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AUTHOR'S EDITION.

REPORT
UPON THE
INSECTS OF THE SEASON IN IOWA.
BY
HERBERT OSBORN.

[EXTRACTED FROM THE REPORT OF THE ENTOMOLOGIST, ANNUAL
REPORT U. S. DEPARTMENT OF AGRICULTURE FOR 1887.]

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REPORT UPON THE INSECTS OF THE SEASON IN IOWA.

By PROF. HERBERT OSBORN, *Special Agent.*

AMES, IOWA, November 30, 1887.

SIR: I herewith transmit to you my report of observations for the summer of 1887. I desire to express my thanks to you and your assistants for the determination of doubtful specimens, and for the many other favors which you have been so ready to grant.

Respectfully,

HERBERT OSBORN.

Prof. C. V. RILEY,
U. S. Entomologist.

THE TURF WEB-WORM OR SOD-WORM.

(*Crambus exsiccatu*s, Zeller, var.)

My attention was first called to this insect, which has proven a most serious pest the present season, by a note from Mr. Henry Barnes, who owns a farm near Gilbert, Story County. Under date of May 24 he writes:

DEAR SIR: Inclosed I send you bottle, in which are some specimens of a worm that is making sad havoc with our sod-corn. They eat the stalk off beneath the surface and many of the leaves are punctured full of holes. In some parts of the field nearly every hill is infested with the "varmint." Can you tell us how long they are likely to continue their depredations, so we can tell whether it will pay us to replant? The land from which the specimens were taken was seeded down some eight years since, and was mainly blue grass and white clover. Has been used for a sheep pasture about six years. Was underdrained and broken up last fall and this spring, and planted to corn with the above result. Will be greatly obliged for any information you can give us on the subject, and should be pleased to hear from you as soon as you can make it convenient, so that in case you can suggest anything likely to relieve us of the pest or enable us to escape his work we may have time to avail ourselves of the knowledge.

Yours, respectfully,

HENRY BARNES.

In reply I recommended replanting and stated briefly the probable history of the insect. This reply was published in the State Register, and shortly after the following letter was received:

OSSIAN, IOWA, June 9, 1887.

SIR: I have seen your answer to Mr. Barnes in the State Register of June 3. Now, my corn has been destroyed in precisely the same way. It was planted on the 8th

of May, and came up immediately and looked very nice, but it was taken in about two days, so that the field looked perfectly bare. We replanted on May 21. The corn came up very nice again; we have harrowed it and plowed once, but there will not be a hill in the field to-morrow night that will not be partially or wholly destroyed. This certainly can not be the same worm that is troubling Mr. Barnes, as they have been in my corn for three weeks, and I can not see any change in their appearance. As it is now too late to try corn again would it be safe to sow corn for fodder? The hay crop in this (Winneshek) county is a failure, and this piece of ground has got to produce something. It was seeded to timothy and clover three years ago and has been used for hog pasture since that time. Inclosed find bottle containing specimens. Will be short of feed next winter and any advice or suggestion will be thankfully received.

Respectfully,

A. W. OXLEY.

To this I replied advising to put in corn and stating my belief that the adults were already issuing from the chrysalis state.*

Early in June I had noticed the striped ground-squirrels on the college lawn digging into the turf and eating something which they withdrew. Examining the places thus dug up I always found the peculiar cocoon of a *Crambus*, and the place would also show the deserted web and burrow of the larva. These squirrels' burrows were very numerous in some parts of the lawn, and in one place I counted twenty-five in the space of a square yard, indicating that the ground-squirrel has disposed of that many larvæ or pupæ of *Crambus* within the given area. At another time I counted fifty to a square yard. Evidently when sod-worms are plenty the ground-squirrel is not an unmixed evil.

I did not at first connect these worms with the ones referred to by Mr. Barnes, but comparisons of specimens of larvæ found in sod here with the imperfect specimens sent by Mr. Barnes, and later with those from Mr. Oxley, satisfied me that they were very probably identical. Subsequent observations made this almost a certainty. I have therefore dealt with them as belonging to the same species.

Evidently we must consider it under the double rôle of a grass pest and a corn pest, and while it certainly causes in the aggregate vastly more damage to grass than to corn its work is more noticeable on the latter crop, since it so completely destroys fields planted upon sod infested by the young worms.

Since this insect has assumed so great an importance to two staple crops, and as its life history and habits have been but partially recorded, I have devoted as much time as possible to a study of it the present season and will give the result of my studies in detail.

Its distribution and injury so far as the corn crop is concerned may be gleaned in part from the Iowa crop report, which has kindly been placed at my disposal by the secretary of the State Agricultural Society, Hon. J. R. Shaffer. Aside from the localities given in the following list there was considerable damage in this (Story) county, and, as stated by Mr. Oxley, in Winneshek County.

Extracts from crop report.

BREMER COUNTY.—Corn on old ground injured by a small green worm.

CLINTON COUNTY.—Cut-worms injured corn on timothy sod and old pastures.

DAVIS COUNTY.—Corn on sod and fallow ground has been destroyed by Web-worms.

FAYETTE COUNTY.—Corn looking well, notwithstanding the severe drought; some planted on timothy sod injured by Cut-worms, but general stand good.

HENRY COUNTY.—Meadow-worms working at the roots of grass.

VAN BUREN COUNTY.—A worm resembling the Cut-worm has done serious damage to corn; it built a web in the hill and would eat whole fields planted on new ground.

