



Original Article

Occurrence and identities of insect pests of vegetables in Ikorodu, Lagos, Nigeria

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ABSTRACT

This survey was aimed at determining the occurrence as well as identifying the insect pests of tomatoes (*Solanum lycopersicum*), amaranths (*Amaranthus* spp.), lettuce (*Lactuca sativa*), green onions (*Allium cepa*), and cabbage (*Brassica oleraceae*) grown during the rainy season in Ikorodu, Lagos, Nigeria, for effective control and management. After giving informed consent, structured questionnaires were used to collect demographic data from the participants, including age, sex, education level, and pest control strategy. Two vegetable arable farms were then selected, of which one was in Igbogbo town, close to Ikorodu metropolis (labeled A) and the second was in Bayeku town, which is far from Ikorodu metropolis (labeled B). After visual counting of pests on the vegetables early in the morning and late in the evening, they were captured with snoop nets, aspirators, and forceps, and then transferred to the laboratory in specimen tubes and rearing jars in triplicates, where they were identified using hand lenses and identification keys. The results show that the vegetable farmers were middle-aged men with at least a secondary school education, and chemical application was the most widely used pest control measure in the area. Farm A had 127 pests, with *Solanum lycopersicum* accounting for 57 (44.88%), followed by *Amaranthus* spp. (23, representing 18.11%), *Brassica oleraceae* (19, representing 14.97%), *Lactuca sativa* (18, representing 14.17%), and *Allium cepa* (10, representing 7.87%). Farm B had 101 pests, of which *Solanum lycopersicum* accounted for 44 (43.56%), followed by *Amaranthus* spp. with 22 (21.78%), *Lactuca sativa* and *Brassica oleraceae* each had 13 (12.87%), and *Allium cepa* had 9 (8.92%). Aphids were the most predominant pests with 69 members, followed by hornworms with 32, thrips and pumpkin bees each had 27, cutworms had 26, and white flies had 24, respectively. Overall, the results showed that there is a heavy pest infestation of vegetables in Ikorodu. Farmers need to be educated on pest control and management.

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1. Introduction

Vegetables are important farm products that form a major part of the human diet owing to their rich nutrients and vitamins. The nutritional constitution of a vegetable depends on species, but generally contains a small amount of protein or fats, vitamins A, B6, and K, as well as pro-vitamins and carbohydrates [1]. Vegetables also contain abundant phytochemicals and dietary fiber, which have been shown to reduce or prevent cardiovascular disease and obesity [2]. Vegetables are eaten as meals and as snacks [3]. Common vegetables include tomatoes, salads, spinach, onions, lettuce, amaranth, peppers, carrots, cabbage, and

garlic. Due to its widespread consumption, vegetable cultivation offers a strong economic opportunity for alleviating poverty and unemployment in developing nations [4, 5].

Unfortunately, neither the nutritional nor economic importance of vegetables is fully realized [5]. Insect infestations, diseases, high input costs, transportation, and market accessibility are major barriers to vegetable production [6]. Of the aforementioned constraints, insect pests contribute significantly to all crops' losses worldwide. According to the Food and Agricultural Organization (FAO), up to 40% of global crop production is lost to insect

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pests annually, and at least \$70 billion is spent annually on invasive insect pest diseases [7]. In Africa, including Nigeria, insect pests damage between 5 and 40% of all food produced [8, 9]. Insect pests feed on and damage crops in the field or after harvest, cause a nuisance, or transmit diseases to plants, humans, and other animals [8]. The appearance of the crop, which may display specific types of pest damage or disease signs, is frequently the first indication of the existence of a pest or disease [10]. According to their methods of feeding, the two primary types of crop damage produced by insect pests are damage from biting and chewing of plant materials and damage from piercing and sucking [10]. Common insect pests of vegetables are varied species of the order Homoptera, Lepidoptera, Hemiptera, Orthoptera, Coleoptera, Diptera, Acarina, and Thysanoptera [11, 12]. Some other groups of pests other than insect pests include viruses, fungi, weeds, nematodes, birds, and rodents, among others [8].

