

U. S. DEPARTMENT OF AGRICULTURE.

THIRD REPORT

OF THE

UNITED STATES.

ENTOMOLOGICAL COMMISSION,

RELATING TO

THE ROCKY MOUNTAIN LOCUST, THE WESTERN CRICKET, THE ARMY
WORM, CANKER WORMS, AND THE HESSIAN FLY;

TOGETHER WITH

DESCRIPTIONS OF LARVÆ OF INJURIOUS FOREST INSECTS, STUDIES
ON THE EMBRYOLOGICAL DEVELOPMENT OF THE LOCUST
AND OF OTHER INSECTS, AND ON THE SYSTEMATIC
POSITION OF THE ORTHOPTERA IN RELATION
TO OTHER ORDERS OF INSECTS;

WITH

MAPS AND ILLUSTRATIONS.

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hairy than in the male, while the 10th (terminal) joint is acute at the tip and subdivided into four subjoints. The abdomen is as long and as wide as the thorax, ending in a long, sharp point, the short but distinct ovipositor extending slightly beyond the tip of the body. There is a slightly marked pale spot above on the second segment. Length 2.4 millimeters (0.10-0.12 inch).

This parasite was first described by Say, his specimens occurring at Philadelphia; it was observed by Herrick in 1833, in Connecticut, and in 1877 we bred it from puparia of the Hessian Fly received from Ohio; and, as stated by Professor Cook, it is sufficiently abundant in Michigan to destroy the Hessian Fly in great numbers, and is probably distributed throughout the Hessian Fly area.

So destructive are this and other parasites to the Hessian Fly that as early as 1841 Herrick claimed that in Connecticut "a very large proportion, probably *more than nine-tenths*, of every generation of the Hessian Fly is destroyed by parasites." This work is mainly, we doubt not, done by the chalcid parasite under consideration. It is to this insect more than to any other means in nature that we owe the general immunity in certain years from the attacks of the Hessian Fly in most wheat regions, and to this cause that during certain years the fly is kept wholly within its bounds. Few people, even naturalists, have any adequate idea of the good done by these minute parasites. What was the fact in Connecticut in 1841, and the few years preceding, has been the case in Michigan, according to Mr. F. S. Sleeper, of Galesburg, Mich., who writes us that the Hessian Fly was nearly exterminated in Kalamazoo County by *Semiotellus destructor*, nearly all the "flaxseeds" in the crop of 1877 having been destroyed by this friendly parasite. He writes us that in the autumn of 1877 he found these parasites in the wheat-fields in countless numbers, and that the perfect Hessian Fly was difficult to find.

No one since Herrick recorded his observations has made very careful observations on the habits of these parasites. He states that:

It pierces the sheath of the stalk (making a hole too small to be detected by a powerful microscope), and deposits an egg in the pupa within. This is done chiefly in June. The perfect insect is evolved in the summer and autumn succeeding, eating its way through the puparium and the sheath of the leaf.

Herrick also states that a second parasite, very similar to the *Semiotellus destructor*, "but with mere rudiments of wings, is sometimes evolved from the pupæ of the Hessian Fly. I am in doubt whether it should be considered a distinct species or only a variety."

A third parasite was reared by Herrick in Connecticut. It is an insect of the tribe *Chalcidix*, whose genus he did not determine. Its habits were like those of *Semiotellus*, and wingless females of this species were also found.

A fourth parasite, noticed by Herrick, belongs to Latreille's tribe *Oxyuri*, but the genus was not determined. In habits it agreed with

The foregoing parasites, but it was evolved later in the year. Herrick adds that all the parasites mentioned "are likewise evolved in the spring from the Hessian Fly pupæ of the summer previous."

The fifth parasite has quite different habits. It was said by Herrick to deposit its eggs in those of the Hessian Fly. Herrick, its first discoverer, thus speaks of it:

The insect is abundant in the autumn. I first saw it September 23, 1833, in the act of depositing its eggs in the eggs of the Hessian Fly. From subsequent observations it appears that four or five eggs are laid in a single egg of the Hessian Fly. The latter egg hatches, and the animal advances to the pupa state as usual, but from the puparium no Hessian Fly ever comes forth. This parasite forms within the puparium a silky cocoon of a brownish color.

