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POISONOUS AND INJURIOUS PLANTS OF COLORADO

BY

L. W. DURRELL *and* I. E. NEWSOM

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Poisonous and Injurious Plants of Colorado

By L. W. DURRELL and I. E. NEWSOM

In our vast area of grazing land, amounting to over 30 million acres, a number of poisonous or injurious plants occur. Each year these plants exact a costly toll from the livestock of Colorado, often as much as 8 percent.*

It is the purpose of this bulletin to describe and illustrate the poisonous or injurious plants of the state, that they may be recognized and destroyed and areas infested with them avoided. A summary of the available knowledge concerning the poisonous properties of the plants is also given, with remedial measures where these are known.

Conditions Influence Poisoning

The conditions of the range and of the poisonous plants play an important part in poisoning of livestock.

Some plants are more poisonous at certain times and under certain conditions than others, and care in use of range at these times may avoid injury. Thus common deathcamas is a spring plant which dries after blossoming and disappears. Most cases of sheep poisoning from deathcamas occur in May and June, when the plants grow in advance of the grasses and are eaten to the exclusion of other plants.

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*Send in suspected plants for identification. When livestock poisoning occurs and such common plants as larkspur are not responsible, make an examination of the pasture where the animal was feeding, and send in any suspected plants for identification to the Department of Botany, Colorado State College, Fort Collins.

Send a whole plant when possible—roots, leaves, stems, and flowers, also fruit or seed when available. Identification is seldom possible from leaves or roots alone. Fragmentary samples are at best unsatisfactory and are often useless.

Wrap specimens in several thicknesses of moist newspaper, and several more of dry wrapping paper; if possible, enclose in a pasteboard box and send by mail. If the sample is too large to be mailed in one piece, cut it into several convenient lengths.

It will be helpful if a description of the place and manner of growth of the sample is also sent.

The contents of the poisoned animal's stomach are seldom of any value in identifying the cause of plant poisoning.

The seeds of the lupines are especially poisonous, and greatest harm comes from these plants late in summer, when pods are full of seed. Lupine-infested areas should then be avoided. As the seeds frequently fail to mature in dry seasons, there is less chance for damage in such years.

The low larkspurs are spring plants, and in lower elevations they disappear by July. If cattle are kept from ranges covered with them until July, there is little danger of loss. The tall larkspurs blossom later and do not die until frost. After blossoming, however, they have lost much of their poisonous property. Larkspurs are most poisonous when the leaves are wet from dew, rain, or snow.

Larkspur and milkweed poisoning are most likely to occur either during seasons of drought and short feed or on overgrazed areas. In either case the poisonous plants are the most conspicuous and attract the animal. Under similar conditions waterhemlock roots are pulled up and eaten when ordinarily, with plenty of forage, they would not be touched.

Rotation and Allotment in Use of Range

Some of the poisonous plants affect certain classes of animals and not others. Thus larkspur is most injurious to cattle and deathcamas to sheep; sneezeweed is harmful to sheep but not to horses.

Many losses may be prevented by placing upon the range those animals that will not be harmed by such poisonous plants as may grow there; thus larkspur ranges are available for horses and sheep.

Care in Driving or Bedding Animals

If animals are bedded for several nights in the same place they are likely to eat anything near the bedding ground. As the good food is exhausted, poisonous plants, if present, may be eaten. Where poisonous plants are growing it is safe to take a new bedding ground every night. This not only is advantageous in preventing poisoning but in preserving and maintaining forage and preventing overgrazing.

The same principle applies to fixed driveways. These should be eliminated. Constant cropping of the palatable plants along such trails tends toward the increase of unpalatable kinds which in many cases are poisonous. Generally speaking, cattle and sheep should be drifted when moved from one pasture to another. A hurried animal grabs at food not ordinarily eaten, and in this way it often eats poisonous plants. Animals taken directly from cars or pens are often hungry for green food and eat poisonous plants not ordinarily touched. Further, animals strange to a range are more liable to poisoning than native stock.

Eradication of Poisonous Weeds

The eradication of poisonous plants on the range is difficult. The application of such chemicals as calcium chlorate and salt is effective on small patches of weeds but is not advised for large areas. Salt has been most generally used and is effective on such plants as brake ferns.

The chlorates of calcium or sodium, now so commonly used for farm weeds, have been tried in this and other states on larkspur; but while they are effective in killing the poisonous plants, the cost in most cases is too great to justify their use except on small patches.

Destruction by digging, though laborious, has proved the most satisfactory method of destroying weeds. The Forest Service for a number of years has been successfully grubbing out larkspur in the Colorado forest ranges. Areas of larkspur or waterhemlock constituting poison areas can be cleaned up in this way. It is impracticable, on the other hand, because of their great numbers, to eradicate deathcamas, lupines, or sneezeweed in this manner.

Close herding of animals not injured by the poisonous weed may be used to keep down the injurious species but is not very effective.

Range Management Determines Losses

Overgrazing is either a direct or a contributing cause of stock poisoning. Poisonous plants in general are not palatable and are eaten only under stress of necessity. Under conditions of overgrazing the grasses and other more tasteful plants are cropped to destruction, especially where too-early use is made of the range; and the poisonous plants, where present, overrun

the range. Animals run on such overgrazed areas, especially in dry seasons, find little to feed on but poisonous species of plants, or those of low nutritive value.

The relation between the scarcity of food and losses from eating poisonous plants cannot be too forcibly emphasized. A number of plants ordinarily not considered poisonous may cause injury under conditions of food scarcity.

One of the most practical methods of preventing stock poisoning is by range improvement, which can be accomplished by deferred-and-rotation grazing. Deferred-and-rotation grazing means the division of a range so that stock may be grazed alternately on different sections. The animals are kept off part of the range from early spring until the plants produce seed and recover from the effects of previous grazing. It is a method of management of range livestock based upon the requirements of the plants that make up the pasture.

Our native pastures can produce more forage under the deferred-and-rotation method than under continuous grazing. Good native pastures produce the largest and cheapest gains, and they can be maintained and improved, and the yield of native forage plants increased, by the deferred-and-rotation system of management. The system favors the growth of the more-valuable grasses and other forage plants, and reduces the poorer-quality plants and poisonous weeds.

Poisonous Plants*

There are large numbers of poisonous plants in this state. Some of these are of great importance from the standpoint of stock poisoning; others are of minor importance, being but slightly poisonous or poisonous only under some circumstances; still others are merely suspected of being poisonous. Undoubtedly there are a number of plants poisonous or injurious to stock that are not so recognized, but that future study or experience will reveal.

In the following pages the various poisonous or injurious plants found in Colorado are listed by their common names. A few are mentioned that have some medicinal properties.

*For index of plants see page 74.

ACONITE, monkshood, *Aconitum columbianium* (fig. 1).—This is a plant 3 to 6 feet tall, with leaves and stems more or less hairy or sticky. The leaves are large, and each is cut into a number of segments that resemble larkspur leaves. The flowers are blue-to-white and characterized by a hood-like cap. The fruit pod is three-parted, resembling the pod of the larkspur. It is frequently confused with larkspur.

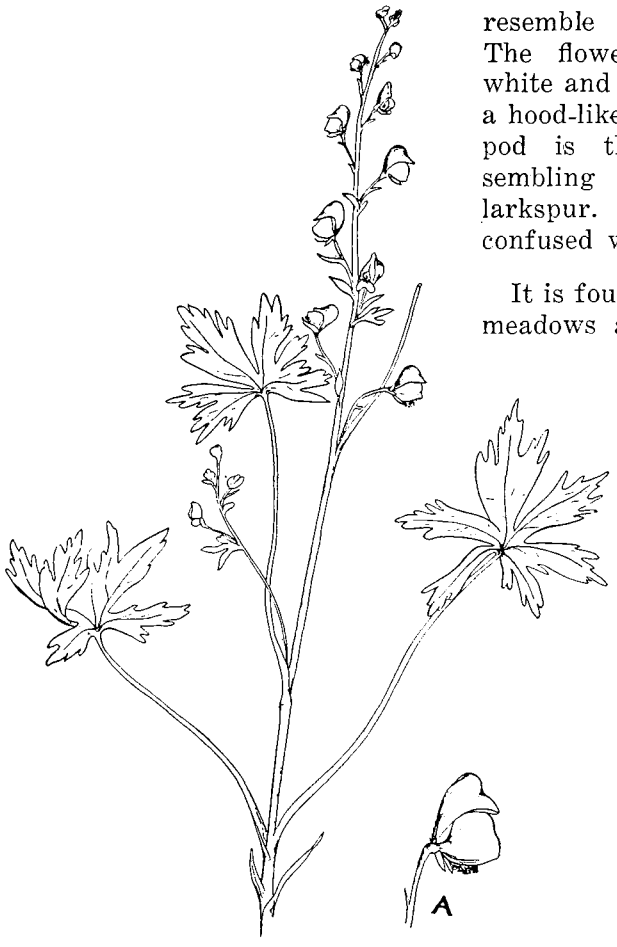

Figure 1.—Aconite; *A*, flower enlarged.

It is found chiefly in wet meadows and open woods in the western part of the state, at altitudes of 7,000 to 10,000 feet. The plants grow sparsely and are not as prevalent as larkspur. They grow from early summer to frost. The seeds and roots are chiefly the poisonous parts.

The plant is most poisonous just before flowering. It contains the poisonous principles "aconitine" and "aconin." Sheep and horses may be affected. The plants are not often eaten and are so sparse that they are of little importance in poisoning stock on the range.

Symptoms of poisoning are muscular weakness, irregular and labored breathing, weak pulse, bloating, belching, constant attempts at swallowing, and contraction or dilation of pupils of the eyes.

No special antidote for aconite poisoning is known. Inhalations of ammonia, camphor, or sulfuric ether, and hypodermic injections of digitalin or atropine stimulate breathing and tend to overcome the depression of the heart.

ALGAE.—Green algae form the so-called scum on ponds and watering tanks. They are thought to be injurious to livestock, although there is no definite evidence to this effect. They do cause water to have a bad odor, however. They can easily be destroyed by a small amount of copper in the water. Copper sulphate or blue vitriol, 1 part in a million in the water, is sufficient to kill them. A piece of sheet copper, such as the bottom of an old copper boiler in the watering tank, will give off enough copper to destroy the algae.

Figure 2.—Arnica, *Arnica cordifolia*

Recently poisoning by certain species of blue-green algae has been reported from Minnesota. As some of these same algae live in our mountain lakes, it seems worth while to mention them here. After hard winds the lake algae, commonly known as "water bloom," are blown and washed to the shore. There they collect in great quantities, so the water is full of these minute plants. Animals drinking from this scum-covered water along the shore get large quantities of the algae and are poisoned by them.

ARNICA, *Arnica* sp. (fig. 2).—Several species of this plant grow in Colorado. They resemble *Arnica montanum* (arnica root) from which the official preparation of arnica extract is made. They are suspected of poisoning.

ARROWGRASS, sourgrass, goosegrass, *Triglochin* sp. (fig. 3).—It is a plant with dark-green leaves, growing in clumps 6 to 12 inches tall. The leaves are somewhat grass-like but round, not flat as grass leaves. The flower stalks are slender and 12 to 30 inches long. The flowers are very small and greenish, arranged closely along the long flower stalk. There are two species found in this state, *Triglochin palustris* and *Triglochin maritima.*

This plant grows along the edges of sloughs, and especially in wet, salty places. It is a perennial, coming up early in the spring.

The leaves have been shown to be poisonous, both dry and green. The plant is believed to be poisonous at any period of growth. It is most effective on hungry animals.

The poisonous principle is thought to be prussic acid. Prussic acid in combination to the amount of 0.02 to 0.6 percent has been found in this plant. Sheep and cattle are affected. (For symptoms and remedial measures see "Prussic Acid Poisoning.")

Figure 3.—Arrowgrass, *Triglochin maritima*

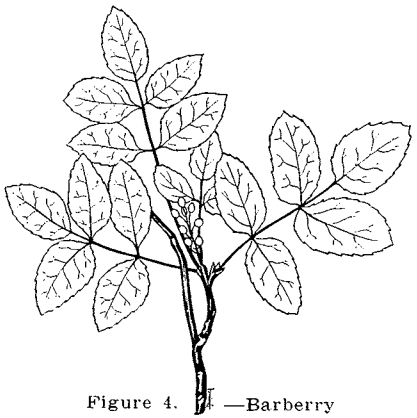

Figure 4.—Barberry

BARBERRY, Oregon grape, *Berberis aquifolia* (fig 4).—This is a small, low shrub with crisp, spiny leaves; small, yellow flowers; and clusters of purple-blue

berries. It is common in the mountains and contains alkaloids with emetic and cathartic properties.

