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Investigation on the entomological and beneficial insect pests associated with cucumber (*Cucumis sativus*) production in South Western Nigeria

Falade MJDOI: <https://doi.org/10.22271/j.ento.2022.v10.i2a.8979>**Abstract**

Cucumber production has gained recognition as one of the essential market vegetables in Nigeria because of the continued awareness of the numerous health benefits attached to its consumption. This has progressively affected its cultivation, leading to increased insect pest outbreak. Based on the above, the study was conducted at the Ekiti State University Teaching and Research Farm, Ado-Ekiti, to ascertain the entomological and beneficial pest associated with the production of cucumber and the damage caused by each insect. Cucumber variety Cu 999 was planted at a spacing of 30cm x 30cm. Insect feeding modes and frequency of occurrence were recorded on the plant from 6 am to 7 pm in 2 hours slots catches, which were done twice per week. The collected insect pest was identified for the damage caused to the plant. The study shows that insects were found on the stem, leaves and flowers of cucumber, some of them damaged the various parts of these plants while others were beneficial. The collection of each insect obtained consists of insect pest, predators and pollinators there were 23 insect species belonging to fifteen different families and seven orders. Out of these, 23 species belonged to Homoptera (44%), which has the highest frequency of occurrence. This was closely followed by Coleoptera (39%), Hemiptera (21.7%), Orthoptera (13.0%) and Hymenoptera (13%). The other Lepidoptera and Dermaptera had an occurrence of 4.3% each. The study concluded that there were varied degrees of entomological and beneficial insect pest associated with cucumber production.

Keywords: Cucumber, entomological pest, catches, damage**Introduction**

Cucumber belongs to the family Cucurbitaceae, it is one of the most important vegetable crops grown in both the tropical and subtropical regions ^[4]. Estimated world cucumber production in 2020 was 91.3 million metric tonnes (MMT), with China being the largest producer accounting for about 77% of the output (70.3MMT) (4). West Africa especially Nigeria, Egypt, Ghana and Niger are the key Cucumber producing countries. Egypt is the largest producer in Africa accounting for about 488, 723 tonnes which are closely followed by Nigeria (27,000 tonnes) ^[3]. Despite the increasing relevance of cucumber in Nigeria, attainable yields and overall productivity in farmers' farms are seriously constrained by inappropriate agronomic practices. scarcity of planting materials, lack of capital, climatic factors, high fruit perishability, lack of production experience and the problem of pests and diseases ^[8].

Generally, shifting weather pattern has often resulted in changing climate, which tends to threaten agricultural productivity ^[10]. To cope with these changes, adaptive strategies that will ensure crops are protected or become resilient to these changes in weather conditions are of utmost importance. Unfortunately, insect pests are real problems for producers because of the damage they cause, pesticides are most often used to control these pests. The effect of which has resulted in a significant reduction in the entomological diversity present in crops ^[7]. While pesticides can control some phytophagous insects, they also contribute to the decline of other functional groups of insects such as predators, parasitoids and pollinators, which are essential for maintaining the equilibrium agro ecological systems. Crop protection as a control option must be preventive rather than curative ^[2], therefore, the first preliminary step for successful protection of crops from pests is the adequate knowledge of such pests to have an understanding of the life cycle, mode of feeding, time of the invasion of crop and frequency of occurrence. This requires a frequent inspection to detect the onset of an attack and attempt to halt their development by the most appropriate means.

There have been various studies about insect pest's role in reducing the yield of cucumber productivity ^[11].

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Reported the preliminary study of insect pests associated with cucumber production in the Ogbomoso agricultural zone, the study concluded that four insect pests belonging to two families were observed to affect cucumber production. Similarly, [1] reported that about four beetles and three aphids attack cucumber, reducing yield or productivity. Based on the above, this study was carried out to assess both the beneficial and harmful insect on cucumber at different growth stages in Ado-Ekiti south western Nigeria.

