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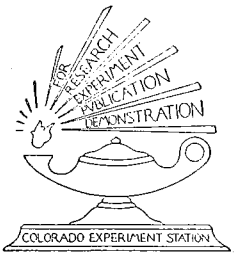
COLORADO PLANTS INJURIOUS TO LIVESTOCK

BY
GEO. H. GLOVER and W. W. ROBBINS



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COLORADO PLANTS INJURIOUS TO LIVESTOCK

By Geo. H Glover and W. W. Robbins

INTRODUCTION

Since Colorado is a mountainous state, with a considerable area of the plains district "above water," it is reasonable to assume that grazing under open-range conditions will always be an important factor in the livestock industry of the State. Poisonous plants have a special economic significance in the breeding and handling of livestock under these conditions. It is impossible to estimate, with any considerable degree of accuracy, the aggregate loss to the livestock industry from poisonous plants, but roughly estimating the known losses in certain counties, we may safely assume that it amounts to several millions of dollars annually.

The Experiment Station receives many letters of inquiry relative to plants that are suspected of being detrimental to livestock and many specimens are sent for identification. This bulletin is calculated to assist stockmen and farmers in the identification of poisonous plants, to offer a few suggestions relative to preventive and remedial measures and to site special conditions under which certain plants are known to poison animals. The authors have attempted, by illustration and description, to correct some popular errors in the identification of certain plants that, in appearance, have a striking resemblance, such as the death camas and wild onion. Again, space is given to consideration of several plants, like algae and corn smut, which are incorrectly thought to be poisonous.

CONDITIONS OF POISONING

It is important to know the conditions under which poisoning is most liable to occur. There can be no doubt that animals, when left to themselves, will by instinct exercise considerable judgment in the selection of their food. Experience has shown that more animals are poisoned when being crowded by the herdsman, and, in case of cattle, when they are handled at the time of "round-up." When being driven, animals will grab at weeds that they would not otherwise touch.

When animals are very hungry they are not very particular in the selection of their food. Many disastrous cases of poisoning occur when cattle and sheep are taken directly from the yards to the ranges after a long shipment.

Larkspur, and probably some other plants, are known by experience to be far more poisonous when the foliage is wet from dew, rain or snow. When poisonous plants, like the death camas, start to grow in advance of the native grasses, they are eaten almost to

the exclusion of everything else. An acrid, bitter or otherwise disagreeable taste does not always bar stock from eating the first green food that appears in the spring time. Again in the late summer the native grasses often cure early from drought and injurious plants like loco and lupine remain green. It is obviously true that stock will eat most poisonous plants that are green in preference to grass that has dried up and this no doubt accounts for the loco habit being acquired more often in the late summer and fall.

The stage of growth has much to do in determining whether or not certain plants will be eaten at any particular season of the year. The larger species of larkspur and the water hemlock become coarse and objectionable after flowering and are seldom eaten. On the other hand, some plants are relished throughout the period of their growth. The death camas is eaten with avidity just before the flowering stem is formed; equisetum is eaten more after being cured with the hay, and matured lupine with the seed pods appears to be relished by sheep. To analyze all of the conditions under which poisoning occurs seems to be a hopeless task. The subject is complex. In the realm of poisons we are still groping in the dark, and there are many mysterious cases of poisoning that are quite unaccountable.

The reputation of a plant as poisonous or non-poisonous may be affected by many circumstances. It is found to be true that certain parts of a plant may be poisonous while other parts are not, and that the quantity of poison in any particular part may vary widely under different soil and climatic conditions and at different periods of growth. It is necessary to know the entire history of a plant before declaring it poisonous or non-poisonous. For example, the poison in lupines is confined almost entirely to the seeds, and if cut before going to seed makes a fair quality of hay. In water hemlock the poison is found largely in the roots of the mature plant. In calabar bean the very poisonous alkaloid eserine is found in the cotyledons. In aconite seeds, the central part contains most of the aconite. Not only may the amount of poison in any particular part of a plant vary greatly at different stages of growth, but it has been shown by Dr. J. P. Lodsy, in Java, that in case of cinchona the amount of akaloid in the leaves varies greatly between night and day and that the alkaloid is formed in the leaves during the day and deposited in the branches or bark during the night. Because of the fact that the most active principle in most plants is not uniformly present in any particular part of the plant, there is, as might be expected, contradiction in rating plants as poisonous or non-poisonous. It is a matter of common observation that while a large number of animals in a herd may be poisoned, a few almost invariably escape, and all are seemingly under the same conditions. The num-

ber poisoned and the degree of poisoning depend upon three factors: The quality of poison, the quantity of poison, the racial as well as individual susceptibility to the particular poison in question. There is the greatest diversity in animals as to susceptbility to poisons. In Prof. Rudolph Kebert's text on Practical Toxicology is found the following information bearing on this subject: "The smallest snail will withstand more strychnine than an adult man. Many of the strongest cardiac poisons have no action whatsoever upon insects. Great care is necessary in thus reasoning from even the effects noted in experiments with warm-blooded animals approaching nearer to man. The rabbit can take more morphine than can a man of fifty times the animal's weight. Doses of lead, nicotine cytisin, etc., sufficient to fatally poison do not injure the goat. Amygdalin does not affect dogs, but it kills rabbits. The hedge hog takes with apparent enjoyment, a dose of cantharides that would kill several persons under excruciating pain. The bite of the most venomous snake does not harm him; he can even accommodate no inconsiderable quantity of hydrocyanic acid. Whereas the frog is extraordinarily susceptible to the digitalis poisons, they have no effect upon the toad."

Another factor that complicates the grazing of animals, on a range where there are poisonous plants, is the uncertainty of their feeding habits; this is especially true of sheep. It is not an uncommon experience to see sheep eating greedily of plants that they have not been seen to eat before and will not eat the day or week following. This seemingly unaccountable appetite may be manifested in eating either poisonous or forage plants and may be true of the entire band or a few individuals. When a few individuals have been poisoned, it is safer to conclude that they alone have been eating certain poisonous plants than it is to assume that they were the only ones that were susceptible. In most cases it will be found that a majority of the band will be eating largely of certain plants, and where the small species of larkspur and death camas are both growing they will eat largely of one or the other throughout the season. All things considered it is impossible to predict with any degree of certainty whether or not animals will eat of a particular poisonous plant if allowed to graze unmolested.

PREVENTIVE MEASURES

Much more can be accomplished in prevention of poisoning than in treatment of animals after they have been poisoned. This principle is generally recognized to be true in its application to all diseases, and is especially true in this instance, for the reason that under range conditions, horses and cattle, especially, are without an attendant and are often not seen for days or weeks at a time.

Stockmen are advised to become familiar with the most common poisonous plants, to know the season of the year or other conditions of poisoning, and to herd their animals away from dangerous areas. At the same time, there is some danger in herding animals away from dangerous areas, as many stockmen will testify. Many stockmen who have practiced herding animals from the worst poison-weed ranges, have still suffered heavy losses, and claim to have a smaller loss when the animals are allowed to roam at will and exercise their instinct unmolested in the selection of forage. It is true that the driving of animals to places where there are but few poisonous plants is dangerous under conditions already mentioned, but nevertheless, much may be accomplished in preventing heavy losses by herding animals entirely away from poison-weed areas.

Considering the immense area of grazing lands in the State, and the wide distribution of poisonous plants, their eradication, save in pastures or in certain restricted districts, seems like a hopeless undertaking. Plants that tend to grow more in patches, like the woody aster, monkshood, death camas and false hellebore, promise more in the way of extermination by the use of the grub hoe, than do loco, larkspur and lupine, which are more widely distributed. One instance came under observation in which all the loco weeds on a section of land, under fence, were removed by digging, and three years later the pasture was apparently as badly infested with loco weeds as before, much to the discouragement of the owner. The displacement of noxious weeds and poisonous plants by aggressive forage plants, has received some attention by the Montana Experiment Station and the Forestry Service. For this purpose, the smooth brome grass and the western wheat grass, or "bluejoint," have been considered the most promising. It will require several years at least and much patient endeavor to form a sod with smooth brome grass, sufficiently thick to replace larkspur, camas and loco weeds, which are indigenous and very persistent. The prospect for eradicating poisonous plants by this means is not very encouraging.

ALGAE—GREEN SCUM, GREEN SLIME, WATER MOSS

The algae are simple plants that do not bear leaves, stems, roots, and flowers. Their methods of reproduction are comparatively simple. They are common the world over, living in the water or in very moist situations. The green scum or slime so frequently observed upon the surface of pools, stagnant ponds, reservoirs, ditches, and streams is a growth of algae. Algae also sometimes form heavy growths at the bottom of the water, frequently being attached to stones, sticks, and mud. They are also commonly found in tanks and water troughs, and, in such places, may not only stop up inlet and outlet pipes, but render the water objectionable to stock.

especially when decay sets in. Decayed algae have a peculiar pig-pen odor.

The common algae found in fresh waters are either blue-green or green in color. Many that occur in the salt water of the ocean are brown or red in color. When the green algae, the forms with which we are most familiar, begin to decay, they may change to brown or reddish-brown.

The individuals of some kinds of algae are microscopic, but when found in mass give a distinct color to the water in which they live. Small pools of water may become greenish in warm weather and on inspection with the unaided eye one is not able to see the organisms causing this coloration. But microscopic examination reveals the presence of millions of small plants.

The question is often asked: Will the green scum found in the watering tank or trough, in water drunk by stock, render the water poisonous? Although algae may give water an objectionable appearance or odor, they do not render it poisonous either to stock or human beings. Furthermore, it is not at all probable that even decaying algae injure the water to the extent of making it poisonous.

However, on account of the objectionable odor that decomposing algae impart to water and on account of their tendency to close up drains and pipes, it is often highly desirable to get rid of them. Algae are now quite easily prevented from growing in water by treatment with copper sulphate.

Eradication.—Use 1 part of copper sulphate (blue vitriol) in 1 million parts of water. Practically, this treatment is best effected by placing a few pounds of the crystals of copper sulphate in a gunny sack, tying this behind a boat and rowing about the pond or reservoir. Fifteen pounds of copper sulphate to 1 million gallons of water is a practical proportion. In the case of a water trough, through which water is steadily running, a small sack of copper sulphate suspended near the inlet will suffice to kill all green scum. If the water in the trough is not freely running in and out, the suspension, in the water of a small sack of blue vitriol for a short time now and then throughout the season will keep green scum from collecting. The small quantities of sulphate that go into solution are harmful to the algae, but do not injure livestock or human beings.

FUNGI

The fungi are an immense group of plants that vary widely in shape, size, color, and habits of living. They do not have roots, stems, leaves, flowers, and seeds. They are rather simple in structure and methods of reproduction. Probably the best known fungi are the molds on bread, fruit and cheese, the rusts and smuts of the cereals, the toadstools and mushrooms, the mildews, and the fungi

causing such well-known diseases as blight in potato, alfalfa leaf spot, leaf spot of strawberry, potato scab, leaf spot of beet, wilt of flax, etc.

Some of the fungi work on the outside of the plant they infest, while others do their injury within. In most cases, the conspicuous part of the fungus is the spore-bearing stage.

Poisoning by Fungi.—Many plants of this group are poisonous for animals. There is a disease which has been variously named by different investigators, practitioners and others, as food poisoning, forage poisoning, mold poisoning, blind stagger, sleepy stagger, cerebrospinal meningitis, etc., that has been known for a century at least and has caused widespread devastation among animals. The so-called "Kansas Horse Plague" has been quite generally attributed to forage poisoning.

Sporadic cases of this disease are very common in all parts of the United States and at all seasons of the year.

Symptoms.—The first symptoms noticed by the casual observer are depression, drooping of the head, closing of the eyes, difficulty in swallowing, staggering gait, walking in a circle and in some cases pushing the head against the manger or a post. Paralysis follows and the animal finally goes down, and dies within a few hours, or in some cases may live for several days.

Prevention.—The fact that an animal has had the disease does not protect it from a subsequent attack. It should be an absolute rule among farmers and stockmen to *never feed decayed, moldy or spoilt food to animals.* Moldy ensilage, decayed potatoes, carrots, sugar beets, musty hay, and moldy corn stalks are especially dangerous.

Prevention is difficult in those cases that occur on the open range or in grass pastures. The poisoning is presumably from fungi that develop on the grasses under certain climatic conditions. In these cases animals should be taken immediately from the pastures and fed hay that was cut the previous year or earlier in the season.

Treatment.—Many animals that would otherwise die may be saved by appropriate treatment. The services of a competent veterinarian should be sought without delay. Do not try to give any medicine by the mouth for the reason that the throat is paralyzed and the substances, especially if a fluid, will be liable to pass into the lungs and kill the animals. Hundreds of horses were killed in this way during the Kansas outbreak.

MILDEWS

There are two groups of mildews, the *Downy Mildews* and the *Powdery Mildews.* The downy mildews form a downy, white growth upon leaf, stem, and fruit surfaces. One of the most common downy mildews to be found in Colorado on cultivated plants is

that growing on alfalfa. Many native plants are infested with these fungi.

The powdery mildews are parasitic fungi, very common on the leaves of many cultivated and wild plants. The growth at first has a cobwebby appearance; later, the leaf becomes powdery, due to the production of great numbers of reproductive spores. Still later in the season, fruiting bodies come on the infested plant; these are in the form of black dots, a little smaller than a pin head. Common powdery mildews are those found on the gooseberry fruit, peach, rose, peas, wild and cultivated grasses, and other forage plants. Moist meadows are frequently badly troubled with a powdery mildew. This may be observed to form a white, mealy coating on the leaves. Warm, moist weather favors the development of the mildews.

Poisoning by Mildews.—According to Dr. Pammel, in his "Manual of Poisonous Plants", catarrhal stomatitis (sore mouth) may be produced by eating fodder which has become infested with various fungi, including mildew. The extent to which the mildews are poisonous has never been determined, but they are generally accused of causing inflammation of the digestive tract and other serious digestive disorders.

SMUT

This is a large group of well-known fungi. The best known are those occurring on the cereals. Among these may be mentioned corn smut, stinking smut, or bunt, and loose smut of wheat, loose and covered smuts of barley, loose and kernel smuts of oats, kernel and head smuts of sorghums. Besides these well-known smuts on cereals a number occur on native plants, including grasses and other forage plants. Among these may be mentioned the smut on brome grasses, barnyard grass, Indian millet, manna-grass, squirrel-tail grass, wild rye-grass, fescue grass, hair-grass, slender wheat-grass, etc. Buffalo-grass and grama-grass, the two most abundant and important forage grasses of the Great Plains, are each infested with a smut. These smuts may become very abundant in seasons favorable to their growth. They are especially noticeable in spring and early summer. Hence it is seen that smuts, as a group, are widely spread throughout the State, occurring on both cultivated and wild plants.

Smuts are conspicuous on account of the black, dusty spore masses, which, as a rule, break out on the flowering heads, but also frequently on leaves and stems. A single smutted corn or sorghum plant may produce tremendous quantities of dry, black spores.

Poisoning by Smuts.—It has been a common belief for many years that smuts are injurious to livestock. Feeding experiments, however, have demonstrated that no bad results follow from cattle

eating any of the smuts. Of course, they may cause a sore throat or irritation of the throat when administered in large quantities, but the injury is not fatal. Furthermore, there seem to be no ill effects resulting from feeding siloed smutty grain or forage.

RUSTS

The rusts are an exceedingly large and widely distributed class of fungi. The best know are those on cereals. There are rusts on wheat, oats, barley, rye, and corn.

Any number of cultivated and native plants, many of which are grazed, are the home of rusts. Common forage grasses that are frequently rusted are timothy, orchard-grasses, fescue-grasses, brome-grasses, wheat-grasses, rye-grasses, marsh-grass, squirrel-tail, salt-grass, grama-grass, wire-grass, and many others; in fact there are but few grasses that are not infested more or less with some rust. There are also rusts on peas, vetches, beans, clover, alfalfa, and a great many of the herbaceous plants that may be eaten by stock. Hence it is readily seen that rusts are common everywhere and on a great variety of plants. And it is quite certain that stock eat considerable quantities of the fungus in their grazing and feeding.

Injury from Rusts.—Rusts no doubt cause considerable irritation of the mouth and the digestive organs and when eaten in large quantities give rise to a catarrhal condition or even severe inflammation. Rusty clover and alfalfa are especially objectionable. Rusts, as a group, are not poisonous.

MOLDS

Many fungi are known by the name of "mold." Well-known ones occur on fruit, bread, and cheese. A bluish-green moldy growth develops on hay, ensilage, fodder, and the kernels of corn, barley, and other cereals, usually when they are cured or stored under moist, warm, or poorly-aired conditions.

Poisoning by Molds.—Some of the molds are very poisonous and others are not. The inability to tell which molds are poisonous should make one cautious about feeding moldy foods of any kind. Poisoning by molds was discussed on a previous page under the subject of fungi.

ERGOT (*Claviceps purpurea*)

Ergot is a name applied to one stage of a fungus working in the heads of a number of grasses. The ergot stage is a purple-black, straight or horn-like hard structure about one-fourth to one-half inch long (Fig. 1). It occupies the position of the grain in the head of grass. This hard mass is not a degenerate kernel of grass, however. During the fore part of the growing season, the young and tender ovaries of the grass flower are infected with spores of the fungus, which later develops into the ergot stage. As a result of this infection, a fungus growth covers and penetrates

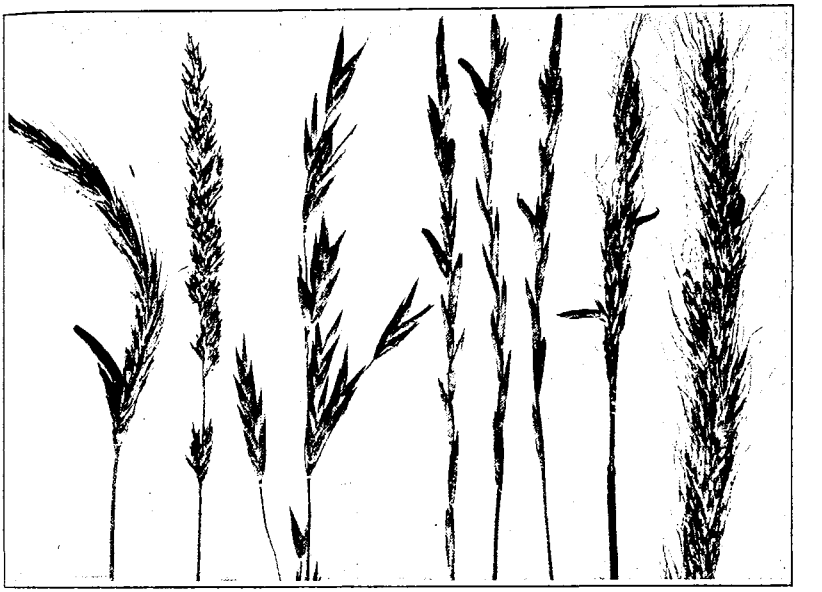


Fig. 1. Ergot: Note the black, horn-like bodies occupying the position of the grain. Ergot is shown here on six different grasses, cultivated rye at the left, the remainder native forage grasses.

the young grass ovary, finally replacing the latter entirely with fungal tissue. Minute spores are then produced in large numbers, and carried to other plants by means of insects and wind. In this way the disease spreads throughout the field. In the latter part of the summer the soft, fungous mass in the head of grass is replaced by the characteristic hard, black structure, commonly known as ergot (Fig. 1). This is the structure by means of which the fungus lives over the winter. The black ergot masses vary in size and shape, depending upon the plant attached. They are the largest on rye.

