



RESEARCH ARTICLE

IDENTIFICATION OF COWPEA WEEVIL (*Callosobruchus maculatus* L. Walp) IN SOME SELECTED LOCAL GOVERNMENT AREAS OF KWARA STATE

Idowu, G.A.^a, Oyewale, R.O.^b, Iborigi, E. F.^b, Bolajoko, M.H.^b, Ibrahim, R.O.^b, Ibrahim, H.M.^c, Olaniyi, R.M.^b^aFaculty of Agricultural Sciences, Nutritional Sciences and Environmental Management, Justus Liebig University Giessen, Giessen, Germany.^bDepartment of Crop Production, Federal University of Technology, Minna, Niger State, Nigeria.^cDepartment of Horticulture, Federal University of Technology, Minna, Niger State, Nigeria*Corresponding Author Email: r.oyewale@futminna.edu.ng

This is an open access article distributed under the Creative Commons Attribution License CC BY 4.0, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ARTICLE DETAILS

Article History:

Received 11 May 2022

Accepted 14 June 2022

Available online 17 June 2022

ABSTRACT

This research work was conducted to determine the Morphometric diversity of *Callosobruchus maculatus* in six Local Government areas of Kwara State, (Ifelodun, Irepodun, Asa, Ilorin West, Ilorin East and Ilorin South). Three (3) markets were surveyed in each of the six (6) local government areas and one measure of infested cowpea with *Callosobruchus maculatus* (Bean weevil) was obtained in each market. Five (5) bean weevils (*Callosobruchus maculatus*) from each of the three locations (market) were kept in different transparent containers containing ethanol solution and labeled (for the different location at which they were obtained). The samples were taken to the insect laboratory (insect museum) of the Department of Crop Protection, Faculty of Agriculture Ahmadu Bello University (ABU), Zaria, Kaduna state for classification. The data were subjected to Analysis of Variance (ANOVA) using statistical package version 9.0 and mean were separated using Duncan Multiple Range Test (DMRT) at 5 % probability. The result obtained showed that Asa and Ilorin South had the largest diversification of *Callosobruchus maculatus* and only *Callosobruchus maculatus* was identified in all the six (6) selected Local Government Areas of Kwara State.

KEYWORDS

Cowpea, Diversification, Local Government, *Callosobruchus maculatus*.

1. INTRODUCTION

Cowpea is scientifically known as *Vigna unguiculata* (L.) Walp, an annual herbaceous legume which is from the family "Fabaceae" and grown predominantly in Africa (Muranaka, 2016). The three that are mostly cultivated out of the four sub species of cowpea are: *Vigna testilis*, *Vigna prudenscense*, *Vigna senesis* (Oyewale and Bamaiyi, 2013). In terms of its plant growth, morphology, maturity and grain types among the cultivated crop plants, cowpea is one of the most variable species (FAO, 2011). Cowpea is an important grain legume in the diet of many people in the third world countries as it provides not only high-quality protein (25.4 %) but also constitute the cheapest source of carbohydrate (56.8 %), calcium, iron, vitamin B, and carotene (Oyewale et al., 2014). In some countries, it is commonly called pulse, black eyed pea, crowder pea, beans and or southern pea but commonly referred to as "ewa" (Yoruba), "wake" (Hausa), "akedi" (Igbo), "nyebbi" (Fulani), "ezor" (Nupe), "evor" (Gwari), "enje" (Idoma), "jok" (Baju) and "ijik" (Ikalu) in Nigeria (Oyewale and Bamaiyi, 2013).