Different methods have been adopted for managing insect pests, which include cultural, biological, use of resistant varieties, use of plant extracts, use of pheromones and chemicals [13]. While other methods are environmentally friendly, chemical control destroys beneficial insects along with insect pests as well as induces toxicity to the environment, vegetables, and living organisms, including humans [14]. Considering the huge damage caused by insect pests, managing and controlling insect pests is a key factor to successful vegetable farming, which begins with the survey and identification of insect pests in every locality before cultivation [11]. Literature searches showed that surveys of insect pests have been carried out in some parts of Nigeria [1, 6, 10]. However, there is a dearth of documented surveys of insect pests of vegetables in Lagos, Southwest Nigeria. This study, therefore, carried out a survey and identified insect pests of vegetables in Ikorodu, Lagos, Nigeria.

2. Materials and Methods

2.1. Description of Study Area

The current research was carried out on selected farms within and on the outskirts of Ikorodu in Lagos, Southwestern Nigeria (Figure 1). Ikorodu is located to the north-east of Lagos at latitude $6^{\circ}37'0.7140''N$ and longitude $3^{\circ}30'29.0592''E$ [15]. The city lies along the Lagos Lagoon and shares a boundary with Ogun State. Ikorodu is in the tropical rainforest and has an average temperature of between $28^{\circ}C$ and $33^{\circ}C$ [16]. Moreover, the city has a long wet and short dry season, with wet seasons peaking in May to September and a dry season in December and January [2, 16]. Ikorodu gets an average of 132.03 millimeters of rain each year, and it rains 193.66 days per year, or 53.06% of the time [17].

Ikorodu is on the outskirts of Lagos, so there is a lot of arable land around the city and settlements under it. Some major towns under Ikorodu include Imota, Isiu, Liadi, Egbin, Ijede, Igbogbo, and Bayeku, all of which have arable land for farming. Some people in Ikorodu are also engaged

in urban gardening, which involves some raising crops along water courses. Among others, some species of vegetables that are grown in Ikorodu include spinach, amaranthus, lettuce, fluted-pumpkin, etc. The majority of these vegetables are sold in the ever-bustling markets in Ikorodu and thus provide income to farmers and sellers. Unfortunately, among other hindrances, insect pests pose a huge economic challenge to farmers. This necessitates the current study to survey and identify insect pests of vegetables in Ikorodu towards effective control and management.

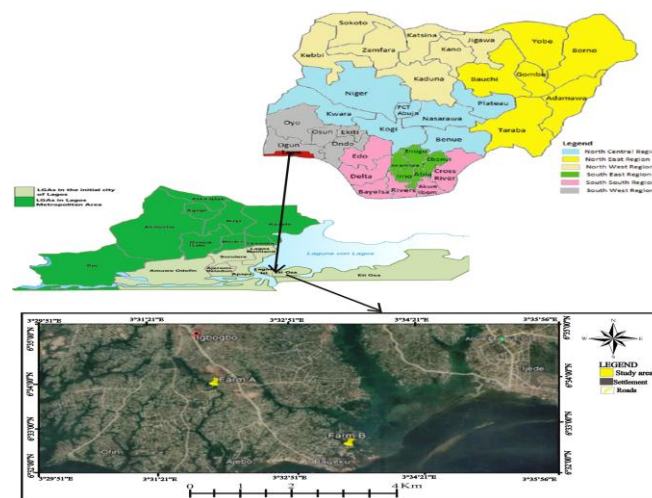


Figure 1: Locations of the study areas

2.2. Study population and Data Collection

Twenty-five vegetable farmers were randomly enrolled in the study. After giving informed consent, each participant was given a structured questionnaire to indicate demographic data such as sex, age, and level of education. After that, the pest control method used by each farmer was recorded. Included participants must have agreed to participate in the study and have been growing vegetables in Ikorodu or environs for at least two years. Excluded participants were those who did not consent to the study and farmers who do not cultivate vegetables. The demographic data was recorded to assist policy makers to know their targets when it comes to decision-making regarding vegetable cultivation in the study area. It will also be useful to researchers.

