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STUDY ON OBSERVED INSECT SPECIES AVAILABLE AND THEIR ABUNDANCE ON COWPEA *VIGNA UNGUICULATA* (L.) WALP AT YOLA AND BIU, NORTH EASTERN NIGERIA

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Abstract: *Cowpea, a protein, carbohydrate and minerals source, was a respected food and cash crop in many countries of the tropics and subtropics. Insect species complex and abundance on cowpea was studied on five cowpea varieties: Banjara, Warware bashi, UAM 1046-6, UAM 1501-1 and BOSAP 288 at Yola in 2019 and Biu in 2020, over 300 km apart in Adamawa and Borno States Nigeria. The main objectives are to observe and record the insect pest species that attack this vital crop and their abundance in this season. Used was a Split Plot Design replicated 3 times. Each replication consists of 5 plots, each plot is divided into 6 subplots, each subplot is 9m^2. Synthetic insecticide, Karate Super 2.5 EC (lamda-cyhalothrin and dimethioate 150g/l) applied at the rate of 1 litre in 400 litres of water, Ginger extract, Moringa leaf extract, Garlic extract, 500g each, the Intercrop and Control. The ginger extract, moringa leaf extract and garlic extract were pounded and the pastes were put in 1 litre of water and sieved, and later, the ginger extract and moringa leaf extract were mixed with 10 litres of water, but Garlic extract was mixed with 5 litres of water. Sorghum (or companion crop) was sown with the cowpea varieties in appropriate subplots. The insecticides were weekly applied. Data was collected during the experiment in the two seasons and during the trials, thirteen (13) and eleven (11) insects were collected and identified at Yola in 2019 and Biu in 2020 cropping season. These insect pests include: Aphis craccivora Koch, Aplecnomis curvipes Fab. Clavigralla tomentosicolis Stal., Messor spp., Vespula vulgaris L., Oedaleus nigeriansis Uvar, Henosoplachna elaterii Rossi, Megalurothrips sjostedti Trybom, Orthettrum coerulescens Fab., Maruca vitrata Fab. and Mantis religiogsa Heli. The Hemipterans, Hymenopterans and Orthopterans were more abundant than the other insect pests, 23.08% at Yola and 16.67% at Biu. Diptera was also 16.67%. When the two locations were combined, the Hemipterans and Hymenopterans were 20%, Orthoptera and Diptera were 8% and 12% in abundance, and the rest Orders were 8% in abundance. Mean yield from the five (5) sampled cowpea plants only per plot were 43.7kgha^{-1} and 36.99 kgha^{-1} per plot at Yola 2019 and Biu in 2020 cropping season respectively. Best control measures against them were given.*

Keywords: *Insect pest species, Cowpea, Abundance.*

Introduction

Cowpea (*Vigna unguiculata* L. Walp) belongs to the family Fabaceace. It is one of the most important crops known to man. It is one of the African indigenous vegetables (AIVs) whose leaves are consumed as vegetable as well as grain in Africa and can play a major role in food insecurity and malnutrition (Langyintuo *et al.,* 2003). Cowpea has a number of common names, depending on the area of production, cultivars and people of the area (Egho, 2010).

Vigna unguiculata is a member of the Vigna (peas and beans) genus, and unguiculata is Latin for "with a small claw", which reflects the small stalks on the flower petals (Small, 2009). The cowpea is cultivated in tropical and subtropical regions of Africa, America and Asia under a variety of ecological conditions. Cowpea is the most important legume in regions where water stress is the major constraints for its production (Santos, 2000). Cowpea is one of the grain legumes most readily available and popular source of plant protein in Nigeria, and that Nigeria produces about 800,000 tonnes, 80% of which come from the northern states. Cowpea like other leguminous crops is important in the developing countries of the world. Nigeria and Niger produce about 49% of the world's cowpea (Ndor and Alhamdu, 2010). Cowpea is cultivated extensively in the sixteen (16) African countries, yielding about 2/3 of the world's production estimated at about 2.5 million tonnes of dry bean per annum. The major producers in Africa are Nigeria, Niger, Burkina Faso, Ghana, Kenya, Malawi, Senegal and Chad Republic (Vanderborth and Baudon, 2001). Nigeria and Niger produce 850,000 and 270,000 tons per annum respectively or approximately 50% of the world's cowpea production (Vanderborth and Baudon, 2001). Cowpea production has numerous constraints particularly insect pests and diseases which cause reduction in dry weight, grain quality and viability making the seed unfit for planting as well as for consumption (Abolusoro, 2001). Apart from the field diseases that limit the yield of cowpea seed borne fungi causes deterioration in cultivation resulting in the reduction of seed viability (Nasir, 2003).

