

tulata, leaving only 49 larvæ, or 10 per cent of the whole number, uninfested; yet 61 larvæ were able to pupate. From these 61 pupæ, however, only 7 adult moths emerged, showing a total mortality among the Army Worm from larva to adult of 98.6 per cent. And since 90 per cent of the larvæ were infested with the eggs of this parasite, it would seem to indicate that, in this case at least, the parasitic fly was decidedly the most important factor in causing the high mortality of the Army Worm. In a few cases it was found that where only a single parasitic egg was attached to a larva, that the host was able to complete its transformations.

The greatest number of parasitic eggs observed on a single larva was 12, with an average of 3 for the entire number (442) infested. The 442 infested larvæ yielded 709 parasitic puparia, or an average of nearly two for each infested larva. The 709 puparia yielded 556 adult parasites. The greatest number of adult flies from a single Army Worm was four. These figures show that the mortality with the parasitic fly from egg to puparium was 52 per cent, and from puparium to adult 22 per cent, making a total mortality from egg to adult of 73 per cent.

This shows that the tendency would be for the fly to continually gain in relative numbers, owing to the lighter mortality, and easily accounts for the complete subjugation of the Army Worm in normal years by this one natural enemy. No other parasites were found in the course of these experiments.

NOTES ON THE HEN FLEA (*XESTOPSYLLA GALLINACEA*)

By GLENN W. HERRICK

During the summer of 1907 the ground beneath one of the dwelling houses on the campus of the Mississippi Agricultural College became infested with fleas to such an extent that the occupants were greatly annoyed by these pests. On examination I found that two species were present beneath the house, namely, the hen flea and the dog flea. The house, of course, stood on brick pillars some distance above the ground, and thus gave opportunity for hens to go under, where they would lay eggs and rear chickens. Dogs and cats also had free access to the space beneath the house. To secure relief the space under the house was treated with a thorough dusting of slacked lime and nothing more was heard from the occupants until the summer of 1908, when the fleas again became troublesome.

On investigation a hen was found sitting beneath the house and she and her nest were literally alive with the hen flea, *Xestopsylla galinacea*.

I do not mean to say positively that this flea was annoying the occupants of the house, for no specimen of this particular species was ever found by me in the rooms. In fact, I was unable to get hold of any of the specimens in the house that were actually causing the trouble.

The fleas on the hen were confined to the face, ear lobes and wattles. These parts of the fowl were almost black with them. By actual count there were 164 on the right wattle, 65 on the right ear lobe, and by estimate, 200 or more on the right side of the face. The pests stood at right angles to the surface, with their heads embedded in the skin, nor were they at all easy to remove. They could not be brushed off nor scraped off with a knife without hurting the hen. I removed some with tweezers, but even with these instruments they came off with difficulty.

We placed the fowl in a large box containing some sawdust and kept her there several days, during which time she managed to free herself from a good many by scratching her head with her toes, and I suspect some of the older, engorged females dropped off to deposit eggs.

I dissected some of the engorged females and found they contained, apparently, well developed eggs. In one I found three white oval-shaped eggs. In another I found five. On June 22 I placed two engorged fleas in each of three vials. On the morning of June 23 (8.30) I found five eggs in vial *a*, five eggs in vial *b*, and three eggs in vial *c*. The eggs were white, oval and considerably longer than broad. They measured from .35 to .4 mm. in length. It appeared so easy to obtain the eggs that I thought a more extended observation might be worth while.

Accordingly, on the morning of June 23 I placed one large, apparently engorged female flea in each of fifteen vials, to ascertain their egg-laying capacities. To my surprise and gratification, eggs were obtained in every case but one and in most cases the larvæ hatched readily, as shown by the following table:

OVIPOSITION RECORD OF HEN FLEA.

June 23.	June 24.	June 25.	June 26.
Fleas placed in vials.	No. eggs.	No. eggs	No. larvae hatched.
Vial a.	2	2	2
Vial b.	2	2	1
Vial c.	1	1	0
Vial d.	3	3	3
Vial e.	4	4	0
Vial f.	7	7	5
Vial g.	3	3	0
Vial h.	1	1	1
Vial i.	4	4	1
Vial j.	4	4	2
Vial k.	5	5	3
Vial l.	4	4	1
Vial m.	2	2	0
Vial n.	1	1	0
Vial o.	3	3	2

It will be seen from the foregoing table that the fleas laid all of their eggs on the day following their placement in the vials and that the larvæ hatched within forty-eight hours after the eggs were deposited. At 9.30 a. m. on June 26 I found most of the larvæ just wriggling out of the egg shells. Some had not yet gotten clear of the shells.

The larvæ were white, very active and from 1.5 mm. to 1.8 mm. in length. They were nearly of the same diameter throughout, with the thorax slightly larger.

I placed them in separate vials along with sawdust, feathers and filth, but, owing, very likely, to unfavorable conditions of moisture and temperature, none of them developed.

Professor Osborn in Bulletin 5, n. s., of the U. S. Bureau of Entomology, p. 145, quotes the observations of Judge Johnson on the life-history and habits of this flea. Judge Johnson says regarding them that "the females bury themselves in the skin of their victims. From the first they hold on with such tenacity that no ordinary brushing will remove them. It seems to be at this stage in their existence that impregnation takes place. The males now are often seen in copula with them and so remain apparently for days, or until the tumefac-

tion of the skin excited by the embedded female closes around her so as to shove them off. Here ends about all actually known of their history." From my observations this account is very probably accurate, except the latter part. I found the males present on the head of the fowl, but did not actually observe them in copulation with the females, although fecundation must have taken place under these conditions. So far as my observations go, however, no tumefactions of the skin of the fowl take place. Judge Johnson farther says: "From analogy we may infer that the period of gestation being completed, the gravid female lays her eggs in this well prepared nidus, or more particularly that they remain or are hatched in her distended stomach, after which they crawl out and drop to the ground."

From the ease with which the females were induced to lay eggs in the vials, I believe they simply drop off when engorged, like a cow tick, and lay their eggs among the debris in the nests of the fowls. At no time was there a tumefaction of the skin or a so-called nidus formed. It seems to me that Judge Johnson must have ascribed the disease known as "the wart disease" to this flea or possibly confused it with that of *Sarcopsylla penetrans*.

Scientific Notes

Toxoptera graminum Rond. has been found very generally distributed over Minnesota during the last summer, wherever wheat is grown, and eggs which were collected out of doors in the early spring near St. Anthony Park hatched in due season, showing that the species can survive our winters, or at least, did survive last winter. Insectary work upon this insect shows it to be much more prolific than *Macrosiphum granaria*.

Three species of locust, namely *M. femur-rubrum*, *M. atlantis* and *M. bivittatus*, have been locally quite destructive in Minnesota this season.

In work with stalk borers, Genus *Papaipema*, during the summer several species have been found to be common in Minnesota, among them *P. furcata* has injured hundreds of young ash in nursery rows by boring in the center, and so weakening the tree that a slight wind breaks it.

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