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# PRELIMINARY INVESTIGATIONS ON THE BIOLOGY, SEASONAL OCCURRENCE AND PARASITES OF TOMATO PINWORM IN TRINIDAD*

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## Introduction

**Lycopersicon esculentum**, tomato, is a very important vegetable crop in Trinidad. In recent years the tomato pinworm **Keiferia lycopersicella** (Walsingham) (Lepidoptera: Gelechiidae) has attained the status of a serious pest of tomatoes and farmers have rather naturally resorted to very frequent applications, in most cases, of highly toxic synthetic pesticides. Previously, insecticiddes were aimed mainly at Agromyziid leaf miners and the fruit worm **Heliothis** spp.

The Ministry of Agriculture in co-operation with the Commonwealth Institute of Biological Control is investigating the prospects of developing a pest management programme for control of the pinworm. The results of the preliminary investigations on the biology, seasonal ocurrence and parasites are presented in this report.

## Materials and Methods

Studies on the life-cycle were carried out in a screened greenhouse with temperatures similar or slightly higher to those outside. Cultures of the pinworm were set up by placing infested leaves in standard rearing cages used in this laboratory (Yaseen 1974). Larvae pupated on the leaves and on emergence adults were transferred to other cages containing young potted plants, where oviposition occurred.

To investigate seasonal fluctuations in 1978, observations were made in an experimental plot of "Floradel" variety tomatoes set up at the Texaco Experiment Station. The seedlings were transplanted on March 16. The plot was divided into 16 subplots each containing two rows of eight plants each. The plants were staked shortly before the observations commenced. Each observation consisted of a total count of

pinworm larvae encountered during a complete inspection of two plants sampled at random in each plot. The larvae were not retained to record parasitism.

Investigations during 1979 were conducted in a half acre plot of tomatoes variety "Calypso" in the market garden at Macoya. The farmer had made routine aplications of chemical pesticides for four weeks after transplanting the seedlings and then abandoned. The plants had been staked before the sampling commenced. The sampling procedures described by Oatman (1970) to observe the tomato pinworm populations were followed. Weekly samples were made by collecting leaves mined by the larvae for 30 minutes, i.e., half man-hour. The mined leaves were inspected for the pinworm larvae as well as the parasite larvae were inspected for the pinworm larvae as well as the parasite larvae and cocoons. Infested leaves were held in a cage in the insectary until moths and parasites had emerged. The numbers of moths and parasites reared from these bulk samples were counted to calculate percent parasitization.

**Life-cycle and Behaviour**

The incubation period varies for 3-4 days and the four larval instars are completed in 13-17 days. The pupal stage lasts for 6-8 days and thus the egg to adult development is completed in 23-28 days.

Mating occurs shortly after emergence and females laid fertile eggs a day after emergence. The minute eggs laid on both the upper and lower leaf surfaces are usually deposited singly. The newly hatched larvae bore through the epidermis and mine the leaf. The larvae feed on the soft mesophyll tissue and initially the mines are serpentine resembling those of agromyziid leaf miners. As they grow, they consume mesophyll from the sides of the tunnel which then apears like a blotch, As the soft tissue is devoured the leaf surfaces become wrinkled and folded. At the beginning of the third instar the larvae emerge from the mines. However, they do not become surface feeders. They remain in protected situations in the leaf curls; they bury their heads in the leaf and feed on the mesophyll. After completion of feeding, the larvae drop and pupate in soil.

Injury to the tomato plant is due to loss of mesophyll by larval feeding in the leaves. The leaves become curled and withered and result in the loss of vigour and yield. Elmore (1937) and Elmore & Howland (1943) reported a high incidence of direct damage to tomato fruits in California, but in Trinidad damage to fruit is rarely observed.

**Seasonal Incidence**

As tomatoes are cultivated throughout the year and with the approximate 3-4 week life-cycle, there may be as many as 14 overlapping generations per year.

Data on seasonal activity assessed as the average larval population per plant in 1978 along with the rainfall data commencing from the date seedlings were transplanted are presented in Table 1.

The pinworm population on the whole did not attain high density. However, the numbers fluctuated greatly with peaks in periods of low rainfall and decreased numbers during periods of high rainfall.

