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A survey of some insect pests of cultivated vegetables in three selected irrigation areas along Jakara river, Kano, Nigeria

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ABSTRACT

The survey aimed at identifying insect pests that attack vegetables grown in three irrigation areas along Jakara River in Kano, Nigeria. The areas were Kwarin gogau, Nomansland and Kwakwaci. Two methods of trapping the insects were employed, namely hand capture for wingless insects as well as hand net for flying insects. Morphological identification of insects was done using taxonomic keys, hand lens as well as light microscope for checking fine structures. Quadrant was used to determine the frequency of occurrence of insect pest on different vegetable plants at different sites, which was used in computing insect pest density. Six vegetable types were found to be predominantly cultivated in the irrigation sites. These included *Lactuca sativa* (Lettuce), *Brassica oleracea* (Cabbage), *Amaranthus* spp (Spinach), *Lycopersicum esculentum* (Tomato), *Abelmoschus esculentus* (Okra), and *Allium cepa* (Onion). The highest insect pest density of 66.7 pest/m^2 was obtained at Kwakwachi area, where Aphid was found only in that site. Caterpillar (Lepidoptera) and Leaf beetles (Coleoptera) were the only pests found in all the three irrigation sampling sites, while Bug (Hemiptera), Aphid (Homoptera) and Thrips (Thysanoptera) were found at Kwakwaci irrigation site. *Amaranthus* (spinach) was found to be attacked by all the insect pests identified (which include representatives from seven orders), with exception of Thrips (Thysanoptera). There was significant difference between number of insects per sites ($P<0.05$). There was also significant difference between average frequencies of insect pest per sites ($P< 0.05$).

Keywords: Insect density, irrigation, survey, vegetables.

INTRODUCTION

The agricultural significance of pests on crop plant is the damage they cause which reduces the quality or quantity (or both) of yield. Often the first manifestation of the presence of a pest or disease is in the appearance of the crop which may exhibit particular types of pest damage or disease symptoms (Hein, 2003).

There are two main types of crop damage caused by insect pests which is related to their mode of feeding (Hinks, 1976). The first is damage due to biting and chewing of plant materials. The groups of insects concerned are Orthoptera (grasshoppers, locusts, crickets), larvae of Lepidoptera (Caterpillar), adult and larvae of many beetles (Coleoptera) and other dipteran larvae

(Sorensen, 1995). The second is damage due to sucking of the plant sap from the phloem (or xylem) system or from general tissues of foliage, roots or fruits (Sorensen, 1995). The main group of insects concerned is Hemiptera (bugs) and the Thysanoptera (thrips) (Sorensen, 1995). Effects of insect pests on crops include reduction of yield, transmission of diseases, reduction of market yield and increase in farm cost. Insect pest with a wide host range will be able to multiply on different varieties of plants, attacking both leafy and succulent types like spinach and tomatoes belonging to Chenopodiaceae and Solanaceae families. Monophagous insects are restricted to a limited member of host plants within the system more especially the leafy types like lettuce (Asteraceae), cabbage (Brassicaceae) and spinach (Chenopodiaceae). If all or most plants in mixed system are palatable to a polyphagous pest, then it is likely that the insect will stay longer due to its ability in widening its feeding choices and hence become more numerous, causing greater damage (Bugwood Digital Library, 1999).

It is important to survey insect pest, because routine use of control measures (i.e. chemical, cultural or both) without taking into consideration the pest density is economically wasteful, also environmentally hazardous chemicals (that destroys natural enemies and other beneficial insects) and toxic contaminants are introduced into the soil thus causing pesticide resistance (Biological Control Task force, 2005; Bugwood Digital Library, 1999). Annual losses in 6 major crops heavily treated with insecticides raised from 11% in 1900 to 18% in 1986 (Sharor, 2001). Plants attacked by disease-causing organisms (bacteria, fungi, parasites and viruses) shows a range of symptoms of which are similar to those produced by insect attack. In the study of crop damage and crop pest, the identification of the damaging organisms is usually made easier by finding the pest near the damage on the plant (Hein, 2003). It is therefore the aim of the present study to evaluate the variety of insects that devour some common vegetables irrigated in Kano with a view to estimating their impact on quality and abundant food production in the study area.

