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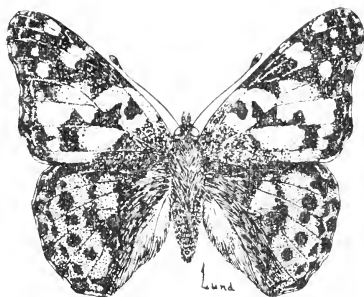
UNIVERSITY OF MONTANA

AGRICULTURAL EXPERIMENT STATION
BOZEMAN, MONTANA

BULLETIN NO. 139

JANUARY, 1921

Eighteenth Annual Report of the
State Entomologist
of Montana



The Thistle Butterfly (*Ianessa cardui* L.), a serious pest of cultivated sunflowers.

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BY
R. A. COOLEY

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LETTER OF TRANSMITTAL

Bozeman, Montana, January 1, 1921.

To His Excellency,
Governor Joseph M. Dixon,
Helena, Mont.

My dear Sir:

In conformity with the law I have the honor to present herewith the Eighteenth Annual Report of the State Entomologist of Montana, which will appear as Bulletin No. 139 of the Montana Experiment Station.

The outstanding features of the year were an extensive and serious outbreak of grasshoppers affecting many counties throughout the state, in which Mr. Strand from this office cooperated extensively with the farmers through the county agents and effected large savings in crops; and the widespread presence of the pale western cutworm which year by year is becoming a more serious situation. Both of these subjects are discussed in the report and your attention is directed particularly to these matters.

Very respectfully,

R. A. COOLEY,
State Entomologist.



Eighteenth Annual Report of the State Entomologist of Montana

CURRENT ENTOMOLOGICAL PROBLEMS

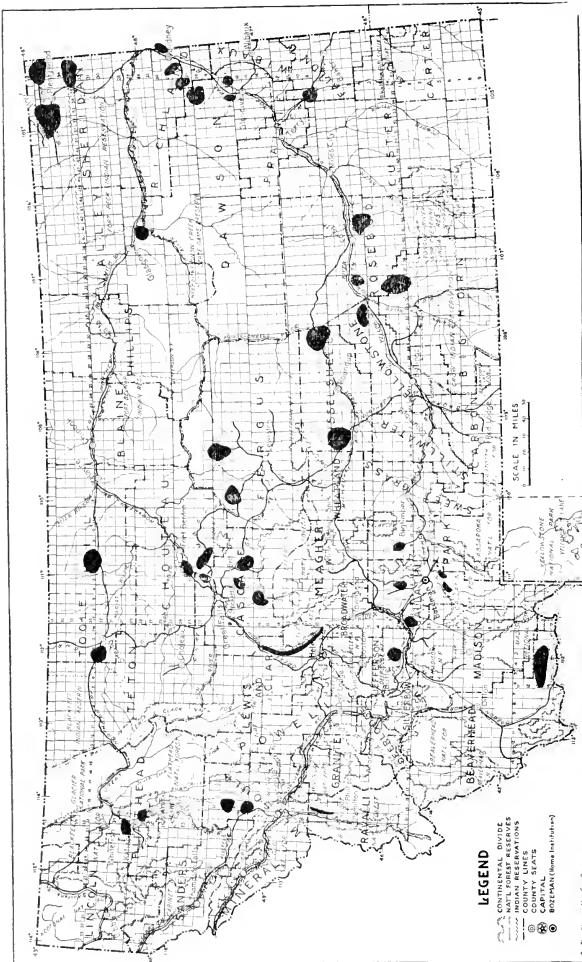
The outstanding entomological problems at the present time are the following:

GRASSHOPPERS

Grasshoppers are to be classified among those insects which are always present in greater or less numbers. More or less damage is done every year. However, during the past few years we have had an unusual number of these insects in portions of the state and the season of 1920 was one of the worst in this respect that we have had in many years. In the accompanying map of Montana the spots in black indicate the actual areas of serious grasshopper damage which were brought to our attention or discovered by representatives of this office. In all, so far as we know, approximately 140,000 acres of Montana lands were seriously affected. Our records show that largely under the guidance of our men approximately 36,790 acres were poisoned, which resulted in a saving of \$634,474.48.*

