A DISSERTATION ENTITLED
NOTES ON LAPHYGMA FRUGIPERDA 
and
OTHER PESTS OF CORN IN TRINIDAD.
Presented in partial fulfilment of the 
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by
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NOTES ON LAPHYGMA FRUGIPERDA

AND

OTHER PESTS OF CORN

IN TRINIDAD.

I. INTRODUCTION.

Laphygma frugiperda, S. and A. has a wide distribution throughout the Tropics, and Sub-Tropics of America.

In the West Indies it is recorded from Jamaica, Cuba, Haiti, St. Lucia, St. Kitts, Grenada, Barbados, Trinidad and from Honduras and British Guiana.

The larva of the moth is commonly known in the West Indies as the corn ear worm a name also, and more aptly applied to Chloridea obsoleta. In the Southern United States it is well known as the fall army worm.

The larva of Laphygma frugiperda feeds on a variety of host plants, but in the West Indies it is chiefly important as a pest of Indian corn.

Throughout Trinidad corn is grown in small patches as a garden crop, the produce being consumed by the cultivator. It is, therefore, difficult to estimate the acreage devoted to the production of the crop since none of it enters into commerce, and indeed considerable quantities of corn are imported from Venezuela and the United States.

Normally the crop is planted with the beginning of the rains in May or June and is ripe for harvest in September. When the plants are some six to eight inches in height the young caterpillars make their appearance, feeding within the throats of the plants. It is rarely that a patch of corn escapes attack to a greater or less degree.
A long drought followed by rain is favourable to the multiplication of the pest. The drought reduces insect life to its lowest ebb, the natural enemies of *Laphygma* are almost exterminated and with the coming of the rains the remaining moths can multiply rapidly and unchecked, their larvae finding abundant food among the freshly grown grasses and the growing crops.

Such conditions in an exaggerated form resulted in the severe outbreak of 1912 when the caterpillar appeared in enormous numbers throughout Trinidad, British Guiana and the Southern United States.

II. DESCRIPTION.

The eggs are laid in masses containing 100 to 150 and lightly covered with down from the body of the female insect. The instinct for ovipositing on any specific food plant or plants is not developed and though a few such egg masses were taken from the under side of corn leaves on an infected plot the number of caterpillars later to be found on the corn was out of all proportion to the number of these eggs.

The larvae which hatch from eggs deposited on plants which cannot serve as food or, as F. W., Urich states is frequently the case, on fences and gate posts, must seek elsewhere for a suitable host. The newly hatched larvae are very active, travel comparatively rapidly and thus if such a host plant exists in the vicinity it may be reached before the larva dies of starvation or falls a victim to one of its numberous predators.

Under laboratory conditions, the eggs hatched in 48 hours, the first act of the young larvae being to devour the egg cases they had just quitted, after which they travelled rapidly round the petri dish in a search for food. When this was supplied in the form of heart leaves of maize they lost no time in setting to work on it, eating
eating strips from the epidermis parallel to the mid rib but not piercing the laminae.

The newly hatched larva is colourless, semi-transparent with a black head and cervical shield and measures 1.25 m.m. in length, its head width being 0.28 m.m. The larva grows rapidly, becoming greenish in colour owing to ingested chlorophyll and attains a length of 3.5mm before undergoing the first moult.

The second instar shows reddish markings on each segment, the pigment appearing in patches in the lateral area of the segments. The remainder of the body is still semi-transparent and the three thoracic and seven paired abdominal ganglia can be seen as orange-red areas through the cuticle.

The average length of the second stage larva is 4.1 m.m., and the head breadth 0.47 m.m.

The third instar exhibits the same reddish markings but the pigmentation is more complete. The pigmented lateral areas are bisected by lines light in colour and the pale dorsal line becomes visible.

Measures 5.7 m.m. in length. Head breadth 0.78 m.m.

In the fourth instar the head is shining black, the lateral areas pale luteus but now mottled with irregular areas darker in colour. The adfrontal sclerites are pale whitish, the labrum bilobed, brown in colour and the six ocelli darkly pigmented.

The cervical shield is black, bisected by a white median line and the lateral areas again bisected by pale sinuous lines; the anal flap dusky and bisected.

The body is reddish grey, the white dorsal and sub dorsal stripes well developed, the lateral lines somewhat broken, the sub-stigmatal band broad, pale and divided by a reddish line. The tubercules are large black and raised, the setae long and black, the legs dusky.
dusky and the underside of the body pale yellowish green.

The fourth stage larva measures 8 m.m. in average length with a head breadth of 1.2 m.m.

The fifth instar possesses the same markings somewhat intensified. It measures 18.5 m.m. in length; head breadth 2.1. m.m.

The sixth instar attains an average length of 30.5 m.m. and a head breadth of 3.0. m.m.

The head length is 3.2. m.m. from the tip of the labrum to the vertex, its greatest breadth 3.0. m.m. The adfrontal pieces reach rather more than three quarters of the distance to the vertex, their sutures somewhat sinuous.

