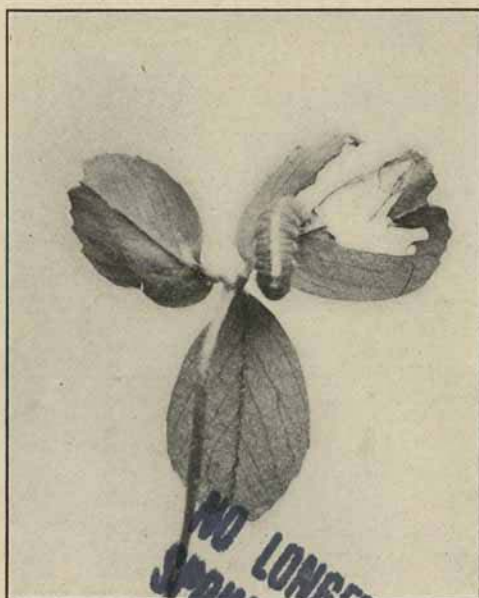


DECEMBER, 1913

EXTENSION BULLETIN No. 7

University of Idaho
College of Agriculture
Department of Agricultural Extension



THE ALFALFA WEEVIL

The Alfalfa Weevil

BY
T. H. PARKS

Any farmer, teacher or student in the State may have the bulletins from the University mailed to his address free of charge upon application to Director Idaho Experiment Station, Moscow, Idaho.

NO LONGER PROPERTY
OF THE UNIVERSITY OF IDAHO
PUBLISHED BY THE
IDaho EXPERIMENT STATION

UNIVERSITY OF IDAHO
COLLEGE OF AGRICULTURE
EXTENSION DIVISION

OFFICERS

W. L. CARLYLE.....	Acting President and Dean
W. H. OLIN.....	Director
R. B. COGLAN.....	County Agent Supervisor

EXTENSION STAFF

E. F. RINEHART.....	Animal Husbandman
E. P. TAYLOR.....	Horticulturist
T. H. PARKS.....	Entomologist, Alfalfa Weevil Control
AMY KELLY.....	Home Economics
C. E. JOHNSON.....	Dairyman
L. C. AICHER..	Superintendent, Aberdeen Demonstration Farm
J. S. WELCH..	Superintendent, Gooding Demonstration Farm
W. H. HEIDEMAN..	Superintendent, Clagstone Demonstration Farm
C. B. HAMPSON.....	Foreman, Caldwell Demonstration Farm

EXPERIMENT STATION STAFF

W. L. CARLYLE.....	Director
J. S. JONES.....	Chemist
J. F. NICHOLSON.....	Bacteriologist
E. J. IDDIGS.....	Animal Husbandman
G. E. FREVERT.....	Dairy Manufacturing
E. V. ELLINGTON.....	Dairy Production
F. L. KENNARD.....	Field Crops
P. P. PETERSON.....	Soils
C. C. VINCENT.....	Associate Horticulturist
H. P. FISHBURN.....	Assistant Chemist
C. W. COLVER.....	Assistant Chemist
W. R. WRIGHT.....	Assistant Bacteriologist
J. C. KINZER.....	Assistant Animal Husbandman
R. A. LAMSON.....	Creameryman
HENRY FULMER.....	Assistant Bacteriologist
F. W. GAIL.....	Assistant Plant Pathologist
H. M. ROOT.....	Assistant Chemist
C. V. SCHRACK.....	Gardener

The regular bulletins of this station are sent free to persons residing in Idaho who request them.

THE ALFALFA WEEVIL*

BY

T. H. PARKS

Summary.

The alfalfa weevil was accidentally introduced into Utah from Europe, where it is present each year but not especially destructive.

It feeds principally upon alfalfa, and will not feed upon wild hay, grasses or grain crops.

It has spread northward from Utah, and is now present in Idaho in southern Oneida county, and in very limited numbers in southern Franklin and Bear Lake counties.

The weevils will probably do no damage to alfalfa in the above counties in Idaho for at least two years.

It is spread by the wind, which probably carries the beetles long distances when they are flying in early spring, and in July.

The alfalfa weevil does not infest the seed, and is not spread in that manner.

The greatest injury to alfalfa is done by the larvae, or worms, which eat the leaves of the first crop, and prevent the second from growing for a time after the first crop is harvested. They do not destroy a stand of alfalfa, but reappear each year to injure the foliage from May until July.

It interferes with the production of seed from the first crop, but not from the second.

The adults are brown snout-beetles about 3/16 inch long, and live over winter in crowns of alfalfa plants and sheltered places. In spring they feed on alfalfa and lay small, yellow eggs inside the stems, through punctures made with the snout. From the eggs, hatch small, yellowish green worms, which feed in the opening buds and young leaves at the tip of the plant. When full-grown, the worm goes to the crown of the plant, spins a silken cocoon around its body, and in about two weeks emerges from the cocoon as a fully developed beetle—the alfalfa weevil. The beetles live over winter to lay eggs the following spring. There is but one brood each year.

* *Phytonomus posticus* Gyll.

There is no reason to believe that the alfalfa weevil will disappear suddenly, or even decrease in numbers by natural control.

Keep ditch banks, fence rows, and alfalfa fields clean of weeds, rubbish and piles of waste hay.

Cultivate the alfalfa field in the spring before growth starts.

If the alfalfa weevil is present, cultivate with spring-tooth harrow in the summer after the first crop is harvested, and go over the stubble with a brush-drag while the ground is dry. This will crush the worms and cocoons present in the alfalfa crowns, and permit the second crop to grow at once.

Plow up old stands, and give alfalfa the care and attention given other crops.

Do not think that the alfalfa weevil will prevent the production of good crops.

Use remedial methods as preventative measures, for fields in or near the present area of infestation.

Study the illustrations shown here and report suspected injury to the Experiment Station, in order to aid in exterminating the weevil in possible areas of new infestation.

Introduction.

The alfalfa weevil has been the cause of much anxiety on the part of Idaho hay growers the past two years, and although now present in but few points in the state, much interest has been aroused over this new pest of alfalfa. This is due partly to the recent quarantine laws enacted by California and Montana against the shipment into those states of alfalfa hay from three Idaho counties. Also because of the desire upon the part of the growers to ward off an outbreak which would threaten to interfere with the production of one of Idaho's most paying crops, and best live stock food, in a state just beginning to develop this long needed industry.

There has been more or less confusion among the farmers of Idaho over the character of the injury due to the alfalfa weevil. However, nearly every one interested in the growing of alfalfa has heard of this insect and its injury to that crop.

