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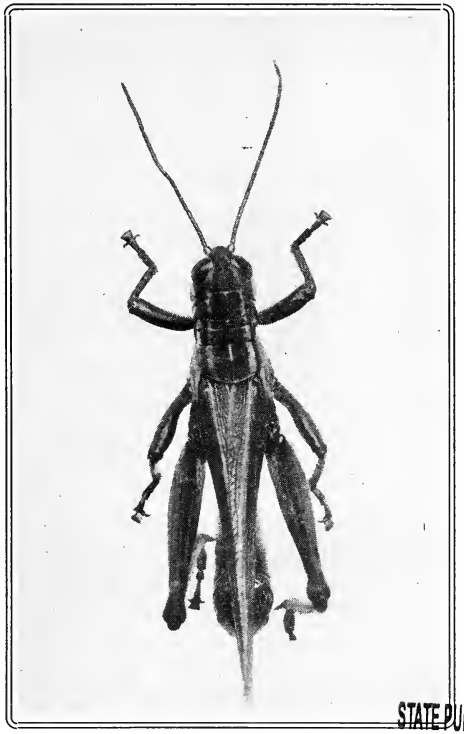
Montana Insect Pests
1949-1950

Thirty-Third Report Of The State Entomologist



MONTANA STATE COLLEGE
AGRICULTURAL EXPERIMENT STATION
BOZEMAN, MONTANA

Bozeman, Montana

To His Excellency
Governor John W. Bonner
State House
Helena, Montana

My Dear Governor Bonner:

I am submitting herewith the Thirty-Third Report of the State Entomologist of Montana. This report contains information concerning insect control programs, the status of the more important and unusual insects, and a preliminary report of range grasshopper investigations. In those cases where control measures have proven to be reliable, they are included in the discussion.

It has been possible during the last biennium to meet more of the demands made upon this office. For example, 74 educational and/or demonstrational meetings were held with a total attendance of 2,512 persons; 1,170 inquiries concerning insect identification, control, and general information were answered; and 72 publications, articles, and radio scripts were issued. This is a substantial increase over the previous biennium. In addition to the above, the monthly publication, "Bugs," which embodies the latest insect control recommendations, is currently sent to about 300 interested people in Montana.

The preliminary report on range grasshopper investigations represents an initial step in the development of an outbreak prevention program. Additional funds over and above those required for the normal operations of this office will be needed to pursue this investigation to its desirable conclusion. An additional budget request has been submitted for this purpose.

Respectfully submitted,

James H. Pepper
State Entomologist

MONTANA INSECT PESTS
1949 and 1950

THIRTY-THIRD REPORT OF THE STATE ENTOMOLOGIST

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INTRODUCTION

It is apparent that the entomological outlook for Montana presents an ever continuing series of new problems. This is to be expected with the general increase and intensification of agriculture which is occurring along with the introduction and spread of new insect pests. Fortunately, new insecticides, new methods of application, and in many cases, fundamental research, are keeping pace with these new problems. However, it is obvious that the efforts to stay ahead of these insect pests cannot be relaxed, for if they are, the insects will in all probability deal serious blows to our agricultural economy.

Grasshoppers, Montana agriculture's leading insect enemy, have been present in increasing numbers during the last biennium. It is quite possible that the outbreak peak has not as yet been reached, and that therefore more severe intestations may be expected during the next biennium. In general, farmer response and control methods have improved to the point that extensive crop and range protection have been realized. It has been demonstrated that recently developed control measures have provided an economical and practical means of killing grasshoppers. This makes it possible to start working on the heart of the problem, that of preventing outbreaks. Once the biological fundamentals which are responsible for grasshopper outbreaks are mastered, it is reasonable to assume that it will be possible to apply our new methods of killing grasshoppers in a manner so as to prevent widespread devastating infestations.

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A gradual but continual spread of Montana's No. 2 agricultural insect pest, alfalfa weevil, has been noted. It appears that alfalfa weevils are spreading west up the Yellowstone River Valley, and infestations north as far as Lewistown have been observed. New methods for controlling the alfalfa weevil have been worked out through extensive investigations and the development of a new insecticide which now make it possible for farmers and ranchers to prevent the serious losses which have been inflicted on alfalfa hay and seed crops.

Weather conditions were unfavorable for Rescue wheat to produce its maximum sawfly resistance qualities in 1950. Consequently, sawflies again appeared to be more numerous. Further tests on all of the wheat varieties available are being conducted, and a number of these show promise of sawfly resistance.

Recent investigations of mosquito control, under Montana conditions, have provided information which for the first time makes large scale control programs practical. It is intended to take this information into those areas where mosquitoes are a problem.

The new potent insecticides which have been introduced and are continually appearing along with new methods of using these materials have presented many problems from the standpoint of proper handling and use. The educational programs conducted during the last biennium have for the most part been effective in getting the needed information to the public. However, further expansion and intensification of these educational programs is desirable in order to prevent the few cases of misrepresentation, misuse, and ineffective insect control that are currently being experienced.

GENERAL FEEDERS

GRASSHOPPER CONTROL

1949 SEASON

As anticipated (see Thirty-Second Report of the State Entomologist), there was a general increase in grasshopper numbers throughout the state in 1949 as compared with 1948. The severity of grasshopper damage in the infested areas was greatly increased by the dry condition which prevailed throughout most of the growing season. Economic grasshopper populations occurred on the range and crop lands in most of southeastern Montana, particularly in parts of Yellowstone, Big Horn, Treasure, Rosebud, Custer, and Powder River counties. In general, most of northeastern Montana was infested with grasshoppers with the 'hopper populations in Daniels County reaching near outbreak proportions. Economic populations of a more localized nature occurred in the south central, north central, and northwestern portions of the state. The

species distribution in crop lands remained somewhat the same as in past years. The predominant species were *Melanoplus mexicanus, Melanoplus bivattatus, Melanoplus packardii,* and *Melanoplus differentialis* (southeastern area).

1949 should prove to be historically important because the first large scale attempt to control range land grasshopper infestations occurred during that year. This attempt was, for the most part, successful and what is probably more important paved the way for the development of more economical and reliable means of controlling range grasshopper infestations. A total of $767,046.97 was expended on this range land program in Montana. Of this amount, approximately $50,000 was state funds, $127,264.35 was county and private land owner funds, $588,487.62 was Federal Bureau of Entomology and Plant Quarantine funds, and $1,295.00 was funds from other federal agencies. A total of 3,863 tons of chlordane and toxaphene dry bran bait was used to treat 949,292 acres of Montana range lands. An average of about 7½ pounds of bait per acre was applied at rates varying from 5 to 15 pounds per acre. Most of the initial baiting was done at the rate of 5 pounds of bait per acre which was found to be insufficient where high populations of grasshoppers occurred. As a result, 181,800 acres had to be rebaited.

Nearly all of the baiting in this program was accomplished by aircraft. The practicability and efficiency of this type of application on vast range land areas was clearly demonstrated.

In general, the control of grasshoppers realized from range baiting was fair to excellent. Occasionally, situations were encountered where many 'hoppers apparently were not feeding on the ground, and thus did not contact and consume the bait. Apparently grasshoppers will only eat bait when they accidentally contact it. Two species of grasshoppers, *Metator pardalinus* and *Phoetaliotes nebrascensis*, apparently would not take bait under any circumstances as adults.

The savings to stockmen resulting from grasshopper control on range lands in 1949 was conservatively estimated to be $2,321,641.

This range land grasshopper control program, like most initial programs, was not perfect in every respect. It is hoped that the following noted imperfections will be of value in planning and perfecting range land grasshopper control programs in the future:

(1) To accomplish a complete job approximately 6,000,000 acres would have had to have been treated. The $767,046.97 available would treat only about 1/6 of this area. It would have required, therefore, about $4,600,000 to do a complete job. It is doubtful if a legislative request for such a sum would receive a great deal of consideration.

(2) Areas had to be delimited in which the available funds could be used. This is difficult if not impossible to accomplish in a fair manner when only approximately 16% of the total infested area can be treated.

