

# Survey of Some Insect Pests of Cultivated Vegetables in Ajiwa Irrigation Site of Katsina State, Nigeria

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## Abstract

A field survey was conducted at Ajiwa irrigation site of Katsina State, Nigeria with a view of investigating the occurrence of insect pests attacking some vegetables cultivated by farmers of the area. Pest samples were collected from five different vegetables (tomato, spinach, lettuce, sweet pepper and onion) which were identified as aphid (Homoptera), cutworm (Lepidoptera), hornworm (Lepidoptera), Pepper maggot (Diptera) and thrips (Thysanoptera). It is revealed that tomato had the highest (30.47%) prevalence, while onion had the least (5.42%) pest prevalence. The results show that the pest prevalence was significantly ( $p < 0.05$ ) different between the vegetable types cultivated at the study area. Both larval and adult stages of the pests were found attacking different parts of the vegetables. Aphid attacked leaves of both tomato and sweet pepper with the highest (24.40) number on tomato. Thrips were the least (5.80) among all the insect pests identified and were the only ones found attacking onion. Members of the Order Homoptera (aphids) were the most abundant pests infesting the leaves of tomato and sweet pepper, while the Thysanoptera had the least (5.81) number of representative (thrips) per vegetable found on the leaves of onion. Out of the farmers interviewed, 50.00% used chemical method, while only 10.00% employed the use of botanicals. Some (12.00%) combined some of the methods such as chemical and cultural, chemical and botanicals, etc, in controlling pests of vegetables at the study area. Identifying insect pests infesting vegetables cultivated at Ajiwa irrigation site could help in proper control measures which would promote vegetable production in the area.

**Keywords:** Insect pests, Irrigation site, Population density, Prevalence, Vegetables

## 1. Introduction

Vegetables are important part of the world agriculture which constitutes a major part of the diet contributing nutrients and vitamins. Vegetables are eaten in a variety of

ways as part of the main meals and as snacks [1]. The nutritional content of vegetables varies considerably, though generally they contain little protein or fats, and varying proportions of vitamins A, K and B6, provitamins, dietary minerals and carbohydrates [1].

Despite the importance of these crops, there are various constraints to their production which include high cost of inputs, transportation, accessibility to market, insect infestation and disease problems [2]. Pests cause a lot of damage on crops including vegetables which reduce the quality and/or quantity of yield [3].

Crop damage by insect pests could be due to biting and chewing of plant materials. Orthoptera (grasshoppers, locusts, crickets), adults and larvae of many coleopterous insects and other dipteran larvae are concerned with this type of damage [4]. Another type of damage is due to sucking of the plant sap from the phloem of xylem system or from general tissues of leaves, roots and fruits. Hemiptera (bugs) and Thysanoptera (thrips) are the main groups of insects concerned with this type of damage [4]. Insect pest that is able to multiply on different variety of plants is said to have a wide host range and termed as polyphagous. Polyphagous insects attack both leafy and succulent types of plants like spinach and tomato. Some insects are restricted to a limited number of host plants especially the leafy types like lettuce, cabbage and spinach. These insects are called monophagous [3].

Farmers generally rated insect pests as the most serious problem because of the pest's significant effect to their crops by reducing the vegetable harvest [2]. A good integrated pest management strategy employs correct identification of insect pests and good understanding of their biology as a key pillar to their control [5]. This involves monitoring the pest population as well as noting the stage of the insect development and only mobilizing control measures when the pest numbers reach the economic injury levels [6].

Several insect pest surveys have been conducted in different parts of Nigeria [2, 3, 7, 8, 9]. However, information on the type of insect pests infesting vegetable grown at Ajiwa irrigation site of Katsina State, Nigeria is scarce. The survey is therefore, planned to investigate the

occurrence of insect pests infesting some vegetables grown in Ajiwa irrigation site.

## 2. Materials and Methods

### 2.1 Study Area

The study was conducted at Ajiwa irrigation site of Katina State, Nigeria. The site is approximately located at 13° 17' N, 7° 05E with 610 m altitude in the Sudan Savanna of Nigeria [10]. The study was conducted between the months of January and May 2012, and sampling was done at two weeks interval across the study period.