Ergot develops upon a number of grasses. Chief of these is cultivated rye (*Secale cereale*) and various species of wild rye (*Elymus*). It also occurs on several wheat-grasses (*Agropyron*), a number of meadow grasses (*Poa*), timothy (*Phleum pratense*), a reed canary-grass (*Phalaris arundinacea*), prairie June-grass (*Koeleria cristata*), and several other grasses.

Ergot is widely distributed throughout this country and Europe. It does but little injury to the grass upon which it is living, but is often the cause of serious troubles in livestock.

Ergotism.—Ergotism is the disease caused from eating grasses that contain ergot. Cattle are most often affected. The disease makes its appearance most often during the winter and spring but may appear at any time.

Symptoms.—Two distinct types of the disease are recognized, namely, spasmodic and gangrenous. There are serious digestive disturbances in both types of the disease.

In the spasmodic form, there are spasmodic contractions of the muscles, numbness of the extremities, tremblings, convulsions and delirium. In the gangrenous form of ergotism, there is, as a result of prolonged constriction of the blood vessels, especially of the extremities, a decreased amount of blood to the parts, and in some cases the circulation is completely obstructed. When the circulation is obstructed, dry gangrene follows and there is sloughing of the tips of the ears, tail, hair, and even the feet may come off as far up as the canon bones. Cold weather, of course, helps to make conditions worse.

Treatment.—In the first place, remove the cause. Examine the hay for the black ergot bodies which grow in place of the kernels of grain in the heads. Treatment is not very satisfactory in well established cases. Tannic acid is the best chemical antidote and its effect is upon the poisons that are not yet absorbed into the circulation. Chloral is probably the most satisfactory physiological antidote. Animals affected with ergotism should be kept warm and treatment should be directed to meet the conditions as they arise.

"TOADSTOOLS" AND "MUSHROOMS" (*Fleshy Fungi*)

There are a great many different sorts of fleshy fungi that are called "toadstools" and "mushrooms," depending upon whether they are considered poisonous or edible. Although a number of these fungi poison human beings, it is doubtful if stock ever eat them.

BLACK SPOT OF GRASSES (*Phyllachora graminis*)

In late summer and fall, there appear on the leaves of several of our forage grasses, jet black spots, especially noticeable along the veins. These spots are very small, scarcely larger than a pin-head, and occur on both surfaces of the leaf, although more abundant on the upper. In Colorado, "black spot" is found on several different forage grasses. It may be the cause of a stomach inflammation in stock.

LICHENS

The most common lichens (Fig. 2) are those forming crust-like coverings on the surface of rocks, or tree trunks, or on the ground. Some are raised considerably above the surface upon which they grow, and are leaf-like. There is a form of lichen in our mountains which hangs in gray-green, moss-like masses from the branches of the evergreens. Lichens have a great range of color: Orange, yellow, green, gray, brown, and black. They are composed of certain algae and fungi growing in intimate relation-

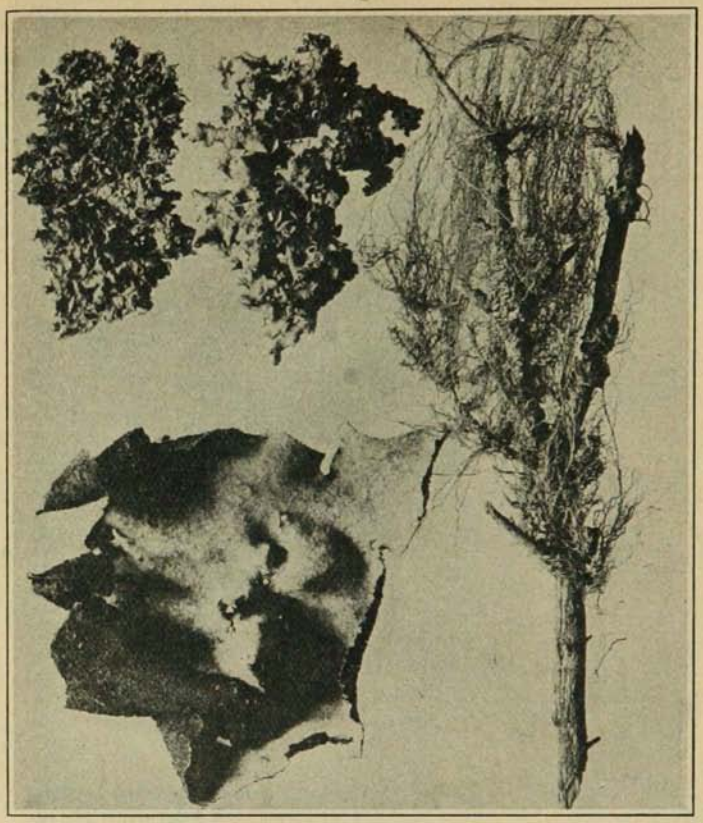


Fig. 2.—Four different lichens

ship. Lichens, as a group, withstand drying very well, and have remarkable powers of recovery when moisture becomes available

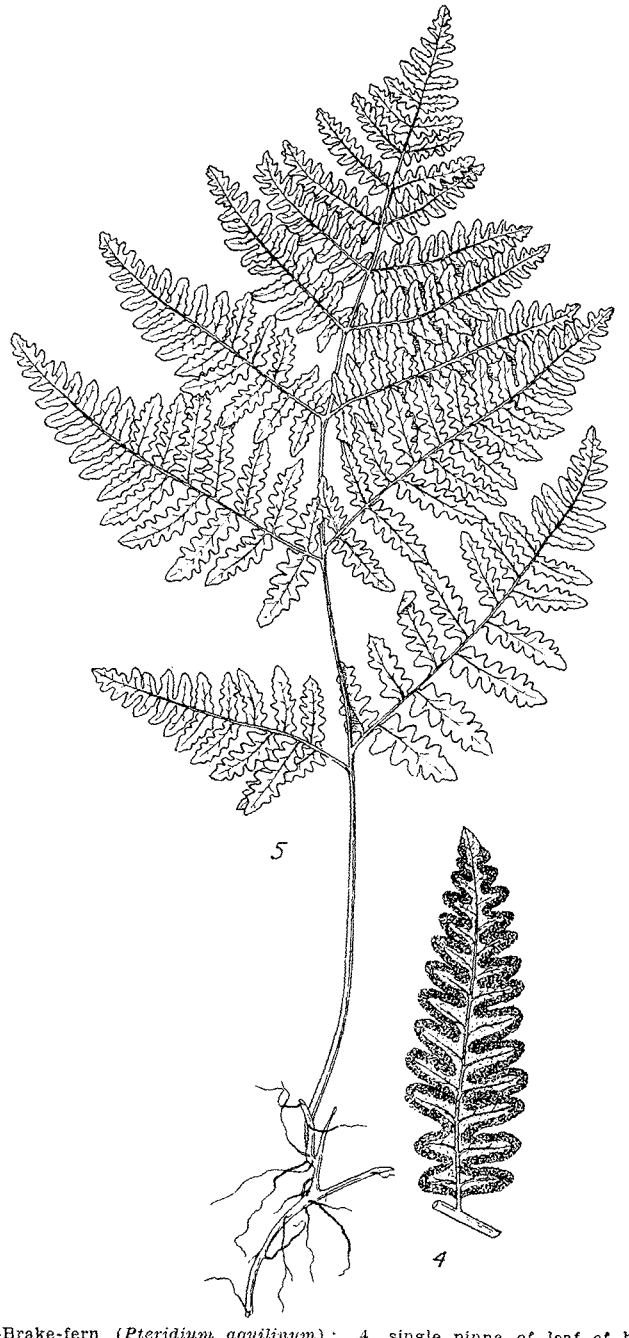
None of the lichens are known to poison stock. It is quite likely that some of the leafy sorts are eaten to a slight extent.

MOSSES

Mosses are familiar to all. They are not as abundant under the dry atmospheric conditions of Colorado as in moister sections of our country. They are the best developed in the mountains, especially along streams and in shaded situations. None of the mosses are known to be, or suspected of being, poisonous to stock.

FERNS

Colorado does not possess a large variety of ferns; furthermore, they do not grow in such luxuriance here, as in the damp, moist woods of the eastern states.



Figs. 4-5—Brake-fern (*Pteridium aquilinum*): 4, single pinna of leaf of brake-fern showing the spore masses on the under surface; 5, single leaf of brake-fern.

Ferns have underground stems that run horizontal to the soil surface. They spread by means of these stems, and also by means of spores. The spores are formed on the under side or margin of the frond (leaf). These spores occur in reddish-brown masses (Fig. 4).

The only fern in Colorado that is suspected of being poisonous to stock is the brake-fern (*Pteridium aquilinum*) (Fig. 5). This plant has widely-spreading, blackish rootstocks. The leaves are two to three feet long, and divided into three main divisions, each of which is again subdivided.

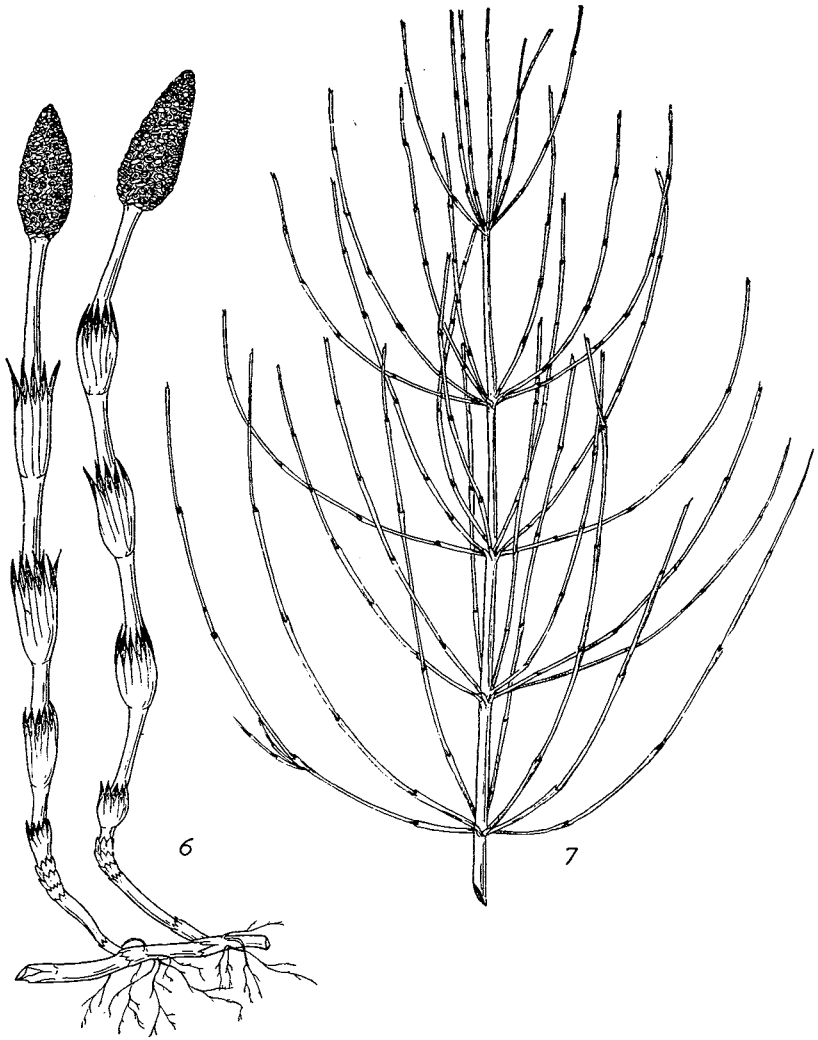
EQUISETUM—HORSETAIL, SCOURING RUSH, JOINTED GRASS

There are several species of Equisetum growing within Colorado. The two most common ones are the Common Horsetail (*Equisetum arvense*), and the Smooth Scouring Rush (*Equisetum laevigatum*). Both are rush-like perennials from underground rootstocks. They have rough, jointed stems that are closed at the joints. The stems are marked with a number of grooves that run lengthwise. At the joints are small, pointed, leaf-like structures, the sheaths. All horestails and scouring-rushes have harsh, rough stems, due to deposits of silica (sand) within.

The common horsetail (Figs. 6 and 7) (*Equisetum arvense*) dies down to the ground each year. It has two kinds of stems. In the early spring there are sent up from the underground rootstocks, simple, unbranched, jointed stems, which bear a spore-bearing cone-shaped organ at the top (Fig. 6). These die down after spore production, and are followed by slender, solid, 4-cornered stems that send out numerous branches at the joints (Fig. 7). The common horsetail is found throughout the State, from the plains up to as high as 10,000 feet. It commonly grows in sandy places, along railways, roadsides, and in low meadows. In meadows, it may become so abundant as to injure the hay. It is here that it gives the greatest amount of trouble.

The smooth scouring rush (*Equisetum laevigatum*) is evergreen. The stems are stout and often reach a height of 5 feet. They may be branched or unbranched. This plant grows all over Colorado from low to high altitudes. It is also found in low ground, particularly in a clay soil.

Poisoning by Equisetum.—Equisetum is so abundant that most people do not suspect that it is poisonous. It is found in much of the native hay of Colorado. Many reports have come to the Experiment Station of serious poisoning of animals that could only be attributed to horsetail. We have never had reports of animals other than horses being affected.



Figs. 6-7.—Horsetail or scouring rush; 6, early spring stems arising from underground stem; note fruiting cones; 7, branching form which appears later than the preceding.

Symptoms.—The first evidence of the trouble is more or less unthriftiness and in most cases diarrhoea. The horse appears thin and the muscles wasted. After two to five weeks, according to the amount of horsetail in the hay, the horse begins to lose control of its limbs, sways and staggers, although its eyes look bright and the appetite is normal. After the muscular symptoms become pronounced the horse will refuse to lie down and if it gets down will

struggle violently to get to its feet. The extremities are cold, and horses that are affected from eating Equisetum suffer greatly from the cold in the winter time. Young horses develop the symptoms much quicker than older ones. Some claim that horses develop a depraved appetite for the weed.

Treatment.—Stop feeding the Equisetum hay and give a quart of raw linseed oil as a physic. After the physic has operated give a teaspoonful of powdered nux vomica, mixed with the feeds of grain, three times a day. If the horse becomes very weak, he should be supported by slings. These cases, if given prompt attention and an appropriate treatment, will recover in most instances.

EVERGREENS (*Conifers*)

The pines, spruces, firs, junipers and cedars are widely distributed over Colorado. They have not been known to poison stock.

CAT-TAIL (*Typha latifolia*)

This common plant, found in marshes at lower altitudes in Colorado, is suspected of being poisonous.

GRASSES

A number of grasses are known to poison stock, while others injure them mechanically by means of their sharp beards or bristles.

Grasses are closely related to, and frequently mistaken for, sedges. Sedges, however, have solid stems, usually 3-cornered. They prefer, as a rule, moister situations than grasses.

POISONOUS GRASSES

JOHNSON GRASS (*Andropogon halapensis*)

This is a perennial from rootstocks. The plant is from 3 to 5 feet tall. The leaves are broad, flat and smooth. The inflorescence or flowering head often measures 1 foot or more in length, and branches profusely. The spikelets are in pairs; one of these has a short stalk, the other is without. The spikelets are covered with long, soft hairs, and are often purplish in color when mature. A beard may be present or absent.

Johnson grass has been reported from several localities in Colorado. In some places it is cultivated, and from such it may escape and become a weed.

Johnson grass is undoubtedly poisonous under certain conditions. Discussion of this subject will be found under the head of Sorghums.

SORGHUMS (*Andropogon sorghum*)

The sorghums comprise a large and well-known group of plants that are used both for their grain, and as hay and fodder. Under the name "sorghum" are included sweet sorghum or sorgo, milo, durra, kafir, broom corn, kaoliang, shallu, feterita, and Sudan

grass. All are annual plants, ranging in height from 3 to 15 feet. The "heads" vary considerably in size, shape and color.

Poisoning by Sorghums.—A large number of plants are known to be poisonous from the presence of prussic or hydrocyanic acid. This acid is known to be one of the most deadly poisons, and it results from the presence in the plant of what is known as a glucoside, which must be acted upon by a ferment. The most important and best known of all the glucosides is amygdalin. A large number and a great variety of plants contain a hydrocyanic acid producing glucoside. Plants that are conspicuous in this class are sorghum, kafir corn, Johnson grass and wild cherry.

Conditions Under Which Poisoning May Occur.—The second growth of sorghum is generally accused of being the more dangerous, but in the late summer, when the second growth appears, the entire plant contains poison. Kafir corn is the least dangerous when grown luxuriantly under irrigation or bountiful rainfall. The conditions which prevail in the arid districts of Colorado are ideal for growing kafir corn that is most dangerous. When kafir corn has made a stunted growth, and in the fall for two or three weeks before frost, the most poisoning occurs. After it has been cured from cutting or frost, it has never been known to kill animals, unless it be later demonstrated that hydrocyanic acid is a causative factor in "Corn Stalk Disease."

The leaves of several species of wild cherry are very deadly to cattle. The special condition under which wild cherry poisons animals is when the leaves are partially wilted.

The poison in question has been found in a great number of both native and domesticated plants and it is quite possible that in many cases where a large number of animals have died mysteriously, without the presence of either infection or any known poisonous plant, that some plant capable of developing prussic acid is responsible.

Symptoms.—A few mouthfuls of highly poisonous kafir corn taken on an empty stomach have been known to kill a cow in ten minutes. At Brighton, Colorado, 32 cows, after being kept in the corral over night, were turned into a field of kafir corn of not over 2 acres, that had been grown above the ditch, and 21 of them were dead in half an hour and four of the others were badly affected.* The first thing noticed in a poisoned animal is giddiness and difficult breathing, with spasmodic defecation and micturition. The pulse is slow and the pupils dilated. In fatal cases this is followed by spasms, general paralysis, delirium and death. In subacute cases the above symptoms will appear in a milder form and the animal may regain consciousness and be on its feet in an hour or two.

*Bulletin No. 77, Nebraska Experiment Station.

Treatment.—Farmers should know the conditions under which the plants mentioned are liable to kill their animals, and take no chances. Acute cases are so rapidly fatal that the animal is often dead before remedial measures can be adopted. In case of poisoning by prussic acid in connection with forage, however, the symptoms usually do not develop so quickly and some assistance may be given. Inhalation of ammonia and throwing alternately cold and warm water over the head and neck have been advised. Hypodermic injections of atropine sulphate to stimulate the heart and respiration are indicated. The chemical antidote (which must be given before the poison is absorbed) is a mixture of ferrous and ferric salt, administered with magnesia or potassium carbonate in solution.

MILLETS

The proso, or broom corn millet, foxtail millets and pearl millet are the principal ones grown. The foxtail millets (*Setaria italica*) are divided into a number of types, chief of which are the Hungarian, German, Common, Golden Wonder, and Siberian. All are annual.

MECHANICALLY INJURIOUS GRASSES

SAND-BUR (*Cenchrus tribuloides*)

The common sand-bur (Fig. 8) is an annual grass with flat leaves. The long stems may be prostrate on the ground for a part of their length. The characteristic feature of the plant is the spiny structure surrounding the spikelet. As a consequence, there is formed a spiny bur, the spines being stout and barbed. There are as many as 20 burs in an inflorescence. The seed matures from July to September. Sand-bur is found growing in sandy soil, as a rule. It occurs throughout Colorado, at lower altitudes.