Cowpea (*Vigna unguiculata* L. Walp) is often attacked by the insect pest in almost every stage of its life-cycle, this results in a substantial quantitative and qualitative losses manifested by seed perforation and reductions in weight, market value and germination ability of seeds thereby leading to the increase in the cost of production and also causing low supply to consumers at higher expense. The weevil also exhibit resistance to chemical control measure thereby increasing the cost of treatment with minimal efficacy. Cowpea weevil, *Callosobruchus maculatus* Fab. (Coleoptera: Chrysomelidae), is considered one of the most important pests that occur during the storage period. It is a field to store pest that can cause a total loss of Yield. The attack, which starts before harvest and

intensifies during storage, may cause total losses (Faroni & Sousa, 2006). It is a holometabolic insect with the egg and adult stage found on the grain and the larval and pupal stages living inside the grain. The damage by *Callosobruchus maculatus* is caused by oviposition on the surface of grains and subsequent larval penetration in the grains which results in weight loss, decreased retail and nutritional value, reduced level of product hygiene (presence of droppings, eggs, and insects), and reduced seed germination rate (Faroni and Sousa, 2006). *Callosobruchus maculatus* is a species known commonly as cowpea weevil or cowpea seed beetle. It's a member of the leaf beetle family chrysomelidae and not true weevil. This Common pest of stored legumes has a cosmopolitan distribution, occurring on every continent except Antarctica. The beetle most likely originates in West Africa and moved around the world with the trade of legumes and other crops. The ability to withstand a high degree of inbreeding has likely contributed to this species prevalence as a pest (Ebenezer, 2010). *C. maculatus* is commonly referred to as a weevil; they lack the distinctive snout of weevils and, in fact, belong to a different group, the bruchid beetle, a subfamily of Chrysomelidae beetles. It can be distinguished from other bruchid beetles by its more elongated body and red-brown coloration as an adult. The beetle's elytra are short in comparison with the rest of its body and do not cover the last segment of the abdomen.

The eggs of *Callosobruchus maculatus* are translucent before hatching and are 0.75mm in length. The eggs are small, flat and off-white once the larva has hatched from the egg. They are firmly glued to the surface of pods and pulses. If the pods have opened, eggs are laid directly onto the seeds. Eggs are small, smooth and have domed structures with oval, flat bases. When newly laid they are translucent grey and inconspicuous. Upon hatching the empty eggs shells are white, and clearly visible to the naked eye. Eggs hatch within 5-6 days of oviposition.

Quick Response Code



Access this article online

Website:
www.trab.org.my

DOI:
10.26480/trab.02.2022.21.24

A range of traditional methods such as use of ash, sand, dry pepper and botanical extracts have been employed by resource-poor farmers in Africa. Naturally occurring plant products such as garlic, peppermint and chilies have been used to protect agricultural products against pests for many years in some parts of the world. The aim of this study was to determine the differences that might occur among the species of *Callosobruchus maculatus* through morphometric identification of cowpea weevil in some selected Local Government Areas of Kwara State and the results there in will serve as a sound background for cowpea weevil (*Callosobruchus maculatus* L. Walp) species identification and for the establishment of higher taxonomic classification as well as for consideration on the weevils evolutionary development, will have a long way in reducing if not total prevention of resistant menace of various species to adoption of management strategies of *Callosobruchus maculatus*.

2. MATERIALS AND METHODS

2.1 Study Area

Six (6) Local Government areas (LGAs) were selected for the study in Kwara State, namely, Asa, Ifelodun, Irepodun, Ilorin West, Ilorin East and Ilorin South LGAs.

2.2 Sampling Techniques

Three (3) markets were surveyed in each of the six (6) local government areas. One measure of infested cowpea with *Callosobruchus maculatus* (Bean weevils) was obtained and five (5) weevils from each market were randomly selected and kept separately in a covered container containing ethanol solution.

2.3 Classification Techniques

Five (5) bean weevils (*Callosobruchus maculatus*) from each of the three locations (market) were kept in different transparent containers and labeled (for the different location at which they were obtained). The samples were taken to the insect laboratory, (Insect Museum), of the Department of Crop Protection, Faculty of Agriculture Ahmadu Bello University (ABU), Zaria, Kaduna State for classification. Morphometric measurement was carried out using Mi-scope, where some features of the insect such as the Whole body length (WBL), Body width (BW), Hind limb (HL), fore limb (FL), Head (H), Antennae (A), Tarsi (T), Width of femur (WF) and Femur (F) were measured. Afterwards, the microscope was used to view and compare the collected insect with other Genus of *Callosobruchus maculatus* in the insect collection boxes present in the Museum.

