STUDY ON THE CORRELATION OF INSECT PEST INFESTATION OF GUINEA CORN (*Sorghum bicolor*) STORED IN KASARAWA AND KUFFA FOOD WARE-HOUSES IN SOKOTO METROPOLIS, SOKOTO STATE-NIGERIA.

ABSTRACT

Farming of Guinea corn in Sokoto is face with a lot of Crop protection problems which prevent full scale production of this crop in the state and Nigeria at large. A study was conducted to assess the correlation of insect pest infestation of Guinea corn stored in Kasarawa and Kuffa Food Ware-houses in Sokoto Metropolis Sokoto State-Nigeria. A total of Two Hundred and Fourty (240) grain samples were collected and examined for insect pest infestation using compound microscope and the result was analyzed using Chi-square statistical tool. The result of this study showed that 172/240 (71.67%) were positive for insect pest infestation. There were significance difference between the infestation and nature of the food ware-house ($P<0.05$). The result of infestation in relation to the location were the samples are collected from the food ware-houses shows that, top location 71/80 (88.75%) has the highest rate of the Infestation, followed by the middle location 53/80 (66.25%) and the least Infestation was recorded in the bottom location of the food ware-houses 30/80 (37.50%). There is also a significance difference between the infestation and locations where the samples are collected from the food ware-house ($P<0.05$). Of the two species identified, *Tribolium confusum* is found in all the three food ware-houses with the frequency of 0.7 and 0.6 respectively while *Tribolium casteneum* was found only in Kuffa/Old Kara food ware-house with the frequency of 0.2. This may be related to the nature of food ware-houses. Used of resistance varieties, Improve sanitation, proper maintenance and fumigation of the food ware-house in and out during storage and while receiving new produce will help to reduce the rate of insect pest infestation in the study area, Sokoto State and Nigeria at large.

Key Words: Insect Pest, Infestation, Guinea Corn, Food Ware-house, Sokoto.

1.1 INTRODUCTION

Most of the Sorghum produced in Nigeria is stored at farm/village Level by rural farmers to ensure domestic consumption and seed for planting in the next season [1]. [1] Added that storage is particularly important because agricultural production is seasonal while the demands for agricultural commodities are more evenly spread throughout the year. In this circumstance, there is a need to meet average demand by storing excess supply during the harvest season for gradual release to the market during off-season periods to stabilize seasonal prices. Safe storage of grains against insect damage is a serious concern [2]. Insect pests have been the major problem of Agriculture in the tropics for long as favorable conditions exist for the pest and poor post-harvest handling facilities which results in substantial waste of farm produce and hence, considerable loss to the economy [3].

Sorghum grain is produced for human consumption and for animal feeds. The stem and foliage are used as green chop, hay, silage and pasture. In some areas, the stalk is used as building materials and plant remains (after the head is harvested) may be used as fuel [4]. Seeds are saved from the previous harvest but little conscious selection is practiced apart from rejecting the types that are unpalatable. However, most varieties are well adapted to the duration of the growing season and farmers realize it is unwise to sow seed from other areas. Therefore, the distribution of sorghum varieties is likely to follow the pattern of natural vegetation [5].

Several factor are responsible for infestation considerably pest inflict their damage on stored product mainly by direct feeding, some species feed on endosperm causing loss of weight and quality, while other species feed on germs resulting in poor seed germination and less viability [6]. [7] Report that, due to damage done by insect, grains loss value for making consumption or planting. Most storage pests are able to increase in numbers drastically within a relatively short period of time and affect the overall production of Sorghum annually. This research is aimed at studying the insect pest infestation of guinea corn stored in Food Ware-houses in Sokoto metropolis with a view to identify the possible ways of preventing and controlling the insects pests infestation in the study area.

[8] Observed that, pests are one of the major constraints to agricultural production in Africa particularly in Nigeria. A large number of insect and mite pest attack crops during all stages of growth- from seedling to storage [8]. One of the major problems facing Nigeria is shortage of food [9]. Agricultural

productivity and total annual food and fiber production in Nigeria are pitiably poor and much below expectation. Nigeria has been feeling the pinch of general food shortage through soaring food prices, particularly since the end of the civil war in 1970 and this is largely contributed by lost and damage cause by pest [10].