We received numerous appeals for help but were able to comply with only a part of them. Much more could have been done if we had had another assistant. Our method is to cooperate with the county agents in grasshopper control as in the control of other pests. It should be realized that the control of insect pests on a large scale is such a specialized subject that the county agent is in need of the assistance of a specialist. The county agent who has once gone through an outbreak of grasshoppers can conduct campaigns against these insects but the insect pests of any state are variable. Besides

*Careful estimates in the eighteen counties where this work was carried on show that 36,790 acres in crop were poisoned, that by this poisoning adjoining crops were saved to the extent of 7,265 acres, bringing the total acreage saved to 44,055. At \$15 per acre, which is a low estimate of the value of crops in the counties affected, the gross saving amounts to \$660,825, and when the cost of poisoning apart from labor—\$26,350.52—is deducted, an actual money saving of \$634,474.48 is shown.



Map of Montana, indicating by black spots the areas of serious grass-hopper damage in 1920.

those which we always have, those present in one season may disappear and others come in from other places, so that the county agent is continually confronted with new problems with which he is not familiar. It is very desirable that the legislature provide for the employment of another deputy for this office, as thereby we will be able to serve the farmers of the state in a much larger way.

The species concerned in the grasshopper experiences of 1920 were mainly the warrior grasshopper (*Camnula pellucida*) and the lesser migratory locust (*Melanoplus atlantis*), together with the two-striped locust (*Melanoplus bivittatus*). These were the species which during the summer months appeared in enormous numbers in various parts of the state.

It is of interest to note that early in the season, beginning in the latter part of February, we received reports, particularly from northeastern Montana, that young grasshoppers were already hatching in large numbers. Knowing that the usually destructive species did not appear as early in the season as this, steps were taken to inquire into the situation and it was found that certain species which are not ordinarily looked upon as pests had appeared in very unusual numbers. The two species referred to are *Stirapleura decussata* and *Hippiscus pardalinus*. After looking into the situation we reported to the farmers that we believed these insects would not develop in seriously injurious numbers and the experience of the season later bore out our prediction.

Attention is being given to improving the arsenic bran mash formula which is used in the control of these insects and at the same time reducing the cost of the materials in the formula as much as possible. This Experiment Station has found that amyl acetate, or the so-called "banana oil," may be used in place of ground lemons or oranges and that the use of this chemical not only reduces the cost materially and increases the effectiveness of the formula but also cuts down the labor fully one-sixth. We do not possess complete figures regarding the amount of amyl acetate used last year but the incomplete figures which we have clearly show a definite saving in materials alone of over \$2,000.

PALE WESTERN CUTWORM

Within a short period of years the pale western cutworm, previously almost a rare insect, has become well known throughout the

greater part of Montana owing to the serious damage which it has inflicted upon cereals and other crops. The following table of losses by percentages of total seeded areas in the various counties for which we had definite information during the season of 1920 will indicate the seriousness of this pest:

Hill County	25.1	per cent
Liberty County	47.1	" "
Cascade County	35.	" "
Jefferson County	36.01	" "
Broadwater County	23.9	" "
Chouteau County.....	30.7	" "
Phillips County	16.9	" "
Teton County	29.	" "
Average.....	30.4	" "

When the counties of Pondera, Glacier, Blaine, Judith Basin, Lewis and Clark, and part of Park County, where it is estimated almost as large a percentage was lost, are included with the above counties, fully one-fourth of the total grain-producing acreage of the state is represented. At \$12 per acre, which is the average value of farm crops over that territory, there was a money loss of \$2,600,000. Then, considering that the pale western cutworm occurs in practically every other county of the state east of the continental divide besides those already mentioned, where an average loss of from 2 per cent to 5 per cent was inflicted, the total loss amounts to well above \$3,000,000 for the one year 1920.