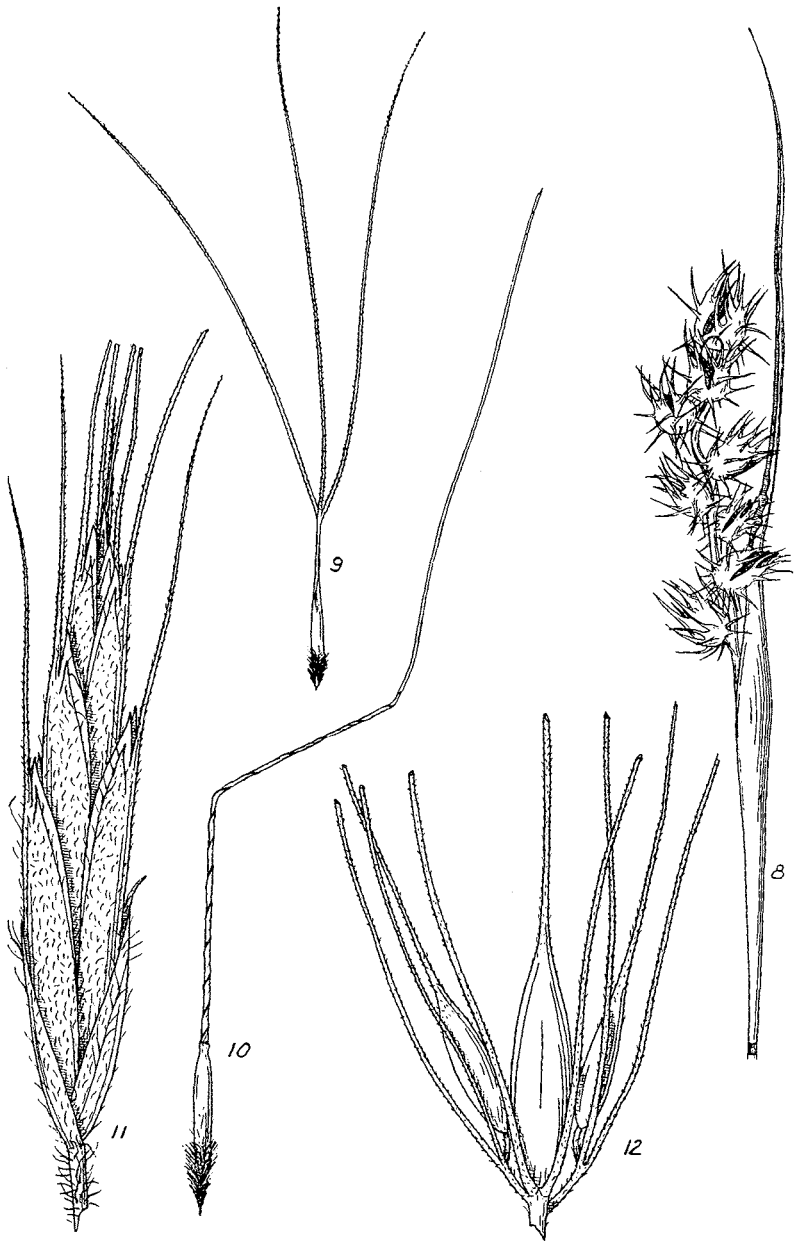
POVERTY-GRASS, WIRE-GRASS, THREE-AWNED-GRASS (*Aristida longiseta*)

This is a tufted, silvery-colored perennial with numerous rolled, wire-like leaves at the base of the plant. Its common height is about 1 foot. There are some varieties that are much more robust, however. The flowering head is 4 to 8 inches long. The spikelets are small and 1-flowered. The grain is tipped by three beards or awns (Fig. 9), thus suggesting the common name "three-awned-grass." The lower end of the mature seed is very sharp-pointed.

Wire-grass is one of the chief grasses of the Great Plains. In certain places in eastern Colorado it forms an extensive growth. It is also found on dry hills, up to an altitude of 9,000 feet.

FEATHER-GRASS, PORCUPINE-GRASS, OAT-GRASS (*Stipa*)

There are a number of different Stipas growing in Colorado, all of which are tufted perennials The leaves are usually rolled.



Figs. 8-12.—Mechanically injurious grasses; 8, sand-bur; 9, grain of three-awne grass; 10, grain of porcupine grain, showing long, twisted beard; 11, spikelets of down brome-grass; 12, triplet of spikelets of squirrel-tail grass.

The inflorescence branches. Each spikelet produces one seed which falls at maturity from the flowering head. Each grain bears a long beard (Fig. 10), which is twisted at the base, where it joins the body of grain, and is more or less bent. The base of the grain is very sharp-pointed, and the small barbs on it point upward. Hence, the grain may work inward easily, but on account of the direction of the barbs, it is impossible for it to work outward, or to be pulled out easily. It matures its seed from July 15 to August 15. The mature seed immediately drops to the ground.

The Western Stipa, or needle grass (*Stipa comata*) bears beards that reach a length of 4 to 6 inches. This grass is abundant in sandy soil throughout the plains and foot-hill regions. There are a number of other species of Stipa, which differ from needle grass in having beards usually less than 2 inches long. In these, also, the beards are twisted and bent, and the grain-base is sharp-pointed, and may in some instances work mechanical injury to stock. One of the very common short-bearded Stipas is Vasey's Stipa-Grass (*Stipa vaseyi*). It is particularly abundant in the foot-hills. It grows from 3 to 6 feet high and bears an inflorescence 8 to 18 inches long. The beard on the grain is usually bent twice, and twisted to the second bend.

WILD OATS (*Avena fatua*)

This is an annual plant much resembling ordinary cultivated oats. It has long, slender stems, and hence it usually stands above cultivated oats. It is distinguished further from cultivated sort by its strongly bent beard, and the long, reddish-brown hairs at the base of the grain. The seeds ripen earlier than those of wheat and oats. The seed is barbed.

DOWNY BROME-GRASS, AWNED BROME-GRASS, SLENDER CHESS (*Bromus tectorum*)

This brome-grass is an annual. It stands 1 to 2 feet tall. The leaves are soft hairy. The flowering head has slender, drooping branches. The spikelets (Fig. 11) are on very thin stalks; they bear a number of seeds. They may become purplish at maturity. Each seed has an awn which equals the seed itself in length.

This plant is becoming increasingly abundant in Colorado, occurring in fields, along roadsides and in waste places. In many localities it has made its first appearance the last year or two. Up to now it has been seen only at lower altitudes.

The beards on the seeds frequently cause serious injury to stock. The bearded seeds work in under the teeth causing inflammation, and in some instances a loss of the teeth.

WILD BARLEY, SQUIRREL-TAIL GRASS (*Hordeum jubatum*)

In the West, this common grass is an annual or short-lived perennial. It grows from 6 inches to 2½ feet high, in bunches.

The head is 4 inches long or less, pale green, often purplish. The beards on the seed-bearing, and sterile flowers are long, and the flowers are surrounded by long, beard-like glumes so that the whole head is covered with long bristles (Fig. 12) that are rough and upwardly barbed. The head breaks up at maturity and the parts are scattered broadcast.

Squirrel-tail grass is common in alkaline soils, about ponds, lakes and reservoirs, along irrigating ditches and streams, in meadows, and in fields wet from seepage. It is a common sight in Colorado to see ponds and lakes surrounded by a well-marked zone of squirrel-tail. Squirrel-tail grows over the entire State up to as high as 9,000 feet.

The plant is not only troublesome as a weed in cultivated fields but it is a great source of injury to stock. Although it may be eaten by all classes of stock when young, when mature the awns have very injurious effects.

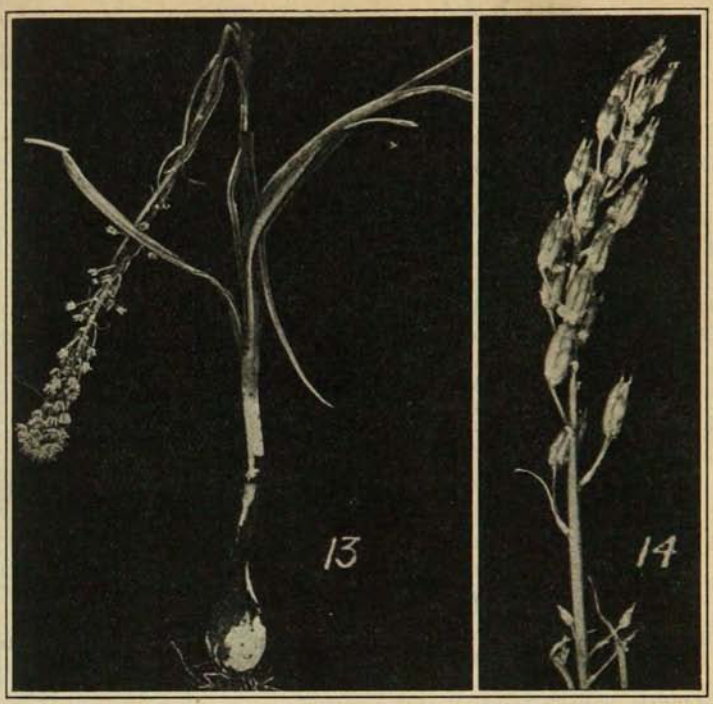
Wind is the chief agent in the dissemination of the seed, but in the irrigated sections its spread by water is common. Plants growing on the banks of irrigating ditches drop their seed into the running water, which carries them to fields where they are distributed over the land. Every precaution should be made to prevent the seeding of squirrel-tail along ditches. If possible, mow the infested area several times during the season to prevent seeding.

Mechanical Injury from Grasses.—As a group, the mechanically injurious grasses frequently inflict serious wounds. The beards may bore into the skin, or the mucous membrane of the mouth, causing ulcerations. They have been known to bore into the intestines, causing fatal inflammation. The beards of Stipa grasses are reported as injuring the eyes of sheep. Sheep have also been known to die from body wounds inflicted by the beards of grasses. In some instances the beards work in under the teeth, causing inflammation and the formation of pus. As a result, the animal may lose its teeth. Ulcerations of the jaw bones sometimes follow.

DEATH CAMAS (*Zygadenus*)

There are several species of death camas growing within Colorado. The following description is made general enough to include all of them. There is no attempt to distinguish between the different sorts, for such a distinction is of no advantage, in this case, to the practical man.

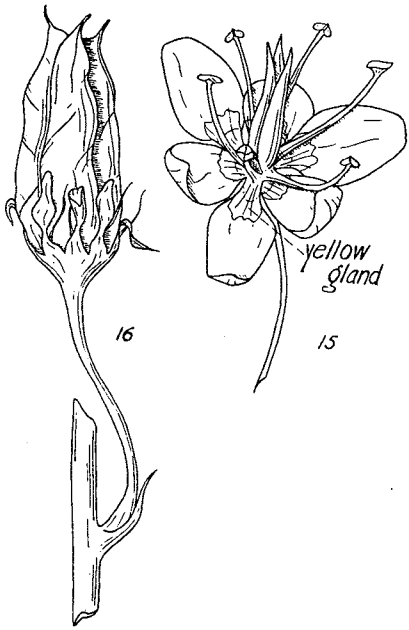
The plants are perennial from a bulb (Fig. 13). This bulb is made up of a series of layers, like the onion, the outer ones being thin, blackish-brown, and peeling off, showing the white-colored layers beneath. The bulbs are, as a rule, very deep-seated, so much so that it is difficult to get them up without breaking the stem. An average size bulb is about 1 to 1½ inches long and ½ to 1 inch



Figs. 13-14.—Death camas: 13, entire plant; 14, fruiting stalk.

thick. It tapers above into the solid stem. A tuft of roots arises from the under side. Plants vary in height from 8 inches to 2 feet. They are smooth throughout, no hairs or bristles being present. The leaves are long, narrow, and more or less folded along the midrib; they resemble those of the onion. There are usually six to seven fully formed leaves on a plant. The flowers are at the tip of the stem, in an inflorescence 3 to 10 inches long; they are greenish-yellow or whitish in color. Each flower (Fig. 15) has six segments, about one-half inch long; at the base of each segment on the inner surface is a golden yellow, shining gland, which may be seen without the aid of a hand lens. The lowermost flowers mature their fruit first, in fact there may be flowers and fruit in the same flowering group. The fruit (Figs. 14 and 16) is usually 3-parted, the separate parts united except at the very tip.

Considering the different species found in Colorado, death camas occurs throughout the whole State, from low to high altitudes. There is some evidence that plants growing at high altitudes belong to a species that does not contain as much of the poisonous principle as plants at lower elevations.



Figs. 15-16.—Death camas: 15, single flower, showing three sepals, three petals, six stamens, one pistil, and yellow glands; 16, single pod.

Death camas makes its appearance in the spring and early summer. At lower altitudes the flowers are in bloom during June. During maturing of fruit, the flower stalk may lengthen considerably. It is abundant in the foot-hills, sometimes on stony hillsides, also on sandy plains, but more abundant in moist, sandy swales. As a rule they do not form a close stand; the individual plants are rather scattered.

Death camas may be confused sometimes with several other plants. One of these is the white hellebore (*Veratrum speciosum*) (Fig. 17). It has rootstocks instead of bulbs, the leaves are large and oval and clasp the stem, and there are no glands at the base of the petals and sepals of the flower. Another is the spiderwort (*Tradescantia*), which has leaves very much like those of death camas, but no bulb; the flowers are blue and much larger. Another is the sand-lily (*Leucocrinum*), a low plant, close to the ground, with large white lily-like flowers. The wild onions, of which there are a number of species, are most frequently mistaken for death camas. They have bulbs and leaves that are similar to those of death camas. However, the odor of the wild onion should be sufficient to distinguish it from the death camas. The flowers are arranged quite differently in the onion as may be seen readily by comparing Figs. 13 and 18. Occasionally, the mariposa lily

(*Calochortus*) is mistaken for death camas. In this, the underground stem is a corm, that is, a solid structure, not made up of layers. Furthermore, the flowers are few in number, large, and showy.

Symptoms of Poisoning.—The symptoms of poisoning by camas are quite characteristic and one should be able to recognize these cases with a considerable degree of certainty. At first the animal is uneasy, and an irregularity of the muscular movements of the body is apparent. This is followed by complete loss of muscular control, rapid and difficult breathing, spasms and a frequent but weak pulse. The one condition that especially characterizes poisoning by death camas is the complete muscular paralysis without loss of consciousness.

Preventive and Remedial Measures.—There is only one way to prevent poisoning by death camas and that is to keep animals away from it. It is then of first importance that stockmen be able to identify the plant. It is first seen in the spring about the same time as the first green grass and dries up and disappears in middle summer. Its close resemblance to wild onion will help some in its identification.

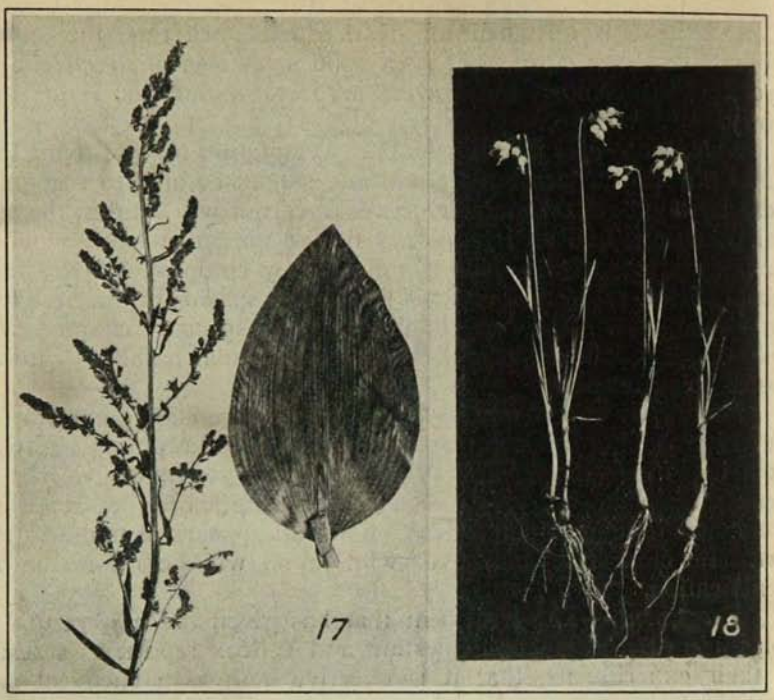
Treatment.—The treatment that has given the best results is potassium permanganate. Chestnut and Wilcox report, as a result of their experiments, that it is effective both as a chemical and physiological antidote. For sheep, three to six grains, according to the size and age of the animal, of potassium permanganate and an equal weight of aluminum sulphate are dissolved in at least a pint of water and given at one dose by drench. Twenty grains of each dissolved in a quart of water constitute a dose for an average-sized horse, and 30 to 50 for cattle.

It is very important that all of the potassium permanganate be dissolved, otherwise flakes may adhere to the walls of the throat or stomach, and cause intense irritation. Some stockmen make a practice of carrying this antidote in their saddlebags, ready for immediate use, during the spring months when there is the greatest danger of poisoning from camas. This practice is to be recommended, since the antidote is equally effective for poisoning by larkspur, and larkspur and camas are most dangerous at about the same time in the early spring months.

WHITE HELLEBORE, FALSE HELLEBORE

(*Vertrum speciosum*)

This perennial (Fig. 17), from a thick rootstock, grows from 2 to 7 feet high. The leaves are large, broad, and bear prominent veins, running parallel. The inflorescence may be over a foot long. The branches of the inflorescence are directed upward, and each has a long, narrow leaf at its juncture with the main stem. The in-



Figs. 17-18.—17, leaf and flowering group of white hellebore; 18, wild onion or garlic, often mistaken for death camas.

florescence is covered with soft, white hairs. The flowers are whitish, each has three sepals, three petals, six stamens and a single pistil. The plant is not abundant in Colorado. It has been observed in a few localities, chiefly in the western half of the State. It occurs from 6,500 to 12,500 feet altitude. It prefers moist soil, such as is found along streams and in meadows.

Poisoning by White Hellebore.—The swamp hellebore is not relished by animals, since it is acrid and bitter, but some cases of poisoning are reported. The seeds have been eaten by chickens with fatal results and a case is reported by Prof. Chestnut in which all of the members of a household were poisoned by eating the young leaves, mistaking them for marsh marigold. The root is said to have been used by the Indians in making snuff.

Symptoms.—Several poisonous substances are found in hellebore. Veratrin, which may be separated into several poisonous bases, causes extreme depression of the heart and respiration and general paralysis. The poisoned animal is first seen drooling saliva, vomiting or attempting to vomit, with colicy pains, shallow breathing; the skin becomes cold and clammy and there are muscular tremors and in fatal cases the animal dies in convulsions.

Treatment.—This consists in giving tannic acid as a chemical antidote with alcohol, strychnine and atropine to support the heart and respiration. Raw linseed oil may be given to relieve the local irritation and laudanum or morphine to relieve the pain.

SCRUB OAK (*Quercus*)

There are a number of species of scrub oak in Colorado. They are all small trees or shrubs, their common height being 10 to 15 feet. As a rule they grow in rather dense clumps. Scrub oak in Colorado is found in the foothills and mountains of the western slope, and as far north on the eastern slope as an east-west line about midway between Castle Rock and Denver.