(3) It is impractical for stockmen to rely on the availability of governmental funds when in outbreak years (which cannot be accurately predicted) their entire operation may be at stake.

(4) As has been previously indicated, the toxaphene or chlordane dry bran bait is not effective at all times against range land grasshoppers under Montana conditions.

It will be noted in the 1950 program that some of these imperfections have been successfuly dealt with. In the section headed "Grasshopper Investigations", it will be seen that other imperfections are receiving extensive consideration. The ultimate objective should probably be a program of outbreak prevention—stopping the grasshoppers on a much smaller scale before they get started. This objective is well within the realm of reason, and it can in all probability be accomplished by the individual stockman to his direct economic advantage.

Sodium fluosilicate bran sawdust wet bait materials were made available to those counties desiring to participate in a crop land bait program to the extent of mixing the bait and making it available to farmers. During 1949, 1,594 farmers and ranchers participated in spreading sodium fluosilicate wet bait. Approximately 877,807 acres of crop lands were protected by this program which represented an estimated saving of $6,885,636 to the farmers and ranchers. In addition, an estimated 63,218 acres were protected by chlordane sprays, and 282,320 acres were protected by toxaphene sprays. A grand total of 1,223,345 acres was, therefore, protected by the crop land grasshopper control program. It is estimated that, in spite of this rather extensive crop land grasshopper control program, $6,982,889 worth of crops were destroyed by grasshoppers in 1949.

1950 SEASON

There were more grasshoppers over the state as a whole in 1950 than there were in 1949. In general, the damage was moderate due to excellent growing conditions for crops and range plants. Economic populations occurred in the north central (east to North Dakota), southeastern, and south central portions of the state. Smaller, more localized infestations occurred in the extreme northwestern and southeastern areas. The grasshopper species distribution was about the same as in 1949, except that *Camnula pellucida* was present in greater numbers in the north central and northwestern areas.

A cooperative range baiting program was organized in southeastern Montana with the Federal Government through its Bureau of Entomology and Plant Quarantine Grasshopper Control Division furnishing the bait materials, the counties mixing the bait, and the individual ranchers hiring aircraft to apply the bait. Ninety-two thousand acres of privately owned range land were baited under this program. In addition, the Federal Government baited 142,000 acres of public domain entirely at federal expense. Sodium fluosilicate bran sawdust wet bait was not used on crop lands during the growing season. Only 79,540 acres were baited for fall protection of newly seeded winter wheat. Farmers and ranchers made extensive use of toxaphene, chlordane, and aldrin insecticides for crop and range grasshopper control as recommended. It is estimated that a total of 700,000 acres of crop and range land were protected in this manner. Aldrin, a new chlorinated hydrocarbon insecticide, was used on a testing basis applied principally by aircraft, on approximately 80,000 acres of crop and range land. Excellent results were obtained with this insecticide, and it will probably be used extensively in the future, primarily because of its low cost per acre.

OUTLOOK FOR 1951

It is difficult, if not impossible, to consistently predict grasshopper outbreaks with a reasonable degree of accuracy. On the basis of past history and the information available, the following is expected for 1951: An increase in grasshopper numbers in an area running diagonally through the central part of the state from Billings to Great Falls, and extending nearly to the Canadian border; an increase of grasshoppers in the area from Great Falls east to Valley County and from the Canadian border to the Missouri River; an increase in grasshoppers in the Gallatin and Shields River valleys; an increase in grasshoppers in the general area infested in 1950 in Missoula, Lake, Sanders, Flathead, and Lincoln counties; a reduction in grasshoppers in the southeastern area from Billings east and south of the Yellowstone River; and a reduction of grasshoppers in the northeastern area including Daniels, Sheridan, Roosevelt, and Richland counties.

RANGE GRASSHOPPER INVESTIGATIONS

These investigations of range grasshoppers, their plant associations, and the damage caused by the 'hoppers were supported jointly by the State Entomologist, Montana Agricultural Experiment Station, and Montana State College. This represents a preliminary step in what is hoped will become a project which will get at the fundamentals behind grasshopper outbreaks. It is conceivable that once these fundamentals are mastered, it would then be possible to economically prevent grasshopper outbreaks.

1949-1950 MONTANA RANGE GRASSHOPPER STUDIES

Range grasshopper studies were carried out during 1949 and 1950 on the Kendrick Cattle Company OW Ranch, Decker, Montana. Daily observations of grasshopper activities were made from the time of the first hatch in the spring until the majority of the 'hoppers had disappeared in the fall. Grasshopper populations were sampled and utilization of grasses in the two dominant vegetative types found in the area was measured. In addition, daily temperature and precipitation records were kept.

Within a forty acre range land area of the OW Ranch, the following grasshopper species were found in 1949:

(1) *Acrydium granulatum* Kirby
(2) *Acrydium acadicum acadicum* (Scudder)
(3) *Pseudopomala brachyptera* (Scudder)
(4) *Mermeria maculipennis* Bruner
(5) *Opeia obscura* (Thomas)
(6) *Aeropedellus clavatus* (Thomas)
(7) *Psoloessa delicatula* (Scudder)
(8) *Ageneotettix deorum* (Scudder)
(9) *Drepanopterna femoratum* (Scudder)
(10) *Aulocara elliotti* (Scudder)
(11) *Eritettix tricarinatus* (Thomas)
(12) *Acrolophitus hirtipes* (Say)
(13) *Amphitornus coloradus* (Thomas)
(14) *Phlibostroma quadrimaculatum* (Thomas)
(15) *Cordillacris crenulata* (Bruner)
(16) *Orphulella pelidna* (Burmeister)
(17) *Camnula pellucida* (Scudder)
(18) *Encoptolophus costalis* (Scudder)
(19) *Chortophaga viridifasciata* (DeGeer)
(20) *Dissosteira carolina* (Linnaeus)
(21) *Hippiscus rugosus* (Scudder)
(22) *Arphia pseudonietana* (Thomas)
(23) *Arphia conspersa* Scudder
(24) *Hadrotettix trifasciatus* (Say)
(25) *Spharagemon equale* (Say)
(26) *Spharagemon collare* (Scudder)
(27) *Xanthippus corallipes* (Haldeman)
(28) *Aerochoreutes carlinianus* (Thomas)
(29) *Circotettix rabula* Rehn and Hebard
(30) *Trimerotropis cincta* (Thomas)
(31) *Trimerotropis campestris* McNeill
(32) *Trimerotropis bruneri* McNeill
(33) *Derotmema haydeni* (Thomas)
(34) *Metator pardalinus* (Saussure)
(35) *Trachyrhachis kiowa* (Thomas)

(36) *Schistocerca lineatum* Scudder
(37) *Hesperotettix viridis* (Thomas)
(38) *Hypochlora alba* (Dodge)
(39) *Aeoloplus turnbulli* (Thomas)
(40) *Phoetaliotes nebrascensis* (Thomas)
(41) *Melanoplus dawsoni* (Scudder)
(42) *Melanoplus mexicanus* (Saussure)
(43) *Melanoplus keeleri* (Thomas)
(44) *Melanoplus infantilis* Scudder
(45) *Melanoplus confusus* Scudder
(46) *Melanoplus bivittatus* (Say)
(47) *Melanoplus differentialis* (Thomas)
(48) *Melanoplus bowditchi* Scudder
(49) *Melanoplus femur-rubrum* (DeGeer)
(50) *Melanoplus occidentalis* Thomas
(51) *Melanoplus gladstoni* Scudder
(52) *Melanoplus packardii* Scudder

Approximately one-third of the above grasshopper species were too few in number to make detailed observations of their activities. It was possible, however, to make detailed observations of the remaining 'hopper species.

The results of detailed observations indicate that there is great variance in the feeding habits and food-plant preference of those range grasshoppers studied. Fifteen of the species *(3, 4, 5, 8, 9, 10, 13, 14, 15, 18, 21, 22, 34, 35, 40) were found to be strictly grass feeders. The majority of these species may be considered to be general grass feeders, although a decided preference for certain species of grass was evident when these grasses were available to the 'hoppers. Five of the grass feeding 'hopper species *(5, 13, 14, 15, 35) were found to be so highly selective in their feeding that they were found only in areas where the grass which they preferred was growing.

