



## Susceptibility of the Infestation of Cowpea (*Vigna Unguiculata*) to Bean Weevil (*Callosobruchus Macullatus*)

O.A. Oke\* and A.A. Adeagbo

Department of Biological Sciences, Federal University of Agriculture, Abeokuta, Nigeria

(Submitted: February 08, 2012; Accepted: April 11, 2012)

### Abstract

*Callosobruchus maculatus* (bean weevil) is the major insect pest that reduce both the quality and quantity of cowpea in the store. Infested cowpea seeds were bought at Lafenwa, Kuto, Itoku, and Iberekodo market. The samples of infested cowpea that were bought at the markets were analyzed in the laboratory for the insect pests present in the infested cowpea using sample size of 500g. The number of the different growth stages of the insect i.e. the egg, larvae, pupa and adult that were found in each sample were counted and recorded. The morphometric study of the major body parts such as the whole body length, head capsule, thorax and abdomen were carried out. The range of the whole body length ranged from 2.1-2.75mm with a mean body size of 2.5mm. The range of the size of the head capsule fell between 0.4-0.6mm with a mean size of 0.5mm. The thorax size ranges from 0.7-0.9mm with a mean size of 0.8mm. Also, the abdominal size ranges from 0.9-1.4mm and the mean of the abdominal size is 1.2mm. Weight of 100 uninfested cowpea was 10.58g. Weight of 100 infested cowpea was 7.5g. Therefore, weight lost due to *C. maculatus* infestation was 3.08g. The infestation of cowpea by *C. maculatus* brought about adverse effect of loss of weight of the cowpea. This will course down-grading of the cowpea grains and lowering of the market value. The existence of different developmental stages of *C. maculatus* in the grains of cowpea will course contamination of food i.e. the eggs value, larvae, pupae and the adults of *C. maculatus* will make food unattractive and cause aesthetic violation of food. Also, the infestation of *C. maculatus* will bring about reduction in the germinating capacity or seed vigor or vial ability of the cowpea seeds.

**Keywords:** Susceptibility, Cowpea, Weevil, Infestation, Weight and Viability

### 1.0 Introduction

Most cowpea farmers in sub-Saharan Africa are confronted with low yields caused by insect pests and disease. Over the past few years, however, this picture has been gradually changing due to the establishment of many regional pest management projects. Cowpea is susceptible to a wide range of pests and pathogens that attack the crop at all stages of growth. These include insects, bacteria, viruses, fungi and weed. The main pests during the growing season are the Aphids, while the main storage pests are the Bruchids. Both of these pests can severely reduce the quantity and quality both in the field and store. Bruchids are major pests on cowpea in Africa which attack dried cowpeas and other related stored seeds. They are mainly found on cowpea grains in storage and may be the main constraint to increased cowpea production. Bruchid weevil is a

cosmopolitan pest of stored legume seeds (Credland, 2001). They are widespread throughout the temperate and tropical world. Several species of bruchid are agricultural pests that have the potential to destroy stores of legumes. One species in particular, the cowpea weevil, *C. maculatus*, is a cosmopolitan pest that causes considerable economic damage (Profit, 1997).

### 1.1 Life Cycle of *C. maculatus*

Once inseminated, adult females will lay (oviposit) single fertilized eggs on the external surface of bean. Individual eggs (0.75mm long) are oval or spindle shaped, clear, shiny and firmly glued to the bean surface. Eggs laid by females *C. maculatus* hatch in 5 to 20 days.

