EFFECT OF TWO HOST PLANTS ON THE BIOLOGY OF *ETIELLA ZINCKENELLA* TREIT.

BY

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ABSTRACT

This study was conducted under laboratory conditions of 25±1°C and 60±5% R.H. on two host plants; soybean, *Glycine max* L. and leblab, *Dolichos leblab* L. Fertilized eggs of *Etiella zinckenella* were laid singly or in small groups and its incubation period averaged 4.6±0.40 and 5.2±0.24 days on soybean and leblab, respectively. The number of fertilized eggs per female averaged 49.4±0.55 eggs with a maximum of 14.4 eggs/day on soybean, while, it averaged 63.4±4.81 eggs with a maximum of 25.4 eggs/day on leblab. Egg hatchability averaged 59% on soybean and 62% on leblab. The average of larval stage was 17.8±0.13 days on soybean and 15.5±0.10 days on leblab, while, the average of pupal stage was 16.7±0.30 days and 16.3±0.42 days on soybean and leblab, respectively. The percentage of moth emergence ranged between 65-80% and the sex ratio was 1:1:1 in favor of males. Pre-oviposition, oviposition and post-oviposition periods were calculated on both host plants.

The averages of male and female longevities were 10.4±0.20 and 15.2±0.18 days, respectively. The total life cycle under the mentioned laboratory conditions averaged 49.1±0.7 days on soybean and 42.2±1.66 days on leblab. Certainly, leblab was the most preferable tested-host plant to *E. zinckenella*. This preference was probably due to the characteristics of leblab pods, e.g. colour, size and texture.

INTRODUCTION

Soybean, *Glycine max* L. is one of the most important crops in Egypt for its great value as a source of protein and oil. Therefore, the areas planted with soybean were increased about 31 times in the last decade (Records of the Egyptian Ministry of Agriculture).

Several insect pests attack soybean during the different growth stages and affect the quality and quantity of the yield. Limabean pod borer, Etiella zinckenella Treit. (Lepidoptera: Pyralidae) is a serious pest on soybean because of the destructiveness of larval feeding on the seeds inside the green pods (Parvin, 1982 and Wang, 1982).

Many biological studies on E. zinckenella had been done in various countries (Popova, 1957; Peiu, 1967; Singh & Dhooria, 1971 and Kobayashi, 1976). In Egypt, a little attention was given to the biology of this pest, whereas, the only published study was contributed by Abul-Nasr and Awadalla in 1957. Subsequently, the present work was an attempt for better understanding the biology of E. zinckenella on two host plants; soybean and leblab. The obtained biological data can be used in the near future in crop-pest management programs.

MATERIALS AND METHODS

A stock culture of Etiella zinckenella Treit. was first established in the laboratory by collecting the infested pods of limabean (Phaseolus limensis), Cowpea (Vigna sinensis) and leblab (Dolichos leblab) from different farms at Giza governorate. These infested pods were kept in rearing cages (48x31x22 cm) under laboratory conditions of 25±1°C and 60±5% R.H. Every 2-3 days larvae were transferred from the old dried pods to the fresh ones of soybean. This procedure was continuously repeated until larvae reached the last instar. The full grown larvae were individually kept in plastic containers (12 cm in diameter and 6 cm in height) till pupation and adult emergence.

To study adult longevity, copulation, oviposition site, the number of deposited eggs and life span, ten newly emerged pairs of male and female moths were introduced into 16x8 cm chimany-glass cages (a pair per cage). Each chimany-glass lamp was placed on one-half petri-dish (9 cm in diameter) lined with a dry filter paper and its top was covered with a piece of muslin held in position by a rubber band. The ten cages were daily supplied with 10% sugar solution in 1x3 cm glass tubes for moth feeding, dry filter papers for absorbing the excess humidity and 3 cm long fresh branches of soybean with attached pods for laying eggs. To prevent the dryness of soybean branches, they were inserted into small tubes filled with water. The experiment was terminated with the death of moths.

To study egg incubation period, 100 eggs deposited within 24 hours on soybean pods were transferred to 9 cm petri-dish and kept in an incubator (25±1°C and 60±5% R.H.) until hatching. By a daily inspection egg incubation period, hatching process and rate of hatchability were recorded.