JOHNSON COUNTY.—Cut-worms destroyed 25 per cent. of the corn planted on sod.

JONES COUNTY.—Corn two weeks ahead of last year. That replanted on account of Cut-worms is gaining on the other.

*In answer to further inquiries as to results in these fields Mr. Barnes informs me that the replanted corn was not materially injured by the worms, and that taking drought and Chinch Bugs into account produced a very fair crop. He further says that the portion of his field most damaged was the part plowed in spring. Mr. Oxley states that the worms took three plantings for him, but that he then planted to fodder-corn and raised a most excellent crop; he says worms worked in this a little at first, he thinks as late as June 27, but did no serious damage.

POWESHIEK COUNTY.—Cut-worms are doing some damage to corn.

WARREN COUNTY.—Corn somewhat injured by grub and Cut-worms, but as a whole prospects were never better for a good crop.

APPANOOSE COUNTY.—Some sod worms; no material damage from them as yet.

CEDAR COUNTY.—Corn injured by Cut-worms, on sod ground much had to be replanted.

CLARK COUNTY.—Corn damaged by Cut-worms.

DAVIS COUNTY.—Corn on sod taken by Cut-worms; many replanting the third time.

DELAWARE COUNTY.—Some timothy fields entirely destroyed by Cut-worms; many being plowed up and planted to corn.

JEFFERSON COUNTY.—Corn on old ground good, but is being destroyed by Cut-worms on timothy sod; much has been replanted.

JOHNSON COUNTY.—Corn a good stand, except that on timothy sod has been cut off by worms.

KEOKUK COUNTY.—Corn planted on sod injured by Cut-worms and much had to be replanted.

LEE COUNTY.—Corn generally good and forward for the season. New Web Wire-worm cut off most of the corn planted on sod plowed this spring.

POTTAWATTAMIE COUNTY.—Cut-worms and ground moles doing some damage to corn, but generally it is a good stand and color.

VAN BUREN COUNTY.—Corn planted on timothy sod being replanted the third time, Cut-worms taking all corn planted on sod ground.

WAPELLO COUNTY.—Corn on sod ground had to be replanted.*

The extent of its ravages in meadows in other parts of the State I am unable to give with any precision. On the college farm, both on the campus and in the pastures and meadows, it has been very abundant and the grass has suffered seriously. In patches the damage was such that it has not recovered; while over large areas the grass being cut off above the crown has grown up rapidly since the fall rains. During the severe drought, which extended till the 1st of September, the damaged portions did not show plainly, as the whole surface was dried up, but after the rains such areas were much slower in becoming green. But that the damage was not due to dryness was evidenced by the greatest damage occurring in depressions or in places where there was the most moisture, instead of on the tops of the knolls or in specially dry places. On the line of the Northwestern Road from Ames to Clinton I saw in the latter part of August many meadows and pastures presenting the whitened patches indicative of the presence of this pest. Outside the State, in Illinois and Wisconsin, I found evidence of it wherever I went.

The insect is distributed widely over the country, and I doubt not has been destructive in all the Upper Mississippi Valley, though probably a large portion of the damage done by it has been ascribed to the drought or other causes.

The injury to corn results only from planting upon sod. As it is very desirable to make this transfer when the meadows have been severely injured it becomes of the utmost importance to the corn crop to avoid the damage done, which necessitates replanting and causes vexatious delay. The measures necessary to avoid this damage I believe to be simple and practicable, and they will be fully stated under the head of remedial measures.

Habits and life history.—Owing to the abundance of this species upon the college lawn I have had opportunity to observe it during the entire season in all stages, and though some points of interest remain to be studied, I am able to state the principal facts in regard to its life history. Enough I am confident has been determined to form a solid basis for recommendation of remedial measures.

During the last of May and fore part of June larvæ and pupæ were abundant, and were observed as late as June 10. On June 7 the moths were plenty, and June 9 they were flying to lights in the houses by thousands. They came to my study in swarms, and I was afterwards told by students that they gathered to the electric lights in the college building in such numbers as to seriously interfere with their work. On the morning of the 10th, having closed the windows of my study the night before to prevent the moths from escaping, I counted over one hundred moths at one window, and the window-sill, the sash, and the floor in front of the window were thickly strewn with their eggs. On slightly pressing the abdomen of a female with thumb and finger she extruded, one by one, thirty-five eggs, after which none were extruded by pressure, but upon dissection of the moth I found ninety well-formed ova and a large but uncertain number of formative stage in tubes of the ovary. As this was a captured female and she had had time during

* I have included in the above extracts those given as Cut-worms, etc., though some of these very likely may refer to other species than *C. exsiccatu*s.

the night to dispose of eggs which I did not count, I could not determine the full number possible from a single individual, but from those counted and those partially formed in the ovary it seems perfectly safe to say that each female can deposit at least two hundred eggs. The eggs are yellowish-white, oval in shape, with usually fifteen longitudinal ridges. In a few instances I noticed more. When extruded they are held momentarily at the tip of the abdomen, giving them time to dry, so they do not adhere to any object upon which they drop, but before the extrusion of another egg are snapped sharply away by a contraction of the lips of the vulva, which appears to be armed with a row of minute bristles. Eggs in this way were thrown quite a distance, and when being deposited in grass would be sent well down among the dead leaves at the surface of the sod. In a few cases I noticed one egg remain till the next was extruded, and the two would adhere slightly, but doubtless the natural extrusion is not so rapid as that induced by pressure.

