STUDIES ON THE SOURCES OF THE PINK BOLLWORM INFESTATION

By

ALY MOURSY SOLIMAN HEGAB

B.Sc. AGRICULTURE

ENTOMOLOGY

Thesis Submitted in Partial Fulfilment of the Requirements for the Degree of Master of Science (Entomology)

Plant Protection Department

Faculty of Agriculture

Ain Shams University

1974

APPROVAL SHEET

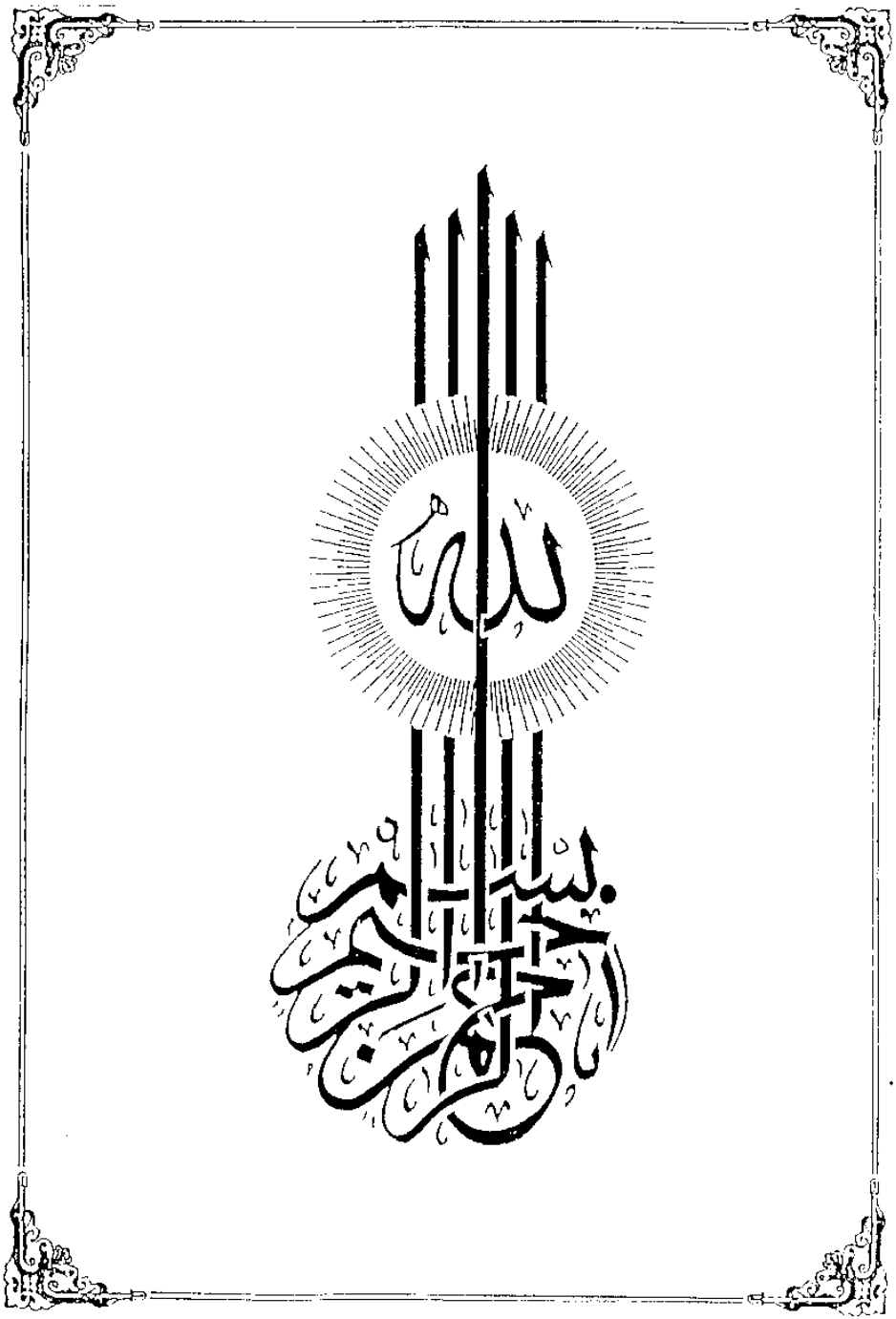
Title of Thesis : Studies On The Sources Of The Pink Bollworm Infestation

Degree : M.Sc. Agriculture (Entomology)

Approved by :

Committee in Charge

D a t e : ---------------------------



BIOGRAPHY

Name : Aly Moursy Soliman Hegab.

