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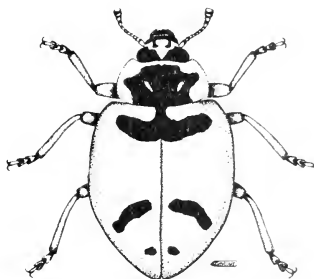
AGRICULTURAL EXPERIMENT STATION

BOZEMAN, MONTANA

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Fourteenth Annual Report
of the State Entomologist of
Montana



The Five-Spotted Ladybug, *Hippodamia 5-signata* Kirby

BY
R. A. COOLEY

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Fourteenth Annual Report of the State Entomologist of Montana

INSECT PESTS OF 1916

THE MITES AND TICKS (ACARINA)

The Pear-Leaf Blister-Mite (*Phytoptes pyri* Pagnat). The pear-leaf blister-mite was reported as doing a great deal of damage to apple trees in the Bitter Root Valley during the past season. Further experimental work in the control of this insect has been outlined for next season.

THE BRISTLE TAILS AND SPRING TAIL (THYSANURA)

The Fish Moth (*Lepisma saccharina* Linn.). As usual there were several inquiries regarding the fish moth, which seemed plentiful in warm closets and cellars.

The Snow Flea. Several reports were received, accompanied by cans containing millions of specimens of a black Collembolan, which is more or less plentiful on standing water. This year it was unusually abundant, even on damp rotted boards, leaf mold and old rags. No damage could be attributed to it.

Collembola in the Soil. Reports were received regarding a tiny, white Collembolan, which was found to be plentiful in the soil in greenhouses but not doing any apparent damage. In the college greenhouses we have found what is apparently this same insect injuring leaves of cucumber that were near the ground.

COCKROACHES AND GRASSHOPPERS (ORTHOPTERA)

The German Cockroach (*Blatta germanica* Linn.). Inquiries regarding the control of cockroaches were frequent. The most common one was the German cockroach, *Blatta germanica*. The Oriental cockroach, *Periplaneta orientalis*, was also reported but not as being abundant.

Grasshoppers (*Acerididae*). There was no serious outbreak of grasshoppers this year, but late in the summer small outbreaks were reported from widely separated communities. The species which appeared to be doing the most damage was *Melanoplus atlantis*. Owing to its appearing late in the season, this insect did its greatest

damage by climbing the full-grown grain stalks and cutting off the heads. Slight injury was done also to newly seeded winter wheat. In the early spring, about the first of May, grasshoppers were surprisingly abundant north of Miles City. No specimens were sent us and we cannot state what the species was.

The Sand Cricket (*Stenopelmatus* sp.). More inquiries than usual were received regarding the sand cricket or Jerusalem cricket. Several specimens were sent in as curiosities, with requests for information.

THRIPS (THYSANOPTERA)

A Grain Thrips (*Anaphothrips striatus* Osb.). There was a considerable loss in oats, with a slighter loss in barley and wheat, due to a sterility of the florets caused by the feeding of this thrips. In several instances, especially where the head had not completely emerged from the boot, live specimens of thrips were secured, which were determined as this species. In several sections oat fields were examined and the loss from this insect was estimated at about 10 per cent.

The Onion Thrips (*Thrips tabaci* Lind.). The onions growing on the experiment plots on the college farm were found to present a rather sickly appearance, which was at first attributed to hail injury. Closer examination revealed the fact that the injury was mostly due to the onion thrips. Adults and young were both found in great numbers on the leaves.

Thrips on Nasturtiums. Nasturtium leaves were sent in for examination which showed typical thrips injury. A few of the thrips were found but they were dead and so dried and broken that it was impossible to make a determination of the species.

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

The Bedbug (*Cimex lectularius* Linn.). Requests for information about bedbug control were fully as numerous if not more so than in previous years. It is hoped to publish a leaflet containing an account of the habits and control methods of the bedbug for distribution before next season.

The Chinch Bug (*Blissus leucopterus* Say). This insect was reported from three different localities, but as no specimens were sent in for identification the reports have not been verified. The chinch bug occurs, so far as we know, only in a few counties in

northern Montana, where no damage to speak of has been done. It is not likely that this insect will be very injurious in our climate.

The False Chinch Bug (*Nysus angustatus* Uhl.). This insect is rapidly becoming a pest in the State, and this year it has been reported as being exceedingly plentiful in grain fields. It is often mistaken for the real chinch bug and is the cause of many of the chinch bug reports received at this office. In one instance this insect was found in great numbers, in all stages of development, on an old discarded mattress.

The Buffalo Treehopper (*Ceresa bubalus* Fab.). Very often a man walking through an apple orchard will notice twigs, and at times most of a tree, which show a peculiar, gnarled or stunted appearance. These twigs on closer examination will be seen to have scars or tiny incisions, which give them a decidedly "braided" appearance. These are the results of the egg punctures of the buffalo treehopper, and while the insect does not feed on the apple, these egg punctures may be the cause of more or less stunting or killing of twigs or whole trees. Inquiries concerning the cause of this injury are frequent.