To estimate the durations of larval instars, 100 recently hatched larvae were introduced into five 9 cm petri-dishes (20 larvae/dish) by a fine camel hair brush. These five dishes were daily provided with fresh soybean pods and examined for the existence of the exuviae. Starting from the third instar, larvae were individually reared in 2x8 cm plastic tubes that were every day supplied with fresh soybean pods. The plastic tubes were frequently inspected for moulting. When the mature larvae (5th instar) ceased feeding, they were singly removed to 1x3 cm glass vials covered with muslin to pupate. The pupae were under daily examination to estimate the pupal duration and the percentages of moth emergence.

The above experiments were carried out under laboratory conditions of 25±1°C and 60±5% R.H. In addition, the previously mentioned experiments were repeated to test limabean pod borer on the second host plant, leblab pods.

RESULTS AND DISCUSSION

Egg Stage:

The newly deposited eggs were oval and white. Their length measured 0.6-0.7 mm with an average of 0.67 mm and their width measured 0.3-4.5 mm with an average of 0.39 mm. Prior to hatching, the white colour of eggs changed to yellow with red spots on the chorion and the head capsules of the young larvae were easily detected through the chorion. The recently hatched larva used its mandibles to make an exit hole in the chorion. The average of the incubation period of fertilized eggs was 4.6±0.4 days (3-6 days) when the eggs were laid on soybean pods, while, it was 5.2±0.24 days (4-6 days) when the eggs were deposited on leblab pods. At the temperature of 25±1°C and the relative humidity of 60±5, the percentage of hatchability of E. zinckenella eggs ranged between 55-64% with an average of 59% and between 56-70% with an average of 62% on soybean and leblab pods, respectively.

Larval Stage:

Limabean pod borer has five larval instars. The newly hatched larva is soft and white with black spots between

joined segments. Each spot has dark brown hairs. On the last abdominal segment, there is a black spot with dark brown hairs. The legs and prolegs of this first instar are pale and well developed. Prior to moulting its colour changes to yellow. Its feeding caused ringed scratches on the external surface of the host seeds. The second instar larva is yellowish white and on the last abdominal segment there are many hairy spots. Also, larvae of this instar feed on the outer surface of soybean or leblab seeds on the same feeding area of the first instar or on new areas. The colour of the third instar is dark gray except the 10th abdominal segment which is pale orange. Before moulting, its colour changes to be grayish green. Starting from this instar, larvae feed on the interior contents of one of the seeds of the host plant. The morphological characters of the fourth instar are quite identical to that of the third instar larvae causes a great damage because they feed on the internal contents of more than one seed inside the pod. The fifth instar larvae are alike the fourth instar ones, but they are large and able to feed on all seed parts.

Averages and ranges of the measurements of the head and the body of the five larval instars besides their durations in case of infesting soybean and leblab pods are presented in Table (1).

The durations of the larval stage under the used laboratory conditions varied from 16-21 days with an average of 17.8±0.13 days on soybean and from 15-19 days with an average of 15.5±0.10 days on leblab. The faster development of the larval stage on leblab is an indication that leblab plant is more preferable host to E. zinckenella larvae than soybean.

Pre-Pupal Stage:

The colour of the pre-pupal stage is yellowish green and it measures an average of 9 mm in length (8-11 mm) and 2.5 mm in width (2-3 mm). Its duration under the laboratory conditions ranged between 2-4 days with a mean of 3.0±0.29 days on soybean and between 1-5 days with a mean of 3.0±0.39 days on leblab. So, the larval feeding on either host plant does not affect the duration of the pre pupal stage. Corresponding results were obtained by Abul-Nasr & Awadalla (1957) and Singh & Dhooria (1971).

Pupal Stage:

The pupa of E. zinckenella is obtect. The new-shaped pupa is soft and light green and during the developmental

Table (1): The averages and ranges of the measurements and the durations of the five larval instarts of E. zinckenella at 25 ± 1°C and 60 ± 5% R.H.