To show perhaps a little more clearly what this cutworm has been doing, one hundred fields personally inspected during the summer showed a loss of 2,437 acres out of a total of 6,844 in 1919, and in 1920 a loss of 3,382 acres out of 6,844, or 35.7 per cent in 1919 and 49.4 per cent in 1920. Mr. George O. Sanford, manager of the Sun River Irrigation Project, has stated to us that of the 15,300 acres seeded to crop on the Greenfield Bench in 1920, 7,345 acres was a total loss and that some damage was done to the remainder. Using the figures he has given for the average yields on the undestroyed acreage—wheat 11.5 bushels, oats 20.86 bushels, and flax 6.31 bushels—the average value of the principal farm crops of that section was at least \$15 per acre. Accordingly, using that as a fair valuation per acre of the crops destroyed, the pale western cutworm

inflicted a loss of \$110,175 in this one comparatively small territory. Although these losses took place on irrigable land, no water was available until after the first of June. Were it not that irrigation made it possible in some cases to reseed and grow a late crop on part of the originally destroyed area, the loss would have been 55 per cent instead of 48 per cent of the acreage in that district.

Farmers generally throughout Montana should realize that the pale western cutworm is a pest of the first magnitude, ranking with the alfalfa weevil and others of great power of destruction.

This insect came into prominence for the first time in 1911 in the southern part of the province of Alberta, Canada, where several hundred acres of grain were destroyed and where in the following year the estimated loss was between 30,000 and 35,000 acres. The first record of its occurrence in Montana was in the northern part of the state in 1915. Since that time it has been spreading southward and in 1920 was found to occur quite generally over that part of Montana east of the continental divide, with the exception of some few districts in the southern part of the state.

Every effort is being made to find a remedy for this insect and the director of the Experiment Station has been as liberal as possible in the allowance of research funds to this department for studying this insect. We are glad to report that some progress has been made and that a publication dealing with what is known about this insect and methods for its control has just been issued and is now available for distribution.

FRUIT-TREE LEAF-ROLLER

The fruit-tree leaf-roller or Colorado leaf-roller, as it is sometimes called, (*Archips argyrospila*) is doing serious and rather extensive damage to apple trees in the Bitter Root Valley. Our attention was first called to it during the spring of 1920 when reports of its presence and the damage it was doing were brought to our notice from Ravalli County.

The eggs of this insect are laid by the parent moth on the bark of the apple tree during July and hatch in the early spring just as the leaf buds are unfolding. The very minute worms go to the buds and soon secrete themselves by burrowing among the tender leaves. As the leaves expand the worms web them together and remain hidden. It is characteristic of this insect to appear in

such numbers as to completely defoliate the trees. One defoliation prevents a fruit crop and a very few successive defoliations will kill the trees. Careful estimates show that this insect did \$25,000 worth of damage in the Bitter Root Valley during the year 1920. Inspectors of the Board of Horticulture and representatives from this office have found the leaf-roller to be widely prevalent throughout pretty much all of the Bitter Root Valley and indications are that unless determined steps for its control are taken it will continue to multiply and extend its distribution until the whole valley is involved, in which case very extensive damage may result. In company with representatives of the Board of Horticulture, the State Entomologist held public meetings of fruit growers in the early spring of 1920 and advised the use of miscible oils to be applied before the buds had started. This is the standard remedy for this insect and has been moderately successful in other states where it has been used. The time was so short that it was not possible to conduct any preliminary experiments for the purpose of getting more exact information to govern us, and very unfortunately the oil that was used did not control the outbreak and serious damage resulted.