2.4 Data Collection and Analysis

Data on the measurement of the whole body, body width, hind limb, fore limb, head, antennae, tarsi, the width of femur and femur were collected using MI-Scope. The data collected were converted from pixel per length (P/L) to millimeter (mm). (96pixel= 25.4mm; 1pixel = 25.4mm/96 which is 0.26458333mm).and subjected to Analysis of Variance (ANOVA) using statistical package version 9.0 and means were separated using Duncan Multiple Range Test (DMRT) at 5 % level of probability.

3. RESULT

3.1 Morphometric Diversity of *Callosobruchus Maculatus* in The Three Markets of Ifelodun Local Government Area of Kwara State

The result in Table 1 revealed a significant difference ($p \leq 0.05$) in the Tarsi of *Callosobruchus maculatus* collected from Share market as compared to both Ganmo and Idofian market in Ifelodun local government area. After which there was no significant difference in the remaining features of the insect measured.

3.2 Morphometric Diversity of *Callosobruchus Maculatus* in The Three Markets of Irepodun Local Government Area of Kwara State

The result (Table 2) revealed a significant difference ($p \leq 0.05$) in the whole body length of *Callosobruchus maculatus* collected from Oro market as compared to Omuaran and Ajase markets of Irepodun Local Government Area while Omuaran and Ajase markets are not significantly different. The head recorded in Oro market was significantly different ($p \leq 0.05$) from Omuaran market but not significantly different from the head collected

from Ajase market. Also, the head recorded from Ajase market was not significantly different compared to both Omuaran and Oro markets. All other features of the insect measured were not significantly different.

3.3 Morphometric Diversity of *Callosobruchus Maculatus* in The Three Markets of Asa Local Government Area of Kwara State

The results on Table 3 showed that there was significant difference ($p \leq 0.05$) in the hind limb of *Callosobruchus maculatus* collected from Laduba market as compared to Afon market but showed no significant difference with Aboto market while Aboto market was not significantly different as compared with both Laduba market and Afon market. But there was no significant difference in the remaining features of the insect measured.

3.4 Morphometric Diversity of *Callosobruchus Maculatus* in The Three Markets of Ilorin West Local Government Area of Kwara State

The results on Table 4 showed a significant difference ($p \leq 0.05$) in the hind limb of *Callosobruchus maculatus* collected from Mandate market as compared to Ojaoba market and Ojatuntun market but Ojaoba market and Ojatuntun market are not significantly different from each other. Also, there was significant difference ($p \leq 0.05$) in the head of *Callosobruchus maculatus* recorded from Ojatuntun market as compared to both Mandate market and Ojaoba market.

3.5 Morphometric Diversity of *Callosobruchus Maculatus* in The Three Markets of Ilorin East Local Government Area of Kwara State

There was no significant difference ($p \leq 0.05$) among the features of *Callosobruchus maculatus* collected from the three markets in Ilorin East Local Government Area of Kwara State Table 5. Although the longest whole body length was recorded in Ipata market while Obo market has the shortest hind limb, the shortest head, the shortest antennae and the shortest femur.

3.6 Morphometric Diversity of *Callosobruchus Maculatus* in The Three Markets of Ilorin South Local Government Area of Kwara State

The results on Table 6 showed there was no significant difference among all the features of *Callosobruchus maculatus* collected from the three markets of Ilorin South Local Government Area.

3.7 Morphometric Diversity of *Callosobruchus Maculatus* in The Six Local Government Areas of Kwara State

The results on Table 7 showed a significant difference ($p \leq 0.05$) in the whole body length of *Callosobruchus maculatus* collected from the Six Local Government areas of Kwara State. Asa, Ilorin South and Ilorin East L.G.A are not significantly different but significantly different ($p \leq 0.05$) from Ifelodun, Irepodun and Ilorin West Local Government Area.