MATERIALS AND METHODS

Study area and sampling sites

The study was conducted on three irrigation areas within the first ten kilometers along the course of the Jakara river (21 km) within Kano metropolis. The entire river is located between. 12^{o} 01 'N, 8^{o} 29' E and 12^{o} 06' N, 8^{o} 38' E, at an altitude of 486.5m (Encarta, 2009). The three irrigation sites were Kwarin gogau (adjacent to the Kano main abbatoir, Kwakwaci (located off Katsina Road) and Nomansland (located near Zungeru road in the vicinity of Nomansland, Kano). The sizes of the farms studied ranged between 0.5 and 1.0 ha.

Sample collection

Each farm selected for the survey was divided into four quadrants and from each part four plants were selected at random within the square meter. After quick visual count of the insects on the plants, they were then captured from those plants and taken to the laboratory for identification. Population size of each of the insect species was also taken into consideration. Materials and methods used for collecting insect samples include swoop nets for flying insects, aspirators for collecting tiny insects, pair of forceps and hand picking for larvae and slow moving insects. Polythene bags, specimen tubes and rearing jars were used to transfer the insects to the laboratory and alcohol (70%) was used to preserve them for identification. The plants were sampled at seedling stage, vegetative stage, flowering stage, fruiting stage and at harvest of the cultivated vegetable crops.

Insect pest identification and quantitative assessment

Morphological identification of pest was done using hand lens, and utilizing identification keys (Zim and Cottam, 2000). They were then placed into their respective groups. The pest status were determined based

on the degree of damage caused to plant and named in a scale of 1 – 3, where 1 = little or not important; 2 = cause little and occasional damage and 3 = common and causes serious damage (Adamu et al., 2000).

Statistical analysis of the data obtained

Data obtained from the sampling sites were subjected to Contingency table and Chi – square Goodness-of-fit analysis in order to check for any significant difference or otherwise of the variables testing the Null hypothesis (Ho: there is no significant difference between insect pest density per sites and vegetable types).

RESULTS AND DISCUSSION

Six vegetable types were predominantly cultivated in the irrigation sites. These include *Lactuca sativa* (Lettuce), *Brassica oleracea* (Cabbage), *Amaranthus* spp (Spinach), *Lycopersicum esculentum* (Tomato), *Abelmoschus esculentus* (Okra), and *Allium cepa* (Onion). The highest insect pest density of 66.7 pest/m^2 was obtained at Kwakwachi area by aphid species (Table 3). *Amaranthus* (spinach) was found to be attacked by all the insect pests identified (Tables 1, 2, 3 and 4) (which include representatives from seven orders), with exception of Thrips (Thysanoptera). Caterpillar (Lepidoptera) and Leaf beetles (Coleoptera) were the only pests found in all the three irrigation sampling sites, while Bug (Hemiptera), Aphid (Homoptera) and Thrips (Thysanoptera) were found at Kwakwaci irrigation site. There was significant difference between number of insects per sites and vegetable types ($P \leq 0.05$) and there was also a significant difference between average frequency of insect pest per sites and vegetable types ($P \leq 0.05$).

At Kwarin gogau, cabbage was the most frequently infested by insect at 61.8% prevalence, while okra was the least at 2.9%. In Kwakwachi site, Spinach was the plant that was greatly attacked at a rate of 81.4% and lettuce being infested at a level of 4.8%. The prevalence of pest at Nomansland was highest on lettuce (39.5%) followed by Spinach (34.9%) with onion showing the least frequency of association with the insects.

The population of larva of Lepidoptera in Kwarin gogau was at a level of 7 per stand of *Amaranthus* and at 2.3 pest/m^2.