It is the purpose of this bulletin to set forth in a simple and concise manner, the history, habits, and injury which is done by this insect, together with illustrations to show these in such a way that the farmers of this state may be better acquainted with its work. In this manner, it is hoped to be able to guard against new outbreaks of the weevil in the hay-growing sections of the Snake River Valley and other parts of the state, by securing concerted action between the farmer and the state in the very beginning of the infestation. This

can only be brought about by the grower being able to recognize the work of the weevil, and report it to the Experiment Station before the pest has spread over new territory too large for the use of practical methods to bring about its rapid extermination.

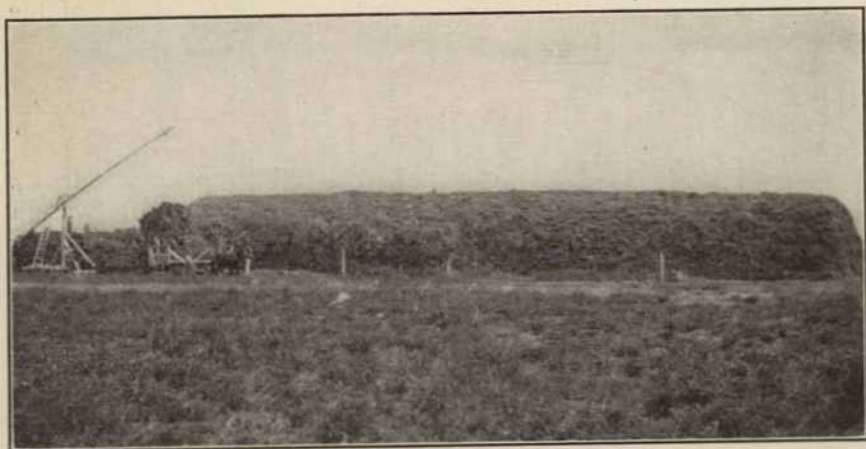


FIG. 1.

Harvesting Alfalfa Hay in the Snake River Valley in Southern Idaho.

For the benefit of the growers situated in the counties now bordering on the present infestation, there is given an outline of the care and cultivation of alfalfa fields to be used in fighting the alfalfa weevil. This is used very successfully in the infested fields in Utah, and if put in practice by Southern Idaho farmers, would go far toward preventing serious injury from the weevil, and at the same time increase the yield of hay the cost of application several times over.

The facts herein presented which concern the importance of the presence of the alfalfa weevil within or threatening the hay fields of Southern Idaho, are the result of investigations made during the summer of 1913 in the southeastern counties of the state. Much of the information about the life history and some of the illustrations were secured by the writer during 1911 and 1912, while engaged in the investigation of this insect for the Bureau of Entomology of the United States Department of Agriculture, and which Dr. L. O. Howard, Chief of that Bureau, has kindly given permission to be used in this work. The United States Department of Agriculture and the Utah Agricultural Experiment Station have been co-operating in the investigation of this insect. Both have been doing excellent work, the former in biological studies and more especially in introducing foreign parasites from Europe to prey upon the weevil in an attempt to effect

a permanent control, and the latter in cultural methods and treatment of infested fields to reduce the annual loss to a minimum. The results of their work to date, have been published in Bulletin No. 112 and Circular No. 137 of the Bureau of Entomology, U. S. Department of Agriculture, and Bulletin No. 110 and Circular No. 10 of the Utah Agricultural College and Experiment Station.

Distribution.

The alfalfa weevil is well distributed over Europe, where it has been present for years but is not especially destructive. It was in some unknown manner introduced into Utah, and has now become well established there, and from where it has spread to Idaho and Wyoming. In Idaho the weevil is now found in southern Oneida county from Malad City south to the Utah line; in southwestern Franklin county near Weston; and in extreme southern Bear Lake County, at Pegram and near Fishaven. It is found in very limited numbers only at any of these points, although they will probably be abundant enough in a few years to do noticeable injury to the hay crop. No weevils can yet be found in Bannock county or at any point farther north or west in the hay-growing sections of the Snake River Valley, and if any infestation exists in the State of Idaho outside of the above named points it has not yet developed enough to attract attention. In Utah the weevils are found over all of Rich county wherever alfalfa is grown, and during 1913 noticeably damaged alfalfa in fields within $2\frac{1}{2}$ miles of the state line at Fishaven, Idaho. This point represents the extreme northern limit of infestation along Bear Lake and it is only with difficulty that any specimens can be found over the state line in Bear Lake County, Idaho. Weevils are present in southern and western Cache County, Utah, and also eastern Boxelder County, where serious damage was done to alfalfa at Brigham City during 1913. The beetles are present in injurious numbers south to the southern end of Utah County, and can be taken as far south as Juab and Millard Counties.* The writer collected specimens at Almy, Evanston, Cokeville and Lyman, Wyoming, in 1911, while to the west the Great Salt Lake Desert apparently has served as a barrier to their spread.

The infestation in 1913 extends over an area approximately 180 miles long by 90 miles wide, the beetles being found in the infested area wherever alfalfa is grown. This represents the spread during a period of nine years, as the year 1904 marks the time of first injury from the weevil at Salt Lake City.

* Cir. No. 10 Utah Agr. College and Exp. Sta.