2.3. Insect Pest Collection

Two vegetable arable farms of about 0.5 hectare each, containing lettuce (*Lactuca sativa*), amaranths (*Amaranthus* spp.), tomatoes (*Solanum lycopersicum*), onions (*Allium cepa*), and cabbage (*Brassica oleraceae*), were selected for the study. The study was conducted in the rainy season, between May 2022 and July 2022. One of the farms, labeled A, was located in Igbogbo town, close to Ikorodu metropolis, while the second one, labeled B, was in Bayeku town, on the outskirts of Ikorodu. After a quick visual count of the insects on the vegetables early in the morning and late in the evening, swoop nets were used to capture flying

insects; tiny insects were collected using aspirators; and a pair of forceps and hand picking were used for larvae and slow moving insects. The insects were then transferred to the laboratory in specimen tubes and rearing jars in triplicates.

2.4. Insect Pests Identification

Morphological identification was done in the laboratory using hand lenses (Manufactured by Dongta Glass; Ø 60 mm), and utilizing identification keys [10].

2.5. Ethics Statement

The Ethics and Research Committee of the National Open University of Nigeria, Lagos, approved the study. The participants also consented to the study.

2.7. Statistical Analysis

Data obtained from sample sites were subjected to one-way analysis of variance using MINITAB Statistical Software (version 20). The same software was also used to draw charts.

3. Results and Discussion

3.1. Demographic Characteristics of the Respondents

The demographic characteristics of the respondents are shown in Table 1. The majority of the respondents are middle-age men with at least a secondary education. Furthermore, the majority of the farmers adopted chemical control method without strict compliance with guidelines.

The indiscriminate use of chemicals in the areas suggests that the vegetables may not be safe for consumption. If ingested with vegetables, pesticide residues may be utilized, egested, stored, or built up in body fat [18]. Accumulation of pesticide residues in humans or other animals has been implicated in many health hazards involving the skin, gastrointestinal system, nervous system, respiratory system, reproductive system, and endocrine system [18]. Prenatal exposure to pesticide residues through human breast milk has also been implicated in some pediatric diseases [19]. The finding of the current study is in line with that of Akinwale and Oyeyemi [20], who reported the prevalence of middle-aged (30–39) men among vegetable farmers in certain areas in Lagos, Nigeria. The findings are also consistent with those of [21], who observed that the majority of vegetable farmers in Yakurr, Cross River, were of middle age (36–46 years). However, unlike in the current study, the majority of the vegetable farmers reported by [21] were females. The findings are also consistent with a survey carried out by [22], who observed that pesticide applications (chemical control) are the most widely used pest control and management practice for vegetables in Lagos and Ogun States, Nigeria.

Table 1: Demographic characteristics of vegetable and fruit farmers in Ikorodu, Lagos, Nigeria

No	Age	Sex	Level of education	Method of insect pest control	Adherence to pesticide application guidelines
1	33	Male	Secondary	Chemical and IPM	No
2	32	Male	Secondary	Chemical and IPM	No
3	48	Male	Tertiary	Chemical method	No
4	30	Male	Secondary	Chemical method	No
5	55	Male	Tertiary	Cultural method	No
6	31	Male	Secondary	Chemical and IPM	No
7	61	Male	Tertiary	Cultural method	No
8	54	Male	Tertiary	Cultural method	No
9	40	Male	Secondary	Biological method	No
10	36	Male	Secondary	Chemical method	No

3.2. Prevalence of Insect Pests in Selected Vegetable Farms in Ikorodu

Table 2 shows the prevalence of insect pests on vegetables in two farms in Ikorodu, Lagos. In Farm A, a total of 127 insect pests were caught from vegetables. Among the pests, the highest number was isolated from *Solanum lycopersicum* (57), followed by *Amaranthus* spp. (23), *Lactuca sativa* (18), *Brassica oleraceae* (19), and *Allium cepa* (10). In Farm B, a total of 101 pests were isolated, of which *Solanum lycopersicum* had 44, followed by *Amaranthus* spp. with 22, *Lactuca sativa* had 13, *Brassica oleraceae* had 13 and *Allium cepa* had 9.

