

BIOLOGICAL STUDIES ON BRUCHIDIUS INCARNATUS BOH.  
WITH SPECIAL REFERENCE TO THE EFFECTS  
OF THE RADIATION ON THE  
DEVELOPMENTAL STAGES

BY

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## I. INTRODUCTION

Bruchidius incarnatus Boh., is one of the most important pests of stored beans and leguminous seeds in Egypt. It infests dry beans in stores in all seasons of the year as well as in the field soon after being mature. The eggs laid ~~are~~ on the mature beans in the field as soon as they ripen. The larvae hatch and bore into the beans after a short period of wandering and feed on the inside of the seeds, reducing their nutritive value and germination ability.

The broad bean Vicia faba is the principal host of Bruchidius incarnatus Boh. The insect infests also other leguminous seeds. De Luca (1962) recorded it on other seeds such as chick peas Cicer arietinum, flax, Dolichas lablab and peas.

Bruchidius incarnatus Boh. was studied by a few investigators; these studied mainly such aspects as synonymy and geographical distribution (Sckilsky 1905, Winkler 1927, Zacher 1930 and De Luca 1962).

No detailed studies have been previously carried out on the biology and behaviour of this species. The present work deals with the general biology and the

effects of irradiation on the different developmental stages of this insect pest.

## II. REVIEW OF LITERATURE

### A. General biology of the broad bean weevil Bruchidius incarnatus Boh. :

The distribution of the broad bean weevil Bruchidius incarnatus Boh. was discussed by many researchers. Sckilsky (1905) reported that the pest is found in Spain, Tunisia, Canary Islands and in Egypt. Winkler (1927) added Africa as another wider area for its distribution. Zacher (1930) found the insect in Germany. De Luca (1962) in Algeria reviewed the literature on both Bruchidius algricus and Bruchidius incarnatus which have frequently been confused with each other. He also redescribed them in detail and recorded B. incarnatus as dominating in Tunisia. Bruchidius incarnatus in spite of being a serious pest, both in Egypt and other parts of the world, the literature about it is very scanty. The literature concerning other stored-grain insects is on the contrary very voluminous, especially of those infesting broad bean and other leguminous seeds. Larson (1927) working on Bruchus quadrimaculatus found the favourable habitat for oviposition and classified the seeds utilized in this respect according to the site of infestation. Herford (1935)

reported that the chemical composition of the different seeds used had a great effect on the activities of the subsequent adults. El-Sawaf (1956) stated that the different kinds of larval seed-foods, showed that the effect was very highly significant on Callosobruchus maculatus. He also mentioned that previously infested seeds might have a characteristic scent which stimulated oviposition by the females. The same author (1958) proved that the insects, he examined did have shorter life cycle when reared on unfavourable seeds. Headle (1917) stated that the number of eggs laid by the female bean weevil Acanthoscolides obsoletus when kept at 25°C. and 100% R.H. was 42 while it was 27 when kept at 62% R.H. at the same temperature. Domenichini (1954) reported that only one egg was laid per seed. Caswell (1958) stated that nearly half the number of eggs was laid by the female during the first two days after emergence. Rajak (1965) stated that the female of Callosobruchus chinensis laid 50-103 eggs in its life time. Brindley (1933) and Larson (1938) studied the durations of the various larval instars, differentiating them by the gradual enlargement of the larval head capsule. Dominichini (1954), Hafez and Osman (1956), and El-Sawaf (1958) gave various informations