It is probable that it is the species first discovered by Herrick in Connecticut which Professor Cook has detected ovipositing in the eggs of the Hessian Fly.¹¹²

It is black and looks not unlike a tiny gnat. The female feels for the egg with her antennæ, and when found intrudes the fatal egg, which, I find, takes three-fourths of a minute; full three times as long as it takes the Hessian Fly. The little parasite is much longer, too, in finding the eggs than is the fly in laying them. I find that each egg receives one, two, or three of the parasite's eggs. The eggs of these latter are tardy in hatching, so that the larva of the parasite may feed on the maggot of the Hessian Fly, not her eggs. These pupate in the puparium of the fly.

Platygaster error Fitch?—Having received one of these egg-parasites from Professor Cook, I find it to be so much like the *Platygaster error*

¹¹² Our attention has been called by Mr. Howard to the fact that as a rule to which there is no known exception, egg-parasites issue as adults from the eggs of their host; and on reflection it seems to us that the *Platygaster* in question is entirely too large to be regarded as a true egg parasite, those known to be such being of minute size. Fresh and very careful observations are therefore needed on this point, and it is possible that both Herrick and Cook have been in error, and that the eggs were inserted in freshly hatched larvae when little larger than the eggs. We append Mr. Howard's criticism:

"Fitch's description of *Platygaster error* (which name you apply to the so-called 'egg-parasite' in Bulletin 4) is so general that it will apply to almost any species of the genus. And now a word as to the egg-parasite. So contrary is it to all analogy in the whole group of parasitic Hymenoptera, to say nothing of the well-known habits of the genus *Platygaster*, that a parasitic egg should be deposited within the egg of a host and not hatch until the larva of the latter has issued, that I look upon the reported observations of Herrick, and especially of Cook, as in the highest degree improbable.

"1. No other case is on record, to my knowledge, where an egg-parasite does not issue as an adult from the egg of its host.

"2. European species of *Platygaster* are known to lay their eggs in *larvæ* of *Cecimyidæ* only,

"3. The difficulties in the way of making such an observation as Cook records are practically insurmountable.

"The second point alone would, in my judgment, settle the matter, as the generic habits of parasites are very uniform."

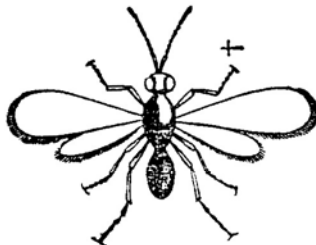
Respectfully, yours,

L. O. HOWARD.

of Fitch (Fig. 9) that I refer it to that species, though with a
This is probably also the parasite referred to by Mr. Herrick.

It is shining black; the head is finely punctured, rounded, and slight-
broader than long, being about as wide as the thorax. The anten-
are about as long as the head and thorax.
are slender, but apparently a little shorter
than in *P. error*, the penultimate joint
a little broader and squarer than he
sents (and they are very different from *P.*
gaster tipulae), these joints not being "twice
as long as thick," but only $\frac{1}{2}$ to $\frac{1}{3}$ longer, much
as represented by Fitch in his figure,¹¹²⁴ the
terminal joint is long, oval, not so wide as
those just behind it, and it tapers to a
rounded point. The thorax is rounded ovate, but little longer than
broad, black, with the scutellum high, rounded and pitted. The abdomen
men is flattened, oval, twice as long as wide, being a little longer than
the thorax, but not quite so wide. The legs are pitchy black on the
femora; the tibiae dull reddish-brown, darker towards the end; the tarsi
are 5-jointed, dark brown, hairy, with the basal joint reddish at the base
(Fitch says the legs of *P. error* are pitchy black; but in the specimen
before me they have a decided reddish tinge.) The wings are veinless,
clear transparent, irised. Length 1.8 millimeters, being a little larger
than Fitch's *P. error*, which was 0.05 inch long. I am disposed to refer
this specimen to Fitch's species, but should it be found to be quite
distinct, it may receive the name *Platygaster herrickii*. It seems to be
genuine *Platygaster*.

FIG. 9.—*Platygaster* of the Hessian Fly.



Fitch states that *Platygaster error* is seen in company with the wheat
midge (*Diplosis tritici*) on the wheat ears in New York, and is very nume-
rous some years, but he thinks it doubtful whether it preys upon the
midge.

