

**IX. PARASITE OF THE LARVA OF THE TOMATO WORM MOTH: PROTOPARCE QUINQUEMACULATUS\***

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**Outline and Statement of Methods**

The spring and summer, in the central portion of Oklahoma, in 1924, seemed to be particularly favorable for the growth and development of the tomato worm moth, *Protoparce quinque-maculatus*. Locally, the distribution of the larvae was very uneven, as in some sections the tomato patches were practically defoliated, while in others the pests were comparatively few in number.

In a tomato patch owned by the writer, the larvae were unusually numerous, so that they promised to seriously injure the crop unless held in check in some manner. In the attempt which was made to control the pests, certain observations concerning their life histories were noted, and these form the basis for the following discussion.

The following experiments were planned to obtain data upon the problem. The larvae were gathered from numerous tomato patches around Norman, Oklahoma, and were put into breeding cages, where they were fed twice daily with fresh tomato leaves. In most cases the larvae were taken during the third moult, as larvae younger than that are extremely hard to find, owing to their small size and green color.

The larvae ate ravenously and grew very fast as they became older. After maturity they became restless, stopped eating, and started walking all over the cage, trying to dig into every corner they came to. They were then transferred to fruit jars, one third full of soil, where they quickly dug in, and pupated. After the larvae had begun to pupate, cheese cloth was tied over the jars, to prevent the imagoes, or whatever emerged from escaping.

**General Observations**

Upon some of the larvae, after they were nearly full grown, dirty brownish spots appeared upon the sides in close proximity to, or surrounding the spiracles. Some of the larvae were dissected to ascertain the cause of this phenomenon, and were found to contain parasitic, maggot-like grubs, which were imbedded in the fatty tissues immediately beneath the skin, and were evidently feeding upon it. They were found close to, and sometimes at-

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tached to the tracheae of the host, perhaps to insure a good supply of oxygen.

Here at least was one check upon the tomato moth larvae. Fourteen days after the first worm went into the soil, several big, bristly, greyish flies were found in the space in the jar immediately below the cheese cloth. Examination proved them to be the Red Tailed Tachina Fly, *Winthemia 4-pustulata*.

Kellogg says of them: "Everyone who has undertaken to raise butterflies and moths from their caterpillars, has been compelled to make the acquaintance of certain heavy bodied bristly flies, which appear now and then from the cocoon or chrysalis of the expected moth or butterfly.

These are the Tachina Flies, and in their appearance and parasitic habits, are representative of the large family of house fly cousins known as the Tachinidae. The females fasten their eggs to the skin of young caterpillars, the hatching larvae burrowing into the body of their crawling host and feed upon the body tissues.

Sometimes the larva is killed before it can pupate, but usually not, spinning its cocoon and pupating with its fatal parasites still feeding inside. But the butterfly never emerges; in its place buzz out several of these Tachina flies."

Howard tells of an instance observed by him where the buzzing of swarms of Tachina flies, hovering over and laying their eggs upon a great horde of army worms could be heard a great distance. Also that, "A great outbreak of army worms in northern Alabama in 1881, when all the crops were threatened with total destruction, was completely frustrated by Tachina flies."

Kellogg describes *Winthemia 4-pustulata* in "American Insects", as a parasite of the army worm *Leucana unipuncta*. Lutz, in his "Handbook of Insects," observes that most Tachinids are quite indiscriminate as to the particular species of Lepidopterous larvae they parasitize.

For purposes of observation the writer was in the middle of his patch one afternoon. Two or three tomato worms had been collected, when a commotion was noticed in the leaves of a nearby tomato plant. Investigation revealed three female Tachinids depositing eggs upon a half grown larva. The worm knocked from side to side, emitting saliva and the juice of chewed up tomato leaves profusely, defending itself as best it could. The flies seemed to be little disturbed, for they successfully deposited eggs upon it.

As the Tachinids were not frightened by human intrusion; the worms previously collected were held close to the besieged one. The flies immediately transferred their attention to the new larvae, as they lay in the palm of my left hand. As normal, healthy, unparasitized larvae are quick to defend themselves, my hand was soon covered with "tobacco juice":—(Saliva and chewed tomato leaf juice).

After a lull in the battle, the flies commenced to deposit eggs on my fingers, evidently unable to distinguish between them and the larvae.

#### **The Parasitic Larvae of *Winthemia 4-Pustulata***

The larvae, when full grown are from five to seven millimetres in length and from two and one half to three millimetres in diameter. Immediately preceding pupation they grow rapidly, more rapidly, in fact than the host is able to devour tomato leaves and form tissue. As a female Tachinid often deposits a large number of eggs upon a single larva, the entire body contents are often devoured, leaving only the skin. The greatest number of parasites observed in a single individual was thirty eight. The parasites were all of the same size, showing that they were hatched from eggs deposited by a single female, or group of females on the same day.

Numerous instances were also observed where different sizes of fly larvae were in the body of the single tomato worm, varying from small, almost microscopic, newly hatched larvae, to the mature ones almost ready to pupate. In these cases the more mature larvae devour the body contents of the host, and leave the younger parasites to perish for lack of food.

#### **Parasitism in Other Sphingid Larvae**

During the summer, several larvae of that comparatively rare hawkmoth *Pholus pandorus* were collected. The disappointment can be easily imagined when all of the *pandorus* larvae were found to contain *Tachina* fly larvae. Twenty-one maggots were taken from one individual and twenty-eight from another.

#### **The Number of Adult Flies as Related to the Amount of Moisture**

As has been stated, the pupating larvae were put into fruit jars about half full of soil and allowed to pupate therein. The moisture factor was not taken into consideration at first, but it was soon noticed that the parasites did not emerge from the dead body of their host. Upon examination, the fly pupae were

found to be dried up within their pupa cases. It was also noticed that the unparasitized tomato moth larvae formed their pupae and emerged in the jars which contained relatively dry soil.

The soil was moistened. When the normal unparasitized larvae pupate in damp or wet soil, they are apt to be attacked by a mould, which destroys them. The parasitic maggots, however, show no such susceptibility to the mould, and when a parasitized larva is attacked by the mould, the parasites develop normally. Extremely dry dusty soil is detrimental to both host and parasite.

Since larvae pupating in a moist soil have the added ravages of the mould, as well as those of the Tachina fly, and as neither the mould nor the fly maggot thrives in a dry soil, it seems that the percentage of moisture in the soil has a direct influence upon the numbers of adult tomato moths produced.

If the soil is dry, large numbers of Tomato moths will undoubtedly appear, accompanied by a correspondingly small number of mature Tachinids, while moist soil will produce the opposite effect, namely, the production of larger numbers of Tachinids, and fewer Tomato Moths.