BIOLOGY AND CONTROL OF THE SMALL PURPLE LINED BORER *CHILO SIMPLEX* BUTL.

By

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Thesis

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

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C O N T E N T S

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I N T R O D U C T I O N

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I N T R O D U C T I O N

Graminous plants are considered as the most essential crops in Egypt. Several varieties are cultivated such as summer and nili rice, maize and millet, and also wheat, barley, sugar-cane and some other plants. The area cultivated with these plants was estimated in 1966 as slightly less than five million acres. It is thus why that special attention should be paid to the insect pests which attack these crops, the most important of which are the borers. They cause a great deal of damage to these plants, resulting in enormous yearly loss in their yields.

Amongst the most injurious borers infesting graminous plants in Egypt three species are considered as "indigenous", namely the Pink borer, Sesamia cretica Led.; the purple-lined borer, Chilo sp. and the European corn borer Pyrausta nubilalis Habner.

They were first recorded in Egypt since more than fifty years, and since then voluminous work on their biology and economic status had been carried out. The nature of damage and loss of yield caused by an individual species was rather difficult to investigate, since the three species may occur together in the same field and even on the same plant.

The knowledge about their secondary host plants is very scanty, specially the graminous weeds. Thus a complete and thorough survey fo each species and its allied forms seems to be very necessary not only in Lower and Upper Egypt, but should be extended to the eastern and western deserts, particularly the oasis including those of the new valley and Sinai.

The synonimy of the borers in general is continuously progressing together with the records of new species and the change of their generic status. It is thus necessary that an up to date identification of the adults should be carried out, whether they were collected directly from the fields or bred from collected larvae.

A tremendous amount of work has been carried out on the chemical control of borers both in Egypt and in other countries. It is noteworthy that most of the plants, e.g. maize, millet, broom corn and sugar cane, have a tall nature in their growth, a matter which almost always necessiated the use of a special spraying technique.

The work carried out in this thesis can be summarized under the following items :

1. A thorough morphological and taxonomic study of the species present in Egypt under the genus Chilo and which was first recorded as Chilo simplex.

2. An inclusive survey of the wild and cultivated host plants aiming to the investigation of the geographical distribution of the insect in Egypt, its population density, and correlating this with the prevailing climatogical factors, specially temperature and humidity.

3. A study of the susceptibility of corn and maize to infestation by the common species of borers in Egypt.

4. The control of the insect under local field conditions.

REVIEW OF LITERATURE

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REVIEW OF LITERATURE

The lesser-cane borer Chilo suppressalis Wlk, previously known as C. simplex Butl., and recently identified by Stanislaw Blezynski of the Polish Academy of science, as C. agamemnon Blez., is commonly found in Egypt infesting and causing serious damage to maize, sugar-cane, rice, sweet corn and many other graminous grasses. It was previously studied by several authors, who tackled the problem from various aspects and so, it was found more convenient to cite its literature in accordance to its life history.

In regard to the oviposition period, Asa, and Fey al. (1924) stated that the insect has two oviposition periods in China, i.e. in the middle of July and the beginning of August. Kurihara (1929) in Japan stated that 78% of the moths started oviposition one day after emergence, and 26% of the eggs were laid in the first oviposition, the rest being oviposited subsequently at intervals of 1 - 3 days. Kuwana in Japan (1930) stated that oviposition continued over a period of 1 - 2 weeks, noting that the longevity of moths of the first brood was 3 weeks and that of the second brood was 2 weeks. Ozaki, (1940) in Japan stated that the overwintering

clusters ranged from 5 - 6 with a maximum of 20, and that the average number of eggs per cluster ranges from 30 - 60 with a maximum of 300. He also stated that the egg-clusters of the first brood are laid on the upper surface of the leaves, 1 or 2 inches from their tips, but those of the second are laid on the sheath of the plant and are difficult to locate. The estimated average number of eggs in Japan was310 per female,, ranging from 7 - 952, and that the eggs are laid at night,

the rate of development varied considerably in different localities. Kaburabe, et al. (1940), in Tokyo, stated that the female contains an average of 558 egg, but 50 - 60% of the eggs only, were despoited.Gomez (1949) found that females of Chilo suppressalis, Wlk., caged on out door plants deposit an average of 209 eggs in 2 - 4 days, almost on the under surface of leaves. Kurihara, (1929) stated that the number of eggs produced by a female of Chilo simplex is closely related to the size of its body.