Also, the body width was significantly different ($p \leq 0.05$) among the Six Local Government area, the longest significant ($p \leq 0.05$) body width was recorded in Asa L.G.A and the shortest body width was recorded in Ifelodun L.G.A. Asa, Irepodun, Ilorin West and Ilorin South are not significantly different compared to Ifelodun and Ilorin East while Ifelodun and Ilorin East showed no significant difference.

In the same vein, there was a significant difference ($p \leq 0.05$) in the hind limb of *Callosobruchus maculatus* collected from Irepodun and Asa L.G.A compared to other Local government areas. There was no significant difference in the fore limb recorded in all the Local Government areas. The head of the insect pest *Callosobruchus maculatus* collected from Ilorin West and Ilorin East were significantly different from Ifelodun, Irepodun, Asa and Ilorin South Local Government Area. The antennae collected from Ilorin East and Ifelodun L.G.A was significantly different from other Local Government Areas. There was significant difference in the Tarsi and width of femur collected from Ilorin West compared to other Local Government areas. Also, the femur collected from Asa and Ilorin South was significantly different from other Local Government Areas.

Idofian market and Share market in Ifelodun Local Government Area, Omuaran market and Ajase market in Irepodun Local Government Area and Mandate market in Ilorin West Local Government Area were all significantly different ($p \leq 0.05$) from the markets in other Local Government Areas.

Table 1: Morphometric diversity of *Callosobruchus maculatus* in the three markets of Ifelodun Local Government Area of Kwara State

MARKET	WBL	BW	HL	FL	H	A	T	WF	F
Ganmo Market	78.28a-f	37.85abc	65.87b-e	42.16ab	23.78abc	36.22bcd	24.48a	11.42abc	26.05a-d
Idofian Market	71.16ef	35.27bc	65.10b-e	43.13ab	22.28b-e	38.82a-d	25.25a	10.38abc	25.89a-d
Share Market	75.09def	36.77abc	59.95de	42.20ab	22.37b-e	36.85a-d	16.69b	10.40abc	21.99cd
SE+	2.64	2.17	3.09	2.92	1.67	2.62	2.14	1.37	2.06

Means with the same letter(s) within a column are not significantly different by Duncan Multiple Range Test (DMRT) at $p \leq 0.05$.

KEY: Whole Body Length (WBL), Body Width (BW), Hind Limb (HL), Fore Limb (FL), Head (H), Antennae (A), Tarsi (T), Width of Femur (WF), Femur (F)

Table 2: Morphometric diversity of *Callosobruchus maculatus* in the three markets of Irepodun Local Government Area of Kwara State

MARKET	WBL	BW	HL	FL	H	A	T	WF	F
Omuaran Market	72.52 ^{ef}	38.77 ^{abc}	69.49 ^{bcd}	47.85 ^{ab}	19.98 ^{cde}	43.95 ^{ab}	22.63 ^{ab}	10.98 ^{abc}	23.67 ^{bcd}
Ajase Market	69.33 ^f	40.19 ^{ab}	77.49 ^{bc}	41.57 ^{ab}	22.84 ^{a-e}	37.55 ^{a-d}	23.66 ^a	10.40 ^{abc}	28.63 ^{ab}
Oro Market	87.74 ^{ab}	40.50 ^{ab}	75.29 ^{bc}	45.24 ^{ab}	26.61 ^a	37.74 ^{a-d}	24.78 ^a	11.68 ^a	28.24 ^{abc}
SE±	2.64	2.17	3.09	2.92	1.67	2.62	2.14	1.37	2.06

Means with the same letter(s) within a column are not significantly different by Duncan Multiple Range Test (DMRT) at ($p \leq 0.05$)

KEY: Whole Body Length (WBL), Body Width (BW), Hind Limb (HL), Fore Limb (FL), Head (H), Antennae (A), Tarsi (T), Width of Femur (WF), Femur (F).