BLACK LOCUST, *Robinia pseudacacia* (fig. 5).—Black locust is a tree or tall shrub bearing white, pea-like clusters of flowers; it is frequently planted for windbreaks or shade. A poisonous substance, "robitin," has been isolated from the black locust. The bark and shoots of this plant are considered poisonous to livestock.

Figure 5.—Black Locust

Figure 6. Blazing-star

BLAZING-STAR, western snakeweed, *Liatris punctata* (fig. 6).—It is not known to be poisonous to stock, but has powerful diaphoretic action. Tea from this plant produces sweating; formerly it was used for this purpose.

Figure 7.—Bouncing-bet

BOUNCING-BET, soapwort, *Saponaria officinalis* (fig. 7).—Bouncing-bet is an introduced perennial plant with large clusters of pink five-petaled flowers. It is common around old gardens and often escapes to fence rows and roadsides. In water the juice produces profuse lather, hence the name "soapwort." Sometimes this plant is used to remove grease spots from clothes. It contains the poisonous glucoside "saponin."

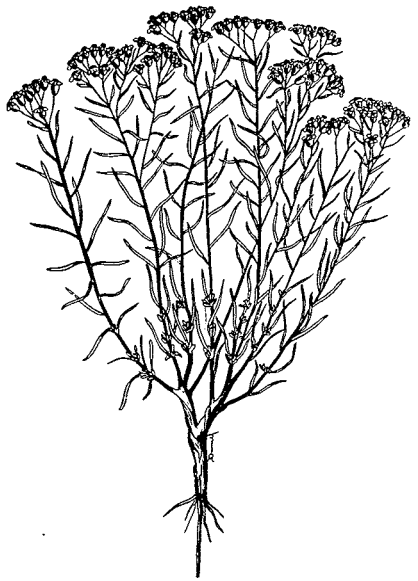

Figure 8.—Brownweed

BUCK BEAN, *Menyanthes trifoliata* (fig. 9).—This plant is suspected of being poisonous. It contains the bitter principle "menyanthin."

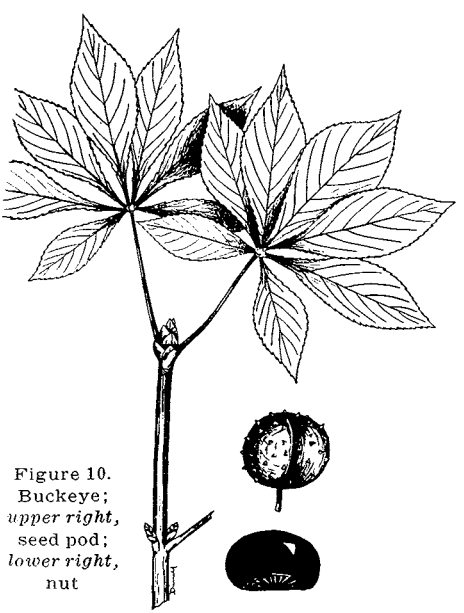

Figure 10. Buckeye; *upper right,* seed pod; *lower right,* nut

BROWNWEED, *Gutierrezia sarothrae* (fig. 8).—This is a common weed of the plains and foothills regions. It is a low, erect, bushy plant growing from a woody base, and is 9 to 18 inches tall. The flowers are yellow, in small heads that are borne in large numbers on the ends of the branches.

Brownweed grows in masses along roadsides and on overgrazed pastures. It is not readily eaten, except when forage is scarce. Under conditions of poor pasturage it may cause poisoning.

Figure 9.—Buck Bean

BUCKEYE, *Aesculus glabra* (fig. 10).—Buckeye is an ornamental tree occasionally grown in yards and parks. It was introduced from eastern states. It has large leaves

divided into seven leaflets; and conspicuous, prickly fruit containing large, shiny, brown nuts. The sprouts, shoots, young twigs, and nuts are poisonous and may be fatal to cattle, sheep, and hogs. The poisonous principle affects the nervous system, resulting in trembling, dilation of pupils, paralysis, incoordination of movement, coma, and death. Children have been known to die from eating the nuts, and dogs have died from chewing on them. The flowers of a California species are reported as poisonous to honeybees.

CASTOR-BEAN, *Ricinus communis* (fig. 11).—The castor-bean is a large, rank-growing annual frequently cultivated in gardens. Clusters of prickly pods are borne at the ends of branches; these contain large, light-colored, bean-like, spotted seeds. The seeds contain a poisonous substance, "ricin," that resembles bacterial toxins. Castor-beans are known to cause death of horses, and it is said that three seeds are enough to kill a man. Symptoms usually appear some days after eating the beans or press cake from which castor oil has been extracted. There is purging, loss of appetite, dejection, shivering, abdominal pain, high temperature, and death in about 3 days.

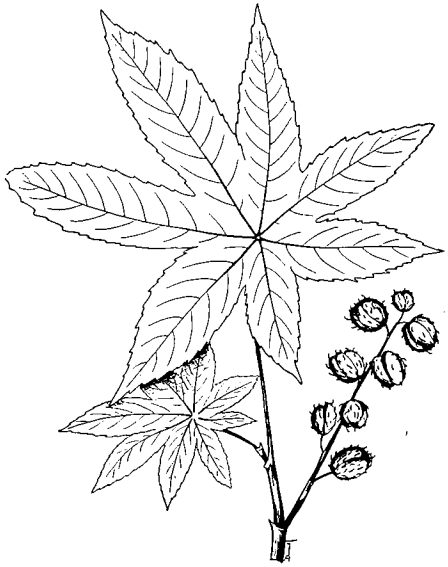

Figure 11.—Castor-bean

CATTAIL, *Typha latifolia, T. angustifolia.*—The common cattail is a familiar plant of marshes and swamps. Ordinarily animals do not eat cattail, but it has been reported as causing poisoning to stock grazing it. Buttercups frequently grow along the edge of cattail swamps, and sickness due to eating them may be erroneously attributed to cattails.

CEDAR, red cedar, juniper, *Juniperus* sp.—There are several species of juniper in Colorado. They are shrubs or low trees growing in the foothills and mountains. Juniper berries contain a poisonous oil. It is questionable whether cattle eat juniper, and cases of poisoning of stock in groves where junipers grow are more likely caused by larkspur that grows under the juniper.

CHERRY, wild cherry (fig. 12).—The cherry is a possible source of poisoning. (For discussion see "Prussic Acid Poisoning.")

CHICORY, *Cichorium intybus* (fig. 13).—Chicory is a coarse, branching perennial with narrow leaves, bright-blue flowers, and deep roots. It contains a bitter glucoside, "chicorin." If it is eaten in large quantities it imparts a bitter flavor to milk.

COCKLE, purple cockle, corncockle, *Agrostemma githago* (fig. 14).—Cockle is a hairy annual weed growing about 1 to 1½ feet tall, with sharp, narrow, hairy leaves and conspicu-

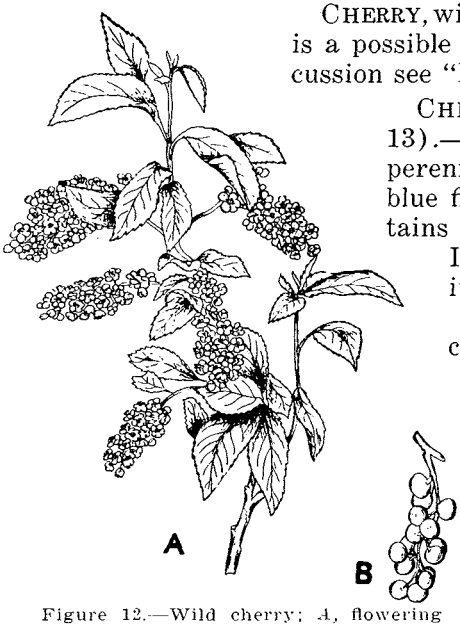

Figure 12.—Wild cherry; *A*, flowering branch; *B*, fruit cluster

Figure 13.—Chicory

Figure 14.—Cockle

ous, reddish-purple flowers. The seed capsule is large, one-celled and filled with numerous large, black, rough seeds. The seeds are sometimes found as an impurity in wheat and may occur in screenings and flour, where their presence can be detected by the odor and by pieces of black seed hulls. Repeated use of such flour or feed produces illness. Though the green plant is harmless, the seeds are poisonous; about ¼ pound per hundredweight of animal will cause death. All stock and poultry are susceptible to the poison. Pigs are especially sensitive to it.

The toxic principle is known as "saponin" or "sapotoxin." This is soluble in water, in which it froths when shaken.

The symptoms are intense irritation of the digestive tract, vomiting, vertigo, diarrhaea, hot skin, sharp pain in the spine, depressed breathing, and difficult locomotion. Coma may be followed by death. In chronic form, from eating small quantities over a long period, chronic diarrhaea and depression, loss of strength, and nervousness result.

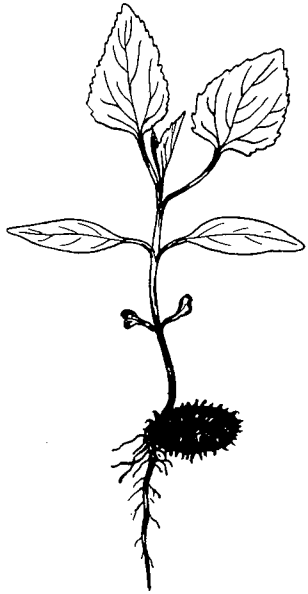

Figure 15.—Cocklebur (seedling)

COCKLEBUR, *Xanthium echinatum* (fig. 15).—This plant is a stout, branching annual 1 to 3 feet tall, producing spiny burs. It may be found in waste places and at roadsides in low altitudes. The seeds may be dormant a year or more before germinating.

The seedlings, which are poisonous, come up in the spring; they are most poisonous at the two-leaf stage. The poisonous principle is a glucoside. Hogs are chiefly affected, though cattle and sheep may become poisoned. Young pigs are especially susceptible. About 12 ounces are necessary to poison a 50-pound pig.

The symptoms usually do not develop until several hours after the plants are eaten. There is considerable depression, the pulse is rapid and weak, and the respiration is labored. Pigs may vomit. The effect of the poison is most noticeable on the liver, which organ is frequently mottled, especially in the case of pigs that have been poisoned.

No specific antidote is known. Milk, fat, or oil given to the animal is often effective in counteracting the poisonous effects. Cockleburs should be mowed before they seed. (See also "Mechanical Injury.")

COLORADO RUBBER PLANT, pingue, *Hymenoxys floribunda* (fig. 16).—This is a small, bushy plant about a foot tall, arising from a thick, woody stalk. The bases of the stems are covered with a wooly growth. The plant grows in dry soil at elevations of 4,000 to 10,000 feet. The flowers are dark golden-yellow and aster-like. The plant contains some rubber, but attempts to extract this rubber commercially have not been successful.

Figure 16.—Colorado Rubber Plant

Poisoning of sheep from this weed has been reported from the southwestern part of Colorado. Poisoning usually occurs late in the season under conditions of starvation, where the animals are forced to eat the plant due to hunger. When properly fed there is little danger from this weed.

The exact nature of the poisonous properties of the weed is not known. It is thought that the injurious effects are due to impaction.

CONEFLOWER, *Rudbeckia hirta* (fig. 17) ; western coneflower, *R. occidentalis* (fig. 18) ; goldenglow, *R. laciniata* (fig. 19).—These plants are reported as poisonous to cattle, sheep, and hogs grazing on the tops or eating the roots.

The symptoms include digestive trouble, colic-pain, and loss of consciousness.

