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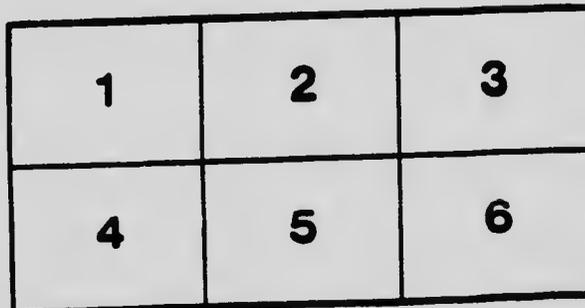
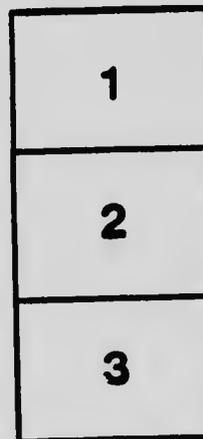
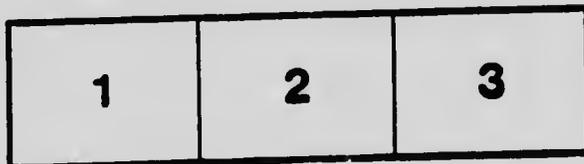
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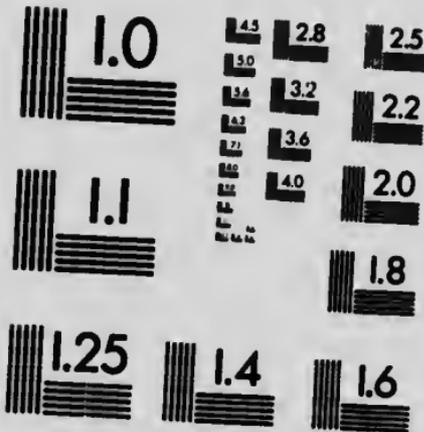
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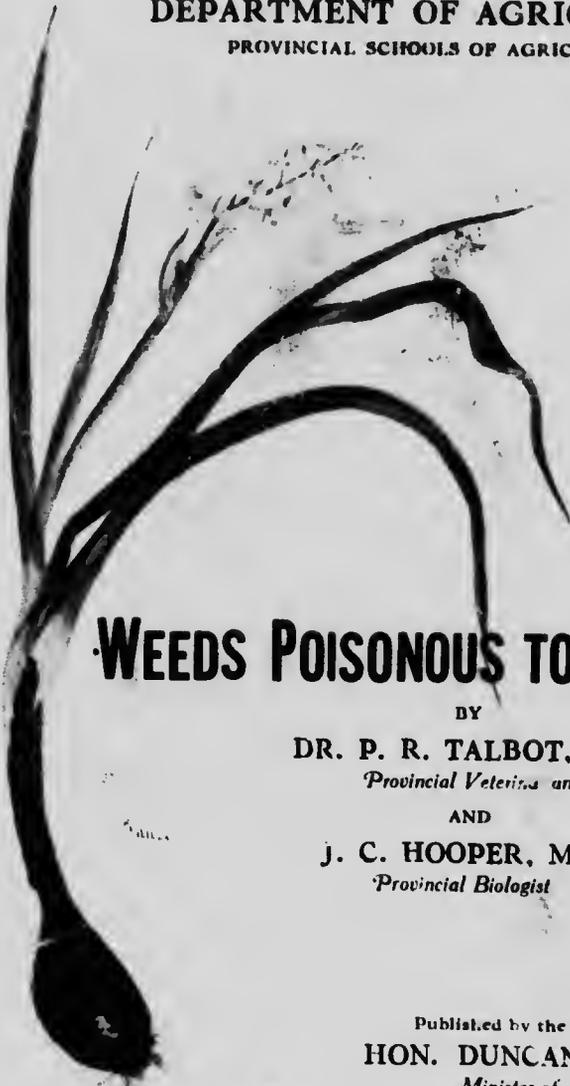
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PROVINCE OF ALBERTA
DEPARTMENT OF AGRICULTURE
PROVINCIAL SCHOOLS OF AGRICULTURE

BULLETIN No. 1



WEEDS POISONOUS TO LIVESTOCK

BY

DR. P. R. TALBOT, V.S.
Provincial Veterinarian

AND

J. C. HOOPER, M.A.
Provincial Biologist

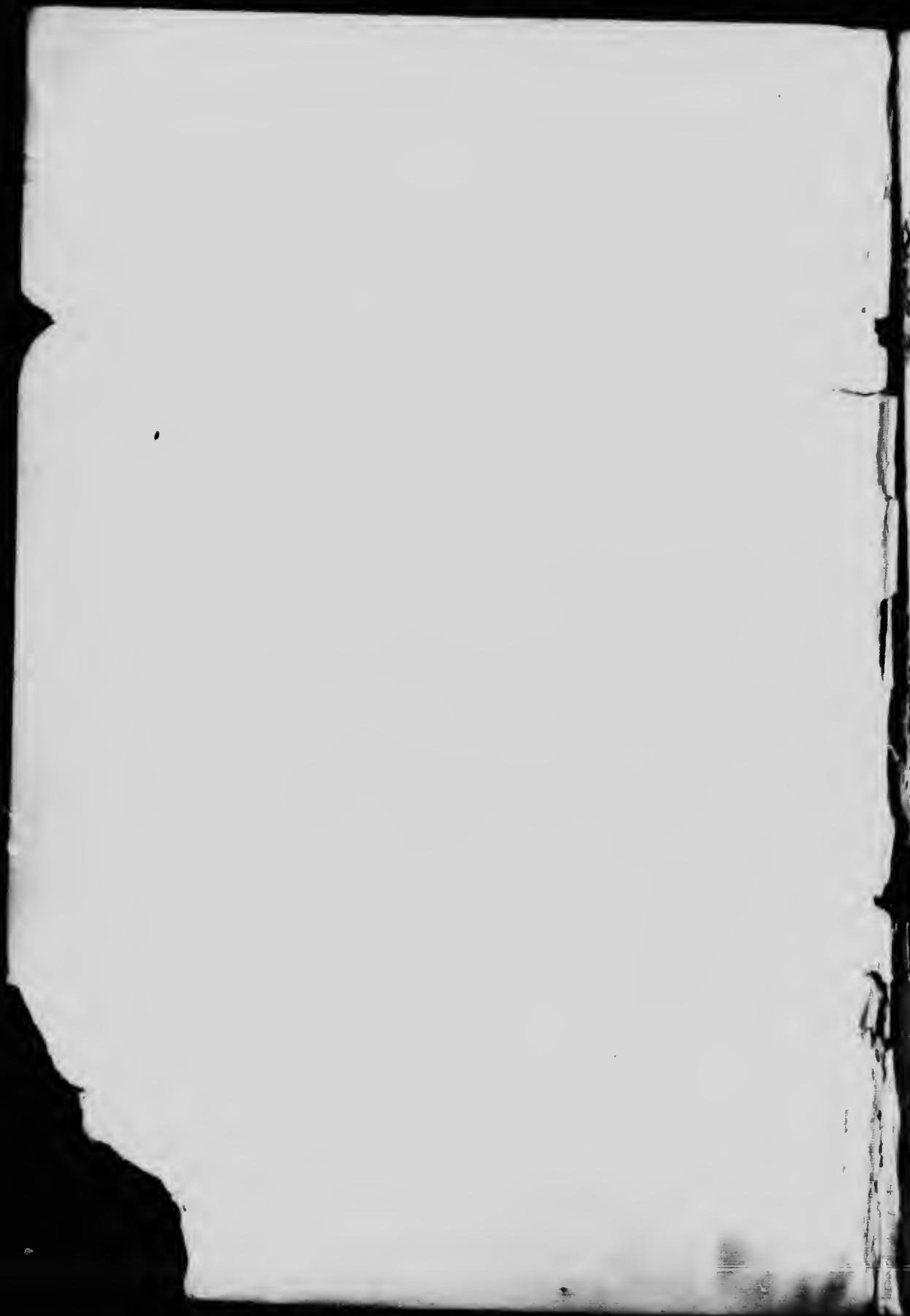
Published by the Direction of the
HON. DUNCAN MARSHALL
Minister of Agriculture

