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Assessment of damage and losses to kolanuts caused by kolanut weevils *Balanogastis kolae* (Desbr) Coleoptera: Curculionidae

W. Esther[1], A. M. Petu-Ibikunle[2], A. Audu[2] and Y. Y. Shallagwa[1]

1. Department of Agric. Engineering, Ramat Polytechnic, Maiduguri, Nigeria
2. Department of Agric Sci. and Tech. Ramat Polytechnic, Maiduguri, Nigeria

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ABSTRACT: A study was carried out to assess the damage and losses to kola-nuts caused by kola-nuts weevils in Maiduguri. The experiment were carried out in Laboratory using split plot design and the treatment were *Cola nitida* and *Cola acuminata* as the main factors and fours levels of insect infestation as the sub-factors. The results showed that caffeine content of cola reduces significantly with increasing levels of infestation and the caffeine content of the two species differs significantly. The interaction of caffeine content between the cola species is also significant. The weight significant and they have equal opportunities of drying out and the storage method has very high level of significant.

Keywords: Kola-nuts, kola-nut weevils, Storage methods.

Introduction

The term "Kola" is the collective name for the seed of four tree species namely cola, acuminate schott and Endl. (Agboola, 1979). It belongs to sterculeacea family. Kola is one of the major tree crop grown in Nigeria today, the two species of kola that are of commercial importance include *Cola nitida* and *cola acuminata* while *Cola verticillata* is less importance due to the nuts scimy nature when chewed (Daramola, 1981). The first two are produce mostly in western states of Nigeria and is the main source of income for most farmers in the western states. The product of kolanut in Nigeria rose from 24,000 tonnes in 1940 (Hensen, 1964) to 120, 000 tonnes in 1966 (Van Ejnattern, 1973)

An increase in production by 24% between 1966 and 1976 was reported (Opeke, 1992) while Van Ejinattern (1973) projected that an annual production figure rise to 163,000 tonnes by 1985. These increases in production are probably traceable to the increase in awareness of the importance of the crop. The various uses of kolanuts has indoubtedly created a high demand for it excess of its production. Kolanut are used widely as a stimulatant and raw material for soft drink factories. (e.g. Coco-cola and Pepsi Cola) infact the original formulation of Coca cola was thought to be made of kola and cola. At presenty, Cocaine tree, Coca leaves and kola are used to make the cocaine (Simpsor and Conner, Ogorzaly 1986). More recently, kolanuts (seed) are used in production of kola wine and in the manufacture of certain drugs, Cocoa butter and so on (Jeattle, 1970, Eka, 1971, Ogutuga, 1975, Opeke, 1993). Kolanut is also used in social functions, while its tannin content qualifies it as a good source of dyes in textiles and thread

(Daramola, 1987, Oludemokun, 1979). In most cases, the nuts are chewed raw to suppress hunger and thirst and to inhibit fatique while its caffeine content acts to prevent sleep

About 70% of the total world product of kolanuts comes from Nigeria (Quarco, 1973, Jacob, 1973). Out of this, 10% is exported while the rest are consumed locally (Quarco, 1973). Kola is grown principally in the rain forest zones of Southern Nigeria (Ndubuaku, 1989). However a considerable proportion of the product is transported to the Northern parts of the country where there is a great demand for kolanuts. Kolanut are packaged in multiple layers of old cement papers bags lined internally with fresh Banana leaves. Basket could be used in place of old cement paper bags: both of which make it possible for the nuts to loss moisture gradually and still remain fresh and in an acceptance condition for the consumer (Daramola, 1983). It was also observed that the taste and quality of koalnuts improved with storage period. Nuts could be stored for three to six months. Ivbijaro (1976) recorded an average moisture content of 40% and 36% respectively with an increase in sugar content 9% (in fresh nuts) to 18.5% after six months of storage. These conditions have been reported to favour oviposition and development of the kolanut weevils in the absence of an adequate control measures, especially in the early stages on the extent of qualitative losses in stored in Borno state. Moveover, there are limited information on weevil infestation on stored kolanut in Borno state. This study therefore, estimate the quality of losses arising from weevils infestation and to investigate the effect of weevil infestation on caffeine content of kolanuts.

Materials and Methods

The study was conducted at the science Laboratory of Department of General Agric, Ramat Polytechnic, Maiduguri from 1997 to 1998. The study was conducted in phases.

Market surveys were carried out in order to asses the infestation by kolanut weevils on storage facilities which could be importance predisposing factors. Laboratory study were carried out to determine the effect of weevils infestation on the caffeine content of kolanut at different categories of infestation. *Cola nitida* and *Cola acuminata* were the Varieties used and the Storage methods used were: Basket with Plantain leaves, Pod storage, Open evaporative cooling, and Open storage.