On June 11 the moths still shut up in my room had deposited eggs in greater numbers than the night before, and some of them confined in a glass jar had also deposited many.

The eggs collected on June 10 hatched on June 18, and I infer that fertilization of the females had taken place previous to their flying to light. A point which I did not carefully determine is the proportion of males to females in those gathering to lights, but my impression is that the females were largely in excess.

Some of these newly-hatched larvæ were placed in a jar with earth and fresh grass, others in a jar without earth, while still others were scattered over a small area of grass out of doors in a place convenient for observation. These last could not afterward be found at all and the grass showed no signs of their presence. Being in a very dry location and the grass becoming badly dried up I suspect they did not obtain sufficient moist food to enable them to start their growth. The young larvæ when supplied with fresh grass collected at the broken ends and fed with avidity. Their bodies, at first pale, became after feeding yellowish-green, the head and upper part of the first segment being black. On the 20th I noticed that one of the larvæ had formed a tube by drawing together the edges of a blade of grass, while still others had gone under the earth at bottom of jar. Unfortunately, duties that could not be postponed prevented attention to these larvæ and a few days later they were all dead. One, however, had formed a basket-work attached to blades of grass. This had probably been formed as early as June 25. By the middle of July the larvæ were becoming conspicuous by their ravages in corn, and subsequent observations were made either directly in the field or upon larvæ collected and confined. Notes for July 13 and 16 record larvæ numerous in part of one field of sod-corn confined to a portion of the field last plowed. As the time of plowing appeared to be an important item I obtained, through the kindness of Mr. F. S. Schoenleber, the exact dates of plowing of the fields planted to sod-corn. One field plowed 9th to 11th of May contained no turf web-worms and no signs of their work. Another field had been plowed in part May 12, 13, 15, and 18. The remaining central portion was plowed on the 7th and 8th of June. The portion first plowed was entirely free from injury by worms, while the part last plowed was badly infested. The line of separation between that first plowed and that last plowed was in some places distinctly indicated by the missing hills or damaged stalks, indicating the presence of worms. It seems reasonably certain, therefore, that *Crambus* eggs were deposited on the central part in the grass before the sod was turned June 7 and 8, and the larvæ hatching by the 15th to 18th of the month had no other resource than to attack the corn which came on shortly after. As already stated, *Crambus* adults were abundant June 7, and had doubtless been present in fewer numbers for several days, so there was opportunity for the eggs to be deposited on the grass land prior to the plowing June 7 and 8; while from the absence of worms in the other sod-corn it was evident that no eggs were laid on the ground plowed previous to the first of June. None have, with possibly one or two reported exceptions, ever been found in corn-fields except when planted on sod. The exceptions, if referring to this species, may probably be accounted for in other ways than by assuming eggs to be laid on plowed land.

In corn the young worms construct a web from half an inch to an inch below the surface of the ground, usually winding it irregularly among the roots and stalks of corn. Frequently a number of these worms occur in a single hill, but as a general rule only one or two are found well developed. Hills infested by these worms have the stalks when small cut partially or entirely off, sometimes, I judge, the upper portion being entirely devoured. Larger stalks have cavities gouged out of the sides at the surface of the ground and a little above. The leaves also are eaten at base and numerous holes scattered over the blade. Sometimes these holes are arranged with a peculiar regularity, occurring in transverse rows three to five holes in each row, and the rows about the length of the worm apart. The stalks at

the surface of the ground are sometimes blackened and decayed, and in some instances I thought I detected their work on the roots. Naturally they do not find food in such abundance as in grass and may be expected to take whatever they can most readily attack.

On July 20 larvæ were found in corn apparently full grown and ready to pupate. Specimens confined in a glass jar with a little earth matured, two adults issuing and first noticed August 3, both fresh and apparently but recently expanded. Larvæ were found in corn as late as August 9, and from these I had one adult issuing during my absence and first seen by Professor Hitchcock August 25.

In grass land the larvæ form a web-lined burrow about half an inch beneath the surface of the sod, extending as the larva grows to a distance of 4 or 5 inches, nearly straight, and opening at the surface of the sod. The grass above and surrounding these burrows is cut off just at the surface of the ground; and where the worms are plenty the grass cut off forms a complete mat, which can be drawn aside, exposing the burrows of the larvæ. By pushing up the sod along the burrow the web and worm are brought to view. The roots and usually the crown of the plants, except directly above the burrow, are unaffected, though from the failure of some patches to revive even six weeks after rains have entirely restored other parts of the lawn it would seem that in some spots the worms were so hard pressed for food as to eat down into the crown. August 4, and for a number of days thereafter, full-grown worms forming cocoons could be found in abundance, and gradually adults became more numerous, till in the middle part of August and until the fore part of September they were again abundant. They were swarming to lights August 11. From this on the adult decreased in number, and the last record I have of seeing them is October 3.

This is as far as I have made positive observations on the species, but it is probably safe to infer that the eggs laid in the fall hatch and the young larvæ establish themselves in burrows where they pass the winter and awake to resume feeding in the spring. By the latter part of May the bulk of this brood is full grown, and, as we have seen, the moths issue in swarms between the 7th and 20th of June.

