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MONTANA INSECT PESTS

1955 - - 1956

Thirty-Sixth Report of the State Entomologist

MONTANA STATE COLLEGE
AGRICULTURAL EXPERIMENT STATION
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To His Excellency

Governor J. Hugo Aronson

State House

Helena, Montana

My Dear Governor Aronson:

I am submitting herewith the Thirty-sixth Report of the State Entomologist of Montana. This report contains information concerning insect and related pest problems which have occurred in Montana during the last biennium.

The time of the State Entomologist and his staff during these two years has been spent as follows: Several hundred insect specimens were submitted each year for identification, information on damage, and recommendations for control. Insect problems in the field were evaluated and control recommendations were furnished. Uniform insecticidal recommendations were compiled, revised, and printed each year for use in the state. Other material dealing with insects was prepared by this office when it was needed, and news releases concerning important developments were furnished to the press and radio stations. In some cases, the State Entomologist's Office acted as a coordinator of Federal-State programs and served as a clearing house for insect information to be given to federal reporting services. Federal legislation affecting the pesticide situation in Montana was interpreted and evaluated (the recently enacted Miller Bill contains over 1,200 separate actions which must be presented to the public in understandable form). Contact was maintained with industry, government, and the applicators of pesticides to keep Montanans informed of current developments. Educational programs for adults and youth groups were conducted. Special projects were carried out including work on goatweed eradication and grain sanitation and a Khapra beetle survey. Several thousand colonies of bees were inspected each year to prevent the build-up and spread of disease. Pertinent research was carried on in cooperation with Montana State College and the Montana Agricultural Experiment Station. Special emphasis was given to grasshopper research aimed at alleviating Montana's most crucial entomological problem.

This office has endeavored to meet all of the demands involved in the activities mentioned above and will continue to do so to the best of its ability.

Respectfully submitted,

James H. Pepper
State Entomologist

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MONTANA INSECT PESTS
1955 and 1956

Thirty-sixth Report of the State Entomologist

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INTRODUCTION

During the past biennium many insect species which were formerly of only passing interest have increased to economic proportions. Conversely, some of our normally abundant species have been significant by their absence. Grasshoppers have been the biggest single economic problem with which we have had to deal.

Household and ornamental insect pests are either becoming more numerous or else the public is becoming more aware of their presence. Recently, a much larger proportion of the requests directed to this office is for information and recommended control measures for these types of insects.

Present control methods of livestock insect pests leave much to be desired both from convenience of application and, in the case of cattle grubs, effectiveness. Louse control on cattle is a costly, time-consuming job, if it is done correctly and effectively. Cattle grub control as generally practiced does little to reduce future reinfestation, and it is carried out at a time when most of the damage to meat and hides has already been done. Wood tick control on sheep poses a problem, especially where sheep have to be trailed into central areas to be sheared. Solution of these problems would materially reduce the multimillion-dollar insect loss which is taken by the livestock industry each year.

A prevention approach to pest control has always been emphasized as a basic principle by this department. This principle applies not only to insects but to other animals which may be involved in such things as grain contamination. In this latter respect we have cooperated with the Federal Food and Drug Administration in attempting to reduce losses due to seizure of contaminated grain. Since insects are not the major contributing factor to contamination as they are in neighboring states, emphasis has been placed on rodent, particularly mouse, control. A thorough comprehension of the factors responsible for mouse build-up is being utilized in advising grain trade people on the best methods of controlling these pests. These basic principles have been emphasized in our literature, discussions, and meetings.

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We have accomplished much along the lines of grain sanitation since the Food and Drug reports show Montana wheat to be relatively free of obnoxious contaminants.

Goatweed continues to pose a threat to valuable rangeland in western Montana. Although this weed can be controlled by chemical means, inaccessibility of infestations rules out this method in many cases. In 1948 the first importations of *Chrysolina gemellata* and *C. hyperici*, the goatweed beetle which feeds exclusively on goatweed, were made into the state. Since that time other colonies have been brought in and many transfers from established colonies of beetles have been made. Control of the weed has been accomplished in some areas and in others evidence of control is becoming apparent. Another insect enemy of goatweed was brought into the state in 1954 and 1955 to hasten control of this noxious weed. Unlike the *Chrysolina* species which feed on the leaves and buds, the new insect is a root borer. It has worked very well under conditions unfavorable for *Chrysolina* and should prove an important addition to our beneficial insect fauna.

RANGELAND GRASSHOPPER RESEARCH

Studies of grasshoppers inhabiting Montana rangelands have been continued during the past biennium in cooperation with the Montana Agricultural Experiment Station and Montana State College.

The primary objectives of the rangeland grasshopper research in Montana are the prevention of outbreaks and the minimizing of significant annual losses in forage. It is realized that grasshoppers are an integral part of the grassland environment in which they live and as such are subjected to the numerous, complex, and interrelated forces of that environment. Therefore, an attempt is being made to study these environmental forces and to determine how they affect the biology and behavior of the various grasshopper species present.