The frons is pale brown, the epicranium darker brown, the lateral posterior areas mottled with pale colouring. The median epicranial suture is well developed; the clypeus large, yellowish, translucent, the post clypeus darker.

The cephalic shield is black bisected by the white median line. The dorsal line on the body segments is pale, indistinct and broken, the sub-dorsal line whitish, more distinct and the space between mottled with red and ochreous.

The lateral is commonly represented merely by a pale mottling. The area between the sub-dorsal and sub-stigmatal lines is darker than that between the dorsal and sub-dorsal.

The stigmata are yellow surrounded by a raised black border; the sub-stigmatal band very broad, pale yellow mottled with red.

The venter is greenish yellow sometimes mottled with red.

The intensity of pigmentation varies considerably among individuals from the same batch of eggs, some being markedly lighter in colour than others.

Duration
Duration of the instars.

The following figures are from observations made on fifty larvae of *Laphyrgma frugiperda*, and show the average duration of the instars.

<table>
<thead>
<tr>
<th>Instar</th>
<th>Duration</th>
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<tbody>
<tr>
<td>1st</td>
<td>60 hours</td>
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<tr>
<td>2nd</td>
<td>24 &quot;</td>
</tr>
<tr>
<td>3rd</td>
<td>48 &quot;</td>
</tr>
<tr>
<td>4th</td>
<td>72 &quot;</td>
</tr>
<tr>
<td>5th</td>
<td>60 &quot;</td>
</tr>
<tr>
<td>6th</td>
<td>72 &quot;</td>
</tr>
</tbody>
</table>

The individual durations varied but little from these averages and in no case did the total period from hatching to pupation exceed 1½ days.

The Pupa.

The brown, obtect pupa measures some 12.5 m.m. in length. The full grown larva leaves its food plant and burrows into the soil, and at a depth of from ½ inch to 2 inches forms a rough cell in which it undergoes the penultimate moult. When no earth was provided in the breeding cages the larvae pupated readily and the duration of the pupal instar was in no way affected.

The duration of the pupal stage is remarkably uniform, ten days usually and rarely eleven elapsing between pupation and the emergence of the imago.

The period between emergence and oviposition is apparently two to three days, but the observations made were not sufficient to determine the period with accuracy.

Host Plants.

Numerous plants of the family Gramineae serve as hosts for the larva of *Laphyrgma*. In the United States it is known to attack wheat,
wheat, oats and barley. In Trinidad maize is the favourite food plant. When sorghum or millets are planted they are liable to attack and when no crop plants are available the larva can maintain itself on a number of grasses including the widespread weed known as nut-grass, *(Cyperus rotundus)*.

The pest is recorded as attacking cotton in the West Indies, devouring the leaves or attacking the bolls. Cotton is attacked, apparently only when intense, sporadic outbreaks occur, when more suitable host plants fail and under bad cultural conditions, when grasses which may act as hosts are growing in the fields.

In British Guiana *Laphygrama frugiperda* commonly attacks rice, and is known as the rice worm, but is fortunately fairly readily controlled by flooding.

Occasionally, in the case of heavy outbreaks of the pest sugar cane is attacked, and it is necessary to have recourse to spraying.

**Control.**

**Natural control.**

The fluctuations in numbers of the pest from year to year, the sporadic outbreaks in response to certain climatic conditions likely to have an adverse influence on insect enemies would indicate the operation of natural controlling forces.

The nature of these forces has not been thoroughly investigated so far as the West Indies are concerned.

**Parasites.** The writer has not obtained parasites from eggs or larvae taken in the field. During the severe outbreak of 1912 in Trinidad, F. W. Ulrich obtained a Tachinid from pupae of *Laphygrama frugiperda*. The species has not been identified, but would seem to belong to the genus *Winthemia.*

**Predators.**
Predators.—A field of corn infested with Laphygma larvae is a happy hunting ground for the larger Vespid and Pompilid wasps. Polistes rubignosus, the common "Jack Spaniard" of Trinidad, Apoica pallida, a nocturnal vespid, and related species are always to be found in numbers crawling over the plants and through the holes in the leaves eaten out by the larvae. Since these Vespoids are much more conspicuous than the larvae hidden within the funnel of the corn, one investigator of maize problems has reported that "Jack Spaniards were very injurious eating large holes in the leaves."

A large black Pompilid common in the fields would readily seize a caterpillar offered to it, administer a few bites with its powerful mandibles and fly off with its victim.

A Carabid beetle of the genus Calosoma was noted which would, also, seize upon and carry off the larvae.

While the larvae remain within the throat of the plant, they are to a large extent protected from these predators and fall victims only when the plant has unfolded all its leaves and exposed the tassel or when the full grown larva migrates to the ground in order to pupate.

Artificial control.

As the larva is protected from its predaceous enemies by its position within the plant so is it protected from arsenical dusts applied in the usual manner.

To be effective each plant must be treated individually, the dust being poured into the funnel of the plant. Where a very small area forms the unit of production, as in the West Indies this system is readily applied and there are few years when the application would not justify itself.