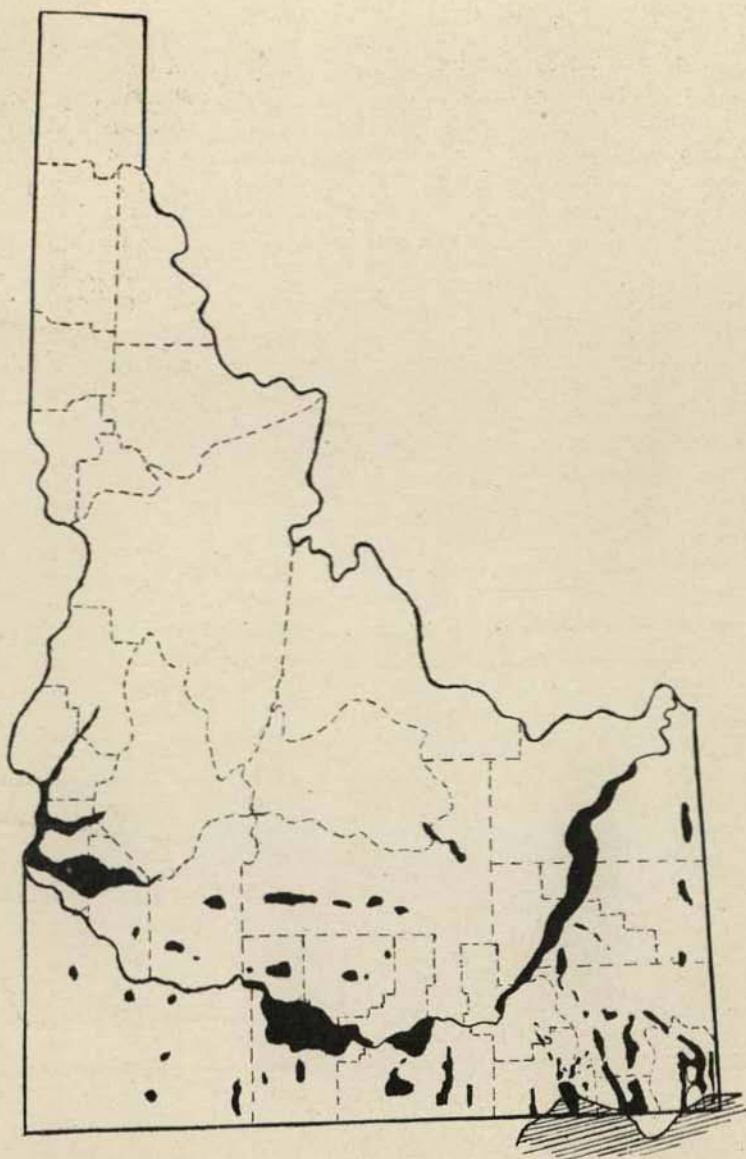


FIG. 2.

Map showing where alfalfa is grown in Southern Idaho, and the distribution of the alfalfa weevil within the state in 1913.

Principal alfalfa growing section shown by black areas.

Presence of the alfalfa weevil shown by shaded area.

The weevil entered Idaho from Utah since 1911, and has yet done no visible damage to alfalfa in Idaho fields.

Means of Distribution.

Thus far distribution appears to be almost entirely by flight and the wind has proved to be the main agency of dispersion by carrying beetles from infested fields to fields beyond the original area of infestation. The beetles are flying during two seasons of the year. The first in early spring when they are traveling from winter quarters to alfalfa fields, and the second in July and August when the new generation of beetles has appeared, and when many fly into the air and leave the infested fields to be carried to new fields beyond. On April 2, 1912, the writer observed the beetles falling indiscriminately in alfalfa and grain fields, along roadsides and right-of-ways, and to alight within a few feet of open ore cars in the railway yards at Salt Lake City.

Thus far, no mountain ranges appear to obstruct the progress of the beetles and the larvae and adults have been found feeding on isolated alfalfa plants in mountain canyons far removed from cultivated fields.

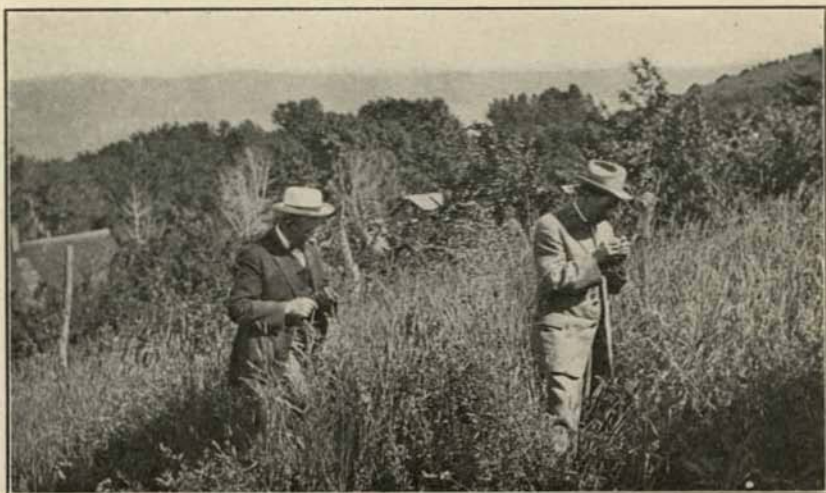


FIG. 3.

Field of alfalfa along the shore of Bear Lake where the alfalfa weevil has increased in numbers very rapidly during the past two years.

The rate of dispersion must be influenced by the direction and velocity of the wind during the time the beetles are on the wing. In the Malad Valley they have traveled northward at the rate of about 25 miles per year. Corinne, Utah, was the northernmost point at which specimens could be taken by agents of the U. S. Bureau of Entomology in 1911, while in July, 1913, they could be found at Malad

City, Idaho. Along Bear Lake, the spread northward has not progressed to any extent during the past two years, although along the west and south shore of the lake the insect has increased in numbers very rapidly. The slow progress northward here may be attributed to the prevailing southwest wind during the time the beetles are flying, and which drops them into the lake and the desert country to the east.

Owing to the fact that no hay is shipped into Idaho, from the infested area, there is little danger of the pest being introduced into this state in that manner. However, as a precautionary measure, a quarantine has been placed by this state against Utah hay. Railway trains are particularly apt to carry the beetles during the time they are flying, but we have thus far found no new areas of infestation that can be attributed to this or any other artificial agencies of dispersion.

There is very little danger of the weevil being imported in alfalfa seed from Utah, provided it has been properly cleaned by screening.

No prediction can be made as to the probable northward trend of the weevils due to natural agencies but there is apparently little resistance offered to their progress because of the existence of cultivated land and plenty of alfalfa from the Utah-Idaho state line northward to Bingham, Bonneville and Fremont Counties.