Scrub oak is considered poisonous by many stockmen. They will take the pains to keep their stock from the oak thicket. It is very likely that most cases of poisoning resulting from cattle grazing in scrub oak thickets are due to larkspur which grows therein.

GREASEWOOD (*Sarcobatus vermiculatus*)

The common greasewood of the West is a shrub, 2 to 8 feet high. Its numerous branches are very stiff and rigid, and frequently somewhat spiny; the bark is smooth and white. The leaves are thick, narrow, 1 to 2 inches long, and pale green in color. The flowers are small, inconspicuous and greenish.

Greasewood is characteristic of dry, alkali flats. It is distributed throughout the State, chiefly at lower elevations.

It is likely to be confused with several other shrubs: Winter fat or winter sage (*Eurotia lanata*) is a low shrub, coated with a mat of white, woolly hairs which may become reddish-brown. The common shrubby salt-bushes (*Atriplex canescens and Atriplex confertifolia*) are somewhat rigid or spinescent shrubs with smooth, white bark, much resembling greasewood. The leaves of the salt-bushes, however, are covered with minute scales, which give them a characteristic scurfy appearance. Those of greasewood are smooth. Furthermore, the leaves of the two salt-bushes given above are not long and slender, as in greasewood, but rather narrowly oblong in one, and oval in the other. The spiny Grayia (*Grayia spinosa*) also has mealy or scurfy leaves. The shrubby species of rabbit brush (*Chrysothamnus*) may be distinguished from greasewood by their flowers, which resemble those of goldenrod.

Greasewood is considered a forage plant, but is strongly suspected of being poisonous at times. Prof. Chestnut reports on this plant as follows: "A correspondent in New Mexico states that on one occasion he counted as many as one hundred sheep that had been killed by eating the leaves of this plant. It is claimed that cows are not affected by eating it at any time and that sheep can eat it quite freely in winter. Death is perhaps due more to the bloating effect than to any poisonous substance which the plant contains."

Fig. 19.—Cow-herb, cow cockle, wheat cockle (*Saponaria vaccaria*).

RUSSIAN THISTLE (*Salsola pestifer*)

The Russian Thistle is so well known that a description is unnecessary. In Prof. Pammel's "Manual of Poisonous Plants" is found the following: "The sharp spines on the plants not only irritate and worry both horses and men but often, by breaking under the skin, cause festering sores on the horses' legs, so that in many localities it has been found necessary to protect them with high boots or leggings."

COW-HERB, COW COCKLE, WHEAT COCKLE (*Saponaria vaccaria*)

A smooth, branching annual plant (Fig. 19) 8 to 16 inches tall. The leaves are opposite and lance-shaped. The flowers are a beautiful pink, in open clusters at the top of the plant. The calyx is 5-angled, and much enlarged in the fruit. The plant is a pest in some sections of the State, particularly in grain fields. It is found mostly at low altitudes.

The seeds of Cow Cockle are often found in wheat screenings, and are known to be poisonous. Prof. Pammel says: "According to Sohn it contains the substance *saponin*, a neutral, sharp, amorphous substance, having a burning taste and producing a violent sensation. The toxic substance is partially removed by baking." Saponin-like bodies are also found in the common plant known as "bouncing bet" and corn cockle.

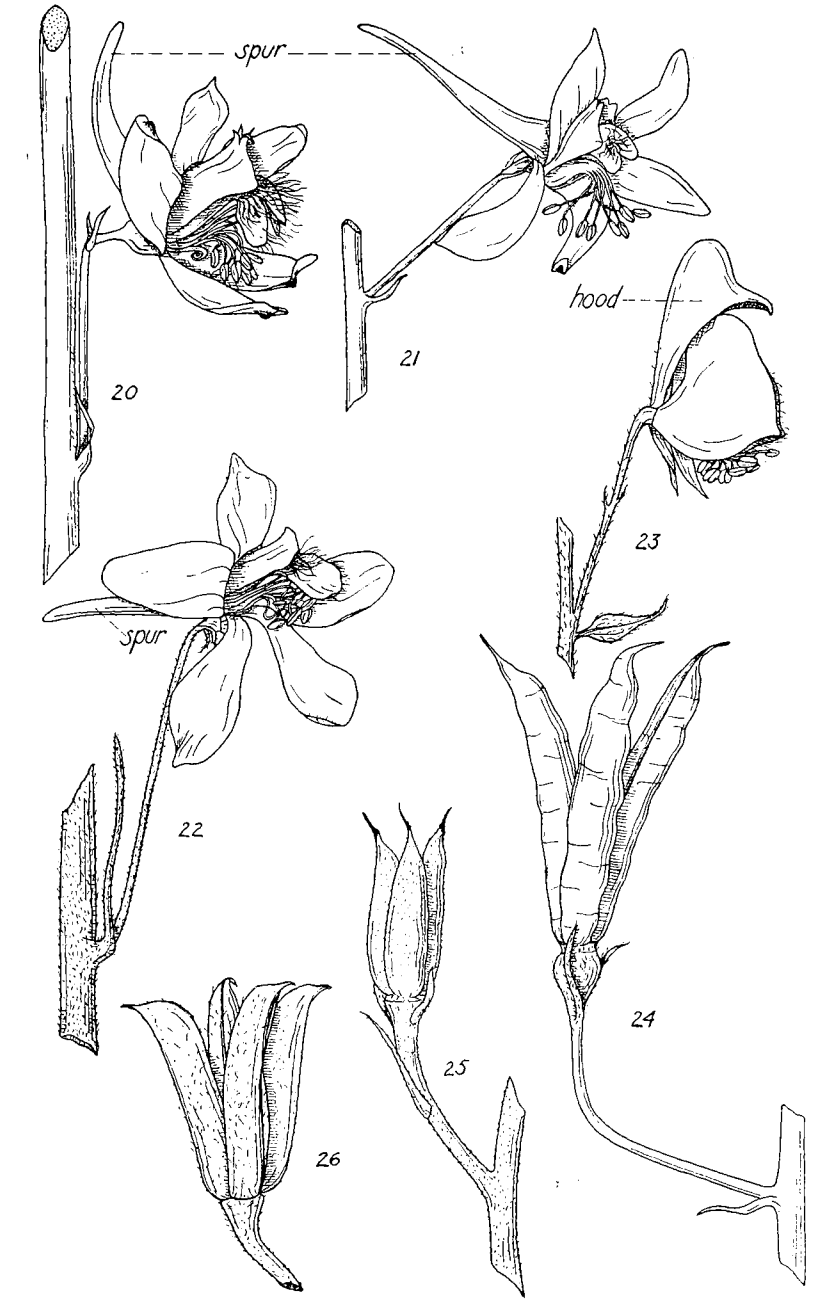
LARKSPUR (*Delphinium*)

As a group, the larkspurs are easily recognized by the single long "spur" (Figs. 20, 21, 22) of the flower. A single sepal of the flower is prolonged into a spur, and encloses two petals which are likewise extended. Larkspurs may be distinguished from aconite or monkshood, which they closely resemble, by the form of the flower. In aconite or monkshood the upper sepal, instead of being spurred, as in larkspur, is enlarged and has the appearance of a hood (Fig. 23) over the other flower parts, hence the name monkshood. These differences are brought out in the drawings.

A number of native plants are often mistaken for larkspur, especially in the young stage. Chief of these is the wild geranium, of which there are several species within our borders. There are two small leaves (stipules) (Fig. 30) at the base of the geranium leafstalk; these are absent in larkspur. The false mallow (Fig. 31) (*Malvastrum coccineum*), when young, may be mistaken for larkspur. Its leaves are coated with hairs that are in star-shaped groups (Fig. 32). The leaves of the common spring anemone (Fig. 34) (*Pulsatilla hirsutissima*) with lavender flowers, are much more divided and in a fashion different from those of larkspur. The wind flower (Fig. 33) (*Anemone*) has leaves quite similar in shape to those of larkspur but the hairs are longer and more spreading. Both the common spring anemone and the wind flower have a characteristic group of leaves (*involucre*) on the flowering stem (see Fig. 36). In Fig. 35 is shown the highly divided leaf of Virgin's Bower (*Clematis douglasii*) which may be mistaken at times for that of one of the larkspurs. The stockman should thoroughly familiarize himself with the appearance of young larkspur plants.

There are a number of species of larkspur growing in Colorado, the principal ones being as follows: Purple, or Nelson's larkspur (*Delphinium nelsonii*), Geyer's larkspur (*Delphinium geyeri*), Penhard's larkspur (*Delphinium carolinianum penhardii*), subalpine larkspur (*Delphinium subalpinum*), and tall larkspur (*Delphinium glaucescens*).

Purple, or Nelson's Larkspur (*Delphinium nelsonii*). The easily detachable cluster of thickened tuberous roots (Fig. 38) is characteristic of this species. The plant (Figs. 27 and 37) rarely exceeds 2 feet in height; about 1 foot is its common height. The leaves are divided into a large number of narrow segments. The flowers are blue, the two petals, not prolonged as spurs, each have a cobwebby tuft of white hairs in the center of the broad blade, on the outer surface. The fruit (Fig. 24) may be smooth or hairy.



Figs. 20-26.—Larkspurs and aconite: 20, flower of Penhard's larkspur, note the erect flower stalk and spur; 21, flower of Nelson's larkspur; 22, flower of Geyer's larkspur; 23, flower of aconite; note the "hood"; 24, fruit of Nelson's larkspur; 25, fruit of Geyer's larkspur; 26, fruit of aconite.

This species is the earliest of the larkspurs. It may be seen in bloom as early as April 20 at low altitudes. In the foothills it is usually past blooming by June 1.

Its altitudinal distribution is from 4,000 to 10,000 feet. It is found all over the State within these limits.

Geyer's Larkspur (*Delphinium geyeri*) (Figs. 28 and 40).—This is a taller plant than the preceding, ranging in height from 10 inches to over 2 feet. The root is thickened and somewhat woody. There is a cluster of thick, dull-green leaves at the base of the plant; they are cut into numerous long, narrow segments, each segment being tipped with a white, hardened point. The flowers are blue.

This larkspur is a plant of low altitudes, seldom growing above 7,000 feet. It blooms during the first part of July.

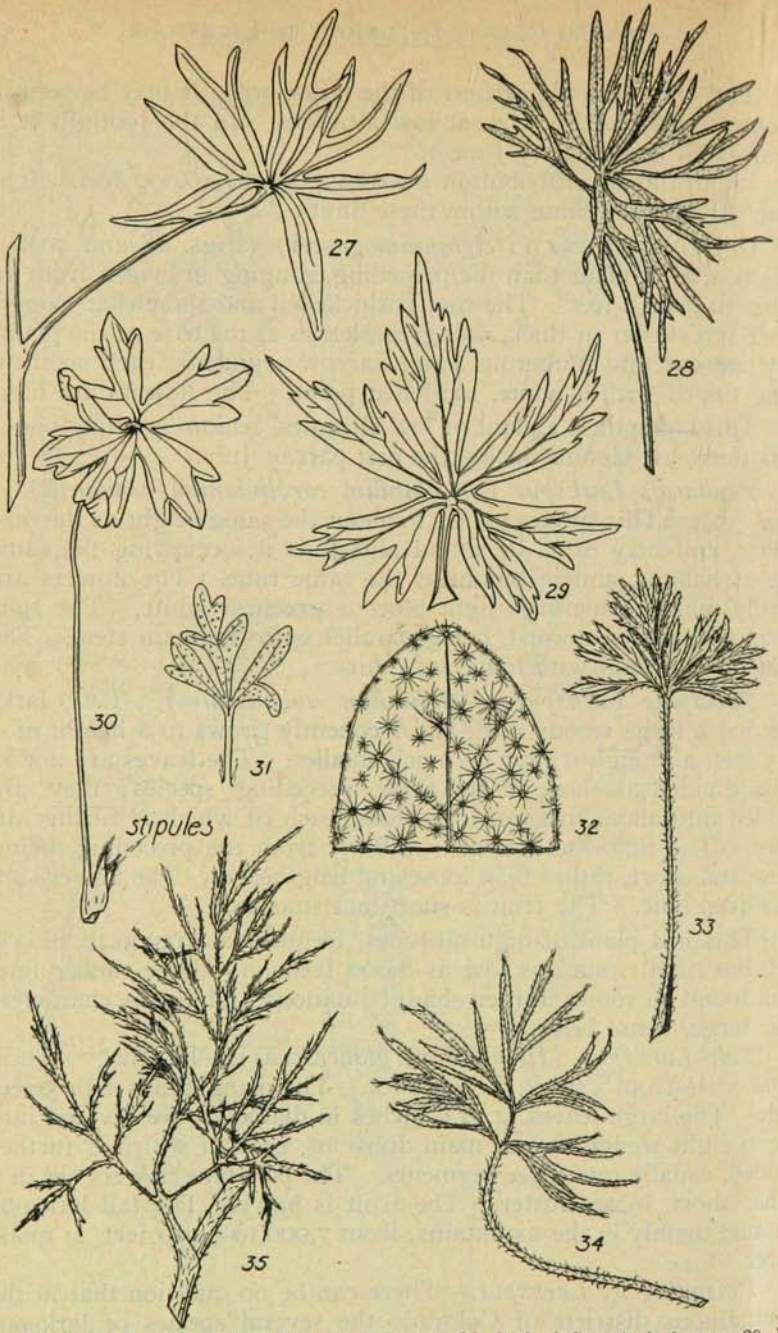
Penhard's Larkspur (*Delphinium carolinianum penhardii*).—(Fig. 39). This species grows to about the same height as the preceding, and may often be found alongside it, occupying the same sort of habitat, and in bloom at the same time. The flowers are usually white, sometimes light blue or greenish white. The spur commonly points upward, being parallel with the main stem. The petals are covered with long, soft hairs.

Subalpine Larkspur (*Delphinium subalpinum*).—This larkspur has a large woody root, and frequently grows to a height of 4 or 5 feet, although it may be much smaller. The leaves are not as finely divided as those of the three preceding species; they are divided into about five main divisions, each of which is further divided. The inflorescence also differs from the preceding, being dense and short, rather than loose and lengthened. The flowers are very deep blue. The fruit is short and smooth.

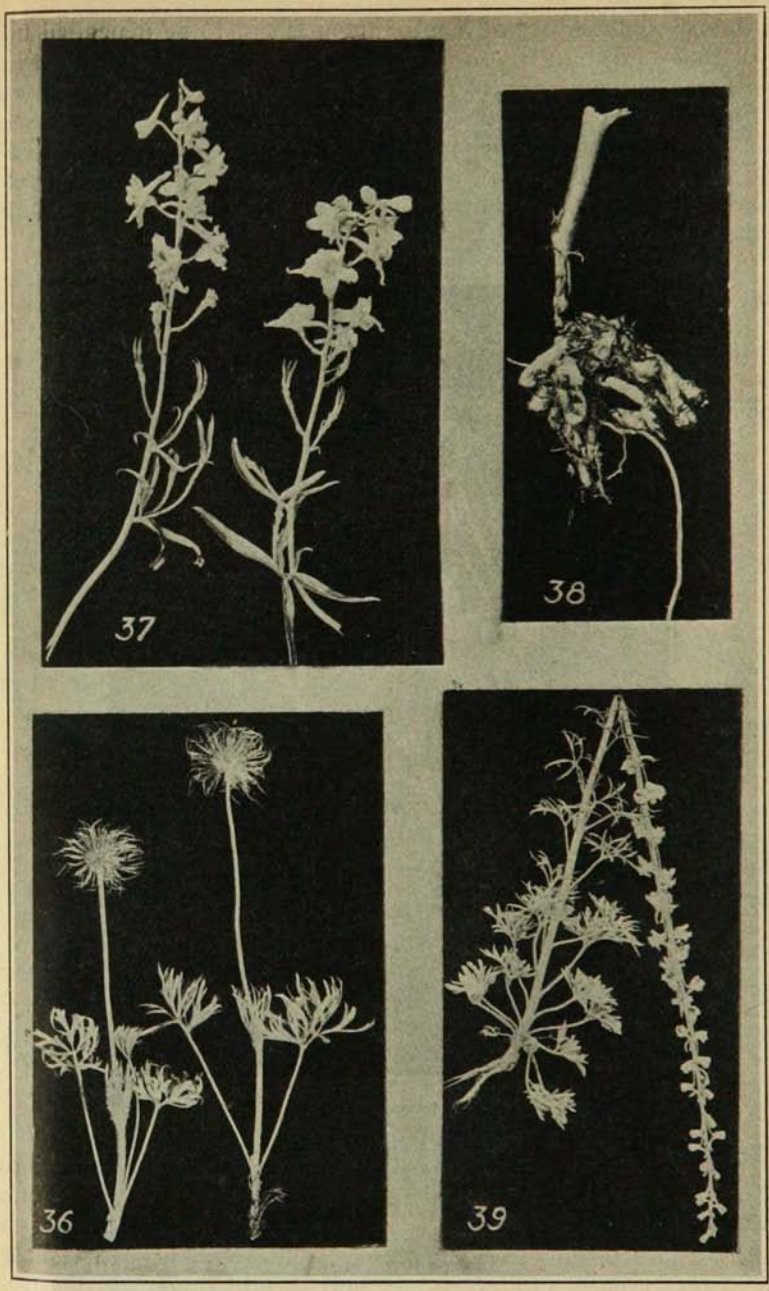
This is a plant of high altitudes, frequent at 10,000 to 11,000 feet, but often found as low as 8,000 feet, and above timber line. It is found in moist, rather shady situations and forms characteristic, large, dense beds.

Tall Larkspur (*Delphinium glaucescens*).—In this, several stems arise from a thick, woody root. The plant stands 1 to 5 feet high. The large leaves, 2 to 6 inches in diameter, are divided into five to eight wedge-shaped main divisions, each of which is further divided, usually into three segments. The pale blue flowers are in a rather short, loose cluster. The fruit is hairy. The tall larkspur is found mainly in the mountains, from 7,000 to 9,000 feet, in moist places.

Poisoning by Larkspur.—There can be no question that in the mountainous districts of Colorado the several species of larkspur cause a greater loss to stockmen through poisoning than all other poison weeds combined. Laboratory experiments indicate that the different species vary as to their poisonous qualities, and that the



Figs. 27-35.—27, leaf of Nelson's larkspur; 28, leaf of Geyer's larkspur; 29, leaf of aconite; 30, leaf of wild geranium; note the two leaf-like structures (*stipules*) at the base of leaf stalk; 31, leaf of the false mallow; 32, portion of leaf of false mallow, enlarged, showing the star-shaped hairs of the surface; 33, leaf of wind flower; 34, leaf of anenome (*Pulsatilla*); 35, leaf of Virgin's Bower. Figs. 30 to 35, inclusive, are leaves of plants often mistaken for those of larkspur.



Figs. 36-39.—36, anenome (*Pulsatilla*), the leaves of which are frequently mistaken for those of larkspur; 37, leaves and flowers of Nelson's larkspur; 38, easily detachable cluster of thickened, tuberous roots of Nelson's larkspur; 39, Penhard's larkspur.

poisonous qualities of any one of them is not to be depended upon at all times throughout the season. The white larkspur, which grows on the plains east of the mountains, has never been reported to the Experiment Station as having caused any trouble. Stavesacre which is derived from one species of larkspur has long been used in medicine. The eclectic physicians use it for its specific action on the reproductive organs but its principal use has been to destroy lice on the heads of children.