Materials and Methods

Location of the experimental site

This experiment was conducted at Ekiti State University Teaching and Research Farm Ado-Ekiti, The University Teaching and Research Farm are located at latitude 7.7129°N and longitude 5.2523°E with a mean annual rainfall of 1478mm, and the average minimum and maximum temperature are 27.2 °C and 22.9 °C respectively. The relative humidity ranges from 47.38% to 88.19%.

Pre-planting, Planting and Post- Planting operation

The site was cleared of existing vegetation and packing of debris was carried out before it was made into ridges. The experimental plot was tilled using a hoe and poultry manure was incorporated into the soil before planting. Cucumber variety Cu999 was planted at a spacing of 30cm X 30cm. Two seeds were planted per hole and thinning was done to one seed per stand after germination, wetting of the plant was done twice in the morning (6-7 am) and evening (6-7 pm). Weeding was done twice with the use of a hoe. Three weeks after germination, Staking was done and the rope was used to twine the cucumber to support the stem of the plant and also prevent trailing of the branch on the ground. Harvesting was done six weeks after planting.

Study of the of Insects behavior on cucumber plant

The frequency of insects in the cucumber was determined based on observations of the stem, leaves and open flowers every day, during each of the following daily time frame from the 10th, 13th, 16th, 19th, 22nd, 25th, 28th and 31st day after planting (DAP), the insects were monitored in the morning (6-7 am) and evening (6-7 pm) in a slow walk along with all plants, the identity of all insects that visited *Cucumis sativus*

was recorded. Specimens of all insect taxa were identified. For each species, two to five insect specimens were captured. These insects were conserved in 5ml of ethanol for subsequent taxonomy determination. All insects encountered on stem, leaves and flowers were registered and the cumulated results were expressed in a number of visits to determine their relative frequency in the entomology of the cucumber plant. In addition to the determination of insect frequency, direct observations of the feeding behavior of cucumber plant were made on insect fauna in the experimental field. The plant products harvested by insects during each visit were registered based on the foraging behavior on a flower, nectar foragers were seen extending their proboscis to the base of the corolla while pollen gatherers scratched anthers with the mandibles or the legs; on the stem and the leaves, stem feeders and leave feeders were seen eating those parts of the plant.

Identification of the insects

Before the identification of insects, petri dish were sprayed with ethanol and cleaned with tissue paper. Filter paper was spread inside the petri dishes before the identification of insect, the insects were washed with ethanol and then placed in a petri dish and later preserved in the refrigerator. The identification was carried out using a stereomicroscope and family identification in respect to its morphology.

Data analysis

The occurrence of the insect population was graphically represented and means subjected to analysis of variance (ANOVA) using SPSS statistical software.

Results

Insects found on cucumber plants

A total of 23 insects species belonging to fifteen Families and seven Orders were seen visiting the cucumber plant (Table 1). Out of these, nine species belong to the Order Coleoptera and one to Dermaptera. The order Hemiptera, Orthoptera and Hymenoptera, were five, three and three respectively. While the order Homoptera and Lepidoptera were 1 respectively (table 1). Among the Coleoptera species, *Epicauta hirticornis*, *Diabrotica barberi* and, *Podagrica malvae* was the most frequent pest.