### 2.2 Sample Collection

Methods of Imam *et al.* [3] were followed for sample collection. The sampling site was divided into four quadrates and five plants were selected within the square meter at random from each part. Different methods and materials were used for collecting the pests, depending on the type of the pest. Sweep nets were used for collecting flying insects, aspirators for collecting tiny insects, pair of forceps and hand picking for collecting larvae and slow moving insects. Beating sheets were also used for collecting camouflaged or hidden insect pests where a small sheet was placed beneath the plants and the insect pests knocked down from the plant onto the sheet by beating with a stick. The insects were then picked up from the sheet with the aid of hand lens and forceps and placed into vials. Observed insects on the plants sampled were counted and then captured from those plants and placed in specimen tubes and rearing jars containing alcohol (70%) for preservation. The preserved insects were then transferred to the Biology laboratory of Umaru Musa Yar'adua University, Katsina, Nigeria for further studies.

### 2.3 Identification of Insect Pests Sampled

Identification of the preserved insects was done morphologically using hand lens, stereoscope microscope and identification keys [11]. Orders and families of the insect pests recovered were also identified.

Type and part of vegetables on which pests were recovered were also noted. Population density and prevalence of the collected insect pests were also determined.

### 2.4 Farmers' Perception on Integrated Pest Management

In order to study the way farmers perceive the significance of insect pest management using integrated pest management strategy, fifty randomly selected farmers of the study area were interviewed using structured questionnaires to obtain information concerning their farming activities. Questions on the type of vegetables cultivated, incidence of insect pests, and control methods employed were addressed in the questionnaire.

### 2.5 Data Analysis

Data collected were summarized into frequencies and percentages, and then subjected to chi-square for tests of significance using SAS statistical guide. Significantly different means were separated using LSD at  $p < 0.05$  level of significance [12].

## 3. Results

Results presented in Table 1 reveal that cultivation of different types of vegetables by farmers of Ajiwa irrigation site varies significantly ( $p < 0.05$ ). Tomato and sweet pepper had the highest (22.00%) frequency of cultivation by farmers of the study site, followed by onion cultivation (20.00%), while those who cultivated all the vegetables selected (lettuce, spinach, tomato, sweet pepper and onion) were the least (4.00%). The Table also indicates that cultivation of lettuce, spinach and onion was also very low (6.00%).

Table 2 shows the prevalence of insect pests of some cultivated vegetables and their respective densities at Ajiwa irrigation site. It is revealed that tomato had the highest (30.47%) prevalence with 8.15  $m^{-2}$  mean pest density, while onion had the least (5.42%) pest prevalence with mean pest density of 1.45  $m^{-2}$ . The results show that the pest prevalence was significantly ( $p < 0.05$ ) different between the vegetable types cultivated at the study area.

The insect pests recovered were the aphids (Homoptera:), cutworm and hornworm (Lepidoptera), pepper maggot (Diptera) and thrips (Thysanoptera) (Table 3). Both larval and adult stages of the pests were found attacking different parts of the vegetables. Table 3 indicates that aphid attacked leaves of both tomato and sweet pepper with the highest (24.40) number on tomato while the hornworm, pepper maggot and thrips were found on the fruits of tomato and sweet pepper, and leaf of onion respectively. Thrips were the least (5.80) among all the insect pests identified and were the only ones found attacking leaf of onion. Members of the Order Homoptera (aphids) were the most abundant pests infesting the leaves of tomato and sweet pepper, followed by Lepidoptera (cutworm, and hornworm) on the leaves of spinach and lettuce, and fruits tomato, while the Thysanoptera had the least (5.81) number

of representative (thrips) per vegetable found on the leaves of onion (Table 3). Generally, there was significant ( $p < 0.05$ ) difference between the average number of pests per vegetable.

