SUMMARY

The pink bollworm, Pectinophora gossypiella (Saunders) are subtropical insect species, which feed on annual plants. Those species are multi-voltine with diapause likely to occur at any season of the year apparently independently on the weather. Modern methods of insect control require a detailed knowledge of insects seasonality since accurate forecast of season activity are necessary for population management.

The aim of the present work is to study the effect of some factors on the initiation and termination of diapause stage of the pink bollworm larvae.

Samples of larvae were collected at weekly intervals throughout the cotton season from flowers, green and dry bolls from Kalyobia Governorate. Samples from each stage of plant growth were reared in the laboratory at a constant temperature of 27°C. 4th instar larvae were sexed and the sex ratio was estimated. Normal and undersized pale coloured larvae, referred to as abnormal larvae were collected and sexed.

I.a. Sex ratio during the season of 1985 :

Results showed that at the beginning of the season in June the sexual ratio was in favour of males (3 ♂: 1 ♀) in samples collected from infested flowers.

The reverse was true in August where the ratio was (1 ♂: 1.8 ♀). In November and December the ratio became again in favour of males (1.6 ♂: 1 ♀) and (2.5 ♂: 1 ♀) respectively.

I.b. Normal and abnormal larvae :

Abnormal larvae appeared throughout the August-November period, and it was proportionally higher among males. Those larvae invariably failed to enter into diapause stage, accordingly they were completely absent in December where all the larvae collected were in diapause.

II. Influence of temperature on diapause in the 4th instar larvae :

The effect of three constant temperatures were studied, i.e. 15, 20 and 27°C on larval weights, time and percentage of pupation, malformation in pupae and adults, percentage of diapause were estimated after 30 days and six months.

There was a general loss of larval weight at all temperatures investigated and in both sexes, males were more affected than females and the magnitude of loss was inversely proportional to temperature being negligible at 27°C.

The duration of the larval period was inversely proportional to temperature and at 27°C the larval

duration period did not reach the threshold of diapause, while the degrees of 15 and 20°C were conducive to diapause.

Pupation increased with the rise of temperature to reach a maximum of 100 % at 27°C. At lower temperature more females pupated than males.

Malformations in pupae occurred at 15 and 20°C but not at 27°C. The percentage of malformation was inversely proportional to temperature and males were more affected than females.

Low temperatures extended the duration of the pupal period and weight was reduced by low temperatures the effect was more noticeable with males.

The percentage of eclusion of adults was low at the temperatures of 15 and 20°C, never reaching 50 %, this proportion was always lower among males compared with females. This percentage was 100 % in both sexes at 27°C.

Diapausing larvae : By lowering the temperature more diapause occurred with a larger proportion among males. Statistically the effect of temperature and the interaction of sex and temperature were significant.

At the temperatures of 15 and 20°C, 50 % of larvae went into extended diapause for six months with higher

percentage of males than females. Temperature, sex and their interaction were found to be statistically significant. At 27°C, no extended diapause occurred.

At the end of six months the effect of the three constant temperatures on total mortalities throughout the experiment was calculated. Percentages of mortalities rose at low temperatures with higher percentage mortalities in males. At 27°C, no mortalities occurred. The effects of temperature and sex on mortalities were found to be statistically significant.

III. Effect of sublethal doses of insecticides on diapause :

The above experiment was repeated using 4th instar larvae dosed with ca. 10 % dosages of one of three insecticides; fenvalerate, cypermethrin and chlorpyrifos.

Log-dose mortality line indicated that the descending order of toxicity of the three insecticides was fenvalerate, cypermethrin and chlorpyrifos. Statistical analysis showed the differences between the susceptibilities of males and females to be not significant.

A substantial loss of weight occurred one week after treatment among treated larvae at the three constant temperatures investigated, the loss was higher among females than males. Treatment with insecticides did

not prevent diapause at low temperatures, but there was a reduction of diapausing larvae, the reduction was more noticeable among males and the most effective insecticides was fenvalerate.

