BIOLOGICAL AND ECOLOGICAL STUDIES ON THE COTTON LEAFWORM SPODOPTERA LITORALIS BOISD (Lepidoptera, Noctuidae)

Thesis

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By

KHAIRAT KHAIRY EL-RAFI
B. Sc. Agric. Ain Shams University

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Approved by:

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Committee in Charge

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INTRODUCTION

The cotton leafworm *Spodoptera littoralis* Boisd is a well known polyphagous insect in Egypt. It has long been established in this country as a major pest of cotton as well as of several other field and truck crops. Although it has attracted the attention of many workers owing to its general distribution, nultitude of generations, and wide range of host plants yet the effect of different hosts on its biology still needs further work. Additional Laboratory work concerning the effect of temperature and relative humidity on its life-cycle is also needed as a prerequisite to a better understanding of its response to such factors in the field. The need is also felt of the precise influence of the type and pH of the soil on the dynamics of this insect particularly during the pupal stage.

The present work covers all the preceding aspects. Experiments were carried out at the Cotton Leafworm Research Division, Ministry of Agriculture, Dokki. The nutritional studies were continued for nearly three successive years; 1966, 1967, and 1968.

REVIEW OF LITERATURE

Effect of Host Plants on the Biology:

Jones (1913) drew the attention to prodenia litura F. as a serious pest of tobacco, which was the principal crop in the Philippines. The larvae favoured the young leaves and buds, thus rendering the infested plants of no economic value.

Corbett (1922) claimed that p.litura F. has a wide range of host plants, including castor oil plant.

Simmonds (1925) recorded bananas, roses and coconuts among the host plants favoured by p.litura. He observed that the emerging larvae feed for a short time on the lower surfaces of the leaves and then get dispersed mainly downwards.

Otanes (1957) studied the life-cycle and the damage caused by p.litura F. in Philippines. He stated that the insect was abundant and caused considerable damage to rice plants, especially in the seedling stage.

In Formosa, Sonan (1937) studied p.litura F. as a pest of tobacco. He stated that all stages can be found at any time of the year and that the insect has 8 generations a year.

Swezey (1941) mentioned that p.litura caused great damage to banana leaves in Hawaii and recorded its presence

in Somoa. He added that the larvae skeletonise the leaves, and that few of them were parasitized by a species of Euplectrus.

Mendizabal and Villalba (1941) recorded p.litura as a pest of economic importance that causes serious injury to Kitchen-garden crops, maize and lucerne in Spain. Three generations of the moth were observed. The duration of the egg, larval and pupal stages recorded were 2-4, 15-20 and 7 days respectively.

Brief notes on the general appearance of the different developmental stages, life-history and the distribution of p.litura F., in Fiji were given by Lever (1943). He mentioned that the larvae feed either by cutting off young shoots or act as defoliators. Under laboratory conditions the egg, larval, and pupal stages lasted 3-4, 16-19 and 10-11 days respectively. The same author added that though eggs may be laid on leaves of cocoanut, larvae never attempted to feed on this plant.

A comprehensive study of the effect of 20 host plants on the durations of the different developmental stages of p.litura was carried out in Calcutta by Basu (1944). The experiments were carried out in the laboratory at a temperature of 19-22°C. The size of the larva , pupa and

adult, together with the duration of the larval and pupal stages were recorded. The shortest larval and pupal periods were obtained when larvae were fed on cauliflower, mulberry, lettuce and palm.

The resulting adult insects were relatively larger than those fed on other food plants-cotton leaves caused long developmental periods and produced smaller insects. Banana, cabbage and papaya were intermediate in their effect. At lower temperatures, development was retarded and all developmental stages took longer times.

Prodenia litura was also recorded by Mason (1947) as a serious pest of potatoes and other vegetable crops in Palestine.

According to Jarcyzk (1957), the pupal stage of p.litura took 7.5 days for the females and 9 days for the males at 25-26°C., At 28-29°C., the pupae of both sexes required 6.5 and 7.5 days respectively.

Hosny & Kotby (1960) studied the host plants favoured by the moth for egg-laying and hence their value as trap--crops. Castor oil plants, Cowpea, cotton, maize and sunflower were distributed at various densities in two experimental areas. The statistical analysis of the data indicated

that the above-mentioned sequence of the plants may be their proper arrangement as fas the host-preference is concerned. In their opinion castor oil plant presented a working possibility to act as a trap-crop for the ovipositing moths in cotton fields. The effect of the comparative density of cotton raws to other host-plants (2:1, 3:1, 4:1, 5:1 and 6:1) on the ratio of oviposition on cotton plants were also tested but showed no significant difference, a result, which may suggest the economic practicability of the last ratio.

Moussa et al (1960) working on the host plants of this insect found that the life-cycle was much shortened on berseem, being relatively prolonged on cotton. Okra favoured larvae to produce moths of high egg potential. On the other hand, the first instar larvae failed to survive on grape vine and corn.

Nasr and Ibrahim (1965) investigated the effect of food on the biology of the cotton leaf-worm in relation to larval colouration. They found that larvae fed on cotton flowers were light brown in colour, while those offered leaves of cotton or sweet potato attained the normal colour. Feeding on cotton flowers was found to shorten the duration of the life-cycle and to give the heaviest weight of pupae. However, the life-cycle was much prolonged, and the lightest weights of pupae were obtained when larvae were offered leaves of the

same plant. There has been a negative relationship between the weight and duration of the pupal stage. The highest number of eggs was deposited by females emerging from larvae reared on sweet potato leaves.

Abul-Nasr et al. (1966) mentioned that the egg-batches of the cotton leaf-worm are of different shapes. Some were of no definite shape, others were oval, round, quadrangular or triangular. In Giza, the quadrangular shape seemed to be the most common, while in Sakha, the oval shape was predominant. They could classify the egg batches into three size-groups, according to the measure of their outline contour. They also observed that the size varied during the season in the same region. Most of the egg-batches were found on the upper third of the plants, and on the lower surface of the leaf blade. They concluded that although the soil moisture may influence the dispersion of the egg batches in space, yet there has been no significant difference between the distribution of the egg-batches in the different sections of the cotton field during July and August.

Badr, (1967) studied the effect of feeding on the development and reproduction of the cotton leaf worm p. litura. The host plants she used as food included cotton leaves, cotton seedling, leaves of castor oil, grape vine