Table 4 shows that most (90.00%) of the farmers interacted confirmed the incidence of pests attacking vegetables cultivated at the study site, while all (100%) of them agreed that control of these pests attacking their vegetables is necessary. The Table 4 indicates that the application of different types of control measures taken by the farmers in controlling pests is significantly ( $p < 0.05$ ) different. Out of the farmers interviewed, 50.00% used chemical method, while only 10.00% employed the use of botanicals. Some 12.00% combined some of the methods such as chemical and cultural, chemical and botanicals, etc, in controlling pests of vegetables at the study area.

Table 1: Types of Selected Vegetables Cultivated by Farmers of Ajiwa Irrigation Site

Types of vegetables cultivated	No. of Farmers	Per cent (%)
Lettuce, Spinach and Onion	3	6.00
Lettuce, Spinach and Tomato	4	8.00
Tomato, Sweet pepper and Onion	5	10.00
Tomato and Sweet pepper	11	22.00
Tomato and Onion	8	16.00
Onion only	10	20.00
Tomato only	7	14.00
All of the above	2	4.00
<b>Total</b>	<b>50</b>	<b>100.00</b>

Table 2: Prevalence of Insect Pests of Cultivated Vegetables at Ajiwa Irrigation Site

Vegetable Type	Mean No. of Pests Caught	Mean Density Per site ( $m^{-2}$ )	Prevalence (%)
<i>Lactuca sativa</i> (Lettuce)	16.40	4.10	15.33
<i>Amaranthus spp</i> (Spinach)	21.60	5.40	20.19
<i>Lycopersicum esculentum</i> (Tomato)	32.60	8.15	30.47
<i>Capsicum annum</i> (Sweet pepper)	30.60	7.65	28.60
<i>Alium cepa</i> (Onion)	5.80	1.45	5.42
<b>Total</b>	<b>107</b>	<b>26.75</b>	<b>100</b>

Table 3: Pest Types, Parts of Vegetables Attacked, Pest Stage and Mean Number of Pests per Vegetable at Ajiwa Irrigation Site

Pest Type	Order	Vegetable	Part	Pest Stage	Mean number of Pests
Aphid		Tomato	Leaf	A	24.40
		Sweet pepper	Leaf	A	24.00
Cutworm		Spinach	Leaf	L	21.60
		Lettuce	Leaf	L	16.40
Hornworm		Tomato	Fruit	L	8.20
Pepper Maggot		Sweet pepper	Fruit	L	6.60
Thrips		Onion	Leaf	A	5.80

Aphid	Homoptera	Tomato	Leaf	A	24.40
		Sweet pepper	Leaf	A	24.00
Cutworm	Lepidoptera	Spinach	Leaf	L	21.60
		Lettuce	Leaf	L	16.40
Hornworm	Lepidoptera	Tomato	Fruit	L	8.20
Pepper Maggot	Diptera	Sweet pepper	Fruit	L	6.60
Thrips	Thysanoptera	Onion	Leaf	A	5.80

L = Larva; A = Adult

Table 4: Farmers Perception on the Control Methods Employed against Insect Pests of Vegetables Cultivated at Ajiwa Irrigation Site

Variable	Frequency	Per cent (%)
<b>(a) Incidence of Pests of Vegetables</b>		
Yes	45	90.00
No	5	10.00
<b>Total</b>	<b>50</b>	<b>100.00</b>
<b>(b) Need for the control of the Pests</b>		
Yes	50	100.00
No	0	0.00
<b>Total</b>	<b>50</b>	<b>100.00</b>
<b>(c) Control Methods Employed</b>		
Chemical	25	50.00
Cultural (handpicking, late planting, crop rotation, etc.).	14	28.00
Use of Botanicals	5	10.00
Combined Methods (e.g. chemical & cultural, etc)	6	12.00
<b>Total</b>	<b>50</b>	<b>100.00</b>

#### 4. Discussion

There were five types of selected vegetables species cultivated at the study site and these are lettuce, spinach, tomato, sweet pepper and onion. Some of the farmers cultivate only one type of vegetable such as tomato and onion. This might be due their high market demand especially to the southern part of Nigeria. More farmers cultivate tomato and sweet pepper than those cultivating other vegetables.