In comparison, Farm A (close to the metropolis) was more infested than farm B (at the outskirts), possibly because urban areas tend to be hotter than rural areas, a condition that promotes the multiplication of insects [23]. There are also hypotheses that there are fewer insect predators in the cities and that urban plants are more stressed, both of which increase plants' susceptibility to pests [23]. Of the vegetables, *Solanum lycopersicum* had the highest number of pests, which may be due to its succulent and fleshy fruits with a lot of sap. This study also found a high prevalence of pest infestation on *Amaranthus* spp., *Lactuca sativa*, and *Brassica oleracea*, which could be due to their large and soft leaves that could easily be consumed. However, a study is needed to ascertain these assertions. *Allium cepa* attracted the least number of insect pests in the current study, probably because the vegetable is known to excrete certain phytochemicals from its roots as well as aromas from its leaves, both of which repel insect pests [24]. The findings of the current study are consistent with those of [25], who reported heavy pest infestations on vegetables in Ojo, Lagos. [26] also reported heavy infestations of vegetables by insect pests in Enugu, Southeastern Nigeria. A survey carried out by Suleiman [1] in Katsina, Northwestern Nigeria, also observed heavy insect pest infestations on

vegetables. The overwhelming consistency of the current study with previous ones shows that there is a high prevalence of insect pests on vegetables in Nigeria. Nigeria is averagely warm with medium to high precipitation (depending on season and locations), which are ideal conditions pointed out by [27] to boost the multiplication and spread of insect pests. Moreover, [28] opined that climate change has increased temperatures and altered rainfall patterns, turning pests that were once minor or secondary pests into major pests. These factors boost the growth, migration, and dispersal of some insect pests. Additionally, as a result of more carbon dioxide being released into the atmosphere and part of it being stored by plants, the ratio of carbon to nitrogen in plant tissue is rising. This has resulted in increased feeding by herbivorous insects to compensate for the plants' lower nitrogen content [28]. This has ultimately led to the population expansion of insects worldwide.

Table 2: Prevalence of insect pests in vegetable farms in Ikorodu, Lagos

Vegetables	Mean pest caught per vegetable		Prevalence (%)	
	Farm A	Farm B	Farm A	Farm B
<i>Lactuca sativa</i>	18	13	14.17	12.87
<i>Brassica oleracea</i>	19	13	14.97	12.87
<i>Amaranthus</i> spp	23	22	18.11	21.78
<i>Solanum lycopersicum</i>	57	44	44.88	43.56
<i>Allium cepa</i>	10	09	7.87	8.92
Total	127	101	100.00	100.00

3.3. Identities of Insect pests on Vegetable Farms in Ikorodu

The identities of insect pests caught from vegetable farms in Ikorodu are shown in Table 3. Of the 228 pests isolated, aphids were the most prevalent pest with 69, followed by hornworms with 32, both pumpkin beetles and thrips each had 27, cutworms were 26, whiteflies were 24, flea beetles with 11, grasshoppers with 7, and leaf miners with 5 (Figure 2).

In summary, aphids, hornworms, thrips, whiteflies, pumpkin beetles, and cutworms were the most dominant pests on the two farms. Aphids are soft-bodied yellowish insects with two cornicles on the abdomen and often live on new shoots, crowns, and undersides of leaves [11]. Aphids feed on phloem sap with long and flexible stylets and are abundant due to their high reproductive potential, their dispersal capacities, and their survival strategies [29]. Damage caused by aphids includes reduced chlorophyll, yield loss, decreased growth, wilting and curling of leaves, and browning and yellowing of leaves [30]. In the current study, aphids attacked mainly *Solanum lycopersicum* and *Lactuca*