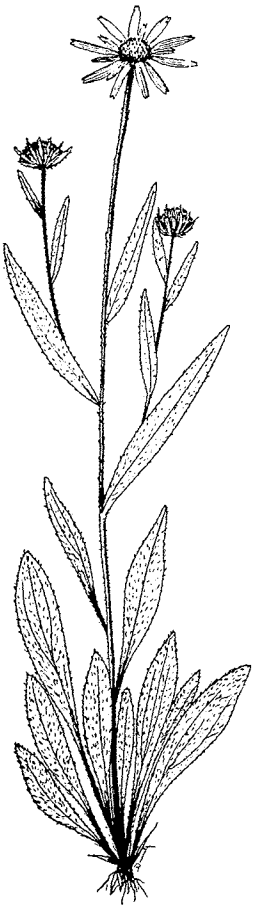

Figure 17.—Coneflower

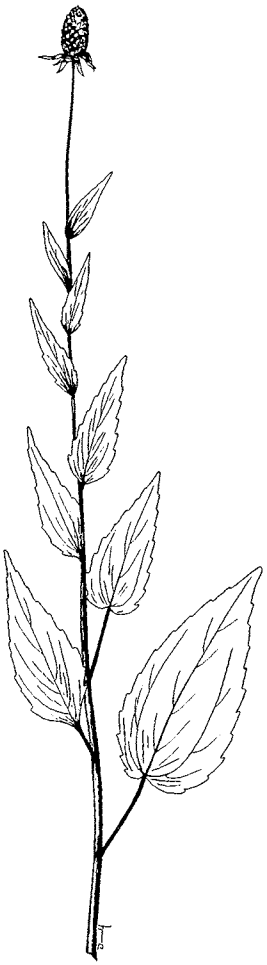

Figure 18.—Western Coneflower

Figure 19.—Goldenglow

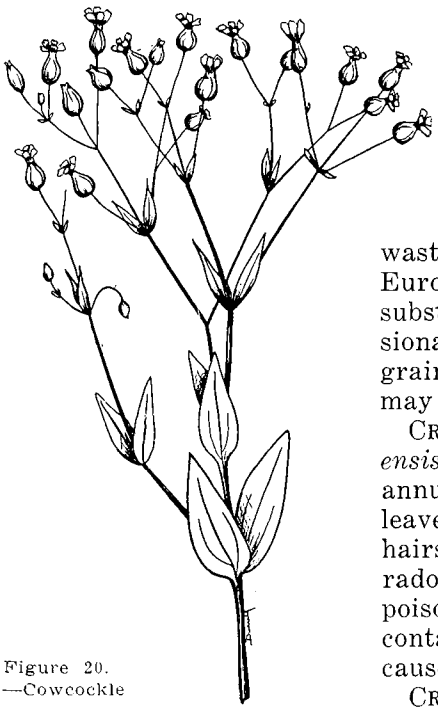

Figure 20.—Cowcockle

COWCOCKLE, *Saponaria vaccaria* (fig. 20).—This plant is closely related to bouncing-bet. It is a smooth, erect plant 1 to 2 feet high, with opposite leaves and branches; flowers are pink; the fruit is angled. It is commonly found along roadsides and waste places. It was introduced from Europe. It contains the poisonous substance "saponin." The seeds occasionally get mixed with those of grains. Either the plant or the seeds may cause poisoning.

CROTON, Texas croton, *Croton texensis* (fig. 21).—This is a branching annual plant 1 to 2 feet high, with leaves bearing small, star-shaped hairs. It is sometimes found in Colorado and has been reported to be poisonous. Members of this family contain an irritating oil that will cause burning of the skin.

CROWFOOT, *Ranunculus eremogenes* (fig. 22); cursed crowfoot, *R. repens* (fig. 22), *R. abortivus* (fig. 23).—

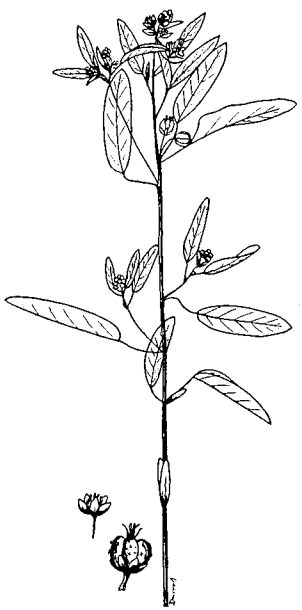

Figure 21.—Croton; *left*, flower and seedpod, enlarged

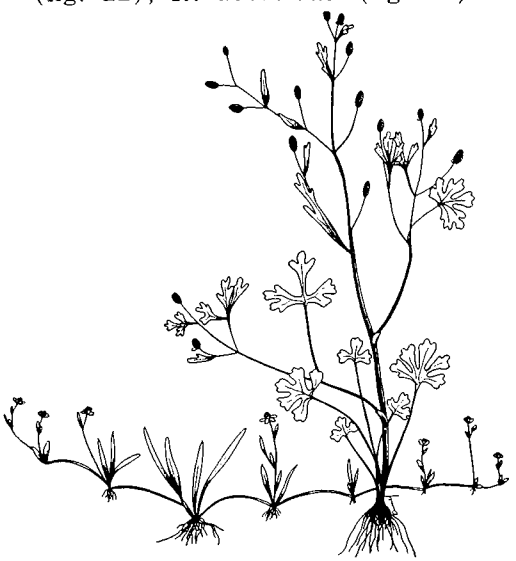

Figure 22.—Crowfoot; trailing plant, *Ranunculus repens;* upright plant, *R. eremogenes*

Figure 23.—Crowfoot; *Ranunculus abortivus*

These species of crowfoot, sometimes called buttercup, are known as poisonous and are found in Colorado; they grow in damp or marshy places along streams, or at the edge of lakes or reservoirs. The two latter species are trailing plants, and all three have bright-yellow flowers. These plants contain an acrid narcotic substance known as "anemonal" that affects horses, cattle, sheep, and hogs. As far as is known, all species of crowfoot have these acrid, irritating properties. The poisonous properties of these plants are lost on drying.

The effects of eating crowfoot are irritation and inflammation of the digestive tract, resulting in colic and nausea, and even in convulsions and stupor.

DEATHCAMAS, camas, *Zygadenus intermedius* (fig. 24).—Other common names are poison sage, swamp-camas, alkali-grass, and poison onion.

Figure 24.—Deathcamas, *Zygadenus intermedius*

Camas is a perennial herb 4 to 18 inches tall; it has grass-like leaves arising from a deep-seated bulb. The flowers are yellowish-white, borne in close clusters at the top of a tall stalk. The plant is often mistaken for wild onion but has no odor. It is found on sandy plains as well as in foothills, appearing in early spring before grass is well started. Flowers bloom by the last of May or the first of June, after which the plants die down.

Other species in the state are *Zygadenus elegans*, which is scarcer and is found in high altitudes, and *Z. nuttallii*, found on the plains.

All parts of the plant are poisonous. Small amounts, often a few plants, are sufficient to cause poisoning. Camas is poisonous throughout the life of the plant. Animals are

usually poisoned by camas just before the plant blooms, especially where forage is scarce.

Sheep are more frequently poisoned than cattle or horses, due perhaps to the method of grazing. Frequently a large number of sheep will be poisoned at one time when grazing a camas patch.

The poisonous principle at one time was thought to be "zygadenine," but it is now doubtful whether that is the substance responsible.

Symptoms of camas poisoning include increased breathing, salivation, and nausea which in some instances leads to vomiting. This is followed by weakness, staggering, and convulsions. Finally the animal falls to the ground and goes into a comatose state, remaining in that condition for several hours or sometimes one or more days. The temperature is at first slightly increased, and then with coma falls below normal and remains there until death.

Since the active principle is less soluble in alkaline solutions,

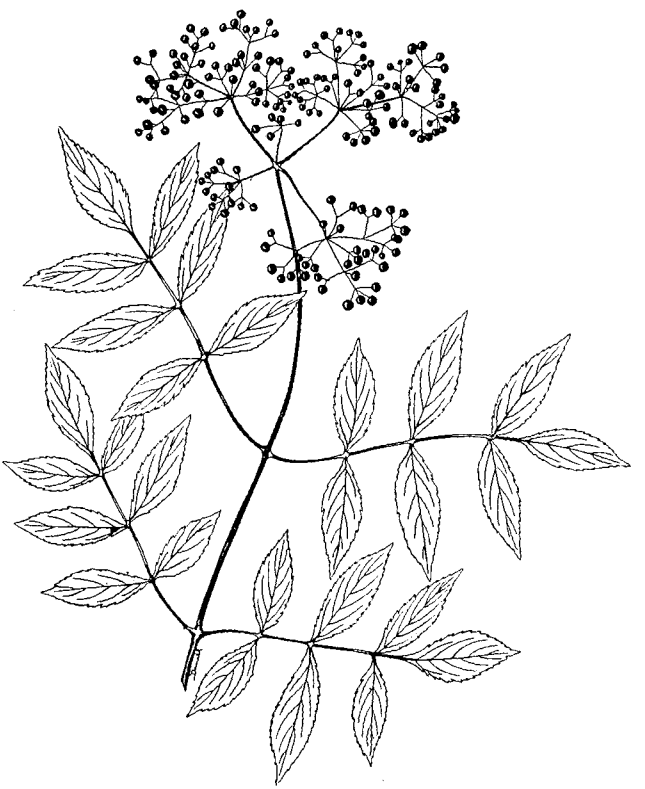

Figure 25.—Elder

some have recommended the administration of common baking soda in tablespoonful doses. This could be tried, dissolved in water. Earlier workers recommended potassium permanganate and aluminum sulfate, each in 5-grain doses, for sheep. Beath recommends the hypodermic injection of atropine sulfate, 1/30 grain, and picrotoxin, 1/8 grain. The probability is that the efficacy of any of these treatments will depend upon the size of the dose of the poison ingested. The most recent recommendation of Beath is caffine sodio benzoate, which he states is quite effective.

Herding the sheep away from camas areas, particularly in the forenoon, is found of value in prevention. The sheep are much more likely to eat the camas plants when hungry; consequently, especial care should be taken at that time. Several instances of serious poisoning have been observed immediately after unloading sheep from a railroad journey or after holding them in a bare spot during the night.

ELDER, *Sambucus canadensis* (fig. 25).—The elder is a shrub 5 to 10 feet high, with rapid-growing stems having large pith. The leaves are compound, and the small, white flowers are borne in large, open clusters. The roots and bark of this plant are poisonous. The flowers and berries, if eaten raw, are said to be poisonous. The flowers are diuretic and a mild diaphoretic stimulant.

Figure 26.—Ergot; *A*, head of rye with ergot kernels; *B*, head of smooth bromegrass bearing ergot kernels

ERGOT, *Claviceps purpurea* (fig. 26).—Ergot is a fungus or mold that grows in heads of grain and grasses. It is occasionally found in grain for feed, and on grasses in pastures. The ergot kernels are large, hard, black bodies that develop in place of the seed. When these ergot kernels fall to the ground, or are sown with seed, they germinate and later give off spores, or seeds of the fungus, which in turn infect the heads of the next crop of grain or grass.

The ergot kernel contains "ergotoxine" which is poisonous to cattle, sheep, horses, and man.

The poisoning may be acute if large quantities of the ergot kernels are eaten, or the results may be slow and cumulative if small amounts are eaten regularly. The result of ergot poisoning is the contraction of the smooth muscles. This may result in abortion in pregnant animals; it may result in stoppage of the blood stream in the small blood vessels of the extremities; or it may affect the nervous system, resulting in dullness and depression. Gangrene of the hoofs or other extremities may result. Delirium, spasms, and paralysis before death may occur.

If taken in time, animals may recover by being put on good feed. Tannin is an antidote. Ergoty grain or native hay containing ergot should not be fed. Experiments have shown, however, that a small amount of ergot in an amply-balanced ration is not injurious to dairy cattle.

Where there is ergot in seed to be planted it should be removed; otherwise the succeeding crop may be badly infected. Dip the grain into a 25 percent solution of common salt in water. The ergot kernels float to the top and can be skimmed off. The clean grain can then be washed of salt, and dried and planted.

FALSE-HELLEBORE, *Veratrum speciosum* (fig. 27).—This plant is a tall, broad-leaved perennial growing in damp pastures and meadows at high altitudes. The plants grow in clusters or clumps and, being straight and tall, are quite conspicuous. The stem is terminated in long, erect clusters of small, yellowish-green flowers. The plant is acrid and resembles the American hellebore *(Veratrum viride)* and probably has the same poisonous properties. It is doubtful if it is of serious importance, as it is seldom eaten. In the high mountain meadows cattle may be seen grazing among the false-hellebore plants, but not on them.

Figure 27.—False-hellebore, *Veratrum speciosa*

FERNS, braken, brake fern, *Pteridium aquilinum* (fig. 28).—The brake fern is common in higher altitudes in the state, grows from a perennial rootstock, and is usually

found growing at the edge of meadows or among the aspens near the edge of meadows, and often on rocky soil. The rhizomes were eaten by the Indians. It is seldom, if ever eaten by livestock except occasionally in hay, when it is reported as causing poisoning of horses and cattle. The action of the poison is slow, and considerable hay must be eaten over a period of several weeks before animals show the effects.