A representative from this office made a careful study of the entire situation during the summer and arranged to conduct experiments after the eggs had been laid. These experiments consisted of removing whole limbs on which had been laid large numbers of egg clusters, spraying them with different miscible oils in various strengths, then leaving them in a greenhouse under observation at the college, and later comparing the numbers that had hatched in each experiment.

Parallel with this experiment trees in the orchard were sprayed and limbs were removed and carried to the greenhouse at Bozeman where observations were made. Indications at the present time are that we shall be successful in finding among the tests a satisfactory remedy to be used in the orchards of the Bitter Root Valley during the spring of 1921. It is our intention to give definite attention to the control of this insect and bring it under control if a means can be found.

THE ALFALFA WEEVIL SITUATION

The alfalfa weevil is a very destructive pest of the alfalfa plant which was first found in this country in the vicinity of Salt Lake

City in 1904. Both the Experiment Station of Utah and the United States Department of Agriculture took steps to bring it under control and there has been maintained a branch office of the United States Bureau of Entomology at Salt Lake City ever since, the purpose of which is to study this insect alone.

Many farmers in Montana who have not had experience with this weevil believe it to be a destroyer of the seeds of alfalfa. This is not the case, as the small green-colored worms hatching from eggs laid by the small beetles feed entirely upon the foliage and stems of the growing plants. So serious has this insect become that it has in many cases almost completely destroyed the hay crop in infested fields and has been so prevalent in localities where it has been established for a long time as to seriously interfere with the production of alfalfa. Many growers have given up the attempt to grow this crop and the whole agricultural industry has been seriously affected.

This insect has spread from year to year, its extension having gone mainly northward. It is now present in practically all portions of Utah where alfalfa is grown, much of southern Idaho, a few counties in eastern Oregon, and in certain counties in Colorado and Wyoming. Its northward extension has reached almost to the Montana boundary, as it is now present in the first county across the Montana line in Idaho, namely, Fremont County.

The alfalfa weevil spreads overland from field to field and is at first generally present in such small numbers that it is not detected many miles in advance of where it is doing damage. For this reason it may be already in Montana. It has in a few instances been carried, in connection with industry, into remote localities. In this way it appeared in Delta County, Colorado, and in Payette County, Idaho, each of which localities is becoming a new center of distribution. We believe that the main source of danger is the shipment of alfalfa hay, and Montana's quarantine which has been in force since 1913 has been aimed mainly at the prevention of shipping alfalfa hay into Montana from infested localities. The quarantine was raised in the spring of 1920 and large amounts of alfalfa hay were shipped in from southern Idaho and were distributed widely throughout the state, thereby relieving a very serious shortage of hay. It is possible that the weevil was introduced at the same time. Because of these shipments of hay from Idaho and because of the danger which con-

tinually exists that the insects may be introduced, it is wise for the farmers of Montana to be on the lookout for this insect during the next few years and insects found doing damage, suspected of being from this species, should be promptly sent to the Experiment Station. It will be necessary to take immediate action when this insect appears. We believe there should be a fund under the control of the Board of Examiners, which it may liberate to meet emergencies which may arise from the alfalfa weevil or from the presence of other dangerously injurious insect pest or plant disease.

Numerous states in the west have established quarantines against the states of Utah and Idaho and portions of Colorado, Oregon, and Wyoming. In cases where the states have established quarantine lines within the state, thereby separating the districts or counties which are infested, the other states have quarantined only the infested localities or counties and have allowed shipment from the weevil-free counties. When in a few years Montana has the weevil, as we fear she will have, it will be necessary for us to establish quarantine lines around the infested localities as they appear, as otherwise surrounding states and the Dominion of Canada will undoubtedly quarantine the whole of the state of Montana. It is the purpose of this office to search for this weevil annually during the next few years and in case colonies are found we shall be in need of sufficient funds to take the necessary steps for control and for the protection of the state as a whole. It is our purpose to call upon the Board of Examiners for allowances from the proposed emergency appropriation, if it is made. To fully meet the situation the present legislature should enact a law authorizing the Governor to quarantine infested localities within the state of Montana. The passage of such a law is earnestly urged.

