

GRIFFIN-BUG.

'94

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Graduating Thesis.

Subject: - Chinch-bugs.

Outline: -

Entomology of Insect.

Description;

Mode of Reproducing;

Habits.

Distribution of Insect. -

Extent of Injury to man.

Destruction of Bug.

Conclusion.

Were you to ask the western fruit grower which insect is most injurious to his efforts, he would undoubtedly answer 'the Curculio'. Were you to confront the western grain grower with this same question, he would certainly answer 'the Chinch-bug'. And he would be right. The Hessian fly, often simply called 'the fly', injures the wheat by its larva or maggot living between the sheath and the stem and thus absorbing the sap before it reaches the fruiting portion. The 'Weevil' in certain favorable seasons does considerable damage by its little orange-colored, legless larva sucking the sap from the growing kernel. The 'joint-worm' may at times assist in allaying the growth of the plant by causing abnormal enlargements of the joints. The 'Plant-louse', the 'White-grub', the 'Wire-worm', and certain 'Cut-worms' each have a tendency to lessen the return of the western grain-grower, but the combined effort of all these

does not equal the damage done by the
chinch-bug. He is undoubtedly the meanest
insect the western farmer has to deal
with.

Notwithstanding this fact there are some people,
and farmers, too, who do not know this insect when
they see it. This is not because they have never
seen their little enemy, but because they often
confuse it with the 'Flower-bug' which has a
bright orange yellow larva instead of a red and
which is quite destructive to the chinch-bug,
it being carnivorous in its habits. Owing
to this mistake which sometimes happens,
I have deemed it profitable to give a
thorough description of our most insidious enemy.

The typical chinch-bug (*Blissus leucosternus*; Say.) is as the name of the order,
Hemiptera, indicates, a half-winged insect.
It is about three twentieths of an inch long
and less than one third so wide. The body
is a glossy black covered completely by very
minute gray hair or down. The basal
joint of the antennae is of a honey-yellow;
the second joint tipped with black, while
the anterior two joints are black; beak
is brown; wings are very thin and both wings

and wingcovers are white, the latter being black at their insertion, and having near the middle two short irregular black lines with a black oval spot on the outer margin. The legs are of a dark honey-yellow with the terminal joints of the feet black. The thighs are also a little dilated and honey-yellow in color.

(Abridged from Dr. Wm. LeBaron's Description)

This insect unlike most insects requires only a few weeks, depending upon the climate, to pass from the egg to the full grown, mature insect. The greater portion of insects require at least twelve months to complete their circle of changes, and a few as the round-headed apple-tree borer and the May-bug require three years. One species of Locust requires thirteen years, while another, known as the 'seventeen year locust' requires seventeen years to complete its development. In the other extreme there are some insects which require only a few weeks and produce as many as seven or eight generations in a single season. The number of generations of chinch-bugs in a single season varies with the latitude from one in the northern part of the United States to four or even

firs in Texas. This would make for Kansas about three each season.

The egg of the chinch bug is deposited by the adult female early in the spring of the year at the base of the wheat or rye plant, usually about one inch and a half or two inches under the surface of the ground. The egg is almost microscopic in size, usually ovate in form and of a pale blue or white in color. This egg expands slightly and gradually takes on a reddish-pink color due to the red skinned larva showing through the walls of the egg. The egg hatches usually about the middle of April, depending upon the weather. The larva eats as soon as it is born and continues to eat till the day that it dies, not being able to live more than thirty-six hours after hatching until it has had something to nourish it. Hence the advantage as some have said of planting an acre or two of wheat in the fall and in spring pasturing very heavily as this will draw the bugs from other parts of the farm to deposit their eggs there, and then plowing it under just as the eggs are beginning to hatch.

Were you to pull up a stalk of
 wheat about the first of May and examine
 the roots you would most likely, if the
 field had been bothered with chinch-bugs,
 find the lower part of the stem almost
 completely covered with the little red larva,
 looking very much like little red-worms, and
 fastened by their beaks to the filament from
 which they are sap-sucking the sap.
 As they grow older they loose their hold and
 ascend to the surface where they begin
 their visible work on the main body of the
 plant. It is one of their peculiar traits
 to work close to the surface and hence
 the dying of the plant at the top of the ground.
 Hundreds of these little sap suckers will
 cluster around the base of one plant and
 puncturing it with their beaks will gradually
 drink its life away. Thus they continue
 dragging and killing plant after plant,
 until the crop is either destroyed or
 harvested.