The weight and total number of number of nuts in each sample batch were determined. That is, The nuts were separated into the infested and un-infested batches and the weight as well as the number of nuts in each of the categories were recorded separately. The presence of adult emergence holes was used to diagnose the infestation of the nuts and the percentage of damaged was calculated as:

$$\% \text{ of damaged nuts} = \frac{\text{Number of infested Kolanuts X 100}}{\text{Total number of kolanuts in sample}}$$

The infested nuts were open with scapel, the portion of each nuts which displayed no infestation or damage were removed and discarded The weight of the discarded nuts were was taken and the percentage weight loss was calculated as :

$$\% \text{ weight loss} = \frac{\text{Number of Discarded Nuts X 100}}{\text{Total weight of sample}}$$

Caffeine content analysis were done in an analytical experiment, the analysis were conducted at least two times for each category that is, for infested and uninfested nuts. Infested batches of white and red Variety of kolanuts were purchased and sorted out according to the number of emergence holes as a Mild infestation, Moderate infestation. Another batch of uninfested white and red nuts were obtained and the caffeine content was determined according to Irgolic et al., (1982) methods. Two samples of grated kolanuts was put into a round bottom flask and 300ml of distilled water were added to each. The mouth of the flask were covered with condenser and then connected to closed but running tap or closed jar of water and were each of the flask were placed on electric heater. As soon as the content beg an to boil the closed tap or Jar of water were opened to drain the water and the set were allowed to stand for one hour. As the content was boiling, the refluxing system was turned on and the refluxed was sieved out grated Kola (with 0.1mm and 0.2mm sieve) into 200ml beaker. The residue were discarded and the filtrate was retained and placed in ice block for 15minutes; Thereafter, 100ml of the filtrate were placed in a 250 ml separatory

funnel amd 120ml of chloro form were added gradually. The corked separatory funnel was shaken until the chloroform, water interface was established and after 50 minutes clear solution was formed into which caffeine dissolved in chloroform. It was later put into 50ml beaker and chloroform evaporated over a water bath. The weight of the resultant yellowish white caffeine crystals was taken on mettler P-165 electric balance.

The amount of caffeine was calculated as Amount of Caffeine in Un-Infested nuts X(g) – Amount of Infested nuts X(g) – Z(g), which is expressed as percentage thus

$$\frac{Z(g) \times 100}{X(g)}$$

Arc sine transformation was used to transform the data for percentage reduction of caffeine infested kolanut and the transform data were subjected to Analysis of Variance.

Results

Table 1 shows that a significance difference was recorded in the weight of the varieties of kolanuts after two weeks of storage, *Cola nitida* recorded a higher weight loss (404.00g) compared to *Cola acuminata* which has the weight loss of 397.19g. In the weight loss of the storage methods: Banana leaf lining has the highest weight loss (459.00g) compared with other storage method. Open evaporative cooling (429.38g), Pod storage (387.50g) and Open storage (326.50g) respectively. There is no significant effect in the interaction between storage method and Kola varieties with weight loss.

A significant difference were recorded in the percentage damaged among kola varieties with highest percentage recorded in *Cola Acuminata* (66.04%) compared to *Cola nitida* which recorded lowest percentage of 65.14%. The highest percentage among storage methods were recorded an Open evaporative (70.41%) compared to other methods.

Table 1: Weight loss and percentage of damaged nuts in kolanut species.

	Weight loss	Percentage of damaged nuts
Kola variety (A)		
Cola nitida	404.00	66.044
Cola acuminata	397.19	65.144
SE	32.8	1.68
LSD (P=0.05)	80.36	4.11
Storage Method (B)		
Banana leaves lining	459.00	70.20
Open Evaporative Cooling	429.38	70.41
Pod storage	387.50	63.23
Open storage	326.50	58.54
SE	17.68	1.76
LSD (P=0.05)	37.13	6.53
Interaction A x B(C)	NS	*

*Significant at P=0.05

Table 1: Caffeine content in kolanut species.

	Caffeine Content (%)
Cola Variety (A)	
Cola nitida	126.88
Cola Acuminata	77.73
SE±	0.4998
LSD (P=0.05)	1.225
No. of Drills Holes (B)	
1 – 3	10.14
4 – 6	7.758
7 – 10	5.860
10 above	1.907
SE±	0.311
LSD (P=0.05)	0.653

In Table 2 a significant difference was recorded amongst the two species of kolanut. There are much different in the caffeine content of the two species with higher content recorded on *Cola acuminata* (126.88%) compared to *Cola nitida* which recorded lowest percentage of 77.73%.

In response to the treatment, a significant Caffeine content were also recorded in kolanut according to the level of infestation and the following values were obtained 1.97, 5.68, 7.76 and 10.11 respectively.

Discussion

Kolanut losses weight due to tissue respiration and evapotransiration. This physiological reaction is activated by high temperature and low relatively humidity. Moisture loss therefore become remarkable and consequently is not known. In this study apart from the weight loss recorded; losses due to insect infestation were also recorded and estimated as reduction in caffeine content and percentage nut damage. This confirmed the study by Patternson (1992) which showed that Ceratitis kolae is next to the weevils as a pest of kolanut. Albert et. al., (1992) suggested that hearly all the stands of kolanut trees in Nigeria are infested by kolanut weevils. The most important pest of kolanut are Balonogastris kolae and Sophorirhinus Species (Daramola and Taylor, 1975a). The weevils are field to store pest of kolanuts and their eggs are usually laid inside the nuts or pods during the feeding entry or exit points made by other insect or directly with pods or nuts.

Moisture loss in stored kolanut is responsible for nut loss and this can be minimized by appropriate method. The caffeine content of kola differs within species and kola variety and this reduces level of infestation. The degree of weight loss in kola differ with the species likewise the degree of infestation and rate if depletion of its caffeine content.

Conclusion

Moisture loss in stored cola is responsible for the not loss. This can be minimized by appropriate method. The caffeine content of cola differ with species and kola variety. Thus reduces will level of infestation.

The degree of weight loss in kola differ with the species likewise the degree of infestation and rate of depletion of its caffeine content.

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