According to USDA food data base, cowpea has the highest percentage of calories from protein among vegetarian foods (Monica, 2007). In terms of benefits derived from cowpea, the pods are eaten raw or cooked. The seeds can be threshed from the pods which contain 8-20 seeds and stored or processed to flour for industrial use. The husk is a source of animal feed. cover crop for maintaining soil productivity and reducing the rate of soil erosion as well as conserve moisture. Cowpea is a good source of protein, carbohydrate, fats, fibre, vitamins and minerals to millions of people around the globe. On dry weight basis, it contains 23.4% protein, 1.8% fat, 60.3% carbohydrates, 1.3% fibre and vitamins A, B_1, B_2 and C. It is also a good rich source of mineral elements like zinc, iron and calcium. The leaves of cowpea are also cooked (Santos, 2000). Lemma *et al.* (2009) said that cowpea is one of the most important food legumes in the hot dry tropics and Sub-Saharan Africa. In many places especially in East Africa, cowpea is an important food crop that ensures food security and improves the quality of diet of rural populations mainly because it

is rich in proteins, more accessible and in biological value because it contains high level of lysine and tryptophan. The food crop, cowpea, can be consumed in the form of grain or dried and cooked green leaves; it can also be used for animal feed and as cover crop (Santos, 2000).

Some Major Insect Pests of Cowpea

Insect pests have been identified, among other *factors*, as major constraints in cowpea cultivation (Egho, 2010). The major insect pests reported on cowpea which cause severe damage in the field are the foliage beetle, *Ootheca mutabilis* Sahl, the cowpea aphid, *Aphis craccivora* Koch., the flower bud thrips, *Megalurothrips sjostedti* Trybom, the legume pod borer, *Maruca vitrata* Fab. and a host of pod-sucking bugs which include *Clavigralla tomentosicolis* Stal., *Anoplecnomis curvipes* Fab and *Aspavia armigera* Fab from seedling to harvest phase, cowpea is under perpetual siege (Egho, 2010). Apart from the direct damage to crop, some of the insect pests such as *A. craccivora* Koch and *O. mutabilis* Sahl cause indirect injurious damage to the crop, by transmitting viruses which further worsen the crop condition (Stoetzel and Miller, 2001; Borowiak-Sobkowiak *et al.,* 2017). Where the crop is cultivated, insect pests are known to attack it. However, cowpea insect fauna varies from locality to locality, that is, not all insects occur in all regions (Navas, 2014). The activities of insect pests have greatly contributed to the low yields of cowpea in African countries and control of cowpea pests has been by application of synthetic chemicals (Abtew, 2015 and Choudhary *et al., 2017*). According to Egho (2010), yield of cowpea can be high if production constraints are adequately addressed. This includes attacks and damages to the crop by insect pests which largely contribute to low yields ((Egho, 2010).).

Insect pests fauna of dry season irrigated cowpea at Maiduguri studied in relation to the phenology of the crop during the cold dry season where the crop growth is almost at a standstill which lengthen the pre-flowering stage and expose the crop to greater damage by foliar feeding insects includes the *Melanagromyza phaseoli* Trybon which reach pest status, where nine (9) other species were collected, viz-viz: *Aulocophera solani* Kalt, *Empoasca* spp., *Chrotogonus brevipennis, Oodeleus nigeriansis, O. senegalensis, Anoplecnomis curvipes, Henosepilachna elaterii* (Rossi), *Piezotrachelus varium* Wagn and the predator, *Exochomus flavipes* which occurred in insignificant numbers (Malgwi *et al.,* 2015; Minta *et al.,* 2016).