Fig. 40.—Geyer's larkspur (*Delphinium geyeri*).

Symptoms.—The symptoms manifested in affected animals are similar to those of aconite poisoning. Cattle are most often poisoned and the first thing noticed is stiffness, especially of the fore legs, and pronounced straddling of the hind legs in walking. The animal usually falls to the ground several times and the muscular movements become more and more irregular. There is drooling of saliva, with frequent swallowing. Perhaps the most char-

acteristic symptom is the quivering of the muscles, especially on the sides and legs. In fatal cases the animal dies in convulsions. There is not sufficient difference in the symptoms of poisoning by the different species of larkspur to warrant special consideration of each.

It is a well known fact that animals are most often poisoned from eating larkspur when it is wet, after a rain or snow storm, or in the early morning after a heavy dew or frost.

Since larkspur and death camas are both found on the same range at a time when they are most poisonous, it may be difficult to tell in a given instance which is responsible. The symptoms are quite characteristic in each instance and a comparison of the symptoms given should enable the reader to decide with a considerable degree of certainty.

Animals when poisoned, and if not restrained, will start for the nearest water hole; the death of many animals near water holes has been deemed sufficient cause in many instances for suspecting that the water has been maliciously tampered with by an enemy.

Areas that are badly infested with larkspur should be abandoned until the danger period has passed, which period will vary, according to altitude, from the middle of June to the first of August. When limited areas are particularly infested with larkspur, the practicability of fencing and of digging the plants is to be considered.

Treatment.—When an animal goes down from larkspur poisoning it should be turned until the head is higher than the body, to relieve the breathing. Under no circumstances should attempt be made to drive the animal further. The benefit derived by bleeding the animal, as claimed by some stockmen is questionable. When there is excessive bloating the rumer (paunch) should be punctured on the left side with a sharp knife (withdrawing it immediately after the puncture is made), or what is far better, with a trocar and cannula. This latter instrument, which costs but a dollar or two, should be kept at the ranch and carried by the range rider during the larkspur season. Potassium permanganate, as a chemical antidote, is found to be very effective in larkspur poisoning (discussed in connection with remedies for death camas), but the inconvenience of carrying quart bottles of the solution ready for use, renders it of little practical value.

Dr. C. Dwight Marsh has reported very satisfactory results from use of the following formula, administered hypodermically:

Physostigmin salicylate	1 grain
Pilocarpin hydrochlorid	2 grains
Strychnine sulphate	½ grain

Most stockmen are familiar with the use of a hypodermic syringe, having used it in vaccinating cattle for blackleg. A 4-

dram, all metal syringe will be the most convenient, and can be secured at any instrument house. The drugs can be secured at drug stores in tablet form, and after being dissolved in water, are ready for immediate use. The amount of each drug indicated in the formula is intended to be given at one dose for an animal weighing 500 or 600 pounds. One-half ounce of boiled water should be used to dissolve the tablets and two or three doses can be carried along with the syringe, for immediate use. Dr. Marsh expresses his confidence in the above treatment in the following words: "If they (stockmen) are willing to try this remedy, they can without doubt save the lives of most of the animals poisoned during drives or round-ups."

MONKSHOOD, ACONITE (*Aconitum*)

The common monkshood or aconite (*Aconitum columbianum*) (Figs. 39 and 41) in Colorado is a tall species, 3 to 6 feet high. The plant is more or less hairy and sticky. The large leaves are cut into a number of segments. The flowers have the characteristic "hood"; this feature has suggested the name "monkshood." The flowers vary from blue to white. The fruit (Fig. 26) is similar to that of larkspur. The species is prevalent in our mountains between the altitudes of 7,000 and 10,000 feet. Its preferred habitat is moist meadows and open woods. At 9,000 to 10,000 feet it is usually found growing among low shrubbery.

Poisoning by Aconite.—There is some confusion in differentiating aconite from its near relative larkspur. In one locality on the western slope the tall larkspur has for years been called aconite. Aconite is a very poisonous plant but because of its limited distribution, and its widely scattered habit of growth, it is not much eaten. Animals have been seen to reject the plant even after taking it in the mouth, because of its peculiar local effect. The general effect of aconite is much the same as larkspur. There is great muscular weakness, shallow, irregular and labored breathing, a small and weak pulse, bloating, belching, drooling frothy saliva, and often a peculiar clicking sound caused from the constant attempt at swallowing. The pupils of the eye may be either contracted or dilated, but as the end approaches, remain dilated.

Treatment.—This consists essentially in overcoming the depression of the heart. Inhalations of ammonia, camphor, sulphuric ether, and hypodermic injections of digatalin or atropine. The formula recommended for hypodermic use in case of larkspur poisoning is quite appropriate in this case.

WILD CHERRY (*Prunus*)

The three common species of cherry in Colorado are the chokecherry (*Prunus melanocarpa*), wild red cherry (*Prunus pennsylvanica*), and sand cherry (*Prunus besseyi*).

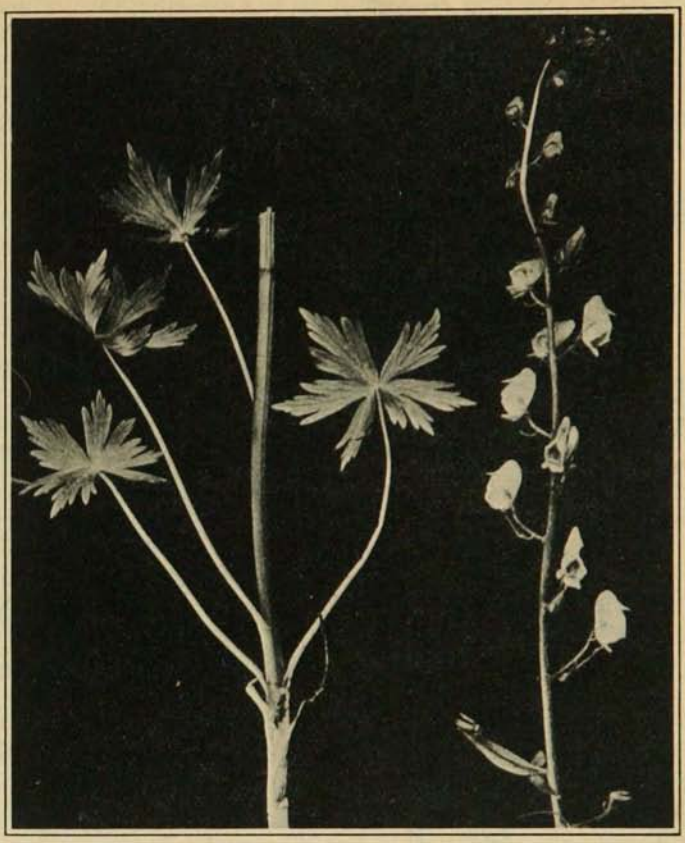


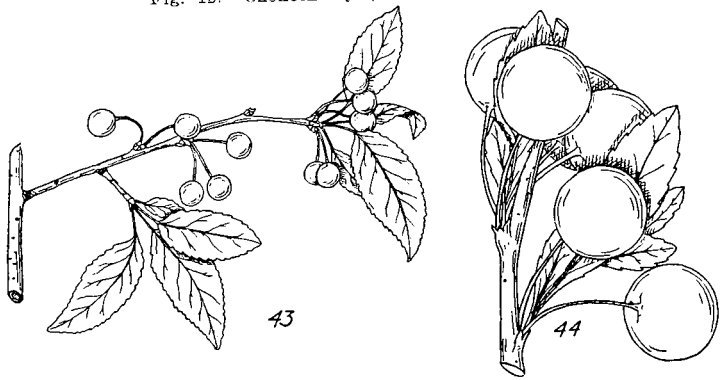
Fig. 41.—Aconite (*Aconitum columbianum*)

Chokecherry (*Prunus melanocarpa*) (Fig. 42).—This is a tall shrub or small tree, sometimes attaining a height of 15 to 20 feet. The leaves are rounded or slightly heart-shaped at the base and pointed at the tip; the margin is marked by fine teeth. The flowers, of the true cherry type, are in long, unbranched clusters (see Fig. 42), and in this respect chokecherry is distinguished from the wild red cherry and sand cherry; the two latter have the flowers in short clusters in the leaf axils. The ripe fruit of the chokecherry is black and has an astringent taste.

Chokecherry is found on plains and foothills throughout Colorado. It is quite a characteristic gulch plant.

Wild Red Cherry (*Prunus pennsylvanica*) (Fig. 43).—This is a small tree, in our region, seldom reaching a height of over 30

Fig. 42.—Chokecherry (*Prunus melanocarpa*)



Figs. 43-44.—43, wild red cherry (*Prunus pennsylvanica*); 44, Bessey's sand cherry (*Prunus besseyi*).

feet, usually much smaller, and even in some instances almost shrub-like. The leaves are 3 to 4 inches long and ½ to 1 inch wide, rounded at the base and pointed at the tip; the margin is finely toothed. The flowers occur in the leaf axils, four or five in a group, all the flower-stalks arising approximately from the same region on the stem. The small, spherical fruit has a light red color.

In Colorado, wild red cherry occurs along streams and on hillsides. It seems to be found only in the eastern half of the State, on plains and in the foothills.

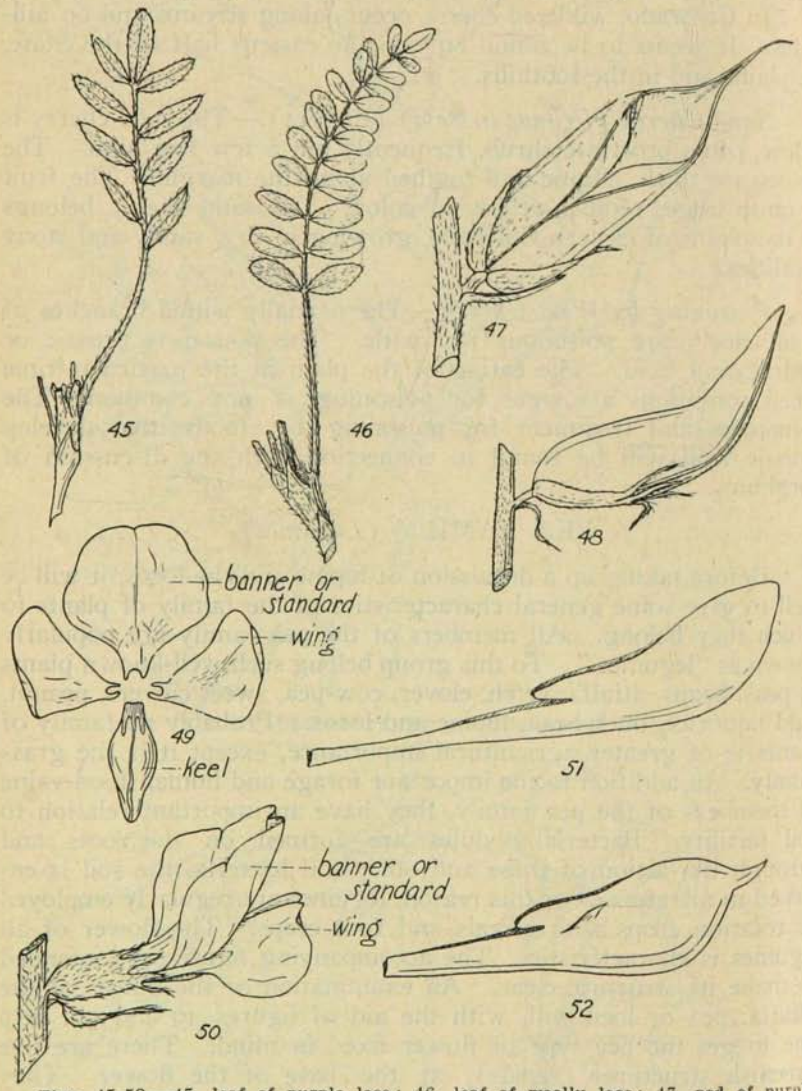
Sand Cherry (Prunus besseyi) (Fig. 44).—The sand cherry is a low, often prostrate shrub, frequently but a few feet high. The leaves are thick, elliptic and toothed along the margin. The fruit is quite large, reddish-yellow in color. The sand cherry belongs to the plains of eastern Colorado, growing in dry, sandy and stony localities.

Poisoning by Wild Cherry.—The partially wilted branches of wild cherry are poisonous for cattle. The poison is prussic or hydrocyanic acid. The eating of the plant at the particular time when conditions are right for poisoning is not common. The symptoms and treatment for poisoning by foods that develop prussic acid will be found in connection with the discussion of sorghums.

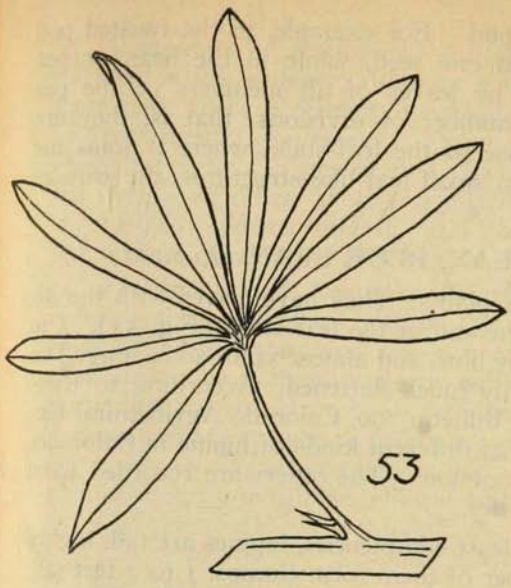
PEA FAMILY (*Legumes*)

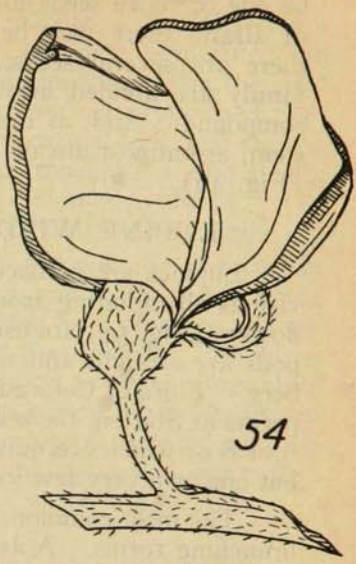
Before taking up a discussion of lupine and the locos, it will be well to give some general characteristics of the family of plants to which they belong. All members of the pea family are popularly known as "legumes." To this group belong such well-known plants as peas, beans, alfalfa, vetch, clover, cow-pea, sweet clovers, peanut, wild liquorice, buck bean, lupine and locos. Probably no family of plants is of greater agricultural importance, except it is the grass family. In addition to the important forage and human food value of members of the pea family, they have an important relation to soil fertility. Bacterial nodules are formed on the roots, and through the action of these and other soil bacteria, the soil is enriched in nitrates. For this reason, legumes are regularly employed as rotation crops with cereals and root crops. The flower of all legumes is characteristic. The accompanying figures are intended to make its structure clear. An examination of the flower of the alfalfa, pea or loco will, with the aid of figures 49 and 50, help one to get the pea type of flower fixed in mind. There are five greenish structures (sepals), at the base of the flower. They partially enclose the colored parts (corolla) of the flower. There are four main parts to the corolla of the flower; a broad upper one

(*banner or standard*), two *wings*, one on each side, and a lower structure shaped like the keel of a boat, and called the *"keel."* The keel is really composed of two petals which are united along the middle line of the keel. It encloses the stamens, which produce the pollen, and also the ovary, which develops into the pod. The fruit of all peas is a pod or "legume." It consists of two halves which split apart (Fig. 47) at maturity along their edges. There may

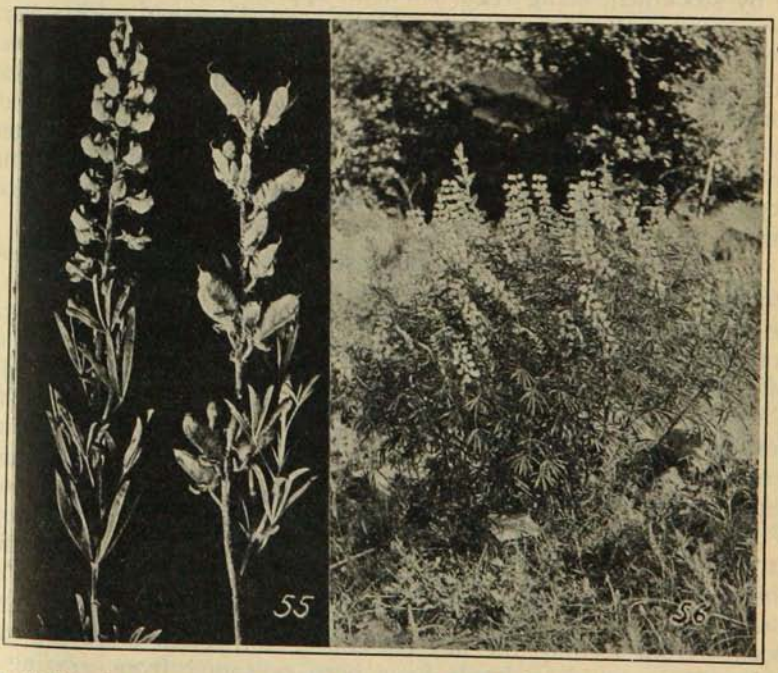


Figs. 45-52.—45, leaf of purple loco; 46, leaf of woolly loco; 47, pod of purple loco; 48, pod of woolly loco; 49, diagram of pea flower, dissected; 50, side view of purple loco flower; 51, keel of woolly loco; note the blunt point; 52, keel of purple loco; note the sharp point.





Figs. 53-54.—Spreading lupine (*Lupinus decumbens*). 53, single leaf; 54, flower.



Figs. 55-56.—Spreading lupine (*Lupinus decumbens*): 55, flowers and fruit; 56, single plant; it is about 2 feet tall.

be one or more seeds in a pod. For example, in the twisted pod of alfalfa there may be but one seed, while in the bean or pea there are several seeds. The leaves of all members of the pea family are divided into a number of divisions; that is, they are compound. And, at the base of the leaf-stalk, where it joins the stem, are almost always two small leaf-like structures, the *stipules* (Fig. 46).

LUPINE, WILD BEAN, BLUE BEAN (*Lupinus*)

Lupines are herbaceous plants. They have leaves with the divisions all radiating from the end of the leaf-stalk (Fig. 53). The flowers (Fig. 54) are usually blue, and almost as broad as long. The pods are straight and usually much flattened. According to Rydberg's "Flora of Colorado," Bulletin 100, Colorado Agricultural Experiment Station, there are 24 different kinds of lupine in Colorado, 6 or 8 of which are quite common. The others are recorded from but one or a very few localities.

The most common, at least conspicuous, lupines are tall, highly branching forms. A number of them form clumps, 1 to 2 feet tall. Very frequently a small annual lupine (*Lupinus pusillus*) is sent in by stockmen, being regarded with apprehension by them. This lupine is usually 4 or 5 inches high, much branched, and covered with long, stiff hairs. Another very common species is the spreading lupine (*Lupinus decumbens*) (Figs. 55 and 56). Each plant forms a dense clump, 1 to 3 feet high. The leaflets are green above and silvery-hairy beneath. The flowers are in very dense clusters, and vary from blue to white. This species is abundant in rather deep soil at lower altitudes. It is also found throughout the foothills.