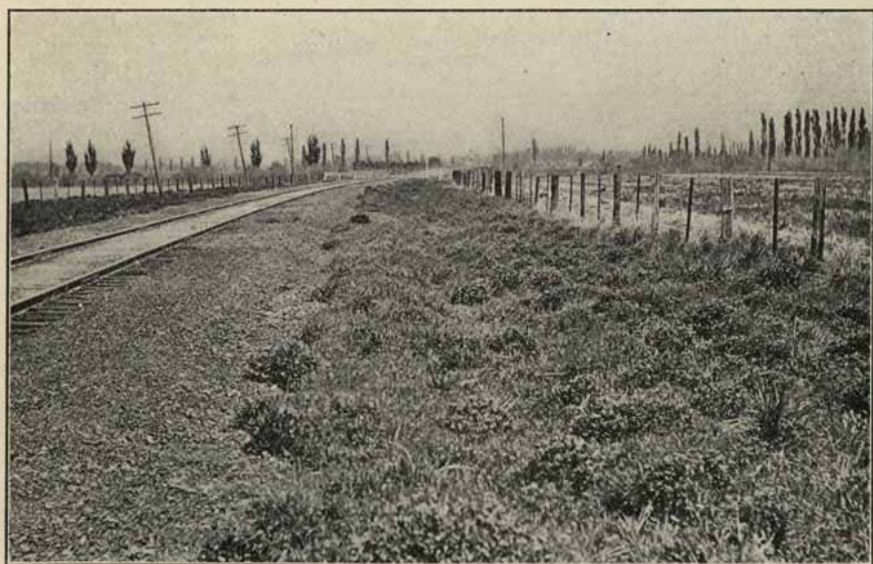


FIG. 4.

Volunteer alfalfa growing along the railroad right-of-way. A favorable place for new colonies of the alfalfa weevil to become established due to the beetles being carried by trains.



FIG. 5.

Volunteer alfalfa growing in the streets of Gooding, Idaho. A favorable place for the alfalfa weevil to become established, due to beetles being shipped in commodities sent from the Salt Lake Basin.

Food Plants.

Alfalfa is the main food plant for the weevil in this country. They will feed on red clover in confinement, but in the Salt Lake Basin fields of red clover are not attacked, even when joining alfalfa fields badly infested with the weevil. It will feed readily on sweet clover and has been frequently found feeding on white clover, burr clover and several species of wild vetch.

Wild hay, timothy, grasses and grain crops are not subject to attack.

Injury.

The principal damage due to the alfalfa weevil is caused by the larvae, or worms, and is done to the foliage of the first crop during the latter part of its growth, and to the second crop for several weeks after the first crop is harvested. Some injury is done in the early spring by the beetles making oblong punctures or cavities in the green stems where they feed, but the main injury is done later by the worms feeding on the young leaves as shown in Fig. 6. This is the condition that attracts the grower's attention to their presence the first year injury results, and is noticed during May and June in fields having an altitude of between 4,000 and 5,000 feet. The injury continues until the time the first crop is ready to harvest, the worms feeding when very young in the young buds, and later between the open-

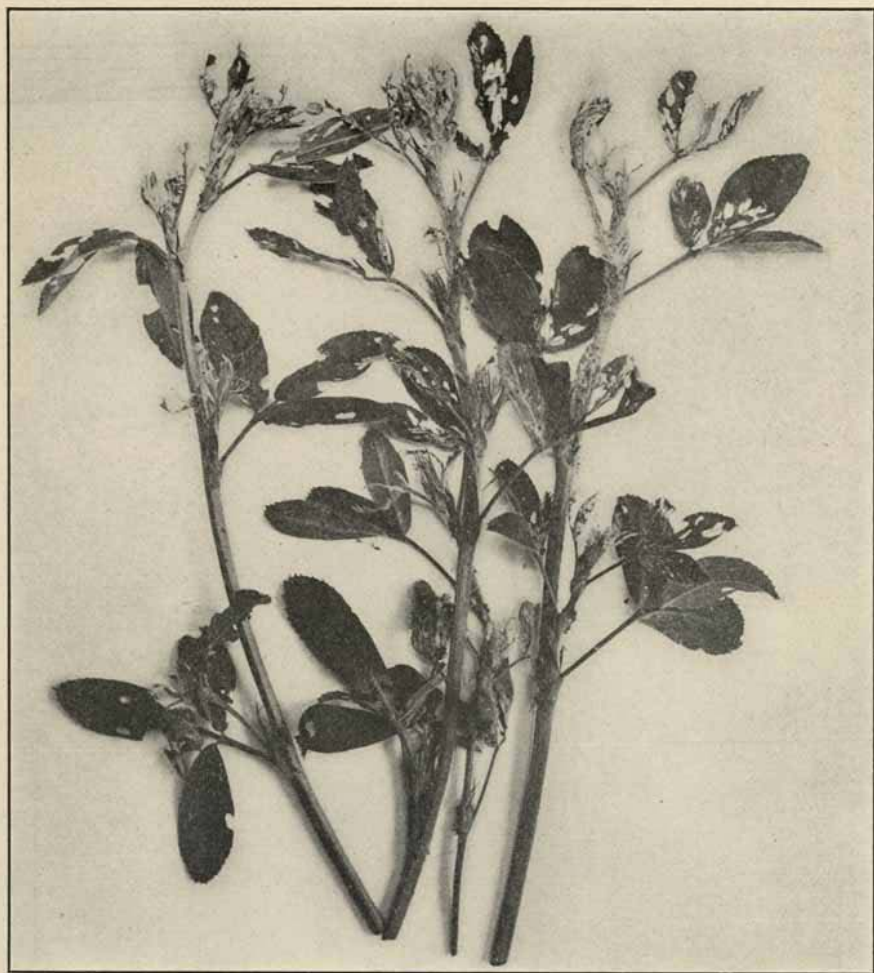


FIG. 6.

Tuft of alfalfa injured by the larvae of the alfalfa weevil.

ing leaves until they have so badly injured the tips of the plants as to prevent them from blossoming, and thus making it impossible to secure seed from the first crop. The injury may become so severe as to stop the growth of the hay before it is ready to cut. One of these fields is shown in Fig. 7. After the first crop is harvested, the worms go down to the stubble and devour the green leaves as fast as they appear, even feeding on the green stubble in an effort to keep from starving. This serves to keep the field bare for a time,

or until the majority of the worms have spun their cocoons and transformed to pupae. This means that the second crop is delayed from three to five weeks where no summer cultural methods are used, and results in the third crop making but little growth before the approach of winter. In higher altitudes, where but two crops are secured, the second crop would be so delayed that it would be caught by the frost before ready to harvest, whether grown for hay or seed.

The weevil does not destroy the stand of alfalfa, but merely reappears each year to injure the foliage from May until July.



FIG. 7.

Seriously infested field of alfalfa showing stage at which growth was arrested by the larvae of the alfalfa weevil.

