

INSECT AND VERTEBRATE PESTS ASSOCIATED WITH CULTIVATED FIELD PEA (*PISUM SATIVUM* LINN) IN NORTHERN GUINEA SAVANNA OF NIGERIA

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ABSTRACT

Pisum sativum commonly called field pea (Family; Fabaceae). The aim of this study was to determine the incidence and identify pests of field pea in major growing areas of Nigeria. The larval stages of the insect were collected from different field pea farms in Northern Guinea Savanna of Nigeria (Shika dam, Katanga and Zangon Danbarno, Sabuwa, Rapiyan fan in Barkin Ladi and Razek fan). The percentage incidence of pest's infestation was calculated for each sampling location. Identification of the pests was done using identification keys. Shika dam has the highest percentage incidence of insects with 60 % followed by Katanga, Zangon Danbarno and Rapiyan fan with 20 % while Razek fan has 15 %. Sabuwa has the least with 10 %. A total of six insect pests were identified from the six different sampling locations (*Spodoptera exigua* Hwan, *Spodoptera exempta* Walk, *Heliocoverpa armigera* Hubn, *Etiella zinckenella* Trevisch, *Tetranychus urticae* and *Caliothrips* sp.) and one mammal (*Rattus* sp.). All the insect pests are more devastating at seedling stage; however, *Tetranychus* sp. and *Caliothrips* sp. proceed up to podding stage. Farmers are advised to practice sole cropping and avoid intercropping with susceptible hosts.

Keywords: *Pisum sativum*, Pests

INTRODUCTION

Pisum sativum (field pea) belongs to the family Fabaceae. It is one of the six major pulse crops cultivated globally and is second highest yielding legume, next to broad bean. It is consumed both as fresh vegetable as well as in a dried form constituting a significant amount of protein in the vegetarian diet. The seeds are highly nutritious and are grown for food as well as for rotational benefits in cereals grains production. The inclusion of peas in crop rotation is agronomically very significant. The nutritional value of dry pea seed is similar to other grain legumes and contains 18-30 % protein, 35-50% starch and 4-7 % fiber (Shivani, 2017).

In Nigeria, field Pea is grown mainly in Kaduna and Katsina during the months of November to April, however in Plateau state it is cultivated during the rainy season. The plant is grown mainly as cash crop in Nigeria with the price being encouraging as in 2017 a bag of 100 kg was sold at ₦250,000: 00 ((\$ 694.44).

A number of factors both biotic and abiotic militate against field pea production (Shivani, 2017). Among the biotic constraints, insect pests are probably the main factors damaging field pea from seedling to fruiting stage. Large numbers of insect pests attack all parts of the plant at different stages which are as many

as 24 insect species being reported. The major insect pests include; pea stem fly (*Melanogromyza phaseoli* Tryon), pea leaf miners (*Chromatomyia horticola* Goureau), and thrips (*Caliothrips* sp.) (Prasad *et al.*, 1983; Bijur and Verma, 1995; Yadav and Patel, 2015). The authors (Shanower *et al.*, 1999; Kooner and Cheema, 2006) reported damaged by insects as major factor responsible for low crop yield on legumes which causes leaf death. There are no reports of pests infesting field pea in Nigeria, hence the need for this study.

MATERIALS AND METHODS

Survey of Insect and Vertebrate Pests in Northern Guinea Savanna of Nigeria

Field survey was carried out on insect and vertebrate pests infesting the crop in both irrigated and rain-fed fields in northern guinea savanna. Irrigated areas are; Shika dam, Katanga and Zangon Danbarno in Sabon Gari Local Government Area of Kaduna State and Sabuwa village in Local Government Area of Katsina State during the dry season. Rain-fed areas are; Rapiyan fan in Barkin Ladi and Razek fan in Jos South Local Government Area of Plateau State. Hand-held Geographic positioning system (GPS) was used to determine the coordinates of each sampling site.

Katanga is located at longitude 11°10'13" and latitude 7°46'39". Shika dam is located at 11.4°N and longitude 7.75°E. Zangon Danbarno is located at longitude 11°18'27" and latitude 7°73'23". All these three locations were found in Kaduna state where they grow three varieties of field pea i.e. gray seed, green seed and white seed variety except Zangon Danbarno where only gray seed and green seed varieties are cultivated for three to four months under surface irrigation with source of water from the river. The plants are being intercropped with tomato, onion and sweet potato or grown in sole cropping in all the three locations of Kaduna state. Sabuwa irrigated fields were located at 11°10'13"N and latitude 7°46'39"E in Katsina state with surface irrigation from bore hole, with the three varieties being cultivated, mostly intercropped with tomato, onion or maize. Rapiyan fan is located at Longitude 9°56'26"N latitude 8°96'87"E and Razek fan located at 9°76'5"N and latitude 8°81'42" in Plateau state. Also the three varieties of field pea were cultivated under rain – fed with sole cropping and few intercropping with potatoes as shown in figure 1.

