LARVAL ACTIVITY OF PINK BOLLWORM UNDER DIFFERENT ENVIRONMENTAL CONDITIONS

By

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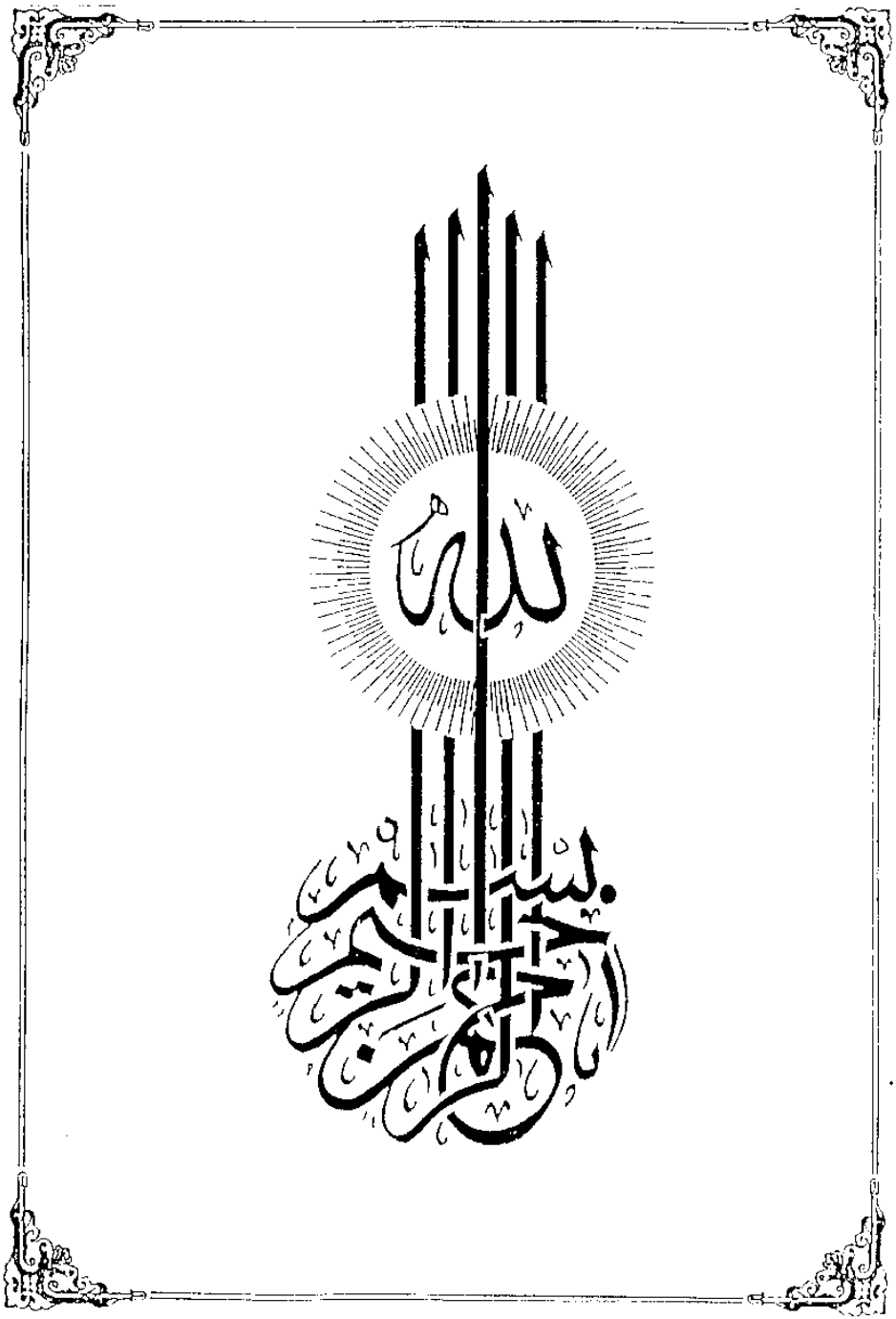

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I. INTRODUCTION

The diapausing Larvae of pink bollworm, Pectinophora gossypiella Saunders survive the winter inside the seed in dry bolls which remain attached to cotton sticks after picking. They are also found in dry infested bolls which fall to the ground and buried in the soil. Several soil factors, depth of the buried larvae, soil moisture and temperature influence the survival of larvae. Bishara (1954) and Khalifa (1971) mentioned that early in the season, when green bolls are not yet available the only feeding sites for the larvae are the flower-buds and flowers where they feed on pollen grains.