Factors affecting grasshopper distribution and abundance are being determined through studies of the direct and indirect effects of such things as the composition of the vegetation (*i.e.*, kinds and abundance of plants), the amount of foliage cover (*i.e.*, bare ground and plant litter), land management practices, and weather. The cause of fluctuations in grasshopper numbers is being attacked by studying such things as the presence of specific food-plants, general plant composition, and ground cover on grasshopper population changes. Behavior patterns of the various species which include feeding habits, local movements, migratory tendencies, and selection of egg laying sites are being studied.

During the past biennium considerable emphasis has been placed on the measurement of the amount of seasonal damage done to range-

land vegetation by various grasshopper populations. It is hoped that from such measurements it will be possible to predict the amount of damage one would expect to a particular plant complex under various conditions by any grasshopper species or combination of species which may be present. Such information is extremely important in determining the situations under which it is economically sound to apply chemicals for the control of a rangeland grasshopper species.

Most of the above research has been directed toward relating grasshopper responses to the forces in their immediate surroundings. However, it is now evident that unpredictable changes take place within the grasshopper itself which make it impossible as yet to predict the effect which a particular force such as weather, food-plants, etc., will have on the future behavior of a particular population. Therefore, future studies will of necessity include studies of the physiology of the insect. From such studies, which will relate the behavior and activities of the grasshopper to both its internal and external environment, it is hoped that it will be possible to predict from one year to the next whether grasshoppers will increase or decrease in a given area.

It is believed that from the knowledge obtained from these investigations a workable and economically feasible grasshopper control policy involving either insecticides, land management, or both can be attained.

GENERAL FEEDERS

GRASSHOPPERS (Orthoptera: Acrididae)

1955 Season

Melanoplus mexicanus mexicanus, the migratory grasshopper, showed up in generally larger numbers this year, especially in the central part of the state. *Aulocara elliotti*, the big-headed grasshopper, was the most important range species with local damaging populations in Fergus, Gallatin, Madison, and Broadwater counties. *M. bivittatus*, the two-striped grasshopper, remained a problem in wheat field borders in the north central part of the state. *M. differentialis*, the differential grasshopper, occurred on corn in the eastern part of the state and *M. femur-rubrum*, the red-legged grasshopper, caused some crop damage in the lower Yellowstone Valley. *Camnula pellucida*, the clear-winged grasshopper, was a problem in the southwestern portion of the state on range. *Aeropedellus clavatus*, a range species, did local early damage to range in the central part of the state. Due to excellent moisture conditions and the resultant high production of range forage, eastern and central Montana ranges suffered little from grasshopper depredations even though fairly large numbers of damaging species were present locally.

1956 Season

In some areas, range-damaging species declined in numbers while other areas showed definite increases. Again, the big-headed grasshopper was the most widespread and destructive. Grass removal by this species occurred in harmful proportions in Yellowstone, Big Horn, Jefferson, Broadwater, Madison, Sweet Grass, Stillwater, Fergus, Golden Valley, Musselshell, Wheatland, and Judith Basin counties. The clear-winged grasshopper has also shown up in greater numbers this year in foothill areas in Fergus, Gallatin, Ravalli, Madison, and Blaine counties. It has remained about the same in Beaverhead County. The migratory grasshopper has generally increased in numbers in many areas and was much more common in the extreme eastern part of the state and in local areas west of the mountains. *Aeropedellus clavatus*, a rangeland species which has usuallly completed its life cycle by mid-July, showed up in generally larger numbers in the central part of the state where it fed mostly on crested wheat grass and related species. The Colorado grasshopper, a needle-and-thread grass feeder, was also present in larger numbers generally.

In general the most severe rangeland grasshopper problem seemed to be centered in the central part of the state. Scarcity of forage due to drought conditions aggravated the situation considerably, since any forage that was available was doubly valuable under these conditions. Any attempt at accurately predicting future population trends is dependent on a complete knowledge of all the factors which affect grasshopper numbers. Although many of these factors are as yet unknown, past experience would indicate that the following may happen: infestations in Beaverhead, Broadwater, parts of Jefferson and Madison, and parts of Musselshell and Golden Valley counties should subside somewhat; infestations in Stillwater, Yellowstone, and Sweet Grass counties may remain the same. Potential infestations were present in many areas over the state which could become serious if favorable conditions prevail next year.

OTHER IMPORTANT PESTS

MORMON CRICKETS *(Anabrus simplex)*

In 1955 Mormon cricket infestations occurred in Big Horn, Judith Basin, and Meagher counties. In 1956 virtually the same areas were infested. Local control programs were instituted in all of these areas where farmers felt that crops were endangered. The large size and banding habits of crickets make for rather exaggerated estimates of their potential destructiveness. Since they feed on many plants, but seem to prefer broad-leaved weeds, they should not be viewed with too much alarm unless high populations or bands move into small grains or other cultivated crops.

It has become apparent during the last year that control of these pests by chemicals is a definite possibility. Heretofore, baiting was the only acceptable method of control because of the extremely resistive nature of the Mormon cricket toward poison sprays. During grasshopper control work in 1955 it was noted that crickets in the same areas were also controlled. Consequently, cricket control using chemicals alone was tried during 1956. On large areas treated by aircraft with one ounce of dieldrin per acre the kill appeared satisfactory.