The White Fly (*Alleeodes vaporariorum* West). The greenhouse white fly was the cause of considerable annoyance and loss to greenhouse men all over the State. Requests for control information were frequent. We have known of the presence of this insect for many years.

The Green Apple Aphis (*Aphis pomi* DeG.). The green apple aphid was not as abundant as formerly, but was reported from various parts of the State as doing slight damage to apple trees. Our experience has been that this insect continues in destructive abundance year after year.

The Western Wheat Aphis (*Brachycolus tritici* Gill.). This wheat aphid was scarce this year, being found in only one or two scattered localities. The severe winter which killed off much of the winter wheat, may have killed off a high percentage of the lice.

The Woolly Apple Aphis (*Schizoneura lanigera* Hausm.). This injurious insect is becoming one of the most serious pests to apples in the Bitter Root Valley. Owing to lack of funds it has been impossible to do any work on its control.

MOTHS AND BUTTERFLIES (LEPIDOPTERA)

The Imported Cabbage Worm (*Pieris rapae* Linn.). This cabbage worm was as plentiful as in previous years and attracted considerable attention. Cabbage patches all over the State suffered some loss from it. Wherever the remedies we have proposed have been used, the insect has been controlled.

Clothes Moths (*Tinea* sp.). Clothes moths were reported in several instances as being harmful. Fumigation with hydrocyanic acid gas was tried and was successful in controlling them.

The Bud-Moth of Apple (*Tructoecera ocellana* Schiff.). This insect appeared in an unusual role on apples this year. The tiny larvae fed on the fruit just before picking time, making holes and scars on the surface. While the damage to each fruit did not amount to much, it was enough to drop first-class fruit into the cull class and cut down the value of the crop.

The Mediterranean Meal Moth (*Ephestis kuehniella* Zell.). The Mediterranean meal moth was reported in corn meal in town, and again in the feed bins of the poultry department at the Experiment Station. The ground feed in the bins became so matted together that it was difficult to get it out. This is an important pest in flour-mills, warehouses and stores.

The Polyphemus Moth (*Telea polyphemus* Cramer). The cocoons of the polyphemus moth were collected at Huntley. There is no record of any damage being done, but persons who find any of the very large and showy moths often send them in.

The Red-Humped Apple Caterpillar (*Schizura concinna* S & A). This insect pest of the apple was reported from the Bitter Root Valley but was doing no great amount of damage. It occasionally eats off the foliage from a few small limbs.

The Sugar-Beet Webworm (*Loxostege sticticalis* Linn.). In late July and early August reports of damage being done by the sugar-beet webworm were frequent. They were at first reported as feeding on Russian thistle, but later fed on flax and sugar beets. It seems clear that this injury was by the second brood of the insect.

The Tent Caterpillar (*Clissiocampa americana* Fab.). Several large nests of the tent caterpillar were noticed on apple trees in various localities. They did not seem to be doing any extensive damage but, as usual, were defoliating a few branches.

FLIES (DIPTERA)

The Currant Fruit Fly (*Epochra canadensis* Loew.). The currant fruit fly continues to do as much damage to currants as in previous years. As yet no entirely satisfactory control measure has been found for this pest.

Horse Flies (*Tabanidae*). Horse flies were as abundant as usual, and pestered the picnickers and campers as well as horses in the canyons about the State.

The March Fly (*Bibio albipennis* Say). Larvae of a *Bibio*, probably *albipennis*, were sent in with requests for information. So far as is known, these insects caused no damage whatever, but their presence in garden soil in great numbers aroused suspicion.

The Nose Fly (*Gastrophilus haemorrhoidalis* Linn.). The nose fly, while plentiful, is not recorded as having made any great advance in its spread this season. Some interesting facts regarding the egg and egg-laying habits of this fly were brought out this summer by Dr. R. R. Parker, of the Board of Entomology. These have recently appeared in the Journal of the New York Entomological Society.

The Onion Maggot (*Phorbia ceparum* Meade). The onion maggot was abundant this year and completely destroyed several rows of onions on the plots at the Experiment Station. Reports of damage done by this insect were received from various parts of the State.

Wheat Stem Maggots (*Meromyza americana* Fitch and *M. nigriventris* Macq.). There was no report of serious injury by the wheat stem maggot until the latter part of July. The damage at this time was done to the plant while in blossom. The stalk was cut just above the last node, causing the head to die, while the leaves appeared perfectly healthy. This trouble was general in Montana.

BEETLES (COLEOPTERA)

Blister Beetles (*Epicauta maculata* Say and *E. pennsylvanica* D. G.). These two species of blister beetles were reported as being injurious to sugar beets. They are both common in Montana and have been injurious for many years.

Nuttall's Blister Beetle (*Cantharis nuttalli* Say). This blister beetle was reported from the Judith Basin Substation as feeding on

horse beans on the forage crop plots. It is a common native species which feeds on a great variety of plants.