about the larval and pupal stages. The longevity of certain male and female adult insects in stored grain and the factors affecting them were discussed by Larson (1938), Schoof (1941) and Hafez and Osman (1956). The effect of mating on the female longevity was investigated by Zaazou (1948) and Osman (1956), who found that unmated weevils of both sexes lived longer than mated ones. Caswell (1958) stated that the life span of the female was elongated by leaving it with the male. The effect of different temperatures and humidities on adult emergence was studied by Caswell (1958) and El-Sawaf (1958). Oviposition and egg hatching were investigated by Skaife (1919), Kunhikannan (1920), Menusan (1934), Zaazou (1948), Hafez and Osman (1956), Davis (1960), Howc (1965) and Rajak (1965). They also dealt with the effect of temperature and relative humidity on the development of the embryos, the hatching of larvae and on the larval and pupal stages. The mode by which the newly hatched larvae could penetrate through the seed tissues of the plant host was reviewed by Brindley (1933) and Davis (1960). The development of Callosobruchus maculatus from the newly hatched larvae to the adult stage inside the seed was studied by Larson (1938).

B- Biological effect of gamma irradiation :

1. Effect of gamma rays on the immature stage :

Brockway (1956), in his studies on the effect of X-irradiation on the pupae of Tenebrio molitor, reported that all pupae used as control or given 500 r and 1000 r hatched normally. Of those given 2000 r only 33% hatched normally. All pupae given 2500 r to 20000 r hatched abnormally. The average period of pupation for the controls was 8.15 days. Means of 9.0, 10 and 11 days were recorded for those given 500 r, 1000-4000 r and 5000-20000 r respectively. Furthermore at doses of 5000-20000 r only 50% of the pupae hatched. At 2500 r the emerging adult was unable to shed the pupal cuticle, which remained in a mass on the tip of the abdomen.

Kipiani and Tsetskhladze (1956), studied the effect of gamma rays on the pupae of Bombyx mori. They reported that pupae produced in different seasons were characterized by different resistances to gamma rays. Exposure to 200000 rep, 150-180000 rep and 100000 rep kill 100% of the pupae of the first, second and third seasons respectively. Gamma irradiation caused a slight delay in the pupal development. Observations showed that a lethal dose of

200000 rep also ensures preservation. According to Bletchly and Fisher (1957), eggs of Anelium and Xestobium were killed when exposed to 4000 r 1-4 days, after being laid but older eggs required 48000-58000 r. Newly hatched larvae did not survive even when irradiated at much lower dosages. The development of Lyctus larvae was arrested when treated with 8000 r, but higher doses were required to produce rapid mortality.

Bletchly (1958), working on Luctus brunneus, reported that normal development was possible after irradiating pupae at 4000 r.

In Bombyx mori L., Colombo (1958) found that the fecundity was much decreased among females treated at the fifth larval stage or early pupae than those treated in late pupae.

Howden and Auerbach (1958), studied the effect of gamma radiation on Trogoderma sternale Jayne and they reported that all doses applied to the larvae adversely affected the reproduction of the resulting adults, but the reduction in the population caused by exposure to 4000 r or less might have been due to lowered vitality or morphological deformity.

Terzian and Stahler (1958), studied the effect of gamma radiation on the eggs of Aedes aegypti, and they reported that eggs were the most sensitive to irradiation during the prehatching period, the LD<sub>50</sub> varying from 800 r to 7500 r, and the most resistant were 3 to 5 days old eggs, the LD<sub>50</sub> ranging from 30000 to 75000 r. Progeny could be reared only from eggs which had been irradiated at dosages less than 2500 r. Whenever larvae could be grown successfully to adults, the resulting adults laid viable eggs if physically capable of mating.

Bruel and Bollaert (1960), reported that doses of 1000 r destroyed 99% of the eggs (2-day-old) of Sitophilus and 2500 r were required for destroying 98% of the egg of S. granarius. S. granarius was more resistant at all stages of development than S. oryzae. The differences in resistance decreased at later stages, 3500 r prevented development of S. oryzae, but 5000 r was required for S. granarius.

Van de Woestijne and Brande (1960), working on Dyherbia kuehniella Z. showed that eggs and larvae were killed at 13000 r. Seventy-two percent of eggs irradiated at 4500 r gave rise to adults. Emergence of those was delayed by two days, and few of them reproduced. When the