Damage assessment of *Helopeltis schoutedeni* Reuter (Hemiptera: Miridae) on selected cashew accessions in the field.

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ABSTRACT

The bug, *Helopeltis schoutedeni* Reuter sucks the sap from the shoots, inflorescence, developing nuts and apples of cashew, thereby causing considerable crop loss. Due to the far-reaching consequences associated with the application of pesticides for controlling pests, this study aimed at exploring the option of evaluating for resistance among cashew accessions, which is cost effective and environment–friendly. Field study was conducted on eight cashew accessions comprising 40 stands each during the flowering/fruiting and post-flowering seasons. Data was collected on the total number of twigs and total number of infested twigs by the bug from the base to girth at breast height of 1.2m. Young and mature cashew plants raised from Brazilian Jumbo nut- size were the least damaged with infestation levels of 9.01% and 8.9%% respectively during the flowering/fruiting period, while during the post-fruiting season, infestation levels of 22.02% and 4.37% were observed on young and mature cashew plants raised from Jumbo nut-size respectively. Mature cashew stands raised from Indian medium and Indian small nut-sizes were often the most susceptible with infestation levels of 44.64% and 40.83% respectively during the flowering/fruiting period. Attack was more severe during the flowering/fruiting period which might be due to the abundance of food sources through flushing. While this field evaluation is on-going, further studies will be conducted to ascertain the mechanisms of resistance.

Keywords: cashew genotype, infestation percentage, crop season

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INTRODUCTION

The cashew tree, *Anacardium occidentale* L. is a tropical tree crop. It originated in Brazil and was introduced to Nigeria by the Portuguese traders between the 15th and 16th century (Ohler, 1988). The cultivation of cashew started in the former Eastern region of Nigeria where it was grown for the purpose of checking the menace of erosion and soil degradation. The world major producers of cashew nuts are India, Tanzania, Mozambique, Nigeria and Cote D'Ivoire. At present, it is grown in almost all the agro-ecological zones in Nigeria. The cashew nut production has been on steady increase from 30,000 metric tonnes in 1990 to 636,000 metric tonnes in the year 2006 (FAO, 2007).This significant increase has been due mainly to the involvement of private entrepreneurs, Federal and State Governments, Cooperative societies and affluent farmers in cashew cultivation (Aliyu and Hammed, 2008). The total land area under cashew cultivation has increased to 320,000 hectares (FAO, 2007). The introduction of Brazilian cashew biotype with improved and desirable nut and kernel quality characteristics by the Cocoa Research Institute of Nigeria (CRIN) has further increased the crop's spread and popularity in Nigeria (Hammed *et al*., 2007, Asogwa *et al*., 2008).

Cashew is grown commercially for its kidney-shaped nut, which is ranked third among edible nuts in the international market in terms of demand (Azam-Ali and Judge, 2001). The nut is healthful and nutritious; it contains carbohydrate (21 %), protein (22 %), unsaturated fats and lots of mineral elements. Other products derived from the tree include cashew nut shell liquid (CNSL), which is a versatile liquid for both industrial and medicinal purposes. The pseudo-apple is a very rich source of vitamin C. The bark is also medicinal.

In Nigeria, the production of cashew is impaired mostly by problems associated with its pest complex. Cashew hosts a wide range of pests and diseases. These pests infest its various parts including roots, stems, twigs, branches, flowers and inflorescence and the pseudo-apples. The major insect pests include the longhorn beetle-*Analeptes trifasciata* Fabricius (Coleoptera: Cerambycidae) which girdles stems and branches, the red-banded thrips- *Selenothrips rubrocinctus* Giard (Thysanoptera: Thripidae) which attack the leaves and the fruit scrapper- *Pachnoda cordata* Drury (Coleoptera: Scarabaeidae) in descending order of importance (Adeyemo and Okelana, 1989). Other economic insect pests are *Plocaederus ferrugineus* (Anikwe *et al*., 2007) and *Helopeltis schoutedeni* (Mokwunye *et al*., 2011).