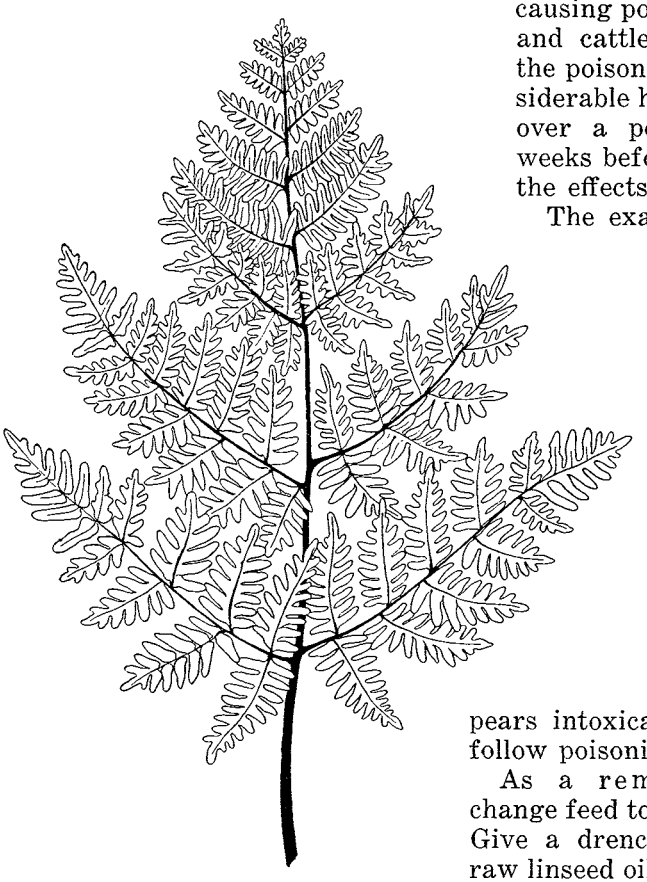

Figure 28.—Fern

The exact nature of the poison is not known, but its action is cumulative.

The symptoms of the poisoning are unsteady gait, good appetitie, constipation, nervousness, and dilation of the pupils; the animal stands with its legs apart and appears intoxicated. Death may follow poisoning.

As a remedial measure, change feed to hay free of fern. Give a drench of a quart of raw linseed oil. Feed clean hay and warm bran mash; keep the animal warm and quiet.

Ferns can be eradicated by plowing, though 2 or 3 years' cultivation may be necessary to destroy them all. Fertilization and liming checks them. In places where cultivation is impossible, salting or treating with chlorates are effective.

FETID MARIGOLD, *Dysodia papposa* (fig. 29).—This is a small, bushy, low-growing plant 4 to 8 inches tall, common to short-grass plains and foothills. The top of the plant is covered with small, yellow flowers in the fall. The plant is so named because of the strong odor, similar to that of the garden marigold.

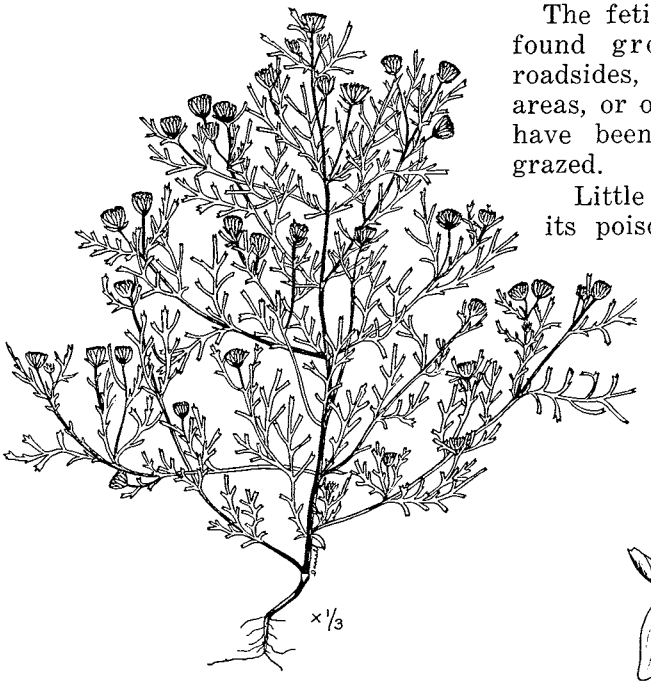

Figure 29.—Fetid Marigold

The fetid marigold is found growing along roadsides, on old plowed areas, or on ranges that have been badly overgrazed.

Little is known of its poisonous properties, but it is thought to be injurious or even fatal where large quantities are eaten. Animals on very poor pastures containing fetid marigold may easily get too much of this plant.

FLAG, *Iris missouriensis* (fig. 30).—The wild blue flag, or iris, common to wet mountain meadows, is a perennial plant with erect, narrow leaves and tall flower stems bearing conspicuous, blue flowers arising from a thick rootstock. The rootstocks of *Iris missouriensis* have been reported as poisonous. It is thought to have the same properties as *I. versicolor*, which contains a poisonous substance, "irisin," in the rootstock that produces irritation of the gastrointestinal tract, resulting in vomiting and purging.

The leaves are sometimes cut with park hay and have been reported to cause depression and labored beathing, if eaten in large quantities.

FLAX, wild flax, *Linum rigidum*.—This yellow-flowered, wild species of flax has been

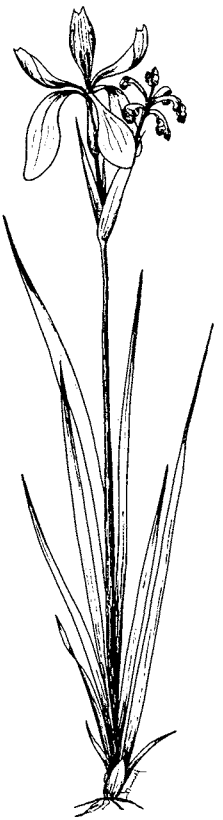

Figure 30.—Flag. *Iris missouriensis*

reported as the cause of sheep poisoning. *Linum usitatissimum* is the cultivated flax; flaxseed cake has been reported as causing death of livestock due to prussic acid.

FOXGLOVE, *Digitalis purpurea.*—Foxglove is a poisonous annual or perennial plant common in gardens. It was introduced from Europe and is well known as a medicinal plant. It contains several poisonous glucosides. The action is cumulative, and the active principle stimulates the heart muscles.

GOLDENROD, *Solidago rigida* (fig. 31), *S. mollis* (fig. 32), *S. concinna* (fig. 33).—These species of goldenrod which grow in Colorado have been reported as occasionally poisonous to livestock. The plants are characterized by their erect growth, narrow leaves, and dense terminal clusters of small, yellow flowers.

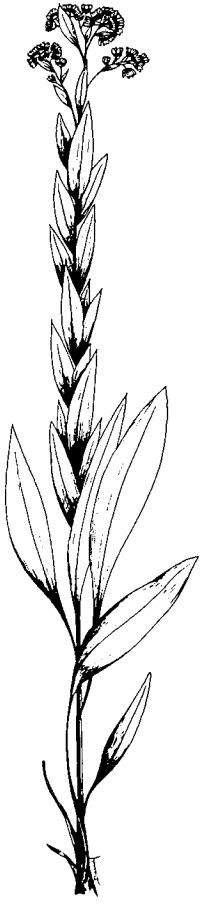

Figure 31. Goldenrod, *Solidago rigida*

Figure 32. Goldenrod, *Solidago mollis*

Figure 33. Goldenrod, *Solidago concinna*

Sheep are the animals chiefly poisoned by goldenrod, either by grazing on the green tops or by eating dried plants in hay. Grazing on patches of goldenrod or feeding hay containing much of the weed should be avoided. About 1 pound of the plant may cause fatal poisoning.

Symptoms of goldenrod poisoning are violent shaking or trembling of the back and legs, followed or accompanied by weakness and unsteadiness of gait. The poisoned animals have a desire to chew sticks or any small objects.

There is no known remedy. Animals should be herded away from patches of goldenrod and given access to plenty of salt. In hay the yellow flowers of goldenrod are easily recognized, and care should be used in feeding hay containing large amounts of the weed.

GREASEWOOD, *Sarcobatus vermiculatus* (fig. 34). — Greasewood sometimes is called "chico." It is a shrub 2 to 5 feet tall, with stiff, rigid branches that are often spiny. The bark is smooth and white, and the leaves narrow, thick and pale-green. The flowers are small, inconspicuous, and greenish. The plant grows in dry alkali flats.

Figure 34.—Greasewood; *right*, flowers

Usually greasewood is good forage, but it may cause poisoning when animals are very hungry and eat a large amount in a short time. One and one-half pounds or more per hundredweight of animal, eaten on an empty stomach in a short time, will cause poisoning; symptoms show in 2 hours. If eaten slowly with other feed, no harm results. Greasewood contains large amounts of sodium and potassium oxalates that are considered responsible for the poisoning. In wet spring, plants are devoid of poison; in drought, poison is more concentrated.

GROUND-IVY, *Glecoma hederaceae* (fig. 35). —This low, creeping perennial plant belongs to the mint family. It was introduced from Europe. It has round,

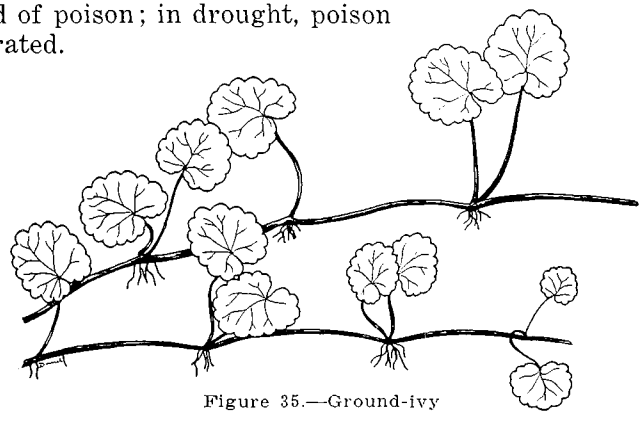

Figure 35.—Ground-ivy

scalloped leaves and small, pale-blue flowers. Usually it is found in damp, shady ground of gardens and waste places. The plant contains a volatile oil and bitter principle and has been reported as poisoning horses. Symptoms are salivation, sweating, dilation of pupils, and panting for breath. The plant is easily destroyed by cultivation.

GROUNDSEL, *Senecio integerrimus,* (fig. 36), *S. riddellii, S. plattensis* (fig. 37).—These species of groundsel occurring in Colorado have been reported as causing stock poisoning. They are woody herbs with terminal clusters of yellow flowers.

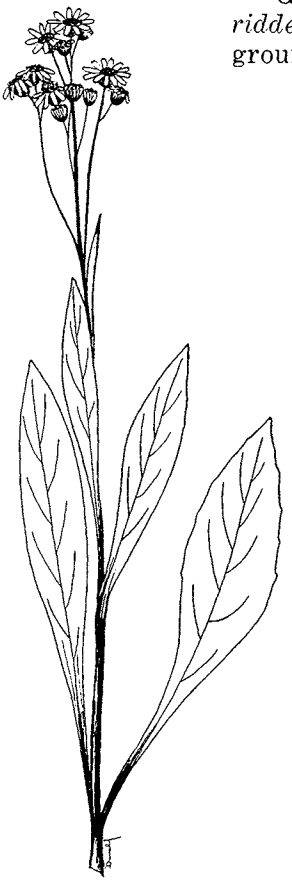

Figure 36.—Groundsel, *Senecio integerrimus*

Figure 37.—Groundsel, *Senecio plattensis*

These plants are eaten by livestock under conditions of overgrazing and feed deficiency during the summer. The occurrence of the trouble from this weed is sporadic. It seems probable that the various species differ somewhat in their poison content, and quite surely that the younger plants are more poisonous than the older. Generally speaking, the younger plants are more readily eaten; and where they become palatable before the surrounding grass, animals grazing on them are likely to develop symptoms of the disease. Clawson found that *Senecio longilobus* was more active than the other species tested by him. With this species a steer was poisoned by a single feeding of 1 percent of its body weight, a horse by 2 percent, and a sheep by 2½ percent.

The poisonous principle seems to be entirely unknown. Apparently it is destructive chiefly to the liver cells.

Diseases under various names have been described in several countries which are now believed to be due to grazing on senecio forage. In South Africa the disease was known as "molteno disease" in cattle and "dunziekte" in horses. In New Zealand it was known as the "Winton disease" of cattle, and in Canada as the "Pictou disease." Van Es described it in horses under the name of "walking disease," and Mathews describes a similar condition in cattle in the Great Bend region of Texas.

