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# Effects of Different Levels of Infestation and Storage Durations on the Development of *Callosobruchus maculatus* (Fab.) in Stored Cowpea *Vigna unguiculata* (L.) Walpers

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***ABSTRACT***

*Experiments were carried out on the levels of initial infestation with Callosobruchus maculatus (Fab.) of (1, 2 or 3 copulating pairs) per 100g cowpea seed stored for three durations (1, 2 or 3 months) under prevailing tropical storage temperature of 26-31$^0$C and 65-75% relative humidity. Adult progeny development, percentage seed damage and severity of damage vary significantly in cowpea seeds infested with the different pairs of C. maculatus and stored for three different durations. The mean number of adult progeny that develop in cowpea seeds infested with 3 pairs of C. maculatus and stored for 3 months was significantly higher when compared with those of 2 months and 1 month respectively. Similarly percentage seed damage of cowpea seed infested with 3 pairs of C. maculatus and stored for 3 months was also higher with mean number being 98.86%, when compared with 2 months (55.76%) and 1 month (4.65%). Percentage damage of cowpea seeds infested with 3 pairs and stored for 3 months was significantly higher than those stored for 1 or 2 months. The severity of damage also follows similar trend.*

***Key words:*** *Cowpea, Callosobruchus.maculatus, development, Levels of infestation, storage durations.*

## Introduction

Cowpea (*Vigna unguiculata* (L.) walpers) is one of the most widely consumed, versatile and nutritious legumes (Ehlers and Halla, 1997). It has being consumed by humans since the earliest practice of agriculture in developing countries of Africa, Asia and Latin America, where it is specially valued as a veritable source of dietary protein, vitamins and minerals (Singh *et al*., 2003). Cowpea is the most economically important indigenous African leguminous crop and is very important to the livelihood of several millions of people in West and Central Africa. Rural families that make up the larger part of the population of these regions derived from its production, food and animal feed alongside cash income (Langyintou *et al*., 2003). Aveling (1999) reported that in Nigeria the cowpea is sometimes used as a coffee substitute and the penducles of certain cultivars are used for fibre production. Cowpea is frequently consumed in West Africa as fried "Akara, boiled and steamed, moi-moi", both of which are prepared from ground beans. However, before harvest or during storage the seeds are vulnerable to many

insect pests which constitute the major constraint on profitable production of cowpea seeds. In the tropics, more than three-quarters of agricultural output of the peasant farmers are kept at village level using simple storage devices (Appert, 1987). The cowpea bruchid (*Callosobruchus maculatus* (F.) is an important pest of stored cowpea, with ample distribution in tropical and sub tropical regions, where this crop represents one of the main sources of protein in human diet (Lale and Ajayi, 2001; Raja *et al.*, 2007). The insect infest the cowpea before harvest and causes both quantitative and qualitative losses to seeds in storage facilities (Mbata, 1993). Under traditional storage conditions 100% infestation of cowpea occur within 3 to 5 months of storage (Caswell and Akibu, 1980). *C. maculatus* also causes reduction in market value and germination of the seeds (IITA, 1989). The objective of this study was to determine the effects of different levels of *C. maculatus* infestation and different storage durations on the damage of cowpea seeds.

**Materials and Method**

The experiment was conducted in the Entomological Laboratory of the Department of Crop Protection, University of Maiduguri under tropical storage temperature of 30-32$^0$C and 70-75% relative humidity. The cowpea cultivar (Borno brown) used for this experiment was obtained locally from Maiduguri Monday Market. Sound and clean cowpea seeds were sorted out and stored in the refrigerator (at 4$^0$C) Prior to the setting of the experiment, 100 g of cowpea seed was weighed into 100 ml glass jars and infested with 1, 2 and 3 pairs of copulating adult *C. maculatus* and store for three months. The experiment was as arranged in a completely randomized block design with three replications. The insects were allowed to lay eggs throughout their life span afterward which both live and dead insects were removed at the end of duration of storage. The parameters taken were the number of adults that emerged in each replicate, percentage seed damaged and severity of damaged seeds. Severity of seed damage (number of adult emergence hole per seed) was obtained by dividing the number of adult emergence holes by the number of damaged seeds.

**Data analysis**

Data obtained from this experiment were subjected to two way analysis of variance (ANOVA) and difference between means were separated by the least significant difference LSD at 5% level of probability (Gomez and Gomez, 1984).

**Results**

Table 1 shows the mean number of adult *C. maculatus* that emerged in cowpea seeds infested with 1, 2 or 3 copulating pairs of *C. maculatus* and stored for 1, 2 and 3 months respectively. Results in table 1 shows that at 1, 2 or 3 pairs levels of infestation,

significantly higher number of F1 adult progeny developed in seed stored for three months duration than in those stored for 1or 2 month. The result also indicated that after 2 and 3 months of storage, significantly ($P<0.05$) higher adult progenies developed in cowpea seeds that were infested with 2 and 3 pairs of *C. maculatus* than in those stored for 1 month (Table 1). On the whole average progeny development significantly ($P<0.05$) increased with increasing storage duration and level of infestation.

