

Full Length Research Paper

Biology of major insects mainly *tribolium castaneum* (herbst) in cocoa beans

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Investigations were carried out to study the stored product insects associated with stored cocoa beans at private godowns located at Sennakallpalyam, Dharapuram in Tamil Nadu, India during 2010-2011. The tools used were normal sieve sample, UV light trap, pheromone trap and stack probe trap. The trap catches compared in all methods major insect got is *T. castaneum* hence the biological studies were carried out on the major insect attacking stored cocoa beans namely red flour beetle, *T. castaneum*. Insects cultured on cocoa bean host had high fecundity 60 percent, hatchability 93 percent, mean developmental period is about 240 DAS and growth index 4.18 DAS.

Keywords: *Tribolium castaneum* (HERBST), fecundity, growth Index.

INTRODUCTION

Cocoa is an important commercial crop grown the world over. Cocoa (*Theobroma cacao* L.) is called "food of gods" and it is the third important beverage crop next to coffee and tea. Cocoa is affected by over 1,500 insects in different cocoa growing countries of the world both in field and storage. In Ghana, dry cocoa beans were monitored for insect pests associated with the cocoa in storage from 1995 to 2000 and eleven species were identified. These includes *Tribolium castaneum* (Herbst.), *Cryptolestes ferrugineus* (Stephens), *E. cautella* (Walker), *Lasioderma serricornis* (F.) and *Araecerus fasciculatus* (De Geer) (Jonfia-Essien, 2001; 2004). The majority of insects associated with stored cocoa beans are also infesting other dried food stuffs, such as grain, seeds and dried fruit. Insects documented mainly are, *P. interpunctella* (Hubner), *Ephestia spp.* (Walker) and *T. castaneum* (Herbst.) (Jacobson, 1984). Therefore, the aim of this study was to study the different growth stages and biology of *T. castaneum* on cocoa beans.

MATERIAL AND METHODS

Infested cocoa beans were collected periodically from Sennakallpalyam, Dharapuram (DT) in the State of Tamil Nadu and were used as a source of infestation. Adult *T. castaneum* beetles emerging from these infested beans were used to initiate the mass culture. This culture was further multiplied for various laboratory studies. Freshly emerged adults were used for different experiments. Fifty gram of cocoa beans was taken separately in 250 ml plastic containers with four replications. Twenty five freshly laid eggs per container were placed and the bio-parameters viz., egg period, larval period, pupal period, adult longevity, egg hatchability, larval weight, pupal weight, adult weight, larval size, pupal size, adult size, mean developmental period and growth index were calculated. The mean for all the bio parameters were worked out (Plate 1).

The mean development period of the test insects was calculated using the formula given by Howe (1971)

$$D = \sum (AXB)/C$$

where,

A= Number of adults emerged on nth day

B= 'n' days required for their emergence

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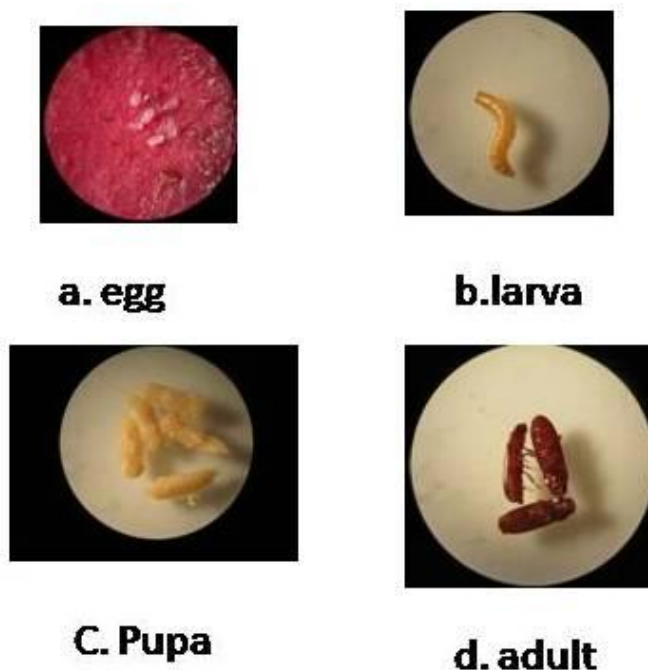