The insect is double-brooded, though scattering moths may be seen as late as last of June for the spring brood and as early as first of August and late as fore part of October for the fall brood.

The life history, as I have observed it and supplying by inference the winter condition of one brood, may be summarized as follows:

Moths of the spring brood appear in June; early stragglers by the 1st, the bulk of the brood from the 7th to the 15th, and late stragglers till the 1st of July. These deposit eggs which hatch in eight days from time of deposition. The larvæ require from five to seven weeks to become full-grown, forming in the meantime a web-lined burrow in the sod, within a portion of which or in sod close by they form a cocoon and change to the pupa stage. The pupa stage is passed in from twelve to fifteen days, the fall brood of moths appearing in August, early stragglers the 1st of the month, the bulk of the brood during the middle of the month and till the 1st of September, and late stragglers are seen till fore part of October. Moths of this brood deposit eggs for the fall and winter brood of larvæ, which larvæ mature by the latter part of May, pupating during last of May and fore part of June. These produce the spring brood of moths which appears in early June and the cycle is complete.

Description of different stages.—Reference has already been made to the appearance of different stages, and technical descriptions of some of the stages in other publications makes it unnecessary to go into detail here. I may state in brief, however, the most striking characters, in order that the insect may be recognized by those interested. It may be said, however, that it so closely resembles other species of the same genus that except to the professional entomologist a separation is next to impossible. Differences in habit, however, will assist in distinguishing them.

The egg is .55^{mm} long and .30^{mm} in diameter. It is fluted or ribbed longitudinally, the ribs numbering usually 15, rarely 16 or more. They are yellowish white, becoming darker as they reach the time for hatching.

The larva when newly hatched is .70^{mm} to .75^{mm} in length. The body is pale, almost white, while the head and upper part of the first segment is dark brown or blackish. The body is provided with scattering fine hairs. When full-grown it is nine-tenths of an inch long when extended, of a light brownish color, the head and upper part of first segment darker, and the head blotched with blackish. The segments following the first have glassy, slightly elevated, darker spots, from which arise fine hairs.

The pupa is bright reddish brown, half an inch in length, the terminal part obtuse and blackish. It is inclosed in an elongate oval cocoon made of a thin web and covered with green frass, which looks much like bits of grass cut fine, and indeed they seem to be but partially digested. A cocoon formed in a glass jar from corn

leaves seemed to be cut and used entirely undigested, and I surmise the material is cut especially for this purpose and passes directly through the body, to be used on the cocoon.

The moth is of a light ashy color, and fresh specimens show two obscure oblique dark stripes passing from the hind border toward the apex on the front wings. The wings are folded closely around the body when at rest. The length of the body is about one-half inch, and the wings expand an inch and one-eighth to an inch and one-fourth.

Remedies.—Under this head we must treat separately the measures to be adopted for corn and meadows or pastures.

As corn is attacked only when planted on sod, the damage being done by larvæ hatching from eggs deposited in grass or by larvæ that have partly obtained their growth in grass, all methods of prevention should recognize the time at which eggs are deposited and the larvæ mature.

When the worms are already at work in the corn the cheapest and best method is probably to replant, for the larvæ must all or nearly all mature by the middle of June at latest, and then no further damage need be feared. Reports show that this practice was successful, though in many cases fields were planted the third time. It would be well in planting on sod plowed late in the fall before to delay planting as long as practicable, thus starving out the majority, at any rate, of the worms, and then, if necessary, replanting as soon as possible when hills show presence of worms. If possible, however, the plowing should be done early in the fall, so as to prevent the eggs being deposited, or if deposited to starve out the larvæ before they have prepared for their winter fast. To be most effectual the plowing should be done before the 1st of September, and if the land be meadow land not used for fall pasture it will be safest to plow as soon as possible after the crop is off. When the sod is to be plowed up in spring it should be deferred if worms are present till they begin to change to pupæ, or for this latitude till the middle of May, and should be done before the moths make their appearance, or by the 1st of June. Our notes show that here sod plowed in May remained entirely free from worms, while that plowed the second week in June, just after appearance of moths, was badly infested. If noticed when they first begin their work on corn it is probable that the use of bisulphide of carbon would effectually destroy them, but it is doubtful whether it would be as satisfactory as replanting. The worms are easily detected, since they are to be found in their webs in the day-time, and they can be picked out by hand quite rapidly, as I know from experience. Possibly boys could be employed to collect them with good profit. These methods should be resorted to only in cases where preventive measures have not been employed. But in this case prevention is so easy that there seems little need of trouble from the pest when its habits are understood.

In meadows badly infested and thereby run out one method to be adopted, where circumstances will permit, is to plow up the sod and plant to another crop; but to avoid damage to the new crop, especially corn, the sod should be turned before the 1st of June, if in the spring, and if in fall before the 1st of September. If, however, the plowing is done prior to the egg-laying either of spring or fall the moths will fly to such pastures and meadows as are left and concentrate there, thus causing greater damage. On this account some plan should be adopted to prevent, if possible, that source of damage. If the land can lie after plowing to starve the worms it will be a good plan to defer plowing till eggs are laid and then turn them under to starve. In fact, knowing the cycle of life in the insect, and the time at which eggs are laid and the worms hatch and mature, each cultivator can adapt his measures to the special circumstances of his particular field.