DEATH CAMAS



EDMONT

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1919



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LETTER OF TRANSMITTAL

HONORABLE DUNCAN MARSHALL,
Minister of Agriculture,
Edmonton.

Sir,—

I have the honor to submit herewith Bulletin No. 1 of the Provincial Schools of Agriculture, entitled, "Weeds Poisonous to Livestock," by Dr. P. R. TALBOT, V.S., Provincial Veterinarian, and J. C. HOOPER, M.A., Provincial Biologist, and to recommend that it be published for general distribution.

I have the honor to be, Sir,

Your obedient servant,

A. E. MEYER,

Superintendent, Schools of Agriculture.

Department of Agriculture, •

Edmonton, December 20th, 1919.



ACKNOWLEDGMENTS

We are indebted to the Agricultural Experimental Station of the University of Nevada for the use of the cuts for the colored Plate on the cover, and for Figures 3, 6, 7, 9, 13, 14 and 15.

We are indebted also to the Montana Agricultural College Experiment Station for the use of the cuts for Figures 1, 2, 4, 5, 8, 10, 11 and 12.

The colored Plates I., II., III. and IV. were drawn by Norman Criddle, Ottawa.

PREFACE

Poisonous weeds cause heavy losses of livestock annually to many ranchers and stockmen in Alberta. It is estimated that there is more loss of livestock from plant-poisoning than from any other single source. This loss is due largely to the fact that many ranchers and stockmen are not acquainted with the various poisonous plants, and consequently are not able to use measures to prevent stock from eating the poisonous weeds, or to give the proper treatment to poisoned animals.

This bulletin has been prepared to give information required for the identification of the most dangerous poisonous weeds found in Alberta, the methods of handling to prevent stock from eating these weeds, and the symptoms and treatment of animals affected.

It is hoped that by application of the information supplied in this publication, ranchers and stockmen will be able to greatly lessen losses of livestock due to the eating of native poisonous plants.



WEEDS POISONOUS TO LIVESTOCK

INTRODUCTION

The poisonous weeds of Alberta found to be most dangerous to livestock are: Tall Larkspur, Low Larkspur, Death Camas, Water Hemlock, White Loco-weed, Woolly Loco-weed, and Showy Loco-weed. These poisonous weeds may occur on ranges and other grazing areas, and may be found in hay cut on native prairie meadows. When stock are grazing on ranges and pastures there are several circumstances which tend to increase the danger of plant-poisoning.

The poisonous weeds usually begin to grow early in the spring, offering green, succulent forage before the native grasses have made much progress. Hence, stock may be tempted to eat this poisonous food before good forage becomes plentiful.

In the early spring months, during rainstorms and late snowstorms, stock often seek shelter in coulees and ravines. Certain poisonous weeds, especially the tall larkspur, grow in these locations, and stock are thus exposed to these plants, when they are very poisonous.

After snowstorms, grazing plants are often covered and only the poisonous plants are left standing above the snow.

When stock come out from their places of shelter, in which they have been during long-continued rains, they are very hungry and exercise little discrimination in their choice of forage.

It is believed that certain plants are more poisonous when wet with rain or dew than under other conditions.

When the ground is wet after rainstorms, animals can much more readily pull up the roots and bulbs of plants, as they pull or nip off the stems and leaves. In some plants, such as the water hemlock, a great deal of the poisonous principle is contained in the rootstock and roots, and in the case of the death camas much of the poisonous principle is contained in the bulb.

It is also possible that storms accompanied by winds may beat down the weeds and the grass together, so that stock cannot distinguish them readily.

During dry seasons, on dry areas, and on stony, gravelly locations pasture may become scarce, and stock then do not exercise a choice in the food they eat.

The greatest losses of sheep from poisoning occur when sheep are being transferred from one range to another. This is due to the fact that they cannot make the same choice of forage while being hurried over the range as they can when they are allowed plenty of

time to spread out and to select their food. When sheep are being trailed from one range to another, they should be handled in such a way that they never become very hungry at any time. Before they begin to move they should be allowed to fill up. Each night, herders should see that the sheep are "bedded down" in the best pasture obtainable. Then in the morning good pasture will be near at hand and the sheep can begin grazing early. The action of the poisonous principle seems to be more rapid when the sheep are hungry and hot.

METHODS OF HANDLING TO PREVENT STOCK FROM EATING POISONOUS WEEDS

Eradication of the Poisonous Weeds.—Cultivation will destroy all the native poisonous plants. In localities where it is desirable or possible to cultivate, weed-infested areas may be broken and sown to some good grass mixture. The kinds of grasses used in the mixture will depend upon their suitability to the particular district.

In localities where it is neither desirable nor possible to cultivate, the plants may be grubbed or dug out. When poisonous plants are grubbed out, the work should be done thoroughly.

Fencing the Weed-infested Areas.—Weed-infested areas are sometimes enclosed, or are shut off from the rest of the range by means of a strongly built fence. Such areas may sometimes be used as pasture for animals not affected by the particular weed enclosed or shut off. For example, sheep and horses may be turned into a tall larkspur area even in the dangerous period with practically no danger of loss. The areas may be thrown open to all stock when the dangerous periods are past.

