethoate in cymbush super proved more superior than the actions of the individual active ingredient of the three plant extracts. Cymbush super had significantly lower pod-sucking bug population than neem seed oil, garlic and bitter melon because of it systemic and contact action on the pest which have provided protection to the cowpea pods including the newly developing young shoots, peduncles and green pods (Kamara *et al*., 2007, Ahmed *et al.,* 2009, Degri, 2011 and Degri *et al*., 2012). The three plant extracts showed low efficacy in reducing the pod-sucking bug population during the two seasons because their individual active ingredients Azadirachtin in neem

seed oil, triterpenoids and saponin in garlic and saponin-glycocide in bitter melon were not as toxic as that of symbush super. Also their actions are contact and not systemic so therefore, they could not provide protection to the peduncles and the old and newly developing pods for a long period (Sharah and Ali, 2008, Dzemo *et al*., 2010).

Table 1: Effect of aqueous plant extracts and cymbush super on cowpea pod-sucking bug population in 2010 and 2011 cropping seasons after spraying in Maiduguri

Treatment	Mean population of cowpea pod-sucking bug	
	2010	2011
Garlic bulb	0.30	0.26
Neem seed oil	0.30	0.26
Bitter melon	0.50	0.60
Cymbush super	0.25	0.10
Check	7.75	6.00
SE∀	0.10	0.34
LSD (0.05)	0.2	0.8

There were significantly more undamaged pods/plant, more pods/plant and higher pod weight/plant, higher seed weight and significantly higher grain yield recorded in cymbush super treated plots than neem seed oil, garlic and bitter melon during the two cropping seasons (Table 2, 3 and 4). Cymbush super having systemic and contact action on the pod-sucking bug protected the peduncles and the pods against the pests. It has stopped the nymphs and adults from feeding on the sap from the developing young shoots, peduncles and green pods which usually cause seed defarmation, premature seed drying, seed abortion and pod shriveling (Ogunwolu and Ameh, 2000, Muthomi *et al*., 2007 and Ahmed *et al*., 2009).

Table 2: Effect of aqueous plant extracts and cymbush super on cowpea pod damaged in 2010 and 2011 cropping seasons in Maiduguri

Treatment	Mean damaged pods/plant	Mean undamaged pods/plant
Garlic bulb	5.30	19.36
Neem seed oil	4.90	18.20
Bitter melon	7.00	16.11
Cymbush super	4.70	21.34
Check	10.29	6.10
SE∀	0.60	1.20
LSD (0.05)	1.39	3.11

The neem seed oil, garlic and bitter melon extracts could not protect the peduncles and pods from being sucked and fed by the pod-sucking bug because of their contact action which do not last long like systemic action. This therefore led to the lower undamaged pods/plant, lower pods and pod weights/plant, lower seed weight and grain yield during the two cropping seasons. This result agreed with the findings of Degri *et al* (2012) who reported that post-flowering insect pests such as the pod-sucking bugs (PSBs) attack at flowering and podding stages are a significant and serious constraints to increased and sustainable cowpea grain production in the savanna zone of Nigeria. Pod-sucking bug pests like the cylindrical pod-sucking bug (*Riptortus* sp) which attack and suck the sap from the reproductive structures of cowpea during their early developmental stage cause serious seed deformation, drying, abortion, pod shriveling which resulting to loss of seed (Egho, 2010).

Table 3: Effect of aqueous plant extracts and cymbush super on pod/plant and pod weight/plant in 2010 and 2011 cropping seasons in Maiduguri

Treatment	Mean pods/plant	Mean pod weights/plant (g)
Garlic bulb	23.31	14.26
Neem seed oil	25.24	15.31
Bitter melon	23.21	12.37
Cymbush super	26.10	17.09
Check	15.98	9.30
SE∀	0.78	0.50
LSD (0.05)	1.80	1.01

Table 4: Effect of aqueous plant extracts and cymbush super on 100 seed weight and grain yield in 2010 and 2011 cropping seasons in Maiduguri

Treatment	100 seed weight (g)	Mean grain yield (kg/ha)
Garlic bulb	14.96	942.20
Neem seed oil	15.10	976.11
Bitter melon	14.70	886.02
Cymbush super	19.13	1210.28
Check	10.32	310.13
SE∀	0.50	63.10
LSD (0.05)	1.02	137.42

The untreated check had more number of pod-sucking bugs attack hence the lowest number of undamaged pods, lowest number of pods, lowest pods weight and significantly lowest grain yield in both seasons. This suggest that cowpea grain production without insecticide application will suffer from heavy insect pests attack in the field especially pod-sucking bugs and hence the colossal economic loss to the farmers (Singh *et al*., 2008).

Table 5 show the cost-benefit analysis for controlling the cylindrical pod-sucking bug (*Riptortus dentipes*) of cowpea. Cymbush super EC produced the highest grain yield and profit followed by neem seed oil, garlic bulb while bitter melon had the lowest grain yield and profit. The result showed that bitter melon had the highest cost benefit ratio (1:1475.70) followed by garlic bulb (1:784.17) and neem seed oil (1:405.71) while the conventional insecticide cymbush super EC had the lowest cost-benefit ratio (1:120.03). This indicates that aqueous plant extracts used to control pod-sucking bug on cowpea during the two cropping seasons gave more economic benefit when compared to the synthetic insecticide cymbush super EC. This is because of the higher cost of the synthetic insecticides than the indeginous plant materials which are readily available, easy to prepare and applied by the farmers, Ahmed *et al*., 2009, Degri *et al*., 2012).

Table 5: Cost-benefit analysis of controlling *Riptortus dentipes* using plant extracts and cymbush super in Maiduguri in 2010 and 2011 cropping seasons

Treatment	Grain yield (kg/ha)	Yield value (x/ha)	Cost of treatment (x/ha)	Yield value minus cost of treatment (x/ha)	Cost-benefit ratio
Garlic bulb	942.20	235,550.00	300	235,250.00	1:784.17
Neem seed oil	976.11	244,027.50	600	243,427.50	1:405.71
Bitter melon	886.02	221,505.00	150	221,355.00	1:1475.70
Cymbush super E	1210.28	302,570.00	2,500	300,070.00	1:120.03
Check	310.13	77,532.50	0	77,532.50	-

CONCLUSION

This study showed that cowpea production with neem seed oil, garlic and bitter melon spray can help in protecting the shoots, peduncles and pods from being damaged by pod-sucking bug. These aqueous plant extracts have proved to be potential candidates as alternative to synthetic insecticides in the savanna region. This work has established that these plants have significantly reduced pod-sucking bug population and improved pod production and grain yield when applied at 100g/l at 7-days intervals.

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