The Bumble Flower Beetle (*Euphoria inda* Linn.). The bumble flower beetle was reported again this year, eating the kernels from the almost ripened ears of corn. It does not seem to be abundant enough to cause any great amount of damage.

The Colorado Potato Beetle (*Leptinotarsa decimlineata* Say). The Colorado potato beetle was abundant, and at the Huntley Experimental Farm it completely cleared off the dry-land potato plots in spite of three applications of arsenicals. In this instance the insects were present in very unusual numbers.

A Cottonwood Beetle (*Monoxia debilis* Lec.). For the first time, this beetle has been reported as doing considerable injury to cottonwoods. Specimens were sent in from several localities and were determined as this species.

The Cottonwood Leaf Beetle (*Lina scripta* Fab.). Many reports were received regarding the cottonwood leaf beetle, which seemed to be unusually common this year. It was especially harmful to nursery stock. In one instance it was so plentiful that arsenicals did not prevent damage to the trees.

Cottonwood Mining Beetle (*Odontota* sp.). This cottonwood miner was not as plentiful as usual, though reports of it were received from widely separated localities. Some years it almost completely blackens the foliage of the cottonwood tree.

The Larder Beetle (*Dermestes lardarius* Linn.). This common American and European household pest was sent in a number of times as in previous years and was especially harmful to stored food products in private houses.

The Rosebud Curculio (*Rhynchites bicolor* Fab.). The rose curculio did some damage to cultivated roses but was not as abundant as previously.

The Spinach Carrion Beetle (*Silpha bituberosa* Lec.). There was considerable damage to sugar beets in some localities due to this insect. This damage was not as extensive as in some previous years.

The Ten-lined Leaf Chafer (*Polyphylla decimlineata* Say). There was one request for information about this large and showy beetle. It was doing no damage but merely had aroused the curiosity of the finder.

Wireworms (*Elatерidae*). Wireworms were not as troublesome as in previous years and no large areas of wheat were reported injured by them. There was a report of wireworms doing damage to potato tubers, but this was not extensive.

BEES AND ALLIED FORMS (HYMENOPTERA)

Alfalfa Seed Chalcid (*Bruchophagus funebris* How.). The alfalfa seed chalcid was found in the seeds of volunteer red clover in the western part of the State. An examination of clover seed sent into the State Grain Laboratory from various localities for testing, has not resulted in finding any more evidence of this very injurious insect.

The Leaf Cutter Bees (*Megachile* sp.). These bees drew considerable attention this season when the cut leaves of shade trees and shrubs were noticed. This insect cuts leaves of corn, roses, poplar, lilac, box elder and many shade trees. The nests were found in the soil and sent in by one inquirer.

THE OFFICE OF STATE ENTOMOLOGIST IN MONTANA

Many of the States in this country maintain a separate office of State Entomologist at a considerable expense in order that in addition to the research conducted at the Agricultural Experiment Station the various phases of the practical control of pests may be adequately cared for.

By an act of our legislative assembly approved March 4, 1903, the entomologist of the Experiment Station was designated as State Entomologist. He receives no compensation for his services other than that received from the State College but his necessary traveling, office, and laboratory expenses are paid from a small fund appropriated for the purpose. This sum was \$300 for the first year and was gradually increased during the following twelve years until \$2000 was appropriated. The last legislature appropriated for the expenses of the State Entomologist the sum of \$2700, but on account of shortage of funds only \$2000 was allowed by the State Board of Examiners.

This office has now been established fourteen years and during this time has witnessed many outbreaks of pests, some of which have been severe. It is believed that very much has been done to alleviate these outbreaks and that large sums of money have been saved to our farmers, gardeners, stockmen, and fruit growers.

Several additional laws have been passed, placing new duties on the State Entomologist. Including the original act, they are as follows:

State Entomologist Law: Session Laws, Eighth Legislative Assembly 1903, Chapter 59 (p. 124).

Insecticide and Fungicide Law: Session Laws, Twelfth Legislative Assembly, 1911, Chapter 26 (p. 38).

Pests and Plant Diseases Quarantine Law: Session Laws, Thirteenth Legislative Assembly, 1913, Chapter 61 (p. 117).

State Board of Entomology Law: Session Laws, Thirteenth Legislative Assembly, 1913, Chapter 120 (p. 466).

The duties of the State Entomologist are in addition to his regular duties at the State College and Experiment Station.

The duties of the State Entomologist's office alone have grown year by year **until they require a large amount of time and labor.** In June, 1916, an assistant on part time was employed to be the representative of this office in carrying out the provisions of the State Entomologist law. The man appointed is Mr. Howard L. Seamans, a graduate in entomology from this college in the class of 1916. He is well qualified both by training and natural abilities for his position. Two-thirds of his time is given to the work of this office and for this service he receives \$800 per annum, the remainder of his salary being paid by the college for teaching.