2.0MATERIALS AND METHODS

2.1 Study Area

The study area consists of two metropolitan Local Government Areas of Sokoto, Sokoto North and Wamakko Local Governments. Sokoto metropolis is geographically located between the longitude $13^0$01'/$13^0$05 North and latitude of $5^0$10'/$5^0$18' East as seen in figure 1. Sokoto metropolis covers the extensive geographical area of about 20 square kilometer with a total population of over one million people (Ibrahim *et al*., 2020). Sokoto metropolis shares border with Kware L.G.A Local Government Area to the North, Dange Shuni Local Government Area to the South, Silame Local Government Area to the West and Sokoto South Local Government Area to the East respectively. The peoples are predominantly Hausa-Fulani whose main occupation is farming and animal husbandry (11). The vegetation of the State falls under Sudan Savannah which is characterized by abundant grasses with scattered trees. The grasses are usually short 1.5 – 2m whereas the trees are short, few and scattered; not more than 15m tall. The main annual rainfall is about 1000mm. Rainfall usually starts from May and ends in September (11).

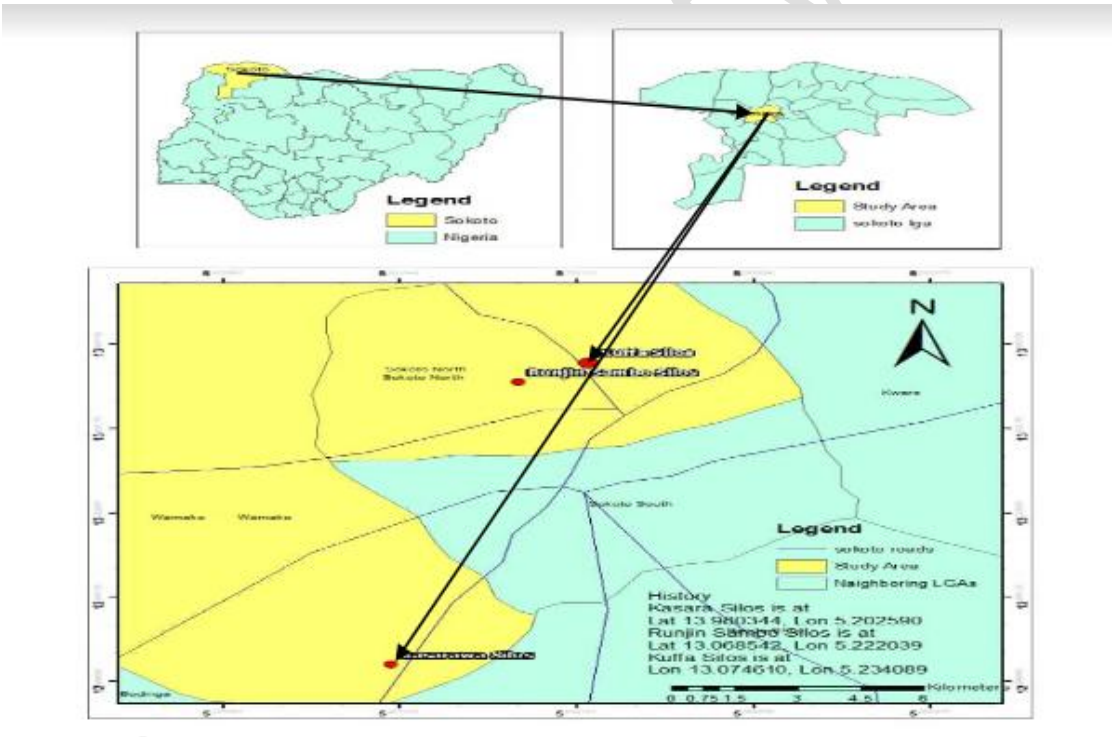

Figure 1: Map of Sokoto and its Environs showing the study area
Source: GIS Lab. Department of Geography SSU 2021