Nine species *(20, 24, 31, 32, 36, 37, 38, 39, 48) of range grasshoppers ignored the grasses entirely and fed solely upon forbs. As was the case with grass-feeding 'hoppers, a certain amount of preference in the selection of plants eaten was demonstrated by the forb-feeding 'hoppers. It was noted that one *(39) species of grasshopper fed only on the fleshy forb members of one plant family (Chenopodiaciae); two others *(38, 48) fed only on the five sagebrush species found in the area. The common rosebush was the main diet for another species of grasshopper *(36) and broom-snake weed was eaten mainly by one species *(37).

In addition to those 'hoppers found to be specific on either the grasses or the forbs found on the range, ten species *(12, 25, 26, 33, 42, 44, 46, 49, 51, 52) were noted feeding on both forbs and grasses.

*Refers to species listed above.

As the young of some grasshopper species developed, changes in their feeding habits were noted. In the earlier stages of their development some were found feeding mainly on dry plant materials found on the ground. As they developed, green food-plants were included more and more in their diet. Some species consumed large quantities of dry plant materials throughout their life while others never included dry plant materials in their diet. After some species reach the adult stage in their development very little feeding can be detected.

1950 MONTANA RANGE PLANT STUDIES

The area studied comprised approximately two sections of range land on the OW ranch, 22 miles southeast of Decker, Montana. The distribution of vegetation in this region is determined by variations of topography and soils. A resistant sandstone stratum caps the higher plateaus. The dominant vegetation on the sandy loam soils, derived from the weathering of the underlying sandstone, is big sagebrush *(Artemesia tridentata)*. Sparse stands of ponderosa pine *(Pinus ponderosa)* occur along the edges of these mesas and along the ravines which cut into them. The steep slopes below the pines are thinly populated with big sagebrush, snake weed *(Gutierrezia sarothrae)*, yucca *(Yucca glauca)*, blue grama grass *(Bouteloua gracilis)*, side oats grama *(Bouteloua curtipendula)*, little bluestem *(Andropogon scoparius)*, mat muhly *(Muhlenbergia squarrosa)*, june grass *(Koeleria cristata)*, red three-awn *(Aristida longiseta)*, and various herbaceous plants such as wild alfalfa *(Psoralea tenuiflora)*, prairie clover *(Petalostemon purpureus)*, sulphur flower *(Eriogonum* sp.*)*, and pussy toes *(Antennaria* sp.*)*.

Deep, well-drained alluvial fans which slope gently downward from the steeper eroded slopes support a dominant stand of big sagebrush with june grass, needle-and-thread *(Stipa comata)*, and blue grama.

Hills and benches of lower elevation are capped with beds of scoria. Practically pure stands of bluebunch wheatgrass *(Agropyron spicatum)* are present on gravelly sands which have weathered from the scoria parent material on top of the hills and benches and on steep north-facing slopes. Sandy loam soils on the top of the benches and on the gentler slopes support a dominant stand of needle-and-thread and western wheatgrass *(Agropyron smithii)* with some june grass, feather bunch grass *(Stipa viridula)*, and blue grama. Gravelly soils on steep west-facing and south-facing slopes are populated with little bluestem, side oats grama, red three-awn, mat muhly, blue grama, snake weed, and yucca. Heavy clay soils in the swales and valley bottoms are dominated by western wheatgrass. On lighter soils around the periphery of

this type, feather bunchgrass becomes more abundant, forming dominant stands. On deep clay soils at lower elevations where subsoil moisture is present, stands of silver sage *(Artemesia cana)* and greasewood *(Sarcobatus vermiculatus)* occur.

From the standpoint of grazing value, the communities dominated by western wheatgrass and needle-and-thread western wheatgrass are of greatest importance. Representative areas of both of these types were selected for study in an area which had been sprayed with approximately 1⅔ ounces of aldrin per acre to control grasshoppers and in a comparable unsprayed area. The percentage of ground cover of the various plant species in each community was determined by the point method of analysis. The percentage of ground cover for the western wheatgrass type is given below.

WESTERN WHEATGRASS TYPE

Name of Species	Percentage of Ground Cover	
	Sprayed Area	Unsprayed Area
Agropyron smithii	11.9	9.3
Bouteloua gracilis	0.1	0.5
Bromus japonicus	0.9	2.4
Festuca octoflora		0.1
Koeleria cristata		0.1
Poa secunda	0.5	1.0
Schedonnardus paniculatus		1.2
Stipa comata	0.1	0.2
Stipa viridula	0.8	
Astragalus sp.	0.5	
Artemesia frigida	0.2	0.6
Draba nemorsa	0.2	
Eurotia lanata		0.1
Gaura coccinea	0.1	
Lactuca sp.	0.1	
Lappula occidentalis	0.3	
Lepidium densiflorum	0.6	0.3
Leucocrinum montanum	0.1	
Malvastrum coccineum	1.0	0.1
Opuntia polyacantha		0.6
Phlox hoodii	1.1	
Plantago purshii	0.2	1.0
Taraxacum officinalis	0.2	
Tragopogon pratensis	0.8	0.1
Vicia americana	0.7	
Total Density	20.0	17.6

The percentage ground cover for the needle-and-thread western wheatgrass community is given below.

NEEDLE-AND-THREAD WESTERN WHEATGRASS TYPE

Name of Species	Percentage of Ground Cover	
	Sprayed Area	Unsprayed Area
Agropyron smithii	1.7	1.0
Aristida longiseta		0.2
Bouteloua gracilis	1.7	1.2
Bromus japonicus	0.3	3.5
Koeleria cristata		1.9
Poa secunda	0.3	0.3
Stipa comata	7.0	7.6
Stipa viridula	1.2	1.5
Carex spp.	0.3	1.5
Artemesia frigida	1.5	1.3
Artemesia tridentata		0.6
Cirsium undulatum	0.3	0.2
Malvastrum coccineum		0.7
Opuntia polyacantha		1.0
Phlox hoodii		0.1
Tragopogon pratensis		0.3
Total Density	14.3	22.9

In order to obtain a measure of grasshopper utilization, the grasses in plots four square feet in area were clipped in the two community types in both the sprayed and unsprayed areas. The first plots were clipped from July 6-14, immediately after the spraying operation; and two successive clippings at monthly intervals were made in the same area in which the first clippings were made. The plots were laid out at 10 foot intervals in the first clipping and subsequent clip plots were located adjacent to those clipped the first time. The weights of grasses obtained are expressed in pounds per acre air dry weight. A total of 87 plots were clipped in the sprayed area, and 114 plots in the unsprayed area. Grasshopper populations were measured by the cage method approximately every third day in the areas of study. The average population over the two months clipping period is given in the following table:

WEIGHT OF GRASS CLIPPINGS
(Expressed in Pounds Per Acre Air Dry Weight)

	Grasshoppers per Square Yard	First Clip	Second Clip	Third Clip	Increase or Decrease
Sprayed Area					
Wheatgrass Type	Total <1	442	545	612	+150
Needlegrass-Wheatgrass Type	Total <1	660	800	696	+ 36
Unsprayed Area					
Wheatgrass Type		521	329	269	-262
(a) Grass Feeders	4				
(b) Grass-Forb Feeders	2				
(c) Forb Feeders	<1				
Needlegrass-Wheatgrass Type		564	516	316	-248
(a) Grass Feeders	4				
(b) Grass-Forb Feeders	3				
(c) Forb Feeders	1				

The decline in weight of grass as a result of grasshopper utilization in the unsprayed area amounted to 262 pounds per acre in the wheatgrass type and 248 pounds per acre in the needlegrass-wheatgrass type, or 255 pounds per acre when expressed as an average of the two. There was a gain in weight of 150 pounds per acre on the wheatgrass type in the sprayed area, and 36 pounds per acre on the needlegrass-wheatgrass type, which would give an average figure of 93 pounds per acre. Total utilization by grasshoppers would be the sum of the loss in weight on the unsprayed area plus the gain in weight on the sprayed area. This would amount to 412 pounds per acre on the wheatgrass type and 248 pounds per acre on the needlegrass-wheatgrass area, an average of 380 pounds per acre. If one were to assume that in the absence of grasshopper utilization this range would yield the weight of grass present on the date of the third clipping on the sprayed area, the amount of grass consumed by 'hoppers would amount to 54% of the total yield.