Herding the Stock Away from Poisonous Areas.—Riders may be employed during the dangerous months to herd stock away from poisonous areas. If this method is used, riders should herd the stock carefully during stormy weather in spring and early summer.

Value of Salt.—All kinds of livestock require a regular and plentiful supply of salt. If an animal does not get its required amount of salt, it develops a perverted or depraved appetite, and will then eat poisonous plants that it possibly would not touch, if its appetite were normal. Animals should be supplied with salt regularly and abundantly. The salting grounds should not be near poisonous weed areas during the periods when the weeds are dangerous. The salting grounds should be changed from time to time, in order that the pasture near them may not be grazed down too closely, and only objectionable plants left.

Value of Good Water.—Livestock should have access to plenty of good water. When stock cannot get plenty of good water, they sometimes develop a depraved appetite. Strongly alkaline water should be avoided, as it is thought that it develops a perverted or abnormal appetite in stock.

General Precautions.—Hungry stock exercise little discrimination in their choice of forage. If animals are in a very poor condition when they are turned out in the spring, they should be put on a range that is free from poisonous weeds. Every precaution should be taken to see that stock do not become too hungry at any time. A range should not be allowed to get pastured down too closely. When stock are to be moved after being unloaded from a train, they should be allowed to fill up on good hay before they begin to move. They will then be less likely to snatch at any or every plant as they are being transferred to the range. When stock are being driven across a range, they should not be hurried along too quickly.

WEEDS POISONOUS TO LIVESTOCK

LARKSPURS

Two kinds of larkspurs are found in Alberta: (1) tall larkspur, called also poison, poison-weed, and cow-poison; (2) low larkspur, called also purple larkspur, and small larkspur.

TALL LARKSPUR

(*Delphinium glaucum* or *Delphinium Brownii* Rydb.)

The tall larkspur is an erect, rank-growing, smooth, green plant from two to six feet in height. The leaves are round in outline and deeply divided into lobes, the lower leaves being large and long-stemmed, while the upper ones are smaller, more finely cut, and shorter-stemmed. Rich bluish-purple flowers, with a curved spur on each, terminate the stalk. (See Plate I., opposite page 12).

The stalks of the tall larkspur occur singly, or in clumps of two or three, and grow from one or more crowns or upper parts of the roots. The stalks are smooth, green, or green with a tinge of purple, round, and hollow. When the stalks are young they are covered with a whitish coating. The lower three-quarters of the stalk bear the leaves, while the upper part bears the bluish-purple flowers.

The leaves of the tall larkspur are smooth, green, circular in outline, but deeply divided into from three to five segments, each segment more or less cut into smaller ones. (See Plate I., opposite page 12). The leaves toward the base of the stem are large, from three to six inches in diameter, with leaf-stems about four inches long. The upper leaves are smaller, having narrow lance-like segments, and much shorter leaf-stems.

The flowers of the tall larkspur are a rich bluish-purple. At higher altitudes the blue color usually becomes more prominent. Each flower has a cone-shaped spur, one-half inch long, curving upward, and resembling in shape the spur on a lark's foot. (See Plate I., opposite page 12). The length of each flower to the tip of the spur is about three-fourths of an inch and the width about one-half inch. The flowers are arranged on a fairly open axis, six to eighteen inches long, which may be single or branched. (See Fig. 1, page 13). As the flowering-axis continues to grow throughout the

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PLATE I.
TALL LARKSPUR



growing season, we may find mature seed at the bottom of the axis, while at the top the flowers are just opening.

The dry fruit, which contains the seed, is usually composed of three upright compartments, each opening lengthwise to allow the seed to escape. The seeds are brown, quite small, rough, and angular.

The root of the tall larkspur is perennial, that is, it may live more than two years. It is woody, and consists of a number of fibrous branches which grow to a depth of from six to eight inches. Each root has one or more crowns from which new stalks spring up year after year.



FIG. 1. Flowers of tall larkspur. One-third natural size.

Where the Tall Larkspur is Found.—The tall larkspur is found in the foothills, and along the mountain sides, at an elevation of from four thousand to nine thousand feet. It grows very plentifully in the underbrush of poplar and willow scrub which occurs usually on those slopes of hills and coulees facing the north and east. The tall larkspur grows most abundantly within half a mile of some creek, ditch, or spring. It requires shade and a rich, fairly moist, well-drained soil.

In the Dominion Forest Reserves we have observed the tall larkspur growing abundantly beneath poplar and willow scrub timber. It occurs in the timber.



FIG. 2. Clump of young tall larkspur. One-eighth natural size.

Seasonal Growth.—In the southern part of the Province the young stalks begin to shoot up early in May. About the tenth of May the tips of the young stalks may be seen when the dead leaves are pulled away. Usually by the twenty-fourth of May, they are about six inches high, bearing several green, succulent leaves. A photograph of a young clump of tall larkspur as it appears about the middle of June is shown in Fig. 2, on page 14). The stalks reach their maximum height by the end of July. The flowering period usually begins early in July and ends early in August. The mature seeds have fallen to the ground usually by the end of August. In the northern part of the Province the tall larkspur is from one to two weeks later in starting to grow.

Throughout the whole of Alberta, however, the seasonal growth of the tall larkspur is governed by the altitude, and the climatic conditions of the spring and of the summer.

PLANTS COMMONLY MISTAKEN FOR THE TALL LARKSPUR

The Wild Pink Geranium (*Geranium Bicknellii Britton*) is commonly mistaken for the tall larkspur in the spring and early



FIG. 3. Wild pink geranium. This plant is commonly confused with the tall larkspur during early spring.

summer before the flowers have appeared. (See Fig. 3, page 1) In general shape the leaves of the geranium resemble very much those of the tall larkspur. The leaves of the geranium, however, are covered with fine white hairs, and when the leaves are pinched between the fingers they give the characteristic geranium odour. The leaves of the larkspur are smooth and do not give the geranium odour. The flowers of the geranium are pink, and have no spots. The wild pink geranium is not poisonous.

The Tall Anemone (*Anemone virginiana* L.).—The leaves of the tall anemone during the early stages of growth are very commonly mistaken for those of the tall larkspur. The leaves of the anemone, however, are smaller and grow in a clump from that part of the stem at the surface of the ground. The tall larkspur has such a clump of leaves arising at the surface of the ground. The anemone grows from nine to eighteen inches high, and has a single white flower at the top of the stem. The tall anemone is not poisonous.

Parts of the Tall Larkspur that are Poisonous.—All parts of the tall larkspur are very poisonous, but the young stalks and leaves cause the greatest loss of cattle.