Methods and Materials

The experiment was conducted in the teaching and Research Farm of the Department of the Crop Production and Horticulture, Modibbo Adama University, Yola and Biu in Adamawa and Borno States of Nigeria in 2019 and 2020 cropping seasons respectively.

Yola is located at latitude 19°10'N and longitude 12°35'E and an altitude of 158.5m above sea level in the northern guinea savannah of Nigeria (Adebayo and Tukur, 1999). The annual rainfall ranges from 900-1300mm, the length of rainfall is usually 150-160 days and mostly from May to October (Adebayo and Tukur, 1999; World Weather.com, 2019). The annual minimum and maximum temperature of the area ranges between 20.2°C to 48°C respectively (ADADP, 1998; World Weather.com, 2019).

The seeds of cowpea cultivars (Banjara, Warware bashi, UAM 1046-6, UAM 1501-1 and BOSAP 288) was obtained from Borno State Agricultural Development Programme (BOSADP) and seasoned farmers who were known cowpea producers.

Biu is located in Northern Guinea savannah region of Nigeria between latitude 10°55'N and latitude 12°13'E and an altitude of 750m above sea level. The annual rainfall ranges from 800-1051mm with soil texturally classified as clay loam The annual minimum and maximum temperature of the area ranges between 23.5°C and 32°C respectively (Weather Atlas, 2019).

The seeds of cowpea cultivars (Banjara, Warware bashi, UAM 1046-6, UAM 1501-1 and BOSAP 288) was obtained from Borno State Agricultural Development Programme (BOSADP)

Agronomic and Cultural Practices

The experimental sites at Yola in 2019 and Biu in 2020 cropping seasons were ploughed, harrowed and ridged by tractors. Three (3) cowpea seeds were sown per hole and after germination, they were thinned to two (2) seedlings per hole and later, SSP fertilizer was applied on the cowpea farm at the rate of 25 Kg P_2O_5 a.i. ha^{-1} to each plot immediately after sowing, which tallies with the practice of Hassan (2009).

Seed dressing: The seeds of the cowpea varieties were dressed with Fanasan D before planting in order to encourage good germination and protection against soil-borne, seed-borne pests, bacteria and other predators such as ants and birds damage at germination and seedling stage as supported by Alabi and Emechebe (2004).

Seed planting: The seeds of cowpea were planted in the first week of August in both at Yola and Biu in 2019 cropping seasons at a spacing of 60cm by 60cm between rows and within rows at a sowing depth of 3-5cm. Ungerminated seeds per hole were supplied 7days after germination of the seeds. The sorghum was planted at the time of cowpea seed planting (Quin, 1997 and FAO, 2010).

Weeding and fertilizer application

Hand weeding was carried out three (3) times after emergence. SSP fertilizer was broadcast applied on the cowpea plots before sowing (as done by Dugje *et al.* 2009), the SSP fertilizer was applied twice.

Experimental Design and field layout

The experiment consists of six (6) treatments: Control, Karate Super, Ginger rhizome extract, Moringa leaf extract, Garlic extract and Intercrop (or companion crop plant) which was laid out in a Split Plot Design replicated three (3) times. Each replication contain five (5) plots and each plot was subdivided into six (6) subplots, thus 30 subplots per replication. Vertical length was 25.5m and horizontal length was 19m, which is equivalent to 1555.5m^2. 2m was made as a pathway between replications.

Preparation of Botanical extract and spray application

The synthetic insecticide, Karate Super 2.5 EC (lamda-cyhalothrin mixed with dimethoate 150 gm/litre) was carefully applied at the rate of 1 litre in 400 litres of water per hectare (i.e. 2.5ml/litre of water).