REVIEW OF THE PRINCIPAL STATE INTERESTS

IN ENTOMOLOGY IN 1916

THE ALFALFA WEEVIL

The alfalfa weevil is not a destroyer of alfalfa seeds as is often thought, but feeds both as a larva or grub and as an adult beetle on the green foliage of the alfalfa plant. This insect has been in Utah in injurious abundance for a considerable number of years and in recent years it has spread to the States of Idaho and Wyoming. Much damage has been done to the alfalfa industry in localities where the insect has been long established. Special and vigorous measures for the control of the alfalfa weevil are necessary where it is abundant, in order to secure a profitable crop of hay. To put these measures into operation and follow them energetically as must be done, is expensive. It is highly desirable, therefore, that

this insect be prevented, if possible, from gaining entrance into Montana. To this end, as has been previously reported, a quarantine has been established by proclamation of the Governor, which permits certain classes of agricultural products to be admitted into Montana only under rigid regulations. It is believed that this quarantine will do much to prevent or delay the introduction of this insect, which, if it should gain admittance and become established, would probably destroy annually many thousands of dollars worth of property for Montana farmers.

The first quarantine in Montana was established in 1913, and since that time further information regarding the alfalfa weevil has been accumulated by those who have been giving special attention to the subject. During the spring of 1915 a conference of the official entomologists of the western States was held at Salt Lake City, together with representatives of the State of Utah, the United States Bureau of Entomology and the Utah Experiment Station, for the purpose of acquiring all the information possible, exchanging ideas, and, if possible, agreeing on uniform regulations to be recommended to the several States for their consideration. The conference was very profitable for all and uniform recommendations were adopted. These recommendations became the basis of a revised quarantine proclamation, which was issued by Governor S. V. Stewart on June 24, 1916.

This proclamation follows:

Quarantine Proclamation

Whereas, It has become known to me that an injurious insect, popularly called the alfalfa weevil, and scientifically known as *Phytonomus posticus*, exists and is dangerously injurious to alfalfa in the State of Utah, and in certain counties in the State of Idaho, to-wit: Bear Lake, Oneida, Bannock, Franklin and Power, and in certain counties in the State of Wyoming, to-wit: Unida and Lincoln.

Now, therefore, I, S. V. Stewart, Governor of the State of Montana, under and by virtue of the authority conferred upon me by Chapter 61 of the Session Laws of the Thirteenth Legislative Assembly, do hereby declare and proclaim a quarantine against said State of Utah, and said counties of Bear Lake, Oneida, Bannock, Franklin and Power, in the State of Idaho, and the counties of Unida and Lincoln in the State of Wyoming, and forbid the importation into Montana of the following agricultural products and other articles, excepting under conditions and regulations as specified:

1. Alfalfa hay and other hays of all kinds, and cereal straws.
2. Fresh fruits and vegetables, exclusive of potatoes, excepting under the following regulations;
 - a. Shipments for Montana to be made only from points designated by the recognized State pest inspection officer of the State shipping into Montana, said officer to notify the State Horticulturist of the State of Montana by registered mail, or by telegraph, of the designation of all shipping points in the aforesaid State of Utah or counties of Bear Lake, Oneida, Bannock, Franklin and Power in Idaho, or counties of Unida and Lincoln in Wyoming; said notification to be sent, and its receipt to be acknowledged, before any shipments are made to the State of Montana from said designated points.
 - b. Shipments to be repacked from orchard or field boxes into new, clean boxes, or other fresh containers.
 - c. All wagons or other conveyances used in hauling to the place where repacking is conducted to be kept free of alfalfa hay, other hays, straw, and all other means of contamination.
 - d. All packing houses to be at all times free of alfalfa hay, other hays, straw, and other means of contamination.
 - e. Each package to be plainly stamped or tagged with an official certificate of the State from which the shipment originates, stating that it has been inspected and passed in compliance with these regulations and stating where it was repacked and inspected.
3. Potatoes unless accompanied by an official certificate signed by the recognized State pest inspection officer of the State from which such shipments of potatoes originate, setting forth that the potatoes have been passed over a screen, placed in fresh, clean sacks and packed in cars that are free of alfalfa hay or other means of contamination.
4. All nursery stock, unless accompanied by a special certificate setting forth that such nursery stock has been fumigated for the alfalfa weevil in an air-tight enclosure subsequent to being boxed, baled or packed for shipment, with cyanide of potassium or cyanide of sodium at the rate of one ounce to each one hundred cubic feet of enclosed space.
5. All agricultural emigrant movables, unless accompanied by an official certificate of inspection made under oath and setting forth that such agricultural emigrant movables have been inspected and found to be free of contamination by alfalfa hay, all other hays, and cereal straw.
6. All railway shipments of livestock unless shipped in cars that are free of alfalfa hay, all other hays, and cereal straw, throughout all that portion of the journey that is within the State of Utah and counties of Bear Lake, Oneida, Bannock, Franklin and Power in Idaho, and counties of Unida and Lincoln in Wyoming.

All Horticultural Inspectors of the State of Montana are hereby instructed and required to refuse admission into the State of Montana to all such articles as are herein designated from said State of Utah and counties of Bear Lake, Oneida, Bannock, Franklin and Power in Idaho, and counties of Unida and Lincoln in Wyoming, except under the conditions herein enumerated. If any such articles as are hereinbefore listed be shipped into the State of Montana in violation of this quarantine they must be at once destroyed or returned to the shipper at his expense.