2.2 Sample Size Determination

The sample size was determined by the method used by [11] for calculating sample size.

$$N = \frac{Z^2pq}{d^2}$$

Where:
N = sample size, Z = standard normal distribution, p = prevalence factor, q = complementary proportion of P (1-p), d = tolerable margin of error
Thus
N=?, Z= 1.96, p = 0.0851 (Inovo *et al* 2000 and Wayne 2010), q = 1- p = 1- 0.0851 = 0.9149, d = 5% (0.05)
Therefore

$$N = \frac{1.96^2 \times 0.0851 \times 0.9149}{0.05^2}$$

$$= \frac{3.84 \times 0.0779}{0.0025}$$

$$= 120$$

Therefore, a total of one hundred and twenty (120) samples from each of the two selected food ware-houses will be the subject of this study. Thus, a total of two hundred and forty (240) samples will form the subject of this research work.

2.3 Samples Collection

Sorghum samples were collected randomly from 2 food ware-houses located in Sokoto metropolis, one hundred and twenty (120) from each food ware-house given a total of two hundred and forty (240) samples collected as subject of this study. 1kg of guinea corn were extracted from the randomly selected bags from difference location (top, middle and down) using local extracting tools and put into a polythene bags. All the polythene bags were systematically levels according to their food ware-houses for easy identification [12].

2.4 Identification of Insect Pest

The collected samples were immediately transferred to entomology laboratory, Department of Biological Sciences, Usmanu Danfodiyo University, Sokoto for identification of difference type of insect pest with the help of a qualified laboratory technologist as described by [13].

2.5 Statistical Analysis

Data were analyzed using simple percentage and prevalence values within each factor, (Location, type of insect pest etc) were statistically compared using Chi-square (χ^2) tests at confidence interval (CI) of 95% as described by [11].

3.0 RESULTS

3.1 Prevalence of Insect Pest in the Study Area

The total of two hundred and Fourty (240) samples were collected and examined for insect pest infestation in the study area, the result of insect pest infestation, showed that 172/240 were positive for the infestation which represent a total of (71.67%) as see in table 1.

Table 1: Prevalence of Insect Pest in the Study Area

Food Ware-house	No. Samples	No. Positive (+)	Prevalence (%)
Kuffa/Old Kara	120	100	83.33
Kasarawa	120	72	60.00
Total	**240**	**172**	**71.67**

χ2=3.84, df= 1, P= 0.0016

3.2 Prevalence of Insect Pest Infestation in Base on Location of Sample

The result of insect pest infestation in relation to location were the samples are collected showed that, there is high rate of infestation at the top location 71/80 (88.75%), followed by the middle 53/80 (66.25%) and least insect pest infestation was recorded in the bottom location 30/80 (37.50%) of the food ware-houses as seen in table 2.

Table 2: Prevalence of Insect Pest Infestation Based on Location of Sample

Location	No of Sample	No. Positive (+)	Prevalence (+)
Top	80	71	88.75
Middle	80	53	66.25
Bottom	80	30	37.50
Total	**240**	**231**	**64.17**

χ2= 5.9915, df= 2, P= 0.0000

4.3 Prevalence of Insect Pest Infestation in Relation to Species

The result of insect pest infestation in relation to the species identified in the study area shows that, only *Tribolium confusum* is identified in all the food ware-houses in the study area at the frequency of 0.7, and 0.6 respectively. Similarly, *Tribolium casteneum* is only identified in Kuffa/Old Kara Market food ware-house with a frequency of 0.2 as seen in table 3.

Table 3: Prevalence of Insect Pest Infestation in Relation to Species

Sample Area	Species Identified	Frequency (%)
Kuffa/Old Kara	*Tribolium confusum*	0.7
	Tribolium casteneum	0.2
Kasarawa	*Tribolium confusum*	0.6
	Tribolium casteneum	- - - -

χ2=7.81, df= 3, P= 0.0000

4. DISCUSSION

The result of the present study on correlation of insect pest infestation of Guinea corn (*Sorghum bicolor*) stored in Kasarawa and Kuffa/Old Market Food-ware Houses showed that the overall prevalence stood at 71.67%. This high prevalence may be associated with the nature of food-ware house, the structure of the building, oldness of the food ware-houses, poor sanitary condition and lack of maintenance.