Table 3: Morphometric diversity of *Callosobruchus maculatus* in the three markets of Asa Local Government Area of Kwara State

Asa L.G.A	WBL	BW	HL	FL	H	A	T	WF	F
Laduba Market	84.81 ^{a-d}	37.91 ^{abc}	90.59 ^a	44.13 ^{ab}	24.21 ^{ab}	38.04 ^{a-d}	24.01 ^a	11.97 ^a	28.01 ^{abc}
Aboto Market	86.78 ^{ab}	42.03 ^{ab}	78.67 ^{ab}	43.89 ^{ab}	25.25 ^{ab}	37.76 ^{a-d}	24.12 ^a	11.91 ^a	31.41 ^a
Afon Market	83.73 ^{a-d}	43.34 ^a	73.50 ^{bcd}	49.58 ^a	22.28 ^{b-e}	44.23 ^{ab}	22.30 ^{a b}	11.90 ^a	31.36 ^a
SE+	2.64	2.17	3.09	2.92	1.67	2.62	2.14	1.37	2.06

Means with the same letter(s) within a column are not significantly different by Duncan Multiple Range Test (DMRT) at ($p \leq 0.05$)

KEY: Whole Body Length (WBL), Body Width (BW), Hind Limb (HL), Fore Limb (FL), Head (H), Antennae (A), Tarsi (T), Width of Femur (WF), Femur (F).

Table 4: Morphometric diversity of *Callosobruchus maculatus* in the three markets of Ilorin West Local Government Area of Kwara State

Ilorin West L.G.A	WBL	BW	HL	FL	H	A	T	WF	F
Ojaoba Market	77.59 ^{b-f}	38.05 ^{abc}	67.81 ^{bcd}	42.23 ^{ab}	19.51 ^{de}	41.85 ^{a-d}	21.94 ^{ab}	8.76 ^{bc}	21.38 ^d
Mandate Market	70.55 ^{ef}	37.60 ^{abc}	52.01 ^e	40.95 ^{ab}	18.78 ^e	38.76 ^{a-d}	16.76 ^b	8.59 ^c	22.12 ^{cd}
Ojatuntun Market	76.05 ^{c-f}	39.14 ^{abc}	65.29 ^{b-e}	41.19 ^{ab}	24.30 ^{ab}	40.11 ^{a-d}	20.34 ^{ab}	10.20 ^{abc}	24.54 ^{bcd}
SE±	2.64	2.17	3.09	2.92	1.67	2.62	2.14	1.37	2.06

Means with the same letter(s) within a column are not significantly different by Duncan Multiple Range Test (DMRT) at ($p \leq 0.05$)

KEY: Whole Body Length (WBL), Body Width (BW), Hind Limb (HL), Fore Limb (FL), Head (H), Antennae (A), Tarsi (T), Width of Femur (WF), Femur (F).

Table 5: Morphometric diversity of *Callosobruchus maculatus* in the three markets of Ilorin East Local Government Area of Kwara State

Ilorin East L.G.A	WBL	BW	HL	FL	H	A	T	WF	F
Obo Market	78.66a-f	38.59abc	65.29b-e	40.52ab	19.15de	31.58d	24.03a	11.04abc	25.14a-d
Baboko Market	79.06a-f	32.50c	75.34bc	36.21b	21.42b-e	38.18a-d	20.38ab	10.00abc	27.29a-d
Ipata Market	85.68abc	39.20abc	67.25bcd	45.79ab	23.04a-d	32.57cd	19.68ab	10.30abc	26.78a-d
SE+	2.64	2.17	3.09	2.92	1.67	2.62	2.14	1.37	2.06

Means with the same letter(s) within a column are not significantly different by Duncan Multiple Range Test (DMRT) at ($p \leq 0.05$)

KEY: Whole Body Length (WBL), Body Width (BW), Hind Limb (HL), Fore Limb (FL), Head (H), Antennae (A), Tarsi (T), Width of Femur (WF), Femur (F).

