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Analysis of traders' perception and adaptive techniques in the control of kola weevil, *Balanogastris kolae*

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A survey involving 160 kola nut traders who were randomly selected in two local governments of Ondo state was conducted to examine pest management practices carried out by the traders. Interview schedule structured questionnaire was used in a multi-stage random sampling to select 40 kola nut traders from two villages in each local government. Results showed that most of the respondents were already old with the mean age of 67 years, 87.5% were female, while 80.0% were married. Also, 25.0% had no formal education, 50.0% took farming as primary occupation. 80% traders used phostoxin tablets in preserving their kola nuts after proper curing though 40% still made use of gammalin 20 despite environmental concerns. Since 50% of traders used phostoxin, effectiveness of the fumigation was implicated as a preferred protectant. 80% of the respondents sources for chemical majorly from the hawkers, though only 35% of respondents were aware of the recently approved pesticides for use on kola, while 10% of the traders claimed to be aware of the ban. Thus, only 15.6% of traders claimed to be aware of health implications. Finally, the results of chi-square analysis revealed that relationship between socio-economic variables and insect pest control is highly significant. Traders were faced with a lot of constraints such as poor extension visit, paucity of information about the practice which consequently affected pest management practice on their farms.

Key words: Phostoxin, gammalin 20, preservation, insecticide, fumigation.

INTRODUCTION

In Nigeria, the cola species of economic importance are *Cola acuminata* and *Cola nitida* (Quarco, 1973; Daramola, 1983). Oluokun and Olalokun (1999), reported that two million metric tonnes of kolanut produced annually in Nigeria represents 70% of world production. Therefore, Nigeria is the major producer of kola nuts (Jacob, 1973; Asogwa et al., 2006) and a significant proportion of Nigerian population derived their means of livelihood from kola farming, trading and industrial utilization. Kola nut is closely associated with traditions and culture of many tribes in Nigeria (Daramola, 1978; Opeke, 1987). *C. acuminata* is commonly used in social, religious, ritual and ceremonial engagements in the Southern and Middle-belt parts of Nigeria. *C. nitida* "kola

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commerce" is increasing in demand for its usage in pharmaceutical industries and for production of soft drinks, wines and candles (Ogutuga, 1975). Its uses have inevitably created a high demand in excess of its production (Oladokun, 1985).

Daramola (1973, 1978), reported that the kola weevils, *Balanogastris kolae* Desbr and *Sophrorhinus* spp are the most destructive pest of kola nut in West Africa. They are "field-to-store" pests as their infestation is initiated in the field and persists in storage (Daramola and Ivbijaro, 1975). Percentage infestation ranges from 30 to 100% depending on the sanitary condition on the farm and the time of harvest (Daramola, 1973); this accounts for a loss of about 60% of the produce (Quarco, 1973). Eggs are laid on the nuts or in other parts of the fruit. The larvae feed inside the nut leaving tunnels filled with frass. Circular holes are made in the nuts by emerging adults thereby exposing the kola nuts to secondary invasion by micro-organisms, especially fungi (Daramola, 1983; Odebode, 1990). The average period from oviposition to the emergence of the adults of *B. kolae* is 29 and 31 days for *Sorphrorhirus spp.* Breeding was noted to continue throughout the year on leftover nuts and nuts produced between the main harvest season (Daramola, 1974; NRI, 1996). These weevils are reported to attack wounded or damaged fruits.

Nut quality

The quality of the kola nuts is adversely affected by the presence of weevils. Adult weevils feed on the nuts. The damages caused destroy the nuts thereby lowering its market value (NRI, 1996]. The value of kola nuts is also determined by the quality such as size, flavor, keeping quality and colour. White colour nuts are regarded as superior to pink and purple nuts in flavor. However, flavor and keeping quality are determined by the efficiency of curing and storage.

Control

Kola weevils are controlled chemically by fumigation of the nuts with phostoxin (Gerald, 1967), dipping of weevil-infested nuts in concentrate of 0.03% gamma BHC emulsion (Ivbijaro, 1977) and irradiation of kola nuts using gamma radiation generated from cobalt 60 (Daramola, 1973; 1978). Control of kola weevils in stored produce with the aid of a fumigant (methyl bromide) was proposed by Alberta and Mallamaire (1955) (Table 1). Re-infestation may be prevented by spraying of the storage space with DDT or BHC.