Table 1
Incidence of tomato pinworm on tomato and rainfall recorded at Texaco Experiment Station. April-August 1978

| | Abril | | May | | | | | June | | July | | | August |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling date | 14 | 19 | 24 | 4 | 10 | 18 | 26 | 1 | 16 | 3 | 14 | 24 | 8 |
| Pinworm larvae per plant | 5.5 | 9.9 | 11.1 | 23.8 | 1.7 | 3.0 | 4.9 | 1.8 | 0.5 | 1.1 | 0.3 | 1.5 | 0.6 |
| Rainfall (mm) | 5.8* | 0.0 | 4.6 | 0.0 | 16.3 | 14.7 | 96.8 | 39.6 | 80.5 | 130.8 | 96.8 | 186.4 | 100.8 |

* from March 16

The pinworm population on the whole did not attain high density. However, the numbers fluctuated greatly with peaks in periods of low rainfall and decreased numbers during periods of high rainfall.

Data assessed on a man-hour search basis and the weekly rainfall data for the same period for the study at Macoya in 1979 are presented in Table 2

Table 2.
Incidence of tomato pinworm larval population on "Calypso" tomato plant foliage, larval parasitism and rainfall. Macoya, Trinidad, 1970.

| | | | Tomato pinworm | | Parasitism | |
|---|---|---|---|---|---|---|
| Data | | Rainfall (mm) | Larvae | No. adults emerged | No. adults emerged | % |
| April | 9 | 6.1 | 553 | 286 | 106 | 27.0 |
| | 16 | 40.9 | 669 | 264 | 167 | 38.8 |
| | 23 | 3.6 | 882 | 385 | 132 | 25.5 |
| | 30 | 0.8 | 831 | 410 | 174 | 29.8 |
| May | 7 | 13.2 | 902 | 271 | 148 | 35.3 |
| | 14 | 0.3 | 771 | 387 | 178 | 31.5 |
| | 21 | 3.3 | 1142 | 552 | 207 | 27.3 |
| | 28 | 12.7 | 987 | 461 | 191 | 29.9 |
| June | 4 | 69.3 | 251 | 122 | 52 | 29.9 |
| | 11 | 171.7 | 31 | 17 | 4 | 19.1 |
| | 18 | 32.8 | 37 | 15 | 8 | 34.8 |
| | 25 | 150.6 | – | – | – | – |

The tomato pinworm population had considerably increased four weeks after the seedlings had been transplanted and from a larval density of 551 larvae per half hour search on April 9 it had reached a peak of 1142 per half hour search on May 21, i.e, 100 percent increase in population in six weeks. The populations remained high through the dry season when the weekly rainfall was comparatively low. With the onset of rains towards the end of May there was a sharp decline in the numbers of the pinworm larvae and from a low of 251 larvae perhalf an hour search on June 4 the numbers had become insignificant during the periods of comparatively high rainfall in three weeks when the study was terminated

**Parasistes**

Three species of parasites were reared from the tomato pinworm larvae in 1979. These included *Bracon* sp., *Microchelonus* sp. (Braconidae) and *Euderus* sp. (Bylophidae). Of these, *Microchelonus* is an egg-larval parasite. *Bracon* sp. was the most dominant and obtained through all the samples. *Euderus* was also encountered in all the samples but the numbers were more numerous towards the later part of the study.

During investigations at Macoya *Microchelonus* was not obtained from pinworm larvae until late April-May whereas it was obtained a Trichogrammatid *Trichogramma brasiliensis* (Ashm.) was reared from pinworm eggs collected at Macoya and Aranguez.

## Discussion and Conclusion

Oatman (1970) considers that high temperatures and low or no rainfall provide very favourable conditions for a rapid increase of tomato pinworm populations. In Trinidad, the mean maximun and mean minimum temperature do not fluctuate greatly, but our data do indicate that the tomato pinworm is abundant during periods of low rainfall and its population is greatly reduced during periods of high rainfall, i.e., its severity as a pest is greatly reduced by heavy rainfall.

While the parasite populations showed a corresponding increase in the numbers of the host, the percent parasitism remained fairly constant and the native parasites do not adequately suppress the populations of the tomato pinworm. Several parasites of the pinworm are known from other areas and attempts are in progress to introduce certain of these into Trinidad.

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