Poisoning by Lupines.—Because of their practical importance, stockmen should become sufficiently acquainted with these plants to be able to recognize them at a glance. The white loco weeds are sometimes improperly called lupines. Lupines remain green and offer a succulent forage after most other plants have become dry. They are eaten mostly in the late fall and constitute one of the chief forage plants. Lupine is cut for hay in Montana and is eaten greedily by all kinds of stock. The principal poison in lupine is lupinotoxin and it is confined mostly to the seeds and seed pods. The chronic condition of lupine poisoning is known as lupinosis. It is apparent that lupine hay, to be safe, must be cut either before the pods have formed or late in the season after the pods have matured and most of the seeds fallen out. While most poisoning occurs from feeding the hay containing the seeds, there are cases reported in which animals have been poisoned from grazing on lupines in the late summer and fall.

Symptoms of Poisoning.—Chronic lupine poisoning is not common in this country, although a few cases have been noted. In acute cases there is cerebral congestion accompanied from the start by great mental excitement. Sheep are more often poisoned than horses or cattle. Sheep at first become frenzied, butt into things, fall over each other, show irregularity of movements, and finally have violent spasms, and in fatal cases die in convulsions. The symptoms somewhat resemble those of poisoning by strychnine.

Preventive and Remedial Measures.—Prevention consists in avoiding the ripe lupines both on the range and in the hay. Acute cases of lupine poisoning are not common in Colorado and no experiments have been made in treating the disease. Potassium permanganate would probably be effective as a chemical antidote if given early in the attack before too much poison is absorbed from the stomach. After absorption the physiological effects may be counteracted by morphine, chloral and other sedatives.

LOCO WEED

The name "loco weed" is applied to a great many different plants. The true locos and those which are commonly mistaken for locos all belong to the pea family. All are herbs. They have the typical pea flower: Five green sepals, a white, purple, or red corolla composed of a single large banner, two wings and a keel. The loco fruit is a pod ("legume"). The leaves are compound, that is, made up of a number of separate leaflets. There is always an odd number of leaflets (Fig. 45) which means that a leaflet, not a tendril, is at the tip of the leaf. In nearly all cases the leaflets are numerous, and come off on either side of the main axis of the leaf, seldom radiating from the end of the main axis, as in lupine.

The true locos and those resembling loco belong to two groups (genera) of the pea family. These groups are known by botanists as *Aragallus* and *Astragalus*. The common purple loco is an *Aragallus,* while the woolly loco is an *Astragalus*. Of course there are many different species of *Aragallus,* and also many of *Astragalus*. But the two large groups, with all their species, are distinguished from each other quite easily by an examination of the flower. If the two wings of an *Aragallus,* for example the purple loco (*Aragallus lambertii*) flower, are pulled aside so that one may see the tip of the keel, it will be seen that this is sharp-pointed (Fig. 52). On the other hand, the keel of the *Astragalus* flower, for example woolly loco, (*Astragalus mollissimus*) is blunt and rounded at the tip (Fig. 51). There are recorded nine different sorts of *Aragallus* in Rydberg's "Flora of Colorado," and in the same book 81 different species that might be referred to the genus *Astragalus*.

As was intimated above, there are many different plants that are called loco weed. This name is most commonly applied, however to two species; these are the purple or stemless loco (*Aragallus lambertii*) and the woolly loco (*Astragalus mollissimus*). It is positively known that these two plants cause the loco disease. It is quite probable, however, that a few, at least, of the many allied forms, also possess poisonous properties. Many species, besides the purple loco and woolly loco, have been sent in to the Experiment Station, with the statement that they were the cause of locoing. Many of these species held in suspicion, resemble either the purple loco or the woolly loco. It is well for the stockman to thoroughly familiarize himself with the two known poisonous species, namely, the purple or stemless loco and the woolly loco.

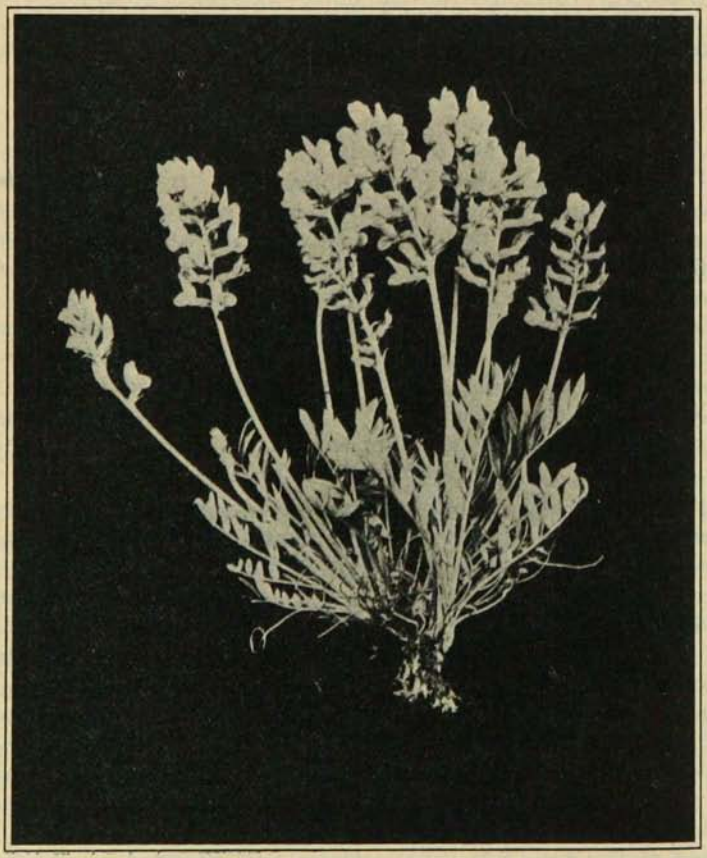


Fig. 57.—Purple loco (*Aragallus lambertii*).

Purple or Stemless Loco (Aragallus lambertii) (Fig. 57).—The purple loco is perennial. It is apparently stemless. The numerous

leaves and flowering stems arise from a hard, woody crown. The plant has a tufted appearance. Where the leaves join the crown, there are a number of papery scales (stipules). The plants are usually 8 to 14 inches high. Each leaf (Fig. 45) has a number of oblong to narrow leaflets, from ½ to 1¼ inches long. They are covered with silky hairs that lie closely against the leaf surface; often the leaves are smooth. The flowers (Fig. 50) are scattered along the end of a leafless stem. This stem may be silky hairy or smooth. The flowers are longer than broad. They are usually purple, but sometimes violet or white. The pod (Fig. 47) is oblong, hairy, rather leathery and measures about ½ to ¾ of an inch long.

Purple loco grows in dry, open soil. It is not found in low, moist land, or to any extent in shaded situations. It is found throughout Colorado, from the lowest altitudes up to about 9,000 feet. In the mountains it is most prevalent in the open parks, where it occurs in dry grassland. At the lower altitudes it is in bloom in early June. At 9,000 feet it comes into flower the latter part of June and the first of July.

There is a variety of the purple loco (*Aragallus lambertii sericeus*) which is stouter in appearance and has more silky, and broader leaflets than the regular form.

White-Flowered Loco (*Aragallus albiflorus*).—This grows in about the same habitats as the purple loco. It precedes the purple one, however, by a week or so. It also extends to higher altitudes (up to 11,000 feet). It is a more robust plant. It is covered with silvery hairs. There are silky white hairs on the calyx and with them, interspersed, a few black hairs. The flower is white, with a characteristic purple tip on the keel. The plant is held with suspicion.

Richardson's Loco (*Aragallus richardsonii*) (Fig. 58).—This is found only in the mountain valleys. It is readily distinguished from the preceding locos by the leaf; in it the leaflets are arranged in bundles of three or four on the stem. The whole plant is more or less hairy; the corolla is large and blue. Suspected of being poisonous.

Woolly Loco (*Astragalus mollissimus*).—This is a perennial (Fig. 59) with a short, stout stem from which arise numerous leaves, and stems bearing flowers. The entire plant is very densely hairy, the hairs being long, silky and somewhat matted together. There are numerous leaflets, which usually measure from one-half to five-eighths of an inch long. The violet-colored flowers are crowded; they are longer than broad. The mature pod is smooth, leathery, curved, and from one-half to three-fourths of an inch long.

Fig. 58.—Richardson's loco (*Aragallus richardsonii*).

The woolly loco prefers dry soil. It is found only at lower altitudes in the eastern half of Colorado. It is a Great Plains plant (Fig. 61). It blooms in late May and early June.

Symptoms Resulting from Eating Locos.—The symptoms are so well known to stockmen that a lengthy discussion of them at this time would be superfluous. The condition may be summarized as a cerebral disturbance with impairment of the special senses and incoordination of muscular movements. Horses, cattle and sheep are affected. The claim is made in Montana that cattle are the least susceptible. The loco weed habit is acquired by imitation and encouraged by scarcity of forage grasses. Stock are not liable to eat poisonous plants when good food is available. If stock can be kept from acquiring the habit when food is scarce, there will be very few locoed animals. When first seen eating large quantities of loco weeds, and presumably acquiring the habit, an animal should be immediately removed from the herd. Young animals are more

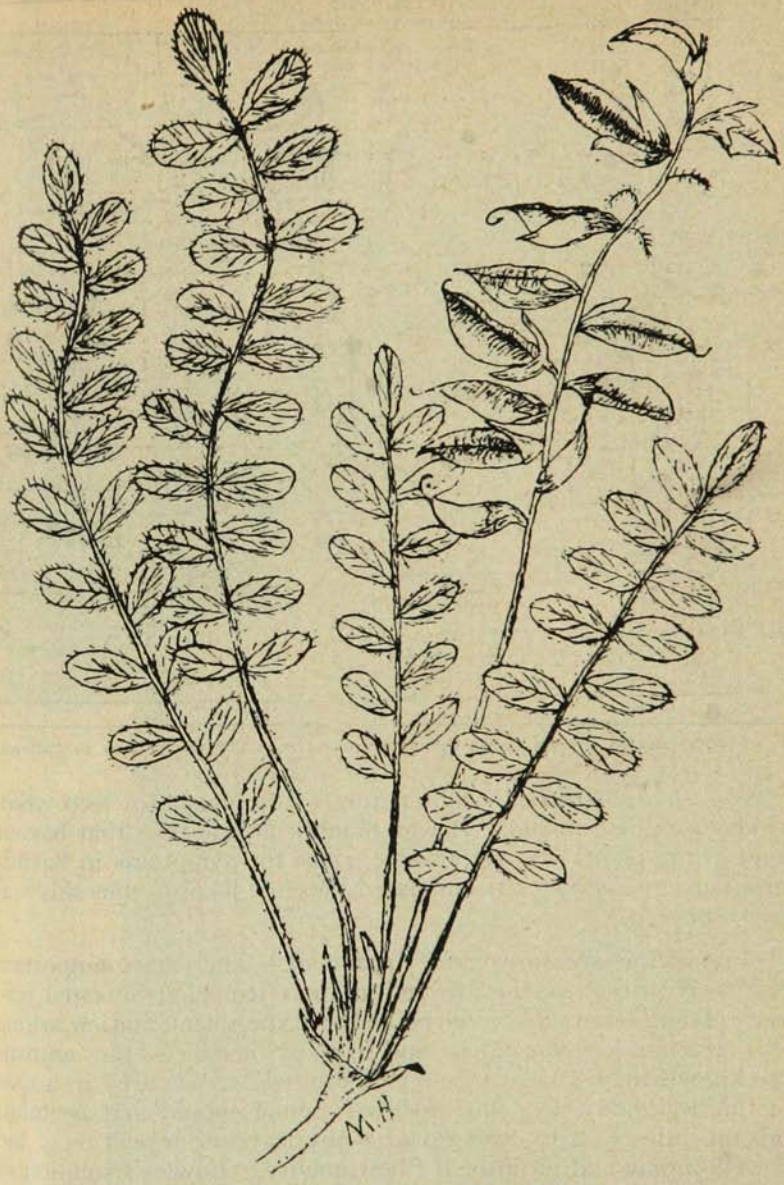


Fig. 59.—Woolly loco (*Astragalus mollissimus*).

apt to acquire the habit than older ones. The habit assumes the form an insatiable appetite for loco weeds, and as a result from eating these exclusively, the animal suffers from an unbalanced ration and from lack of nourishment.

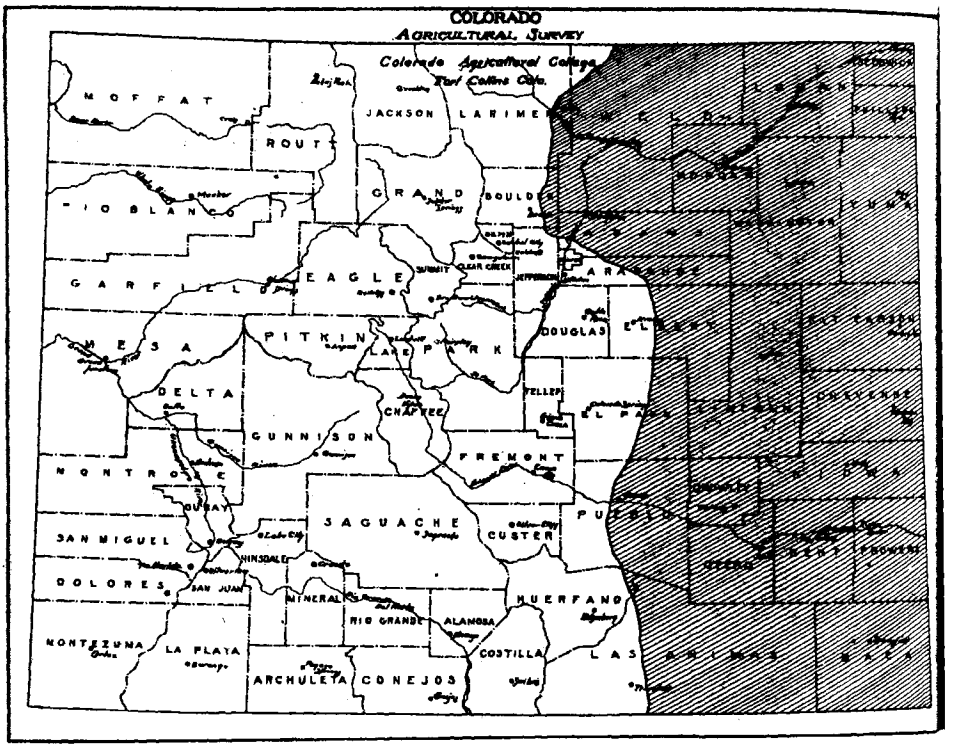


Fig. 61.—The shaded portion shows the geographical range of woolly loco in Colorado.

Poisonous Principle.—The nature of the poison in loco weeds has not been determined. It was thought at one time that barium found in the plants was responsible, since the symptoms in barium poisoning in some respects simulated those of locoism, but this was later disproven.

Preventive Measures and Treatment.—The most important measure is to remove the affected animals from loco-infested pastures. Many letters are received at the Experiment Station asking for a cure for locoed animals and in most instances the animals were known to still have access to the weeds. A "cure" in a case like this is impossible. The afflicted animal should first be taken from the infested area, and given a physic (raw linseed oil), and fed well on hay and grain of the best quality. Fowler's solution of arsenic mixed with the grain may be given as an alterative and tonic twice a day.

The dose for horses and cattle is one-half ounce, and for sheep one teaspoonful. This treatment should not be given continuously longer than two weeks. If the animal can be placed under the care

of a competent veterinarian, strychnine and other remedial measures may be tried. If not too badly diseased, cattle and sheep, with good care and proper treatment, will recover sufficiently to fatten for the block. Horses will recover sufficiently, in most cases, to render a more or less valuable service, but with few exceptions they do not become normal and dependable.

BUCKBEAN (*Thermopsis*)

The common buckbean or yellow wild pea in the State is one with widely-spreading pods (*Thermopsis divaricarpa*). It is a tall perennial with large leaves divided into three leaflets that arise at and radiate from the end of the leaf-stalk. At the base of the leaf-stalk, there are two large, leaf-like structures, the stipules. The flowers are large, pea-like, and yellow. The pods are 3 to 4 inches long, 1-4 inch wide, and spread out from the stem. The plant blooms in the early spring, forming large, bright yellow patches. It grows in rather deep soil along streams, and in draws. It is distributed throughout the state from 5,000 to 11,000 feet altitude.

The buckbean is regarded with suspicion by some. No authentic cases of poisoning from it have come to our attention.

SNOW-ON-THE-MOUNTAIN (*Euphorbia marginata*)

This bright green, erect annual (Fig. 62), 2 to 4 feet high, is conspicuous, due to its white-margined upper leaves; hence the name "snow-on-the-mountain." The plant has a milky juice. It grows on the plains and lower foothills, and is most conspicuous in August.

Poisoning by Snow-on-the-mountain.—More than one hundred species of spurge grow in the United States and many of them are indigenous to Colorado. They have a milky juice that is acrid and corrodes the skin and mucous membranes whenever applied. The milky juice has been used imperically to remove warts and freckles. The snow-on-the-mountain is a very common plant, but is rarely if ever eaten by animals. The plant has not been sufficiently investigated to warrant any definite conclusion regarding its poisonous character. On some closely cropped ranges, this plant will be found as one of a few that has not been molested. Near Lamar, Colorado, where many sheep had died, presumably from eating poison weeds, this particular plant was found to have been denuded of foliage by grasshoppers but without any apparent diminution of their numbers. There was no evidence that sheep had eaten the plants.

SUMAC (*Rhus cismontana*)

The sumac (Fig. 63) of Colorado is a shrub 3 to 7 feet high. The compound leaves have numerous finely-toothed, smooth leaflets that are whitish beneath. The inflorescence is dense and spherical. The fruit is one-seeded and covered with reddish hairs. The

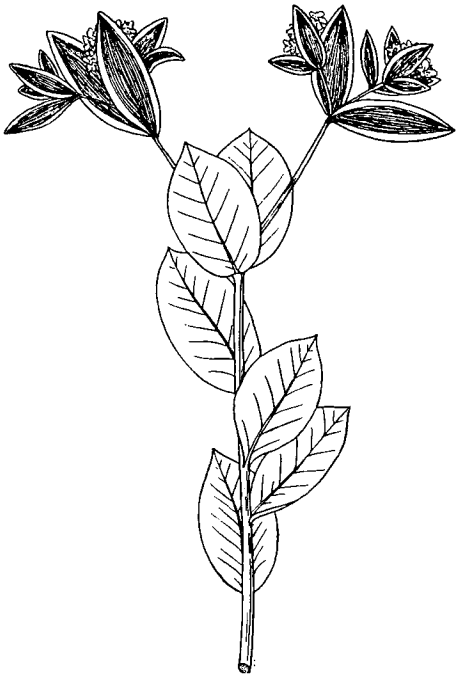


Fig. 62.—Snow-on-the mountain (*Euphorbia marginata*). The upper leaves have white margins.

leaves turn bright red in the autumn. It is found throughout the State at lower elevations, usually forming thickets.

The red fruit of sumac is considered poisonous by some. No cases of poisoning, however, have been brought to our attention.