Idowu and Ojelade (1994, 1995) observed that minimal level of weevil damage was recorded on kola nuts which were obtained from timely harvested pods (35.42%) when compared with the nuts obtained from pods whose harvest were delayed (58.25 to 83.3%). Destruction and proper disposal of all debris from the nuts and the replacement of earthen floors at kola nut deposits with cemented ones (Daramola and Taylor, 1975).

During the first 4 weeks of preservation, the nuts should be carefully and repeatedly examined for weevil infestation. All infested nuts should be removed and destroyed. When nuts are free from weevils, it is necessary to examine them only once a month, and at each examination, the leaves used for lining the baskets should be replaced with fresh materials.

Ndubuaku (2000) reported that the kola weevil exhibit five geotaxis, therefore farmers should concentrate on the physical removal of adult weevils from the bottom of the baskets and that the crevices at the bottom of the baskets should be thoroughly inspected during regular replacement of banana leaves to ensure that the weevils hiding at the bottom of the baskets were not overlooked.

Though, cultural method is laborious and not very effective; it is recommended for the control of kola weevils. This is because kola nuts do not require further processing after skinning and curing before consumption. However, kola nut traders, who are mostly women are pre-disposed to the use of chemicals because of its knock down effects despite the potential hazards posed by pesticides to man and his environment; hence this informed timely search for alternative control measures against the kola weevil (Anikwe and Ojelade, 2005).

Concerted efforts should be made to monitor, regulate and synchronize the various techniques adopted by the traders in controlling weevil infestation. Introduce sanity to the control methods adopted by the traders.

Objectives of the study

The general objective of the study was to ascertain the pests management practices by kola traders in the study areas. The specific objectives are to:

i. Ascertain the socio-economic characteristics of the respondents,
ii. Examine the insect pests affecting kola in the study areas,
iii. Determine methods used by the kola traders to control pests in the study areas.

The hypotheses of the study

HO_1: There is no significant relationship between source of information and pests management practices by kola traders in the study areas.

Table 1. Weevil infestation and control measure.

Name of pest	Damage	Control measure
B. kolae (major)	Larvae and adults feed on the nuts and on the trees	Phostoxin tablet or trigocide capsule as fumigant. Soaking of seeds with husks in gammalin solution

METHODOLOGY

Two local government areas were purposely selected due to the facts that they are known for kola trading. The two local government areas selected were Idanre/Ifedore and Akoko South West LGAs in Ondo State. Forty kola traders were selected in each of the local government area to make a total of one hundred and sixty kola traders for the study.

A total of 160 sampled kola traders were interviewed individually in two Local Government Areas (Idanre Ifedore and Akoko South West) in Ondo State. In the LGAs, four villages (Owena, Ijare, Supare and Oka Akoko) were randomly selected while 40 farmers were sampled from each village giving a total of 160 farmers. Data collected include, socio-economic characteristics, farmers' pest control methods, size and land ownership. Frequencies, percentages, and Chi-square (X^2) were used for presentation and analysis of the data collected.

RESULTS AND DISCUSSION

Table 2 showed that 37.5% of the respondents were between the age group 25 and 45 years, closely followed by (34.4%) of respondents who were between the group of 46 and 66 years; while, few (25.0%) were between the group of 67 and 87 years. It could be seen that middle aged and old traders are involved in the kola nut trading in the area. It involves all stakeholders both strong and feeble because this part of production is invariably less tedious and challenging/tasking. The study reveals that majority of the respondents were in the age range of 25 to 66 years which indicates that they are still active in kola trading.

The distribution based on gender classification revealed that 12.5% were males while 87.5% were females. The dominance of the females over the male maybe attributed to the fact that females are involved in off-farm activities such as buying and selling of farm produce, while their males counterparts were involved in highly energy sapping/demanding part of production restricted to on-farm activities. The implication here is that there would be more hands to do less tedious job but much painstakingly operations in kola production such as collection, de-husking, curing and protection. This is in consonance with Adamu et al. (2006), who stated that majority of rural women engaged in off-farm activities such as packing of farm produce, buying and selling of farm produce, storage of crops among others.