Animals Which are Subject to Poisoning by Tall Larkspur.—The tall larkspur is probably one of the most destructive of the poisonous plants that we have in Alberta, especially in the southern part of the Province. Each year large numbers of cattle are lost in the foothill pastures. From what is known at the present time it is thought that horses are occasionally poisoned by it, but the losses in horses are insignificant.

Symptoms.—Cattle.—The first symptom will probably be the sudden falling of the animal. When cattle have been feeding on pasture which contains larkspur and are started up suddenly or are driven rapidly from the spot where the plant has been eaten the symptoms seem to develop quickly. There is usually a general stiffness of the legs and a difficulty in walking which causes the affected animal to lag behind the herd and finally lie down. In many cases it will regain its feet stagger along with its hind legs spread widely apart, only to fall after a few steps in violent convulsions. Spasmodic twitching of the muscles of the sides of the legs appears intermittently.

In very severe cases the affected animal will lie flat on the ground, occasionally raising the head and letting it fall again. In mild cases the animal may lie practically normal with the head held erect,

but with muscular tremblings well marked. As the heart and the respiratory organs are affected, the pulse will be feeble and the respirations shallow.

Occasionally an animal may fall once, lie prostrate upon the ground for a short time, apparently recover and walk off, to all appearance as if nothing had happened.

Animals poisoned by larkspur are nearly always constipated. In practically all severe cases the animals are nauseated and vomiting and belching gas is a common symptom. Bloating is present in many animals, but not in all. Copious drooling or slobbering is also quite commonly met with.

Treatment.—A large number of animals are poisoned by larkspur on the range, and are already dead before being discovered. Fortunately, however, it is very frequently possible to apply remedies that will lead to recovery. Numerous cases are on record where, in mild poisoning, the animal after it falls has been so placed that the head is kept in a higher position than the rest of the body, and being kept perfectly quiet, recovery has taken place without any medical remedies being applied at all. Attempts to raise the animal upon the feet, or to disturb it in any way, is almost always followed by fatal consequences. As stated previously, bloating is common and should be relieved by tapping with a trocar and cannula into the first stomach. At one time bleeding was supposed to give beneficial results. It is doubtful if it has any value whatever, many claiming that it only produces weakness, and makes recovery less probable. Experiments tried out with potassium permanganate and aluminum sulphate have done good in many known and observed cases; on the other hand many condemn it as utterly useless. Experiments carried out in Experimental Stations in the United States have given beneficial results from the subcutaneous injection of the following:

Physostigmin Salicylate.....	1 grain.
Pilocarpin Hydrochloride.....	2 grains.
Strychnine Sulphate.....	½ grain.

This preparation may be obtained in Veterinary Hypodermic tablets from any drug store. The tablets should be dissolved in about four ounces of water purified by boiling and carefully injected under the skin with a hypodermic syringe. Stockmen accustomed to vaccinating for Blackleg will find the operation simple.

Methods of Preventing Cattle from Eating Tall Larkspur.

—In order to prevent cattle from eating tall larkspur, ranchers and stockmen must locate all the tall larkspur areas on their ranges and

then use one of the following three methods: (1) fencing; (2) grubbing out; (3) herding.

(1) **Fencing Method.**—By this method each tall larkspur area is shut off from the rest of the range by means of a strongly built barbed-wire fence. The cattle can thus be shut out of the areas until the poisoning period is past. The tall larkspur areas may be used as horse and sheep pastures, as these animals are not poisoned to any extent by the tall larkspur. No definite date can be set when the plant ceases to be poisonous, because its maturity varies with the locality and the conditions of the season. If the plants have passed the flowering period and have matured the seed, tall larkspur areas may usually be considered safe for cattle. In most localities in Alberta these areas may be regarded as safe for cattle between the middle and the end of August'.

(2) **Grubbing-out Method.**—By this method all the tall larkspur roots are grubbed or dug out. The effectiveness of the grubbing-out depends upon the thoroughness with which it is done. All tall larkspur roots must be cut off about eight inches below the surface of the ground, so that none will be left to send up stems the following spring. The best time to dig out the roots is during the flowering period, and the work should be completed before the seeds begin to ripen. The roots and the stems should be collected, removed beyond the reach of cattle, and when dry, they should be burned. Even although this grubbing is done very thoroughly, it may nevertheless be necessary to grub the area the following year. The cost of the second grubbing will be small. The areas will then be completely rid of the tall larkspur.

(3) **Herding Method.**—By this method riders are employed during the months of May, June, July, and part of August, to herd the cattle away from the tall larkspur areas. The riders must herd the cattle carefully, especially during stormy weather, because at these times they are most likely to drift into coulees for protection and thus get into the brush and timber where the tall larkspur may occur. If the cattle are driven out of such areas shortly after entering them, ill-effects may possibly not result.

On large ranges where the tall larkspur areas may be numerous and great in extent, it is usually most economical to use the fencing method. On smaller ranges the grubbing-out method, which is the most effective method, may be used. Herding cannot be recommended so strongly as either of the other two methods.

LOW LARKSPUR

The low larkspurs are represented in Alberta by two species, viz.: *Delphinium bicolor* Nutt. or *Delphinium Menziesii*, D.C., and *Delphinium azureum* Michx.



FIG. 4. Low larkspur (one-third natural size).

Low Larkspur (*Delphinium bicolor* Nutt.).—This low larkspur is a slender, slightly hairy, perennial plant from five to eighteen inches high, with several large dark-purple flowers terminating the stem. (See Fig. 4, page 19). Each flower has a conical spur about three-quarters of an inch long, and slightly curved. The length of the flower is from one to one and a half inches. The two small upper parts of the flower are pale yellow with blue veins. The stems are slender, unbranched, and covered with fine short hairs. The leaves at the base of the plant are few in number, long-stemmed, and very deeply divided into five segments, which are again more or less divided into narrow segments. The leaves higher up on the stem are very few in number, short-stemmed, and are very deeply divided into narrow segments. The roots are tuberous and perennial.

Where the Low Larkspur is Found.—The low larkspur found along the foothills on open land, usually in full sunlight grows on hillsides and on the higher banks of creeks. It may be found at all altitudes up to ten thousand feet. It is found usually within a few hundred yards of scrub or timber. The low larkspur requires a fairly rich, fairly moist, well-drained soil.

Seasonal Growth.—The low larkspur begins to grow in May. Blossoms appear the latter part of May and during the summer. The seeds are mature in June and July. The fruit and seeds are quite similar to those of the tall larkspur already described.

Parts of the Low Larkspur that are Poisonous.—All parts of the low larkspur are poisonous.