Table 1: Insect pests associated with cucumber in the study area

Common name	Order	Family	Genus	Species
Orange cucumber beetle	Coleoptera	Chrysomelidae	<i>Aulacophora</i>	<i>Aulacophora</i> spp
Pumpkin flea beetle	Coleoptera	Chrysomelidae	<i>Raphidopalpa</i>	<i>Raphidopalpa foveicollis</i>
Blue cucumber beetle	Coleoptera	Chrysomelidae	<i>podagrica</i>	<i>podagrica malvae</i>
Red pumpkin beetle	Coleoptera	Chrysomelidae	<i>Aulacophora</i>	<i>Aulacophora foveicollis</i>
long horn beetle	Coleoptera	Cerambycidae	<i>Anoplophora</i>	<i>Anoplophora glabripennis</i>
Corn root worm	Coleoptera	Cerambycidae	<i>Diabrotica</i>	<i>Diabrotica barberi</i>
long horn beetle	Coleoptera	Cerambycidae	<i>Pterolophia</i>	<i>Pterolophia caudata</i>
Blister beetle	Coleoptera	Meloidae	<i>Eupicauta</i>	<i>Eupicauta</i> spp
Lady bug beetle	Coleoptera	Coccinellidae	<i>Harmonia</i>	<i>Harmonia axyridis</i>
Ear wig	Dermaptera	Forficulidae	<i>Forficula</i>	<i>Forficula auricularia</i>
Spittle bug	Hemiptera	Aphrophorida	<i>Aphrophora</i>	<i>Aphrophora alni</i>
Squash bug	Hemiptera	Coreidae	<i>Anasa</i>	<i>Anasa tristis</i>
Cotton stainer	Hemiptera	Pyrrhocoridae	<i>Dysdercus</i>	<i>Dysdercus flavidus</i>
Cucumber aphid	Homoptera	Aphididae	<i>Apis</i>	<i>Apis gossypii</i>
Eastern stone grasshopper	Orthoptera	Pamphagidae	<i>Prionotropis</i>	<i>Prionotropis hystrix</i>
Long horned grasshopper	Orthoptera	Tettigonidae	<i>Phlugis</i>	<i>Phlugis manstipa</i>
Grasshopper	Orthoptera	Acrididae	<i>Schistorcera</i>	<i>Schistorcera americana</i>
Cinnabar moth caterpillar	Lepidoptera	Erebidae	<i>Tyria</i>	<i>Tyria jacobaeae</i>
Black cotton stainer	Hemiptera	Pyrrhocoridae	<i>Dysdercus</i>	<i>Dysdercus mimulus</i>

Mode of feeding of the insect pests

In terms of the mode of feeding the insect observed in the cucumber plot were divided into two groups defoliating and sucking insects. Majority of insects from the Order Coleoptera, Orthoptera and Lepidoptera belongs to the defoliating group. The order Coleoptera represented by Chrysomelidae and Cerambycidae (*Aulacophora spp*, *Eupidauta hirticornis*, *Anoplophora glabripennis*, *Diabrotica barberi*, *Podagrica malvae*, *Raphidopalpa foveicollis*, *Harmonia axyridis*, *Pterolophia caudata*, *Aulacophora foveicollis*,) partially devoured the leaves of the plant, resulting in perforation of the limb, the orthoptera consisting of (*Prinotropis hystrix*, *Phlugis mantispa*, *Schistocerca Americana* and Lepidoptera (*Tyria Jacobaeae*) gnawed at the leaf and sometimes cut the stem of the young plant. Sucking insects observed were *Aphis gossypii*, *Dysdercus flavidus*,

Anasa tristis, *Dysdercus mimulus* and *Aphorophora alni*. These insects sting and suck the sap in the leaves and flower (Table 1).

Action of the beneficial insects (Predators and Pollinators)

The beneficial insects observed on the cucumber were the predators and pollinators. The predators captured belong to the family Reduviidae [*Rhiginia crutiata*], Forficulidae [*Forficula auricularia*] formicidae [*Camponotus spp*, *Lasius Niger*]. Some species of the family formicidae attack eggs, caterpillar and larvae of other insect. Several have been found extracting bactrocera from fruit or recovering third stages hopper that have skipped fruit. At flowering stages, several pollinating insect appeared on the cucumber, majority of this belong to the order Apidae [*Apis mellifera*] which forage the flower (Table 2).