Table 6: Morphometric diversity of *Callosobruchus maculatus* in the three markets of Ilorin South Local Government Area of Kwara State

Ilorin South L.G.A	WBL	BW	HL	FL	H	A	T	WF	F
Newkulende Market	88.38 ^a	42.16 ^{ab}	70.73 ^{bcd}	46.81 ^{ab}	23.20 ^{a-d}	47.30 ^a	24.89 ^a	11.24 ^{abc}	28.29 ^{abc}
Tankemini Market	77.97 ^{a-f}	37.51 ^{abc}	74.75 ^{bc}	44.86 ^{ab}	23.35 ^{a-d}	41.65 ^{a-d}	24.35 ^a	11.88 ^a	27.05 ^{a-d}
Yorubaroad Market	79.06 ^{a-f}	39.47 ^{abc}	63.02 ^{cde}	48.74 ^{ab}	22.89 ^{a-e}	42.10 ^{abc}	21.80 ^{ab}	12.11 ^a	26.42 ^{a-d}
SE±	2.64	2.17	3.09	2.92	1.67	2.62	2.14	1.37	2.06

Means with the same letter(s) within a column are not significantly different by Duncan Multiple Range Test (DMRT) at ($p \leq 0.05$)

KEY: Whole Body Length (WBL), Body Width (BW), Hind Limb (HL), Fore Limb (FL), Head (H), Antennae (A), Tarsi (T), Width of Femur (WF), Femur (F).

Table 7: Morphometric diversity of *Callosobruchus maculatus* in the Six Local Government Areas of Kwara State

LGAs	WBL	BW	HL	FL	H	A	T	WF	F
Ifelodun	74.84 ^c	36.63 ^b	63.64 ^{cd}	42.50 ^a	22.81 ^{abc}	37.30 ^{bc}	22.14 ^{ab}	10.73 ^a	24.65 ^{bc}
Irepodun	76.53 ^{bc}	39.82 ^{ab}	74.09 ^{ab}	44.89 ^a	23.14 ^{ab}	39.75 ^{ab}	23.69 ^a	11.39 ^a	26.85 ^b
Asa	85.11 ^a	41.09 ^a	80.92 ^a	44.87 ^a	23.92 ^a	40.01 ^{ab}	23.48 ^a	11.93 ^a	30.26 ^a
Ilorin West	74.73 ^c	38.26 ^{ab}	61.45 ^d	45.87 ^a	20.87 ^c	40.24 ^{ab}	19.68 ^b	9.18 ^b	22.68 ^c
Ilorin East	81.13 ^{ab}	36.76 ^b	69.29 ^{bc}	40.84 ^a	21.20 ^{bc}	34.11 ^c	21.36 ^{ab}	10.45 ^{ab}	26.40 ^b
Ilorin South	82.09 ^a	39.71 ^{ab}	69.49 ^{bc}	46.81 ^a	23.15 ^{ab}	43.69 ^a	23.68 ^a	11.74 ^a	27.25 ^{ab}
SE±	2.64	2.17	3.09	2.92	1.67	2.62	2.14	1.37	2.06

Means with the same letter(s) within a column are not significantly different by Duncan Multiple Range Test (DMRT) at ($p \leq 0.05$)

KEY: Whole Body Length (WBL), Body Width (BW), Hind Limb(HL), Fore Limb(FL), Head (H), Antennae(A), Tarsi (T), Width of Femur (WF), Femur(F)

4. DISCUSSION

The diversity in the features of *Callosobruchus maculatus* measured was conspicuous/ glaring. There were variations among the species observed. The *Callosobruchus maculatus* in New kulende market of Ilorin South Local Government Area possessed longest whole body length (88.38mm) and the longest antennae (47.30mm) while *Callosobruchus maculatus* in Afon market of Asa Local Government Area had the longest body width (43.34mm) and the longest forelimb (49.58mm). In Laduba market of Asa Local Government Area, the longest hind limb was recorded (90.59mm). The longest head (26.61mm) was recorded in Oro market of Irepodun Local Government Area. The longest tarsi were recorded in Idofian market of Ifelodun Local Government Area. Also, Yoruba road market of Ilorin South Local Government Area had the longest width of femur (12.11mm) while the longest femur (31.41mm) was recorded in Aboto market of Asa Local Government Area.