**Table 1**. Mean number of *Callosobruchus maculatus* adult progeny that developed in cowpea seeds infested with different pairs of *C. maculatus* and stored for different durations

| | **Level of infestation of *C.maculatus* in pairs/100g seed** | | | |
|---|---|---|---|---|
| **Storage duration (Month)** | 1 | 2 | 3 | Mean |
| 1 | 18.00 | 28.67 | 48.33 | 31.67 |
| 2 | 418.67 | 511.00 | 726.00 | 551.89 |
| 3 | 832.67 | 1003.67 | 1161.33 | 999.22 |
| Mean | 423.11 | 514.44 | 645.22 | |

SED = 57.9572; LSD (0.05) = 122.8692 (Storage duration) SED = 57.9572; LSD (0.05) = 122.8692 (Level of infestation)
SED = 100.3848; LSD (0.05) = 212.8158 (Interaction)

The mean percentage damaged cowpea seeds by adult *C. maculatus* infested with different pairs of *C. maculatus* and stored are presented in Table 2. Cowpea seeds infested with one pair of *C. maculatus* and stored for one month had the lowest mean percentage damaged of 2.69 %, while 100% damage was obtained in cowpea seeds infested with 3 copulating pairs and stored for 3 Months. Those infested with one pair of *C. maculatus* and stored for three Months had significantly higher mean percentage damage of 6.93%.

**Table 2**. Mean percentage damage of cowpea seeds that were infested with different pairs of *C. maculatus* and stored for different durations

| | **Level of infestation of *C.maculatus* in pairs/100g seed** | | | |
|---|---|---|---|---|
| **Storage duration (Month)** | 1 | 2 | 3 | Mean |
| 1 | 2.69 | 4.34 | 6.93 | 4.65 |
| 2 | 48.92 | 51.80 | 66.55 | 55.76 |
| 3 | 97.66 | 98.93 | 100.00 | 98.86 |
| Mean | 49.76 | 51.69 | 57.83 | |

SED = 4.5292; LSD (0.05) = 9.6019 (Storage duration) SED = 4.5292; LSD (0.05) = 9.6019 (Level of infestation)
SED = 7.8449; LSD (0.05) = 16.6312 (Interaction)

Generally, percentage seed damage significantly (P<0.05) increased with increase in storage period and degree of infestation. Significantly higher proportions of seeds were damaged in seeds infested with 3 pairs of *C. maculatus* and stored for 3 months with mean percentage damage of 100% (Table 2). Severity of seed damage also follow similar trend (Table 3).

**Table 3**. Mean severity of damage of cowpea seeds that were infested with different pairs of *C. maculatus* and stored for different durations

| | **Level of infestation of *C. maculatus* in pairs/100g seed** | | | |
|---|---|---|---|---|
| **Storage duration (Month)** | 1 | 2 | 3 | Mean |
| 1 | 1.21 | 1.35 | 1.34 | 1.30 |
| 2 | 1.66 | 1.88 | 2.02 | 1.85 |
| 3 | 1.61 | 1.92 | 3.24 | 2.26 |
| Mean | 1.49 | 1.72 | 2.20 | |

SED = 0.1082; LSD (0.05) = 0.2294 (Storage duration) SED = 0.1082; LSD (0.05) = 0.2294 (Level of infestation)
SED = 0.1874; LSD (0.05) = 0.3973 (Interaction)

**Discussion**

The levels of infestation and storage duration of *C. maculatus* had significant impact on the bionomics of *C. maculatus*. Results show that as the number of *C.maculatus* increase with storage duration the adult progeny development also increases. The study support the view that *C. maculatus* as an r-strategist (Haines *et al*., 1991) could attain a large populations rapidly and thus deplete exhaustible resources with a given period of time. Maina and Lale (2004) reported that *C. maculatus* increases with increasing initial level of infestation and duration of storage in cowpea and bambara groundnut. The significantly higher number of adult progeny that emerged in cowpea seeds infested with 3 pairs of *C. maculatus* and stored for 3 months suggest that cowpea with heavy level of infestation will suffer serious damage of up to 100% within a period of 3 months if conditions are conducive. This also implies that the longer the storage durations the more economic damage stored produce will suffer. Booker, 1967; Caswell and Akibu, 1980 reported that under traditional storage conditions, 100% infestation of cowpea occur within 3 to 5 months of storage. Losses in seed germination due to *C. maculatus* attack have also been reported to reach 100% for grains with 4 holes per seed (Santos, 1971; Maina, 2005). Severity of damage in seeds that were infested with 3 pairs of *C. maculatus* and stored for 3 months was significantly higher with 3.24 holes per seed; this level of damage will undoubtedly lead to considerable reduction of

germinability in unprotected seeds. This result also reveals that percentage or level of infested cowpea seeds may likely provide an index of prediction of seeds damage in stored cowpea. In the context of tropical Agriculture where most of the farmers produce at subsistence level it is advisable for them to look for possible control measures and good storage facilities for cowpea for longer storage duration against bruchids attack.

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