Although there is a very high natural mortality rate among newly hatched larvae, the rapid rate of multiplication under local weather conditions accounts for the great losses the pink bollworm is able to incur to cotton crop. It is known that the peak of moth emergence from diapause larvae occurs in late April and May and a considerable number of moths dies before having the chance to lay their eggs. If the flowering of cotton coincides with the peak of moth emergence the damage would have been much greater. Planting cotton during the first half of March causes the flowering

season to start towards mid June, nearly one month or more after the peak of moth emergence. The result is that the new crop gets infested by the few moths emerging at the tail of the emerging curve. But once infestation of the new crop takes place in June environmental conditions in the following months are most suitable for the propagation of the pest within the crop.

The pink bollworm is present in most parts of the cotton belt round the world and still threatens the crop and causes a considerable loss in the quantity and quality of the yield. The clean-up campaign enforced in many cotton producing countries, like Sudan, aims at burning all the remaining parts of the plant soon after picking. This has undoubtedly reduced the rate of infestation considerably, but because such campaign is not rigidly performed or because of the failure of controlling diapause larvae in seed there is a need to resort to chemicals. A better understanding of the behaviour of the insect coupled with perfection in adopting the preventive measures will result in successful integrated control.

The aim of the present work is to throw some light on the behaviour of pink bollworm larvae inside green and

dry bolls attached to cotton sticks or buried in the soil. The oviposition sites, vertical distribution of larvae on cotton plants and the relationship between boll-age and infestation are also studied.

II. REVIEW OF LITERATURE

A. Oviposition sites on cotton plants:

Willcocks(1916) and Squire (1939) reported that females pink bollworm may lay their eggs singly or in groups of as many as eight to ten ova. The eggs may be found on almost any part of the cotton plant, including, the bolls,squares, young and old leaves. When laid on bolls they may be placed in one of the grooves near the tip formed by the juncture of the loculi or on the shell of the boll, between it and the enveloping involucres. In some cases eggs were found on the calyx. When laid on the leaves the eggs will be found on the under surface. The hairy under-surface of the young leaves appears to be a very favourite situation for oviposition.

Taylor (1936) also showed that eggs were laid on any part of the cotton plant, but sheltered situations were markedly preferred. The majority were laid on bolls beneath the calyx lobes. Goloviznin (1937) mentioned that eggs of P.gossypiella were usually laid singly on the bolls. Sometimes up to 8 eggs were observed on bolls in the field, probably deposited by several females. In Philippines, Butac (1938) and in Java, Franssen &

Muller (1938), P. gossypiella moths were observed active at night and females laid their eggs singly on green bolls, flowers, buds and under the leaves. Brazzel and Martin (1957) found that cotton terminals were the most favourable vegetative part for oviposition followed by the axils of leaves when bolls were not available. Squares were not preferred for oviposition particularly before bolls were available, since the elongate tips of the square calyx appeared to offer an ideal site for oviposition.

In China, Chu (Seng-fu) (1959) found that P.gossypiella females of the first generation laid their eggs between mid-June and mid July, whilst those of the second and third generation laid their eggs between the 20th. of July to mid August and between the 20th. of August to the last ten days of October respectively. The eggs of the first and second generations were mostly laid on the green bolls on the lower parts of the plant, very few were laid on the leaves of fruiting branches. The eggs of the third generation, however, were laid on bolls of the middle and upper parts of the plant since those of the lower parts were by that time mature.