WESTERN POISON IVY, POISON OAK (*Rhus rydbergii*)

Western poison ivy (Fig. 64), or poison oak, is the only plant in the Rocky Mountain region that is poisonous to the touch. It is a low shrub, 1 to 2 feet high. Unlike the eastern poison ivy, it does not climb or creep. The leaflets come off in threes and when young are folded along the midrib, and quite frequently tinged with purple or dark red. The small yellowish-green flowers occur in clusters in the axils of the leaves. The fruit is globular, berrylike, shining-white, and often persistent on the plant during the winter. It usually grows in rather moist, shaded situations or among rocks. Poison oak or poison ivy should not be confused with scrub oak.

Some people are very susceptible to ivy poisoning. In the human it causes intense inflammation of the skin, with vesicles, edema, itching, and spreads rapidly. A few reports have come to this office to the effect that animals have been poisoned from eating poison ivy, but these reports have not been verified. From a veterinary standpoint, it has little signficance as a poisonous plant.

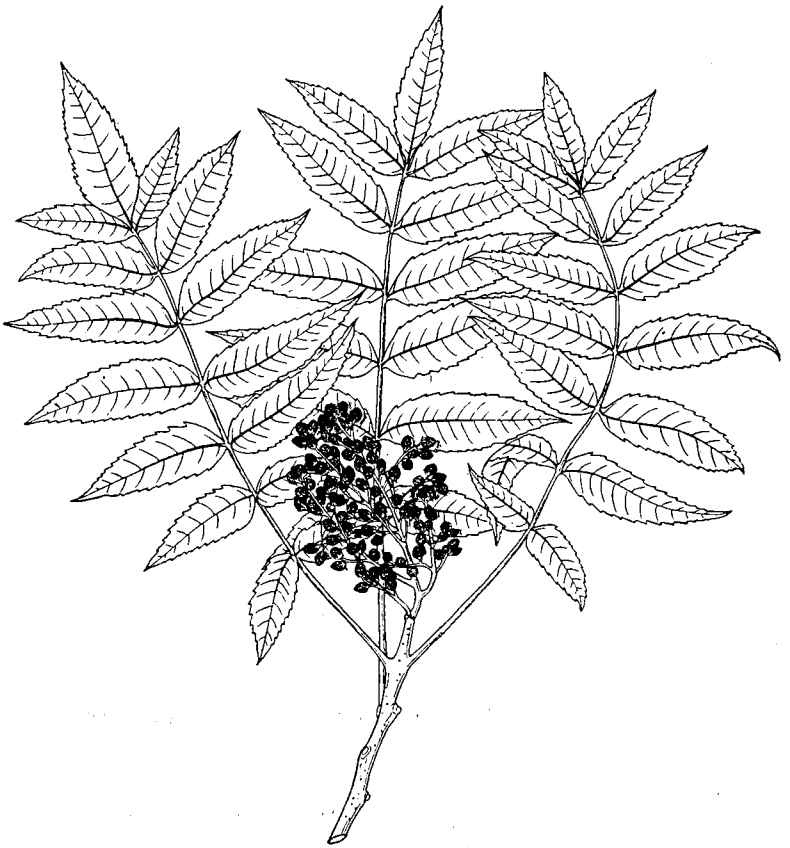


Fig. 63.—Sumac (*Rhus cismontana*)

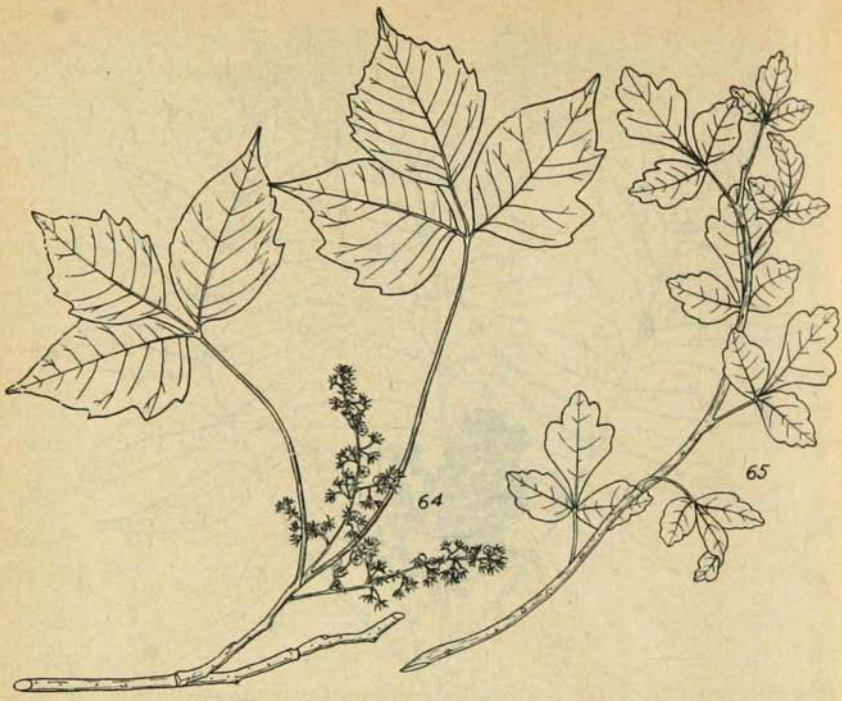
For poisoning by ivy, a popular and effective remedy consists in washing the inflamed skin with a solution made by adding powdered sugar of lead to alcohol, of 50% grade, until no more will easily dissolve.

SKUNK-BUSH (*Rhus trilobata*)

This is a much-branched shrub (Fig. 65), 2 to 5 feet high. The leaves are usually 3-lobed. The flowers are in dense clusters, small, yellowish, and make their appearance before the leaves. The fruit is spherical, red and covered with sticky hairs. The plant has an unpleasant odor, especially when bruised. It grows at lower elevations throughout Colorado, seldom going above 7,000 feet. It is not browsed by animals, because of its objectionable odor.

FALSE MALLOW (*Malvastrum coccineum*)

This is a low, silvery-hairy plant, 4 to 8 inches high. Leaf shape is shown in Fig. 31. The flowers have a characteristic brick-



Figs. 64-65.—64, poison ivy (*Rhus rydbergii*); 65, skunk-bush (*Rhus trilobata*).

red color. The plant grows in dry soil throughout the State, from 4,000 to 9,000 feet elevation. Reports of poisoning by this plant have not been authenticated. Presumably, it is not poisonous.

COWBANE, WATER HEMLOCK (*Cicuta occidentalis*)

This very poisonous plant is a stout perennial, 3 to 7 feet tall. The stem is hollow, smooth, and green. The plant has a very characteristic bunch of thick spindle-shaped roots which contain a yellow, gummy secretion. These are further characterized by being divided into chambers, internally, by cross-partitions. These features are brought out in Fig. 66. Common garden parsnip (*Pastinaca sativa*) that has gone wild, and popularly known as "wild parsnip," is readily mistaken for the water hemlock. The wild parsnip, however, has a single thick, fleshy root (Fig. 67), and not a cluster of roots, as has the water hemlock. These two plants are also distinguished by their leaves (Figs. 68, 71 and 72). The leaves of water hemlock are doubly divided. the leaflets being finely toothed along the margin. The stem of cowbane (Fig. 70) is smooth, that of wild parsnip (Fig. 69) roughened. The small, white flowers are arranged in umbels as in common parsnip (Fig. 74); the fruit resembles that of parsley.

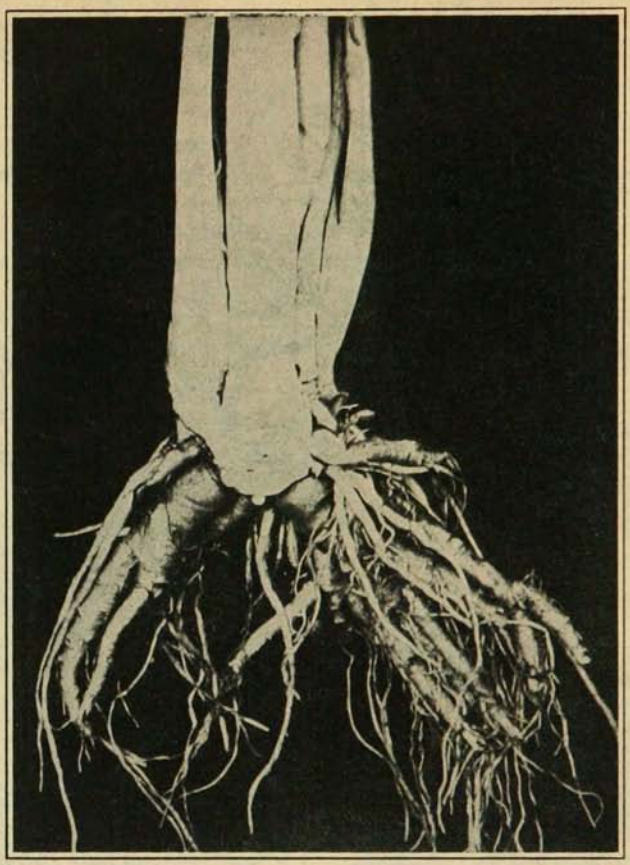
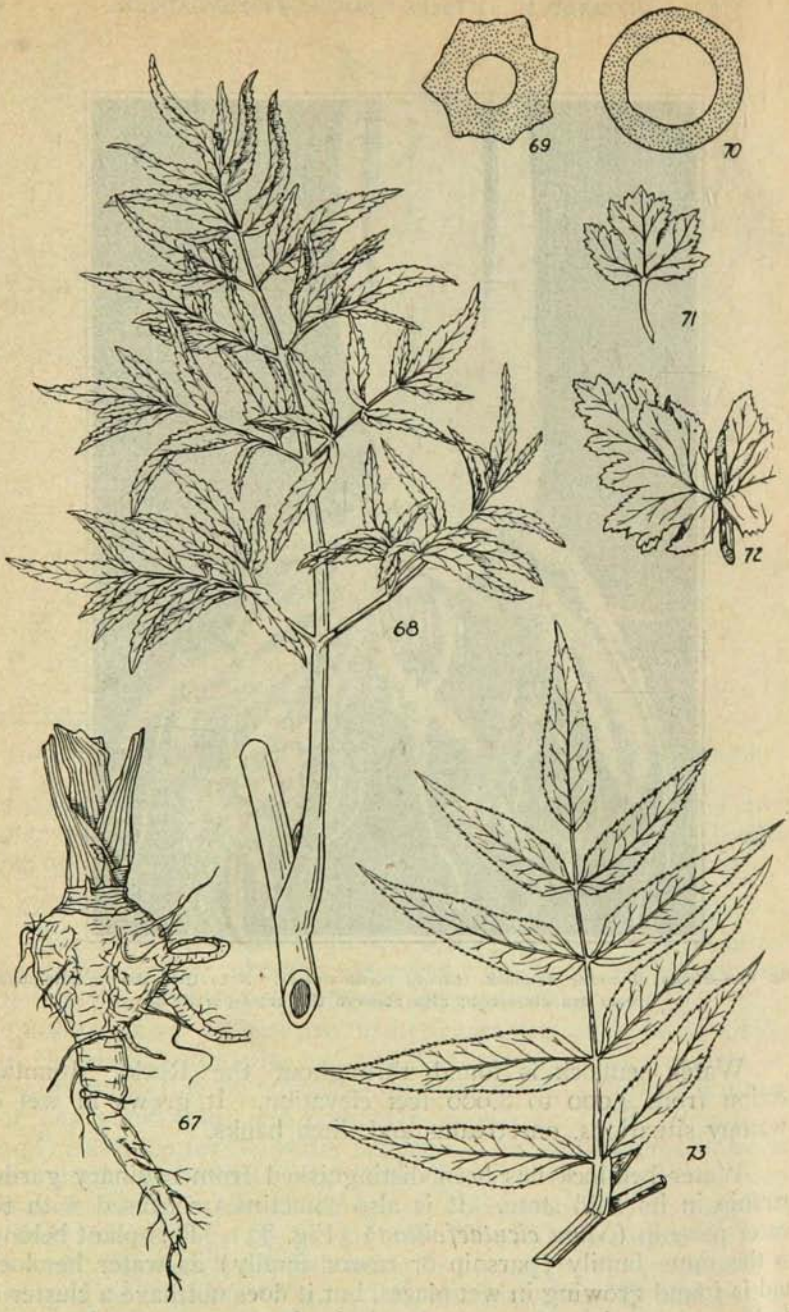


Fig. 66.—Roots of water hemlock (*Cicuta occidentalis*). Note that the spindle-shaped roots are clustered; also observe the cross-partitions.

Water hemlock is found throughout the Rocky Mountain section from 4,000 to 8,000 feet elevation. It grows in wet or swampy situations, on streams and ditch banks.

Water hemlock has been distinguished from ordinary garden parsnip in its wild state. It is also sometimes confused with the water parsnip (*Sium cicutaefolium*) (Fig. 73). This plant belongs to the same family (parsnip or carrot family) as water hemlock, and is found growing in wet places, but it does not have a cluster of fleshy roots as does the water hemlock; furthermore the leaves are not doubly compounded (Fig. 73). The water parsnip has been noted in but a few localities of the State. It is reported as poison-



Figs. 67-73.—67, root of common wild parsnip; note that there is a single root; 68, leaf of water hemlock; 69, cross section of stem of common wild parsnip; 70, cross section of stem of water hemlock; 71, end leaflet of leaf of common wild parsnip; 72, lateral leaflet of common wild parsnip; 73, leaf of water parsnip sometimes mistaken for water hemlock.

ous, but it is likely that it has been confused with the water hemlock.

Poisoning by Water Hemlock.—The American water hemlock is one of the most poisonous plants native to the United States. Every year cases are reported of people, more often children, poisoned from eating the roots of water hemlock, mistaking it for wild garden parsnip. Most of these cases are fatal. The root of a single plant has been known to kill a horse in little less than an hour. Poisoning usually results from eating the roots, but there are instances in which fatal poisoning followed from eating the tops of young plants, and there is strong suspicion that the dried plants in hay may at times be eaten in sufficient quantity to cause poisoning. The roots become accessible by plowing, or, as

Figs. 74-77.—74, common wild parsnip (*Pastinaca sativa*); 75, tall angelica (*Angelica ampla*); 76, cow parsnip (*Heracleum lanatum*); 77, swamp laurel (*Kalmia polifolia*).

frequently happens, the earth is washed away from around the roots on ditch banks. The roots are eaten with more apparent relish than are the dried tops, by both cattle and horses.

Symptoms of Poisoning.—The symptoms are quite characteristic and should be easily differentiated by the layman from those of camas, loco, larkspur or lupine poisoning. The first pronounced symptom is akin to acute spasmodic colic without intermissions from pain. Frequent attempts at micturation and defectation are accompanied by spasmodic contractions of the muscles of the abdomen. The animal is in great agony, and, when prostrate, beats its head violently upon the ground. There is "frothing at the mouth" and in cases that last for several hours, blood may appear in the feces and urine. The spasms rapidly become more and more severe as the brain excitement increases, and the animal finally becomes unconscious and dies in the most violent convulsions.

Treatment.—In very acute cases animals may die in fifteen minutes; in such, treatment is out of the question. If potassium permanganate (as recommended in connection with death camas) can be administered early, it probably will be effective. Melted lard and raw linseed oil are indicated. To relieve the pain, morphine may be given in doses as follows: For sheep, 1½ grains; for cattle and horses, 3 to 5 grains. For horses or cattle, 2 drams of chloroform or 1 ounce of chloral hydrate may be given, highly diluted, by the mouth. If the permanganate has already been given, other drugs should not be given by the mouth.

Cow Parsnip (Heracleum lanatum) (Fig. 76).—This is a stout plant, 4 to 8 feet tall, with large compound leaves that are divided into three main lobes. The base of the leaf-stalk is very much broadened. The flowers are white and in broad umbels. The fruit resembles that of common garden parsnip. It grows in wet ground, especially along streams, throughout the State from 5,000 to 10,000 feet altitude.

The cow parsnip may sometimes be confused with the tall angelica (*Angelica ampla*) (Fig. 75). This is a plant from 5 to 8 feet tall, but is distinguished from the cow parsnip by its purplish stems, and leaves which are twice compound.

The cow parsnip is found in situations similar to those in which water hemlock grows. It can easily be distinguished from the water hemlock, however, by its much greater size, and coarser character. Because of its coarseness, it is not often eaten and is not presumed to be poisonous.

AMERICAN OR SWAMP LAUREL (*Kalmia polifolia*)

The forms of the American or swamp laurel (Fig. 77) growing in the Colorado mountains are dwarfed as compared with the

eastern ones. With us it is a low, smooth shrub, 8 to 20 inches tall. The leaves are evergreen, shiny-green above, paler beneath, the margin often rolled in. The flowers are half an inch broad and lilac-purple in color. The plant grows in mountain bogs, seldom below 10,000 feet elevation.

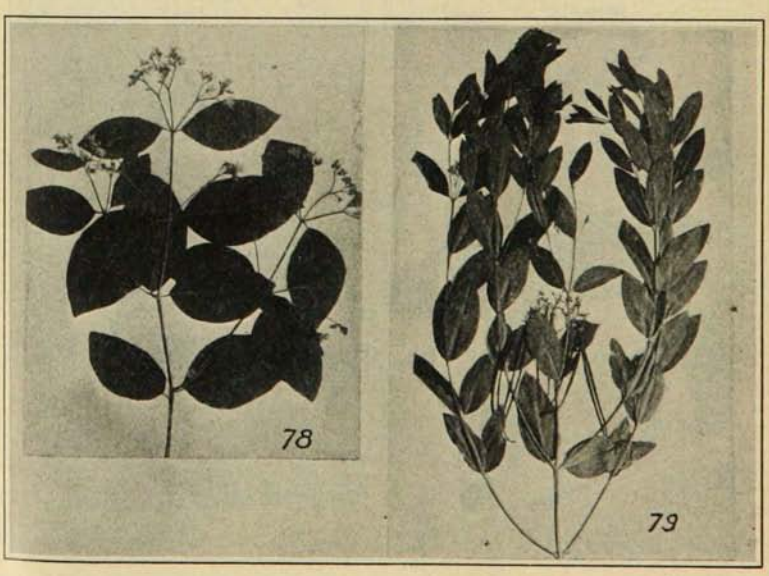
Poisoning by Swamp Laurel.—Colorado stockmen generally know very little of swamp laurel as a poisonous plant. This is probably accounted for from the fact that it grows only on the very high ranges, where relatively few animals graze. It is much dreaded in some sections, however.

SMALL DOGBANE (*Apocynum androsaemifolium*)

This plant (Fig. 78) has a milky juice. It grows from 1 to 3 feet tall, and has widely spreading branches. The opposite leaves are tipped with a very short abrupt point. The flowers are pink.

The plant grows in shaded situations throughout our range, from an altitude of 7,000 to 9,500 feet.

Indian Hemp (*Apocynum cannabinum*). Like the preceding, this plant (Fig. 79) has a milky juice. The stems are 3 to 6 feet tall, and branching. The leaves are opposite and tipped with a short abrupt point. The flowers are greenish-white. It grows at lower altitudes throughout Colorado.