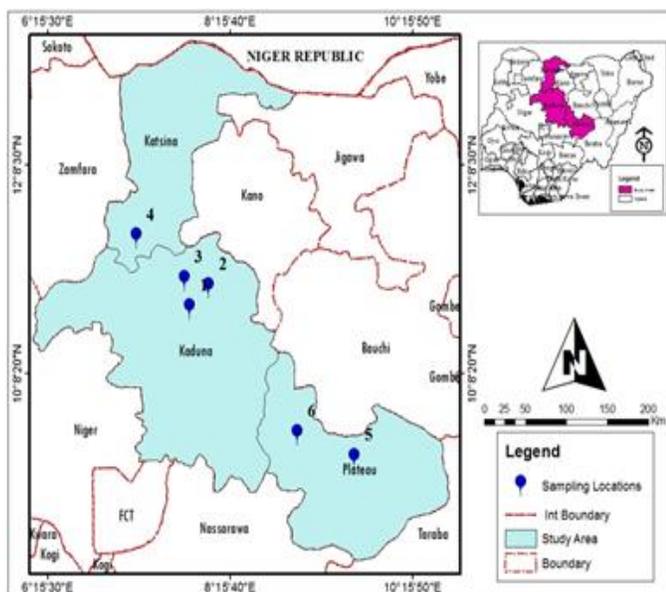


Figure 1: Map of Study Area with Sampling Locations.
Source: Modified From Administrative Map of Nigeria.

Key

- 1= Shika Dam
- 2= Katanga
- 3= Zangon Danbarno
- 4= Sabuwa
- 5= Rapiyan fan
- 6= Razez fan

The fields were inspected for any sign that indicate presence of the pests or the presence of different insect stages; in some cases larval stages were collected and inoculated on two weeks old field pea in the glass house for rearing. Incidence of pest's infestation for each location was calculated using the formula below:

$$\text{Incidence} = \frac{\text{Number of infested Plants} \times 100}{\text{Total Number of plants accessed}}$$

(Endale and Getaneh, 2015)

Identification of Insect and Vertebrate Pests of *P. sativum* L.

The different insects were identified based on different growth stages of the plant. Identification was carried out by identification keys by Scot and Alex; (2007); Patrick *et al.*, (2018) as shown in Table 1, while the adults were collected and taken to the museum of Department of crop protection entomology unit Institute of Agricultural research Ahmadu Bello University, Zaria for confirmation.

Table 1: Features for Identification of Pests Infesting *P. sativum* L.

Name of Pest	Common Name	Identification Features	Part of Plant attacked
<i>Spodoptera exigua</i> Hwan	Small mottled willow	Larvae green in color and smooth. Adults are brown in color with brown forewings and white hind wings.	Leaves
<i>Spodoptera exempta</i> Walk	African army worm	The moth is nocturnal. Larvae are black in color. It possess racquet shape scales at the top of the abdomen	Leaves
<i>Helicoverpa armigera</i> Hubn	Cotton ball worm	Young larvae are pale green. Fore wings yellowish to orange in adults.	Pods and seeds
<i>Etiella zinckenella</i> Trerischk	Pulse pod borer	Larvae are greenish-gray. Adults wings are longer than abdomen fore wing is brownish-gray.	Pod and seeds
<i>Tetranychus urticae</i>	Spider mites	Presence of very fine silk web covering the plants.	Whole plant
<i>Caliothrips</i> sp.	Thrips	Black in color. Very small in size, cigar shaped.	Whole plant
<i>Rattus</i> sp.	Rats	Presence of rat holes with destructed leaves, shoots and mostly pods and seeds.	Leaves, stems, pods and roots

RESULTS

Katanga and Shika dam irrigated fields harbor six types of pests which include; Red spider mite, rats, thrips, leaf and pod borer followed by Zangon Danbarno irrigated fields where most of the pests were found except red spider mites as shown in and Table 2. However, pests found in Sabuwa irrigated fields include; rats, leaf and pod borer while red spider mites and thrips were absent. Similar observations were made in Rapiyan fan and Razez fan in Plateau state were different pests were found except red spider

mites and thrips as shown and Table 2.