Table 2: Beneficial insects associated with cucumber

Common name	Order	Family	Genus	Species
Assassin bug	Hemiptera	Reduviidae	<i>Rhiginia</i>	<i>Rhiginia crutiata</i>
Predatory ant	Hymenoptera	Formicidae	<i>Camponotus</i>	<i>Camponotus spp</i>
Black/garden ant	Hymenoptera	Formicidae	<i>Lasius</i>	<i>Lasius niger</i>
Africa bee	Hymenoptera	Apidae	<i>Apis</i>	<i>Apis mellifera</i>

Frequency of occurrences of the insects visits

The frequency of insects visiting the cucumber depends on the part of the plant visited. (Figure 1) the order Homoptera has the highest frequency of occurrence which show the rate of damage they caused to the plant. This is closely followed by order Coleoptera, Hemiptera, Orthoptera and

Hymenoptera. The order Lepidoptera and Dermaptera had the lowest frequency of occurrence. The frequency of occurrence was calculated by no of order of the insect divided by total number of cucumber pests and insects multiply by 100 which gives the percentage of each order.

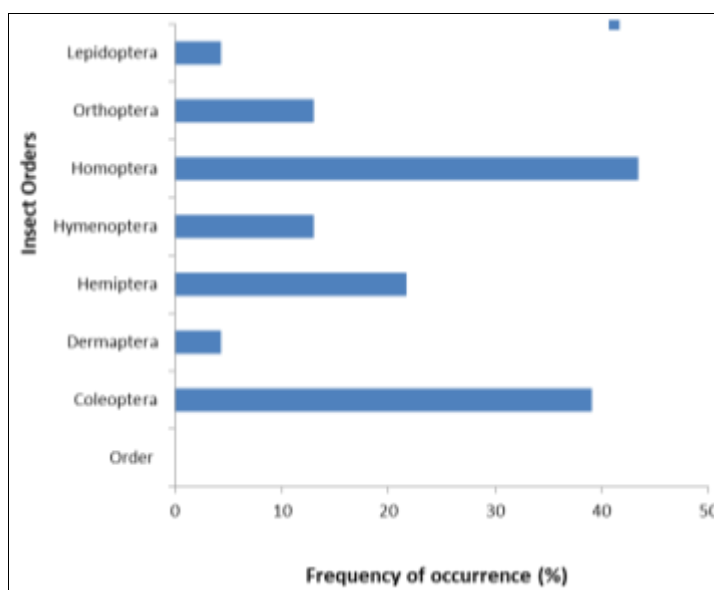


Fig 1: Frequency of occurrence Insects pest





Plate 1: Showing the destruction of cucumber leaves by various insects

Cucumber plants showing herbivory characteristic of blue cucumber beetles, (b) cucumber plant showing herbivory of spittle bug, (c) flea beetle eating up cucumber leaves, (d) cucumber plant showing herbivory characteristics of larvae of Lepidoptera, (e) cinnabar moth caterpillar eating up cucumber plant, (f) cucumber plant showing herbivory characteristics of

grasshopper, (g) Africa bee during pollination, (h) cucumber plant showing herbivory characteristics of katydid (a) Assassin bug (*Harmonia axyridis*), (b) Ear wig (*Forficula auricularia*), (c) Lady bug (*Harmonia axyridis*), (d) Red pumpkin beetle (*Aulacophora foveicollis*), (e) cucumber aphid (*Aphis gossypii*), (f) long horn beetle (*Pterolophia caudata*).