Degree : B.Sc. Agriculture 'Entomology).

Occupation : Demonstrator, Plant Protection Department, Faculty of Agriculture, ZAGAZIG University.

Date of Appointment : 16.11.1969.

Date of Registration : 14.3.1972.

Courses Attended	Grade
Insect Physiology A	Very Good
Insect Physiology B	Very Good
Biostatistics	Very Good
Insect Ecology	Excellent
Special Courses	Excellent
Microbiology	Very Good
Pest Control	Pass
Research and Seminars	Excellent
English Language	Pass

A C K N O W L E D G E M E N T S

The author feels extremely indebted to Dr. M.E. El-Shaarawy, Assistant Professor of Entomology, Faculty of Agriculture, Ain Shams University, Dr. R.R. Iss-hak, Lecturer of Entomology in the same Department and Dr. K.A. Gohar, Assistant Professor of Entomology, Faculty of Agriculture, Zagazig University for suggesting the problem and their helpful advice throughout the course of study.

Sincere thanks are also due to Professor Dr. A.I. Badawy, Head of the Plant Protection Department, Faculty of Agriculture, Ain Shams University for offering all possible facilities throughout this work.

C O N T E N T S

INTRODUCTION

The pink bollworm, Pectinophora gossypiella (Saund.) is regarded as one of the most serious pests of cotton in A.R.E. It causes much loss of the crop and destroys most of the late formed bolls. The loss in the yield due to infestation by this pest may account to about ¼ kentar per feddan (Shehata, 1973).

The female moth lays its eggs on the leaves and bolls of cotton, and these hatch in about a week. The newly hatched larvae soon bore into the bolls and feed on the seeds. After 2-3 weeks, larvae are fully grown and may either bore their way out and pupate in debris on the ground, or may enter a resting stage, laying dormant for a period sometimes as long as 6-7 months or even more, within a whollowed out cotton seed or in two such seeds webbed together with silk.

Where the larva pupates straight away (early generations), the moth emerges after 2 or 3 weeks and is capable of laying eggs. Where the insect enters a resting stage (most larvae at the end of the cotton season), it is enabled to survive among the cotton seed long enough to infest the next year's crop. After ginning, cotton seeds are treated with hot air at a temperature of 58°C for 10 minutes to kill the resting larvae. Cotton sticks bearing dry bolls (containing resting larvae) and commonly stored for fuel on roofs

of houses in villages are thus considered as a main source of infestation to the new crop.

Besides, cotton bolls, the two Malvaceae; Okra (Hibiscus esculentus) and Kenaf (Hibiscus cannabinus) act as attractive host plants for this pest. Examination of fruits of both revealed the presence of living larvae.

The chemical control of cotton bollworms in Egypt is based on periodical spraying of plants which starts when the level of infestation reaches about 10%. Usually two or three sprays are applied using highly efficient chemicals recommended by the Ministry of Agriculture. This procedure for the control of cotton bollworms proved insufficient to keep down the loss of crop from pink bollworm damage, and the crop still suffers from severe infestation and appreciable loss.

The aim of the present work is to throw some light on the following points :

1. The relative importance of the different host plants as a source of infestation with the pink bollworm.

2. The horizontal distribution of the pink bollworm infestation at different distances and directions from the nearest village.

3. The rate of infestation as being affected by chemical application at different levels.

4. The effect of late spraying of dry bolls (after picking) on resting larvae.

It is hoped that such study will be of value in suggesting other effective control measures against this pest.

REVIEW OF LITERATURE

References with regard to the biological and ecological aspects of the pink bollworm Pectinophora gossypiella are voluminous and the present review deals only with three points: host plants and the sources of infestation, effect of chemical treatments on the population density and the incidence and length of diapause.

Host plants and the source of infestation :

Gough (1916) showed that hibernating larvae of P. gossypiella were found in cotton seeds during winter. A large number remained in dry bolls hanging on cotton sticks or in fallen bolls. At the time of sowing, such bolls still contained enormous numbers of living larvae.

Willcocks (1916) stated that the host plants for the pink bollworm in Egypt, other than cotton include, okra (Hibiscus esculentus), kenaf (Hibiscus cannabinus) and holly-hock (Althaea rosea), all being of the Malvaceae.