A total of six insects were identified which include; *Spodoptera exigua* Hwan, *Spodoptera exempta* Walk, *Helicoverpa armigera* Hubn, *Etiella zinckenella* Trerischk, *Tetranychus urticae* and *Caliothrips* sp. and one mammal; *Rattus* sp. *Spodoptera exigua* Hwan and *S. exempta* Walk are two insects identified to attack the leaf of field pea plant from seedling to flowering stage found in both irrigated and rain- fed fields. *Helicoverpa armigera* Hubn and *Etiella zinckenella* Treschk infest pod of field pea plant at early

podding stage, these two insects were found in both irrigated and rain-fed fields. *Tetranychus urticae* (spider mites) was found to infest the whole plant from seedling to harvest. This insect was found only in two locations Katanga and Shika dam irrigated fields. Similar results were found also for *Caliothrips* sp. except that it was found also in Zangon Danbarno. Only one vertebrate (*Rattus* sp.) was found infesting the whole plant in both irrigated and rain-fed fields. The morphological features for the identified pests are shown in Table 1 and Plate 1 to 3.

In terms of incidence of the pests, the highest percentage was observed in shika dam (60 %) followed by Katanga, Zangon Danbarno and Rapiyan fan (20 %) then Rzek fan (15 %) with Sabuwa having the least (10 %) as shown in Figure 2.

Table 2: Distribution of Pests in the Study Areas

Location	PESTS				
	Spider mite	Rats	Thrips	Leaf Borer	Pod Borer
Katanga	+	+	+	+	+
Shika Dam	+	+	+	+	+
Z/danbarno	-	+	+	+	+
Sabuwa	-	+	-	+	+
Razek Fan	-	+	-	+	+
Rapiyam Fan	-	+	-	+	+

Key: + = Present, - = Absent

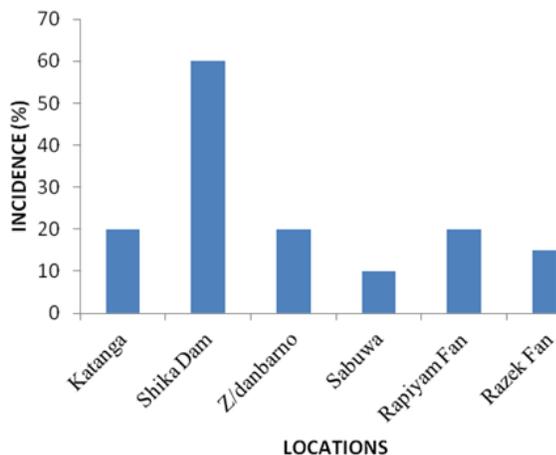


Figure 2: Incidence of Insect Pests of *Pisum sativum* Linn

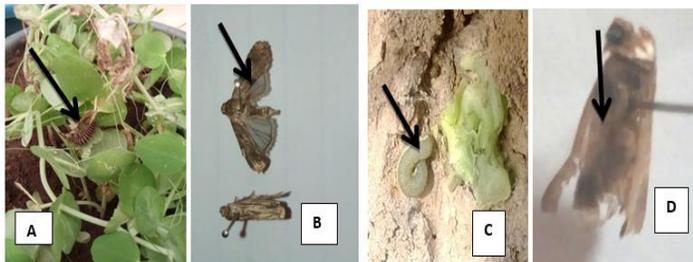


Plate 1: Leaf borers

Key:

A= Larvae of *Spodoptera exempta* B= Adult of *S. exempta*
 C= Larva of *Spodoptera exigua* D= Adult of *S. exigua*

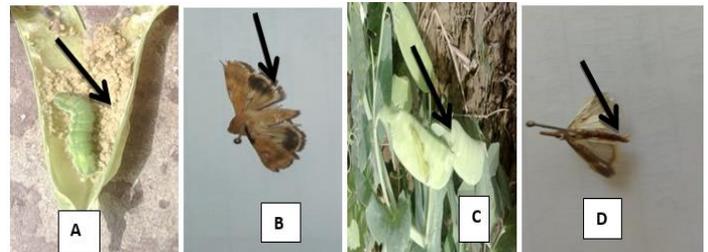


Plate 2: Pod Borers of *P. sativum*

Key:

A= Larva of *Helicoverpa armigera*. B= Adult of *H. armigera*
 C= Larva of *Etiella zinckenella* D= Adult of *E. zinckenella*

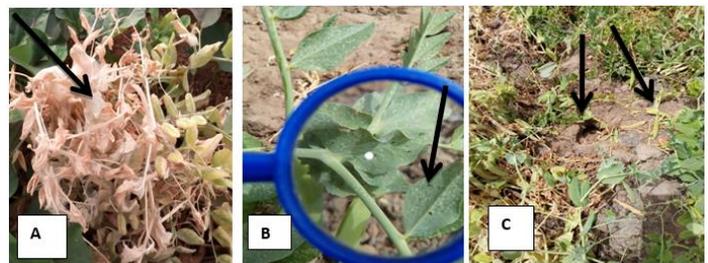


Plate 3: Pest infestation on *P. sativum*

Key:

A= *Tetranychus urticae*. B = *Caliothrips indicus*. C= Infestation by *Rattus* sp.