A weight of 500 grams each of *Moringa oleifera* leaf, Ginger (*Zingiber officinale*) rhizome extract and Garlic (*Allium sativum*) extract were pounded in a clean mortor, and the paste of each was soaked in 1 litre of water and were filtered through a fine sieve into a container, then the filtrate of moringa leaf extract and Ginger rhizome extract was mixed with ten (10) litres of water each, but that of Garlic was mixed with five (5) litres of water and mixed with soap in order to allow the depositing of this biopesticide on the cowpea leaves and it was left for a day, and the filtrate-soap mixture was sprayed on the cowpea crops as done by Merceline (2008), and the Ginger rhizome extract was applied as that of Merceline (2008) and Moringa leaf extract application continued also as done by Ndubuaku *et al.* (2015). The synthetic and biopesticides were applied/sprayed on the cowpea crops at weekly intervals.

Data collection (Insect pests sampling)

The insect pests on each sampled plant on the plots was sampled before applying the insecticides. In both locations, Yola in 2019 and Biu in 2020 cropping seasons, sweep net was used in sampling the insect pests on each plot by moving the sweep net around the cowpea varieties, and after sampling, the sweep net was closed and tied with a rope until they were emptied in a container for identification. Colonies of cowpea aphid *Aphis craccivora* Koch was counted randomly from the five (5) selected cowpea plants per subplot before applying the insecticides. The insect pests were then sorted out into orders, families and species and indentified in the laboratory in the Department of Crop Protection, Modibbo Adama University, Yola.

Yield loss caused by the insect pests for each treated and untreated plants in percentage was handpicked so that the yield loss caused by the insect species complex during the experiment can be determined as it was found to be in line with the report given by Malgwi *et al.* (2011, 2013) using this formula:

$$\text{Yield loss (\%)} = \frac{(Weig \quad of\ undamaged\ seeds - Weigh \quad of\ damaged\ seeds)}{Weight\ of\ undamaged\ seeds}\ x\ 100$$

$$= \frac{(A - a)}{A}\ x\ 100$$

Where A = Weight of seeds of uninfested plants

a = Weight of seeds of natural infested plants (untreated)

DATA ANALYSIS

The data collected was subjected to analysis of variance (ANOVA) based on the Split Plot Design (SPD) and the means was separated using Students Newman Keuls (SNK's).

Results

Insect species complex on cowpea varieties in MAU, Yola at 2019 cropping season

In Yola farm, the main insect pests were aphids (*Aphis craccivora* Koch) in the 11th WAS (Table 1). Majority of the insect pest species found in Yola are eleven (11) in number and they are in the orders of Hemiptera, Hymenoptera, Thysanoptera and Orthoptera. Others include, Diptera, Coleoptera, Odanata and Lepidoptera as well as the order "Dictyoptera".

Hemiptera and Hymenoptera were most predominant. Hemiptera consists of two (2) families and three (3) different species. The families consist of Acrididae – the family of *Aphis craccivora* Koch and Coreidae which consist of two species- the spiny brown bug *Clavigralla tomentosicolis* Stal. and the Coreid/Giant pod bug *Anoplecnomis curvipes* Fab.

Hymenoptera consists of three (3) different families which are: Formicidae of which belongs an insect specie *Messor* spp. that are mostly scavengers that depend on plant stem and roots for their survival in their living areas; Vespidae that include a flower predator specie called the common wasp *Vespula vulgaris* L. and Aphidae that include the insects that pollinate flowers of cowpea plants and other plant species in the name of honey bee, *Apis mellifera* L.

Orthoptera consist of one (1) specie of important well pronounced insect pest specie of the Acrididae family which had an insect pest specie known as Grass hopper *Kraussaria angolifera* Krauss which feeds on stem and root of plants, cowpea inclusive. The 2nd orthopteran family specie is the Nigerian grass hopper *Oedaleus nigeriansis* Uvar whose both adult and nymph stages declares satisfaction for feeding on plant stems as well as foliages.

Diptera is another important order that, in this experiment, participated in allowing its family members Muscidae which consists of *Musca domestica* L., a scavenger that surveys leaves of plants like legumes cowpea inclusive looking for a cheap survival.