Low Larkspur (*Delphinium azureum* Michx.).—The stems of this low larkspur are much stouter than those of the *Delphinium bicolor* already described. The leaves are deeply cut into fairly wide segments. The whole plant is densely covered with fine, short, silky hairs. The stems grow from the base to a height of two feet in height. A very close cluster of bluish-purple flowers terminates the stem. The spur on each flower is quite stout and points downward. The roots are tuberous.

Animals Subject to Poisoning by Low Larkspur.—The low larkspur in this Province seems to be poisonous principally to sheep and calves. Fortunately there are very few areas where the low larkspur is found, and losses from this plant are not frequently reported. The symptoms are similar to those produced by the tall larkspur.

DEATH CAMAS (*Zygadenus venenosus* Rydb.)

The other common names by which the death camas is known in Alberta are poison camas and mystery grass.

The death camas is a slender, grass-like plant having a cluster of from five to seven pale-green, narrow, grass-like leaves. From the centre of this cluster is an erect flower-stem from five to ten inches high, with numerous small greenish-yellow flowers. The leaves and the flower-stem grow from a perennial, underground onion-like bulb. (See Plate II., opposite page 20).

The leaves are from five to fifteen inches long, narrow and grass-like. They are somewhat rough, and have a distinct ridge along the middle of the under surface. The leaves are thicker and more fleshy than those of grasses, and hence are more palatable to stock.

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PLATE II.
DEATH CAMAS



The flowers are greenish-yellow, lily-like, and about one-quarter of an inch in diameter. The flowers grow from different points along the upper part of the flower-stem, forming a fairly close cluster. The flower-stem grows in height during the flowering season and hence the flowers become farther apart as the season advances.

The bulb, from which the leaves and the flower-stem grow, is situated from two to four inches below the surface of the ground. The bulb is covered with thin, membranous, brown coats. The interior of the bulb is very similar to that of an onion, being composed of white fleshy layers, which can be separated from each other. The bulb varies in length from one to one and a half inches. At the base of the bulb there are several fibrous roots similar to those occurring at the base of an onion.



FIG. 5. Death camas. One-third natural size.

Where the Death Camas is Found.—The death camas is found on the open prairie, and on open land on the sides of hills and in crevices and ravines.

Seasonal Growth.—The time at which the plants grow in the spring depends on the weather conditions. They are usually found first on open, fairly moist slopes facing the south. The flowers appear in May and June and the seeds mature in July.

Plants Commonly Mistaken for Death Camas.—The wild onion (*Allium reticulatum* Don.). The wild onion is very commonly mistaken for the death camas. There are, however, three points of difference between the two. The bulb and the rest of the onion plant have the characteristic onion odour, which is lacking in the death camas. The flowers of the wild onion are pinkish-white, while those of the death camas are greenish. All the flowers of the wild onion grow out from one point at the top of the flower-stem, whereas in the death camas the flowers grow from different points along the upper end of the stem. (See Fig. 6, page 22). The wild onion is not poisonous to stock.



FIG. 6. Death camas on the left, and wild onion on the right.

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The Swamp Camas (*Zygadenus elegans Pursh.*) resembles the death camas in general appearance, but is a much coarser plant, owing to the fact that it is usually found in moister locations. The leaves of the swamp camas are wider and longer than those of the death camas. The flower-stem is higher, and the flowers are larger and farther apart on the flower-stem. The swamp camas has the same poisonous principle as the death camas, but being coarser is very seldom eaten by stock.

Parts of the Death Camas that are Poisonous.—All parts of the plant contain the poisonous principle. The bulbs especially are very poisonous. When the soil is wet, there is a greater likelihood of stock pulling up the bulbs.

How the Death Camas Spreads.—The death camas spreads over new areas by means of its seeds. The seeds germinate in spring, and during the growing season produce grass-like plants with small bulbs. The next spring each bulb sends up leaves and a flower-stem.

Animals Which are Subject to Poisoning by Death Camas.—All classes of stock that eat this plant are said to be injuriously affected by it, but apparently in this Province sheep alone are poisoned by it.

Symptoms.—Probably the first symptom of poisoning will be stiffness in the legs and difficulty in walking. There will be also a disposition on the part of the sheep to straggle from the rest of the flock. Frothing at the nose and mouth, rapid breathing, increased flow of saliva, regurgitation through the nose and mouth, sudden jerking of the head and intermittent spasms follow in rapid succession. Finally muscular paralysis takes place, the animal is down and unable to rise and a profound insensibility sets in from which the victim never recovers.

Treatment.—There is a great difference of opinion regarding the treatment for this form of plant-poisoning. Many claim that medicinal remedies are of little avail. In several instances many cases recovered from the administration of permanganate of potash and aluminum sulphate. A teaspoonful of each dissolved in about a pint of water is sufficient for from 10 to 12 sheep. It is claimed by many that bleeding in the extremities, that is, at the mouth and tail, is effective in the early stages of the poisoning.

The supplying of plenty of salt to sheep cannot be recommended too highly. If deprived of salt, sheep develop an abnormal or depraved appetite which eventually results in their acquiring the habit of eating certain plants which otherwise they might not touch at all.

Methods of Preventing Stock from Eating Death Camas.

—Care should be taken to see that stock are not tempted to eat death camas. The range should never be pastured down too closely. Observation of numerous cases leads to the conclusion that practically all losses occur when stock have been turned hungry upon pasture badly infested with death camas. Sheep, especially, should be given proper care when being transferred across a range where the death camas grows at all abundantly. Heavy losses have occurred when sheep have been allowed to consume large quantities of the plant while being driven across an infested area to the regular pasture ground. They should be allowed to fill up on good forage before they begin to move. Early in the morning they should be allowed to graze on good pasture before starting out.

If only small patches of death camas occur on the range, the plants may be grubbed out by loosening the soil with a spade, and then pulling up the bulba. The plants should be grubbed out during the flowering period, as it is very difficult to distinguish the death camas plants from grasses, when the death camas plants are not in flower. The grubbing-out is most easily done when the soil is moist.

Since cultivation of the land readily eradicates death camas, it is sometimes advisable to break the land, and sow to some good grass mixture suitable to the district.

WATER HEMLOCK (*Cicuta maculata* L.).

The other common names by which the water hemlock is known in Alberta are poison parsnip, wild parsnip, cowbane, and beaver-poison.

The water hemlock is a tall, erect, marsh plant from two to six feet high. It may be regarded as a perennial. The stems are fairly stout, streaked with purple, bearing a few pale-green, doubly compound leaves, and many quite flat clusters of very small, greenish-white flowers. (See Plate III., opposite page 24).