DISCUSSION

Field pea in irrigated fields of Shika dam in Kaduna state had the highest percentage incidence of pests compared to the other five locations. The reason may be due to the weather parameters of the location especially low moisture content because the water channels dries up early, also the canopy produced by the different varieties of field pea or susceptible plants intercropped with the field pea may have favored the survival of the pests in the area. Katanga and Zangon Danbarno irrigated fields had low percentage occurrence the most possible reason may be early planting which may have not favors the multiplication and spread of the pests. Similarly Razek fan and Rapiyan fan had the lowest percentage occurrence which may be due early and heavy rainfall in the area destroying the pests or making the locations unfavorable for survival of the pests.

Spodoptera exigua and *Spodoptera exempta* were found to infest the leaves of field pea in this study. Apart from this report on field pea, the two insects have also been reported on other legumes (Zheng *et al.*, 2011; Hua *et al.*, 2013). *Helicoverpa armigera* (Heliiothis) and *Etiella zinckenella* this is the second report on legumes in Nigeria as Dialoke *et al.* (2010) reported the two insects as pod sucking bugs of pigeon pea with highest percentage occurrence of 78 % in Imo State. These insects were found to infest fresh field pea pods in India, Yadav and Patel (2015). Apart from field pea plant, there are numerous reports of *S. Spodoptera*, *S. exempta*, *H. armigera* and *E. zinckenella* on

other host plants such as; cereals, Tomato, pepper, cotton, and ornamental plants in different parts of the world including West Africa, Europe and Asia (Chandra, 1974; Broza *et al.*, 1991; Armes, 1993; Arno, 1999; Devi *et al.*, 2002; Bues, 2003; Camprag *et al.*, 2004; Brevault, 2005; Lammers and Macleod, 2007; Lasa *et al.*, 2007; Gill, 2015; Ecofriendly pest management for food security, 2016; CABI 2019; insect-helicoverpa, 2019). Cereals, Tomato, pepper were found to be grown either intercropped or adjacent field pea farms in both irrigated and rain-fed fields which suggest possible transfer of the insect and also the use of surface irrigation may have served as source of transmission of the insects.

Spider mites and thrips were found only in irrigated fields with the exception of Sabuwa which may be connected with cultivation of cereals, garden egg and vegetable crops around the farms as well as being intercropped with the field pea because these two insects pests have been reported to infest vegetables and cereal crops (Pitkin, 1972, Pelikan, 1990; Mound and Reynaud, 2005; Zur.Strassen and Borges, 2005; Cannon *et al.*, 2007; GPP, 2009; Reynaud, 2010). Similar observations were made in this study, in Shika dam garden egg field adjacent field pea farm was found to be highly infested with these two insects which suggest transfer of the insects between the fields. Planting of rice in nearby fields may have suggested that the larvae of these insects survive on the straw of the rice plants. Identification of *Caliothrips* sp. (thrips) on field pea is in line with the findings of Green Plant Protection (GPP), 2009; Hakim *et al.*, 2013; Cranshaw, 2014; Yadev and Patel, 2015; Malinosk *et al.*, 2019). Most farmers in the study areas do not perceive the presence of thrips and red spider mites as insect threats to the crop because of their minute structures. *Rattus* sp. commonly refers to as rats were among the pests of field pea identified in this study. Even though the rats was unable to be caught, interview with the farmers reveal that rats attack the plants especially the varieties of field pea (gray seed and green seed) which forms canopies compared to the white variety which is erect with few leaves, stipules and many tendrils and does not form canopies. Rodents are among the most important global pests that threaten food production (Singleton *et al.*, 1999a; Stengeth *et al.*, 2003; Wood, 2014).

Conclusion

In conclusion, a total of six insect pests belonging to different orders were identified from the six different sampling locations these include; *S. exigua*, *S. exempta*, *H. armigera*, *E. zinckenella*, *T. urticae* and *Caliothrips* sp. and one mammal (*Rattus* sp.).

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