Brassica oleracea had the highest mean number of pest per crop (35/crop) with a density of 11.7 larvae per square meter. Leaf beetle (Coleptera) had 4 larvae per stand of *Amaranthus* 3 and 7 per stand in *Lactuca sativa* and *Brassica oleracea* respectively. Hemiptera and Orthoptera had a density of 0.7 and 3 pest/m^2 respectively and attacking mainly *Amaranthus* spp, Okra and lettuce. The density increased at Kwakwaci irrigation site and the incriminating insects included some additional species namely aphid and cricket from the order Homoptera and Orthoptera respectively. The population of aphids per plant was about 200 and specifically on *Amaranthus* showing the highest density of 66.7 pest/m^2 and the least was 1 cricket per plant resulting in 0.3 insect/m^2. At the third irrigation site, (Nomansland), grasshopper had the highest density per plant. *Amaranthus* with 7 insects per plant resulting in a 2.3 pest/m^2 (Table 4).

Generally the commonest insect pest in the three irrigation sites were members of the order Homoptera, comprising of 52.0% of the total catch. This was followed by Lepidoptera (26.21%). Coleoptera, Orthoptera and Hemiptera had 12.5%, 8.1%, and 8.1% respectively. The least common insects were those belonging to the order Thysanoptera at 0.26% at the time of the study (Figure 1).

From the data obtained, the calculated value $\chi^2 = 76.06$ was greater than the table values at P = 0.05 and P = 0.01: 27.59 and 33.41, df =17 respectively. Hence the Null hypothesis posited as thus: there is no significant difference between insect pest density per site and vegetable types, as well as between the frequencies of insect pest prevalence per site is rejected.

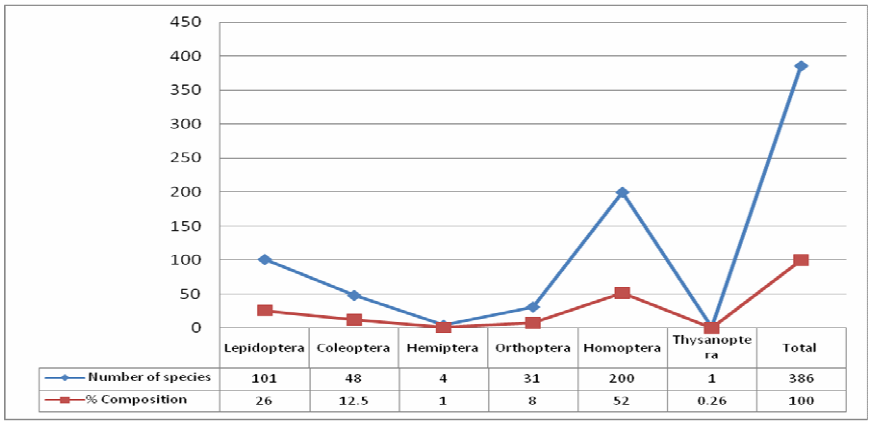

Figure 1 : Composition of insect pest order.

Table 1: Some insect pests of cultivated vegetables in three selected areas in Kano.

Sampling Site	Vegetables	Mean Pest Caught per vegetable	Pest Mean Density Per site (m^{-2})	Prevalence (%)
Kwarin gogau	*Lactuca sativa* (lettuce)	11	3.7	16.2
	Brassica oleracea (cabbage)	42	14.0	61.8
	Amaranthus spp (spinach)	13	4.3	19.1
	Abelmoschus esculentus (okra)	2	0.7	2.9
	Total	**68**	**5.7**	**100**
Kwakwaci	*Lactuca sativa* (lettuce)	13	4.3	4.8
	Brassica oleracea (cabbage)	18	6.0	6.6
	Amaranthus spp (spinach)	223	66.7	81.4
	Lycopersicum esculentum (tomato)	20	6.7	7.3
	Total	**274**	**20.9**	**100**
Nomansland	*Lactuca sativa* (lettuce)	17	5.7	39.5
	Amaranthus spp (spinach)	15	5.0	34.9
	Alium cepa (onion)	3	1.0	7
	Lycopersicum esculentum (tomato)	8	2.7	18.6
	Total	**43**	**3.6**	**100**

Table 2: Insect pest and vegetables attacked at Kwarin gogau irrigation site, Kano, Nigeria.