The stems are green, streaked with purple, smooth, and hollow, except at the joints where the leaves are attached to the stem. (See Fig. 7, page 25). The stems occur singly, or in small clumps of from two to six, and spring up from the underground part of the stem, or rootstock. The rootstock is short, thick, somewhat spherical, and varies in diameter from one-half inch to three inches. The interior of the rootstock is clearly divided by partitions into chambers running at right angles to the main stem. (See Fig. 7, page 25). In the spring these chambers are filled with a liquid, but later they become empty.



PLATE III.
WATER HEMLOCK

The root of the water hemlock consists of a bunch of fleshy, tapering projections attached to the rootstock. These fleshy projections spread out in different directions, and vary in number from



FIG. 7. Longitudinal section of a portion of the stem of water hemlock, and of the rootstock showing cross-partitions.

three to ten. Each projection is shaped like a small parsnip. All the projections have about the same diameter, but vary in length from two to five inches. The roots usually grow quite close to the surface of the ground.

The leaves of the water hemlock are pale-green. They are doubly compound, each leaf consisting of many leaflets appearing as individual leaves. The leaflets are lance-shaped, narrow, pointed at the upper end, deeply toothed, and varying in length from two to five inches. The lower surface of each leaflet is clearly veined.



FIG 8. Flowers of water hemlock. One-third natural size.

The flowers of the water hemlock are small and greenish-white. They are arranged at the tops of the branches of the stalks in dense flat-topped clusters from one to four inches across. (See Fig. 8, page 26). These large clusters are each composed of from fifteen

to thirty-one smaller clusters. In each small cluster there are from sixteen to thirty-three tiny greenish-white flowers. The fruit formed from each flower is small, ribbed, somewhat flattened on the sides, and about one-twelfth of an inch long. At maturity the fruit separates into two boat-shaped parts.



FIG. 9. Water hemlock plants (showing their typical manner of growth with other vegetation).

Where the Water Hemlock is Found.—The water hemlock is found in local patches throughout Alberta in the foothills and on the prairie, always in low, wet, marshy land. It occurs along creeks, irrigation ditches, along the edges of sloughs and lakes, and in low meadow land. It is always more plentiful after a series of wet years.

Seasonal Growth.—The water hemlock begins to grow in May. At first, pale-green shoots are seen. Later on, leaves appear.

pendent from a pithy stem, which afterwards becomes hollow. The flowers appear in June, and continue during July and early August. The seeds are ripe in August and early September.

Plants Commonly Mistaken for the Water Hemlock. Water Parsnip (*Sium cicutaefolium* Schrank).—The water parsnip is an erect, branching plant from two to five feet high, and grows in low, wet places along the borders of sloughs and lakes, and along creeks and irrigation ditches. The leaves of the water parsnip are compound, the leaflets being attached in pairs along the leaf-stem. The leaflets are narrow, lance-shaped, with sharply toothed edges. The difference between the leaf of the water hemlock and the leaf of the water parsnip may be seen by looking at Fig. 10, page 28. The roots of the water parsnip are fibrous, consisting of a number of separate slender parts. The water parsnip is not poisonous.



FIG. 10. On the left, compound leaf of water parsnip. On the right, doubly compound leaf of water hemlock. One-third natural size.

Cow-Parsnip (*Heracleum lanatum* Michx.).—This plant is often called wild rhubarb.

The cow-parsnip is a very large, stout, erect plant from four to six feet high. The leaves are very large, each being composed of three large separate parts called leaflets, which are densely covered on the lower surface with fine white hairs. The small white flowers

are arranged in very large flat clusters at the tops of the branches of the stalks. The cow-parsnip is found in the underbrush of poplar and willow scrub, and also on open land in rich woodland meadows. The cow-parsnip is not poisonous.

Sweet Anise (*Washingtonia longistylis* Torr.).—The sweet anise is an erect, branching plant from two to three feet high. It is found in the shade of poplar and willow scrub, or of timber. It is usually found along a creek or in some other moist location. The leaf is quite similar to that of the water hemlock in general shape. The leaflets of the sweet anise, however, are thinner, broader and more coarsely toothed than those of the water hemlock. The sweet anise is not poisonous.

Parts of the Water Hemlock that are Poisonous.—The rootstock and roots contain the greatest amount of the poisonous principle, cicutoxin. It is known that also the lower parts of the stem contain some of the poison, and that the leaves and stems of young plants contain quite a deal of the poison.

It has been proved that dried water hemlock plants, found in hay cut on native prairie meadows, have been poisonous to stock.

How to Prevent Stock from Eating the Water Hemlock.—The best method consists in grubbing out the roots. As the grubbing can be done quite easily, several acres may be freed from the water hemlock at a comparatively small cost. The roots should be placed beyond the reach of stock and when dry they should be burned. The grubbing should be done in early summer before new seeds have matured.

It has also been found practicable to fence off the infested area by a strongly-built fence.

Animals Subject to Poisoning by Water Hemlock.—Cattle are the most frequent sufferers from water hemlock poisoning, with horses and sheep occasionally, but under certain conditions it is well to remember that it is dangerously poisonous to all classes of stock.

Symptoms.—The poison contained in the root acts rapidly and is deadly. The first symptoms frequently appear in 30 to 60 minutes after the root has been eaten, but where only a small quantity is taken the animal may linger along for two or three days and in some cases eventually recover. The first irregular condition noticed will be a frothing at the mouth accompanied by pronounced un-easiness. When the animal falls to the ground violent convulsions take place, accompanied by the clamping of the jaws and gnashing of the teeth. In some animals great distress and excitement are manifested and during the period of convulsions they will bellow

and groan with pain. The breathing is often hurried and irregular, the pulse rapid and weak, there will be well marked dilatation of the pupil of the eye, and a gradual stiffening of the legs with the head and neck frequently bent backward. The intervals between the convulsions vary as to duration and intensity, the periods gradually becoming shorter, however, until coma takes place and death ensues.

Post-mortem Appearances.—There is usually well marked congestion of the lungs, this being brought about by paralysis of the respiratory muscles and producing death by asphyxiation. Usually the mucous membrane of the stomach is inflamed and parts of the plant may be identified in the stomach's contents.

Treatment.—Any single type of treatment of water hemlock poisoning has been found very unreliable. Remedies which effect a cure in one case prove a failure in others. For cattle the administering of permanganate of potassium, 1 dram, and aluminum sulphate, 1 dram, dissolved in water, has given in some instances beneficial results. Large quantities of melted lard, raw linseed oil or milk have been tried with varying success. Chloral hydrate in one-ounce doses has proved successful in some instances. It is claimed by many living in districts infested with water hemlock that the salting of stock regularly eliminates the danger considerably.