ARMY CUTWORMS *(Chorizagrotis auxiliaris)*

Army cutworm damage was comparatively light during both 1955 and 1956. The northern tier of counties experienced local light-to-medium infestations during the former year. As a rule, these infestations were a month or more later than usual. During 1956 only scattered late infestations were observed. These occurred in Rosebud, Liberty, and Chouteau counties. The newly planted lawns of a housing development in Glendive were ruined by this pest. One of the newer chlorinated hydrocarbon insecticides known as endrin has worked very well against this cutworm at rates of .1 to .2 pound per acre.

BLISTER BEETLES (Coleoptera: Meloidae)

Populations of these insects have been higher during the past biennium. *Lytta cyanipennis*, *L. nuttali*, and *L. sphaericollis* were the most damaging species. Alfalfa, clover, beans, caragana, and other legumes were attacked. Infestations were scattered in many places east of the mountains.

FLEA BEETLES (Coleoptera: Chrysomelidae)

Damage by flea beetles has been scattered but severe in spots. In 1955 there were apparently more of these beetles than in 1956. Alfalfa and beans were the main crops attacked by *Systena blanda* and *Disonycha triangularis*. The Western flea beetle, *Phyllotreta pusilla*, caused severe damage to mustard in Pondera County.

WIREWORMS AND FALSE WIREWORMS
(Coleoptera: Elateridae & Tenebrionidae)

During the fall of 1954 very large field populations of adult false wireworms were noted in the Triangle Area and in spots along the northern tier of counties. In the spring of 1955 there had apparently been a large survival of larvae since extensive infestations developed over the northern part of the state. Where treated seed was planted at the ordinary depth, not too much damage resulted. However, where

deep seed planting was practiced, seedling damage was very high during May and June since the false wireworms did most of their feeding at the ground level. The fact that they fed at least 3-4 inches from the treated seed resulted in the insecticides having very little effect on them.

In 1956 the reduction of false wireworms, combined with the more usual moisture conditions, resulted in a marked decrease of this pest in the Triangle Area. However, occasional spotted damage continued to occur in eastern Montana. True wireworms were either not as common in 1955 or else their depredations were masked by the high population of false wireworms. In 1956 more true wireworm damage occurred in spotted infestations throughout the wheat area and in southern mountain valleys.

A MIRID (*Stenodema* species)

Although we are aware that many of these grass-feeding bugs do damage to our forage crops, the first real evidence of extensive feeding was found on tall wheat grass in Flathead County in 1956. In addition, a crested wheat grass field in Yellowstone County was also attacked. Damage by this insect very closely resembles that of the crested wheat plant bug.

EARWIGS *(Forficula auricularia)*

During 1955 earwigs were very abundant on many garden crops (especially sweet corn) and on ornamentals in the southwestern and western part of the state. During 1956 very few inquiries concerning this pest were received, but indications are that new areas are continually being infested. At the present time all of the area west of the mountains and the area east of the mountains from Helena to Lewistown and south to Park County is infested.

CRESTED WHEAT PLANT BUG *(Labops hesperius)*

In 1955 infestations occurred in Yellowstone County on barley and in Lewis and Clark and Garfield counties on crested wheat. In 1956 McCone County had a local severe infestation on wheat and Judith Basin County an infestation on crested wheat grass.

INSECT PESTS IN FIELD CROPS

Small Grains

CORN LEAF APHID *(Rhopalosiphum maidis)*

One of the most spectacular insect outbreaks in years involved this insect when it appeared on barley in July of 1955. States farther

east had reported high populations by the middle of June but the first infested fields were reported in Montana about the first of July. By the 10th of that month barley throughout the state was infested. Since there were no previous records of this insect's occurrence in the state, a period of intensive study was necessary before control recommendations could be made. As far as we were able to ascertain, barley was the only crop attacked. Corn, wheat, oats, and other cereals were not infested even though grown in mixed stands with barley.

Many of the fields inspected had populations of these bluish-green plant lice averaging several hundred per plant. In these fields the late-planted barley turned yellow and was stunted. In fields where the barley had started to head before being infested the damage was much harder to see and many fields showed no decreased yields at harvest time.

Insect predators in the form of syrphid flies and lady bird beetles completely eliminated the aphids from some fields in a matter of a few days. In other fields, malathion was applied at 12 ounces per acre with very good results.

There were no cases of infestation by this insect in 1956.

WHEAT CURL MITE *(Aceria tulipae)*

This pest which was responsible for such a severe infestation of wheat streak mosaic in 1954 was found only in noneconomic, scattered infestations in 1955. It appeared to be absent in the state in 1956.

ENGLISH GRAIN APHID *(Macrosiphum granarium)*

This summer pest of wheat occurred about the same time as the corn leaf aphid in 1955 in the eastern and northern tier of counties. No damaging infestations were reported, but because of the concurrently large populations of both of these aphids a good deal of confusion existed regarding the status of the English grain aphid until the situation was cleared up. No infestations were reported in 1956.