H. schoutedeni is an economic insect pest of cashew in most growing countries. It is observed to attack both young and mature cashew trees. The bug sucks sap of young flushes, inflorescences, immature nut and apples. The feeding puncture predisposes the plant to fungi infection which in combination with the insect poisonous saliva causes the inflorescence and twig dieback on cashew. In an earlier study conducted by Olunloyo (1979), it was observed that some sap sucking insects were involved in the inflorescence dieback of cashew, which caused about 40% crop loss annually. Hammed and Adedeji (2008) reported that twig-dieback is a major limiting factor in cashew

production in Nigeria. However, in Nigeria, most farmers hardly apply pesticides due to several constraints among which are lack of technical know-how, high cost and unavailability of the pesticides. In addition, cashew is usually treated as a casual crop as the income derived from it is quite poor. As a result, it becomes imperative to build on farmers approach by sourcing for non-chemical alternatives that are eco-friendly and cost effective. Consequently, this preliminary study was carried out to assess the feeding preference of the bug to some selected cashew accessions on the germplasm plot during the flowering/fruiting and post-flowering seasons. The information generated will be used to faciliatate further studies on cashew improvement research.

MATERIALS AND METHODS

Study site: The study was conducted at the Cocoa Research Institute of Nigeria, Ibadan, Nigeria. Ibadan has an annual average rainfall of 2000mm with a bimodal pattern. CRIN is located in the humid rainforest ecosystem with mean solar radiation of 18mj/m^2/day. It lies between the latitude 7º30'Nand longitude 3º 54'E at an altitude of 200m above sea level. The study site was the cashew germplasm plot which was established in 2005 and planted in geometry of 6m by 6m with a total of 320 stands. There were eight blocks containing 40 stands each. Due to some factors affecting the cashew establishment, some stands were missing and gapping up was usually done on a yearly basis. Each block represents an accession and all the stands were observed. The various accessions belong to two selections i.e. the Brazilian and Indian. The Brazilian group comprised Jumbo, Extra Large, Large and Medium nut sizes. The Indian selections included the large, medium, small and madras nut sizes. Data was taken on the total number of twig and the number of twigs damaged by *H. schoutedeni*, which is usually characterised by dieback. This was computed and expressed in percentage. These data were taken separately for mature and young cashew stands for two seasons (at the flowering /fruiting and the post-flowering seasons). Data obtained were subjected to T-test and ANOVA statistical analysis. Means were separated using Turkey's studentized Range Test.

RESULTS AND DISCUSSION

It was observed that all the accessions were attacked by the bug all through the two seasons but damages were at varying levels. Tables 1 and 2 show the comparison between damages done at the two seasons on the young and mature stands respectively. Table 1 shows that there was no significant difference in damage caused by *H. schoutedeni* on young cashew stands of the same accessions in both seasons, thus implying that the bug did not show preference for any of the accession above the others. Meanwhile, there were significant differences in the damage percentage on mature cashew stands raised from Brazilian Large nut size, Brazilian medium nut-size and Indian Large nut-size at the two seasons. In this regards, damage levels were higher at flowering period than during the post-flowering period (Table 2). On mature stands, cashew stands raised from the Indian medium nut-size

had the highest damage level of 45.87% closely followed by the Indian small nut size with 45.68%; the lowest damage level was observed on mature cashew stands raised from Brazilian jumbo nut-size (9.67%) during the flowering season (Table 2).

As shown on Table 3, at the flowering/fruiting season, there were significant differences observed between the young and mature stands of the following accessions: Brazilian extra large, Brazilian large, Brazilian medium, Indian Large and Indian madras nut sizes. Most of the mature accessions recorded higher levels of damages. The bug is usually crypic and prefers cool microclimate and the mature trees with full canopy can provide this form of shade. On the contrary, the other accessions did not show any significant difference in damage level between the young and mature stands (Table 3). Table 4 shows the damage of *H. schoutedeni* on both the young and mature stands of same accessions during the post-flowering season. There was no damage observed on the young cashew stands raised from Brazilian extra large and Indian medium nut-sizes during this period. Most of the accessions did not show significant difference between the mature and young stands; except for the Brazilian large (4.88% and 14.05% infestation on young and mature stands respectively) and Indian madras nut-sizes with 18.37% and 26.73% infestation on young and mature stands, respectively (Table 4). Bug damage level was higher on mature stands than young cashew stands.