Plate:1 Life stages of *Tribolium castaneum*

C= Total number of adults emerged during the experimental period

D= Mean development period (days)

The index of susceptibility of hosts was calculated based on the following formula suggested by Doble (1977).

$$I = F_{\log} / DX100$$

where,

F= Total numbers of adults emerged

D= Mean development period (days)

I= Index of susceptibility

The growth index was calculated using the following formula (Srivastava, 1959)

$$\text{Growth Index} = \frac{\text{Mean per cent pupation}}{\text{Mean larval period}}$$

RESULTS AND DISCUSSION

The biological study of *T. castaneum* was carried out on stored cocoa beans. The results of the study on life history parameters of *T. castaneum* are presented in (Table 1). The female oviposits directly on surface of cocoa beans. The eggs were white, translucent, sticky, slender and cylindrical. Mean egg period was found to be 3.6 days. It was observed that larvae were worm like and white creamish colour with faint stripes and two spines like appendages at the end segment. Larval size was 4.7 mm, the larval period were 23 days and larval weight

ranged from 2.6 to 2.8 mg (Table 2). Pupa remained loose lying in the food materials and was naked. Pupae stages lasted for 8 days, and its weight was 2.1 mg. Pupae size ranged from 3.1 to 3.2 mm. Adult beetle was oblong, flat size was 2 mm and mean adult longevity was 214 days. Mean adult weight was 2.1 mg. Mean developmental period of *T. castaneum* observed was to be 239.5 days *T. castaneum* hatchability was found to be 93 per cent. Growth index was observed to be 4.18. Index susceptibility was observed to be 1.17. Fecundity was found to be 60 per cent.

At the optimum temperature of 35°C, the development times for each stage are 3.1 days for eggs, 16 days for larvae and 4.5 days for pupae at RH 60-80% (Shazali and Smith, 1986). Present studies revealed that *T. castaneum* reared in cocoa beans were of large size and more weight. *T. castaneum* have more mean developmental period in cocoa beans. Developmental time depends on both egg and adult body size with progeny developing from larger eggs growing generally faster, attaining larger size and having higher survival than progeny developing from smaller eggs (Fleming and Gross, 1990).

Both egg and adult size affect egg to adult developmental time. The Index of susceptibility observed in the present study was 1.17. Fecundity of *T. castaneum* in present study was observed to be 60 percent respectively. Egg size and egg number are generally correlated to body size which have important ecological and evolutionary

Table 1. Biology of red flour beetle, *T. castaneum* in cocoa beans.

Particulars	Mean (Days) \pm SD	Range (Days)
Egg period	3.6 \pm 0.24	3-4
Larval period	23 \pm 0.82	22-24
Pupal period	8 \pm 0.82	7-9
Adult period	214 \pm 1.16	212-216
MDP (days)	239.5 \pm 1.26	239-245
Growth Index	4.18 \pm 0.14	3.38-4.18
Fecundity (%)	60 \pm 3.74	50-60
Index susceptibility	1.17 \pm 0.08	1-1.3
Hatchability (%)	93 \pm 0.82	91-93

Table 2. Measurement of different parameters of *T. castaneum*

Parameters	Range (mm)	Average (mm)
Larval size (mm)	4.7-4.8	4.73
Larval weight (mg)	2.6-2.8	2.7
Pupa size (mm)	3.1-3.2	3.1
Pupa weight (mg)	2.0-2.2	2.1
Adult size (mm)	1.9-2.1	2.0
Adult weight (mg)	2.0-2.2	2.1

implication for fitness and fecundity (Fleming and Gross, 1990). Growth Index of *T. castaneum* observed in the present study was 4.18.

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