But they do not stop at the destroying
 of one field. They are in a great measure
 like the grasshopper. So soon as the wheat
 is harvested or they have finished it they

2,400
100
24

migrate to the nearest cornfield and continue their work till frost comes and the stalks get so tough and woody that they can no longer draw any nourishment from it. Now as the chilling days of winter approach, were we to give them our attention we would see thousands of them leaving their work of feeding and seeking hiding places to shelter them from the cold blasts of winter. We would see them flocking by hundreds to the corn shocks, crawling under clods of earth, entering snake holes and spider holes, in fact every place where a wasp's abode could be found there we will find our Mr. Chinch-bug. Should the field happen to be near a timbered strip, or an old rail fence, we would see them crawling between the rails, hiding in the grass and weeds, retreating under the bark of old stumps and logs, and in all the hollow nut shells they can find. They will even hide by thousands under the leaves. One prominent investigator said that in one handful of leaves picked up, in the spring, under a tree near a cornfield there were over five hundred chinch-bugs. In a single hickory nut shell there was twenty seven bugs. They

also store themselves away in the roofs of old houses or barns, covering of sheds and especially in old prairie hay stacks-bottoms.

But I would not convey the thought to your minds that all of these survive the blasts of winter and come out hale and hearty in the spring. This is not so, and what a blessing it is to the farmer that it is not so. Not more than one in one thousand, at the greatest calculation, which leaves the fields in the fall are alive in the spring. Probably this is too great a calculation. In some places it is certainly not more than one in two thousand. This may seem incredible to some people but were they acquainted with their mode of reproduction, the whole matter would certainly be explained.

It has been shown by repeated experiments that an average brood for a female chinch-bug is at least two hundred healthy larva, (the number of eggs being over 500.) Now let us suppose that from a single field only one thousand insects recover in the spring. Taking one half of these as females which in reality is even more, we would have for the first brood in the spring of the year 100,000

larva. As then develop in a very few weeks it would seem but a very short time until the eggs were laid for a second generation. Taking half of the number which we now have, as females, we would have for the second generation 10,000,000 not counting our previous 100,000 for the first brood. Now, as we have said, as the number generations in a single season in Kansas is about three, we would have at the end of the season, continuing our calculation, 1,020,100,000 chinch-bugs. We of course have made a very low estimate to begin with, but with such a few as that, we can see that by the end of the season there would be enough of them to satisfy any farmer that they were still with him.

History of Chinch-bug and its work.

To give a full history of the chinch-bug from the time of its discovery down to the present, we are obliged to distract your attention from our own state to a land far away on the Atlantic Coast. Appearing early as 1783 in North Carolina our chinch-bug was believed to be the Hessian fly (*Cecidomyia destructor*.) Although quite common in these states they did not receive a scientific name until

nearly fifty years after when Prof. Say of
 Indiana, classed it under the genus *Lygaeus*
 with the specific name *Leucopterus*, meaning
 white winged. They became so numerous in
 '86 that they even threatened the growth of wheat
 for a period. In fact this industry was
 actually checked for a time. Again 1809 they became
 so numerous that there was no wheat
 planted for two years. Now comes a calms.
 For thirty years they were almost forgotten,
 as nothing whatever was harmed by them.
 In '39 they appeared in such numbers as
 to attack, wheat, oats, corn, in fact nearly all
 cereals. Many fields were actually burned in
 order that a few might be saved from total
 destruction.

About this time they were noticed in
 in the northern Mississippi Valley. Appearing
 with the advent of the Normans to Norm (1845-44)
 they were believed by ignorant people to have
 been brought by the Normans and were consequently
 called 'Norman lice'. From here they rapidly
 spread both north and south and to some
 extent westward. They were hindered in their
 westward march by the great prairie fire
 which each spring swept over vast sections.

of country, burning everything before it. But they soon became very destructive in this section of country. In '66 the loss of grain from the effect of the chinch-bug amounted to over \$4,000,000 in Illinois, or \$4.70 to each inhabitant, man, woman, and child of that state. In '64 they $\frac{3}{4}$ of all the wheat and over $\frac{1}{2}$ of all the corn in the Mississippi Valley. In '71 a strip of country one hundred miles wide arising in the western part of Indiana and extending westward nearly four hundred miles and embracing an area of more than 40,000 sq. miles was so badly damaged that nearly all crops were lessened in productiveness. Of the spring wheat there was not more than $\frac{1}{4}$ of a crop; oats $\frac{3}{4}$ of a crop; and of barley scarcely $\frac{1}{2}$ of the ordinary production. This is the statistics for the whole area. In many places one or more of said crops was entirely destroyed.