A 1,000 pound beef cow requires 22 pounds of air dry forage per day which would amount to 7,920 pounds per year. Since the 'hoppers removed 380 pounds of grass per acre, the forage they removed from 20 acres of range would carry a 1,000 pound steer for a year. The grazing capacity of this range runs about 35 acres per head; hence, if grasshopper populations were eliminated, grazing capacity could be increased by approximately 50%.

OTHER IMPORTANT PESTS

MORMON CRICKETS *(Anabrus simplex)*

In general, Mormon crickets appeared to be building up in 1949. This condition was more apparent in 1950. Although no crop damage occurred either year, it was considered advisable to treat several of these cricket build-up areas in an effort to head off outbreaks that may occur from these areas in future years. The largest area baited in the 1950 preventive program involved some fifteen sections of land which were primarily range lands and were located in Cascade County south of Ulm. This baiting was accomplished with a DC-3 aircraft owned by the Federal Bureau of Entomology and Plant Quarantine in a program sponsored jointly by the Federal Bureau of Entomology, Cascade County, and the Office of the State Entomologist. In spite of considerable rain on the toxaphene dry bran bait, shortly after and for some period after application, the results were excellent.

In addition to the area baited in Cascade County, the Federal Bureau of Entomology baited 1,600 acres of federal land southeast of Hardin. This was accomplished with smaller aircraft owned by the Bureau of Entomology.

It is practically impossible to predict with any degree of accuracy the probable Mormon cricket infestations in the next several years. It is, however, clear that during the past several years Mormon crickets have been building up in Montana. It is, therefore, reasonable to assume that one or more Mormon cricket outbreaks can be expected in the state in the relatively near future. Fortunately, we now have the insecticides and methods to successfully and economically fight Mormon crickets. It is hoped that it will be possible to prevent outbreaks by the elimination of outbreak source areas as they become known.

GARDEN SLUGS *(Agriolimax* sp.)

Garden slugs have been an important pest to home gardens in the western and south central parts of the state during the last two years. In general, they appeared to be more numerous in 1949 than in 1950. Baits containing metaldehyde with sodium fluosilicate or an arsenical as the toxicant have been effective.

WHITE GRUBS *(Phyllophaga* sp.)

The observation in the last biennial report, "It appears that white grubs are becoming more common throughout the state", apparently was correct. During the last two years white grubs have been reported or found in nearly every county in the state. Economic damage has occurred in some cereal crops, potato plantings, and strawberry beds. In most cases, this damage occurred where plantings were made on land that was previously in sod.

ARMY CUTWORMS (*Chorizagrotis auxiliaris*)

These destructive Lepidopterous larvae were not reported or observed in 1949. In the spring of 1950 a moderate to severe outbreak of army cutworms occurred in Big Horn, Yellowstone, Carbon, Stillwater, Fergus, and Gallatin counties. Less severe, more localized infestations probably occurred in areas adjacent to the larger infestations. The greatest damage from this outbreak occurred in April, primarily on fall planted winter wheat and alfalfa. In the more severely infested areas, high populations of army cutworms were evident in range land adjacent to cultivated areas as well as in the cultivated areas. Comparatively cool, damp weather occurred in May and persisted throughout the balance of the spring. Very little damage occurred after the onset of this cool, damp weather, though the worms could still be found in the fields and apparently were primarily feeding on weeds. A few army-like migrations were observed, but these were not numerous. Excellent control was obtained by the application of sodium fluosilicate bran sawdust wet grasshopper bait. Good control was obtained through the use of two pounds of toxaphene per acre as a spray whenever sufficient foliage was present to carry the toxicant.

PALE WESTERN CUTWORMS (*Agrotis orthogonia*)

No infestations of pale western cutworms were reported or observed in 1949. In 1950 approximately 50 square miles of the Kenilworth area in north central Chouteau County were severely infested. This infestation persisted well into the early summer season causing damage to the crops present and to the later plantings. Nearly all crops in this area had to be planted late, some for a second and third time. Several attempts to combat this outbreak with soil and seed treatments of benzene hexachloride were reportedly unsuccessful.

Serious damage to sugar beets by pale western cutworms occurred in the Bitterroot Valley. In some fields the damage was severe enough to cause as high as 50% loss of the beets in the field.

WIREWORMS (Elateridae Family)

Infestations of wireworms have occurred in practically all areas of the state during the past two years. Damage has been particularly noted in dry land small cereals. The gamma isomer of benzene hexachloride used as seed or soil treatment has provided good control.

BLISTER BEETLES (Meloidae Family)

Blister beetles caused considerable damage to sugar beets in Custer County in 1949 and in Custer and Richland counties again in 1950. Damage also occurred to alfalfa seed fields during both years, particularly in the southeastern part of the state. Damage

was reported in gardens and ornamental shrubbery plantings from nearly all parts of the state. Two pounds of DDT per acre as a spray is apparently satisfactory for controlling these insects; however, the problem of residual protection against new bands of blister beetles moving into the sprayed fields has not been satisfactorily worked out.

FLEA BEETLES (*Epitrix* sp. and *Systena blanda*)

The potato flea beetle (*Epitrix* sp.) has always been a problem to Montana farmers and gardeners when raising cruciferous vegetables. It has also been an economic factor in sugar beet production during the past two years in some parts of Montana. In the Milk River Valley, the Great Falls area, and the Triangle Area where sugar beets are produced, adult potato flea beetles attacked a large percentage of sugar beet fields when the seedling beets were in the early two-leaf stage. This occurred in both 1949 and 1950. In most cases, the beetle attack was severe enough to necessitate replanting or abandoning the field. This condition also existed in the Yellowstone Valley in the Billings area where in addition to adult flea beetle damage, larvae presumably of the same species were found feeding on the seedling hypocotyl. These larvae were not found in the northern area. Damage to the seedling hypocotyl did occur in the northern area; this damage was attributed to adult beetles feeding down in the cracks of the soil on cool days. It should be noted that the potato flea beetle populations in all cases were comparatively low, averaging less than one beetle per row foot; however, it was apparent that these low beetle populations could inflict severe damage to sugar beet seedlings in their earlier stages of growth. Applications of 5% DDT dust at rates varying from 12 to 20 pounds per acre gave protection from potato flea beetles varying from very good to practically no protection.

The two-striped flea beetle (*Systena blanda*) occurred occasionally in sugar beet fields in both the Milk River and Yellowstone valleys. This flea beetle was a consistent economic problem.

THISTLE BUTTERFLY CATERPILLARS (*Vanessa cardui*)

The larval form of the painted lady butterfly was quite prevalent throughout most of the state in 1949. For the most part, its feeding activities were confined to the perennial weed, Canada thistle. Only two cases of crop damage were reported—one in potatoes and the other in beans. One army-like movement from a defoliated Canada thistle patch through a barley field was observed. In this case, only the Canada thistles in the barley field were attacked. The barley was not touched. No thistle butterfly caterpillars were found or reported in 1950.

FALSE CHINCH BUGS *(Nysius ericae)*

Large numbers of false chinch bugs were reported in the fall of 1950 from weedy areas in Fallon County and from hay fields in Big Horn County. It would be well to be alert for these sucking insect pests in the above areas in 1951. During the biennium this insect was not reported as causing economic damage.

FIELD CRICKETS (Gryllidae Family)

These nocturnal feeding insects which are common in grain and alfalfa fields throughout most of the state are normally not numerous enough to be a serious economic factor. Inquiries have been received during the past two years from Carbon, Hill, and Phillips counties, but it is doubtful if these insects were destructive enough to warrant an investment in control measures.