The method which has been recommended to the peasant is as follows. Paris green is mixed with road dust, cheap flour or corn meal
meal as a carrier. A small quantity of this mixture is applied in the middle of the rolled up leaves, the butt end of a pen nib being useful for this purpose.

Paris green is a dangerous weapon which requires the greatest care in its use. It is very liable to scorch the leaves unless carefully diluted with its carrier to the extent of 1 part Paris green to 10 parts of the carrier by weight. The native cultivator who has been induced to dust his plants with Paris green and finds the cure worse than the disease can hardly be considered unreasonable if he refuses to repeat the experiment.

The toxic values of the arsenates of lead, calcium and magnesium which do not scorch the leaves of maize were, therefore, investigated.

For the purposes of the experiment the arsenates were mixed with six times their bulk of corn meal. A test was carried out by placing 3 gms of the mixture in a petri dish with two fourth instar larvae of *Laphygma*. The fourth instar larva was used as being the earliest which could be obtained in sufficient numbers. The larvae fed readily on all the poisoned mixtures and the length of life after feeding was noted as carefully as possible. Each test was repeated five times and thus in each case the length of life of ten poisoned insects was found.

<table>
<thead>
<tr>
<th>Poison</th>
<th>Length of life of poisoned insect.</th>
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<tbody>
<tr>
<td></td>
<td>Maximum</td>
</tr>
<tr>
<td>Paris green</td>
<td>2.75 hours</td>
</tr>
<tr>
<td>Lead arsenate</td>
<td>31 hours</td>
</tr>
<tr>
<td>Calcium arsenate</td>
<td>60 hours</td>
</tr>
<tr>
<td>Magnesium arsenate</td>
<td>142 hours</td>
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The poison exponent of any poison is obtained by comparing the
the length of life of an insect subjected to that poison with the length of life of a similar insect subjected to Paris green at the same time.

The toxic exponents calculated from the table above are shown below.

Lead arsenate \( \ldots \ldots \ldots \) \( .087 \)
Calcium arsenate \( \ldots \ldots \ldots \) \( .044 \)

Thus Paris green is certainly much more toxic to the larvae of *Laphygma* than the other three poisons.

Of these Lead arsenate is the most effective, fairly adhesive and even in a concentrated form does not scorch the leaves. Its great disadvantage is the comparatively long life of the poisoned insect.

Calcium arsenate is considerably less effective and magnesium arsenate of practically no value, the poisoned larvae continuing to eat voraciously and usually pupating. In two cases moths emerged from such pupae, but were deformed and incapable of flight.

These results were borne out by trials in the field, Paris green producing the greatest mortality among the larvae, lead arsenate being less effective, calcium arsenate markedly inferior and magnesium arsenate having little effect.
Growth rate of *Laphygma frugiperda*.

Horizontal scale: 1 division 6 hours.

Vertical scale:
- Body length
  1 division 1 mm.
- Head breadth
  1 division .1 mm.
Lateral and dorsal views of the 5th abdominal segment of *Heliothis obsoleta*.

The corresponding setae are numbered I - IV.
OTHER PESTS OF MAIZE.

The larvae of *Laphygma frugiperda* are known to attack the ears of corn as well as the foliage, but the writer has never found them doing so. Careful examination of the infested plot under observation showed the presence of a noctuid larva in many of the ears but there can be little doubt that, though there is no previous record of the species from Trinidad, the larva was that of *Chloridea obsolete*, the true corn ear worm or American bollworm.

Examination of the silks showed the presence of eggs. These were laid singly on the silks, measured about 1/15 inches in diameter, pale in colour with a yellow tinge and sculptured characteristically. On hatching from these the young larvae travelled up the silks and attacked the cob at the tip.

The full-grown larva measures some 3.75 cms. Head 3 m.m., pale brown mottled with darker brown on sides and vertex. Ocelli 1, 2, 5 and 6 forming a parallelogram, 3 and 4 on line between 2 and 5. Cervical shield fuscous, divided by dorsal line, pale mottled. Ground colour of body yellow green; dorsal line fine, white broadly margined with black pilose area. Sub-dorsal line represented by vague white mottlings and followed by a black pilose area bordering on the lateral line. Lateral line yellowish white. Sub-stigmatal band broad, greenish, white edged below. Spiracles black rimmed. Tubercules large, black conically elevated. Setae black. Venter green. Legs brownish. Crochets of thoracic legs 13 - 15 in number arranged in a biordinal mesoseries, arrangement of setae on the abdominal segments are shown in the figures.

These larvae pupated in the soil and moths obtained agreed with the type description of *Chloridea obsolete*.

The infestation of *Chloridea* was not heavy and the damage done comparatively slight.

Diatracea
Diatraea saccharalis, the small moth borer, commonly attacks maize in the same way as it attacks sugar cane. The young larva bores into the heart of the growing plant and gradually mines the stalk. In some cases the growing point was destroyed early this having the apparent effect of stimulating the plant to produce tillers.

The infestation of Diatraea on the plot under observation was not severe.

The species concerned appeared to be invariably D. saccharalis while an adjacent plot of sorghum (Andropogon sorghum) was attacked in the same manner by a different, but closely related species, Diatraea canella.