REMEDIES, PREVENTIVE AND GENERAL.

Having become familiar with the habits of this insect, which can be
readily observed by farmers, it is not difficult to apply such remedies as
the experience of wheat raisers of the past century in different parts of
the wheat region of the United States has nearly universally found to be
serviceable. Remembering that the first brood of flies appears in
August and continues to hover over the fields until late in September,
if waiting for the fall-sown wheat to appear, it is evident that by delay-
ing the date of sowing until after a frost cold enough to kill the flies,
they may be circumvented; for if the wheat is sown later than the
20th of September in nearly all the Middle and Northern States, the
early frosts will destroy these delicate insects. Late sowing, then, is
the most general, important, and easily applied preventive remedy.

¹¹²⁴ Sixth Report on the Noxious and other Insects of the State of New York, by Asa Fitch, M. D.,
1, fig. 4, a, b. The figure is from Packard's Guide to the Study of Insects.

late sowing of most of the wheat-seed.—All writers, both entomological and agricultural, concur in recommending this easily-applied remedy: at least a part of the wheat should not be sown until after the 20th of September in the Northern States. The writings of Fitch, Harris, and of Cook concur in recommending this course in a district ridden by these flies, even though the wheat is in danger of being injured by the cold autumn or the winter weather. As the year 1877 was a bad fly year, I quote the following explicit testimony from Professor Cook's pamphlet:

In all the century's experience in our country with this insect, this has been the most certain and satisfactory method to prevent its ravages. Even more than thirty years ago this measure is spoken of as unanimously sanctioned and the most efficient remedies. During the past season [1877] I have reliable reports from the following counties: Ottawa, Van Buren, Cass, Kalamazoo, Hillsdale, Saint Joseph, and Lapeer, and with few exceptions it is stated that early-sown wheat was injured badly, while wheat sown after September 20 nearly escaped. In traveling through Ohio and southern Michigan, I found I could often tell the early from the late sown wheat for long distances, the former looking like oat-plants after a hard frost, the latter appearing green and healthy. Often in the same field the line of demarkation was very distinct.

The following newspaper extracts bear upon this subject:

Perhaps the most effectual remedy, or rather preventive, is late sowing. No wheat should be sown in localities where they have already appeared, or in districts adjoining until September 15, and if it is deferred until the 20th it would be all the better. Repeated rolling is said to destroy some of the larvæ, and burning the stubble, where practicable, would certainly destroy many and thus prevent so great devastation of the succeeding crop. The great objection to either rolling or burning is that it destroys both friend and foe alike.

Great care should always be used in destroying all noxious insects lest we also destroy the beneficial ones; the chief of which are the Ichneumon and Chalcis flies. In the counties of Yates, Seneca, Tompkins, and Cayuga, where the Hessian Flies have already made their appearance, it would appear wiser to fit the ground perfectly, apply extra fertilizers, and sow late, rather than run any risk or trust to any methods of destruction. If all infested and contiguous districts would sow late enough so that the wheat would not appear above ground before September 25, I believe the fly could be effectually starved out.—[I. P. Roberts, professor of agriculture, Cornell University, in the *Rural New Yorker*, September 8, 1877.

By the attacks of this (the second or spring) brood of worms, the lower joints of the wheat are weakened, and as soon as the head is formed, and the growth is heavy, the weakened joints give way and the wheat falls over, or, as it is commonly expressed, it "crinkles." If but few larvæ are at work, there will be some kernels of grain in the heads thus affected, but they will be more or less shrunken. If the insects are plenty, the head seldom "fills," and the field looks as if cattle or something else had passed through it, tangling up and throwing down the straw in every direction. There are thus two generations of the Hessian Fly each year, one of which subsists and may be always found at the crown of the roots, and the other at some joint above, and never at the root. If the wheat could be fed off by sheep in the fall, between the time that the eggs are laid and the time of their hatching, this remedy would be perfect. Unfortunately, the wheat is then young, and farmers do not like to risk thus feeding it off. The only remedy left, therefore, is to sow so late that the wheat will not appear above ground before October 1. In this case there is the added risk of winter-killing, because the plants have not time enough to get well rooted before winter. On well-drained, rich land, this danger is greatly prevented, and therefore late sowing and thorough farming seem to be the only available means yet discovered to avoid great