Coleoptera had one family, the Coccinelidae that produced one specie, the lady bird beetle *Henoceplachna elaterii* Rossi whose adult survives as a predator i.e. it feeds on preys in the same environment.

Thysanoptera had graduated one important family member as a pest of flowering plants including cowpea, the legume bud thrips *Megalurothrips sjostedti* Trybom whose adult stage feeds on flowers.

Odanata is an order that had one family member in the cowpea visitation match whose specie scavenge and behave as feeders on the leaves of cowpea and other legumes as observed in the experimental proceedings.

Lepidoptera had a member of the Pyralidae family, the legume pod borer *Maruca vitrata* Fab. that doesn't allow growing leaves on plants to go free, it has to bite and chew and mutilate the leaves' veins and deface their elegant appearances and manifest it to the surroundings.

It is not to be forgotten that the order Dictyoptera was present at MAU, Yola, a Mantidae family member known as the mantids in the insect specie of *Mantis religiogsa* Heli. that feeds on the leaves of cowpea crops and other related plants, and it had contributed its role/ quota in the defoliation of cowpea foliages in this experiment. All the insect species found in this experiment can be seen in the following table:

Table 1: Insect species complex on cowpea at MAU, Yola in 2019 cropping season

Common name	Order	Family	Scientific	Pest stage	Plant part found -damage/activity
Cowpea aphid	Hemiptera	Acrididae	*Aphis craccivora* Koch	Adult/nymph	Leaves, stem, pods – suck cell sap
Spiny brown bug	Hemiptera	Coreidae	*Clavigralla tomentosicolis* Stal.	Adult	Green pods- feed on green pods
*Coreid/giant pod bug	Hemiptera	Coreidae	*Anoplecnomis curvipes* Fab.	Adult	Green pods-feeds on green pods
Harvester ant	Hymenoptera	Formicidae	*Messor* spp.	Adult	Roots/stem – scavengers
*Common wasp	Hymenoptera	Vespidae	*Vespula vulgaris* L.	Adult	Flowers - predator
Honey bee	Hymenoptera	Aphidae	*Apis mellifera* L.	Adult	Flowers - pollinator
Nigerian grass hopper	Orthoptera	Acrididae	*Oedaleus nigeriansis* Uvar	Adult/nymph	Stem/foliage – feeds on leaves
Mantids	Dictyoptera	Mantidae	*Mantis religiogsa* Heli.	Adult/nymph	Leaves – feed on leaves
Housefly	Diptera	Muscidae	*Musca domestica* L.	Adult	Leaves - scavengers
Lady bird beetle	Coleoptera	Coccinelidae	*Henosoplachna elaterii* Rossi	Adult	Leaves – predator
Legume bud thrip	Thysanoptera	Thripidae	*Megalurothrips sjostedti* Trybom	Adult	Flowers – feeds on flowers
Dragon fly	Odanata	Libellelidae	*Orthettrum coerulescens* Fab.	Adult	Leaves – feeds on leaves
Legume pod borer	Lepidoptera	Pyralidae	*Maruca vitrata* Fab.	Adult	Larvae – leave eaters

The famous order Hemiptera, consists of the prominent species that have a relative abundance of 23.08% just like the other order Hymenoptera. Orthopteran and Diptera both have one species each that had participated in the on-going of this experiment and both have relative abundances of 7.69 each. The other orders as from Coleoptera, Lepidoptera, Odanata and Thysanoptera have pinned one family and one specie each as an insect pest participant in the on-running of the experimental research process. Their relative abundances were 7.69% each.

Table 2: Cumulative number of insect species complex at MAU, Yola Experimental farm, Yola in 2019 cropping season.