This quarantine shall not be construed to interfere with shipments of produce to the Yellowstone Park over the Oregon Short Line Railroad, and to Idaho points via Montana over the Gilmore and Pittsburg Railroad.

This quarantine shall take effect and be in force on and after the first day of July, A. D. 1916.

It is specifically understood and intended that this quarantine proclamation shall revoke all previous proclamations on this subject by me made.

IN WITNESS WHEREOF I have hereunto set my hand and caused the Great Seal of the State to be affixed.

Done at Helena, the Capital, this the twenty-fourth day of June, in the year of our Lord one thousand nine hundred sixteen.

S. V. STEWART

By the Governor:

A. M. ALDERSON

Secretary of State.

THE ARMY CUTWORM

The army cutworm is one of our most important pests in Montana. In a previous publication we have stated that in the year 1915 about 100,000 acres of spring wheat was eaten off, requiring reseeding, and that this insect in that one year cost the State on wheat alone at least \$925,000. This loss would have been very much greater had it not been for the use of remedies which were brought to the attention of grain growers through the press and by correspondence. From all over the State we were assured that the remedy proposed, namely, the use of poisoned bran mash, was very effective. Much more grain could have been saved if this office had been notified earlier. This insect feeds on a wide variety of crops and plants and is capable of doing immense damage to agriculture in Montana in the years to come.

This outbreak afforded an opportunity which we had long been seeking to study the early stages and habits of the insect. Excellent

progress was made and a paper giving the results of the studies has been published in the Journal of Agricultural Research.

As a result of our studies it now seems clear that this insect is present in greater or less numbers every year and that there is probably some unsuspected damage done each season. During the spring of 1916 very little damage was reported. This further verifies our previous experience, which is that the army cutworm does not generally appear in very destructive numbers two years in succession.

From reports and specimens which have been sent to us this fall (1916) it is feared that some parts of the State will again be visited by these cutworms in the spring of 1917. From two localities in central Montana we have information that the very small cutworms were very abundant in October and that fall-planted wheat was completely eaten up. If further study of the situation indicates it to be desirable, warnings will be sent out in the spring.

THE WHEAT SHEATH MINER

(*Cerodonta femoralis* Meigen)

It is impossible to say at the present time how important the wheat sheath miner will become in Montana. There is almost no literature concerning it.

This insect is widely distributed in the State, but we have definite information regarding serious damage in only one locality in Missoula County. In one field of wheat it was found by actual count that 95 per cent of the plants were more or less injured, while an adjoining field of oats had 12 per cent damage. What we now know about this insect seems to indicate that it is a species which continues in destructive numbers year after year.

During the past two years an assistant, Mr. H. L. Seamans, has worked out the life history and habits of this important insect quite completely and a paper on the subject has recently been submitted for publication.

SUGAR-BEET ROOT-LOUSE

(*Pemphigus betae* Doane)

Extensive experiments in the control of the sugar-beet root-lice by irrigation were carried on at Huntley, under the Adams Fund. This is the third year that the work has been pursued and the results continue to be very satisfactory. It has been found that

not only is the root-lice controlled but that the tonnage and sugar content of the beets are distinctly increased by the method of irrigation advocated. It seems clear that this work will lead to very largely increased financial returns to sugar beet growers in Montana and other western States.

THE LESSER CLOVER LEAF WEEVIL

(*Phytonomus nigrirostris*)

During the past two years the lesser clover leaf weevil has appeared in great numbers and has been doing damage in one valley in western Montana. The insects feed on the growing clover and are found principally in the terminal growth and opening blossom heads. The larva or grub looks very much like the alfalfa weevil and might easily be mistaken for that insect.

This office has given careful attention to this weevil during the last two years and will continue the study when there is an opportunity.

THE SPINOSE EAR TICK

(*Orintheadoros megnini* Duges)

One of the surprises of the past year was the discovery of the Spineose ear tick on cattle in eastern Montana. This tick has the habit of infesting the ear passages of its host. Surprisingly large numbers of these ticks were taken from the ears of calves and young stock. The effects noted here are much the same as in other parts of the country. Infested stock is irritated and does not do well. Some lose flesh and some die. From what we know at the present time, it seems clear that this tick is present in several counties.

This has been looked upon as a southern species. It occurs in Mexico and in some of the southern States, but it was not supposed that it could endure our climate and be abundant enough to be injurious. In looking up its occurrence in Montana, it was learned that it had been present in the same localities for several years and we now think that this tick is liable to be an important pest. Further attention will be given to it and though no satisfactory remedies are now known, it is hoped that some may be found.