Among the young stands of the various accessions during the flowering season, it was observed that cashew plant raised from Indian small nut-size with 50% damage level was significantly different from the rest of the accessions (Table 5). But it was not significantly different from stands raised from Indian madras with damage level of 21.3%. On the other hand, there were significant differences observed among the mature stands of the various accessions at the same season. Cashew plants raised from Indian medium and small nut sizes were the most damaged with varying values of 45.87% and 45.68% respectively. And these were significantly different from all the Brazilian selections and Indian madras. Mature cashew stands raised from Brazilian jumbo nut- size were the least damaged with 9.67% damage level. Even though it was closely followed by Brazilian large (24.09), Brazilian extra large (24.39) and Indian madras (27.32%), there was significant difference among them (Table 5).

A similar trend was observed on the mature stands during the post-flowering season. Cashew stands raised from Indian medium and small nuts were the most attacked with values of 31.8% and 27.82%, respectively. The jumbo stand had the lowest damage value of 4.37% but it was not significantly different from the Brazilian large, Brazilian medium and Indian large nut –size. It was observed that there was no significant difference among the young accessions during the post-flowering season (Table 5).

Table 1: Evaluation of *Helopeltis schoutedeni* damage on young cashew stands of same accessions during the flowering/fruiting season and post-flowering season at the cashew germplasm plot, CRIN, Ibadan.

Accessions	Damage % Flowering season	Damage % Post-flowering season	T-Test
Brazilian Jumbo	11.67	26.92	ns
BrazilianExtra large	11.11	0.00	ns
Brazilian large	12.50	4.88	ns
Brazilian medium	15.38	22.22	ns
Indian large	19.23	58.33	ns
Indian medium	5.00	0.00	ns
Indian small	50.00	8.33	ns
Madras	38.10	18.37	ns

Means with same superscript along columns are not significantly different. P=0.05

Table 2: Evaluation of *Helopeltis schoutedeni* damage on mature cashew stands of same accessions during the flowering/fruiting season and during the post-flowering season at the cashew germplasm plot, CRIN, Ibadan.

Accessions	Damage % Flowering season	Damage % Post-flowering season	T-Test
Brazilian Jumbo	9.67	5.81	ns
BrazilianExtra large	24.39	14.97	ns
Brazilian large	24.09	14.05	sign.
Brazilian medium	33.13	18.01	sign.
Indian large	35.20	15.75	sign.
Indian medium	45.87	34.27	ns
Indian small	45.68	33.33	ns
Madras	27.32	26.73	ns

Means with same superscript along columns are not significantly different. P=0.05

Table 3: Evaluation of *Helopeltis schoutedeni* damage on young and mature cashew stands of same accessions during the flowering/fruiting season at the cashew germplasm plot, CRIN, Ibadan.

Accessions	Damage % Young stands	Damage % Mature stands	T-Test
Brazilian Jumbo	11.67	9.67	sign.
BrazilianExtra large	11.11	24.39	sign.
Brazilian large	12.5	24.09	sign.
Brazilian medium	15.38	33.13	sign.
Indian large	19.23	35.20	sign.
Indian medium	5.00	45.87	ns
Indian small	50.00	45.68	ns
Madras	38.10	27.32	sign.