Our experience has been that on account of the exceedingly rapid action of the poisonous substance contained in the plant the animal is usually found dead or is too far gone for medicinal remedies to have any beneficial action.

LOCO-WEEDS

Several species of loco-weeds are found in Alberta, those causing the greatest losses of stock being the white loco-weed, the woolly loco-weed, and the showy loco-weed.

White Loco-weed (*Oxytropis Lamberti Pursh.*).—The other common names by which this plant is known in Alberta are the stemless loco-weed and crazy weed.

The white loco-weed is a silvery-white plant from three to ten inches high, growing in tufts or bunches from a perennial root. The leaves are pinnately compound and always shorter than the flower-stem. It belongs to the legume or pea family, and has one or more clusters of yellowish-white flowers that resemble in shape those of the pea. (See Plate IV., opposite page 30).

The leaves of the white loco-weed are from three to nine inches long, and grow in a slanting direction from several very short stems



PLATE IV.
WHITE LOCO-WEED



or crowns at the surface of the ground. The crowns cause the plant to have a bunching or tufted appearance. The leaves are compound, each leaf consisting of from nine to nineteen separate parts called leaflets. The leaflets are arranged in pairs along the leaf-stem with a single leaflet at the end. They are small, narrow, and covered with fine, silvery-white, silky hairs.



FIG. 11. White loco-weed. One-half natural size.

The flowers of the white loco-weed are shaped like those of the pea. They are yellowish-white, fairly large, and are arranged in a close cluster at the top of the flower-stem. (See Fig. 11, page 31). The flower-stem is from three to ten inches high, has no leaves and is unbranched. Within each flower two of the yellowish-white petals are united, forming a keel which is partly concealed by the remaining three petals. At the end of the keel there is a slender spur about

one-eighth of an inch long. This spur serves to distinguish the white loco-weeds from false loco-weeds. (See Fig. 12, page 32). The spur on the keel of the flower must not be confused with the spur at the end of the seed-pod.

Each flower produces a pod somewhat swollen or bladder-like, and containing several seeds. There is a short curved spur at the end of each pod. The plant spreads over new areas by means of the seed.

The root of the white loco-weed is perennial, that is, it may live more than two years. It is tough, woody, and rough. It consists of one main division, varying in depth from six to twelve inches, and several short branches, which branch up from the main division not far below the surface of the ground. These short branches grow up to the surface of the ground, and appear there with one or more silvery-white crowns, covered with scale-like leaves, from which the leaves and the flower-stems grow. (See Fig. 13, page 33).



FIG. 12. (a) Flower of white loco-weed, showing spur on end of keel petal.
(b) Flower of false loco-weed, showing keel petal without spur.
One and one-half natural size.

Where the White Loco-weed is Found.—The white loco-weed is found principally along the foothills at altitudes up to eight thousand feet, on open land on the sides and tops of the higher hills. It is found also on the open unbroken prairie.

In both locations it grows among the native grasses, in rather dry places on stony, gravelly, or sandy land. It grows in abundance on the tops of some hills, and when animals become locoed they usually remain on these hills eating the loco-weed almost exclusively.

Woolly Loco-weed (*Astragalus mollissimus* Torr.). — The woolly loco-weed is white and woolly in appearance, and its flowers are deep purple. The general shape of the plant is very similar to that of the white loco-weed. (See Fig. 14, page 34).

The leaves grow from several soft, white, scaly crowns at the surface of the ground. They vary in length from four to nine inches,

and are shorter than the flower-stems. Each leaf consists of numerous narrow, sharp-pointed leaflets, which are closely arranged along the leaf-stem. The leaflets are very densely covered with fine, white silky hairs, giving the whole plant a soft, white, woolly appearance.

The flowers are deep purple, about one-half inch long, and occur in close clusters at the tops of the flower-stems, which are leafless and unbranched. The flower-stems are also covered with fine, white, silky hairs, and are from six to fourteen inches high.

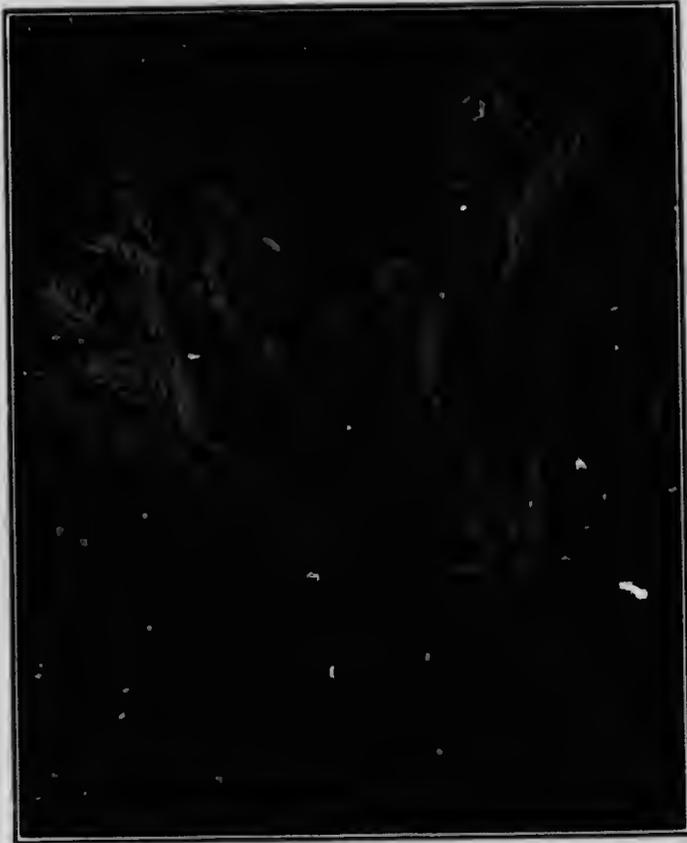


FIG. 13. A white loco-weed showing manner of growth and arrangement of leaflets on axis of leaf.

The root of the woolly loco-weed is very similar to that of the white loco-weed. It has one main root growing to a depth of from five to twelve inches. Near the surface of the ground several branches grow up from the main root, each bearing one or more crowns, covered with scale-like leaves, from which the leaves and the flower-stems grow. These crowns cause the plant to have a bunching or tufted appearance.

Each flower produces a pod covered with long, fine, silky hairs. The pod is erect, and varies from one-half to three-quarters of an inch in length.

Where the Woolly Loco-weed is Found.—The woolly loco-weed is found along the foothills, on open land on hillsides and in valleys. It is found on the open prairie also. In both locations



FIG. 14. Woolly loco-weed.

it grows on stony, gravelly, or sandy land, and always among native grasses.

Showy Loco-weed (*Astragalus splendens*). — This loco-weed has rich purple flowers and is very similar to the other loco-weeds already described.