FOUL BROOD OF BEES

In each annual report of the State Entomologist since 1911, urgent attention has been called to the presence and rapid spread of American foulbrood disease in bees in Montana. We knew of it

soon after this disease came into the State but at that time the infection was confined to a small locality. At the present time it is known to be present not only in the Yellowstone Valley, where it first appeared, but as far west as the Bitter Root Valley. Both in the Gallatin Valley and in the Bitter Root Valley it is known to be rather common. No canvass or survey of the State has been made, but it is almost certain that this highly destructive disease of bees is now general in its distribution wherever bees are kept in Montana. We know of numerous beekeepers who are fighting a losing battle because they do not know how to combat the disease. Many have been driven from the industry already and it is as certain as can be that others will follow unless adequate statewide means of control are adopted.

Beekeeping is a natural and profitable part of diversified agriculture. Properly protected, the industry will annually yield a large profit to rural Montana. Experience has shown that the general run of beekeepers cannot control this disease unaided. The usual method is to have a law on the statutes providing for an inspector, who has authority to examine all bees and instruct how to eradicate the disease. He has authority to destroy bees that are not treated in accordance with his instructions, but he does not have to use this authority often. Beekeepers who wish to continue in the industry generally are glad of the assistance given by the State expert. The inspector, being a well informed man, naturally gives much valuable instruction in beekeeping. He becomes to a considerable extent a traveling instructor and his influence toward building up the bee industry is distinctly felt. Such a law further provides for defense against the introduction into the State of diseased bees or contaminated materials from other States.

The duties of an inspector of apiaries probably connect up with the State Entomologist's office more closely than with any other department of the State's service. The duties could be assigned to the State Entomologist provided sufficient funds were appropriated to employ a deputy for this particular duty. The inspection work alone would not be sufficient to employ the full time of a man. A part of his time might be employed in inspection and the remainder paid for by the Agricultural College for instruction of students in beekeeping or by the Experiment Station for research work, or a man might be temporarily employed during each summer.

By the latter way, however, it might be difficult to get the services of a competent man.

Experience has shown in other States that the inspection service greatly reduces the amount of disease, reestablishes confidence and permits the industry to build up again. Such a law should be passed in Montana.

NOTES ON THE MORE COMMON MOSQUITOES OF MONTANA

By J. R. Parker

That mosquitoes have long been troublesome in Montana is shown by referring to the Lewis and Clark Journal. Thus we find the following entries made by Lewis while the expedition was in the Missouri river valley between Canyon Ferry and Lombard: July 13, 1805, "It is impossible to sleep a moment without being defended against these (mosquitoes) most tormenting of all insects." July 19, 1805, "Musquetoes very troublesome to us as usual." On the return trip, while on the lower Yellowstone Captain Clark made the following entries: August 3, 1806, "Last night musquetoes were so troublesom that no one of the party Slept half the night." August 4, 1806, "Musquetoes excessively troublesom, so much so that the men complained that they could not work at their Skins and I find it entirely impossible to hunt in the bottoms, those insects being so noumerous and tormenting as to render it impossible for a man to continue in the timbered lands." August 5, 1806, "Musquetoes was so noumerous that I could not keep them off my gun long enough to take sight and by that means Missed." Numerous other references to the "very troublesom musquetoe" indicate that the Lewis and Clark Expedition considered the mosquito as one of the greatest drawbacks to the country through which they were traveling.

Mosquitoes are probably as abundant or even more abundant at present than they were in the days of Lewis and Clark. Reports are frequently sent to the office of the State Entomologist stating that livestock is kept in poor condition because it is pestered by mosquitoes, and more and more frequently are requests being received for aid in reducing the mosquitoes in the vicinity of towns and cities.

Acknowledgment is made of indebtedness to Mr. Frederick Knab of the United States National Museum, for the identification of specimens.

The State Entomologist has been able to give but little help in mosquito control work, primarily because the specific identity and the breeding habits of Montana mosquitoes were for the most part unknown, and, secondarily, because funds have never been available for securing such information nor for carrying out an experimental control program.

During the past three years, however, an attempt has been made to study mosquitoes as much as could be done without interfering with other branches of work already outlined. Members of the entomological staff have collected larvae and adults whenever possible, breeding places have been studied, and a few rearing experiments have been conducted. In this way considerable information and material have been collected and the purpose of this paper is to briefly discuss the more common species, which we have found within the State. It should be understood that no extended survey of the State has been attempted and that the species discussed were collected in a few widely separated localities.

MOSQUITOES OF THE GENUS AEADES

The great mass of the mosquitoes of Montana belong to species included by present-day workers in the genus *Aedes*. The general life history of the various species of *Aedes* mosquitoes as worked out by entomologists in other States is about as follows. The winter is passed in the egg stage. Snow water, spring or summer rains, or moisture from some other source causes the eggs to hatch at various intervals during the following season. The eggs do not necessarily all hatch at the first flooding, thus explaining why newly emerged mosquitoes may appear at subsequent floodings. Authorities state that the eggs of *Aedes* species never hatch the same year they are laid, but must be first subjected to the freezing of the winter season. The eggs are laid upon the ground. While the general outline of the life history is known, the details vary considerably in different species and in different localities. It is generally recognized that an accurate study of the life history of each species must be carried out in a locality before intelligent control work can be carried on.