sativa, the same findings that were also reported in Nigeria by Imam et al. [10] and Oso [31]. Hornworms are the larval stages of the five-spotted hawk moth and *Carolina sphinx* moth that feed on and destroy leaves, stems, blossoms, and fruits of host plants [32]. In the present study, hornworms were found mainly on *Solanum lycopersicum*, the same finding that was also reported in Nigeria by [1]. Cutworms are larvae of nocturnal moths and can live in different types of environment [33]. Damage caused by cutworms includes cutting of shoots of young plants above or below the soil surface and defoliation of leaves [33]. In Ikorodu, cutworms were found on *Solanum lycopersicum*, *Amaranthus* spp., and *Brassica oleracea*, which had been previously reported in Nigeria by [34] and [1]. Nymphs and adults of whiteflies damage plants during feeding, and they can act as virus vectors, thus causing significant yield loss to crops [35]. In this study, whiteflies were found in *Lactuca sativa*, consistent with the findings of [36] who reported whiteflies as a prevalent pest of crops in southwestern Nigeria. Beetles have different sizes and colors, as well as enlarged hind legs that allow them to jump [11]. Beetles were majorly found on *Amaranthus* spp. and *Brassica oleracea* in vegetable farms in Ikorodu, which has also been reported elsewhere in Nigeria by [34]. Adult thrips are pointed, slender, reddish yellow, yellow, or white, with two pairs of fringed wings and two long brown spots on their backs [11]. Damage caused by thrips includes scarring and russetting of fruits and can transmit viral diseases [11]. In the current study, thrips were mostly attracted to *Allium cepa*, a finding that was also reported in Nigeria by [37].

Table 3: Identities of insect pests caught on vegetable farms in Ikorodu, Lagos

Dominant spp.	Order	Crops attacked	Total number of insect pest	Prevalence (%)
White fly	Hemiptera	<i>Lactuca sativa</i>	24	10.53
Grasshopper	Orthoptera	<i>Lactuca sativa</i>	7	3.07
Flea beetle	Coleoptera	<i>Brassica oleracea</i>	11	4.83
Cutworms	Lepidoptera	<i>Brassica oleracea</i> and <i>Amaranthus</i> spp.	26	11.40
Pumpkin beetles	Coleoptera	<i>Amaranthus</i> spp	27	11.84
Aphid	Hemiptera	<i>S. lycopersicum</i>	69	30.26
Hornworm	Lepidoptera	<i>S. lycopersicum</i>	32	14.04
Thrips	Thysanoptera	<i>Allium cepa</i>	27	11.84
Leaf miners	Diptera	<i>Allium cepa</i>	5	2.19
Total			228	100

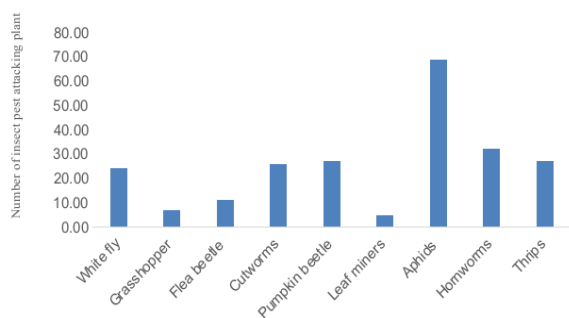


Figure 2: Distribution of insect pests on vegetable farms in Ikorodu, Lagos

4. Conclusion

The results show that vegetable farmers in Ikorodu are middle-aged men with at least a secondary school education. Chemical application is the most widely used pest control measure in the area, without strict adherence to pesticide application guidelines. *Solanum lycopersicum* had the highest number of pest infestations,

followed by *Amaranthus* spp., *Lactuca sativa*, *Brassica oleracea*, and *Allium cepa* in that order. The predominant insect pests of vegetables in Ikorodu are aphids, hornworms, pumpkin beetles, thrips, cutworms, and white flies, respectively. Aphids attack mainly *Solanum lycopersicum* and *Lactuca sativa*; cutworms are found on *Solanum lycopersicum*, *Amaranthus* spp., and *Brassica oleracea*; pumpkin beetles attack mainly *Amaranthus* spp. and *Brassica oleracea*; thrips are mostly on *Allium cepa*, and white flies attack mostly *Lactuca sativa*.

Based on these results, farmers need to be educated on pest control and management. In particular, pesticide application needs to be taught to farmers. Improved strains or breeds of vegetables (i.e., pest-resistant varieties) should be cultivated to reduce pest infestation. More studies like the current one should be carried out periodically, and should cover more vegetables.

Conflict of Interest

The authors declare that they don't have conflict of interest.

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