The table also showed that 50% of the respondents were married, closely by 25% widow; while 15.6 were divorcee, only 9.4% were single, which connotes that marriage is highly cherished by the people in the study area and could lead to increase in household size. The table also revealed that 25.0% did not attend school, while 50.0% of the respondents had primary school leaving certificate while others attended one form of education or the other. This distribution did favour pests management practices since half of the respondents were literate. This is in consonance with Okunola (2006) who stated that education influences various management practices among farmers. Education is a major factor that could influence farmers practices and they could easily adopt technologies transferred to them which increase their income for carrying out insect pest control. The table also revealed that 64.6% of the respondents took farming as their secondary occupation while 20.0% took artisan and other engagements as their secondary occupation. The table also revealed that 76.5% of the respondents took kola trading as their primary occupation while 23.5% took farming, artisan and civil servant as their secondary occupation. This implies kola trading is a major means of livelihood for the traders.

Table 3 showed the respondents' distribution based on insect pest management, it was revealed that for the curing or preservation of kola nuts, 50% of the respondents used phostoxin tablets, while 25% used gammalin 20, while 12.5% used Aldrex 40 while the remaining 12.5% used other materials. This however reflects the effectiveness of phostoxin tablet by the 50% of the respondents. 25% of the respondents used gammalin 20 despite the snag/inadequacy while 12.5% consider the use of both phostoxin tablet and gammalin 20 as their choice insecticide. This implies that various chemical insecticides were used for curing and preservation of kola nuts in the store and most traders in the study area rarely use other phytosanitary methods.

Table 4 showed that 50.0% used fumigant in the preservation of kola nuts while 25.0% used contact source as control method, while the remaining 25.0% used stomach method of control. The implication is that, fumigants are more

Table 2. Socio-economic characteristics of respondents.

Variable categories	Frequency	Percentage
Gender		
Males	20	12.5
Females	140	87.5
Age		
25-45	60	37.5
46-66	55	34.4
67-87	40	25.0
Above 90	5	3.1
Marital status		
Single	15	9.4
Married	80	50.0
Divorcee	25	15.6
Widow	40	25.0
Widower	0	0
Educational status		
No formal education	40	25.0
Adult education	20	12.5
Primary	80	50.0
Secondary	20	12.5
Tertiary	0	0
Secondary occupation		
Farming	80	50.0
Artisans	20	12.5
Others	20	12.5
None	40	25.0

Source: Field Survey 2014.

Table 3. Distribution based on chemical used for kola nut preservation.

Type of chemical	Frequency	Percentage
Gammalin 20	40	25.0
Phostoxin	80	50.0
Aldrex 40	20	12.5
Other	20	12.5
Total	160	100

Source: Field Survey 2014.

convenient for the traders in preserving kola nuts which however resorted to insect free kola nuts. 80.0% of respondents applied the insecticides twice for the control of the insect pests, while 20.0% each was recorded by respondents who applied the insecticide for once or thrice. This indicated that for long preservation, phostoxin should be applied at least twice using a tablet cut into different fractions. This result however confirms the

Table 4. Distribution based on method of kola nut preservation.

Method of control	Frequency	Percentage
Fumigation	80	50
Contact	40	25
Stomach	40	25
Total	160	100

Source: Field Survey 2014.

Table 5. Distribution based on rate/frequency of application.

Application rate	Frequency	Percentage
Once	40	25
Twice	80	50
Thrice	40	40
Total	160	100

Source: Field Survey 2014.

effectiveness of phostoxin tablet in curing/preservation of kola nuts. Some traders used gammalin 20 despite the snag/inadequacy associated with the use of the chemical insecticide. Though some traders also consider the use of both phostoxin tablet and gammalin 20 as their choice insecticide.

Table 5 showed that majority of the respondents (50.0%) bought insecticides from the hawkers, while 37.5% patronised the retail shop, only 6.3% purchased from chemical dealer, while 6.3% of the respondents did not buy from any of the source (Table 6). This implies that traders did not follow proper channel for the right insecticide to use. Traders make do with what is available irrespective of the authencity and originality. The main source of information on chemical used is traced to agrochemical retailers and interactions among the kola traders which is amounted to 91.6% of the respondents. Some kola traders obtained information from their parents. There was however the likelihood that knowledge might be distorted if received from other sources except from experienced extension agents (Tijani, 2006) and associated government agencies. Thus, information source on the status of chemical was traced to fellow kola traders and agrochemical sellers in the vicinity.