WHEAT JOINTWORM *(Harmolita tritici)*

Indications are that the wheat jointworm is building up, especially in the central part of the state. Damage by this pest was reported in Stillwater and Carbon counties in 1955 and probably occurred over a wider area but was not reported since mild infestations are not readily noticed by farmers. During 1956 some particularly heavily infested fields were noticed in Sweet Grass County, which upon evaluation proved to be between 80 and 100 percent infested. Under these conditions the plants were stunted and most of them did not

stand over a foot high, even though the wheat was mature. Cultural control methods are the only effective weapons we have against this insect at the present time.

WHEAT STEM SAWFLY *(Cephus cinctus)*

The wheat stem sawfly continues to expand its economic range in Montana and severe infestations were present in McCone and neighboring counties in 1955. These locations are outside the usual area of damage from this insect. In 1956 economic damage was discovered as far west and south as Sweet Grass County.

WHEAT-HEAD ARMY WORM *(Protoleucania albilinia)*

The wheat-head army worm attacks the ripening heads of wheat. Local infestations were reported in Liberty, Toole, and Hill counties in 1955. Local mild infestations occurred in Chouteau County in 1956.

WESTERN WHEAT APHID *(Brachycolus tritici)*

Hill, Valley, and Yellowstone counties reported this pest in 1955. No infestations were reported in 1956.

PALE WESTERN CUTWORM *(Agrotis orthogonia)*

For the first time in a number of years, the pale western cutworm was a major pest of wheat. In 1955 infestations occurred in Yellowstone, Madison, Gallatin, and Pondera counties. Although these infestations were not of great intensity, they were apparently capable of building up populations for 1956 since rather severe outbreaks occurred in Chouteau, Broadwater, Jefferson, Yellowstone, Pondera, Teton, and Cascade counties. Until the last 2 years the only method of control for this insect has been through cultural practices. Recent evidence indicates that by using one of the new chlorinated hydrocarbons known as endrin control of this pest may be possible with chemicals.

Corn Insects

EUROPEAN CORN BORER *(Pyrausta nubilalis)*

Although this pest is present only in the lower Yellowstone Valley, it offers a rather serious deterrent to corn production in this area. Most of the highly effective chemical control methods require specialized equipment which cannot be economically used on the small corn acreage in this state. However, cultural control with some help from chemicals enables farmers to keep losses from this pest at a minimum.

CORN EARWORM *(Heliothis armigera)*

This pest has been present only in moderate numbers through the last 2 years. It is, however, a nuisance and preventative measures have to be taken wherever sweet corn is raised for market.

Alfalfa and Clover Insects

ALFALFA WEEVIL *(Hypera postica)*

This insect remains the number one pest of alfalfa in the state and each year infests new areas. Practically all of the counties east of the mountains now have economic infestations. Approximately 300,000 acres of alfalfa are treated each year at a cost of about $400,000. Increase in yield where treatment is practiced produces an average of 1 ton per acre more forage and is valued at $4,500,000 for the 300,000 acres for a net saving of over $4,000,000. Each year a series of meetings is held in newly invaded territory to acquaint farmers with the proper control methods.

LYGUS BUGS *(Lygus* sp.)

In areas where alfalfa seed production is important, lygus bugs invariably affect yields. A lot of time and effort has been put into informing producers and spray operators of the correct control practices for this pest. Unfortunately an incorrectly conceived spray program can do more harm than good since pollinators may be eliminated and reduced seed set result. The eastern part of the state, from Roosevelt County south to Wyoming and west to Yellowstone County, is the area most severely damaged by lygus bugs.

CLOVER APHID *(Anuraphis bakeri)*

1956 was the first time that this pest had been present in economic numbers for a number of years. Because of the sporadic nature of infestations, no really reliable methods of control have been worked out. Carbon, Yellowstone, Rosebud, and Big Horn counties experienced difficulty with this insect where clover was grown for seed.

CLOVER SEED CHALCID *(Bruchophagus gibbus)*

This pest was known to be harmful only in Rosebud County in 1955.

Potato Insects

COLORADO POTATO BEETLE *(Leptinotarsa decemlineata)*

No infestations were reported or observed during 1955. Scattered infestations occurred on potatoes in the western counties in 1956.

POTATO PSYLLID *(Paratrioza cockerelli)*

Indications that this pest may be building up in the state were shown by damage to fields in Broadwater and Yellowstone counties. No economic infestations have been reported, but indications of psyllid activity were quite common in 1955. Less activity was noticed in 1956.

WIREWORMS (Coleoptera: Elateridae)

Wireworms are a problem on potatoes mainly in the western part of the state. Flathead, Lake, Missoula, and Powell counties have had economic infestations during the biennium.

Sugar Beet Insects

WEBWORM *(Loxostege sticticalis)*

Webworms were present in the Milk River Valley in mild to moderate infestations in 1955. In 1956 they were important locally in Yellowstone and Carbon counties. Noninjurious second generation worms were received by this office from many scattered points east of the mountains. They were feeding mostly on Russian thistle and other unimportant weeds.

FLEA BEETLES *(Epitrix* sp.)

Early in the growing season of 1955 one of the most severe infestations on record occurred on sugar beets in Richland County. Prompt application of DDT dust over a large area alleviated the situation.