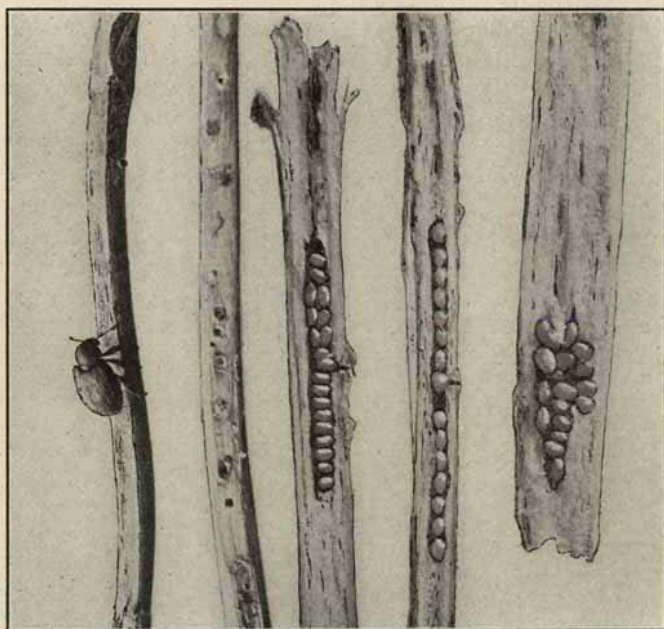
Description and Life History.

The adult alfalfa weevil, Fig. 9 (e), is a dull brown beetle about $\frac{3}{16}$ of an inch in length, oval and having its body covered with small gray and brown hairs. The head is provided with a short beak or snout, as are all of our injurious weevils and curculios. The beetles pass the winter in crowns of alfalfa plants, patches of grass and weeds in waste places, in old stack bottoms, and in litter left in the fields. They become active the first warm days of spring and migrate to the fields of alfalfa where they mate and deposit their eggs.

THE EGG.

The eggs, Fig. 9 (a), are very small, oval, lemon-yellow in color, and are placed inside the stems of alfalfa through punctures

made by the beetle with its beak. Fig. 8 (a) shows one of the beetles photographed while in the act of depositing eggs, while Fig. 8 (b) shows the punctures in the side of the stem, and into which the eggs are placed. Usually from 6 to 14 eggs are inserted in each puncture and are placed up and down the stem in a row, presenting a symmetrical appearance. Fig. 8 (c). After the eggs are deposited, the beetle often seals the puncture with a watery secretion



a b c
FIG. 8.

Egg-laying of the alfalfa weevil.
a—beetle depositing eggs in stem of alfalfa.
b—punctures made by the beetle in depositing eggs.
c—eggs in place inside the stems.
All enlarged.

to protect them from injury. The most of the eggs are deposited from April until June inclusive. The overwintering beetles die during the summer, although a few can be found in the fields as late as September and October. Each beetle deposits between 700 and 800 eggs during the season. The average number deposited by sixteen females used in experiments during the season of 1912 was 726.

THE LARVAE.

The eggs hatch in from 8 to 15 days, depending upon the temperature, and the young larvae, which are small green worms with

black heads, emerge from the stem, travel to the tip of the plant, and here feed unobserved between the unfolding leaves. When about half grown the worms are found with bodies curled in the tops of the plants, and their green color blends so harmoniously with the leaf that they are very difficult to detect. The older larvae feed upon the older leaves, traveling from one to the other and devouring the foliage as shown in the figure on the cover page. Many of them go into the crowns of the plants during the day and come out to feed at night. From 6:00 p. m. to 1:00 a. m. both worms and beetles are found feeding in greatest numbers, although many are found feeding all through the day. When the worms are very numerous they may so injure the foliage as to stop the growth of the plants entirely, thus cutting short the first crop. This occurs in June in fields having an altitude of from 4,000 to 5,000 feet, and during July in fields having an altitude from 5,000 to 6,000 feet. After the first crop is removed, the worms feed upon the stubble until full grown, when they are about $\frac{1}{4}$ inch long, having a pale white stripe running down the middle of the back, and with wrinkles or furrows running across the body. See Fig. 9. (b). They have no feet, are clumsy and unable to travel very far.

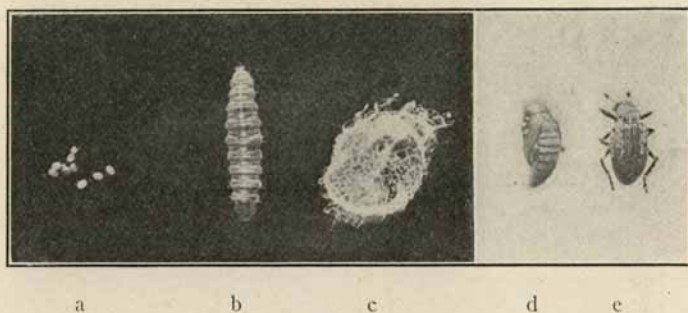


FIG. 9.

Different stages of the alfalfa weevil.

a—eggs; b—larva; c—cocoon; d—pupa; e—adult. All enlarged.

COCOON AND PUPA.

When full grown the worm crawls to the crown of the plant or to the ground and spins around its body a white silken mass of threads or cocoon, Fig. 9 (c), usually attaching this to a dead leaf or perhaps to the side of a stem near the ground. About thirty-six hours after spinning the cocoon the worm changes to the pupa, or resting stage, Fig. 9 (d), and about ten days after, and during July, changes to the adult insect—*THE ALFALFA WEEVIL*.

The newly emerged beetle remains concealed on the ground and about the alfalfa crowns for a few days, then crawls to the