Order	No. of species	Relative Abundance (%)
Hemiptera	3	23.08
Hymenoptera	3	23.08
Thysanoptera	1	7.69
Orthoptera	1	7.69
Coleoptera	1	7.69
Diptera	1	7.69
Odanata	1	7.69
Lepidoptera	1	7.69
Dictyoptera	1	7.69
Total	13	99.99

Table 3: Insect species complex on cowpea at Biu in 2020 cropping season

Common name	Order	Family	Scientific name	Pest stage	Plant part found, damage/activity
Cowpea aphid	Hemiptera	Acrididae	*Aphis craccivora* Koch	Adult/nymph	Leaves, stem, pods – suck cell sap
Spiny brown bug	Hemiptera	Coreidae	*Clavigralla tomentosicolis* Stal.	Adult	Green pods- feed on green pods
Harvester ant	Hymenoptera	Formicidae	*Messor* spp.	Adult	Roots/stem - scavengers
Honey bee	Hymenoptera	Aphidae	*Apis mellifera* L.	Adult	Flowers - pollinator
Housefly	Diptera	Muscidae	*Musca domestica* L.	Adult	Leaves - scavengers
Beanfly	Diptera	Cecidomyiidae	*Melanagramyza phaseoli* Tryon	Adult	Stem base – feeds on stem/roots
Nigerian grass hopper	Orthoptera	Acrididae	*Oedaleus nigeriansis* Uvar	Adult/nymph	Stem/foliage – feeds on leaves
Lady bird beetle	Coleopteran	Coccinelidae	*Henosoplachna elaterii* Rossi	Adult	Leaves – predator
Legume bud thrip	Thysanoptera	Thripidae	*Megalurothrips sjostedti* Trybom	Adult	Flowers – feeds on flowers
Dragon fly	Odanata	Libellelidae	*Orthettrum coerulescens* Fab.	Adult	Leaves – feeds on leaves
Legume pod borer	Lepidoptera	Pyralidae	*Maruca vitrata* Fab.	Adult	Larvae – leave eaters
Mantid (European mantid)	Dictyoptera	Mantidae	*Mantis religiogsa* Heli.	Adult	Leaves – feeds on leaves

emiptera order consists of the prominent species that have a relative abundance of 16.67% just like the other order Hymenoptera. Thysanoptera and Diptera both had two species each that had participated in the on-going of this experiment and both have a relative abundance of 16.67% each. The other orders starting from Coleoptera, Lepidoptera, Odanata and Thysanoptera as well as Dictyoptera graduated one family and one specie each as an insect pest participant. Their relative abundances were 8.33% each.

TABLE 4: Cumulative number of insect species complex at Biu Experimental farm, Biu in 2020 cropping season.

Order	No. of species	Relative Abundance (%)
Hemiptera	2	16.67
Hymenoptera	2	16.67
Diptera	2	16.67
Orthoptera	1	8.33
Coleoptera	1	8.33
Lepidoptera	1	8.33
Odanata	1	8.33
Dictyoptera	1	8.33
Thysanoptera	1	8.33
Total	12	

Insect species complex on cowpea varieties in Biu at 2020 cropping seasons

At Biu in 2020 cropping season, there were nine (9) orders and 12 insect pest species of which the major ones were Hemiptera and Hymenoptera as well as the Dipterans on top with relative abundance of 16.67% each; and the rest of the insect species, that is Orthoptera, Coleoptera, Lepidoptera, Odanata, Dictyoptera and Thysanoptera were 8.33% in relative abundance.

Hemiptera and Hymenoptera were most predominant. Hemiptera consists of two (2) families and two (2) different species. The families consists of Acrididae – the family of *Aphis craccivora* Koch and Coreidae which consist of two species- the spiny brown bug *Clavigralla tomentosicolis* Stal. Hymenoptera consists of two (2) different families which are: Formicidae of which belongs an insect specie *Messor* spp. that are mostly scavengers that depend on plant stem and roots for their survival in their living areas.

Orthoptera family specie found was the Nigerian grass hopper *Oedaleus nigeriansis* Uvar whose both adult and nymph stages declares satisfaction for feeding on plant stems as well as foliages.