Order/Insect pest	Crop	Mean Number of Pest per vegetable crop	Pest stage	Pest Mean Density (m^{-2})	Pest Status
Lepidoptera Caterpillar	*Amaranthus* spp	7	L	2.3	3
	Lactuca sativa	6	L	2.0	3
	Brassica oleracea	35	L	11.7	3
Coleoptera Leaf beetle	*Amaranthus* spp	4	L	1.3	2
	Lactuca sativa	3	L	1.0	2
	Brassica oleracea	7	L	2.3	2
Hemiptera Bug	*Amaranthus* spp	2	L	0.7	1
	Abelmoschus esculentus	2	L	0.7	1
Orthoptera Grasshopper	*Lactuca sativa*	2	I	0.7	3
	Total	**68**		**2.5**	

L = Larval stage ; I = Imago (Adult stage)

Table 3: Insect pest and vegetable attacked at Kwakwaci Irrigation Site, Kano, Nigeria.

Insect Identified	Vegetable Attacked	No. of Insect Caught/Plant	Pest stage	Pest Mean (density (m^{-2})	Pest Status
Lepidoptera Caterpillar	*Amaranthus* spp	10	L	3.3	3
	Lactuca sativa	13	L	4.3	3
	Brassica oleracea	13	L	4.3	3
	Lycopersicum esculentum	4	L	4	2
Coleoptera Leaf beetle	*Aramanthus* spp	12	L/I	4.0	2
	Lycopersicum esculentum	14	L/I	4.7	2
	Brassica oleracea	5	L/I	1.7	1
Homoptera Aphid	*Amaranthus* spp	200	I	66.7	3
Orthoptera Cricket	*Lycopersicum esculentum*	2	I	0.7	2
	Amaranthus spp	1	I	0.3	1
	Total	**274**	**I**	**9.4**	

L = Larval stage ; I = Imago (adult stage)

Table 4: Insect pest and vegetables attacked at Nomansland irrigation site, Kano Nigeria.

Insect Identified	Vegetable Attacked	No. of Insect Caught/Plant	Pest stage	Pest Mean (density (m^{-2})	Pest Station
Lepidoptera Caterpillar	*Amaranthus* spp	1	L	0.3	3
	Lactuca sativa	6	L	2.0	3
	Lycopersicum esculentum	6	L	2.0	2
Coleoptera Leaf beetle	*Aramanthus* spp	3	L/I	1.0	2
Thysanoptera Thrips	*Allium cepa*	1	I	0.3	1
Orthoptera Cricket	*Lactuca sativa*	6	I	2.0	2
	Amaranthus spp	4	I	1.3	2
	Allium cepa	2	I	0.7	1
	Lycopersicum esculentum	2	I	0.7	1
Orthoptera Grasshopper	*Lactuca sativa*	5	I	1.7	3
	Amaranthus spp	7	I	2.3	3
	Total	**43**		**1.3**	

L = Larval stage ; I = Image (adult stage)

Conclusion

The current study has shown that there were various insects pest attacking vegetables predominantly cultivated (i.e. tomato, spinach, onion, okra, lettuce, and cabbage) at the three sampling sites which are Nomansland, Kwarin gogau and Kwakwaci irrigation sites. All of the vegetables studied were attacked by at least one insect pest. The insect pests recovered during the study period were grasshopper and cricket (Orthoptera), aphid (Homoptera), caterpillar (Lepidoptera), Leaf beetle (Coleoptera), Bug (Hemiptera) and thrips (Thysanoptera). The result obtained could be useful as a baseline for further research on control of insect pests in the affected areas, in order to have an informed decision which might be of great benefit to both the farmers as well as the entire nation economically and for the purpose of food security.

Recommendations

Routine survey of insect pest density should be observed by the government concerned, in order to detect early any potential risk to the cultivated vegetables.

- Agronomists should produce insect pest resistant varieties of vegetables as the best controlling measure.
- Farmers should be encouraged to observe crop rotation technique, which is an effective measure for the control of more especially monophagous pest (Adamu et al., 2000).

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