EARWIGS *(Forficula auricularia)*

The relatively recent infestation of European earwigs in the Gallatin Valley has become well established during the past two years, and is rapidly becoming an economic hazard to certain garden produce. These household and garden pests have been numerous over most of western Montana during the last two years and were particularly noticeable in the Ronan area of Lake County. European earwigs are readily controlled by fall and spring application of 5% chlordane spray while they are in buildings and other protected areas.

INSECTS DESTRUCTIVE OF FIELD CROPS

SMALL GRAINS

CRESTED WHEAT PLANT BUG *(Labops hesperus)*

This sucking insect which attacks crested wheat grass is found generally throughout southern Montana. Crested wheat plant bugs were responsible for severe damage to a crested wheat planting in Rosebud County in June of 1949. This is the only known case of economic damage caused by these insects in Montana during the last two years.

WESTERN WHEAT APHID *(Brachycolus tritici)*

The western wheat aphid, a sucking plant louse, was not observed or reported in 1949. Cool, damp weather, such as was experienced during the summer of 1950, is generally favorable for the development of most aphids. In 1950 the western wheat aphid was found in parts of Chouteau, Fergus, Musselshell, Broadwater, Stillwater, Yellowstone, and Gallatin counties. These infestations were not general throughout these counties, but tended to be localized in various winter wheat fields and were often spotted in the field affected. Typical malformed winter wheat heads

caused by the tightly curled sheaths holding the head in the boot were noted in most cases. The procedure of keeping summer fallow free from volunteer wheat, barley, and grasses to prevent a source of infestation the following year was practiced in most cases.

ENGLISH GRAIN APHID *(Macrosiphum granarium)*

The English grain aphid was not reported in 1949, but was reported in Flathead, Ravalli, and Mineral counties in 1950. These infestations were localized in nature, not covering large areas, and in general did not warrant control beyond cultural measures.

SPRING GRAIN APHID *(Toxoptera graminum)*

The spring grain aphid, or greenbug, was not reported in 1949, and occurred in only small localized areas in Sheridan County in 1950. Control beyond cultural measures was not warranted.

SAY'S STINK BUG *(Chlorochroa sayi)*

Say's stink bug was reported in localized areas in Hill County in 1949, and in Rosebud and Hill counties in 1950. This sucking insect if numerous enough is capable of causing damage to grain. It is generally found in economic populations in weedy abandoned lands. Non-economic populations can be found in nearly every part of the state that is under cultivation.

WHEAT STEM SAWFLY *(Cephus cinctus)*

The wheat stem sawfly infestation in 1949 dropped to very low levels in the more severe areas. This was probably due to the late wet spring and the resulting late thin crop. In 1950 a marked increase in infestations was noted. Because losses were small in 1949, a tendency to shift from Rescue wheat probably contributed to the increased losses. It should be noted, however, that in 1950 Rescue wheat did not stand up to its usual performance. Infestations as high as 40% were recorded. The resistance of Rescue wheat is controlled in part by weather conditions, and the 1950 season was the type that reduces its resistance.

The partial failure of Rescue points to the need for better resistant varieties and a determined effort is now being made by various agencies to develop these varieties. The State Entomologist, in cooperation with the departments of Agronomy and Soils and Zoology and Entomology of the Montana Agricultural Experiment Station, and the bureaus of Entomology and Plant Quarantine and Plant Industry, Soils, and Agricultural Engineering of the United States Department of Agriculture are taking the lead in this endeavor. During the past two seasons more than 5,000 varieties of wheat, a large part of the world collection, have had preliminary testing and more are in the process of testing. These include both spring and winter types. It is hoped that out of these new types of wheat, resistance may be found that can be bred into commercially acceptable varieties.

WIREWORMS (See General Feeders)

ALFALFA AND CLOVER

ALFALFA SEED CHALCID *(Bruchophagus gibbus)*

The alfalfa seed chalcid is known to occur throughout most of the state. The worm-like larvae of this insect burrow into the alfalfa seed, hollowing it out and leaving only the shell. The only economic damage to alfalfa seed reported during the past two years was in the Camus Prairie area in 1949. No damage to clover seed by this insect was reported.

ALFALFA WEEVIL *(Hypera postica)*

The area known to be infested by the alfalfa weevil covers all or parts of Wheatland, Sweetgrass, Stillwater, Carbon, Musselshell, Yellowstone, Big Horn, Treasure, Rosebud, Prairie, Custer, Powder River, and Fergus counties. Alfalfa weevil populations and damage to alfalfa appeared to be less in 1949 than in 1947 and 1948. In 1950 the populations were high and the damage was severe in the infested areas where control measures were not conducted. The recently developed control measure of spraying the alfalfa in the early spring with dieldrin makes it possible to successfully and economically combat this serious insect pest of alfalfa.

LYGUS BUGS *(Lygus* sp.)

Several species of Lygus bugs are common throughout the state. These bugs are particularly destructive to alfalfa and clover seed crops. They suck the plant juices from the stem below the blossom and the blossom dries up without forming seed. Economic populations are generally considered to be five or more Lygus bugs per sweep with the standard 15-inch insect net. Lygus bugs are readily controlled with the proper application of DDT, toxaphene, or benzene hexachloride.

SWEET CLOVER WEEVIL *(Sitona cylindricollis)*

The sweet clover weevil appears to be present throughout most of the state, and caused considerable defoliation of sweet clover in most areas where large acreages of sweet clover were grown in 1949. This beetle was not observed or reported west of the Continental Divide in Montana during the past two years. In 1950 sweet clover weevil damage apparently was not as severe as in 1949. Two cases of alfalfa defoliation by adult sweet clover weevils were observed in 1950.

CLOVER HEAD APHID *(Anuraphis bakeri)*

Practically all of western Montana and Carbon County in southern Montana are known to be infested with clover head aphids. Populations in these areas in both 1949 and 1950 were extremely high. Considerable reduction to seed production occur-

red where control measures were not administered. Four-tenths to one-half pound of gamma isomer of benzene hexachloride per acre, properly applied, has satisfactorily controlled this insect.

LESSER CLOVER HEAD WEEVIL *(Phytonomus nigrirostris)*

The lesser clover head weevil has been prevalent in western Montana during the past two years, and is a contributor to the insect hazard involved in the raising of clover seed. Control has been accomplished by a pre-bloom clipping in June, allowing the second growth to go to seed.

PEA APHID (See Pea Insects)

POTATOES

TUBER MAGGOT *(Eumerus* sp.*)*

These fly larvae were found in the Missoula area in 1950 as a secondary infestation in potatoes. The tubers had previously been tunneled by wireworms.

PSYLLID *(Paratrioza cockerelli)*

COLORADO POTATO BEETLE *(Leptinotarsa decemlineata)*

These insect pests have on past occasions been highly destructive to potatoes in Montana. They have not been a serious problem in the last two years. This is probably because potato growers have used DDT, which is very effective against these two potato insect pests.

WIREWORMS (See General Feeders)

SUGAR BEETS

SUGAR BEET ROOT MAGGOT *(Tetanops aldrichi)*

During the past two years, the sugar beet root maggot has been an economic problem in Yellowstone County, and the Bitterroot Valley. Control measures were applied in 1950 on about 50% of the sugar beets in the Bitterroot Valley with satisfactory results. The pre-planting soil application of one pound of gamma isomer of benzene hexachloride mixed with the fertilizer (when sugar beet root aphids are a factor) or four pounds of chlordane (when sugar beet root aphids are not a factor) has given excellent control.

SUGAR BEET ROOT APHID *(Pemphigus betae)*

The sugar beet root aphid, a sucking insect on the beet root, is widely distributed throughout the sugar beet growing areas of western Montana. Infestations in 1949 were high, resulting in considerable damage. Populations were extremely low in 1950. The recommended pre-planting soil application of one pound of gamma isomer of benzene hexachloride mixed with fertilizer has apparently provided satisfactory control.

SUGAR BEET WEBWORM *(Loxostege sticticalis)*

Late outbreaks (August) of sugar beet webworm occurred in the Conrad and Sidney areas in 1949. These late outbreaks have been attributed by some to second generation webworms, but they may be late first generation webworms, and further studies must be made before this point is established. In 1950, relatively small localized outbreaks occurred in Carbon and Richland counties.