A plan by which to greatly lessen the number of moths and the injury resulting from their presence in meadows and pastures may be based upon their habit of congregating in such immense numbers to light. I have shown that the moths thus attracted are in large part at least the females loaded with eggs, and it is probable that they have deposited few eggs if any previous to their flying to the light. Hence every female moth captured means the destruction of from one to two hundred eggs at the least. As the moths come to light by thousands, I think I may say even by millions, within a square mile, it can be seen how important is their destruction. Hundreds of them perish as a result of their own self-destructive habit, but by taking advantage of this habit and placing lanterns over tubs or pans of water in exposed places where they may be seen considerable distances, hosts of moths may be captured and destroyed. A little kerosene on the water will make their destruction certain, as then, even if they succeed in crawling out over those already submerged, or at the sides of the tub, they are quite sure to have received enough oiling to kill them in a short time. A little care in killing those accumulating in houses will also assist in lessening their number. Where electric lights

are in use they may be utilized to especial advantage in the capture of thousands of moths. I see no feasible plan of attacking the larvæ after they are established in the turf.

Natural enemies.—I have already mentioned the fact that the pupæ, possibly the full-grown larvæ, are extensively preyed upon by the striped squirrel (*Spermophilus 13-lineatus*). Unfortunately this sprightly little rodent has a taste for other food, which has gained for it a very unsavory reputation as a farm adjunct. Doubtless where corn is cultivated the injury to that crop will overbalance the good they may do in meadows; but I am inclined to think that for land kept constantly in grass their value is far greater than usually supposed. I know they feed upon the seed of grass and clover and doubtless also to some extent on the leaves and stems, but they also feed on noxious weeds and insects.

During several years' close observation of them on a lawn I have failed to find any indication of serious damage to the turf, and could they be kept in bounds I should feel like recommending that for permanent lawns they be allowed a home for the sake of the insects they devour. They seemed to select the cocoons of the turf-worms infallibly, pouncing upon a certain spot, digging for an instant, and then sitting upright to devour the dainty morsel.

Other mention of the species and related forms.—In his first annual report as State entomologist of New York, pp. 149, 150, Prof. J. A. Lintner gives the result of a breeding of one larva of *Crambus exsiccatu*s in connection with a detailed account of the *Crambus vulgigagellus*, and there expresses the suspicion that the insect is double-brooded.

In the fourteenth annual report of the State entomologist of Illinois, pp. 12-17, Prof. S. A. Forbes describes under the name of *Crambus zeellus*, Fernald, an insect which in many respects resembles the species here discussed. In some respects, however, there is considerable difference, and I have not attempted to determine the relationship between them. This species described by Professor Forbes is mentioned and a letter relating thereto is published in Bulletin No. 12, p. 33, Division of Entomology, United States Department of Agriculture.

I can not overlook the possibility that there may be more than one species included in the records here presented, and indeed for the reports from over the State there is every probability that two or more forms are included under the general name of sod-worms, web-worms, etc.

The occurrence of *Crambus vulgigagellus*, for instance, in company with *exsiccatu*s would account for several apparent discrepancies in reports concerning the time of pupation of the Web-worm. It has been my effort to record the facts as observed and reported, and the distinction of the different species, if such be included, must be worked out in the future. There can be no question, however, that the great body of the swarm appearing here the present season belongs to one species.

THE WHEAT-HEAD ARMY-WORM.

(*Leucania albilinea*, Guen.)

An insect which can without doubt be referred to this species caused very considerable damage in some of the southeastern counties of the State. Unfortunately I was not aware of the damage till too late to secure specimens for determination. Descriptions of the larva and its work, however, are so characteristic that I feel confident it was this species. I subjoin extracts from the Iowa crop report for July 10, 1887, which will show the distribution and damage so far as reported.

It will be noticed that the area included extends from the Mississippi River to a little west of the middle of the State and comprises only the two southern rows of counties, with the exception of Adair, which corners to the northwest upon the last infested county in the second row. Estimates given for two of the counties place the loss at 75,000 bushels (equal to about \$150,000) in one (Jefferson) and at \$30,000 in the other (Wayne). It is possible that these estimates are too high, but if we cut them down one-half and suppose the other eleven counties reported to have suffered in like ratio it would make a total loss of over half a million dollars for the thirteen counties. Doubtful counties out of this area may have suffered more or less, but not so conspicuously as to attract attention. The moths were noted at Ames during the summer, but not in unusual abundance.

Extracts from Iowa crop report.

ADAIR COUNTY.—There is some new insect eating off timothy heads.

APPANOOSE COUNTY.—Timothy heads eaten off by worms. There will not be any seed in Franklin Township. Within the last fifteen days a worm looking like an overgrown measuring worm made its appearance on timothy heads and com-

pletely stripped many pieces, damaging the crop very much; they have disappeared. Timothy light, a small green worm eating off the heads. Timothy heads destroyed by a small green worm.

CLARKE COUNTY.—A worm working on timothy heads.

DAVIS COUNTY.—Worms are eating off timothy heads. Timothy heads eaten off by a peculiar green worm, name unknown. Timothy heads destroyed by a small green worm.

DECATUR COUNTY.—Green worms working on timothy heads. Worms have destroyed timothy heads. Green worms playing havoc with timothy heads. A worm has almost destroyed timothy heads.

DES MOINES COUNTY.—Timothy heads eaten off by a small green worm.