Diptera is another important order that, in this experiment, participated in allowing its family members Muscidae which consists of *Musca domestica* L., a scavenger that surveys leaves of plants like legumes cowpea inclusive and, the 2nd Diptera family member that is of macro-importance in the agricultural production sector is the beanfly *Melangramyza phaseoli* Tryon that master the stem base of some leguminous plants including cowpea, other legumes like pegion pea, etc and cause a havoc on the roots by scraping the stems and roots thereby causing the wilting and drying of some of the affected crops.

Coleoptera had one family, the Coccinelidae that produced one specie, the lady bird beetle *Henoceplachna elaterii* Rossi whose adult survives as a predator i.e. it feeds on preys in the same environment.

Thysanoptera had graduated one important family member as a pest of flowering plants including cowpea, the legume bud thrips *Megalurothrips sjostedti* Trybom whose adult stage feeds on flowers

Odanata is an order that had one family member the dragon fly *Orthetrum coerulescens* Fab. in the cowpea visitation match whose specie scavenge and behave as feeders on the leaves of cowpea and other legumes as observed in the experimental proceedings.

Lepidoptera had a member of the Pyralidae family the legume pod borer *Maruca vitrata* Fab. that doesn't allow growing leaves on plants to go free, it has to bite and chew and mutilate the leaves' veins and deface their elegant appearances and manifest it to the surroundings.

Mean yield at Biu in 2020 from the five (5) sampled cowpea plants only per plot obtained in the experiment conducted at Biu Experimental Farm was 199.77 g/plot (i.e. 36.99 kg ha^{-1}) per plot in 2020 cropping season.

In the combined tables of the insect species complex at Yola in 2019 and Biu in 2020 cropping season, Hemiptera and Hymenoptera orders were most superior in the experimental farms which ranks 20% in relative abundance. The second superior insect pests during the on-going of the experiment were the Dipterans that have a relative abundance of 12% each, while the rest of the insect pest orders were 8% in abundance.

Table 5: Cumulative number of insect species complex at Yola in 2019 and Biu Experimental farms, Biu in 2020 cropping season.

Order	No. of Species Yola 2019	No. of Species Biu 2020	Combined	Relative Abundance (%)
Hemiptera	3	2	2.5	20
Hymenoptera	3	2	2.5	20
Diptera	1	2	1.5	12
Orthoptera	1	1	1	8
Coleoptera	1	1	1	8
Thysanoptera	1	1	1	8
Odanata	1	1	1	8
Lepidoptera	1	1	1	8
Dictyoptera	1	1	1	8
Total			12.5	100

Discussion

Insect species complex on cowpea at MAU, Yola 2019 and Biu in 2020 cropping seasons

Insect pests had been identified among other factors, as a major constraint in cowpea cultivation (Taylor, 1999; Malgwi and Onu, 2004) in the defoliation of cowpea vegetative parts. Egho (2010) said that the major insect pests reported on cowpea which cause severe damage in the field are the foliage beetle, *Oothecca mutabilis* Stal., the cowpea aphid, *Aphis craccivora* Koch, the flower bud thrips, *Megalurothrips sjostedti* Trybom, the legume pod borer, *Maruca vitrata* Fab. and a host of pod sucking bugs which include the spiny brown bug, *Clavigralla tomentosicolis* Stal., the Coreid/giant pod bug, *Anoplecnomis curvipes* Fab. and *Aspavia armigera* Fab. and from seedling to harvest, cowpea is under perpertual siege (as also said by Egho (2010)). The same insect pests were recorded by Singh *et al.,* (1997) in their experimental findings.

In MAU, Yola farm, the main insect pests obtained from the experimental farms were cowpea aphids (*Aphis craccivora* Koch), and other insect pests that were attracted by the cowpea varieties. Majority of the insect pests found in 2019 were in the orders: Hemiptera, Hymenoptera and Orthoptera as well as Diptera. Others include Odanata, Thysanoptera and Dictyoptera (found in Yola only) which had a family - Mantidae which yielded a specie, the mantid, *Mantis religiogsa* Heli. and Lepidoptera which consist of a family Pyralidae with an insect specie *Maruca vitrata* Fab. that feeds on leaves and stem of crops especially cowpea *Vigna unguiculata* (L.) Walp and other common vegetable plants.