It was discovered in the cases of later outbreaks, when the beet foliage is relatively larger, usually closing in the rows, that it is necessary to increase the rate of application of toxaphene from 1½ pounds per acre to 2 pounds per acre. Also, in the case of airplane application, it is necessary to increase the total spray volume per acre (water) from 2-3 gallons to 4-5 gallons.

FLEA BEETLES (See General Feeders)

SPINACH CARRION BEETLE *(Silpha bituberosa)*

Moderate to light damage to sugar beets by the larvae of spinach carrion beetle, a leaf-chewing insect, occurred in Ravalli County in 1949. This insect was not reported or found in 1950.

PEAS AND BEANS

PEA APHID *(Macrosiphum pisi)*

On the average, the pea aphid is of probably greater economic importance in alfalfa in Montana than it is in peas. The damage rendered to alfalfa, particularly seed alfalfa, by pea aphids has never been fully studied; however, pea aphids are nearly always present in alfalfa and occasionally present in extremely large populations. Such large populations occurred in the Fromberg area in 1949, and in several areas, particularly Chouteau, Yellowstone, and Cascade counties, in 1950.

Pea aphids were not reported or found in large numbers in peas in 1949, and were only reported in economic numbers in a small acreage of canning peas in Carbon County in 1950.

PEA WEEVIL *(Bruchus pisorum)*

During the past two years pea weevil infestations have not been of economic importance in field peas. Pre-bloom sweeps in canning peas indicated the presence of adult weevils in western Montana. Wherever adult weevils were found in canning peas, the fields were dusted. One percent rotenone dust applied at rates of from 20 to 30 pounds per acre has satisfactorily controlled this insect.

LATERAL LEAF HOPPER *(Oncometopius lateralis)*

The lateral leaf hopper was reported to be present in beans in the Billings area in 1949. In 1950 a survey was conducted in the above area, and no leaf hoppers were found.

BEAN ROOT APHID *(Trifidaphis phaseoli)*

The bean root aphid was found in the Crow Agency area of Big Horn County in 1950. It was not found or reported in 1949. These aphids which suck the sap of the bean roots, are transported to the bean roots from the roots of their alternate hosts (weeds) by ants. The ants cultivate the aphids for their sweet honeydew secretion. Bean root aphids are best controlled by eliminating the ants with chlordane dusts or sprays.

INSECTS DESTRUCTIVE OF GARDEN AND TRUCK CROPS

CRUCIFERAE

CABBAGE OR RADISH MAGGOT *(Hylemya brassicae)*

No serious outbreaks of cabbage or radish maggot were reported during the last two years. This maggot is, however, a perennial problem in nearly all Montana gardens. Two to three applications of 1½ pounds of chlordane per acre, either as a spray or dust, starting with the cotyledon stage, has given satisfactory control.

IMPORTED CABBAGE WORM *(Pieris rapae)*

This common pest of cruciferae is usually present in most Montana gardens. No severe outbreaks have been reported in the past two years. Frequent applications of 5% DDT dust have prevented serious imported cabbage worm damage.

CABBAGE APHID *(Brevicoryne brassicae)*

Cabbage aphids were only reported or observed in the Bitterroot Valley during the past two years. In this area they were more prevalent in 1949 than in 1950. The cabbage aphid is considered to be a state-wide pest, but it probably was not prevalent in other areas.

ROOT CROPS

ONION MAGGOT *(Hylemya antiqua)*

The onion maggot which is commonly found throughout most of the state was reported by gardeners only in Musselshell and Madison counties during 1949 and 1950. Observations in the western portion of the state indicate that this pest is becoming increasingly prevalent in that area.

ASPARAGUS

ASPARAGUS BEETLE *(Crioceris asparagi)*

The asparagus beetle is present in western Montana, particularly in the Flathead Lake area. Apparently this insect has not been an economic factor inasmuch as the damage has occurred late in the season after the plants have gone to seed.

INSECTS DESTRUCTIVE OF FRUIT CROPS

ORCHARDS

BLACK CHERRY FRUIT FLY *(Rhagoletis fausta)*

In the Thirty-Second Report of the State Entomologist the black cherry fruit fly was erroneously reported as *Rhagoletis cingulata.* The only known fruit fly of cherries in Montana is the black cherry fruit fly *Rhagoletis fausta.* A severe outbreak of this insect, the larvae of which burrows into the cherries, occurred in the southern end of the sweet cherry belt on the east shore of Flathead Lake in 1949. A survey was initiated in 1950, and adult cherry fruit flies were found in 35 out of the 210 orchards in the East Shore area. One dusting of 15% lead arsenate and two dustings of ¾ of 1% rotenone has satisfactorily controlled this insect.

RUST MITES *(Phyllocoptes* sp.*)*

Populations of rust mites in the sweet and sour cherry trees of western Montana were below economic levels in 1949 and 1950.

EUROPEAN RED MITES *(Paratetranychus pilosus)*

European red mites have been known to be present in western Montana since 1947, when they were found in the Polson area. These infestations apparently have not spread to any great extent since they were first noted. They are of economic importance in this area on cherries and apples.

PEAR SLUG *(Caliroa cerasi)*

Several stone fruits are usually subject to attack by the pear slug in Montana. In the past two years they have been reported or found only on sour and sweet cherries and populations were low, but they were of economic importance. Pear slugs are readily controlled by a pre-harvest application of rotenone, or a post-harvest application of toxaphene.

BLACK CHERRY APHID *(Myzus cerasi)*

Black cherry aphids are commonly found wherever sweet cherries are grown in Montana. In general, populations were higher in 1949 than in 1950. In both years black cherry aphids were of economic importance in sweet cherries. Dinitro dormant sprays or toxaphene or tetraethyl pyrophosphate as green tip sprays have effectively controlled this insect.

CODLING MOTH *(Carpocapsa pomonella)*

Codling moths are found everywhere in Montana where apples are grown. Control measures normally undertaken in commercial orchards usually keep this pest below the level of economic importance. The only cases of severe damage to apples by codling

moth larvae noted in the past two years were in home orchards where control measures were not carried out. Codling moths have been satisfactorily controlled by one or two spray applications of two pounds of DDT mixed with 100 gallons of water.

APPLE APHID *(Aphis pomi)*

High populations of apple aphids occurred in western Montana in 1949, followed by relatively low populations in 1950. Satisfactory control was obtained with dinitro dormant sprays.

WOOLEY APPLE APHID (See Ornamentals)

OYSTER SHELL SCALE (*Lepidosaphes ulmi*)

This sucking scale insect, which attacks many ornamental plantings, shade trees, and fruit trees, is nearly always present in unsprayed orchards. Oyster shell scale is readily controlled with dinitro dormant sprays.

PEAR LEAF BLISTER MITES *(Eriophyes pyri)*

This is another orchard pest which is common to Montana, and which is usually present in unsprayed orchards. The pear leaf blister mite is readily controlled with dinitro dormant sprays.

EYE-SPOTTED BUD MOTH *(Spilonota ocellana)*

The larvae of eye-spotted bud moths which feed on the buds and blossoms of apples, cherries, and plums have been present in economic numbers during the past two years. No severe outbreaks have been reported. Dinitro dormant sprays have controlled this insect.

PLUM TREE BORER *(Synanthedon pictipes)*

A tree infested with plum tree borers was observed in Yellowstone County in 1950. This is the only observation or report of this wood-boring insect in the state during the past two years.

PLUM APHID *(Aphis padi)*

The plum aphid is generally found in most of western Montana in economic but not severe populations. Plum aphids are readly controlled with dinitro dormant sprays.

SMALL FRUITS

STRAWBERRY ROOT WEEVIL *(Brachyrhinus ovatus)*

The strawberry root weevil occurs over most of Montana, but no serious infestations were reported in 1949-50. Early spring applications of arsenicals or sodium fluosilicate baits readily control this insect.

MILLIPEDES (Diplopoda Class)

Several cases of millipedes feeding upon the fruit of ripened strawberries have been reported in the past two years. This feeding is suspected to be a secondary type of feeding, with birds or slugs making the initial wound on the berry.