HENRY COUNTY.—A light-green worm 1 inch long has done great damage to timothy heads. A green worm did some damage to timothy heads, but has disappeared. Meadow worms working at the root (of timothy) and a green worm about $1\frac{1}{2}$ inches long, name unknown, working on the head. Timothy heads destroyed by worms. Timothy badly damaged by a small green worm eating the head. Timothy being cut to save it from worms.

JEFFERSON COUNTY.—Some worm working on timothy heads, stripping off chaff and seed and leaving stems naked. Timothy seed, of which this county usually ships about 75,000 bushels, will not exceed the wants of home consumption.

LEE COUNTY.—Timothy injured by a small worm eating off heads. A small green worm has done great damage to timothy heads and is working on oats. Timothy heads destroyed by worms.

LUCAS COUNTY.—A green worm has appeared on timothy heads and will materially lessen the seed crop. Bountiful rains June 10 to 18 promoted growth of timothy 10 per cent.; a worm from half to two inches long appeared about the same time and has devoured whole fields. They do their work principally at night. Timothy seed has been completely destroyed by myriads of green worms. A worm doing damage to timothy heads. A small green worm doing great damage to timothy heads.

RINGGOLD COUNTY.—Timothy will be a short crop in many fields; heads of timothy entirely eaten off by a green measuring worm. Grasshoppers and worms heading timothy; small green worm eating off timothy heads.

VAN BUREN COUNTY.—Timothy heads eaten off by worms. "Army-worms" are destroying timothy meadows. Timothy damaged by drought and a small green worm working on heads.

WAYNE COUNTY.—A worm, name unknown, cutting off timothy heads. Sod (of timothy) injured by spring drought and latterly a worm eating off the heads. There is a small green worm doing much damage to timothy heads. A worm three-quarters inch long is eating the timothy; will not be more than 10 per cent. of a crop, a loss of \$30,000 to this county. Timothy heads destroyed by worm; timothy heads eaten by worms. A worm resembling a Cabbage-worm is destroying timothy heads. A small green worm eating timothy heads.

BLISTER BEETLES.

(*Lytta cinerea* and *Epicauta vittata*.)

Two species of these common beetles were unusually abundant this season, doing considerable damage to various plants, and in a number of instances causing quite serious blistering upon the faces and hands of people. I noticed an item in the daily paper to the effect that in a certain town in Missouri they were so plenty, flying into houses by night and producing such severe blisters, that people were obliged to avoid lighting lamps in the evening. Several of the college students suffered from blistered faces after handling the *cinerea*, and I was myself adorned for several days with a swollen face, having, as often before, gathered a number in my hand and probably while perspiring brushed some part against my face.

Lytta cinerea was the species first noted as abundant. June 7 and 8 it was plenty and stripping leaves of Honey Locust. June 9 I observed some of the beetles feeding upon clover, and that evening noted it attracted to my light. Specimens were received from Hancock County, where it was reported destructive, and it was also reported destructive to potatoes in Cerro Gordo County.

The Striped Blister beetle (*Epicauta vittata*) damaged some of the potato patches in and about Ames, and July 20 I noticed them plenty on injured corn, but as grasshoppers were present they may not have caused the damage. The following items from the crop report apply, most of them certainly, to this species, while some may apply to either this or the preceding species:

ADAMS COUNTY.—A long striped bug is eating potato vines.

CLARKE COUNTY.—Potatoes damaged by a long striped bug.

CLINTON COUNTY.—Flying potato-bugs threaten late potatoes. The Spanish Fly is very destructive to the potato crop.

HENRY COUNTY.—Potatoes have been badly eaten by the long striped bug.

JACKSON COUNTY.—A new species of potato-bug has appeared, but as yet no damage done.

JOHNSON COUNTY.—We have Colorado and two kinds of long bug, the latter headed off by Paris green. Army bugs are very bad on potatoes and corn. Colorado beetles appeared in small numbers and needed no attention, but the flying variety are extremely numerous and doing great damage to potato crop.

MONTGOMERY COUNTY.—A new variety of potato-bugs has appeared, doing great damage. They made their appearance June 8, and are equally destructive as the Colorado and far more difficult to destroy.

Many complaints have come to me that these Blister Beetles can not be killed with Paris green or London purple. This, I think, must be due to the insects traveling about so much, and thus leaving places that have been poisoned for their benefit. If care is taken to spray the whole patch, and especially parts not invaded by the pest, the result would, I think, be much more satisfactory. It should be remembered, too, that especially with London purple effects are not to be noted for from twenty-four to forty-eight hours after application. It should of course be remembered that in the larval stage these insects are beneficial, so that where they become destructive to some valuable crop, should they be destroyed?

THE FALSE CHINCH-BUG.

(*Nysius angustatus*, Uhler.)

The life history of this species, so far as I can find and as I have been informed by Professor Riley, who desired especial observations on the unknown points, has never been fully stated in that no record of the eggs or their place of deposition has been published.

As the species has been quite abundant here I undertook to determine this point, and in July, when adults were plenty and copulating, I made careful search in the ground around roots and among the leaves and blossoms of the common trailing Amaranth (*Amarantus blitoides*) where the insects were most abundant. My search was rewarded July 19 by the finding among blossoms of an egg which seemed reasonably certain to be the one sought, and careful comparison with eggs dissected from gravid females proved them to be identical.