The activities of insect pests have greatly contributed to the low yield of cowpea in African countries and control was achieved by controlling insect pests with synthetic and biochemicals and this is also agreed by the sayings of Omongo *et al.,* (1997) and Egho (2010). Among the orders of insects that attack cowpea, some orders happened to be absent in this locality. Now, anywhere

cowpea is cultivated, insect pests are known to attack it, and insect pest fauna vary from locality to locality, thus not all insect pests occur in all areas or regions as pointed out by Egho (2010).

Diptera is another important order that, in this experiment, participated in allowing its family members Muscidae which consists of *Musca domestica* L., a scavenger that survey leaves of plants like legumes, cowpea inclusive, looking for a cheap survival.

Odanata consists of one insect specie the dragon fly *Orthetrum coerulescens* Fab.from the family Libellelidae and it feeds on plant leaves.

Hemiptera was most predominant, consisting of seven families and nine species; followed by Coleoptera with one families- Coccilinedae and one specie, the lady bird beetle *Henoseplechna elaterii* Rossi.

Orthoptera had one family Acrididae and two species the Nigerian grass hopper *Oedaleus nigeriansis* Uvar and *the grass hopper Kraussaria angolifera* Krauss.

Thysanoptera had graduated one important family member as a pest of flowering plants including cowpea, the legume bud thrips *Megalurothrips sjostedti* Trybom whose adult stage feeds on flowers .

Hymenoptera is in the 2nd position with three families both in 2019 and three species; Formicidae with an insect specie, the harvester ant, *Messor* spp.; Vespidae with insect specie the common wasp *Vespula vulgaris* L. and the family Aphidae with insect specie the honey bee *Apis mellifera* L. Details of the insect species complex collected at Yola experimental plot were provided in the insect species Table 1 and 3.

At Yola in 2019 cropping season, Hemiptera and Hymenoptera had a relative abundance of 23.08% each and the Orthoptera and Diptera contain a relative abundance of 7.69% and the rest of the orders that contain one specie each like the Orthoptera and Diptera had a relative abundance of 7.69% each also. The same insect pests were recorded by Singh *et al.,* (1997) and Egho (2010) in their experimental findings.

The insect species complex collected at Yola consists of nine (9) orders and thirteen (13) insect pest species as indicated above. At Biu in 2019 cropping season, there were eight orders and fourteen (14) insect pest species. Hemiptera, consisting of two families and three (3) species and Hymenoptera that had three (3) families and three (3) species were most predominant during the experiment. The families include: Formicidae which contain a specie, the harvester ant *Messor* sp.; Vespidae family which had an insect specie called common wasp *Vespula vulgaris* L. and the family Aphidae which contains Honey bee *Apis mellifera* L. Coleoptera with one family and one specie lady bird beetle *Henosecplachna elaterii* Rossi (Coccinelidae). The predominance of the insect pests, Hemiptera inclusive, was in line with the approval of Singh *et al.,* (1997) and Emosairue *et al.,* (2004) pertaining the large population of insect pests appearing in a particular area. The Coleopteran, although low in number, cause a lot of damage due to its ability to chew, eat and tear plant (cowpea) parts like leaves, stem and young and matured pods.

Conclusion

The experiment was conducted at Yola in2019 and Biu in the 2020 cropping season in order to arrive at the insect species that use to attack this beautiful and beneficial proteinous crop in the African region, the cowpea. It was observed that a lot of insect pests complex was being attracted by the cowpea varieties, and the major orders obtained were the Hemipterans as well as the Hymenopterans (20% when locations were combined) followed by Dipterans consisting of 12% each. The rest of the orders consist of 8% each in abundance relatively. The Coreid/gaint pod bug *Anoplecnomis curvipes* Fab. (Hemiptera: Coreidae) and Common wasp *Vespula vulgaris* L. (Hemiptera: Vespidae) was found only on the Yola Experimental Farm, not at Biu Farm .

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