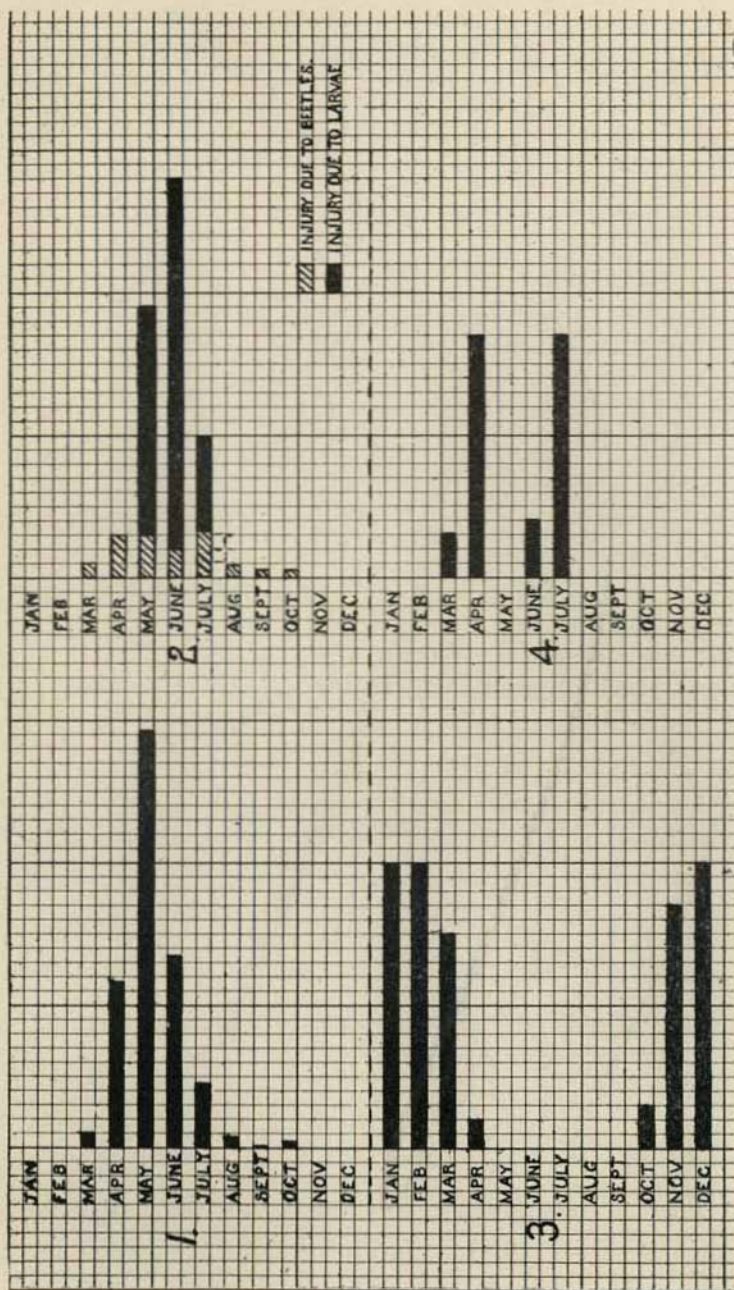


FIG. 10.

LIFE HISTORY CHART OF THE ALFALFA WEEVIL.

1—Distribution of egg-laying during season of 1912.

2—Estimate of the comparative injury due to the beetles and larvae, and its distribution throughout the season.

3—Period during which the beetles are in hibernation.

4—When the beetles fly and spread to uninfested fields.

topmost leaf or stem, spreads its wings and flies into the air. The summer flight occurs in July in the Salt Lake Basin and in August in the higher altitudes in the mountain valleys.

The beetles continue to feed on the stems and leaves during the remainder of the season, but there is little injury to the crop after the disappearance of the worms, and the presence of the beetles is not noticed unless a search is made for them.

A few of the beetles are known to deposit eggs in the fall, but most of the eggs are not deposited until the following spring. The beetles go into winter quarters during October and November.

Natural Control.

There is no reason to believe that the alfalfa weevil will disappear in a few years, as is often the case with destructive outbreaks of grasshoppers or crickets. There are a number of native insects which prey upon it in Utah, such as lady-beetles and tiger-beetles, but they are insects which multiply slowly and feed upon other species also, and are not able to make much progress against the weevil. Toads, reptiles, and a number of birds seek both the larvae and beetles for food, and in this way aid somewhat in its control. The stomach of a toad killed in an alfalfa field near Salt Lake City at the time the worms were beginning to appear, contained 175 beetles and 17 larvae. The Bureau of Biological Survey of the United States Department of Agriculture, found that 31 species of birds, frequenting alfalfa fields, fed upon the alfalfa weevil.

We have no reason to expect that the cold winters which prevail in the high altitude in much of southeastern Idaho will control the weevils, since they thrive in the mountain valleys of Utah at an altitude of between 6,000 and 7,000 feet.

Weather conditions in the spring apparently have much to do with the amount of injury done by the larvae to the first crop of hay, so that it is very difficult to predict what loss will result. A prolonged cool spring results in egg-laying being extended over a long period of time with a less number of larvae feeding at any one time, and the injury resulting not so great but that the plant will have a chance to recuperate. Experiments made during the spring and summer of 1912 at Salt Lake City showed that the rate of egg-laying among the beetles is directly dependent upon the mean daily temperature during the time that the eggs are being deposited. A cold day will check egg-laying, while one or two warm days will greatly increase the number of eggs that is deposited.

The hot, dry weather of our western mid-summers appears to kill many of the pupae left unprotected on the ground after the first crop of hay is removed. It is this factor that aids so effectively in

killing the weevils when these pupae are rendered unprotected by cultivation and the use of the brush-drag after the first crop is removed from the field.

Remedial Measures.

Fortunately, the most successful methods used in fighting the alfalfa weevil are those which prove to be a direct benefit to the alfalfa, even though no weevils are present. They are methods which some Idaho hay-growers have been using before the alfalfa weevil became established in America, and solely because of the increased yield in the hay crop which resulted. This is the practice of cultivating the fields in the spring with a disc, spring-tooth harrow or alfalfa cultivator, and another application again in the summer after the first crop is removed, but this time followed by a brush-drag weighted down so that it cuts through the stubble, and thoroughly brushes the loose soil. For the use of the brush-drag as a remedy against the alfalfa weevil, we are indebted to Doctor E. G. Titus, Entomologist of the Utah Agricultural Experiment Station, who, early in the history of the present outbreak, recognized the value of this tool, later modified by wire brushes in the co-operative work with the U. S. Department of Agriculture. These experiments have demonstrated the value of summer cultivation followed by the use of the brush-drag, and have made the prospects look more hopeful for the alfalfa grower in the weevil infested area.

A number of experiments have been tried in the control work in Utah, which were either unsuccessful or too expensive to be practiced on a large scale. These include the use of arsenical sprays, (which renders the hay unfit for food), the use of collecting machines, burning and steaming of fields and pasturing of cattle and horses.



FIG. 11.

Old stack bottom in which large numbers of beetles lived over winter.

SPRING CULTIVATION.

Cultivating the alfalfa in the spring is advocated in order to accelerate the growth of the first crop, so that it is better able to withstand the attack of the larvae. In the infested area it is necessary that the first crop be cut earlier than otherwise, because of the fact that the longer this crop is left standing, the greater the injury due to the worms present on it. As the unavoidable loss is in the yield of this crop, it is necessary to keep it growing as fast as possible by spring cultivation, which gives the plants an opportunity to grow earlier than under ordinary conditions. It serves to keep out weeds, and kills the eggs and pupae of many injurious insects.

SUMMER CULTIVATION.