The larvae that hatches from the egg burrows from the egg through seed coat and into the bean en

\*Corresponding author's email: [olubodeoke@yahoo.com](mailto:olubodeoke@yahoo.com)

dosperm without moving outside the protection of the egg. Once the larvae burrows into the bean, the remaining egg (shell) becomes opaque white or mottled as it fills with frays from the larvae. The larva burrows and feeds on the bean endosperm and embryo, undergo a series of molts, and burrows to a position just underneath the seed coat prior to pupation. Although the seed coat of the bean is still intact, around (1-2mm) emergence hole is apparent at location where the beetle is pupating. Pupation is the complete metamorphosis of the larva maggot to winged adult. Six or seven generations of *C. maculatus* may occur per year. Later, the adult *C. maculatus* emerges from the emergence hole created on the seed coat of the bean. The adults are fully mature 24 to 36 hours after emergence. Males seek females to inseminate and females store viable sperm in their sperm theca (Bisby et al., 1994). Adults of *C. maculatus* may be found outdoors in flowers in early spring and colonize the cowpea cultures at the end of the rainy season carrying the bruchid populations into stores where they continue to develop (Van Huis, 1996).

The main objective of this project is to determine the sustainability of the infestation of cowpea to *C. maculatus*.

## 2.0 Materials And Methods

### 2.1 Study Area

Four notable markets within Abeokuta city were selected for the collection of infested cowpea. These markets are; Lafenwa, Itoku, Kuto, and Iberekodo markets.

Lafenwa and Iberekodo markets are situated in the Abeokuta North Local Government Area of Abeokuta in Ogun State, while Itoku and Kuto markets are located in the Abeokuta South Local Government Area of Abeokuta, Ogun State.

### 2.2 Collection of Sample (Infested cowpea)

Infested cowpea was brought at the four markets that are mentioned above. Each sample from these four markets was divided into four places, thereby making sixteen samples in all.

### 2.3 Collection of Specimen (*C. maculatus*)

The samples were taken to the laboratory for analysis

in order to determine the number and stages of *C. maculatus* that are present in each market sample using a sample size of 500mg. different insect pests were sought for but only the *C. maculatus* was found.

Damage Assessment of Cowpea by *C. maculatus*  
Damage assessment of the infested cowpea by *C. maculatus* was done by the determination of the weight loss of the infested cowpea. The weight loss due *C. maculatus* infestation by subtracting the weight of known quality of infested cowpea from the weight of equal quantity of infested cowpea.

### 2.4 Identification of *C. maculatus*

The morphological features of *C. maculatus* were used to identify the insect with the aid of magnifying lens. These morphological features include the head capsule which is not prolonged into a long snout. Both the male and the female were distinguished using their body colour; the females are black while the males are brown in colour. Also the female *C. maculatus* are longer than the male *C. maculatus*.

### 2.5 Enumeration of *C. maculatus*

The number of the different life stages of the insect (*C. maculatus*) found in the samples (infested cowpea) as obtained in each market was recorded after counting the different life stages of the insect.

### 2.6 Morphometric Study of *C. maculatus*

The *C. maculatus* that were collected from all the samples obtained in the four markets were put in 10ml ethanol for two minutes in order to kill the insects. Then, twenty out of all the insects were placed one after the other on the graph sheet for measurement of their major parts. The body parts that were measured include the whole body length, size of the head capsule, size of the thorax and the abdominal size.

## 3.0 Results

Number of stages of *C. maculatus* found in the four samples of infested cowpea from Lafenwa Market. In sample 1, three eggs of *C. maculates* were found, no larvae was found and no pupae were found, however, eleven adult were found. In sample 2, seven eggs of *C. maculatus* were found, three larvae were found, no pupae were found, six adults were re-

corded.

In sample 3, no eggs, no larvae, no pupae were recorded, four adults were seen.

In sample 4 also, no eggs, no larvae, no pupae, six adults were seen. It was obvious that adult *C. maculatus* were present in all the samples of infested cowpea from Lafenwa market.

Table 1: Samples of infested cowpea from Lafenwa market showing the number of each stage of *C. maculatus* as found in each sample

Sampling Site	Eggs	Larvae	Pupae	Adults
Lafenwa 1	3	0	0	11
Lafenwa 2	7	3	0	6
Lafenwa 3	0	0	0	4
Lafenwa 4	0	0	0	6

In Table 2 number of stages of *C. maculatus* found in the four samples of infested cowpea from Itoku market are as follows:

In sample 1, five eggs, no larvae, no pupae however 3 adults of *C. maculatus* was found.