While the disease has not been definitely diagnosed in Colorado, senecios are widespread over the state, and a malady of horses which was recognized by veterinarians as the "no-name disease" is believed by competent authority to be the same as that described by Van Es. Clawson has shown that sheep can be poisoned by forced feeding, but there is no evidence that sheep normally suffer any inconvenience from grazing on these plants. In fact, the Canadian authorities felt that sheep were so little susceptible that they could be used for eradicating the weeds so that the range might be made safe for cattle and horses.

Van Es describes the symptoms in horses as consisting of yawning, lack of appetite, impaired sensibility, depression, tendency to chew various inanimate objects, weakness, uneasiness, and finally continual walking, from which the disease derives its name. Animals will walk into fences and trees, and will not easily be turned from their course but will push against such objects. Frequently this pushing continues until the animals fall dead against the obstruction. Occasionally mania results. Yellowish discoloration of the mucous membranes is noted by all workers. Frequent evacuation of the bowels, with straining, is noted.

Clawson mentions particularly a peculiar and distinctive odor coming from the skin. Occasionally there is edema of the skin, with accumulation of fluid on the surface. There is no rise in temperature. The disease may develop in 12 to 21 days after the animals are turned on a particular pasture, and death may follow in a few days thereafter.

Mathews, describing the disease in cattle, mentions also the jaundiced condition of the mucous membrane, the tendency to walk into immovable objects and to continue pushing against them, mania which may result in danger to man, and straining with occasional eversion of the rectum.

The lesions are chiefly seen in the liver. That organ is enlarged and very much mottled. The gallbladder is usually greatly distended with a thick, gelatinous bile. At times the walls of the fourth stomach are greatly thickened with serum, and the visceral peritoneum may be highly edematous. Micro-

scopic examination of the liver shows that its peculiar appearance is due to a great destruction of the liver cells and their replacement by fibrous tissue.

In areas where the senecios are present in large numbers it is better to turn the animals to graze only after the grass is well developed. Later in the season senecios become more fibrous and less palatable. It may be that certain areas will have to be used for sheep range, and cattle and horses removed from them entirely, since, as was shown in Canada, sheep are much less susceptible to the disease. No medical treatment seems to have been of any avail.

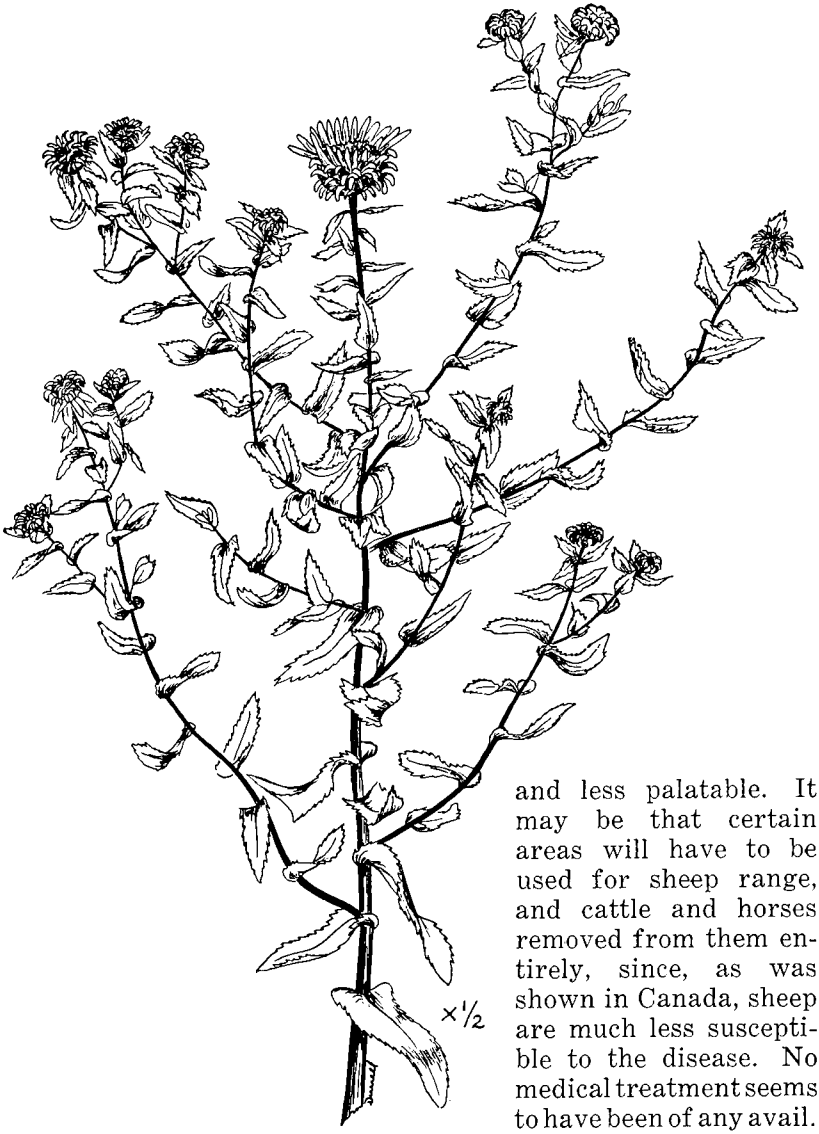

Figure 38.—Gumweed

GUMWEED, *Grindelia squarrosa* (fig. 38).—Gumweed is a resinous, sticky, perennial plant native to the plains region. It is common along roadsides and in overgrazed pastures. It is frequently suspected of poisoning stock but seldom, if ever, is eaten. It contains a bitter alkaloid and two glucosides resembling saponin.

HEMLOCK, waterhemlock, poisonhemlock, *Cicuta occidentalis* (fig. 39).—Hemlock is a stout perennial 3 to 7 feet tall, with hollow, smooth, green stem and a characteristic bunch of

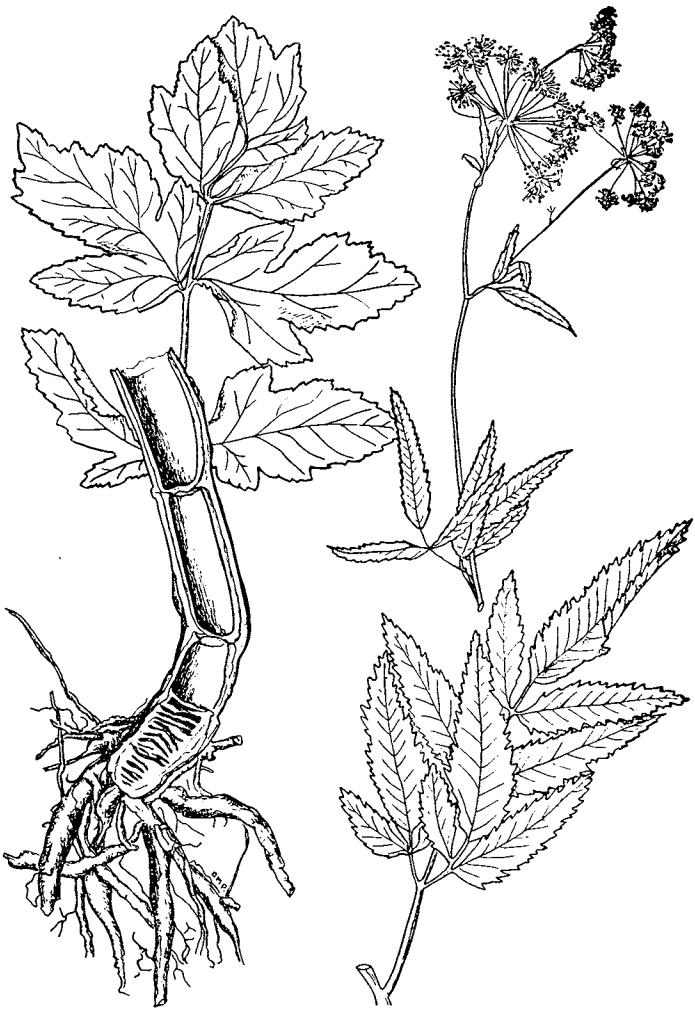

Figure 39.—Hemlock; *left*, root and base of stem, showing broad basal leaf and characteristic partitions in interior of stem; *upper right*, flowering head; *lower right*, leaves

thick, spindle-shaped roots. When these roots are cut a yellow, gummy juice oozes out. On splitting the stem where it joins the roots, cross partitions may be seen dividing this part of the stem into chambers. The leaves are compound, and the leaflets have fine-toothed edges. It is sometimes confused with cow-parsnip *(Heracleum lanatum)* and with the common wild parsnip *(Pastinaca sativa)*. It can be identified readily by the cross-paritions at the base of the stem. The flowers are white and in umbrella-like clusters; the seeds are small.

Hemlock is found throughout Colorado at 4,000- to 8,000-feet elevations, along streams and ditch banks and in wet, swampy places. The plant appears early in the spring and flowers in June to July. All parts are poisonous, though the roots are the most toxic. A small finger of the roots may be fatal. In early spring the tops sprout up before other plants and may be grazed with serious results. Serious losses have been reported in cattle as a result of turning them upon a plowed field where the roots were exposed.

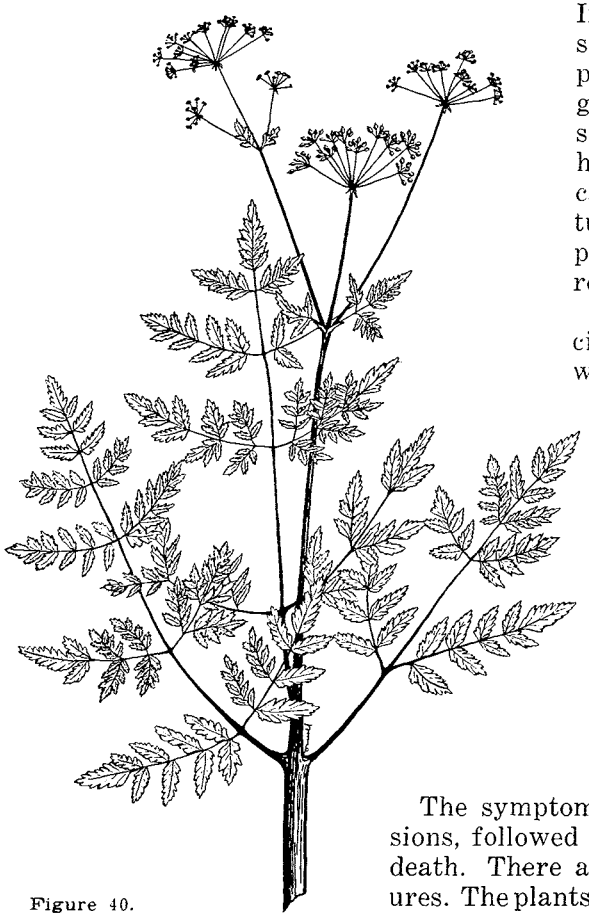

Figure 40.
European Hemlock

The poisonous principle is "cicutoxin," which acts upon the spinal cord and the nervous system. Man and all classes of livestock are affected. Frequent cases are reported of children being poisoned by eating hemlock roots, mistaking them for garden parsnips.

The symptoms are violent convulsions, followed in almost all cases by death. There are no remedial measures. The plants can easily be grubbed out and eradicated.

HEMLOCK, European hemlock, *Conium maculatum* (fig. 40).—This plant resembles the native waterhemlock, except that the lower parts of the stems are usually spotted with reddish or purplish spots and blotches, and the interior of the base of the stem is not cross-partitioned as in the native species. It was used by the ancient Greeks to execute prisoners. The symptoms of poisoning from the European hemlock are like those of the waterhemlock.

This deadly poison plant was introduced into this country from Europe, no doubt, as an impurity in crop seeds. In recent years it has been found in a few places in Colorado and is rapidly spreading.

HEMP, *Cannabis sativa* (fig. 41).—Hemp is a tall, coarse-growing weed with divided, toothed-edged leaves and clusters of small, greenish flowers terminating the stems. The plant is a native of Asia and Europe and was introduced into this country as a fiber crop. It is found growing in waste places and has escaped from cultivation.

It is of no importance as a stock-poisoning plant, but it contains narcotic substances. The dried flower tops have been used since the Middle Ages as a drug plant; and in the Far East it is smoked for its narcotic effect. In this state the marijuana of the Mexicans is hemp. Growing hemp in Colorado is illegal.

Figure 41.—Hemp

HORSETAIL, scouring rush, *Equisetum* sp. (fig. 42).—It is a green, erect, perennial plant growing from 6 inches to 3 feet tall. There are two common species, one bushy and low-growing *(Equisetum arvense)*, and the other tall, slender, and grass-like *(E. laevigatum)*. The plants are characterized by their straight, leafless, jointed stems, which are very brittle and harsh due to the large amount of silica in the tissue. They are commonly found along stream banks and in damp meadows, appearing from early spring until late fall. All parts are poisonous, especially in dry hay. Baled hay with 25 percent or more of horsetails is usually docked on the market. The poisonous principle is not known.