Fifty percent of the respondents recorded between 25 to 50 insect damage level, while 25% respondents experienced between 50 to 75 insect damage level (Table 7). This level of damage is corresponding to the degree of infestation characterised the kola nuts attacked by the various pests in the store. Majority of the traders acknowledge the presence of the kola weevils in the stored kola nuts. Traders also notice some other pests that they cannot be identified. While few claimed ignorance of pests. It was revealed that kola weevils were the common storage pests of kola nuts except few unidentified insects as being complained by the respondents.

From Table 8, it was shown that most respondents (75%) acknowledged the effectiveness of phostoxin over other chemical preservatives. This result however confirms the effectiveness of phostoxin tablet in curing/preservation of kola nuts. Some traders used gammalin 20 despite the snag/inadequacy associated with the use of the chemical insecticide.

The results in Table 9 showed that only 21.9% of the respondents are aware of approved insecticide, while majority of the respondents (78.1%) claimed ignorance of the policy. Also, majority of the respondents (93.7) is not aware of banned insecticide either, whereas only 6.3 of the respondents claimed to have knowledge of banned insecticide. However, the majority of the respondents (84.4%) were not aware of health hazard inherent in banned insecticide, while just 15.6% respondents awared of the risk associated with the over-dependence on insecticide as a means of control.

Table 10 showed the significant relationship between respondents source of information and management practices of pests in the study areas. The result revealed that sex and awareness of approved and banned insecticide has no significant relationship with insect characteristics and insect pest control, while age, educational status, types of chemical and insect damage have significant relationship. However, sources of chemical and types of insects are of significant relationship with insect pest control. This implies that

Table 6. Distribution based on source of chemical used.

Chemical source	Frequency	Percentage
Retail shop	60	37.5
Hawkers	80	50.0
Chemical dealer	10	6.3
Others	10	6.3
Total	160	100

Source: Field Survey 2014.

Table 7. Distribution based on insect damage.

Damage level	Frequency	Percentage
>25	20	12.5
25-50	80	50.0
50-75	40	25.0
75-100	20	12.5
Total	160	100

Source: Field Survey 2014.

Table 8. Distribution based on efficacy of insecticide used.

Potency	Frequency	Percentage
Phostoxin tablet	120	75
Gammalin 20	40	25
Total	160	100

Source: Field Survey 2014.

Table 9. Awareness of approved/ banned insecticides and hazard inherent.

Approved insecticide	Frequency	Percentage
Yes	35	21.9
No	125	78.1
Total	160	100
Banned insecticide	**Frequency**	**Percentage**
Yes	10	6.3
No	150	93.7
Total	160	100
Health hazard	**Frequency**	**Percentage**
Yes	8	5.0
No	152	95.0
Total	160	100

Source: Field Survey, 2014.

Table 10. Chi-square analysis of relationship between socio-economic variables and common chemical used for the control of insect pests.

Variable	X^2	P value	Decision
Sex	90.00	0.00	S
Age	46.25	0.00	S
Educational status	60.00	0.00	S
Types of chemical	60.00	0.00	S
Sources of chemical	20.00	0.00	S
Types of insect	128.75	0.00	S
Insect damage	60.00	0.00	S
Awareness of approved insecticide	50.62	0.00	S
Awareness of banned insecticide	122.50	0.00	S

frequency of information received has a strong effect on the pests and management practices.

Conclusion

The study ascertained the pests management practices carried out by the traders in Ondo State. Forty kola traders were randomly selected from two villages each in the two local government areas of the State. The study revealed that majority of the traders were between 25 and 66 years of age with kola nut preservation (insect pest control) experience. The study also revealed that kola weevils (*Balanogastris kolae* and *Sorphrorhinus* spp.) are the major pests of the kola in the study area.

The study concludes that pests management practices were rife in the study area. However, only unguarded/unscreened method of chemical control tinged/combined with cultural method control were employed in curing and preservation of kola nuts.

Finally, it was revealed that significant association exists between information sources and insect pests management in the study area.

Conflict of Interests

The authors have not declared any conflict of interests.

REFERENCES

Adamu CO, Sodiya CI, Awotunde JM (2006). Agricultural Income-Generating Activities of Rural Women in Ijebu North-East Local Government Area of Ogun State. In Proceedings of Fifteen Annual Congress of Nigerian Rural Sociological Association, pp. 75-76.

Alberta H, Mallamaire A (1955). Les characons de le noix de cola on Afrique; Moyens de les combattre. Bull. Proc. Vouv. Gen. Afr. Occ. Franc. Dir. Gen Sugv. Econ. insp. Gen. Agric. 92:29-88.

