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Effect of Cowpea Seed Coat Texture on the Oviposition and Progeny Development of Callosobruchus Maculatus (F.) (COLEOPTERA: BRUCHIDAE).

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Abstract
Introduction: The cowpea weevil, *C. maculatus* is a very serious pest of stored cowpeas, *Vigna unguiculata*.The infestation starts in the fields and continue to multiplies in storage where sometimes it causes total destructions of the cowpea seeds within a period of 3-4 months. **Objectives**: Present study was conducted to investigate on how cowpea seed-coat texture affects the oviposition behaviour and progeny development of *C.maculatus* under ambient laboratory conditions. **Methods**: 10 white cowpea seeds of equal size but with different seed coat texture (5 smooth and 5 rough-coated) were placed in a glass vial and mixed thoroughly. These were replicated 10 times and each replicate was infested with two pairs of freshly emerged males and females adult *C. maculatus* for the period of 3 days after which the insects were removed. The number of eggs laid on the cowpea seeds of each type (smooth or rough) was counted separately per replicate and the infested cowpea seeds were kept for the assessment of F_1 adults emergence. **Results**: The female cowpea weevils were observed to oviposit freely on all the cowpea seed types but showed a definite oviposition preference for cowpea seeds with smooth seed coat texture.. The reproductive efficiency of the weevils was significantly (p=0.05) lower on the rough-coated seeds. **Conclusions**: Despite the fact that females *C.maculatus* laid more eggs on the smooth-coated than on rough-coated cowpea seeds, but no significant difference (P= 0. 05) was observed with regards to the means of index of susceptibility between the different cowpea seed types.
Key words: *Callosobruchus maculatus*, *Vigna unguiculata* seed coat texture, oviposition, susceptibility index reproductive efficiency.

INTRODUCTION

Cowpea, *Vigna unguiculata* (L.) Walp. is an important tropical and subtropical annual legume grown chiefly for its dry grain, green pods and tender green leaves for fodder (Purseglove, 1974). In West Africa, it is a major plant protein source in various bean foods (Stanton, 1966; Oyenuga, 1967). Severe losses occur to the cowpea crop because of heavy insect pests attacks in the field and storage (Singh and Van Emden, 1979; Ivbijaro, 1983; Durairaj, 1999). The most notorious pest on stored cowpea is the cowpea weevil, *Callosobruchus maculatus* (Fab.), which infests the seeds at storage and assumes special significance as it is a very serious pest causing up to 100% storage loss (Dobie et. al; 1984; Srinivasan and Durairaj, 2007). The estimated losses due to this pest in various pulses ranged from 30-40% within a period of six months and the post harvest seed losses can reach even 100% during severe periods of infestation (Mahendran and Mohan, 2002).

A detailed knowledge of the life history and reproductive behaviour of a pest species is crucial for an understanding of its population dynamics, effective management and control (Nwanze et. al; 1975; Nwanze and Horber, 1976; Ofuya, 1987). Consequently, several workers have studied the oviposition behaviour and progeny development of *C.maculatus* and related pest species (Strong et. al; 1968; Mitchell, 1975; Nwanze and Horber, 1975, 1976; Booker, 1976; Tun, 1979; Wasserman and Futuyma, 1981; Messina and Renwick, 1985; Wasserman, 1985; Giga and Smith, 1987; Ofuya, 1987).

The present study was aimed to investigate how cowpea seed-coat texture affects the oviposition behaviour and the subsequent progeny development of *C. maculatus* under ambient laboratory conditions.

MATERIALS AND METHODS

White cowpea seeds of equal size were selected from cowpea cultivars with rough and smooth testa. Ten cowpea seeds, 5 of each type (smooth and rough), were placed in a glass vial and mixed thoroughly, and this was replicated ten times.

In each of the vials, two pairs of freshly emerged males and females adults (0-24hrs) of *C. maculatus*, were introduced and allowed to oviposit freely for the period of 3 days(72hrs.) after which the insects were removed. The number of eggs laid on the cowpea seeds of each type (smooth and rough) was counted separately per replicate and the infested cowpea seeds were kept for the assessment of the first filial generation (F_1) emergence of adults *C. maculatus* under ambient laboratory conditions.