In sample 2, five eggs of *C. maculatus* were found, no larvae were found, no pupae were found, six adults were recorded.

In sample 3, two eggs, no larvae, no pupae were recorded, five adults were seen.

In sample 4 also, no eggs, no larvae, no pupae, two adults were seen. It was obvious that adult *C. maculatus* were present in all the samples of infested cowpea from Itoku market.

Table 2: Samples of infested cowpea from Itoku market showing the number of each stage of *C. maculatus* as found in each sample.

Sampling Site	Eggs	Larvae	Pupae	Adults
Itoku 1	5	0	0	3
Itoku 2	5	0	0	6
Itoku 3	2	0	0	5
Itoku 4	0	0	0	2

Table 3 reviewed the following:

In sample 1, two eggs of *C. maculatus* were found, two larvae was found and no pupae were found, however, seven adults were found.

In sample 2, two eggs of *C. maculatus* were found, no larvae were found, no pupae were found, eleven adults were recorded.

In sample 3, four eggs, no larvae, no pupae were recorded, fifteen adults were seen.

In sample 4 also, one eggs, no larvae, no pupae, two adults were seen. It was obvious that adult *C. maculatus* were present in all the samples of infested cowpea from Kuto market.

Table 3: Samples of infested cowpea from Kuto market showing the number of each stage of *C. maculatus* as found in each sample.

Sampling Site	Eggs	Larvae	Pupae	Adults
Kuto 1	2	2	0	7
Kuto 2	2	0	0	11
Kuto 3	4	0	0	15
Kuto 4	1	0	0	2

Table 4 illustrate the following:

In sample 1, three eggs of *C. maculatus* were found, no larvae was found and no pupae were found, however, two adults were found.

In sample 2, two eggs of *C. maculatus* were found, no larvae were found, no pupae were found, six adults were recorded.

In sample 3, no eggs, no larvae, no pupae were recorded, one adults were seen.

In sample 4 also, three eggs, no larvae, no pupae, four adults were seen. It was obvious that adult *C. maculatus* were present in all the samples of infested cowpea from Iberekodo market.

Table 4: Samples of infested cowpea from Iberekodo market showing the number of each stage of *C. maculatus* as found in each sample.

Sampling Site	Eggs	Larvae	Pupae	Adults
Iberekodo 1	3	0	0	2
Iberekodo 2	2	0	0	6
Iberekodo 3	0	0	0	1
Iberekodo 4	3	0	0	4

**Head Capsule of *C. maculatus*.**

The mean size of the head capsule of *C. maculatus* was 0.5mm, while the range was 0.4-0.6mm.

**Thoracic Region of *C. maculatus***

The mean of the thoracic region of *C. maculatus* was 0.8mm, while the range was 0.7-0.9mm.

**Abdominal size of *C. maculatus***

The mean of the abdominal size of *C. maculatus* was 1.2mm, while the range was 0.9-1.3mm.

**The body length of *C. maculatus***

The mean of the body length of *C. maculatus* was 2.58mm while the range was 2.2-2.7mm.

**Damage Assessment of cowpea by *C. maculatus***

The damage assessment of the infested cowpea by *C. maculatus* was done by determining the weight lost of the infested cowpea.

The weight lot due to infestation of *C. maculatus* was determined by subtracting the weight of one hundred infested cowpea seeds and from the weight of one hundred uninfested cowpea seeds was determined. Weight of 100 uninfested cowpea seeds was 10.58g.

Weight of 100 infested cowpea seeds was 7.5g  
Therefore weight lost due to *C. maculatus* infestation was 3.08g.