On considering the egg hatching Mirata (1926) in Japan found that eggs hatch in the morning, and the hatching larvae bore into the stalks of plants if they are mature enough, but when the plants are too young they get dispersed by the wind. Van Zwaluwenburg, (1928)

in Honolulu reported an incubation period of 6 - 7 days. Kuwana (1929) reported the same period, and stated that in the seed bed, the first brood eggs are generally found on plants near the border, and thus they should not be transplanted. Murami (1932) in Tokyo estimated the incubation period for the eggs of Chilo suppressalis to range from 30 - 70 minutes for the eggs of one mass, and stated that hatching usually occurs in the morning (5 - 6 A.M.), less frequently in the afternoon (2-4 P.M.), but never during night. Gomez (1949) estimated the incubation period to range from 5 - 6 days at 26 - 28°C, and twice as long at 20 - 22°C. He collected eggs from females collected from districts where winter diapause was pronounced, and incubated them at temperatures ranging from 22 to 35.3°C. He then found that all larvae hatching from eggs kept at 22°C, entered into dispause, while 16.1% of those hatching from eggs kept at 27°C, did not. The maximum percentage (45.7%) of non-diapausing larvae developed from eggs kept at 31°C.

As to the number of larval instars, Katsumata (1935) in Japan in his work on the rice borer Chilo simplex, recorded 5 to 7 larval instars (usually 6 or 7) in the first generation, and sometimes 8 or 9, the winter being passed in the fifth or a latter instar.

With regard to the larval habits, Kuwana (192?) in Japan found that the larvae disperse shortly after hatching and find their ways into the sheath. Some of them usually suspend themselves by threads, and get carried to other plants by wind. Autumn larvae do not bore into the plants on which the eggs were laid. During the harvesting period, larvae are usually found in the stems, 4 - 10 inches above the soil. If the rice is harvested in early autumn and stalked larvae usually leave the straw and bore in other graminous plants. Commun, (1934) at Valencia, reported that larvae hatch in a week and immediately make their ways along the leaves to the stems, where they bore into the young succulent plants. Several days after, they construct shelters from pieces of leaves and bore into other stalks to which the shelters remain attached obliquely.
Gome (1949) at Valencia found that the larvae of the first generation of Chilo suppressalis, feed on the young leaves and leaf sheaths and more from plant to plant by suspending themselves on threads and depending on wind dispersal. Larvae normally select leaf sheaths half way between the water level and the tip of plants for pupation. Some larvae which hatched late in May and early in June (in the laboratory) pupated after 30 - 40 days at an

lasts 10 - 20 days at 17.6 and 15.4°C respectively. Doko, (1936) stated that the optimum temperature for pupal development is 24°C, and that pupae are not affected by variations in humidity. He added that the most favourable temperature for the emergence of the adult is 27°C, at a relative humidity of 100%, and that the period required for the pupal stage varied from 6 days at 32°C, to 9 at 24°C.

On considering the number of generations, Mirata (1927) in Japan, found that Chilo simplex has two generations a year in most of the regions, but only one in the north of Honshu and in Hokkaido, and 3 or 4 in Formosa. Kburaki, and Kamito (1929) gave the same information. The same was also given by Kuwana (1929) and Tanaka (1930) in Japan. Gomez (1940) in Madrid, stated that it has two generations a year with a partial third under favourable conditions. Salem, (1956) in the U.A.R. stated the Chilo suppressalis probably has 7 generations, while Abou El Nasr and El Nahal (1960) estimated them as 3 or 4 on Maize. Ahmed and Kira (1960) stated that it has only 2 generations at end of May and July respectively. Hassanein, and Badawi, (1959) using light traps, stated that it has 1 or 2 generations a year.