Horses are chiefly affected, young animals being especially susceptible.

Symptoms of poisoning include unthriftiness. Afflicted horses become thin. They tremble and their muscles waste. After 2 or 3 weeks of continued feeding on badly-infested hay, the animals lose the use of their limbs. They stagger, and their extremities get cold. Such animals suffer from cold during the winter. Symptoms are slow to appear.

As a remedial measure, stop feeding horsetail hay. Give a dose of physic: 1 quart of raw linseed oil or an ounce of aloes; follow this by powdered nux vomica, 1 teaspoonful three times daily in the feed.

HORSEWEED, *Erigeron canadensis* (fig. 43).—This is an introduced weed of minor importance. It is an annual growing

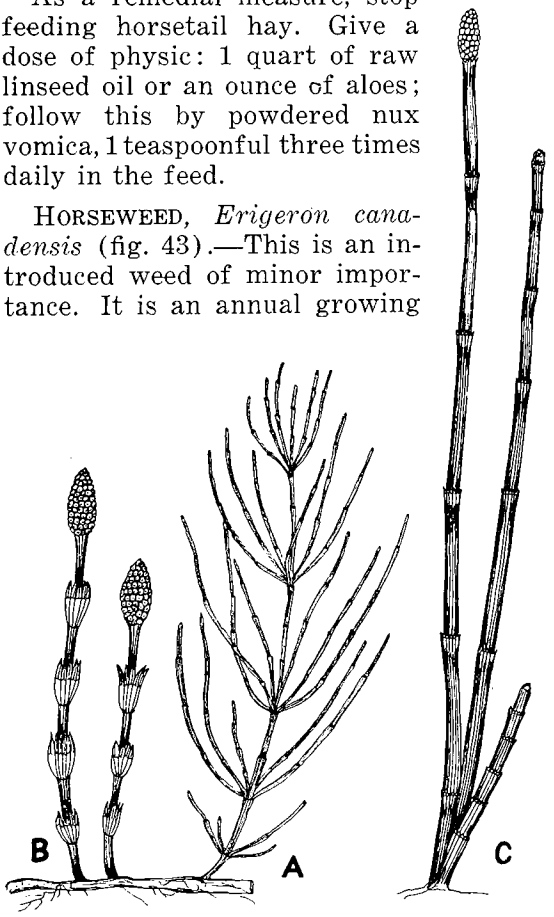

Figure 42.—Horsetail; *A*, vegetative stalk of *Equisetum arvense*; *B*, fruiting stalks of *E. arvense*; *C*, tall scouring rush or horsetail, *E. laevigatum*

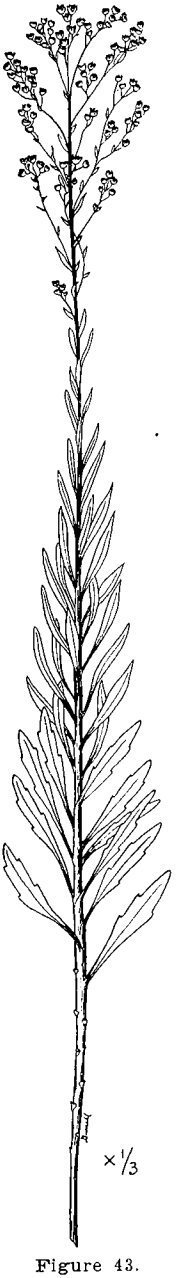

Figure 43. Horseweed

1 to 5 feet tall, with narrow leaves along an erect, slender stem. The flowers are white and aster-like and are borne in loose clusters at the top of the stem.

The plant has an acrid taste and causes irritation of the throat, and colic in animals eating it. When handled by people, the short, stiff hairs on the stem cause an irritation of the skin. It is said to be injurious in hay, and the presence of much of it makes the hay dusty.

INDIAN HEMP, dogbane, *Apocynum cannabinum* (fig. 44); spreading dogbane, *A. androsaemifolium.*—These Indian hemp species native to Colorado are reported as having poisonous properties. They are perennial herbs with milky juice, broad opposite leaves, and clusters of small, bell-shaped, pink flowers. After flowering, long slender pods are produced containing numerous seeds with silky tufts on the end.

The plants usually grow in patches along fences and ditches. They are more or less tough or woody, and distasteful to animals, though the tender shoots in the spring are sometimes eaten.

The roots of *Apocynum androsaemifolium* are bitter; hence the name "bitterroot" is sometimes applied to it. It has an emetic and cathartic action.

A. cannabinum has a similar action, and it is also a heart stimulant with properties similar to those of digitalis. It contains two poisonous glucosides, "apocynin" and "apocynein." From 15 to 20 grams of green leaves are reported as causing serious poisoning in horses and cattle, and a less amount for sheep.

Symptoms are increased temperature and pulse, dilation of the pupils, discoloration and soreness of the mouth, refusal to eat, purging, and sweating due to exertion caused by heart stimuation. Little is known about Indian hemp, and animals seldom eat it. It should be looked upon with suspicion, however.

Figure 44.—Indian Hemp

Figure 45.—Indian-tobacco, *Lobelia splendens*

INDIAN-TOBACCO, *Lobelia splendens* (fig. 45), *L. cardinalis*, *L. syphilitica* (fig. 46).—These species of *Lobelia* occur in Colorado. They are similar to *Lobelia inflata*, the Indian-tobacco of the East and North, the action of which is well known. The narcotic poison of *L. inflata* is similar to nicotine in its action.

The Colorado species are perennial herbs with milky juice. They have alternate leaves, and scattered, irregular flowers are produced late in the season. *L. splendens* has red flowers (sometimes called cardinal flowers), and *L. syphilitica* has blue or white flowers. The latter species was used medicinally by the Indians. Both are suspected of poisoning.

Figure 46. Indian-tobacco, *Lobelia syphilitica*

JIMSONWEED, *Datura stramonium* (fig. 47).—This is a stout weed 1 to 4 feet tall, with broad-lobed leaves and large, white, tubular flowers. The seed pods are large, oval, and covered with spines.

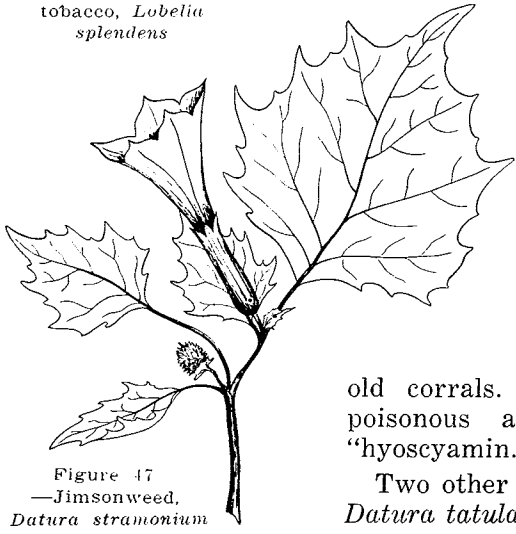

Figure 47 —Jimsonweed, *Datura stramonium*

The plant was introduced into this country in impure seed. It grows in waste places, such as roadsides and along fences, or around old corrals. The plant contains the poisonous alkaloids "atropine" and "hyoscyamin."

Two other species occur in the state, *Datura tatula*, with purple flowers, and

D. meteloides. They closely resemble the previously-described species.

Occasionally children are poisoned from eating the seed of jimsonweed or from sucking the flowers. The plants have a rank, unpleasant odor and are seldom eaten by stock.

Poison victims should be given an emetic or have the stomach pumped out. A heart stimulant and artificial respiration may be necessary. Jimsonweed should be grubbed out and prevented from seeding.

KINNIKINNICK, *Arctostophylos uva-ursi.*—This is a common, trailing evergreen plant of the mountains. It contains an astringent, diuretic substance. It is seldom, if ever, eaten by stock.

LABRADOR-TEA, *Ledum glandulosum.*—Labrador-tea is a low evergreen shrub with alternate leaves covered with resinous dots. The leaves are fragrant when bruised. The plants grow around bogs in the mountains. They are said to be poisonous.

LARKSPUR, poison weed, *Delphinium nelsonii, D. geyeri, D. subalpinum (barbeyi), D. bicolor, D. carolinianum, D. cuculatum, D. elongatum, D. sapellonis, D. scaposum, D. robustum, D. virescens, D. penardii* (fig. 48).—There are a number of species of larkspurs common to Colorado. The above species are known to cause stock poisoning; no doubt all species are poisonous.

For practical purposes these may be grouped into the low larkspurs of the plains and foothills, which die down after flowering; and the tall larkspurs of the higher altitudes, which grow until frost.

The low larkspur is a perennial growing 1 to 2 feet tall. The leaves are divided into a number of narrow segments. The flowers are blue and prolonged into a spur behind. The tall larkspur grows 1 to 5 feet tall, with broad leaves not divided

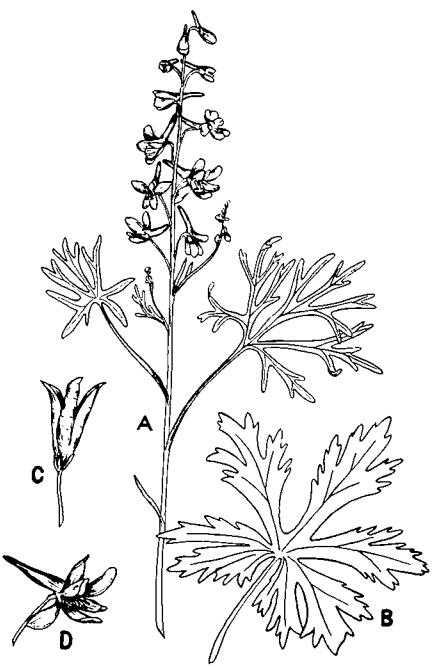

Figure 48.—*A*, Larkspur, *Dephinium nelsonii; B*, leaf of tall alpine larkspur; *C*, seed pod; *D*, flower, showing spur

as finely as those of the low larkspur. Low larkspur is found on open hillsides and parks, at 4,000- to 10,000-feet altitudes. Tall larkspur is found on forest ranges at altitudes of 8,000 to 11,000 feet.

The low larkspur appears early in the spring, dying down after flowering in the first part of June in the lower altitudes. The tall larkspur appears in the middle of June, the time of flowering depending upon the altitude. The tops remain alive until frost.

All parts of the plants are poisonous. Twenty to 25 pounds of leaves are enough to kill.

The low larkspur is poisonous throughout the life of the plant; the tall larkspurs are only slightly poisonous after flowering. They are all poisonous for horses and cattle, but not for sheep. Horses rarely eat enough of the plant to harm them, especially on open range. The leaves of larkspur are especially poisonous when wet by dew, rain, or snow.

Delphinin, which has a paralytic action on the heart and respiratory organs, is the chief poison. Other poisons are "delphisin," "delphinoidin," and "staphisagrin."

The symptoms of poisoning are staggering, falling, bloating, nausea, salivation, frequent swallowing, quivering of muscles, retarding of heart action, and paralysis of respiratory centers. Death comes to the poisoned animal in convulsions. Larkspur poisoning differs from camas poisoning in that it produces paralysis without loss of consciousness.

Grubbing out patches of larkspur is most effective as a preventive precaution, and complete eradication can be attained in 3 years. Chlorate sprays have been found effective in eradicating larkspur, but the cost is about the same as that of grubbing. Avoid range where larkspur grows during the spring and early summer. Pasture larkspur-infested ranges with sheep or horses early in the season, when the plant is most dangerous.

As a remedy, a hypodermic injection of physostigmin salicylate 1 grain, pilocarpin hydrochlorid 2 grains, and strychnine ½ grain has experimentally proved very effective for a 500- to 600-pound animal; double the dose for a 1,000-pound animal. Keep the animal quiet; turn the head uphill; and puncture if badly bloated, but do not bleed.

LICHEN (fig. 49).—Lichens are most commonly found attached to rocks as a scaly green or gray growth. Others grow on the surface of the ground. They are not generally considered poisonous, though most of them contain a bitter principle. Some species in northern countries are used for human food; and the famous reindeer moss of the north, which is a lichen, furnishes

valuable forage for the herds of reindeer. One species, *Parmelia molliuscula,* has been reported as causing stock poisoning. This plant grows on the ground and is sometimes blown about by the wind, forming into drifts. It is most noticeable in the winter, when masses of it become mixed with the drifts of snow.