In Irepodun Local Government Area, the *Callosobruchus maculatus* in Ajase market had the shortest whole body length (69.33mm). Baboko market of Ilorin East Local Government Area had the shortest body width (32.50mm) and also the shortest fore limb (36.21mm).

The *Callosobruchus maculatus* in Mandate market of Ilorin west Local Government Area had the shortest hind limb (52.01mm), the shortest head (18.78mm) and the shortest width of femur (8.59mm). In Ilorin East Local Government Area, the shortest antenna was recorded in Obo market (31.58mm). Share market of Ifelodun Local Government Area had the shortest tarsi (16.69mm) while the shortest femur (21.38mm) was recorded in Ojaoba market of Ilorin west Local Government Area.

5. CONCLUSION

From the above results, Ifelodun Local Government Area showed differences among the features of insect measured in the three markets. Likewise in Irepodun Local Government Area, there were notable variations among the features of *Callosobruchus maculatus* in the markets where Oro market had the longest significant ($p \leq 0.05$) whole body length. Asa Local Government Area showed diversification among the insect *Callosobruchus maculatus* where Laduba market had the longest significant ($p \leq 0.05$) hind limb. The insect from the three markets of Ilorin West Local Government Area showed differences among features of insect

measured. Mandate market had the shortest significant ($p \leq 0.05$) hind limb and Ojatuntun market had the longest significant ($p \leq 0.05$) head.

The three markets in Ilorin East Local Government Area showed no differences among the features of insect measured. Also, the three markets in Ilorin South Local Government Area did not show any diversification in features measured. In spite of all the variations, no new species of *Callosobruchus maculatus* was detected or discovered.

RECOMMENDATIONS

Further studies should be carried out on *Callosobruchus maculatus* in other Local Government Areas of Kwara State in order to discover new species of the insect pest *Callosobruchus maculatus*. The features that are noticeable different should further be considered for differentiation as a tool for discovering new species of *Callosobruchus maculatus*.

REFERENCES

- Ebenezer, O. O. 2010. Management of major field pests and yield of cowpea (*Vigna unguiculata* (L) (Walp) under calendar and monitored application of synthetic chemicals in Asaba, Southern Nigeria. African journal of General Agriculture, 6 (3):177-186.
- FAO. STAT. 2011. Bulletin of Tropical Legumes, <http://www.Icrisat.org/tropicallegumes>, 11
- Faroni, L. R. A. and Sousa, A.H. 2016. Aspectos biológicos e taxonômicos dos principais insetos-praga de produtos armazenados. In: ALMEIDA, F.A.C.; DUARTE, M.E.M.; MATA, M.E.R.M.C. (Ed.). Tecnologia de armazenagem em sementes. Campina Grande: UFCG, 2006. p. 371-402.
- Muranaka, S. 2016, Genetic diversity of physical, nutritional and functional properties of cowpea grain and relationships among the traits, Plant Genetic Resources, 14: 67-76.
- R. O. Oyewale and L. J. Bamaiyi. 2013. Management of Cowpea Insect Pests. Scholars Academic Journal of Biosciences, 1(5): 217-226
- R. O. Oyewale, L.J. Bamaiyi, A. M. Oparaeke, and R. S. Adamu. 2014. Evaluation of four insecticide formulations for the management of insect pests of cowpea. African Journal of food Science and Technology, 5(8): 180-188