The egg is slender, cylindrical, yellow, irregularly wrinkled, and tapering slightly at both ends. The smaller end is orange red. Evidently this is the head end and the orange-red color due to the eyes in process of formation. In eggs from dissected females this color is more diffused and less conspicuous. While eggs may doubtless be deposited elsewhere than upon the Amaranth this may with certainty be stated as one of the places of deposition, and in this locality this weed appears to be the chief food plant of the species. The cases recorded by Professor Riley, however (Mo. Rept., V, pp. 111-113), show that it may at times prove a serious pest. Where their destruction is desired it is evident that collecting and destroying the Amaranth during and after the time of egg deposition would be a preventive measure easy to apply.

A few pupæ and numerous adults, some of them copulating, were observed November 15. Probably these adults winter over to deposit eggs in the spring. I have not, however, seen the adult in the early spring. As the spring brood does not mature till July, and as observations have failed to show any brood maturing between this and late in fall we may consider that for this locality only two broods are produced annually.

On July 14 (evening) I took a number of examples and noted many others that had flown to lights in my house, passing through the mosquito netting that covered the windows.

NOTES ON MISCELLANEOUS INSECTS.

Crepidodera helvines was quite abundant in May and caused considerable damage to the leaves of Poplar and Laurel-leaf Willow. *Disonycha abbreviata* was found upon seedling plants of *Eleagnus*, and I was informed that it was seen eating the leaves. The plants were considerably damaged and no other insect likely to do the damage was present. None were seen after May 20, and no further damage to the plants was observed. *Haltica chalybea* was observed here for the first time on grapes. Adults were seen May 18 and larvæ appeared in June, but no serious damage resulted here. Farther south in the State they caused serious injury.

Anomæa laticlavata was abundant and (June 9) observed stripping leaves of Honey Locust. It fed particularly upon the young leaves on sprouts. Many were noticed *in coitu*, the male with antennæ kept fully extended, and body of male nearly at right angles to that of female. No eggs were found, and none were deposited by beetles in confinement, but those dissected from female were .65 to .70^{mm} long, .40^{mm} wide, oval, some slightly reniform, yellow, and smooth. Twenty-two were taken from one female.

Phyllotreta vittata quite abundant and injurious to cabbages. They were observed (June 28) very plenty on leaves above and below, and one plant was badly injured by their attacks on the stem just above ground. They were also quite plenty on Horse-radish leaves.

Diachus auratus was found (June 29) eating the blossoms of Red Clover and depositing its eggs in the clover heads. The egg is oval, light brown, and covered with minute irregular projections and short, spiny protuberances. The egg before extrusion is smooth, but while passing out is coated with a glutinous substance which hardens and forms the spiny coat. This coat is started upon the end first extruded, and the egg, during extrusion, is gradually rotated by means of the hind legs. This, I take it, is to bring each part of the surface under the openings of the glands secreting the glutinous substance. Looked at from the direction of the insect's abdomen the rotation was in same direction as hands of a watch, for those I observed. Eggs kept in a glass tube (inclosed June 29) were found hatched the morning of July 13. Some of the larvæ had crawled from their egg cases; others were within, except head and legs, and drawing case about with them. Larvæ have the head reddish and the body and legs white. I attempted to feed these on fresh clover heads, but did not succeed.

Alydus eurinus has become quite abundant during past two or three years and occurs quite commonly upon Red Clover. July 21 I watched one closely for some time to see if it fed upon the clover, being careful not to disturb it, as they fly quickly on approach of danger. It could be seen inserting its beak occasionally, then gradually withdrawing it, and to all appearance feeding. Examination of the clover head showed no insects, except a few larvæ of *Phælothrips nigra* and one larva of *Anthocoris insidiosus*, none of which showed any signs of injury. The *Alydus* could not have been feeding upon them. The habits of allied species would favor the vegetable diet, and I believe it may be added to the long list of clover pests.