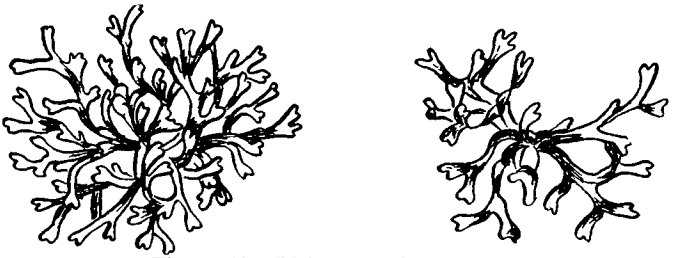

Figure 49.—Lichen, much enlarged

On ranges where there is scarcity of feed, cattle and sheep are known to become poisoned by eating this lichen. Affected animals lose control of their legs and may get down and not be able to rise. With a change of feed and flushing of the animal with plenty of warm water, it usually recovers.

LILY-OF-THE-VALLEY, *Convallaria majalis.*—This is a low plant with broad leaves, arising from a perennial root and bearing erect clusters of small, white, bell-shaped flowers in early spring. It is common in flower gardens. It contains two glucocides: "convallamarin," which has an action on the heart like digitalis; and "convallarin," which has a strong purgative action. It is a possible source of poisoning of animals browsing around dooryards or gardens.

LIMA BEAN, *Phaseolus lanatus.*—This large bean common to our gardens contains a substance that, when acted upon by an enzyme, produces a small amount of prussic acid. Illness sometimes results from eating them. When lima beans are cooked, the first water should be poured off.

LOCO, *Astragalus mollissimus, A. diphysus, Aragallus lambertii* (fig. 50), *A. albiflorus.*—These species of loco occurring in Colorado are known to be injurious. *Astragalus drummondi* and *A. carolinianum* are suspected. *A. campestris, A. bisulcatus* and *A. pectinatus,* usually termed milkvetches, are also considered poisonous and have been associated with selenium poisoning (see "Milkvetch" and "Selenium-Bearing Plants").

The loco plants grow in tufts or clumps from large roots similar to alfalfa roots. The leaves are compound and the flowers pea-like. Some species have white flowers, others blue or purple. The purple loco (fig. 50) is rather typical of the appearance of these plants.

Figure 50.—Loco, *Aragallus lambertii*; A, flower

The plants appear early in the spring, blooming in May and June. All parts of the plant are injurious at any time, but large amounts eaten over a long period are necessary to poison. The poisonous principle is not known. Malnutrition or starvation are possibly the cause.

Horses are chiefly affected. The effects of loco are slow. It may be several weeks before action takes place. Animals may acquire the habit of eating loco plants. The symptoms are loss of flesh, irregularity of gait, erratic actions, and incoordination.

Eating of locoweed usually follows scarcity of forage. Remove the animals from infested areas and feed on good ration. No antidote has been found. Fowler's solution of arsenic mixed with grain should be given as a tonic twice daily.

Loco plants spread slowly by seed and can be eradicated by grubbing or by use of chlorates.

LUPINE, wild bean, blue bean, *Lupinus argenteus* (fig. 51), *L. alpestris*, *L. laxiflorus*, *L. leucophyllus*.—These species of lupines growing in the state are recorded as poisonous. They are perennial, bushy plants 1 to 2 feet tall, growing in clumps. The leaves are finger-like; and the flowers are pea-like in terminal clusters, and usually blue. The pods are usually hairy.

The plants grow chiefly at lower altitudes and most luxuriantly along streams, ditches, and hillsides where there is seepage water and deep soil. They appear early in May, blooming in June.

The seed and pods are the most poisonous parts of the plant. The plants remain green late and are eaten late in the season; there is danger then from seed and pods. Hay containing lupines is dangerous. The poisonous principles are "lupinin," "lupinidin," and "lupinotoxin."

The animals chiefly affected are sheep. Other animals may be affected when they eat a quantity of plants. Lupines are not

often eaten when grass is available. Hungry animals driven through patches of lupine late in the season, when seed pods are formed, are likely to be poisoned.

Poisoning, in acute cases, is accompanied by cerebral congestion and great mental excitement. The animals become frenzied and exhibit violent spasms; in fatal cases they die in convulsions. Chronic lupine poisoning is more common and is associated with liver disorder and jaundice.

No specific remedy is known. Avoid feeding lupines either on the range or in hay. If taken early, potassium permanganate may be effective as a chemical antidote in acute cases. After the poison has been absorbed, the physiological effects may be counteracted by morphine and other sedatives.

Figure 51.—Lupine, *Lupinus argenteus*; A, flower

From 7 to 24 pounds of lupines per hundredweight are necessary to poison horses. From ½ to 1 pound per hundredweight in some cases have been reported as causing death in sheep. Where poisoning occurs, pods and seeds are eaten in large amounts in a short time. The amounts necessary to poison are ordinarily in excess of those eaten by sheep on the range.

MATRIMONY-VINE, *Lycium vulgare* (fig. 52).—It is a slender, trailing vine, usually with a spiny stem on which small, pink flowers are borne. The plant is perennial, and occasionally may be found along fences and ditches where it has escaped from cultivation. It is a troublesome weed and is suspected of being poisonous.

MENTZELIA, stickleaf, *Mentzelia decapetala* (fig. 53).—This is a stout plant common to pastures and roadsides. The leaves are very harsh and spiny. The flowers are large and white-to-yellowish. It is reported as one of the plants that take up selenium (see "Selenium-Bearing Plants").

Figure 52. Matrimony-vine

Figure 53.—Mentzelia

MILKVETCH, *Astragalus bisulcatus* (fig. 54).—This plant and several others, it is claimed, extract the poisonous element "selenium" from certain shale soils. Such plants, if eaten, may cause poisoning of stock (see "Selenium-Bearing Plants").

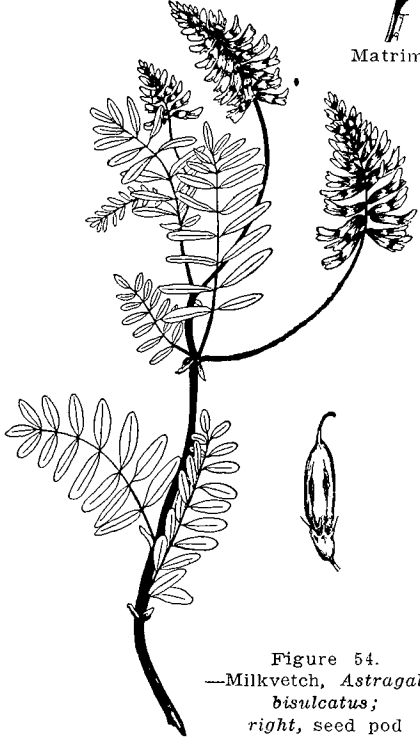

Figure 54. —Milkvetch, *Astragalus bisulcatus; right,* seed pod

The two-grooved milkvetch is common to the ranges of Colorado. It is related to the locoweed and is sometimes called the two-grooved loco. It is a tall, coarse-growing plant with purple-to-pinkish-white flowers and two-grooved seedpods. The plant has an unpleasant odor.

Related to this plant are two other species, *Astragalus campestris* and *A. pectinatus*, that are thought to have a similar poisonous action (see "Timber Milkvetch").

MILKWEED, poison milkweed, *Asclepias galioides*, (fig. 55), *A. verticillata*, *A. pumila* (fig. 55); common broad-leaved milkweed, *A. speciosa* (fig. 56).—These listed species of milkweed are to be found growing in this state. *Asclepias galioides* is the most important species and is responsible for most of the milkweed poisoning. It is usually called whorled milkweed. *A. verticillata*, also called whorled milkweed, resembles it but is a somewhat coarser plant. It is less common, being found farther east but occurring occasionally in the eastern part of this state.

The low whorled milkweed (*A. pumila*, fig. 55) grows generally throughout the state. It is of little importance as a stock-poisoning plant.

A. galioides is a perennial plant 1 to 2 feet tall, growing from a horizontal rootstock (fig. 55). The leaves are narrow and borne in whorls at the joints of the stem. The flowers are greenish-white in spreading, umbrella-like clusters. The seeds are borne in cigar-shaped pods (fig. 55), with tufts of silky hairs attached to the seed. The whorled milkweed differs from the common milkweed in the shape

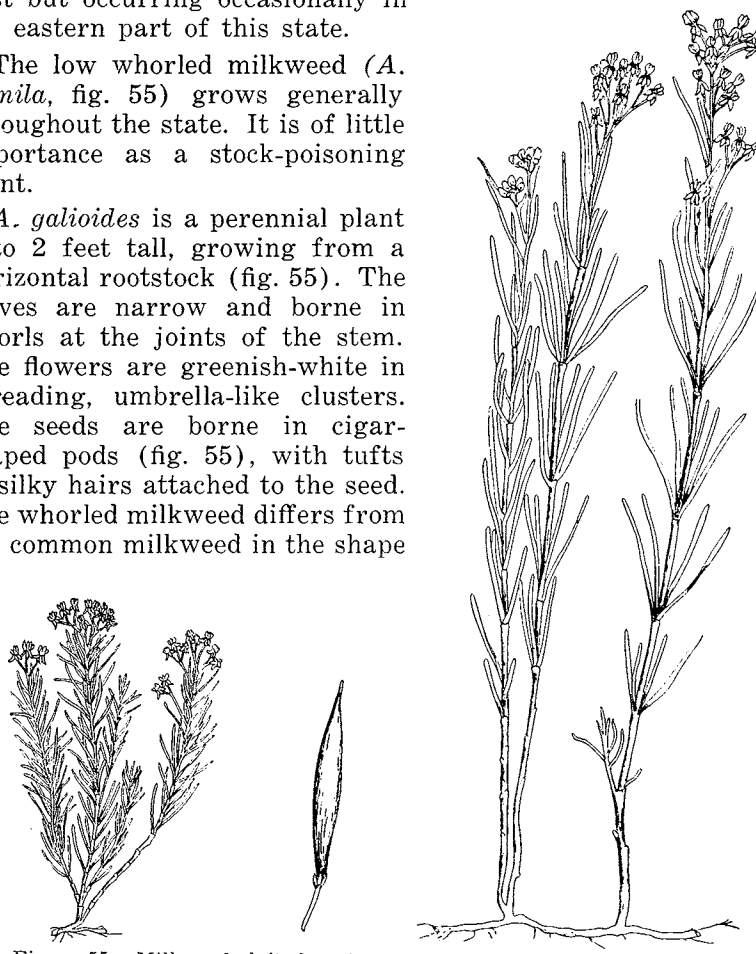

Figure 55.—Milkweed; *left*, dwarf poison milkweed, *Asclepias pumila*; *center*, seed pod of poison milkweed; *right*, whorled milkweed, *A. galioides*

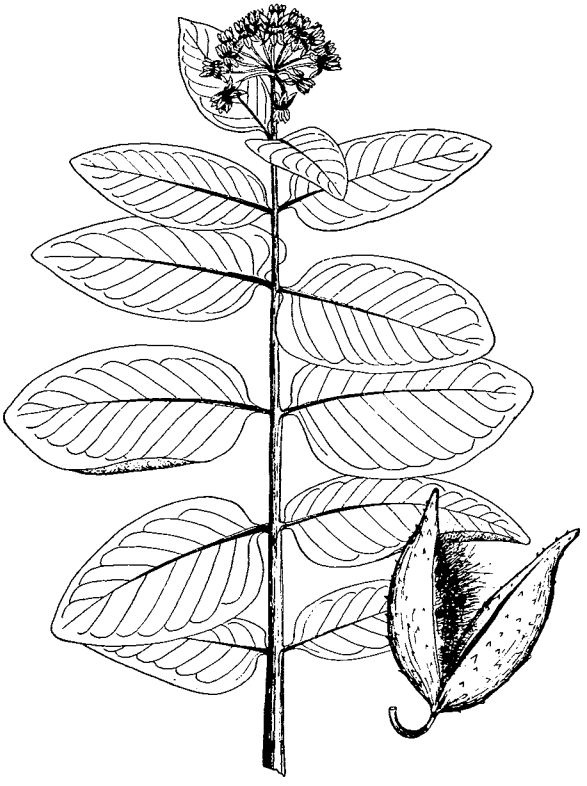

Figure 56.—Common Milkweed; *right*, seed pod

of its leaf, which is very narrow. The common milkweed (*A. speciosa*, fig. 56) has a broad, flat leaf from 1 to 2 inches wide.

The whorled milkweed is found in the southern part of the state, through the Arkansas Valley, and in the foothills and plains south of Pueblo; also in the southwestern part of the state, along roadsides, ditch banks, and waterholes. *A. pumila* is found in overgrazed pastures, usually in plains and foothills.