Cultivating, preferably with a spring-tooth harrow after the first crop is removed, is valuable in tearing apart the stubble and kills many larvae and pupae within their cocoons at this time. It should be done when the ground is dry and prepares a dust mulch for the brush-drag which should follow.

BRUSH-DRAGGING.

The brush-drag should be used immediately after the removal of the first crop and while the ground is dry. It is made, preferably of green hawthorne brush, by arranging the butts in a row and clamping them between two planks, Fig. 12, or weaving them into a harrow. The brush should be kept flat and weighted with a plank or log so that they will go deeper into the furrows and thoroughly

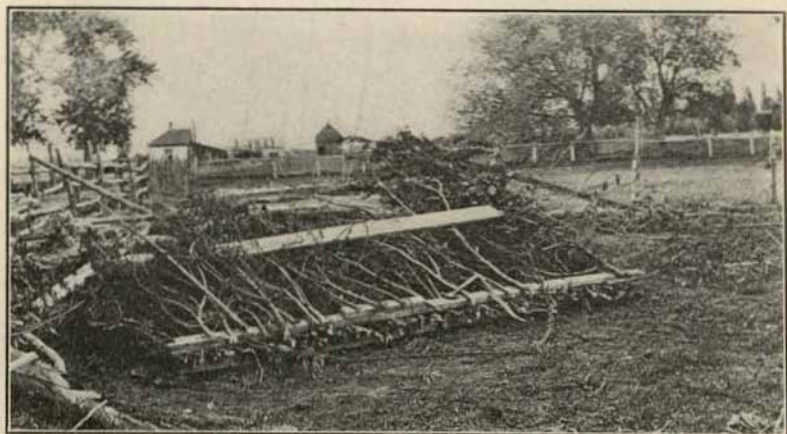


FIG. 12.

Brush drag used to kill the larvae of the alfalfa weevil immediately after harvesting the first crop.

cut through the alfalfa crowns. The fine twigs on the brush tear off and crush the cocoons at this time attached to the stubble, and many not crushed are buried in the hot dust where they die. It may be necessary to run the brush over the field once each way in order to secure the best results. It should be done as soon as possible after the first crop is removed, as the worms soon transform to beetles, after which they are very difficult to kill. The water should be kept off the field for about two days after using the brush-drag, in order to let the hot sun assist in killing the weevils rendered thus unprotected. The field may then be irrigated and the second crop will start to grow at once. Where no treatment is given the field it will remain bare and brown from three to five weeks, or until the majority of the worms change to pupae. The use of the brush-drag is necessary in the weevil infested area to prevent the loss of several weeks' growth. Where it is used properly the good results can be observed at once. The Utah Station estimates that on land treated by summer-cultivation and brush-dragging the gain has been from $1\frac{1}{2}$ to $3\frac{1}{2}$ tons per acre for the second and third cutting, and produced at an outside cost of \$1.25 per acre.

ROTATION.

Alfalfa should be given the care and attention given to other crops and the increase in yield will more than pay for the trouble.

Old stands should be plowed up in localities infested with the weevil, as they are always the most seriously damaged. A new stand can be secured even where the weevils have become well established, as the young alfalfa is not seriously injured the first year.

COMMUNITY WORK.

Farmers living in a community bordering on or near the area infested with the alfalfa weevil, as is the case of a number of alfalfa growing sections in Southern Idaho, should unite to put into practice the above cultural methods. Besides increasing the yield of hay it will serve as a precaution against the alfalfa weevil, which seems certain to push farther into the state. By concerted efforts upon the part of growers situated on the northern border of the infested area, it may be possible to stay the progress of the weevil northward to uninfested fields. Growers will not be aware of the presence of the weevil the first, or perhaps even the second year it makes its appearance in the fields of Southern Idaho. This is all the more reason why they should become acquainted with it early. It is hoped that by using the best known remedial methods as measures of prevention, it may be kept so reduced in numbers that little injury will ever result to the alfalfa crop. Instead, an increase in yield should

result from the methods of clean culture and cultivation, which should be put in use to prevent the alfalfa weevil from becoming established.

In hay-growing sections now remote from the present area of infestation, farmers should be on the lookout for injury suspected to be due to this insect. There is some danger of it being spread through channels of commerce, and farmers in the Snake River Valley and alfalfa growing sections farther north are urged to report to the State Experiment Station injury thought to be due to this insect, so that it may be exterminated before becoming firmly established in new sections outside the present infested area.

Quarantine Orders Pertaining to the Alfalfa Weevil.

The following quarantine orders have been issued against the Counties of Bear Lake, Bannock and old Oneida in Idaho, by the States of Idaho, California and Montana:

QUARANTINE ORDER No. 4.

BOISE, IDAHO, November 12, 1913.

Quarantine Order No. 2, under date of February 24, 1913, is hereby amended to read as follows:

WHEREAS, The alfalfa fields in the following counties of the State of Idaho are infested with the alfalfa weevil (*Phytonomus posticus*); Bear Lake, Franklin and Oneida; and,

WHEREAS, This insect pest is liable to be carried into other counties of the State of Idaho; and,

WHEREAS, The alfalfa production of the other counties of the state is very large and of great value; and,

WHEREAS, There is great danger of other counties of the state receiving this pest through the importation of alfalfa hay and seed, or bees in hives, from the counties aforesaid;

Therefore, It Is Hereby Ordered and Declared, That a quarantine be and is hereby established against all alfalfa hay, or bees in hives found in the above named counties of Idaho, and all horticultural commissioners, local inspectors and deputies of the State Horticultural Inspection Department are hereby instructed and required to refuse shipments into the other counties of the State of Idaho of all alfalfa hay or bees in hives, from the said quarantined counties, and if shipment of such hay, or bees in hives is made into the other counties of the state by any oversight, such shipment must be at once destroyed or returned to the shipper. All transportation companies are asked to refuse for shipment into the other counties of the state any alfalfa hay, or bees in hives from the said infested counties to be transported into other counties of the State of Idaho.

It Is Hereby Further Ordered and Declared, That no alfalfa seed from the said infested counties shall be shipped into any other county of the State of Idaho except upon compliance with the following conditions:

Every lot of alfalfa seed from the said infested counties must be shipped in new seamless sacks, and must be subject to inspection, either at point of shipment or point of delivery, by a deputy inspector or quarantine officer of the State of Idaho. If such inspection is made at point of shipment, all expense incurred therein must be borne by the consignor; if such inspection is made at the point of delivery, all expense incurred therein must be borne by the consignee, and the alfalfa seed shall not be released until the inspection charges are paid. All transportation companies within the said infested counties are asked to refuse for shipment into any other counties of the state any alfalfa seed not contained in

new seamless sacks; and if such container does not bear a certificate of inspection, the transportation agent at point of delivery shall notify the local inspector before the shipment is delivered to consignee.