Means with same superscript along columns are not significantly different. P=0.05

In Nigeria, varietal classification of cashew is at infancy, hence accessions are categorised on the basis of nut sizes. *H. schoutedeni* attacked all the accessions at varying levels. It is worthy to note that the attack was more severe during the flowering/fruiting season; this could be attributed to the fact that the bug sucks the sap of young flushes, inflorescence, immature nuts and apples. The population of the insect increased at the flowering/fruiting season due to the availability of food source hence its damage was more pronounced at this period. Generally, the Brazilian nuts recorded lower infestation levels which in most cases were not significantly different from the Indian nuts.

Table 4: Evaluation of *Helopeltis schoutedeni* damage on young and mature cashew stands of same accessions during the post-flowering season at the cashew germplasm plot, CRIN, Ibadan.

Accessions	Damage % Young stands	Damage % Mature stands	T-Test
Brazilian Jumbo	26.92	5.81	Ns
BrazilianExtra large	0.00	14.97	Ns
Brazilian large	4.88	14.05	sign.
Brazilian medium	22.22	18.01	Ns
Indian large	58.33	15.75	Ns
Indian medium	0.00	34.27	Ns
Indian small	8.33	33.33	Ns
Madras	18.37	26.73	sign.

Means with same superscript along columns are not significantly different. P=0.05

Table 5: Evaluation of *Helopeltis schoutedeni* damage on selected accessions of young and mature cashew stands during the flowering/fruiting season and post-flowering season at the cashew germplasm plot, CRIN, Ibadan.

Accessions	Flowering season		Post-flowering season	
	Damage % Young stands	Damage % Mature stands	Damage % Young stands	Damage % Mature stands
Brazilian Jumbo	11.67b	9.67d	26.92a	5.8c
BrazilianExtra large	11.11b	24.39c	0.00a	14.9b
Brazilian large	12.5b	24.09c	4.88a	14.05bc
Brazilian medium	15.38b	33.13bc	22.22a	18.01bc
Indian large	19.23b	35.20ab	58.33a	15.75bc
Indian medium	5.00b	45.87a	0.00b	34.27a
Indian small	50.00a	45.68a	8.33a	33.33a
Madras	38.10ab	27.32c	18.37a	26.73ab

Means with same superscript along columns are not significantly different. P=0.05

Nymphs and adults attack young and tender leaves, shoots, flowers and fruits (nuts and apples). The saliva of the insects is very toxic and the site of attack is marked by lesions. Severe attack of the shoot may cause dieback and heavily infested trees can be recognized from a distance by their scorched appearance. This corroborates studies carried out by Olunloyo and Esuruoso (1975) that some sap-sucking insects predispose the cashew twigs and inflorescences to infestation by pathogen (*Lasiodiplodia theobromae*). In Tanzania, it has been discovered that the primary causal agent are sucking insect pests, after which a secondary fungus, *Phomopsis spp* gains entrance into the wound and bring about the dieback syndrome (Topper *et al*., 1998, Boma and Topper, 1998). In certain endemic areas, the entire flush dries up and the tree presents a scorched appearance. The infestation of inflorescence results in "blossom blight". The immature nuts infested by this pest develop characteristic eruptive spots and finally shrivel and fall off.

Cashew is a robust tree crop with a natural ability to recover from dieback attack but the yield can be affected because of delay in fruiting. According to Hammed and Adedeji (2008), the period of resumed flushing would have been too late for the plant to produce nut yield in that cashew season. Each insect can damage 3-4 shoots or panicles leading to heavy loss in yield. Under outbreak situations, a damage of 25-30 per cent may be expected. Olunloyo 1979 observed that inflorescence dieback is a major limiting factor affecting cashew nut production in Nigeria, causing 40-45% crop loss annually.

Use of plant resistance to insect pest is a veritable tool that can be used to curb insect pest attack. It is environment –friendly, cheap and sustainable. Improvement of pest resistance in crop requires details on insect feeding behaviour which can be influenced by physical and chemical plant defences. The preference for some of the accessions could be chemically or genetically induced or due to some morphological characteristics such as succulence of shoots. Although this is a preliminary work, however it has provided useful information for cashew improvement research. Further investigation will be conducted on the underlying factors responsible for the interaction observed.

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