Anikwe JC, Ojelade KTM (2005). Evaluation of Tetrapleura tetraptera (Schum & Thonn) fruit for the control of *Balanogastris kolae* (Desbr) infesting stored kola nuts. Ife J. Sci. 7(1):27-30.

Asogwa EU, Ojelade KTM, Anikwe JC, Ndubuaku TCN (2006). Major kola insect pests. In: Insect pests of cocoa, kola, coffee, cashew, tea and their control. Answ. Comm. Concepts, Apapa, Lagos, Nigeria, pp. 57-60.

Daramola AM (1973). The bionomics of kola weevils, *Sophrorhinus* spp (Coleoptera: Curculionidae) Ph.D Thesis, Univ. of Ibadan, Nigeria. 325 p.

Daramola AM (1974). Studies on the survival of the kola weevils between seasons of kola production in Southern Nigeria. Turial 20(3):309-310.

Daramola AM (1978). Insect pests of Cola in Nigeria. Research Bulletin No. 3 CRIN, Ibadan.

Daramola AM (1983). Studies on the control of kola nut weevils, Balanogastris kolae and *Sophrorhinus* spp (Coleoptera: Curculionidae). Trop. Stored Prod. Inform. 46:11-16.

Daramola AM, Ivbijaro MF (1975). The distribution and ecology of kola weevils in Nigeria. Nig. J. PIant Prot. 1(1):5-9.

Daramola AM, Taylor TA (1975). Studies on the re-infestation of kola in store by kola weevils in Southern Nigeria. J. Stored Prod. Res. 11:61-63.

Gerald BM (1967). The control of Balanogastris kolae (Desbr) and Sophrorhinus insperatus (Fst.) (Coleoptera: Curculionidae) in small samples of stored kola nuts using phosphine. Bull. Ent. Soc. 1:43-48.

Idowu OL, Ojelade KTM (1994). The effects of cultural maintenance operations in kola farms on field infestation of C. Nitida nuts by the weevils. Ann. Rep. CRIN, Ibadan, Nigeria 224 p.

Idowu OL, Ojelade KTM (1995). Effects of timeliness of kola pod harvesting on weevil infestation in the field. Ann. Rep. CRIN, Ibadan pp. 28-30.

Ivbijaro MF (1977). Gamma-BHC residues in kola nuts, *Cola nitida* and control of the kola nut weevil, *Balanogastris kolae* Desbr. Indian Exp. Biol. 15(12):1236-1238.

Jacob VJ (1973). Yield characteristics, incompatibility and sterility studies in *Cola nitida* (Vent) schott and Endlicher. Ph.D Thesis. Univ. Ibadan.

Ndubuaku TCN (2000). Studies on the distribution of kola weevils, Balanogatris kolae (Desbr) (Coleoptera: Curculionidae) in traditional storage baskets. Bulletin of Science Association of Nigeria, P 23.

Natural Resources Institute (NRI) (1996). A guide to insect pests of Nigerian crops, identification, biology and control. Federal Ministry of Agriculture, National Reserch Nigeria Oversea Development Admininistration, UK. 253 p.

Odebode AC (1990). Post-harvest rot of kola nuts caused by *Botryodiplodia theobroma* and *Fusarium pallidoroseum*. Ph.D Thesis. Univ. Ibadan. 180p.

Ogutuga DBA (1975). Chemical composition and potential commercial uses of kola nuts, *Cola nitida* (Vent.) Schott and Endlicher. Ghana J. Agric. Sci. 8:121-125.

Okunola JO (2006). Factors associated with adoption of food crops

production technologies by small scale farmers in Niger Republic. Ogun J. Agric. Prod. (in press).
Oladokun MAO (1985). Objectives and achievements in kola propagation research. Paper presented at symposium to mark the 21st Anniv. Establi. CRIN. 10 p.
Oluokun JA, Oladokun MAO (1999). The effects of graded levels of brewers spent grain and kola nut pod meal in the performance characteristics and carcass quality of rabbits. Nig. J. Anim. Prod. 26:71-77.
Opeke LK (1987). Tropical Tree Crops. Spectrum Books Limited, Ibadan, Nigeria.
Quarco T (1973). A handbook on Kola. CRIN., Ibadan. 90 p.
Tijani AA (2006). Pesticide use practices and safety issues: The case of cocoa farmers in Ondo State, Nig. J. Hum. Ecol. 19(3):183-190.