Toson(1963) stated that when the vegetative growth

was only available on young plants, the female moths of P.gossypiella laid their eggs on the small lateral buds and on the lower surface of the leaves between the main veins. Oviposition continued on those parts until about two bolls had developed on each plant. Eggs were then deposited on both the vegetative and fruiting parts. When the cotton plant bears 2-5 bolls on the average, about 5.75% of the eggs were found on the bolls, and 94.25% on the leaves and buds. It was noticed that the number of eggs increased with the increase in the number of bolls per plant. Under field conditions, he added, no eggs were found on the terminal buds or on the young leaves which surrounded these buds. Eggs were never found on the fruiting buds, squares or flowers. The only preferred fruiting parts were the medium sized bolls which were about 20-25 days old. The eggs were deposited singly or in pairs on the vegetative parts and in masses of up to nine eggs on the bolls.

In a study on the bionomics of P.gossypiella on cotton, in India, females were found to lay 37 to 230 eggs each, mainly on the lower surface of the leaves.The eggs hatched in 4-5 days in May-November,(Srivastava et al. 1966). Khalifa (1966) showed that eggs were

mostly laid on the axillary hairy buds of the upper nodes, the outer surface of the bracts and the completely furled leaf on the top of the plant. Shehata (1973) found that the order of preference of pink bollworm moth for laying eggs was flowers, bolls and leaves.

B. Behaviour of pink bollworm larvae on cotton plant:

Ohlendor (1926) observed that bolls when artificially infested with a compact group of pink bollworm eggs, the entrance holes of the larvae were well scattered over the entire boll. He also observed that infestation took place first in the bolls followed by the blooms of a specific plant. Taylor (1936) reported that, in Uganda, approximately 90% of the pink bollworm larvae attempting to enter the boll, were able to gain entrance. It was further noted that when two or more larvae entered the same locule of a boll, only one larva would be recovered. He concluded that the pink bollworm larvae had a cannibalistic character. Squire (1938) stated that easy penetration of bolls by newly hatched larvae of P. gossypiella depended on the degree of roughness of the boll surface, since no marked difference in the moisture content of various types of bolls could be detected.

Squire (1939) found that penetration of the boll was not easy that many of the larvae perished in their attempt to enter the boll. In the early stages of infestation, the larvae preferred 30-36 days old bolls. Bishara (1954) believed that almost all pink bollworm moths emerging in March and April die without finding suitable food for their larvae. Under normal conditions almost 50% of adult emergence occurs before the middle of May.

Laboratory and field observation on the behaviour of pink bollworm larvae carried out in Texas by Brazzel and Martin (1955) showed that when 5-10 eggs were put on one locule 48% of the hatched larvae entered the boll of which 35% only were recovered. When caged singly, 68% of the larvae entered and 95% of these were recovered. When more than one individual entered a locule, generally only one was recovered, larvae seem to be of cannibalistic nature. Newly hatched larvae move over the cotton fruit, and if it is small they frequently encounter one another, they migrate over the plant before entering a fruit. Relatively large numbers of these migrating larvae survive, particularly if there are many fruits on the plant.

In 1960, El-Sayed and Abdel-Rahman noted that the

time required for the newly hatched larvae of P.gossypiella to enter the cotton boll was about 20 to 50 minutes, according to the age of the boll, after which the larva became completely hidden. Also Lukefaher and Martin(1963) observed that the degree of damage was related to age of the boll and number of larvae per boll. As the boll age increased, the damaging effect of the larvae was less evident.

Tsao and Lowry (1963) mentioned that newly hatched larvae moved up and down over the plants principally along the main stems. Most of the larvae that hatched on green bolls, however, did not disperse but entered the boll on which they hatched.

In India, Singh et al. (1965) investigated the susceptibility of bolls of 14 varieties of cotton to infestation by P.gossypiella. They observed a negative correlation between the thickness of the green boll walls and the occurrence of larvae within the bolls.

Khalifa (1967) found that certain ratio of the 1st-stage larvae of the pink bollworm perishes. The larva may crawl for a long time and become unable to penetrate