The Experiment Station has still available a bulletin on the alfalfa weevil and will gladly send it to all who may request it. This bulletin was prepared several years ago and since its publication methods of control have been improved. The principal means of control as now practiced is to spray alfalfa fields with arsenicals.

SUGAR-BEET WEBWORM

For several years past an insect which has been known as the sugar-beet webworm (*Loxostege sticticalis*) has been widely prevalent in Montana. This insect continued in remarkable numbers in

1920 and many farmers believed it to be the army cutworm or confused it with the pale western cutworm, alfalfa weevil, and various other pests of which they had heard. It is primarily a destroyer of weeds and particularly favors pigweed, Russian thistle, and various other related plants. It has in many instances fed extensively on Russian thistles throughout grain crops without doing any damage to the grain. This is the worm which farmers find quite frequently if they examine the ground under Russian thistles, especially through northern and eastern Montana. It is about three-quarters of an inch in length when full grown, pale yellow below and a greenish black above, marked by several white or olive stripes running the full length of the body. It is to be expected that this insect will disappear soon, due to parasitism. We can not, however, predict with certainty how long it will remain. It can not be looked upon as a pest of great importance excepting where it interferes with the sugar-beet industry or destroys gardens.

NEEDS AND PLANS

The Experiment Station Entomologist is by law ex-officio State Entomologist of Montana. From an appropriation of \$300 at the outset this fund has grown by steps until in 1920 it was \$3300. The State Entomologist serves without extra salary for this work and employs an assistant or deputy who, under his direction, conducts much of the work of the office. The assistant necessarily spends much of his time in the field as the particular function of this work is to take actual knowledge of insect control to the farmers and assist them in saving their crops. Grasshopper outbreaks are the occasion for trips to various parts of the state where the farmers are brought together and organized and assisted in securing suitable supplies of poison, bran, etc. The assistant works in cooperation with the county agents. Besides such major pests as grasshoppers and cutworms, there are a great many others of lesser importance which in the aggregate have caused severe losses in Montana each year, or would if they were not controlled, and without doubt the small sum appropriated is returned to the state many times over in the savings effected on the farms.

The work has grown during recent years to such an extent that it is no longer possible to come anywhere near meeting the demands made upon the office with only one assistant. It is respectfully

recommended that an increase in funds be allowed to make it possible to employ a second man to work among the farmers in the state and help keep up the office and laboratory routine which are made necessary by the state work. It is no exaggeration to state that the fund asked for this work would be returned to the farmers at least a hundred fold.

ESTIMATES

Through the proper channels estimates have been submitted to be included in the budget estimates amounting to a total of \$7,550 for the year beginning March, 1921, and \$8,590 for the year beginning March, 1922. These increased figures are to cover the salary of an additional man and his traveling expenses, and a small increase in the working fund of the department, made necessary by the increased demands.

NOTES ON INSECT PESTS OF 1920

SNAILS (MOLLUSCA)

Gray Garden Snail (*Agriolimax agrestis* Linn.). This slimy, disgusting snail caused serious damage to turnips, tomatoes, and lettuce in city gardens which were maintained in the damp condition favorable to its development.

MITES AND TICKS (ACARINA)

Pear-Leaf Blister Mite (*Eriophyes pyri* Pgst.). In the Bitter Root Valley there was a noticeable increase in this pest over last year. Unsprayed orchards suffered severe injury and orchards not sprayed for two or three seasons had the fruit crop ruined.

THRIPS (THYSANOPTERA)

Thrips. A severe outbreak of thrips, species undetermined, occurred during the summer and caused heavy losses to alfalfa seed producers in some sections of the state. In the Yellowstone Valley these tiny pests were especially bad and were responsible for a 75 per cent decrease in the honey crop.