Larval instar	Measurements (mm.)			Durations (days)	
	Body length	Body width	Head width	Soybean	Leblab
1st	1.8 + 0.19 (1-3)	0.30 + 0.01 (0.2-0.35)	0.26 + 0.08 (0.21-0.3)	2.1 + 0.1 (2 - 3)	2.2 ± 0.12 (2 - 3)
2nd	3.7 ± 0.04 (2-4)	0.6 ± 0.02 (0.4-0.9)	0.43 ± 0.14 (0.35-0.5)	3.2 ± 0.11 (3 - 4)	2.8 ± 0.8 (2 - 3)
3rd	8.0 ± 0.04 (4.4-9.3)	1.5 ± 0.05 (1.3-1.7)	0.89 ± 0.01 (0.8-1.0)	4.7 ± 0.15 (4- 5)	3.8 ± 0.15 (3 - 4)
4th	11 ± 0.53 (8 - 12)	2.1 ± 0.05 (1.9 - 3.2)	1.2 ± 0.03 (1.1 - 1.4)	3.9 ± 0.16 (3 - 5)	3.6 ± 0.07 (3 - 4)
5th	16.3± 0.73 (14 - 20)	1.94 ± 0.13 (1.5 - 3)	1.3 ± 0.07 (1.2 -2.0)	3.2 ± 0.13 (3 - 4)	3.1 ± 0.12 (3 - 4)

proceedings it turns to light borwn. Near to adult emergence it becomes dark brown and irritable. Additionally, the pupa swings its abdomen so often. The measurements (length and width) of the purpa are equivalent to that of the pre-pupa. The pupal stage lasted 15-18 days with averages of 16.7±0.30 days and 16.3±0.42 days when larvae infested sobyean and leblab pods, repsectively. Again, the sort of host plant did not affect the duration of the pupal stage.

Adult Stage:

The method of moth emergence is identical to that of other lepidopterous insects. Usually the moth emergence occurrs during night or during early hours of morning. The percentages of adult emergence under the employed laboratory conditions fluctuated between 65-80%. The sex ratio is 1:1:1 in favor of males. Parallel data were reported by Abul-Nasr & Awadalla (1957) and Singh & Dhooria (1971). However, Popova (1957), stated that E. zinckenella male and female moths were evenly proportioned. Consequently, the sex ratio was 1:1.

Oviposition Activities:

In a short time after pairing, the females of E. zinckenella deposited their eggs on the host plant pods. On soybean, females preferred laying eggs on the base and on the ridges of the pods, while, on leblab they preferred the area between the calyx and the pod. The eggs were deposited singly or in small groups of 5-9 eggs. The pre-oviposition period of mated females was 1-2 days on both hosts. The oviposition period varied from 2-7 days with an average of 3.9±0.31 days on soybean pods and from 2-5 days with an average of 3.3±0.07 days on leblab pods. The maximum average of eggs laid per day on soybean pods was 14.4 eggs and the minimum was 1.3 eggs. On leblab pods, the maximum and the minimum averages of eggs/day were 25.4 and 2.3, respectively. The total number of eggs laid/female during its life span on soybean and leblab pods ranged between 25-75 eggs with a mean of 49.4±0.55 eggs and between 39-91 eggs with a mean of 63.4±4.81 eggs, respectively. In general, females of E. zinckenella laid more eggs on leblab pods, whereas, they were darker, larger and smoother than soybean pods. Thus, that preference may due to the differences in colour, size and texture between soybean and leblab pods or due to unknown characteristics. About 80% of the females died on the last day of the oviposition period, therefore, the post-oviposition period of the fertilized females was extremely short. This period ranged between 0.0-2.0 days and between 0.0-1.0 day in case of laying eggs on soybean and leblab, respectively.

Adult Longevity:

The average longevity of the females was 15.2±0.18 days (14-16 days), while, the corresponding longevity of the males was 10.9±0.20 days (10-12 days). So, data emphasize that female moths lived for a longer time than the males.

Total Life-Cycle:

Under laboratory conditions of 25±1°C and 60±5% R.H. the total life-cycle of limabean pod borer fluctuated between 38-63 days with an average of 49.1±0.7 days on soybean and between 35-54 days with an average of 42.2±1.66 days on leblab. Subsequently, the average of the life cycle on leblab was one week less than that on soybean.

Fortunately, leblab the uneconomic plant in Egypt was the most favorable tested-host to E. zinckenella.

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