Aedes curriei Coq.

This is the most abundant, the most widely distributed, and one of the worst biters of our Montana mosquitoes. In collections

of mosquitoes made in the river valleys and plains area a majority of the specimens collected will generally belong to this species.

Larval Records.—Our earliest seasonal record of larvae is May 6, and our latest August 22. This indicates that larvae are hatching from the eggs throughout the late spring and summer months whenever there is sufficient moisture to bring about hatching conditions.

The length of the larval period in eastern Montana was ascertained by Dr. R. R. Parker, in rearing experiments conducted in 1915. On July 16 an inch of rain fell, forming many temporary pools. Larvae collected from one of these pools on July 18 pupated on July 22 and emerged as adults July 25. On August 16 another heavy fall of rain occurred. Larvae collected August 22 from a pool formed by this rain pupated August 24 and emerged as adults August 27. Assuming that the eggs hatched within twenty-four hours after flooding, the larval period would be from five to seven days and the pupal period two to three days.

Larvae have been found in the following situations: "Irrigation water along roadside," "irrigation overflow," "temporary wayside pool," "permanent pool near railroad track," "pool connected with irrigating ditch," "irrigation water in alfalfa field," "temporary pool caused by summer rain."

Record of Adults.—The earliest seasonal record for adults is May 6 and the latest September 5. Specimens were taken on the latter date by H. L. Seamans at Whitehall even though there had been a severe frost the previous night. Adults were very abundant on this late date.

Adults have been found in the following situations: "On edge of slough," "in river bottom," "in town," "hotel porch," "alfalfa field," "damp place in willows," "blue-joint meadow," "sweet clover along railroad track," and in all manner of places.

The adults are voracious at all times except when forced into inactivity by low temperatures or high winds.

Distribution.—This species has been taken in the following localities: Harlem, Chinook, Turner, Miles City, Hardin, Laurel, Huntley, Bozeman, Three Forks, Lombard, Salesville, Dillon, Armstead, Cascade, and Judith Basin.

Aedes sylvestris Th.

Aedes sylvestris is second in importance only to *Aedes curriei*. It occurs in about the same localities, but in our collecting *sylvestris* has occurred in smaller numbers.

Larval Records.—The earliest seasonal record of larvae is May 19 and the latest August 22. The length of the larval stage is about the same as that of *A. curriei* and these two species have been taken repeatedly from the same pool.

Larvae have been found in the following situations: "Temporary pool in town," "pool formed by overflow of irrigation water," "small rather permanent pools," "waste irrigation water," "pool in edge of alfalfa field," "temporary pool caused by spring rains," "temporary roadside pool," "temporary pool caused by summer rains."

Record of Adults.—Our earliest seasonal record of adults is June 4 and our latest August 29. The adults are bad biters both day and night.

Adults have been found in practically the same situations as recorded for *A. curriei*.

Distribution.—This species has been taken in the following localities: Harlem, Chinook, Turner, Miles City, Forsyth, Billings, Laurel, Huntley, Hardin, Bozeman, Three Forks, Lombard, Dillon, Cascade and Florence.

Aedes nigromaculis Lud.

This species is a bad biter and occurs in abundance in some localities, but is not as widely distributed nor as abundant as the two species already discussed.

Larval Records.—The only records of larvae are as follows: "Temporary overflow from irrigation ditch," August 28; "temporary, muddy roadside pool," August 14; "temporary pool in town," August 8.

Record of Adults.—The first seasonal record of adults is June 4 and the last September 5.

Adults have been taken in the following situations: "Edge of slough," "grass above temporary pool," "alfalfa field," "along road," "prairie grass," "at light in towns," "blue-joint meadow," "river valley," "near stock yards," "in grass above pool which had dried out."

It has been noticed that this species is not as bad a biter in daylight as are *curriei* and *sylvestris*; toward nightfall, however, they become exceedingly ferocious.

Distribution.—This species has been collected in the following localities: Harlem, Miles City, Laurel, Big Timber, Cascade, Hardin, Huntley, Powderville, Bozeman, Three Forks, and the Judith Basin. It appears to be especially abundant in eastern Montana.

Aedes spencerii Th.

This species ranks fourth in importance among the species which we have collected.

Larval Records.—The earliest larval record is May 28 and the last June 28.

Larvae have been found in the following situations: "Water on edge of alfalfa field," "temporary pool caused by spring rains," "irrigation water in clover field."

Record of Adults.—The earliest seasonal record for adults is May 6 and the latest July 11.

Adults have been taken in the following situations: "Wild grass," "blue-joint field," "wheat field."

This species is a bad biter both day and night.

Distribution.—*Aedes spencerii* has been taken in the following localities: Cascade, Harlem, Turner, Hardin, Judith Basin, Three Forks, Huntley, and Bozeman.

Aedes pullatus Coq.

While this species has not been found in many parts of the State, it is extremely annoying in several of the higher mountain valleys.