Insect Pests of Peas and Beans

SEED CORN MAGGOT *(Hylemya cilicrura)*

At least two infestations of this pest occurred in Yellowstone and Carbon counties in 1955. Replanting later in the season after the soil had partially dried produced a crop on the previously infested fields. No infestations were reported during 1956.

BEAN WEEVIL *(Acanthoscelides obtectus)*

One infestation in stored beans in Big Timber was reported in 1955. Either heat treatment or fumigation will control this insect in stored beans.

FLEA BEETLE LARVAE (Coleoptera: Chrysomelidae)

In Yellowstone County in 1955 bean fields showed damage resembling that of the seed corn maggot. However, examination showed that flea beetle larvae were feeding on the sprouted seeds.

INSECTS DESTRUCTIVE TO GARDEN AND TRUCK CROPS

In general, insects which feed on these plants were comparatively scarce during the biennium. Leaf hoppers are almost always a problem on truck crops in irrigated valleys since they move into the areas from the surrounding drying range during the summer.

CABBAGE ROOT MAGGOT *(Hylemya brassicae)*

This pest continues to be a problem but not an important one where insecticidal recommendations are followed.

INSECTS DESTRUCTIVE TO FRUIT CROPS

BLACK CHERRY FRUIT FLY *(Rhagoletis fausta)*

This insect continues to be the number one problem of commercial cherry producers in the western part of the state. Although most orchard operators follow approved programs of control, there are still enough unattended and backyard trees to provide continuous reinfestation. It should be stated, however, that much progress has been made in eliminating abandoned trees and other sources of infestation. The cherry fruit fly is known to occur in Ravalli, Missoula, Lake, and Flathead counties.

PLUM NURSERY MITE *(Vasates fockeui)*

This mite, first reported as a serious pest of cherries in 1954, was seldom seen during the 1955 growing season. A serious local infestation occurred during 1956 on the east shore of Flathead Lake.

FOREST TENT CATERPILLAR *(Malacosoma disstria)*

During 1955 this pest was present in Toole County. It was present on apple trees in Broadwater and Hill counties in 1956.

CODLING MOTH *(Carpocapsa pomonella)*

This pest needs control annually throughout the apple-raising counties west of the divide. In addition it does damage in many counties east of the divide.

OYSTERSHELL SCALE *(Lepidosaphes ulmi)*

The south central part of the state including Yellowstone, Stillwater, and Carbon counties showed the heaviest infestation by this pest during the biennium.

TUSSOCK MOTH *(Hemerocampa leucostigma)*

Larvae of these moths defoliated apple trees in Gallatin and Park counties in 1956.

A FRUIT TREE LEAF ROLLER (Lepidoptera: Tortricidae)

This insect caused considerable damage in Liberty County in 1955 on apple and crabapple trees.

CHERRY SLUG *(Caliroa cerasi)*

Infestations on apple trees in Gallatin County and in Carbon County were reported during 1956. Occasional sporadic infestations occur west of the divide.

PLUM POCKET LEAF GALL *(Eriophyes* sp.*)*

Wild and native plums in Fergus and Stillwater counties showed leaf galls caused by this mite during 1956.

GREAT BASIN TENT CATERPILLAR *(Malacosoma fragilis)*

This insect was reported defoliating cherry trees in Broadwater County in 1955. No infestations occurred in 1956.

CHOKECHERRY MIDGE (Diptera: Cecidomyiidae)

Chokecherries showed signs of attack by this insect over extensive areas in the eastern and southern parts of the state. Typical symptoms are hollow, bladder-like fruit, 3 to 4 times normal size, in which the orange or pink larvae are found in numbers ranging from 2 to 10. Since this fruit is wild no economic control methods have ever been worked out.

STRAWBERRY LEAF ROLLER *(Ancylis comptana fragariae)*

In the western part of the state where strawberries are grown commercially, gardeners usually take precautions to prevent outbreaks of this pest. In the south central area where preventative control is not practiced, occasional infestations occur—usually in home gardens.

SPIDER MITES (Acarina: several species)

During 1955 only a few infestations in the south central part of the state were noted. In 1956, due at least in part to the dry weather, very high populations of this insect ranging over all areas of the state were present on raspberries, apple, currant, and ornamental fruit trees. Spider mites are not hard to control with organic phosphates, sulphur, or even water, but because of their minute size damage is often well advanced before it is noticed.

RASPBERRY CANE BORER, CANE MAGGOT, AND ROOT BORER (*Oberea bimaculata, Pegomya rubivora,* and *Bembecia marginata)*

Since drenches of aldrin and pruning of infested stems have been practiced, very few infestations of these insects have been reported in the state.

CURRANT FRUIT FLY *(Epochra canadensis)*

Currant fruit fly continues to be a bad pest of currants and gooseberries in the central and southern parts of the state where preventative control measures are not practiced.

CURRANT APHIDS *(Capilophorus ribis)*

No infestations were reported in 1955. Damage occurred in Sanders and Stillwater counties in 1956.