ATTEST:

W. L. GIFFORD,
Secretary of State.

C. K. MACEY,
State Horticultural Inspector.

QUARANTINE ORDER No. 20.

SACRAMENTO, CALIFORNIA, February 27, 1913.

Quarantine Order No. 17, under date of December 17th, 1912, is hereby amended to read as follows:

WHEREAS, Alfalfa fields in the States of Utah, Wyoming and portions of Idaho are infested with the alfalfa weevil (*Phytonomus posticus*), and,

WHEREAS, The devastation of this insect is very serious, often ruining the entire crop; and,

WHEREAS, Our alfalfa product is very important, its estimated cash value for the present year being a little short of \$50,000,000; and,

WHEREAS, There is danger of our receiving this pest through the importation of all kinds of hay, including alfalfa from the aforesaid districts; and,

WHEREAS, There is also danger of our receiving this pest through the transportation of colonies of bees in hives from the districts aforesaid; and,

WHEREAS, It is a menace to the interests of California alfalfa growers to introduce either nursery and ornamental stock or other plants from the aforesaid districts if packed in tule, hay or straw or shipped in boxes or cars that have not been disinfected;

Therefore, It Is Hereby Ordered and Declared, That a quarantine be and is hereby established against the importation into California of colonies of bees in hives, all hay including alfalfa and other hay and straw in cattle cars from the States of Utah, Wyoming and that portion of Idaho bounded as follows: On the north by the 43d parallel north latitude, on the east by the State of Wyoming, on the south by the State of Utah, on the west by the 113th meridian west longitude and on the northwest by the Snake River in the State of Idaho. All state quarantine guardians and deputies of the State Commissioner of Horticulture are hereby instructed and required to refuse admission into the State of California all colonies of bees in hives and all hay from the said quarantined districts. If such hay and colonies of bees in hives be shipped into the State in violation of this order, they must at once be destroyed or returned to the shipper as required by law.

It Is Hereby Further Ordered and Declared, That all nursery and ornamental stock and other plants imported into the State of California from the aforesaid States of Utah, Wyoming and portions of Idaho must be packed in fresh shavings, excelsior or other suitable packing (excepting tule, hay and straw), and the box containers and cars must be disinfected by fumigation with chemically pure cyanide of potassium, using three ounces to each one hundred cubic feet of space, such fumigation to be given both at the point of shipment and at the point of delivery. Every lot of said nursery and ornamental stock or other plants from the infested districts must be shipped either to a quarantine officer of the State of California or to a quarantine guardian or other person authorized in writing by the State Commissioner of Horticulture to receive it; and every lot of such nursery and ornamental stock or other plants must be delivered at such freight or express office as shall be designated by said State quarantine officer, quarantine guardian or other authorized person, and held by him in quarantine and fumigated as provided for above. All expense incurred in treating for disinfections of such lot of nursery and ornamental stock or other plants shall be paid by the consignee or owner, and the nursery and ornamental stock or other plants shall not be released until the same is paid.

And It Is Hereby Further Ordered and Declared, That no alfalfa seed from the infested districts shall be received into California except upon compliance with the following conditions: Every lot of alfalfa seed from the infested districts

must be enclosed in a container sufficiently tight to prevent the egress of any alfalfa weevils, should any be enclosed, and must be shipped either to a quarantine officer of the State of California or to a quarantine guardian or other person authorized in writing by the State Commissioner of Horticulture to receive it; and every lot of such seed must be delivered at such freight or express office as shall be designated by said State quarantine officer, quarantine guardian or other authorized person, and held by him in quarantine and sufficiently treated until in his judgment the lot should be released. All expense incurred in treating for dis-infections of such lot of alfalfa seed shall be paid by the consignee or owner, and the alfalfa seed shall not be released until the same is paid.

APPROVED BY:

HIRAM W. JOHNSON,
Governor of California.

A. J. COOK,
State Commissioner of Horticulture.

PROCLAMATION OF QUARANTINE.

HELENA, MONTANA, September, 1913.

I, S. V. Stewart, as governor of the State of Montana, * * * do hereby declare and proclaim a quarantine against the importation into Montana of:

1. Alfalfa hay.
2. Forage crops of all kinds, whether loose or baled.
3. Alfalfa seed, unless accompanied by a certificate of fumigation.
4. All nursery stock, unless accompanied by a certificate of fumigation.
5. Fresh fruits and vegetables of all kinds during the months from April to October, inclusive, from the State of Utah; from the counties of Bear Lake, Oneida and Bannock in the State of Idaho, and from the counties of Uinta and Lincoln in the State of Wyoming; except that fruits and vegetables may be shipped into the State of Montana from the State of Utah on and after August 1 of each year under conditions as follows:

a. Shipments for Montana to be made only from points designated by the State Horticultural Inspector of the State of Utah. Said State Horticultural Inspector of said State of Utah to notify the State Horticulturist of the State of Montana by registered mail of the designation of shipping points in the State of Utah. Said notification to be sent before any shipments to the State of Montana are made from said points.

b. Shipments to be repacked from orchard boxes into new, clean boxes or other containers.

c. All wagons or other conveyances used in hauling to the packing houses to be kept free from alfalfa straw, hay or other litter or other means of contamination.

d. All packing houses to be at all times free from alfalfa hay, other hays, straw and other means of contamination.

e. Each package to be plainly stamped or tagged with an official certificate of the State of Utah, stating that it has been inspected and passed in compliance with these regulations, and stating where it was repacked and inspected.

All horticultural inspectors of the State of Montana are hereby instructed and required to refuse admission into the State of Montana to all such articles as are herein designated from said state and counties except under the conditions herein enumerated. If any such articles as are hereinbefore listed be shipped into the State of Montana in violation of this quarantine, they must be at once destroyed or returned to the shipper at his expense.

This quarantine shall not be construed to interfere with shipments of produce to the Yellowstone Park over the Oregon Short Line railroad, and to Idaho points on the Gilmore and Pittsburgh railroad.

This quarantine shall take effect and be in force on and after the twelfth day of September, A. D. 1913.

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

S. V. STEWART,
Governor of Montana.