**4.0 Discussion And Conclusion**

The larvae of these species feed and develop exclusively on the seed of legumes hence the name bean beetle. The adult spend their limited life span (one-two weeks) mating and laying eggs on beans. The primary insect pest causing losses to stored cowpeas in West Africa is the cowpea weevil, *C. maculatus*. Infestation begins in the field at low levels. After the crop is placed in storage, the insect population continues to grow until there is an obvious and severe infestation. This insect causes losses primarily around harvest time, and reproduce in storage (Ntoukam et al, 2000). Cowpea bruchid adults are small beetles; 2-8mm long (Credland, 2001), reddish-brown slightly elongated compared with typical rounded appearance of other members of the

Bruchid family.

The range of the body length size of *Callosobruchus maculatus* was found to be 2.1-2.75mm. The mean size of the body length obtained is 2.5mm. The outcome of the morphometric study of the body length of *C. maculatus* is in close agreement with the observation made by (Lucas, 2001). The range of the size of the head capsule was found to be 0.4-0.6mm and the mean size of the head capsule that was obtained is 0.5mm. The range of the thorax size is 0.7-0.9mm with a mean size of 0.8mm. The range of the abdominal size is 0.9-1.4mm and the mean size of *C. maculatus* that was obtained is 1.2mm. Damaged grains are full of small holes and dead beetles were found inside the grains. The white eggs were glued to the outside of cowpea grain and were clearly visible as small white dots on the grain. Damage and weight loss in stored cowpea seeds is majorly caused by the larvae of *C. maculatus*, which develop within the grain and consume the seed.

In all the four markets, losses in cowpea grain storage are due to the huge presence of *C. maculatus* in the store most especially at market levels. The major problem of cowpea under storage condition is the losses in quality and quantity caused by the presence of *C. maculatus*. All the markets where the study was conducted reveal that the presence of *C. maculatus* in stored cowpea in large number at market level may not be avoidable.

**References**

- Bisby, F.A., Buckingham, J. and Harborne, J.B. (editors) 1994, "Phytochemical Dictionary of The Leguminosae", Plants and their Constituents, Chapman and Hall, London, 1, pp 118.
- Credland, D.W. 2001, "Immigration of insects into bins storing newly harvested grain on 12 Kansas farms", *J. Stored Prod. Res. Cross Ref, PubMed, CSA*, 37, 221-229.
- Faleiro, H.T. and Foster, J.E. 1998, "Insecticidal activities of monoterpenes against *Callosobruchus maculatus* (F) and *T. castaneum* (Herbst)" *J. Stored Prod. Res.* 34, 243-249.
- Jackai, B.B. and T.T. Daoust, 1986, "Some Laboratory observations on the rates of development, mortality and oviposition of several species of

- Bruchidae breeding in stored products". *Bulletin of Entomological Research*, **55**, 437-477.
- Lucas, E.H. 2000, "Anatomy of stored product insect", *Journal of Stored Products Research Entomology*, **93**(6), 1837-1841.
- Ntoukam, K.J., 1996, "Insect Pests of Beans in Africa: Their Ecology and Management", *Annual Review of Entomology*, **41**, 45-73.
- Profit, T.R., 1997, "Survival and reproduction of *Callosobruchus maculatus* in native habitats in Kansas", *J. Stored Prod. Res.*, **44**, 366-372.
- Singh, S.R., 1987, "Insect Pests of Grain Legumes" *.Annual Review of Entomology*, **24**, 255-278.
- Utida, S., 1972, "Phase" dimorphism observed in the laboratory population of the cowpea weevil, *Callosobruchus maculatus*, 2<sup>nd</sup> Report, Differential effects of temperature, humidity and population density upon some ecological characters of the two phases, *Research on population Ecology* **3**, 93-104.
- Utida, S., 1999, "Density dependent polymorphism in the adult of *Callosobruchus maculatus* (Coleoptera, bruchidae)", *Journal of Stored Products Research* **8**, 111-126.
- Van Huis, D.W., 1996, "Integrated Management of Insects in Stored Products", Marcel Dekker, Inc., New York, pp 39-40.