GRASSHOPPERS, CRICKETS (ORTHOPTERA)

Stiroxys trilineata Thom. Females of this species were found to be exceptionally abundant in the foothills in southern Gallatin County.

"Sand" or "Jerusalem Cricket" (*Stenopelmatus* spp.). The curious "sand cricket," sometimes known as the "Jerusalem cricket"

and "the child of the desert," attracted much attention. Inquiries were received from numerous localities throughout the central and eastern parts of the state concerning the identity of this comparatively rare orthopteron.

Large Lubber Grasshopper (*Brachystola magna* Gir.). The largest representative in Montana of the grasshoppers, the females of which measure from two to three inches in length, was more common than for many years past. The State Entomologist's office received almost ten times the usual number of inquiries concerning this insect.

Warrior Grasshopper (*Camnula pellucida* Scudd.). This species was again prevalent in the state and during May and June hatched out in enormous numbers from egg beds in Beaverhead, Missoula, Flathead and other western counties. Had not control measures been forcibly carried out great financial loss due to this insect would have been sustained.

Lesser Migratory Locust (*Melanoplus atlantis* Ril.).

Two-Striped Grasshopper (*Melanoplus bivittatus* Say).

Whereas the warrior grasshopper was the principal species, and in many cases the only one concerned in western Montana, the lesser migratory and two-striped forms preponderated in outbreaks of grasshoppers in eastern Montana.

THE TRUE BUGS, PLANT LICE, ETC. (HEMIPTERA)

Chinch Bug (*Blissus leucopterus* Say.) For the first time since 1911 the chinch bug made its appearance again in the vicinity of Glasgow. Nymphs were collected by County Agent Stebbins on May 27th and sent in to the laboratory.

Currant Aphis (*Mysus ribis* Linn.). This yellowish-green plant-louse, which causes the curling up of currant and gooseberry foliage by extracting the plant juices from the leaves, was more abundant in Montana than for many years past. Many inquiries concerning control measures reached the Department of Entomology too late for any good to result, as spraying must be done before the leaves are badly curled.

Sunflower Aphis (*Aphis cornifoliae* Fitch). This dark-colored aphis which feeds on the under sides of the leaves of cultivated sunflowers grown for ensilage has increased along with the remarkable

increase in the acreage of this new crop and should be mentioned as a possible serious pest.

Sugar-Beet Root-Louse (*Pemphigus betae* Doane). A substantial increase over last year in the prevalence of this insect was noted. Investigations conducted for a long period of years have shown that even a moderate infestation of lice not only reduces the tonnage but also cuts down the sugar content of the beets.

BUTTERFLIES AND MOTHS (LEPIDOPTERA)

Imported Cabbage Worm (*Pontia rapae* Linn.). There was more than the usual amount of damage by cabbage worms. People generally have learned how to control this pest so that our large number of inquiries indicates a great abundance of this pest this season.

Thistle or Painted Lady Butterfly (*Vanessa cardui* Linn.). This insect played a dual role in its activities. Many larvae were found to have destroyed the foliage of the Canada thistle (*Carduus arvensis* L.), an extremely noxious weed in some parts of the state, and on the other hand great numbers of larvae ate so voraciously on cultivated sunflowers that in some cases the defoliation of the plants over many acres was almost complete. Of the insects that have attracted attention as pests of cultivated sunflowers this one seems capable of causing the most damage unless some control method is developed by which it can be combated.

Fruit-Tree Leaf-Roller (*Archips argyrosipila* Walk.). See page 7.

Diamond-Backed Cabbage Moth (*Plutella maculipennis* Curtis). Cocoons enclosing the pupae of this species which were found attached to the heads of wheat in several instances caused some concern to farmers who feared they were threatened with a new wheat pest. The inference is that the larvae fed on wild mustard growing in the fields and crawled to the wheat heads to pupate.