INSECTS DESTRUCTIVE TO ORNAMENTAL PLANTS

Deciduous Ornamentals

ASH PLANT BUG *(Neoborus amoenus)*

The general trend in numbers of this insect has been downward during this biennium. However, moderate infestations continued to exist in central and north central Montana during 1955. Light to moderate infestations were spotted throughout this same general area in 1956.

A BOX ELDER GALL (Diptera: Cecidomyiidae)

A rather severe infestation of this insect occurred in Billings during 1956. No apparent economic damage resulted.

CARPENTER WORM *(Prionoxystus robiniae)*

One infestation of this wood-boring insect was reported from McCone County in ash trees in 1956.

CICADA (Homoptera: Cicadidae)

Cottonwood trees were damaged in Pondera County by these insects during 1955.

COTTONY MAPLE SCALE *(Pulvinaria innumerabilis)*

This insect appears to be on the decline. Two infestations from Chouteau and Flathead counties were reported in 1955. None was noted in 1956.

COTTONWOOD LEAF BEETLE *(Chrysomela scripta)*

Many of the poplar and cottonwood insects appear to be building up in the state. There are many new plantings of these and other tree varieties being used for shelterbelts, and farmers and ranchers are becoming more aware of insect damage since they have a considerable investment involved.

In 1955 the cottonwood leaf beetle was reported damaging cottonwoods in Valley County. It did damage in Chouteau and Glacier counties on cottonwoods in 1956.

A COTTONWOOD LEAF MINER (Lepidoptera: Tischeriidae)

This insect was very abundant in the northern tier of counties during 1956. It is believed to be of little economic importance but it renders trees unsightly because of the dark leaf splotches.

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

This aphid was generally distributed over much of the central part of the state in 1955. In 1956 occasional light infestations were noted in the same area but the population appeared to be declining.

COTTONWOOD STEM GALL MITES *(Eriophyes* sp.*)*

During 1955 infestations were recorded for Glacier, Blaine, and Prairie counties. One infestation from Richland County was reported in 1956.

ELM LEAF APHIDS *(Myzocallis ulmifolii)*

A continuance of the 1954 general infestation persisted through 1955. Almost all extensive elm plantings in the state showed evidence of damage by this insect. During 1956 only residue populations appeared to be present in widely scattered spots.

A LECANIUM-TYPE SCALE (Homoptera: Coccidae)

During 1955 elm trees in Dawson County were infested. By 1956 infestations on sand cherry, rose, caragana, and other deciduous trees were reported from eastern and northern Montana.

LILAC BORER *(Podosesia syringae)*

This insect was not recorded for 1956, but infestations occurred in both lilac and ash in Valley and Rosebud counties in 1955.

MOURNING CLOAK BUTTERFLY *(Nymphalis antiopa)*

This widely distributed pest was present in Liberty County in 1956 where its larvae were defoliating cottonwood trees.

NEVADA BUCK MOTH *(Hemileuca nevadensis)*

This insect was reported from Glacier and Judith Basin counties in 1955 where it was defoliating willow. No reports of activity were received in 1956.

POPLAR BORER *(Saperda calcerata)*

Only two cases of this wood-boring insect were reported during the biennium: one from Cascade County and one from Glacier County.

ROSE CURCULIO *(Rhynchites bicolor)*

The rose curculio is generally present over the entire state and control is a yearly necessity since tame roses are readily infested from wild rose sources. Scattered light damage is present over most of the state east of the divide. Local severe infestations occurred in Roosevelt and Stillwater counties.

ROSE GALLS *(Diplolepis* sp.*)*

At least two species of *Diplolepis* have been responsible for rose stem galls in the state. 1956 brought inquiries from many places in central and eastern Montana regarding this pest. One type of gall is ½-1 inch in diameter and spinose; the other is 1-1½ inches in diameter and smooth. Picking the galls and burning them to prohibit further infestation is the only known control.

ROSE SLUG (Hymenoptera: Tenthredinidae)

Rose slugs were recorded from Hill County during 1955 and from Lake and Stillwater counties in 1956.

SAN JOSE SCALE *(Aspidiotus perniciosus)*

Only one report of this insect was recorded during the biennium —from Lake County in 1955 where it occurred on willow.

SPRING CANKERWORM *(Paleacrita vernata)*

A rather widespread outbreak of this shelterbelt defoliator occurred from the central part of the state to the eastern border during 1955. No cases were reported in 1956.

A TENT CATERPILLAR *(Malacosoma leutescens)*

This close relative of the forest tent caterpillar defoliated elms in Prairie County in 1956.

VAGABOND GALL *(Mordwilkoja vagabunda)*

Infestations of these aphids appear to be down this biennium. However, the northeastern corner of the state had large local populations.

VIRGINIA CREEPER LEAF HOPPER *(Erythroneura ziczac)*

This pest was present in large numbers during 1955 in the central and Triangle areas of the state. No reported infestations occurred in 1956.

Coniferous Ornamentals

BLUE SPRUCE GALL APHID *(Adelges cooleyi)*

During the biennium this perpetual pest continued to cause concern in the area east of the mountains. Trees are not injured but made unsightly by the cone-like galls on the tips of the new growth.