Williams and Bishara (1925) pointed out that the death rate of larvae buried in the ground in winter was low near the surface and high at greater depths. At a depth of 30 cm, no survivals were present. The larvae died very rapidly

in fields previously planted with cotton and sown with berseem. In wheat fields following cotton, the percentage of survivors was however much higher.

Bishara (1930) mentioned that the chief sources of infestation to the new crop fall under three groups : bolls scattered in the field, those buried in the soil and untreated seeds used for planting. He showed that under moist conditions, moth emergence occurred in April and May. But under dry conditions such as in bolls on cotton sticks on roofs of houses and in seed-cotton in villages and ginneries - when ginning was delayed - the maximum moth emergence occurred in July. He added that larvae which were taken with the crop were effectively dealt with in ginneries where seeds were heated to a temperature of 58-60°C which was fatal to them. In spring and summer, many moths emerged from seeds of the previous season. Even in winter, few moths emerged. In warm weather starting from April, the number increased rapidly and reached a maximum in July.

Rude (1932) mentioned (Hibiscus cardiophllus), (Hibiscus coulteri) and (Hibiscus denudatus) as hosts for the pink bollworm in North Mexico.

Bishara (1936) pointed out that cotton sticks contained 75% of all the resting larvae, the remaining 25% was to be

found in the seeds and underneath the soil surface. The peak of emergence was on mid-May. In 1954, the same author stated that bolls which fall to the ground before and during picking or removal of cotton sticks roots and probably 99% or more of contained larvae died.

Shiller (1957) in U.S.A. listed 38 different plant species besides cotton as host plants for the same pest. Out of these, 26 were found to contain resting larvae in seeds during winter.

Fife et al. (1957) stated that a high survival was found when bolls remained on or near the soil surface throughout the fall and winter months. This suggested that deep ploughing for burial of the crop residues could be considered as a practical method of control. However, Wene et al. (1961) found that more moths emerged from buried bolls than from those on soil surface. Burial at 4" deep gave a higher number of emerged moths than when kept on the soil surface. This contradiction between both authors may be due to difference in environmental conditions.

Fife et al. (1963) stated that moth emergence from buried bolls was earlier than from bolls lying on the soil surface. The percentage emergence of moths was 7% in April, 59% in May, 30% in June and 4% in July. They added that

and bolls fallen to the ground are the chief sites for diapause, where the larvae of the pink bollworm can be found in the diapausing stage. Such bolls are considered the main source of the next year's first brood of moths. He added that the cotton pink bollworm infestation in Egypt increases steadily during the season reaching its peak in September. The percentage of infestation ranged between 1% or less in June and may reach 90% or even more in September. The pink bollworm's first generation concentrated in the field nearest to the villages mainly within a range of 250 meters. With the advancement of the seasor, the infestation tended to spread gradually all-over the area. He stated also that cotton was the most preferred host plant for the pink bollworm infestation and for bearing its resting larvae in the seeds. Okra came next to cotton in this respect. Hollyhock ranked third showing however, a distinctive susceptibility when cultivated early in the season as its flowers and fruiting parts are produced at a time when no suitable hosts were available. Manchurian jute, kenaf were of less importance.

Effect of chemical treatments on the population density :

Kamel (1958) studied the effect of certain phosphorous compounds on the control of cotton pests.

Gusathion and its mixture with Diptrex proved the most effective insecticides against both the pink and spiny bollworms. Among chlorinated hydrocarbons, a mixture of endrin and D.D.T. was the best against bollworms. However, endrin alone was the most effective against the spiny bollworm.

Metwally (1958) showed that cotton yield was not significantly affected by the range of 0-10% infestation by bollworms but was reduced gradually with the increase of infestation beyond that range. Accordingly, insecticides should not be used, for the sake of economy, unless the level of infestation reaches 10%.

Brazzel and Gains (1959) pointed out that even though all eggs were placed under the calyx, 75% of the hatching larvae entered the cotton boll above the calyx. This indicated that although the ovicidal action of the insecticides probably contributes to the overall control of the pink bollworm, yet the most effective measures were obtained by the action of the insecticide on the first instar larvae that emerged from below the boll calyx and attempted to enter the exposed portion of the boll above the calyx.

Moursi (1960) showed that sevin when used at the rate of one kilogram of the technical material per feddan was as effective as Endrin against bollworms.