Parts of the Loco-weeds that are Poisonous.—All parts of the plants are poisonous. When animals get the loco-eating habit, they eat not only the leaves and the flower-stems, but also the crowns and as much of the root as they can nip or pull off.

PLANTS COMMONLY MISTAKEN FOR LOCO-WEEDS.

The Yellow Oxytropis (*Oxytropis campestris* L.). — The yellow oxytropis resembles the white loco-weed in the color of the flowers, in the shape of the leaves, and in the general shape of the plant. It differs from the white loco-weed in that it has wider leaflets, and fewer silky hairs than has the white loco-weed. The yellow oxytropis has only a very tiny spur on the keel of each flower.

The Silvery Lupine (*Lupinus argenteus* Pursh.). — The silvery lupine is sometimes mistaken for the loco-weeds. It is a

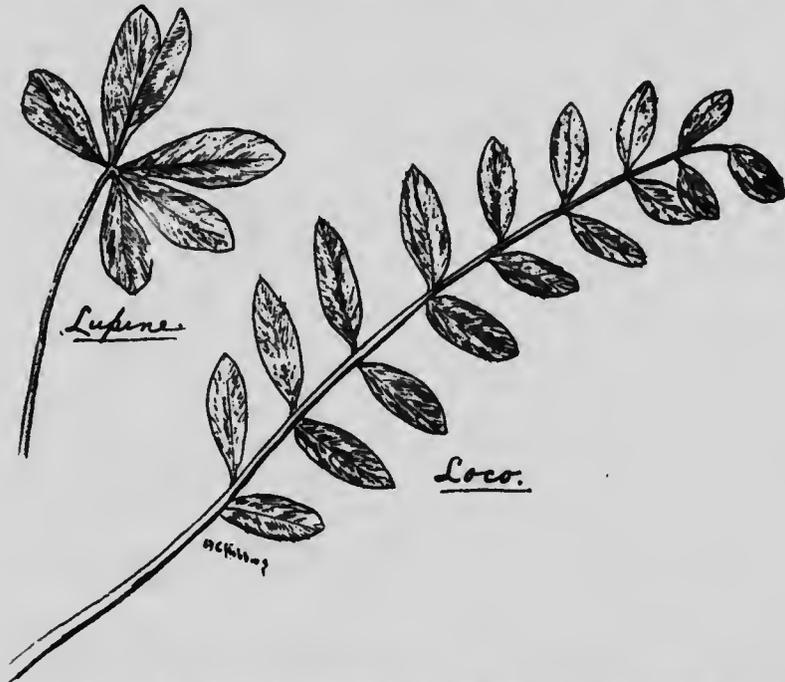


FIG. 15. Showing the arrangement of the leaflets of the lupine on the left, and a typical leaf of the loco on the right.

bushy branching plant, also belonging to the legume or pea family. It grows from one to two feet high, and has a silvery color owing to the leaves and stem being densely covered with fine, short, silvery hairs. The flowers are pale-blue and are arranged in clusters at the ends of the stems and branches. The leaves are compound, each leaf consisting of from five to nine leaflets. The silvery lupine may be distinguished from the loco-weeds by the manner in which the leaflets are attached to the leaf-stem. The leaflets of the silvery lupine radiate out from the end of the leaf-stem like the outstretched fingers from the palm of the hand, whereas the leaflets of the loco-weeds are arranged along the leaf-stem, with an odd leaflet at the end. (See Fig. 15, page 35). The lupines bloom in June and July, and the seeds mature in July and August. The seeds of the silvery lupine are very poisonous.

Animals which are subject to Poisoning by Loco-weeds.

—Of all the classes of stock affected by the loco-weeds, sheep probably are the chief sufferers, horses quite frequently, and cattle rarely. Young sheep and horses more commonly acquire the habit of eating the weeds than older animals and only in rare cases do we find old or fully developed stock affected by them.

Symptoms.—It is well to bear in mind that loco-poisoning develops slowly. The poison in the initial stages apparently affects the nervous system, which will account for the stupidity of the animal, the lack of muscular control when walking, and the failure to judge distances and objects accurately. In severe cases the animal loses both the sense of sight and the sense of hearing.

Affected horses usually wander from the herd and isolate themselves in some infested area where they will eat nothing else but the plant if it can be obtained. The coat becomes rough and shaggy, the gait staggering and slow, the teeth grow long and become loose. Not infrequently the affected animal walks around in circles always turning in the same direction, and apparently unable to go the opposite way. These attacks may pass off to be followed by the recurrence of periods of stupidity succeeded by the same actions as before.

Sheep affected with loco-poisoning will frequently stand with their heads pressed firmly against some object for hours at a time apparently unable to move. There is usually arching of the back and well-marked tremblings. Not infrequently the wool is loosened in patches of various sizes over the body. In other cases a general shedding of wool takes place.

Treatment.—Treatment for loco-poisoning is very unsatisfactory. In the case of horses, as soon as they commence to show

signs of being locoed, they should be separated from the rest of the herd, put on good wholesome food and given Fowler's solution of arsenic in four dram doses daily, in either the drinking water or bran mashes, until recovery takes place. It will be found necessary to keep these horses confined at all times to corrals or stables, for, after once acquiring the taste for loco, if turned upon the range again it will be a matter of a very short time before they will be in as bad condition as ever.

Sheep just affected with loco-poisoning if given a good nutritious ration and confined to pastures absolutely free from the plant, may be fattened sufficiently to be placed upon the market. Magnesium sulphate, four ounces, dissolved in the drinking water will assist in recovery.

Precautionary measures in connection with loco-poisoning are worthy of the utmost consideration. Animals which have plenty of good food rarely contract the habit. Overcrowding of the ranges and too close pasturing will force animals to eat plants which they otherwise would not touch. Recently a great deal of importance has been put upon the supplying of plenty of salt at all times. It is essential to all classes of livestock and no doubt will assist in preventing them from contracting a perverted taste.

Eradication of Loco-weeds.—It is sometimes advisable to grub out the loco plants. To get rid of a loco plant it is not necessary to dig out the whole root; only the crowns need to be cut off. To assure the crowns being cut off, the root should be cut off with a spade two or three inches below the surface of the ground. The best time to do this work is in June and July, during the flowering season. The grubbing should be completed before the seeds ripen.

As the seeds may lie in the ground for several years before germinating, it may be necessary to grub the areas again during the following two or three years, to destroy any plants that may have grown from seeds. The cost of the second or third grubbing would be very small.

When the loco-weeds are confined to one or more hills, it may be possible to shut off the poison-infested areas from the rest of the range by means of a barbed-wire fence.



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