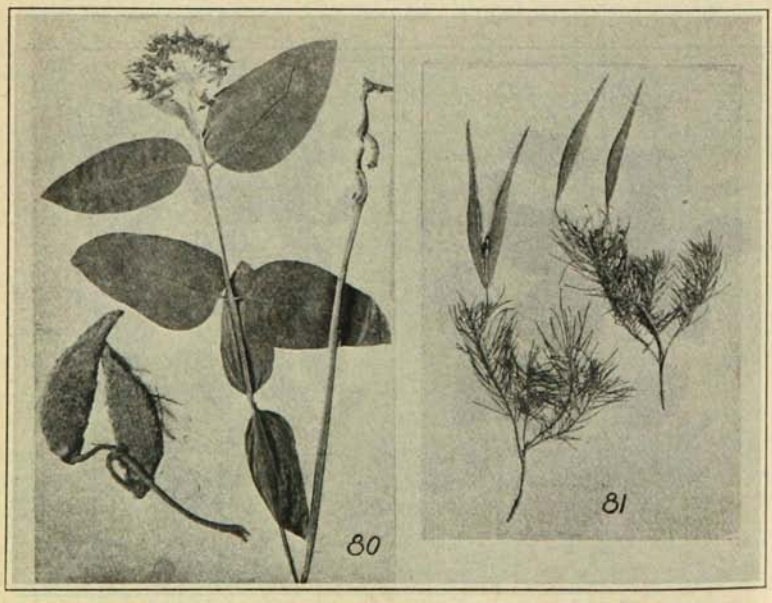
Figs. 78-79.—78, small dogbane (*Apocynum androsaemifolium*); 79, Indian hemp (*Apocynum cannabinum*).

Poisoning by Dogbane and Indian Hemp.—Several representatives of the dogbane family contain active alkaloids which are used in medicine. Indian Hemp is perhaps the best known. It is used as an emetic, cathartic and diuretic. It contains the glucoside *apocynein* and a bitter extractive *apocynin*. Both dogbane and Indian hemp are looked upon with suspicion by stockmen, and they no doubt poison animals occasionally.

MILKWEED (*Asclepias*)

The milkweeds, as a group, are quite well-known. All of them are regarded with suspicion by stockmen, and in some cases at least, this suspicion is justified. All plants with a milky juice are not "milkweeds", that is, of the group known botanically as "*Asclepias.*" For example, prickly lettuce, sow thistle, and prickly poppy all have a milky juice, yet are not true milkweeds. The three above-mentioned have alternate leaves, while the true milkweeds have opposite leaves.

There are many species of true milkweeds within our borders. All are herbs, with opposite leaves (rarely alternate), or sometimes several at a joint on the stem. The leaves and stems are often somewhat woolly, sometimes smooth. The flowers are in umbels, pink, purplish, or white in color, and peculiar in shape. The fruit is a pod which splits open at maturity allowing numerous seeds to come out, each of which has a silky tuft of hairs at the end.



Figs. 80-81.—80, showy milkweed (*Asclepias speciosum*); 81, low milkweed (*Asclepias pumila*).

The most common milkweed in our section is the showy milkweed (*Asclepias speciosa*) (Fig. 80). It is perennial, 2 to 5 feet high, with large, opposite leaves, and purplish flowers in spherical, terminal clusters. It grows in good, rather moist soil on plains and in foothills throughout the State.

The low milkweed (*Asclepias pumila*) (Fig. 81) is 2 to 15 inches tall, and grows from a woody root. The leaves are very narrow and crowded on the stem. The pods are long, slender and

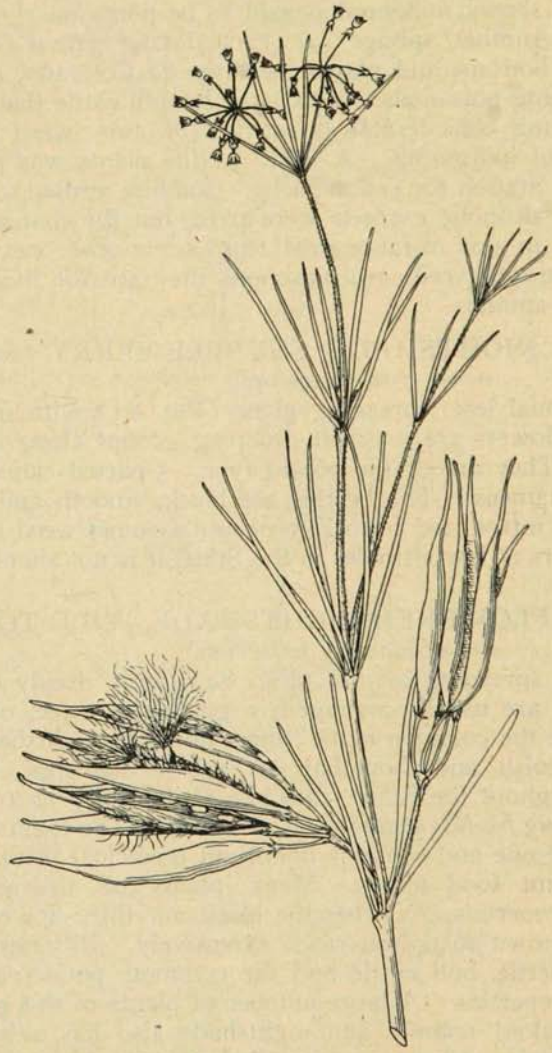


Fig 82.—Whorled milkweed (*Asclepias verticillata*).

much smaller than those in the preceding species. It prefers dry, sandy soil. It is most common at low altitudes.

The whorled milkweed (*Asclepias verticillata*) (Fig. 82) is a leafy plant, 1 to 2½ feet high. The long, narrow leaves are several at a joint of the stem. It grows on dry plains.

There are several so-called green milkweeds in Colorado, the chief one being the green-flowered green milkweed (*Acerates viridiflora*). It is a plains plant.

Poisoning by Mildweeds.—Many of these plants have an acrid juice. The showy milkweed is said to be poisonous. It contains *asclepion.* Another species (*A. verticillata*) grows extensively along river bottoms and native meadows of Colorado, and is suspected of being poisonous. At Olathe several cattle that had eaten hay containing considerable quantities of this weed died with symptoms of poisoning. A sack of the plants was sent to the Experiment Station for examination. Rabbits refused to eat it and watery and alcoholic extracts were tried, but the chances are that the animals in this instance died from some other cause. While many of the milkweeds are poisonous they are for the most part rejected by animals.

BLACK NIGHTSHADE, STUBBLE-BERRY (*Solanum nigrum*)

An annual low, spreading plant (Fig. 83) with oval leaves. The white flowers are in small drooping groups along the side of the stem. They are of the potato type: 5-parted calyx, 5-parted corolla, 5 stamens. The berries are black, smooth and spherical. The plant is introduced from Europe and assumes weed habits with us. It occurs at low altitudes in the State, it is not abundant, however.

THREE-FLOWERED NIGHTSHADE, WILD TOMATO (*Solanum triflorum*)

A low, spreading annual (Fig. 84) with deeply cut leaves. The flowers are usually arranged in groups of three, on nodding stalks, hence the common name "three-flowered nightshade." The fruit is greenish, and about half an inch in diameter. The plant grows throughout the State from low altitudes up to 10,000 feet.

Poisoning by Nightshades (Solanums).—The nightshade family is a large one and contains important medicinal plants and several important food plants. Many plants of the group have poisonous properties. Neither the black nor three-flowered nightshade are known to poison stock extensively. Bittersweet, sandbur, horse nettle, bull nettle and the common potato all contain poisonous properties. A large number of plants of this group contain the alkaloid *solanin,* and nightshade also has a bitter principle *dulcamarin* and two more alkaloids *solanidin* and *solanein.*

Fig. 83.—Black nightshade (*Solanum nigrum*).

Fig. 84.—Three-flowered nightshade (*solanum triflorum*).

The tops and sprouts of the common potato are poisonous when green. The tubers are poisonous when they have turned green from exposure to the sun. Hogs have been poisoned by eating raw potatoes that were wilted and beginning to rot; cases are reported every fall in the potato district in which horses and cattle have been poisoned from eating potatoes left in the fields after harvest. In one instance an entire herd of hogs developed paralytic symptoms after feeding for some time upon a ration consisting almost entirely of raw potatoes that were more or less withered and sprouting. The black and three-flowered nightshades are not a tempting food for animals, which fact no doubt accounts for their being rated of so little consequence as poisonous plants.

SAND BUR (BUFFALO BUR) (*Solanum rostratum*)

A low annual plant, (Fig. 85) yellowish-green in color. The stems, leaf-stalks, flower stalks, and main veins of leaves are armed with stiff yellowish prickles. The deeply-lobed leaves are covered with hairs arranged in small star-shaped groups. The flowers are about 1 inch in diameter and yellow in color. The mature fruit is very prickly. Buffalo bur is a plant of sandy plains.

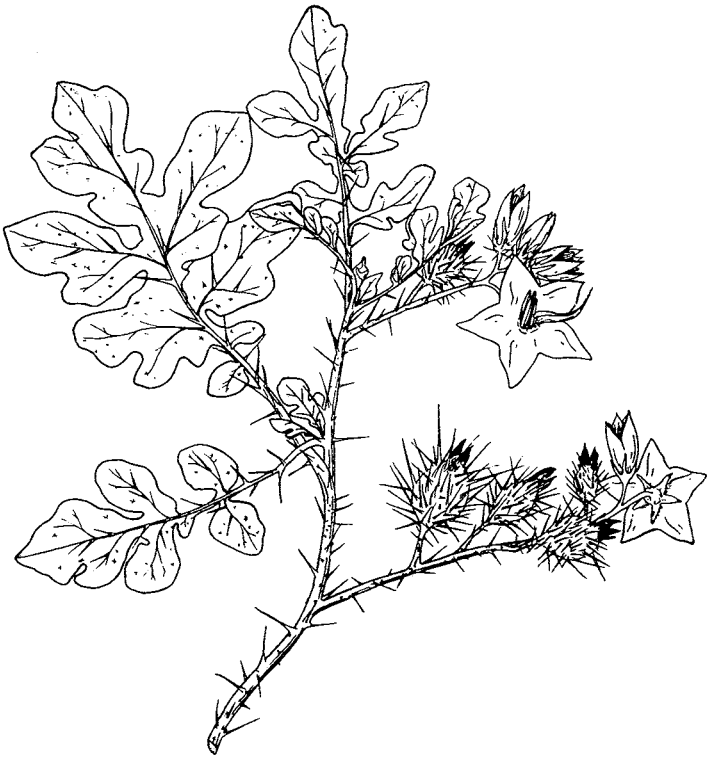


Fig. 85.—Sand bur, buffalo bur (*Solanum rostratum*).

Sand bur is not known to possess poisonous properties. The prickles on the burs sometimes cause serious mechanical injury.

BLACK HENBANE (*Hyoscyamus niger*)

This is a coarse biennial (Fig. 86) plant 1 to 2 feet high. The leaves are wavy along the margin and clasp the stem. The flowers are large, dull yellow in color, with purple veins, and arranged along one side of the stem in a characteristic fashion. When the fruit is mature, it opens at the top by a lid (Fig. 87). The plant has been found in a few localities in western Colorado. It is common in eastern states.

Figs. 86-87.—Black henbane (*Hyoscyamus niger*). 86, leaves, pods, and fruit; 87, single pod, showing how it opens at the top by a lid.

Poisoning by Henbane.—Dr. Chestnut says of black henbane: "One or two cases are recorded in foreign literature in which stock have been poisoned by eating the plant of their own accord, but there is very little danger from it, on account of its ill odor and harsh texture." It is from this plant that hyoscyamin is obtained for medicinal use. It is an anodyne, hypnotic and is poisonous.

JIMSON WEED, JAMESTOWN WEED (*Datura stramonium*)

A rather stout plant (Fig. 88) 1 to 4 feet high, with green stems, and leaves 4 to 8 inches long and angular toothed. The flower is showy, white and about 3 inches long. The fruit is an oval capsule, beset with long, stiff prickles. The plant has been found in waste places at a number of low altitude points in eastern Colorado.

Poisoning by Jimson Weed.—The poisonous alkaloids *atropine* and *hyoscyamin*, the active constituents of belladonna, are also found in the jimson weed. Hyoscyamin is the poison found in

Fig. 88.—Jimson weed (*Datura stramonium*).

henbane and the symptoms caused by it are the same as from atropine. There are a few instances recorded in which cattle have been poisoned by eating the leaves of young plants; with few exceptions, however. Jimson weeds are rejected by animals.

THORN-APPLE, PURPLE STRAMONIUM (*Datura tatula*)

This is very similar to the preceding. It is distinguished from it by its purple flowers and purple stem. It is rare in this State. It is of little economic importance.

THORN-APPLE (*Datura meteloides*)

This plant often grows to be 3 or 4 feet high. The leaves are large, and wavy about the margin; the flowers are white, sweet-scented, 6 to 8 inches long, and the large, nodding pods are armed with short prickles. It is found along streams in southern Colorado, at low altitudes. It is suspected of being poisonous to animals.

WOODY ASTER (*Xylorhiza parryi*)

Although this plant (Fig. 89) has not been reported from Colorado, it may be looked for in the northern part of the State. It has been identified in Wyoming as the cause of the death of sheep. Herewith follows a description of the plant as taken from Bulletin 97, Wyoming Agricultural Experiment Station:

"This plant has a strong woody root more or less branched just at the surface of the ground. From these woody crowns tufts of short branches spring. These bear green, narrow leaves, 1 or 2 inches long, the whole tuft becoming at length several inches high, and finally producing in June, a considerable number of large, white, daisy-like flowers with a yellow center. If the leaves be

Fig. 89.—Woody aster (*Xylorhiza parryi*).

examined, it will be found that they usually bear a considerable number of yellowish or brownish spots caused by a fungus."

The plant begins to leaf out about May 1, and to blossom about June 1. It grows upon gumbo clays such as are frequently found about lakes and ponds.

Poisoning by Woody Aster.—This plant is looked upon as the most disastrous plant for sheep in Wyoming. In Bulletin No. 88 of the Wyoming Experiment Station, the statement is made that stockmen estimate their losses a 14.6% and: "In terms of the last assessment valuation of sheep in Wyoming, this means an annual loss of more than $3,000,000. Sheepmen who have followed the business for the past ten years estimate that of the total losses noted, 60-70% have been caused by poisonous plants, and the remainder by coyotes." This bulletin summarized the investigation of woody aster partly as follows:

"1. The woody aster has been proven to be poisonous to sheep.

"2. The woody aster grows only on alkalied, gumbo-clay soils, and but for the one recorded season, is always heavily infested with the fungus, *Puccinia xylorrhizae*. The presence of the fungus may add to the poisonous character of the plant.

"3. Ninety to one hundred percent of the animals affected die.

"4. Aster poisoning is characterized by lassitude, difficult respiration, muscular weakness, bloat, and final prostration.

"5. Duration of illness: From a few hours to several days.

"6 Treatment: Purely symptomatic and none uniformly successful.

"7. Prevention: Avoid aster patches."

SNEEZEWEED

The name "sneezeweed" is applied to several species, the principal ones being *Helenium autumnale* and *Dugaldia hooperii*.

Helenium autumnale (Fig. 90) is a perennial, erect herb 1 to 3½ feet tall. The leaves are lance-shaped, slightly toothed along the margin; they clasp the stem, their lower edges being continuous with two wings that run down the stem. There are numerous yellow flowers of the sunflower type. The plant grows in wet ground and has been reported from a few localities in the State.

Dugaldia hooperii is a stout plant 1 to 3 feet tall, woolly-hairy, especially above. The stem is leafy, the leaves spatula-shaped, and 3 to 4 inches long. The flowers are of the sunflower type, and yellow in color. The plant is found in the mountains from 7,000 to 12,000 feet throughout the State.

Poisoning by Sneezeweed.—Sneezeweed contains a narcotic poison, and cattle, horses and sheep are no doubt occasionally

poisoned by it. Dr. Chestnut says: "The fine-leaved sneezeweed has been reported from several of the Gulf States, where it is a troublesome weed, fatal to horses and mules. It is not known to what extent cattle may feed upon it with impunity, but the bitter principle in milk and meat sometimes met with in the Southern States is quite generally supposed to be due to these plants."

In the mountainous districts of Colorado, bitter milk and meat are not uncommon, and it can no doubt be safely attributed in many instances to the eating of this plant. Severe poisoning may result from eating large quantities of the plant.

Fig. 90.—Sneezeweed (*Helenium autumnale*).

SAGE (*Artemisia*)

There are many different kinds of sages growing in the State. Rydberg's "Flora of Colorado" gives 39. A number of these are rare. The "sage brush" (*Artemisia tridentata*) of Colorado is a shrub 2 to 12 feet high with silvery leaves that have three characteristic teeth or lobes at the tip. The common low silvery herbaceous

sage throughout the State from low to high altitudes is *Artemisia frigida*. The foliage of this is very finely divided.

Poisoning by Sage.—Western stockmen testify to the poisonous qualities of sage, and animals that have become affected by it are spoken of as "saged." Horses are mostly affected and the most pronounced symptom is a growing paralysis of the hind quarters. Some stockmen, with many years experience, avow that eating sage is fully as disastrous to their herds as are the loco weeds. The evidence of so many experienced stockmen is not to be wholly discredited and this subject is worthy of further investigation.

COCKLEBUR (*Xanthium echinatum*)

Cocklebur is an annual plant with thick stout stems that branch widely. The stem is often marked with dotted brown spots. The leaves may be oval in outline, or heart-shaped at the base. and usually have three main ribs. Stamens and pistils are in different flowers on the same plant. Cocklebur is best recognized by the spiny fruit. The "burs" are densely covered with long prickles. At the tip of the "bur" are usually two stout hooked prickles.

The plant is weedy in nature and may be found throughout the State at low altitudes.

Poisoning by Cocklebur.—Dr. Pammel in his "Manual of Poisonous Plants" makes the following statement: "The injury from this plant probably comes largely from its mechanical action. Stock will probably not eat very much of it, but on account of the hooked awns of the involucre the animal may have a considerable difficulty in removing them. The hairs of the plant cause itching. The plant contains the poisonous glucoside *xanthostrumarin* which resembles *datiscin.*" According to Chestnut, the young seedlings of three species of cocklebur are poisonous for hogs. Dr. Biting thinks the injurious properties are largely mechanical.

COLORADO RUBBER PLANT (*Hymenoxys floribunda*)

This is an herb (Fig. 91) with an aromatic odor. Numerous stems arise from a woody base to a height of about 1 foot. The stems at the base are covered with woolly hairs. Each main stem is branched near the tip, each smaller branch being terminated by a yellow flower. The leaves are divided into several very slender divisions. The plant is found in dry soil at an altitude from 4,000 to 10,000 feet.

Poisoning by Rubber Plant.—Reports of serious losses in sheep from eating the rubber plant have come from Durango, Saguache and Middle Park. The plant is not known to contain any poison; the injurious effects are probably mechanical. It is thought that death results from the formation of indigestible masses that obstruct the digestive tract. On the ranges west of Saguache this is considered a most dangerous plant for sheep and they are systematically herded away from rubber weed patches.

Fig. 91.—Rubber plant (*Hymenoxys floribunda*).

ACKNOWLEDGMENTS

All the drawings in this bulletin, with the exception of Fig. 59, were made by Mr. N. Lee Foster, to whom the writers owe acknowledgment. We express our thanks to the Wyoming Experiment Station for the use of the plate from which Figure 89 is made.

Fig. 92.—Altitudinal distribution of important plants injurious to livestock.

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