Larval Records.—The only larvae of this species which we have found were taken June 13 in small pools found in tracks made by stock in marshy ground.

Record of Adults.—Taken in timber at high altitudes.

Distribution.—Warm Springs, July 1; Gallatin Mountains, June 30; Bridger Mountains, June 18. Further collecting in the higher parts of the State will probably show this species to be quite generally distributed.

Other Aedes Species

The following species of *Aedes* have been collected but not in numbers large enough to warrant considering them at present of

much economic importance: *A. campestris* D & R, *A. fletcheri* Coq., *A. stimulans* (group), *A. idahoensis* Th., *A. hirsuteron*, and *A. fuscus* O. S.

MOSQUITOES OF THE GENUS CULISETA

To this genus belong several species of Montana mosquitoes. Although they are biters, they seldom occur in such numbers as to be annoying. Unlike the *Aedes*, these species pass the winter as the adult and the eggs are laid directly in the water in more or less permanent pools.

We have collected *Culiseta* larvae in the following situations. "Cat-tail swamp," "alkali pool near swamp," "permanent swamp," "swamp along railroad," "irrigation overflow," "horse track filled with irrigation water."

Four species have been found, namely, *Culiseta inornatus* Williston, *C. incidens* Thompson, *C. inpatiens* Walker and *C. alaskensis* Lind. The two most common species are *inpatiens* and *inornatus*.

MOSQUITOES OF THE GENUS CULEX

Only two species in this large group have been found in Montana, namely, *C. tarsalis* Coq. and *C. territans* Walk. *Culex* species are continuous breeders, that is, eggs are deposited directly in the water and hatch the same season. More or less permanent pools are the typical breeding places.

Culex tarsalis Coq.

This is by far the more abundant of the *Culex* species found in Montana.

Larval Records.—Our earliest seasonal record for larvae is June 22 and the latest August 28.

Larvae have been taken in the following situations: "Roadside pool," "small permanent pool," "cat-tail pool," "horse tracks in permanent swampy ground," "deep water in cat-tail swamp," "alkali pools near swamp," "permanent swamp along railroad," "water from irrigations," "pools formed by June rains in marshy ground."

Record of Adults.—Our only capture of adults was made by Dr. R. R. Parker at Laurel in 1914. In connection with a study of house-fly conditions, Hodge fly traps were placed so as to capture all the insects that escaped from the rear of a privy, the door of

which was usually open and the seats uncovered. Among the many insects captured during the month when the traps were in place, July 21 to August 21, were nine specimens of *Culiseta inornatus* and one hundred and thirty-seven specimens of *Culex tarsalis*.

We have no records of *C. tarsalis* taken while biting, although other writers state that they bite at night.

Distribution.—*C. tarsalis* has been taken in the following localities: Victor, Laurel, Yegen, Park City, Three Forks, and Hardin.

Culex territans Walk.

Our only record of this species is at Laurel where the larvae were taken in small permanent pools on August 25, 1914.

MOSQUITOES OF THE GENUS ANOPHELES

This genus is of interest because to it belong the species of mosquitoes which transmit malaria.

Anopheles occidentalis D & K

This is the only species which we have found in Montana and of this we have only three records, which are as follows: along creek, Missoula, June 24, 1914, by R. A. Cooley; in river bottom, Cascade, June 4, 1914, by J. R. Parker; in cabin, Powderville, April 21, 1916, by R. R. Parker.

THE STATE BOARD OF ENTOMOLOGY

The State Entomologist is by law the secretary of the State Board of Entomology, which is charged with the investigation and control of insects which transmit human and animal diseases. The membership of this board is all *ex officio* and all serve without compensation other than that received in their regular positions. The members of the board are the secretary of the State Board of Health (chairman), the State Veterinary Surgeon, and the State Entomologist.

The situation regarding the spotted fever tick will be discussed at length in the report of the Board of Entomology. The work has been continued with success during the past two years. In addition to the work in western Montana we have taken up a study of the tick and fever conditions in the eastern part of the State.

Further attention has been given to the study of the means of control of the house fly.

NEEDS AND PLANS FOR THE NEXT TWO YEARS

We have no plans for expansion of the activities of the State Entomologist's work other than to meet the actual demands made upon us. No two years are alike with respect to pests that become abundant and require attention and each year some new ones appear or come into prominence.

Most of the demands come either by letter or telegram. Many can be taken care of from the office after an examination of the specimens sent in, but in many cases it is necessary for some one to go to the town from which the complaint comes. It is often necessary to keep the insects alive in the insectary in order to study them and learn their identity and habits. Books and equipment are also necessary.

In all of these matters we cannot permit the research work conducted under Federal research funds to be interfered with. The two lines of work—research and State work—are entirely separate and we cannot use Federal funds for the State control work.

The following sums should be provided for the next two years:

	1917	1918
Salary of assistant.....	\$900	\$1050
Traveling and field expenses.....	1000	1000
Laboratory expenses	600	600
Equipment and supplies.....	300	350
	<hr/>	<hr/>
Totals.....	\$2800	\$3000