

Ecological Studies of Pink Bollworm (*Platyedra gossypiella*, Saunders).*

By M. Afzal Husain, M.A. (Cantab.), I.A.S., M. Haroon Khan, B.Sc. (London), A.R.C.S., and Nazir Ahmad, M.Sc.

Entomological Laboratories, Lyallpur, Punjab.

THE Pink Bollworm—a cosmopolitan pest of cotton—shows in the Punjab a peculiar variation in the density of its population. In the south-eastern, sub-montane and the central regions of the province it is so abundant as to be regarded a 'major pest', while in the Canal Colonies and the western districts—the main cotton-growing tracts—it is not a 'pest' and is, in fact, scarce. Evidently, therefore, an abundant supply of its favourite food—the cotton crop—is not the only factor which determines the density of its population.

During the last few years an attempt has been made to analyse the factors which influence the incidence of this pest, in the Punjab. It has been determined that at Rohtak, situated in the south-eastern

Punjab—a region of high incidence—the number of eggs laid by *P. gossypiella*, under natural conditions, throughout the period of its activity, is much higher than at Lyallpur, situated in the Canal Colonies—a region of low incidence. Thus at Rohtak during July, when the attack normally starts, the average number of eggs laid per female, based on the figures of three years (1931-33), varied from 13 to 49, while at Lyallpur this number varied between 2 and 7 only. The maximum number of eggs laid by a female was 326 at Rohtak and only 75 at Lyallpur. Later in the season too, during August, September and October, the average oviposition at Rohtak varied between 30 and 89, and at Lyallpur between 3 and 61 (only once in three years it went to 61, otherwise it was never above 40).

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² Demerec, M., "Behaviour of two mutable genes of *Delphinium Ajacis*," *Jour. Genet.*, 1931, 24, 179-193.

Under experimental conditions it has been established that temperature, acting on the pupae and the adults, largely determines the egg-laying of these moths. It has been determined that the optimum temperature for the full development of the gonads and the maximum deposition of eggs ranges between 75°-82° F. Thus the moths emerging from the pupae kept at 75° F.—a favourable temperature—and exposed to the same temperature, gave on an average 98 eggs per female, but the moths bred under similar condition of temperature and kept at 95° F.—an unfavourable temperature—on an average laid only 23 eggs. On the other hand, the moths emerging from the pupae kept at 92° F.—an unfavourable temperature—and exposed to the same temperature, hardly laid an egg, and even when exposed to a favourable temperature—75° F. gave no more than 7 eggs per female.

Further, it has been found that over 80% of the moths emerging from the pupae kept at a temperature of 92° F. or above, have not the capacity of procreation. The reason for this is that the males bred at such high temperatures, although otherwise normal, are devoid of fully developed sperms and hence incapable of fertilising the females.

The influence of humidity has not been so thoroughly worked out, but the results obtained show that it influences oviposition in much the same way as temperature. A high relative humidity, about 70-95%, has been found to be very favourable for the development of the gonads and the deposition of eggs.

On the basis of the results obtained under controlled conditions, a correlation between the biotic potential and the environmental resistance, *i.e.*, between the initial capacity for increase in numbers possessed by this insect and the resistance offered by temperature and humidity, under natural conditions, has been established. A study of the three years' meteorological data which, unfortunately, are very incomplete for an ecological investigation, has shown that oviposition was highest when the mean maximum temperature acting on the pupa and the adults was about 90° F., the mean minimum 72° F. and the relative humidity 70% or over at 8 hours.

In places where the incidence of attack is high, the temperature and humidity, during

the main period of the activity of the pest—July to October—approximate closely with those favourable for procreation, while in the Canal Colonies and the western districts, where the pest is present in insignificant numbers, both the maximum and the minimum temperatures are much higher and the humidity much lower. These adverse climatic conditions increase the sterility of the males on the one hand, and interfere with the process of egg-laying by the females on the other, thereby limiting increase in numbers. It is not, therefore, as one would imagine, only through the destruction of the individuals born that population is restricted, but perhaps, the restriction in the numbers of the individuals produced is more important. In other words, nature besides being 'red in tooth and claw' also controls birth.

The results obtained afford a basis for forecasting the intensity of Pink Bollworm attack in any particular region. To be able to do so, however, the meteorological conditions during the cotton-growing season and the time at which the moths emerge from the 'long-cycle', *i.e.*, hibernating larvae should be fully known. If the emergence of moths coincides with the fruiting of cotton, and the climatic conditions are favourable for their procreation, then the pest will be serious, as is the case in Egypt, Mexico, Texas and the United Provinces of India. If, on the other hand, the emergence coincides with the fruiting of cotton but the climatic conditions are unfavourable, as at Hyderabad (Sind), the Canal Colonies and the Western Punjab, then the progeny of this pest will be limited in numbers and it will not become serious. At Surat (Bombay) and Wad Medani (Sudan) where the emergence takes place before the fruiting of cotton and most of the progeny destroyed because food is not available, the pest cannot be serious. Lastly in Kenya, Italian Somaliland and Coimbatore (Madras), where the pest remains active throughout the year it will not be serious because most of its progeny would be destroyed during the non-cotton season when the food supply is limited only to the few alternative host plants.

This short note is contributed to stimulate ecological research in this country, as research on these lines provides a sure foundation for scientific pest control.