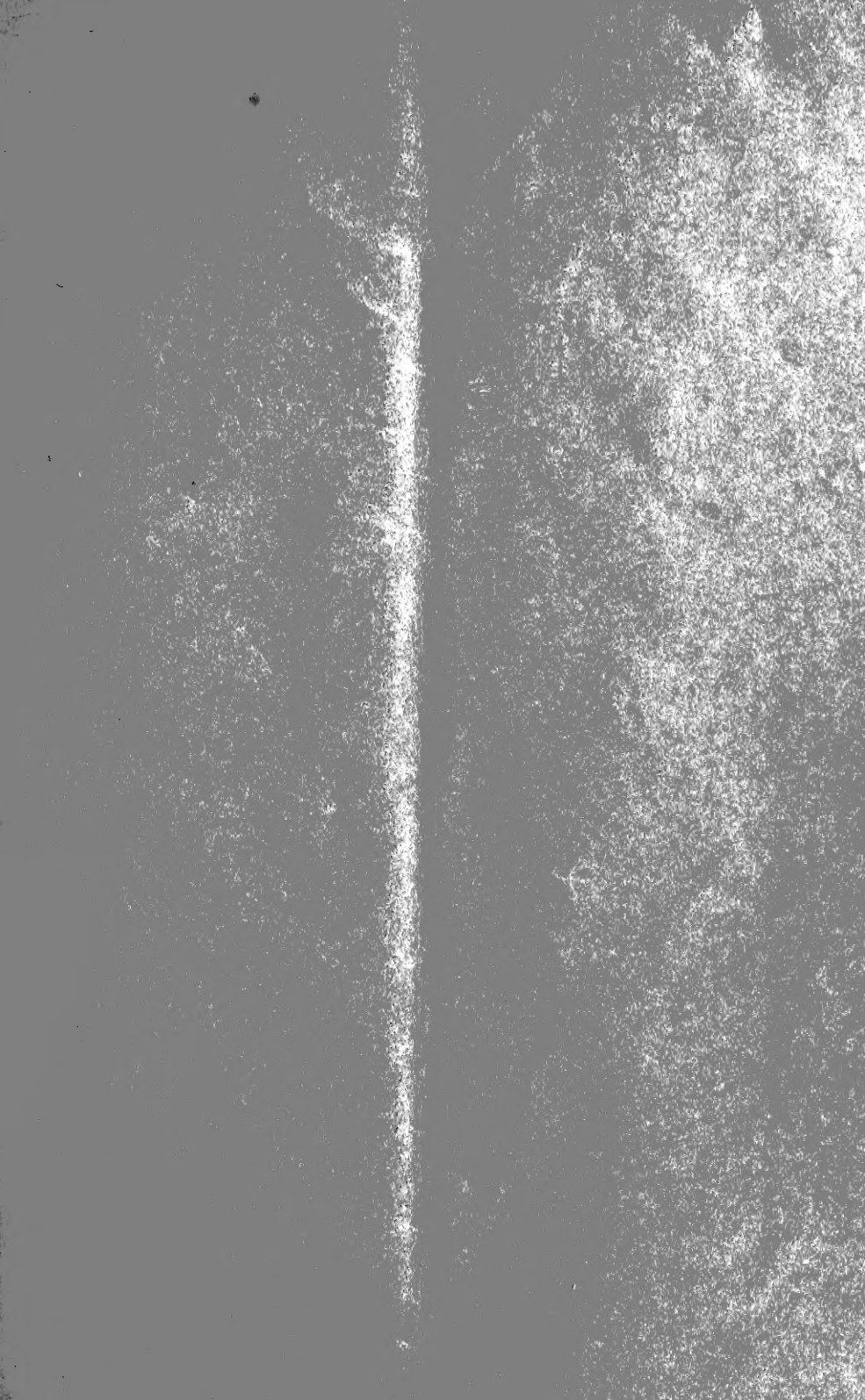
Anthocoris insidiosus, a well-known species, has heretofore been credited with preying upon certain noxious insects, and this summer, finding them plenty in clover-heads with *Phælothrips nigra*, I tested its relation to this species by placing (June 29) one of the pupæ in a glass tube with a number of adults and larvæ of the latter species. In a very few minutes it had red larva impaled and quickly sucked out the liquid contents of its body, so that it was shrunken to simply a head, terminal segment, and legs. On June 30 I placed an adult *A. insidiosus* in tube with clover plant-lice of different sizes and with adult *Phælothrips nigra*. It made no attack upon the other insects at the time, and on July 1 had not eaten any that I could determine. Some of the plant-lice had molted, and this I concluded would account for all shrunken skins present. On July 2 the plant-lice were all dead, only shrunken skins remaining, while the *Anthocoris* was still active. It seems probable that the plant-lice were eaten by the bug, since being supplied with fresh food they might be expected to survive more than forty-eight hours. I also saw the *Anthocoris* inserting beak into tissues of fresh clover blossom. It did not attack the adult thrips.

Piesma cinerea.—The Ash-grey Leaf-bug occurred the past summer in great numbers, but was not observed as abundant on any but noxious plants. A very few were noticed in spring on Grape but no damage to be seen. The same may be said of their occurrence on Plum. July 1 they were noticed in great numbers on *Amarantus retroflexus* (Pigweed or Amaranth), mostly paired, and on the under surface of leaves were numerous eggs, which I took to be of this species. This I proved by confining adults and securing eggs, and further by watching development of larvæ. A very few young larvæ were also noted at this time. The eggs are yellow, elongate, slightly bent, with about ten longitudinal ribs, the head end cut square off, and the red eyes showing plainly in eggs nearly ready to hatch. The larvæ when first hatched are two-thirds of a millimeter in length and a fourth of a millimeter in width, the antennæ four-jointed, the eyes red, and a red spot showing very plainly in the abdomen. By July 12 many larvæ on the plants observed were over half-grown, being at this time green in color. July 19 all stages were abundant, but many in pupa stage and many adults apparently fresh from the pupa stage with the wings delicate, almost white, and the body throughout green, except the red eyes. Two pairs apparently recently-issued adults were noticed *in coitu*. The green color is evidently retained for some time after reach-

ing the adult stage. This species was also observed, though less abundant on *Amarantus blitoides*,

Erythronera vitis was abundant throughout the season, as also *Thrips tritici*, and *Phloeothrips nigra* was present in immense numbers in clover blossoms, both as larvæ and adults, and I think there can be no question but that they get their nourishment from the plant. There seems, however, to be no very decided injury as a result of their presence, though it is to be noted that many clover heads where they are present blacken early and do not set seed apparently as full as they should. I have seen adults of the latter species working their jaws rapidly on the tissues of clover blossoms, but could not discover any of the tissue bitten away.

Tetranychus telarius.—In addition to the usual plants infested by this mite I have observed it this season in egg, larval, and adult stages upon the leaves of clover, their presence being indicated by the usual yellowish or rusty blotches.



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