Plate 2: Result of insects identified under stereomicroscope

Pictures of cucumber insects

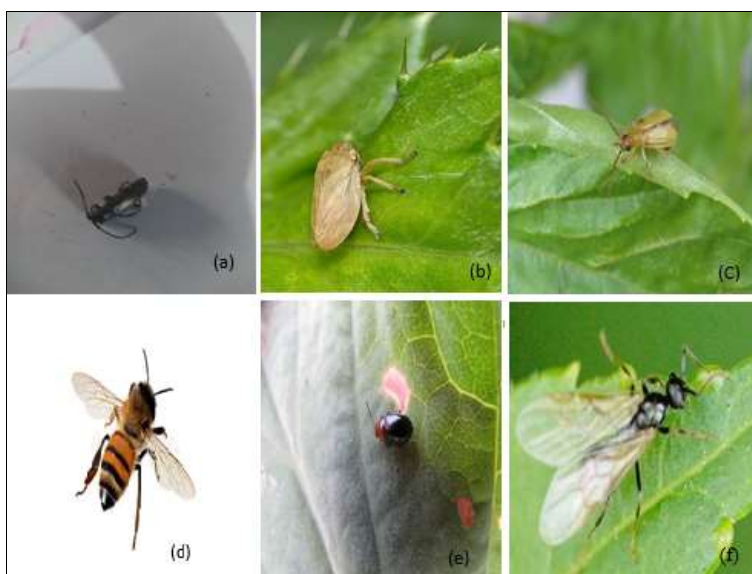


Plate 3: (a) long horn beetle (*Anoplophora glabripennis*), (b) spittle bug (*Aphrophora alni*), (c) cucumber beetle (*Diabrotica barberi*), (d) Africa bee (*Apis mellifera*), (e) blue cucumber beetle (*Podagrica malvae*), (f) black /garden ant (*Lasius niger*)

Discussion

Cucumber production in south western Nigeria is gaining recognition and is on the increase possibly due to the short life cycle of about 6-8 weeks which makes production faster with high turnover rate of investment coupled with the numerous health benefits. This has made it to attract a lot of insect pest which attacked the leaves, stems and flowers thus reducing yields with serious economic implication. This is because the insect pest has direct effect on the photosynthetic rate of the flower. In this study, the cucumber plant attracted a wide range of insect pest, examination of the insect pest revealed that 23 insect species from 15 families and 7 orders were found at different stages of growth reducing yield or productivity. The result of this findings agrees with the work of ^[11] who reported a study on the insect pest associated with the production of cucumber in Ogbomoso agricultural zone. The study shows that four insect pests from two families were reported to attack the cucumber at various stages of production.

In this study, the frequency of the insect visiting the cucumber plot was studied by dividing the number of orders of insect by the total number of cucumber pest and multiplied by 100 to give us the value in percentage. The result of which shows that Homoptera has the highest frequency which is closely followed by Coleoptera while Hymenoptera, Lepidoptera, Dermaptera and Orthoptera had the lowest frequency. The frequency of visit is directly proportional to the damage potential caused by the insect. In addition, the results of this work revealed the actual part of the plant affected, this is important as a guiding principle for us to know the ideal time for the control of the pest. ^[6] reported the role of insect visit on cucumber, the study shows that five insects were known to have deleterious effect on cucumber and that the frequency of visit by *Apis dorsata* was the highest while that of Formica specie was the lowest.

In this study, there were beneficial insect pest that frequently visit the cucumber which were the pollinators and the predators. The predators captured in this study belong to the family Reduviidae, Forficulidae and Formicidae. Some of the species found attack eggs, caterpillar and larvae of other insects, several others have been found extracting bactrocera from fruits or recovering third stage hopper that have skipped fruit. The predators in this regard can be developed as entomopathogenes in further research studies and if successful can be used as classical conservation or as augmentative biological control agents which are the current trends in plant pest and disease management, this is because they are components of integrated pest management strategies ^[9]. Reported the use of insect pathogenic viruses as microbial agents for the control of Lepidoptera pest. Similarly ^[5], reported the management of insect pest of fruit crops in hot and humid regions with special reference to date palm and lasora by using entomopathogenes, the study shows that a high degree of success was recorded. Once the entomopathogenes are established, they are usually stable and do not endanger bio-diversity, bio-security, natural resources as well as human beings unlike the use of insecticides, fungicides, fertilizers and nematicides. The pollinators on the other hands play important role in fruit development by their foraging activities.

Conclusion

This study shows that there are several insect pests affecting the production of cucumber in Ado-Ekiti South Western,

Nigeria. Some of them reduces yield or productivity with serious economic implications while others are beneficial. The study also shows that these insect pests belong to various orders and family.

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