WHITE GRUBS (See General Feeders)

CURRANT FRUIT FLY *(Epochra canadensis)*

The currant fruit fly which is widely distributed throughout the state appeared only in light infestations during the last biennium. Two to three applications of rotenone sprays satisfactorily controlled this insect.

RASPBERRY ROOT BORER (*Bembecia marginata*)

During the last two years the raspberry root borer has been prevalent throughout western Montana and has been found in Yellowstone, Prairie, and Dawson counties in eastern Montana. Good management of the raspberry planting such as proper cultivtivation, fertilization, pruning, etc., appears to be the best means of preventing serious damage.

RASPBERRY SAWFLY *(Monophadnoides geniculatus)*

The raspberry sawfly has been of economic importance in western Montana in both 1949 and 1950. It is readily controlled by the proper application of rotenone dusts and sprays.

INSECTS DESTRUCTIVE OF ORNAMENTALS

DECIDUOUS

BOXELDER BUG *(Leptocoris trivittatus)*

This brilliantly red marked sucking insect is present nearly every place in the state where boxelder trees are grown. Many reports and inquiries on this insect have been received during the past two years, most of them being concerned with boxelder bugs in homes, which they commonly invade.

ASH BORER *(Podosesia syringae fraxini)*

The ash borer was found or reported only in Valley and Wibaux counties during the last biennium.

GREEN ASH APHID *(Prociphilus venafuscus)*

The green ash aphid which is found throughout most of western Montana infested nearly all green ash in that area in 1949. In 1950 very few of these sucking plant lice were reported or observed. The green ash aphid is readily controlled by a dormant application of dinitro or dormant oil sprays.

ASH FLOWER GALL (*Eriophyes fraxiniflora*)

The ash flower gall, which is caused by mites attacking the flowers of male ash trees, was reported in Yellowstone and Stillwater counties in 1949. No reports were received in 1950.

WILLOW LEAF GALL *(Pontania* sp.*)*

One specimen of willow leaf gall was received from Shelby in September of 1950. This leaf gall is caused by a Hymenopterous sawfly.

POPLAR BORER *(Saperda calcarata)*

The poplar borer, which is probably quite common throughout most of Montana, was reported only from Powder River County during the last two years.

COTTONWOOD LEAF-STEM GALL *(Pemphigus populi-transversus)*

Numerous inquiries and specimens for identification have been received concerning this aphid gall during the last two years. These galls usually develop near the middle of the petioles of the leaves, and are often as large as one-half inch long and an inch in diameter. The gall is somewhat spherical in shape with a relatively smooth covering which opens by a transverse slit extending more than half way around the gall. During the early summer the interior of the gall is crowded with aphids.

VAGABOND GALL *(Mordwilkoja vagabunda)*

This is another aphid gall which is common to cottonwoods throughout the state. The vagabond gall is easily distinguished from the cottonwood leaf-stem gall because of its peculiar convoluted form and its occurrence at the tips of the twigs.

COTTONWOOD LEAF BEETLE *(Chrysomela scripta)*

The cottonwood leaf beetle, the larvae of which are voracious feeders of cottonwood leaves, was reported in Fergus County in 1949. This is the only report received on this insect during the past two years although it probably occurs throughout most of the state.

ELM LEAF CURL APHID *(Eriosoma americanum)*

Elm leaf curl aphids occur over all of the state where American elm are grown. They have been particularly prevalent during the past two years in most of these areas. This species is known to attack only American elm and the principal injury from the sucking activities of this insect is a rolling or curling effect of the leaves

WOOLEY APPLE APHID *(Eriosoma lanigerum)*

The wooley apple aphid which is also known as the wooley elm aphid occurs generally throughout the state on apple and elm trees. A serious infestation occurred in the Gallatin Valley in 1950. This destructive insect has not been an economic factor during the past two years in commercial apple plantings.

LILAC BEETLE *(Brachyrinus meridionalis)*

The lilac beetle infestation reported at Hamilton in the Thirty-Second Report of the State Entomologist is still present. There has been little or no noticeable change in the population density nor has any spread been detected.

RED SPIDER (Tetranychidae Family)

In 1949 red spiders were numerous on evergreens, roses, and other ornamentals throughout most of the state. Very few red spiders were reported or observed in 1950. This perennial pest of many ornamentals is readily controlled by a thorough application of tetraethyl pyrophosphate sprays.

CONIFERS

BLUE SPRUCE GALL APHID *(Adelges cooleyi)*

Pine cone like galls at the tips of spruce twigs which are caused by the blue spruce gall aphid have been noted practically everywhere in the state. Benzene hexachloride sprayed just prior to the opening of the buds or tetraethyl pyrophosphate sprayed just after the buds are open readily control this gall former.

SPRUCE LEAF-TIER *(Epinotia nanana)*

In its feeding process the spruce leaf-tier hollows out the spruce needles. It then ties these hollowed out needles into a group, leaving unsightly groups of needles hanging on the tree. These insects were reported in Custer and Toole counties in 1949 and in the Townsend area in 1950.

SPRUCE BUD WORM *(Archips fumiferana)*

During the last biennium the spruce bud worm was reported in Ravalli and Toole counties. It is readily controlled by a spring application of a 1% DDT spray.

PINE LEAF SCALE *(Chionaspis pinifolioe)*

The pine leaf scale which infests spruce as well as pine is prevalent throughout all of Montana. Many inquiries have been received regarding this insect from most areas of the state during the past two years. The pine leaf scale is readily controlled by a spring application of dormant oil sprays.

DESTRUCTIVE HOUSEHOLD INSECTS

CLOVER MITES *(Bryobia praetiosa)*

Clover mites are perennial household pests throughout most of Montana, having been reported on many occasions during the last two years. These small eight-legged arachnids make a spring and fall migration into houses. As far as is known, they cause no damage in the household, but their presence is disconcerting to housewives. Spray applications of tetraethyl pyrophosphate around the house, in the areas where clover mites occur, prior to the spring and fall migrations usually solves this problem.

CLOTHES MOTHS (Tineidae Family)

Clothes moths commonly occur throughout all the state. They are readily controlled with a proper spray application of 5% DDT or chlordane.

SILVERFISH (*Lepisma saccharina*)

This fragile fleet-footed household insect commonly occurs in Montana. Inquiries have been received from Flathead, Yellowstone, Gallatin, Dawson, and Lake counties during the biennium. Proper applications of 5% chlordane sprays provide successful control.

DERMESTIDS (Dermestidae Family)

Dermestids constitute another group of household insects which occur commonly throughout the state. It should be noted that dermestids as well as several other commonly occurring household insects can become well established in inner wall insulation which is of plant origin, making it difficult, if not impossible, to eliminate the infestation. A case such as this occurred in a building in Lake County where wheat chaff insulation was used between the walls and in the ceiling. Dermestids became established in this insulation and provide a continuous source of reinfestation into the main part of the building. In most cases, dermestids are readily controlled with a spray application of 5% DDT or chlordane.

TERMITES (Isoptera Order)

Termites occassionally become established in buildings in Montana. Infestations were reported in Yellowstone and Richland counties in 1949. No infestations were reported in 1950. A new method of DDT soil treatment rids and protects buildings from termite infestations.

CEREAL INSECTS (Coleoptera Order)

Stored grain insects and household cereal insects occur commonly throughout Montana. The stored grain problem is usually minor because of the normal low moisture content of Montana stored grains. Stored grain insect infestations may be more of a problem in the fall and winter of 1950, inasmuch as large quantities of grain have gone into farm storage in relatively poor condition.

Infestations of household cereal insects in breakfast food, flour, and other cereals frequently occur, with the confused flour beetle (*Tribolium confusum*) being the most prevalent. These infestations are readily eliminated by destroying the infested cereals, cleaning up the storage areas, and spraying the storage areas with either 5% DDT or chlordane.

SPIDERS (Araneida Order)

Several species of spiders commonly infest houses and buildings in Montana. Most of these are readily controlled with a spray application of 5% chlordane.