A JUNIPER BORER *(Phloeosinus dentatus)*

This small snout beetle was reported for the first time in the state from Powder River County. It bores into the bases of juniper twigs causing death of the terminal parts.

PINE LEAF SCALE *(Phenacaspis pinifoliae)*

Pine leaf scale on spruce was uncommon in 1955, but it was very abundant in the Triangle Area and in spots west of the mountains in 1956.

RED CEDAR APHIDS *(Lachnus sabinae)*

Only one report of this pest was recorded for the biennium. This was from Dillon in 1955 on *Juniperus* sp.

A SPRUCE BARK BEETLE (Coleoptera: Scolytidae)

This pest attacked ornamental plantings of spruce in the Yellowstone Valley in Park County.

SPRUCE BUDWORM *(Choristoneura fumiferana)*

Extensive infestations of this defoliating insect occurred in southwestern and central mountain areas of the state. Some of these infestations subsided naturally; others were sprayed out. A few ornamentals, especially in southwestern Montana, were infested but easily controlled with DDT.

SPRUCE LEAF MINER *(Taniva albolineana)*

Only one infestation of this pest was noted. Spruce in Pondera County suffered some damage in 1956.

DESTRUCTIVE HOUSEHOLD INSECTS

CARPET BEETLES (Coleoptera: Dermestidae)

Dermestids appear to be the number one destructive pest of household furnishings in the state. Since these insects feed on many things and are capable of withstanding wide variations in conditions they are particularly hard to exterminate. During the biennium inquiries regarding these pests have been received from practically all parts of the state. It is becoming evident that DDT is not as effective as was formerly thought. To control these insects chlordane and dieldrin will be recommended in the future, along with frequent house cleaning.

TERMITES (Isoptera: Rhinotermitidae)

Many more cases of termites than usual have been reported during this biennium. In 1955 several inquiries from northeastern Montana were received. In 1956 houses in Fallon, Fergus, Lewis and Clark, Deer Lodge, and Stillwater counties were found to be infested. In some cases damage was extensive.

CARPENTER ANTS *(Camponotus* sp.)

Carpenter ants do not feed on wood as do termites but do considerable damage by burrowing into the wood for nesting sites. Summer

cabins in wooded areas are especially vulnerable to this sort of attack. During the biennium questions concerning control in the above circumstances were answered by this office.

PSEUDOSCORPIONS AND SOLPUGIDS

(Pseudoscorpionida and Solpugida)

During the course of the biennium numerous questions concerning the identity and possible destructiveness of these animals were answered. Neither one, of course, is harmful but lives on other small arthropods it manages to capture. Likewise neither one has poison glands so a pinch is the worst damage it can inflict to humans. In almost all cases reported, the animals were found in houses.

COCKROACHES (Orthoptera: Blattidae)

At least two occurrence records of the brown banded roach are available for Montana. The first record was in Bozeman in 1954. In 1956 specimens from Glendive were submitted for identification. The oriental and German roach are recorded from many places over the state with the exception of the northeast corner.

CLOVER MITES *(Bryobia praetiosa)*

The problem of clover mite migrations into dwellings is still with us in most sections of the state. A new method of control using oils and organic phosphate insecticides promises better results than the phosphate alone since the oil acts as an ovicide and eliminates future population increases. Deer Lodge and Silver Bow counties had exceedingly large populations during 1955-56 but local severe infestations occurred state wide.

FLATHEAD BORERS (Coleoptera: Buprestidae)

Two cases of house damage were reported in 1955 from Pondera and Daniels counties.

ANTS (Hymenoptera: Formicidae)

Ants as household pests are common over the state and some inquiries concerning identification and control are received each biennium.

BED BUGS *(Cimex lectularius)*

In contrast to the last biennuim when a number of cases were reported, only one house in Lewis and Clark County was recorded as infested during 1955-56.

CLOTHES MOTH *(Tinea* sp.)

One case of clothes moth damage was handled by this office. This inquiry originated in Richland County.

BLACK WIDOW SPIDER *(Latrodectus mactans)*

Although these arthropods are fairly common in the state they seldom become a problem. Only when houses have been vacated for a period of time is control necessary.

STRAWBERRY ROOT WEEVIL *(Brachyrhinus ovatus)*

Every year strawberry root weevil adults wander into a number of houses over the state resulting in questions concerning identification and control from the owners. Five to 10 such inquiries are answered each year.

SWALLOW BUGS *(Oeciacus vicarius)*

During 1956 a schoolhouse in Lewis and Clark County was heavily infested with these bird parasites. Some children received painful bites but removal of the swallow nests and application of insecticides brought the insects under control.

POWDER POST BEETLE *(Stephanopachys substriatus)*

An infestation of a newly constructed residence in Billings was recorded during 1956.

ORIBATID MITES (Acarina: Oribatidae)

These unusual pests occurred in a commercial building in Billings. Their source was traced to pigeon nests in an abandoned ventilating system.

INSECTS OF MAN AND ANIMALS

MOSQUITOES (Diptera: Culicidae)

With preliminary studies completed to indicate the sources of mosquitoes in the Milk River Valley, the work during the present biennium was concentrated on land and water use techniques needed to prevent mosquito build-up. In addition, chemical evaluations are now being conducted to find out which insecticides are best under the existing conditions.