Codling Moth (*Cydia pomonella* Linn.). Reports from the Yellowstone Valley, together with a personal inspection trip, show that this most important pest of the apple is becoming firmly established in that locality. In the Bitter Root Valley the pest was much worse than ever known before. Perhaps the most serious damage was done in the vicinity of Florence but orchards over the entire district suffered much codling moth injury. In orchards which were given the proper spraying gratifying results were secured.

Sugar-Beet Webworm (*Loxostege sticticalis* L.). See page 10.

Polyphemus Moth (*Telea polyphemus* Cramer). This beautiful large moth, which feeds in the larval stage on a wide variety of trees and shrubs, was very common in the state this season.

Pale Western Cutworm (*Porosa grotis orthogonia* Morr.). See page 5.

Noctuids in Cottonwood Bark (*Onycha grotis rileyana* Morr. and *Ufeus plicatus* Grote). In 1915 we reported *Onycha grotis rileyana* as causing damage to cottonwood trees in Silver Bow County by feeding beneath the green bark. Much damage in the same locality was done this year by what was apparently the same species but specimens were not reared through. *Ufeus plicatus*, doing similar damage, was reared from specimens taken at Melstone.

FLIES (DIPTERA)

Ox-Warble Fly (*Hypoderma lineata* DeV.). This pest, often known as the "heel fly," was reported by farmers in the Centennial Valley to have attacked horses, as regular ox-warble lumps similar to those on cattle were found on the animals' backs.

Nose Fly (*Gastrophilus haemorrhoidalis* L.). This pest, which is the most bothersome of all our animal parasites, has now extended its range over the entire state, whereas in 1913 it was known only in the far eastern counties.

Flesh Flies (*Sarcophaga kellyi* Aldrich), which are the principal natural check on destructive grasshoppers, were present over most of the grasshopper-infested regions in the central and eastern sections of the state. The flies deposit on the hoppers living maggots which, after gaining entrance to the body cavity, feed on the juices and tissues of the hoppers, eventually causing their death.

Western Wheat Stem Maggot (*Hylemyia cerealis* Gillette). This insect, which works through the stems of the young plants, did a moderate amount of damage to spring wheat in central Montana.

BETTERLES (COLEOPTERA)

Colorado Potato Beetle (*Leptinotarsa decemlineata* Say). A remarkable reduction in the number of "potato bugs" was noted all over the state.

A Sunflower Pest (*Chrysomela exclamationis* Fab.). For many years known as a common feeder on wild sunflowers, this insect has now transferred its attention to the giant Russian sunflower grown

for ensilage. The larvae congregate on the young heads and upper leaves of the plants where they do considerable damage, although this feeding has not affected the later development of the heads, so far as we have noticed.

Nuttall's Blister Beetle (*Cantharis nuttalli* Say). The large purple blister beetle which occurs so frequently in gardens and alfalfa fields in Montana was again more than usually abundant.

Wireworms (*Elateridae*) are becoming more and more important as a grain pest in Montana and during the present season severe injury by wireworms to flax and alfalfa was reported to the State Entomologist.

A Sunflower Weevil. Family *Curculionidae*. An unknown weevil, which bored through the stalks of cultivated sunflowers, causing severe damage, occurred in the northern part of the state. An attempt to rear the larvae failed.

A Strawberry Crown-Borer, (Chittenden 6830, Mont. Rec. No. 1853). This borer, which is about the same size and has about the same larval habits as *Tygloderma fragariae* Riley but which is not believed to be that species, was the cause of a severe loss in the young strawberry settings in a locality in the southern part of the state. Specimens have not yet been determined.

BEES, WASPS, ETC. (HYMENOPTERA)

Alfalfa Chalcis Fly (*Bruchoplagus funebris* Howard). This insect has become well established in Missoula County where considerable damage to alfalfa seed has resulted.

Horn-Tail (*Urocerus flavicornis* Fab.). A pupa of this insect taken from a redwood water pipe at Divide was received in the laboratory, as well as an adult of the same species from Belgrade.