The lowest percentage of pupation at the two diapause inducing temperature occurred in male and female larvae exposed to cypermethrin, while fenvalerate and chlorpyrifos were comparable in males, in females pupal formation figures were slightly higher in chlorpyrifos.

An increase in the percentage of malformations in pupae occurred in survivals of insecticides treatments, the phenomenon was discussed alongside reports in the literature on morphogenetic effects of pesticides.

Insecticidal treatment prolonged pupal duration at the three constant temperatures used with a more pronounced effect on males, and as would be expected pupal weights were adversely affected by insecticidal treatment, the least reduction in weight was brought about by chlorpyrifos.

An additional reduction in adult eclusion was brought about by insecticides, the reductions were larger in females than in males. Malformations of adults were increased among survivals of insecticidal treatments.

Treatment with insecticides reduced the percentage of diapausing larvae, the reduction varied with sex and insecticide. Analysis of variance of this parameter showed that the effect of temperature and insecticides were significant but the effect of sex was not.

Exposure to insecticides reduced the percentages of larvae entering extended diapause (6 months) at the temperatures of 15 and 20°C. The reduction was more pronounced in male than in female larvae. Statistical analysis supported these observations.

Total mortalities after 6 months were computed, it was evident that insecticidal treatment increased this percentage significantly at the three constant temperatures used and with the three insecticides investigated.

IV. Influence of some allelochemics on the biology of the newly hatching larvae of P. gossypiella (Saund.) :

The newly hatching larvae were reared on diets containing gossypol and coumarin at 27°C suffered mortalities throughout the larval stage. Mortalities were concentrations dependent, probit analysis showed that coumarin was about 4.56 time more toxic than gossypol at LC_{50} level. The two compounds caused a slowing down of the rate of development of larvae the figures were statistically significant.

Weight of larvae and pupae were reduced, the reductions were proportional to concentration, in coumarin, male larvae were affected more than females, those deductions were verified statistically. There was a reduction in the percentage pupation in the two compounds and the reduction was proportional to concentration.

There were substantial increases in malformed pupae, the effect was more pronounced with coumarin.

The two compounds caused elongation of the pupal duration, coumarin caused more elongation than gossypol for this period.

There were appreciable percentages of failure to produce adults from pupae in the two compounds, percentages were higher in coumarin. Among formed adults there were persistant, dose dependent percentages of malformed adults, gossypol was more effective.

The two compounds slow down the rate of development, but the figures obtained did not prove the compounds to be diapause induces.

Adults from larvae reared on the two compounds laid significantly less numbers of eggs. The frequency of mating was adversely affected by the two compounds and hatchability among the eggs laid was reduced, there was a slight decrease in the proportion of mated females in

the gossypol treatment, in both compounds the frequency of mating was less than control.

V. Comparison between some body components in different physiological cases of 4th instar larvae of P.gossypiella (Saund.) :

Some body components of 4th instar larvae of pink bollworm were compared in different physiological conditions; active larvae at the beginning of the season, abnormal larvae at the middle and the end of the season, diapausing larvae; larvae coming out of diapause and larvae reared on coumarin containing diet.

1. Fresh and dry weight and water percent :

Results revealed that the fresh weight of females at the different physiological cases were heavier than males, also males and females, in or out of diapause were heavier than otherwise. The differences between larvae at the beginning of the season; abnormal larvae at the middle and the end of the season and larvae exposed to coumarin were not significant. The same trend was found for dry weights.

Results revealed that water content was lowest in diapausing larvae and larvae coming out of diapause; while water content in other cases were comparable.

2. Amino acids :

Seventeen amino acids were identified and quantified in the body hydrolysates of larvae in the above conditions. There was 3-4 folds increase in glutamic acid in diapausing, abnormal and coumarin treated larvae in comparison with active larvae.

Similar patterns were found for valine, isoleucine and leucine, the three being reported as essential amino acids to insects and similar in structure, routes of synthesis and catabolism.

There was some deficiency of tyrosine in abnormal and coumarin treated larvae. An increase in ammonia was noticed in active males.

The overall picture suggested that a least part of the increase in weight of diapausing larvae may be due to an increased protein content.