ANTS (Formicidae Family)

Household infestations of ants which are common throughout

the state are readily controlled by locating the nests and spraying that general area with 5% chlordane.

FLIES (Muscidae Family)

Resistance of houseflies to chlorinated hydrocarbon insecticides has received considerable attention over the United States during the past several years. It appears that this condition is also occurring in Montana. This is substantiated by several cases reported by custom pest control operators. Houseflies have apparently become resistant in one case to DDT and in another to lindane after two or more years of successive use of these insecticides. This clearly indicates the need of frequently changing insecticides when they are used consistently in one area.

INSECTS DESTRUCTIVE OF MAN AND ANIMALS

MOSQUITOES (Culicidae Family)

In general, conditions were more favorable to mosquito development in 1950 than they were in 1949. In certain areas of Montana, particularly the Milk River Valley, mosquitoes represented a serious hazard to the livestock industry, as well as an important nuisance to man. Recent work conducted by the Montana Agricultural Experiment Station on mosquito population sources and practical control measures will probably pave the way to economical, more practical, area-wide mosquito control programs in Montana in the future.

CATTLE GRUBS (*Hypoderma lineatum* and *Hypoderma bovis*)

There were no noticeable changes in the severity in cattle grub infestations during the past two years as compared with previous years that cattle grubs were studied and observed. It has become apparent through intensive research studies conducted by the Montana Agricultural Experiment Station and observations in the field that the present methods of cattle grub control practised by stockmen on beef cattle in Montana fall far short of providing economic returns in terms of grub reductions and protection of cattle from these insect parasites.

CATTLE LICE (Anoplura and Mallophaga Orders)

Three species of cattle lice are commonly found on Montana cattle. Two of these are sucking lice, *Haematopinus eurysternus* and *Linognathus vituli*, while the third is a biting louse, *Bovicola bovis*. All cattle inspected during the winter and early spring have been found to be infested in varying degrees, indicating that this is a general condition. Infestations of cattle lice are generally found to be more severe during particularly hard winters; consequently, severe cattle louse infestations generally occurred during the hard winters of 1948 and 1949.

The reasons for this winter population increase are not as yet completely clear. Both the usual poor condition of the cattle in a severe winter and the possibility of a more desirable habitat for the lice must be taken into consideration. Fall spray treatments with lindane have successfully prevented severe louse buildups in the winter and early spring and their resulting detrimental effects to cattle.

SHEEP TICKS *(Melophagus ovinus)*

Sheep ticks are common in all of the sheep raising areas of the state, and often cause considerable damage. Excellent control has been obtained with rotenone dips and sprays.

HORN FLIES *(Siphona irritans)*

Horn flies generally occur throughout the state, and when uncontrolled cause considerable weight reductions to cattle. The use of methoxychlor sprays on dairy cattle and DDT sprays on range cattle have successfully provided economic control of this insect.

MINK MAGGOTS (*Wohlfahrtia opaca*)

Several cases in Gallatin County of primary myiasis occurred in the summer of 1950 on small pups which for the most part were from two to four weeks of age. Only one case of this myiasis is known to have occurred on an adult dog. No cases of myiasis on mink were reported.

MISCELLANEOUS INSECTS

GRASSHOPPER MITES (Trombidiidae Family)

Numerous inquiries concerning *Trombidium* mite parasites on grasshoppers were received in 1950. This is a rather common condition and is not known to be an important factor in the reduction of grasshopper populations.

SUN SPIDERS (Solpugida Order)

Sun spider specimens were received for identification from Daniels County in 1949 and Lewis and Clark and Cascade counties in 1950. This ferocious appearing arachnid is primarily a nocturnal predator of insects and other arachnids.

CHOKE CHERRY MIDGE *(Contarinia virginianiae)*

The orange to pink colored larvae of the choke cherry midge feed inside of the choke cherry, causing swollen deformed cherries. This insect occurs commonly throughout Montana and was reported in Park, Flathead, Lake, and Lewis and Clark counties during the biennium.

BIENNIAL REPORT OF THE MONTANA STATE APIARIST 1949 AND 1950

The beekeeping industry is changing rapidly in nearly every section of the United States, especially in the legume seed producing areas.

With new advances in the bee business, commercial beekeepers are constantly demanding more information on pollination, the effects of insecticides on bees, and the effects of herbicides on bee pastures.

The bee business produces nearly one million dollars' worth of honey and beeswax annually, and according to the United States Department of Agriculture, bees are worth 10 to 20 times this amount for pollination of fruits, vegetables, and legume seed crops.

Honeybees have been used for pollination of fruits and vegetables for many years, but little attention has been given bees as pollinators of legumes until very recent years. Experiments in Utah and California show that alfalfa pollinated by honeybees increased the yield of seed as much as six times.

Several beekeepers in Montana have placed bees on alfalfa seed plots this year, and will receive a portion of the seed as payment for pollination services. These beekeepers have reported that the seed production has been increased, but that their bees in these fields have been able to store only enough honey to carry them through the winter.

This office has assisted beekeepers in placing the bees properly in the field to do the most efficient job of pollination, and has recommended the best insecticides to be used for controlling destructive insects in the fields without harming the bees.

Many Montana beekeepers are requesting that research be conducted to aid them in their problems connected with pollination services. Funds are not available at the present time for this type of work.

The year 1949 was the poorest honey year in Montana since records have been maintained. Montana normally produces 100 pounds of honey per colony annually. In 1949 the per colony yield was only 55 pounds. The reports for the 1950 honey crop are not all in yet, but it looks as if the crop will average about 70 pounds per colony.

The 62,000 colonies of bees in Montana are operated by about 150 commercial beekeepers who depend almost entirely on the sale of honey for their livelihood.

TABLE OF AMERICAN FOUL BROOD INCIDENCE IN COLONIES INSPECTED BY THE ASSISTANT STATE APIARIST

County	No. Colonies Inspected	No. Diseased Colonies	Percent Diseased Colonies
	1949		
Big Horn	1920	26	1.3
Cascade	869	11	1.2
Carbon	130	0	0.0
Gallatin	790	14	1.8
Jefferson	69	0	0.0
Fergus	688	28	4.1
Wheatland	22	0	0.0
Golden Valley	55	0	0.0
Yellowstone	244	28	11.5
Ravalli	308	4	1.3
Madison	278	2	0.7
Lake	228	19	8.2
	Total 5601	Total 142	Average 2.5
	1950		
Big Horn	768	5	0.6
Cascade	193	2	0.2
Dawson	128	0	0.0
Fergus	50	0	0.0
Flathead	990	9	0.9
Gallatin	1128	6	0.4
Lake	983	43	4.3
Lewis and Clark	36	3	8.3
Ravalli	1166	61	5.2
Teton	32	0	0.0
Yellowstone	821	42	5.1
Golden Valley	4	0	0.0
Wheatland	12	0	0.0
	Total 6311	Total 171	Average 2.5

The beekeepers in the north and eastern parts of the state kill their bees each fall and buy bees from the south each spring. This means that about 20,000 colonies of bees are shipped into the state each year. Difficulties are encountered in moving bees from one state to another because of the laws of different states. In 1949 the Montana Assistant State Apiarist was appointed by the Apiary Inspectors of America to serve with inspectors of several other states to draw up a uniform set of regulations covering the interstate shipment of bees. These regulations were adopted by the states involved, making it much easier for the inspectors to control interstate movements of bees and at the same time making it easier for the beekeepers of these states to procure bees of better quality.

Disease control has been the main objective of the State Apiarist. The use of sulfathiozol as a preventive of American foul brood has made it possible for some commercial beekeepers to almost eradicate this disease from their yards. However, inspection is still necessary to keep this disease from spreading and causing large areas to be infected with American foul brood.

During the war, many people bought one or two hives of bees so that they could produce a little honey for home use. Sugar has been readily available during 1949-50, and honey has gone down in price. Consequently, many small operators have neglected their bees, and these bees have become a serious source of disease in many areas of the state.

The report on inspections on page 32 is not a true picture of the disease problem in Montana. It has been possible to inspect only those areas where the disease problem was most acute.

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