This finding was in agreement with the finding of [14] who reported 65.25% damage cause by insect pest infestation in their study in south western Nigeria. Similarly, this study was also in line with the findings of [15] who reported 65% infestation of insect pest in their study on the control of *Sitophilus zeamais* (Motsch) (Coleoptera: Curculionidae) on Sorghum Using some plant powders in Katsina State North Western Nigeria. However, the result was in contrast with the findings of [16] who reported 16% weight loss to stored Sorghum within 6 months of storage and that of [17] who recorded sorghum grain damage of 29% sixty four day after introduction of *S. zeamais*.

The result of this study was slightly higher than the findings of [18] who also reported 53% damage cause by insect pest infestation in Sorghum after 28 days of storage under laboratory condition of 23 ± 2ºC and 65 ± 5% RH. These laboratory assessments have indicated that insect pests causes severe damage to stored sorghum which could likely lead to food insecurity, especially in rural areas where sorghum serves as their primary food.

The result of insect pest infestation based on the location were the samples are collected in the bag revealed that, top location (88.75%) has the highest rate of the infection, followed by middle location (66.25%) and least infestation was recorded in bottom location (37.50). This may be related to the availability of oxygen in the top location than the middle and bottoms locations.

This was in agreement with the findings of [16] who reported high prevalence at the top of the bag/sac in their study on the control of Sitophilus zeamais (Motsch) (Coleoptera: Curculionidae) on Sorghum Using some plant powders in Katsina state north western Nigeria. Similarly the result was in contrast with the findings of [15] who reported high prevalence in bottom and middle locations in his study on the infestation of selected stored grains by insect pests kept in different granaries in Sokoto metropolis.

However, the frequency of the insect pest infestation in relation to the food ware-houses showed that *Tribolium confusum* has the highest frequency and if found in all the food ware-houses with a frequency of 0.7 and 0.6 in Kuffa/Old Kara market and Kasarawa food ware-houses respectively. While *Tribolium casteneum* is only found in Kuffa/Old Kara market food ware-house with a frequency of 0.2.

5. CONCLUSION

The findings of this research have indicated high infestation of insect pest in the study area. use of pesticides whose utilization is the only way for ascertaining achievement in this respect is not easy because of their cost and availability. Other control majors whom are relatively easy to adopt should be explored and exploited. Establishment of plant clinics at district or local government level, staffed with competent pathologists and an entomologists will ensure sound surveillance service with the aim of supplying technical assistance to the farmers and village extension workers in terms of diagnosis, control, correct use of pesticides and use of disease free planting materials which will finally result good and proper storage of good yield of sorghum with insect pest resistance. There was also an indication that the activities of the agricultural extension agents was poor and indeed necessary within the study area in order to educate the farmers on best management practices of the crop pest and diseases before during and after harvesting. Implementation of sorghum pest's management plan emanating from this study is expected to improve the capacity of the benefitting storage and enable the attainment of sustainable crop productivity.

6. RECOMMENDATIONS

1. Cleaning of store, keeping the surrounding clean before receiving a new stock. Also old and new stocks should not be mix i.e it should be separated will help to reduce the insect pest infestation.
2. The stores should be fumigated to prevent and also kill few pests inside the stores. The sacs and the residue of the store should be disinfected before using them again for storing.
3. Farmers and government are expected to seek help from an extension workers or an expert in crop protection as soon as they see any sign of insect pest on their stored Guinea corn.
4. Routine survey of insect pest density should be carried out by the government concern in order to detect early any insect pest infestation in the study area.
5. The government should also build more concrete store to reduce the rate of insect pest infestation in the study area drastically, this is why during the study negative result was observed in the only concrete store located in the study area.
6. Further investigation should be carry out by researchers to improve better understanding of damage cause by insect pest to our farm produce with a view to develop proper food security in the nation and world at large.

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