Basing a calculation upon the statistics from the Department of Agriculture of the U. S. the estimate of the actual amount of grain destroyed in this area can be determined. For the part of Indiana ravaged by chinch-bugs the crops should have been as follows: - wheat 10,000,000 bu.; oats 13,300,000 bu.; barley 1,000,000 bu.;

whereas the amount actually destroyed would be according to these figures and the previous one, - wheat 7,500,000 bu.; oats 3,300,000 bu.; and barley 500,000 bu. This together with the other damages would, for the whole community, amount to over \$10,500,000.

They damaged not only barley wheat and corn, but also oats, clover, millet, cane, timothy, sorghum. From a report of 793 townships of Ill in 1887 the damage to corn was follows: - none in 384 townships; slight in 126; moderate in 30; considerable in 47; great in 37; very great in 48; nearly complete in 102; and complete in 24. Damage to wheat was about the same as that of corn and other crops were effected variously. The total loss of the state was reckoned at \$11.50 for each inhabitant, man, woman, and child of Ill. Thus I might continue on down to the present time with illustrations of the extent of damage done by these little pests. Although they have never reached such a universal strength since '87, we need only to recall their work of '90 and '91 to prove to us that they are still thriving in sufficient numbers to satisfy the farmer and the Entomologist.

There are many things however which tend to hold these insects in check in their ever onward march; and well enough that there are, for were they not limited at all in their tendency to increase in numbers, they would need only a few years to sweep all vegetation from the face of the earth. The greatest check upon them, as with all living beings, is nature, and it is of nature and its relation to the increase of the chinch-bug that we will now speak.

We have already seen that of all the bugs which leave the fields in the fall only a small portion survive in the spring. And why is this? Can it be that there are simply the old ones dying off to give way for the new ones? No not this. Experiment has shown that a very large proportion of them will live over under proper care and treatment. It has been proven that it is not the extreme cold that affects them but the changes from cold to warm and then to cold again that has the desired effect. The bug that can get so far into the ground or a log that he does not thaw out with every little warm spell is the one that is most likely to live through winter. But he

is not secure yet. The cunning little shrew is liable to find him, or perhaps one of his more hardy fellow insects, and he is no more. Many birds live almost wholly on insects and in winter they search every place for them; scratching the dead leaves and chipping off the rotten stumps and logs. But this is only one of the many things they have to struggle with. When spring comes with its cold heavy rain and frost as the poor creatures are crawling out of their winter shelter, many are unable to succumb. When summer comes and the heat and frequent rains make it hot and sultry, they are liable to several contagious diseases which occasionally sweep them almost wholly from existence. In 1888 the disease 'Antony's throat' raged all over the country reducing the chick-bug to almost a minimum.

The larva of the lace winged fly feed upon them to a considerable extent. The *Carnaria pennsylvanica* makes them a portion of its food. It is held by some that the common quail makes it his business to devour a considerable number of them, but this is quite doubtful. But with all these

enemies to contend with the chick-bug occasionally over fences and destroys the seeds for miles in extent.

Let us now turn to the devices resorted to by man to protect himself against these little enemies. Beginning with the simplest and most easily performed we will say, plant your grain early so that it may have a good start by the time the young chick-bugs are hatched. Sowing salt with the grain is sometimes a help as it acts as a fertilizer and invigorator to the plant, and has to a certain extent, also, a repulsive effect on the bugs. As the chick-bug winters in great numbers under clods of earth and in spring deposit their eggs a couple of inches beneath the surface it is quite evident that a fall plowing followed by a heavy rolling in the spring will at least retard them in their progress, and kill some of the old ones. Hence the common remark that wheat sown on corn stubble and harrowed in is less liable to be affected by chick-bugs.