The reproductive efficiency (RE) of females, *C. maculatus* on each cowpea seed type was determined by the proportion of the F_1 adults that emerged over the total number of eggs laid on that seed type multiplied by hundred (Ibvijaro, 1990). While, the susceptibility index for each cowpea seed type was assessed according to the formula given by Dobie, (1974) as follows:

$$\text{Susceptibility index} = \frac{\text{Log}_e Y \times 100}{T}$$

Where Y = Total number of F_1 adult progeny emerged.

T = Median developmental period (days), estimated as the time from the middle of the oviposition period to the emergence of the 50 percent of the F_1 adult progeny

RESULTS

The mean numbers of eggs laid on the cowpea seeds were 16.04 $\pm$ 22.70 and 145.20 $\pm$ 29.40 on the smooth and rough-coated cowpea seeds respectively (Table 1). Similarly, the reproductive efficiency values recorded from the smooth and rough-coated cowpea seeds were 45.10 $\pm$ 6.80 and 59.70 $\pm$ 12.10 percent respectively.

Significant differences (p=0.05) between smooth and rough-coated cowpea seeds with regards to oviposition and reproductive efficiency (Table 1) but a non-significant (p=0.05) difference between the cowpea seed texture with regards to F_1 adults progeny emergence, developmental period and index of susceptibility were observed.

DISCUSSION

The fact that this study revealed that the cowpea weevil, *C.maculatus* laid more eggs on the smooth-coated cowpea seeds than on the rough-coated cowpea seeds confirms the results of earlier workers (Booker,1967; Nwanze et.al;1976; Nwanze and Horber,1976; Giga and Smith,1989) who inferred that surface texture of smooth-coated cowpea seeds permitted firm attachment of the eggs and offered more surface area than pitted, rough-coated cowpea seeds. The corrugated, undulating configuration of the rough seed coats may have provided a stimulus of instability to the gravid bruchid females.

In this study, the reproductive efficiency of *C. maculatus* was however, higher in the wrinkled and rough-coated cowpea seeds than in the smooth-coated cowpea seeds. This could probably be due to the inability of the first instar larvae to penetrate the smooth- coated cowpea seeds; the surface of which offered firm attachment processes for the eggs and poor grip for the young larvae. The pitty porous configuration of the rough, wrinkled testa, however, could provide primary pockets into which the first instar larvae could fix their mandibles, thus facilitating the penetration of the young larvae *C. maculatus* (Iloba, 1985). This observation was, however, contrary to that of Nwanze et. al; (1975), who reported that the smooth testa where more easily penetrated. Thus, the mechanism of resistance in cowpea, may be completely dependent on the type of legume variety, seed physico-chemical characterization and the bruchid species, among others. For instance, the failure of *C. maculatus* to develop on *Phaseolus vulgaris* and on a variety of chickpea, *Cicer arietinum*, were attributed to thick testa (El-Sawaf, 1956) and spiny seed coat (Raina, 1971) respectively.

It is interesting to note that there was statistically no significant difference (P=0.05) between the mean indices of susceptibility of the smooth and rough-coated cowpea seeds in this study. Thus, if resistance is governed by trypsin inhibitor content (Gatehouse et. al; 1979; Gatehouse and Boulter, 1981; I I T A, 1989), the preferential selection of smooth over rough-coated cowpea seeds is more likely to be physical rather than biochemical.

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Table

Table

Table 1. Influence of cowpea seed-coat texture on oviposition, F_1 adult progeny development, susceptibility index and reproductive efficiency of *C.maculatus* (Fab.) in cowpea seeds with different seed-coat texture.

Texture	Mean no. eggs laid	Mean F_1 adult emergence	Mean developmental period (days)	Susceptibility index	Reproductive efficiency(%)
Smooth	161.04±22.7	71.85±9.71	24.83±1.52	17.19±1.18	45.13±6.78
Rough	145.18±29.4	79.24±6.30	24.26±1.80	18.0±1.45	59.69±12.
t-values	2.20*	1.18*	0.31^{NS}	0.50^{NS}	3.35*

** Significant (P=0.05); NS-not significant (P=0.05).*