Findings of this survey also indicated that farmers of the study area were aware of the incidence of pests such as aphids, cutworms, hornworms, pepper maggots and thrips that negatively affect the vegetables production. Tomato had the highest prevalence of pest infestation by aphids and hornworm on both leaves and fruits respectively. Presence of aphids on tomato agrees with the findings of some researchers like Umeh *et al.* [13] who reported aphids as the most occurred insect pest attacking tomato in six states of Nigeria. Another survey by Olaniran *et al.* [2] in Ogbomoso Agricultural Zone of Nigeria confirmed the occurrence of caterpillars such as hornworm infesting tomato and some other fruit vegetables, and also identified these pests as the most damaging pests of fruit vegetables in Africa. The findings of the study have shown that aphid had the highest percentage of occurrence which was found attacking leaves of tomato and sweet pepper. Foster and Obermeyer [14] explained that aphids cause a lot of damages to vegetable by sucking plant juices, injecting toxins into the plant, secreting honeydew and transmitting certain plant viruses.

In addition to aphids, hornworm was also attacking fruits of tomato in some sites of the Ajiwa irrigation area. Hornworm is the larval stage of the five-spotted hawk moth (*Manduca quinquemaculata*) of the family Sphingidae of Lepidoptera [15]. Farmers' perception of insect type infesting fruit vegetables in Ogbomoso Agricultural Zone of Nigeria revealed similar findings that moth caterpillar is one of the serious pests damaging tomato fruits [2].

Variegated cutworm (*Peridroma saucia*) was another pest that seriously attacked foliage of spinach and lettuce. This is confirmed by Foster and Obermeyer [14] who reported that cutworms use to climb plants and feed on foliage part. Cutworm is the larval stage (caterpillar) of moth which hides on the day and comes out and feeds on the leaves at night, and has been recognized as a serious pest damaging vegetables [16].

Occurrence of pepper maggot (*Zonosemata electa* (Say)) attacking fruits of sweet pepper has been noticed. Pepper maggot is the larval form of a fly belonging to the Family Tephritidae of the Order Diptera. Explanation by Ridge [17] confirms that pepper maggot attack pepper fruit. The author added that the damage can be seen as a small puncture wound made by the female fly ovipositor while laying eggs after which the eggs hatch into the maggots (larvae) that burrow into the pepper fruit. Although the results from this study showed that pepper maggot was the second least occurred pest of the selected vegetables, Barlow and Kuhar [18] reported that a single maggot can cause 100% infestation leading to the destruction of the entire fruit. This means that the low prevalence of the pest should not be overlooked.

Thrips were the insect pests found attacking onion leaves at Ajiwa irrigation site. This finding is in conformity with that

of Alston and Drost [19] who reported that thrips is the key insect pest of onion in most onion production regions of the world. Although this is the least infestation found among the vegetables sampled from Ajiwa irrigation site, thrips population increases rapidly under hot, arid condition and can lead to economic loss [19].

The findings of this survey also revealed that most of the farmers engaged in using chemicals methods of control, while some of the farmers applied other methods such as cultural method which include hand picking, crop rotation, intercropping and manipulation of planting times. Findings of Umeh *et al.* [13] highlighted that intercropping of tomato with crops such as cereals, tubers and other vegetables reduced insect infestation in some parts of Nigeria. The current study showed that a small number of the farmers use botanicals for the control of pests of vegetables at Ajiwa irrigation site which might not be unconnected to the lack of awareness on the use of botanicals for the control of insect pests. It has also been found that there were farmers who used to combine two or more methods of controlling pests for effective performance and better yield.

#### 4. Conclusions

This study has found that there was occurrence of insect pests attacking a variety of vegetables grown at Ajiwa irrigation site. These pests are representatives of five different families (Aphididae, Noctuidae, Sphingidae, Tephritidae and Thripidae) of four insect orders (Homoptera, Lepidoptera, Diptera and Thysanoptera). It has been observed that the farmers practiced different type of control methods against the insect pests on their vegetables, such as chemical, cultural, botanical and combined methods, though concentrated more on chemical method. Information obtained from this study provides a record of insect pests found in the study area for the first time, and would definitely assist in promoting pests control through Integrated Pest Management (IPM) approach by understanding the type of pests occurring on Ajiwa irrigation site.

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