According to David M. Scribner one may, and has already said, diminish the number of bugs for the succeeding year, by planting a

price of fall rice for spring pasture. Pasture heavily in the spring and this will draw the bugs from other parts of the farm there to deposit their eggs. about the time for the bugs to hatch the rice should be plowed under and the ground rolled well. As the young ones cannot live but a few days without anything to eat and are almost helpless for travelling, this will certainly do away with some of them. It seems to me that it would certainly pay farmers to try such experiments as this as it will cost nothing but a little time.

Many places in the north where irrigation is practiced the ground is flooded for a time in the spring and consequently large numbers of bugs destroyed. There is one thing that should be practiced by every farmer and that is to burn all rubbish or trash, old hay, corn stalks and all bordering grass or weeds on his farm. It has been found to be almost useless to plant spring wheat or barley on ground which has been badly affected with bugs during the preceding season, unless all means are taken to disinfect the field.

We will now take up some of the means to prevent migration. When one field, say wheat,

is destroyed or harrowed, which is badly infected with bugs, they will immediately migrate to the next nearest field which is usually a corn field. What we want now is some treatment to prevent them from travelling from one field to another. One method sometimes resorted to is simply to plow a furrow around the field and when this gets dry plow another one, and so on. As you know the bugs do not fly, and they will not even freshly plowed earth, so they will collect in great numbers along these furrows and will soon starve to death.

Another means is by tarbanding the field infected and thus keeping the bugs in a pen. This is done by setting on edge a row of boards the whole way around the field leaving them about three inches above the ground. Now with a can of tar, an old teapot or coffee-pot if you please, pour a small stream of tar on the edge of the boards the whole way around the field. The bugs will not touch the tar and will gather by millions along the edge of this fence and can be starved to death or else scalded with kerosene. The tar having to be renewed each day however, the difficulty of both time and

expense arises. They may also be destroyed by pouring hot steam on the stubble, such as might be had from the engine of a steam thrasher. Even after the bugs have gotten into the corn field, it has been proven of great benefit to steam the corn by pouring hot steam on the lower part of the stalks. It will invariably kill the bugs and does not hurt the corn in the least. In addition to this one might put some repulsive odored substance in the water and thus prevent others from following.

We will next treat of the disease of chick-bug as used by man against them, giving special attention to the experiments of Prof. F. H. Snow. Prof. Snow of the State University of Kansas began his experiments with the chick-bug disease in '89. In the following year according to his request, Congress appropriated a small sum of money to him with which to carry on his experiments. With this he improved his laboratory and also his facilities for carrying on experiments. By means of air tight jars he succeeded in preserving the disease over winter (90-91) and this made it possible to continue the disease from year to year.

He soon found that he had more than one disease at work in his jars and it was but a short time until he was propagating three diseases. There were the 'Entomophthora ulmifurva', a white fungus; The 'Microascus Bacteria', a bacterial disease; and the 'Trichoderma' another fungus. The first one of these requires a special kind of weather and the second one received most attention from Prof. Snow. In order to test his experiments on the large scale, he sent some of the diseased bugs into a couple of fields near by and, having good success in communicating the disease to the bugs of the fields, they were nearly all dead in a few days.

A *Lafayette* editor hearing of his marvellous success published a highly complimentary description of his work and added that 'anyone who wanted to rid their fields of the various pests need only to send to Prof. F.H. Snow of the University for some diseased bugs and they would be once freed from these unwelcome visitors.'

As Prof. Snow was not aware of this publication, the numerous applications which came in from far and wide somewhat surprised him, but he soon understood the situation and began at once to fill a number

of the orders. He did, however, publish a list of rules for carrying out the experiments and requested every applicant to send him some fresh bugs with his order, and finally to give a full report in writing of manner of handling them and his success. Since that time he has sent out many thousand lots and not only in this state but in several adjoining ones.

Of all experiments in Kansas in '91, 78.4 percent were said to be successful. The amount saved by the farmers was calculated to be about \$190,000. In '92, 67.9 percent were reported successful, with an estimated saving of \$105,000. In '93, 57.8 percent were reported successful, with an estimated saving of \$310,000.00

In conclusion I would say, that although the chinch-bug has at times been master of man, so to speak, I do think that was every farmer to give close attention to the development of this device and would keep his premises neat and tidy, the number of chinch-bugs would be reduced greatly and in a few years they would be almost a thing of the past to the grain grower.