Elsewhere in the state a few towns are carrying on mosquito control programs and the Office of the State Entomologist furnishes technical information wherever it is requested. An informational bulletin relative to mosquito control has been prepared and distributed.

CATTLE GRUBS *(Hypoderma lineatum, H. bovis)*

During 1955 this office, in cooperation with the Montana Agricultural Experiment Station, conducted tests with phenothiazine fed with salt mixtures to cattle for cattle grub control. Although a reduction in early grubs was evident, no discernible difference was found in late grub populations which appear to be harder to control. New compounds based on this internal medication principle will be tried if and when they are released for experimental use.

CATTLE LICE (Mallophaga and Anoplura)

During the winter of 1954-55 an experiment conducted to evaluate the efficiency of cable-type back rubbers for louse control was carried on by this office. It is apparent that this method will control lice if the back rubbers are properly constructed and used. In those cases where cattle are reluctant to use these devices, spraying or dipping is still the best method of control. A publication discussing the species of lice, life histories, pros and cons of various control methods, and other technical information is now in preparation.

SHEEP KEDS *(Melophagus ovinus)*

Sheep keds are present state wide wherever sheep are raised. A rotenone spray or dieldrin dust appears best for control.

WOOD TICKS *(Dermacentor andersoni)*

During 1955 and 1956 bands of sheep trailing to shearing pens have become heavily infested with wood ticks. In some cases paralysis and death have resulted. As of the present time no practical means of control have been developed. It is thought that perhaps an underbelly spray of fairly high concentrate dieldrin may be of value.

HORN FLIES *(Siphona irritans)*

Only moderate populations of these pests were observed during the biennium.

DOG LICE *(Linognathus setosus)*

Only one case of dog lice was brought to our attention during the biennium. A dog in Pondera County was heavily infested but responded readily to treatment.

STORED GRAIN INSECTS

The clean grain program in Montana is carried out to a large extent by this office. That it has struck home and has been taken seriously is attested to by the fact that few lots of wheat from Montana have been condemned by the Food and Drug Administration because of sanitary reasons. Two publications by this office and numerous meetings at which thousands of farmers were contacted have added materially to the effectiveness of the program. Among those stored grain insects identified during the biennium were: confused and red flour beetles, Pondera County; rusty grain beetle, Liberty County; Mediterranean flour moth, Richland County; mealworms, Liberty and Flathead counties; bran bugs, Pondera and Chouteau counties; fungus beetles, Liberty County; and grain mites, Valley and Gallatin counties.

BIENNIAL REPORT OF THE STATE APIARIST

1955 and 1956

During the past biennium the State Apiarist has carried out his various duties as prescribed by the Montana Apicultural Law. The State Apiarist, operating on the premise that regulations should be resorted to only when education fails, has, through his assistant, placed major emphasis on the education of beekeepers in more efficient and profitable methods of production and marketing. He has also worked toward educating the public to more favorable acceptance of the beekeepers and an understanding of their problems. Beekeepers report that in recent years many farmers have been coming to them and requesting that bees be placed on their land, whereas a number of years ago beekeepers often had trouble getting the farmers to allot a small piece of ground on which bees might be kept.

Last year the State Apiarist's Office conducted a 2-day school in beekeeping at one of the 4-H summer camps. It was very well received and already several informal applications for such a school have been requested by others. Articles for magazines and news releases attempting to better inform the general public in matters of beekeeping practices have been written and talks to school children have been made.

Movie films from the State Apiarist's Office are often used at meetings of adults who are interested in beekeeping, and on two occasions the State Apiarist's Office has sent a man to talk to nearby Rotary Clubs.

This office offers timely tips to beekeepers on their operations and often makes recommendations on prices so as to provide for more orderly marketing of honey and beeswax. The State Apiarist's Office offers moisture testing and color grading of honey as a free service to Montana beekeepers. It also provides for identification

of any bee disease samples which may be sent in. At the last national meeting of the American Beekeeping Federation a representative of the Montana State Apiarist's Office was asked to talk to a group of beekeepers on diseases of bees and their control. At this same meeting the Assistant State Apiarist was appointed to act as director for the northwestern United States area of the organization known as "Apiary Inspectors of America."

Recommendations have been set up and distributed to all registered beekeepers in Montana for a modern program of honey house sanitation.

For the past 4 or 5 years the problem of spraying both with insecticides and herbicides has become increasingly difficult for the beekeeper. During the past year at least 500 colonies were reported to the state office as being either partially or completely knocked out by indiscriminate spray poisoning. Recommendations have been made on proper sprays and amounts to use and on proper time of application, but considerable work remains to be done before a complete solution is found for the spray poisoning problem.

During the year 1955 approximately 3,700 colonies were inspected. Approximately 1.4 percent of these showed disease and were destroyed.

During the calendar year 1956, which is not complete at time of writing, approximately 3,200 colonies have been inspected and have shown a disease incidence of 2.4 percent. Most of the diseased colonies were found in two yards, and they have been destroyed. Commitments have been made to inspect about 1,000 more colonies during the remainder of this season.

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