The tall whorled milkweed appears the latter part of May and the first of June, and blossoms the first 2 weeks in July. All above-ground portions are poisonous. It is dangerous at all times, especially where forage is scarce. This is particularly true of *A. pumila*, which is found on overgrazed pastures. The tall whorled milkweed is poisonous also as dried hay. The poisonous principle is a toxic glucoside. The quantity of *A. galioides* required to poison is 2 pounds per hundredweight of animal. *A. pumila* is about one-third as poisous as *A. galioides*.

Sheep, cattle, horses, and chickens are affected. The symptoms of poisoning are dullness, followed by a comatose state manifest 14 to 17 hours after feeding; weakness of the hind quarters; and staggering. This is followed by convulsions at intervals until death. The heartbeat is very rapid at first, but it rapidly becomes weaker. The pupils of the eyes are dilated. The average period of sickness before death in *A. galioides* cases is 4 hours and in *A. pumila* cases 48 hours.

No specific antidote for milkweed poisoning is known as yet. Keep the stock away from whorled milkweed patches.

Eradication by digging is advisable where patches of the weed are small. All the roots must be destroyed, as they will send up new shoots if fragments are left in the soil. Chlorates have been used successfully on patches of poison milkweed. The plants have an unpleasant taste and are not usually eaten by stock unless forage is scarce, as in dry pastures or where plants may protude through the snow.

The common milkweed (fig. 56) is a tall, coarse-growing perennial plant common to pastures and roadsides. It contains a white, milky juice. It is considered slightly poisonous, especially to sheep; but it is rarely, if ever, eaten by stock.

MOLDS.—Many molds, or fungi, may be found on hay and feed that has become wet, or that has not been properly stored or cured at harvest.

Probably no question is put to us more frequently than that of the toxicity of mold-infected foodstuffs. In times past diseases have been attributed to molds that have later been found to be infectious. Heavy losses are constantly occurring, and on examination molds are found in the feed, which is often considered sufficient to incriminate the molds. This is especially true for silage, hay, immature corn, beet tops, and probably a variety of other feeds.

After all these years it is surprising that there is so little accurate information on the poisonous properties of the various molds. Fitch and Eckles, in Minnesota, carried on experiments with moldy silage with negative results. Graham, in Illinois, found that when silage is injurious to horses the molds are not the toxic substances, but that they only change the reaction so that a bacterial growth may take place to produce the toxin of botulism.

Sweetclover poisoning seems to be associated with the development of a mold on the hay, but even there the mold itself has not been found injurious. In South Africa *Diplodia zeae* on corn was blamed for deaths in sheep and cattle, but work in this country with the same mold, using laboratory animals, was repeatedly negative. Ergot, which is a fungus growing on rye and some other grasses, is undoubtedly poisonous and produces very definite symptoms, which are described under "Ergot."

Probably most of the feedstuffs in Colorado contain some mold, so that when losses occur it is always easy to find these organisms. Certainly silage, alfalfa hay, beet pulp, beet tops, and immature corn are almost always moldy. While we do not recommend the feeding of exceptionally moldy feeds, there is little critical evidence that they are actually injurious. It is probable that, with exceptionally moldy feedstuffs, it is better to limit the amount in the ration.

MUSHROOMS (fig. 57).—In discussion of poisonous plants the question of poisonous mushrooms or toadstools always arises. Mushrooms are fungi, or molds, that live as a web of fine threads on organic matter in the soil. At certain times, especially after rains, they send up the fleshy, umbrella-shaped fruiting bodies that we term the mushroom or toadstool. This mushroom bears the spores, or seeds, of the fungus on gill-like plates on the lower side of the mushroom cap.

As poisoning sometimes results from eating the wrong kind of mushroom gathered in the field or forest, it is well to know the characteristics of the poisonous kinds.

The poisonous species of mushroom in this state belong to the group known as "*Amanita,*" our most characteristic representative being *Amanita muscaria.*

The poisonous amanitas, as shown in the accompanying figure, arise from a bulbous base that often has the appearance of a ragged-edged cup when the mushroom is picked. The stem is surrounded by a ragged collar, and the cap of the mushroom breaks off easily from the stem and has a scaly red top; the underside, however, is light-colored, and the spores borne on this under side are white. Other mushrooms that are nonpoisonous may have colored caps or collars on the stem, or may arise from what appears as a bulbous base, but the deadly amanita has all these characteristics which should be looked for.

The amanitas contain a powerful heart poison that stops the heart muscles, and but a small amount is sufficient to kill. Avoid any mushroom having a bright-colored,

Figure 57.—Poison Mushroom

Figure 58.—Nettle

scaly cap, with a ring or collar around the stem and bulbous base.

NETTLE, *Urtica gracilis* (fig. 58).—The nettle is a perennial herb covered with stinging hairs. The leaves are ovate-lanceolate, heart-shaped at the base, with edges serrate. The flowers are small and in slender, branched clusters. The hairs of this plant contain formic acid, which is very irritating to the skin of animals and man, and which produces a rash.

NIGHTSHADE, *Solanum* sp.—Many plants of this group contain poisonous substances. The nightshade (*Solanum nigrum*, fig. 59) is a small, bushy plant with small, white flowers and green or dark blue-black berries. It is occasionally found in fields, gardens, and waste places. It contains an alkaloid, "solanin." Another related plant, the cut-leaved nightshade, (*S. triflorum*, fig. 60), is more common; it also contains "solanin" and is considered poisonous.

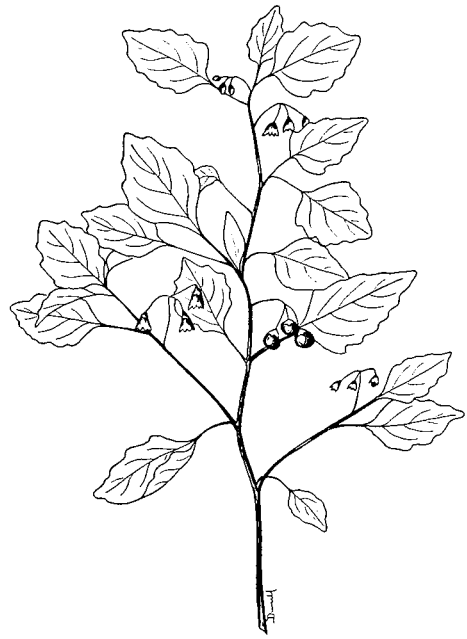

Figure 59.—Nightshade, *Solanum nigrum*

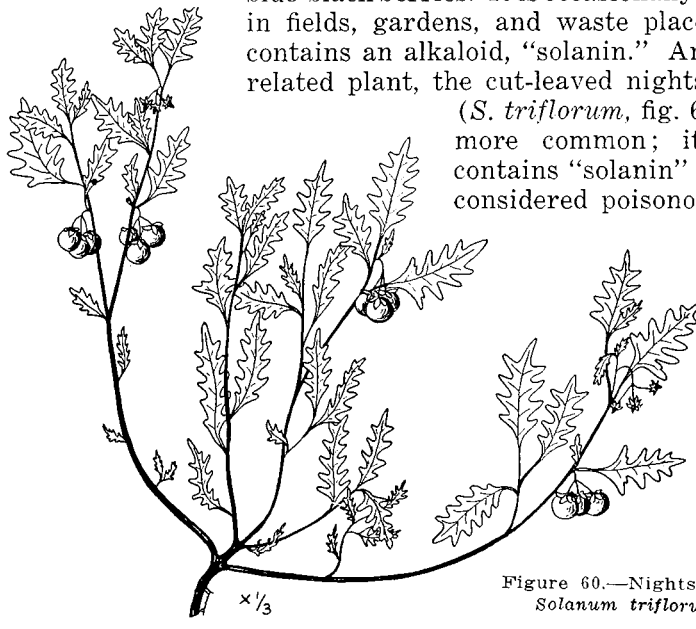

Figure 60.—Nightshade, *Solanum triflorum*

All members of this group of plants, including potato, tomato, and wonderberry, may contain "solanin" or other poisonous substances and should be regarded with suspicion.

OAK, *Quercus gambellii* (fig. 61).—Species of oak in this state are known to be poisonous or injurious to stock. *Quercus gambellii* has been definitely reported as causing livestock poisoning.

Poisoning from oak usually occurs in the spring when cattle browse the young leaves and twigs. Some supposed cases of oak poisoning have been due to the eating of larkspur growing among the trees.

Ordinarily oak browse furnishes a valuable element in the forage of range animals. When cattle are fed exclusively on oak leaves they may be subject to intestinal disturbances; on an overgrazed range this condition may become serious, especially if cattle are in poor condition. If forage is plentiful, no serious results may be expected.

Feeding experiments indicate that animals must feed on oak for a considerable period to be affected. Short periods of feeding are not injurious. Even with continuous and heavy feeding, only a small percentage of the animals are injured. A small supplementary feed, as little as 3 pounds of alfalfa daily, is sufficient to prevent oak poisoning. In Colorado only cattle have shown evidence of oak poisoning, although experimentally it is possible to produce the condition in sheep.

Oak leaves are known to contain large amounts of tannin, but the symptoms of oak poisoning have not been reproduced with this agent.

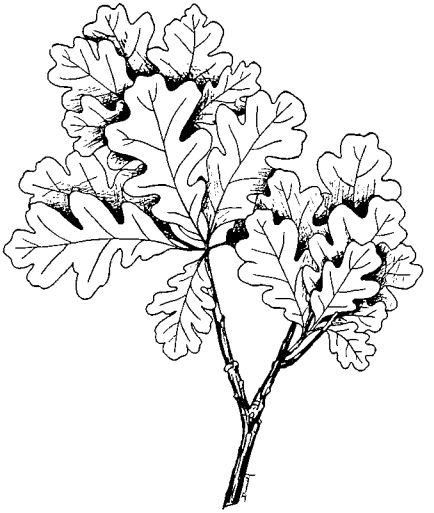

Figure 61.—Oak

The symptoms of oak poisoning include constipation, which seems to be the earliest symptom noted. The feces are dry and finally appear in small pellets. Later they are passed frequently, but in small amounts. They are often surrounded with mucous, and even with blood. Straining is frequent. Still later the feces may become watery, but they are always scanty and always dark in color. The animal loses its appetite, appears gaunt, rapidly emaciates, and

has little desire to move about. The coat becomes starey; the nose is dry and becomes cracked; and the muzzle may scale off. Weakness continues, and the animal may die in from 2 weeks to a month or more.

There are no very distinctive lesions of oak poisoning, but there is usually some evidence of inflammation of the small intestines. The contents of the large intestine are usually scanty and very dark in color, but seldom surrounded with inflammatory areas. Emaciation is usually extreme, and there is evidence of anemia.

Animals become poisoned on oak during the early spring when there is practically no other forage, or later in the season when the grass dries up. Consequently, if animals must be turned out at these times, they should be fed hay or cottonseed meal as a supplement. Apparently a very small amount of hay will prevent the development of the disease. In order to reproduce the condition, the animals must be fed wholly on oak leaves. Since constipation is such a factor in the disease, it was thought that the administration of epsom salts might be helpful, but experience indicates that this is not the case. No treatment so far has proved satisfactory.

Avoid turning cattle upon oak browse when grass does not furnish sufficient supplementary forage.

ONION, wild onion, *Allium* sp. (fig. 62).—The wild onion is common to fields and pastures and may become serious in affecting flavor of milk (see "Weeds Affecting Flavor of Milk"). Several species grow in the state. They are easily recognized by their slender, round leaves, and by their bulbs and the onion odor.

Several serious losses in cattle running on fields of cultivated onions have been reported in the state. Losses usually occur late in the fall, after the onions have been dug and certain of them left on the ground. After a short time on such a field, cattle show symptoms of illness, stop eating, occasionally show brain disturbance, pass urine stained with blood, and die within a few days. At the post mortem the odor of onions in all body tissues is very noticeable. While no definite feeding experiments have been conducted, the repeated losses under such conditions make it inadvisable to attempt to pasture cattle on onion fields.

Figure 62. Onion

PARSNIP, wild parsnip, *Pastinaca sativa* (fig. 63).—This is a common garden parsnip that has escaped from cultivation. It is occasionally found in pastures and waste places. The plant is an annual or biennial

with a fleshy root. Tests have not revealed any poison present in the plant, and feeding tests show no effects; yet many conflicting reports exist as to the plant being poisonous. Cases of so-called parsnip poisoning are usually traced to waterhemlock. Parnsip is known to produce irritation of the skin, however.

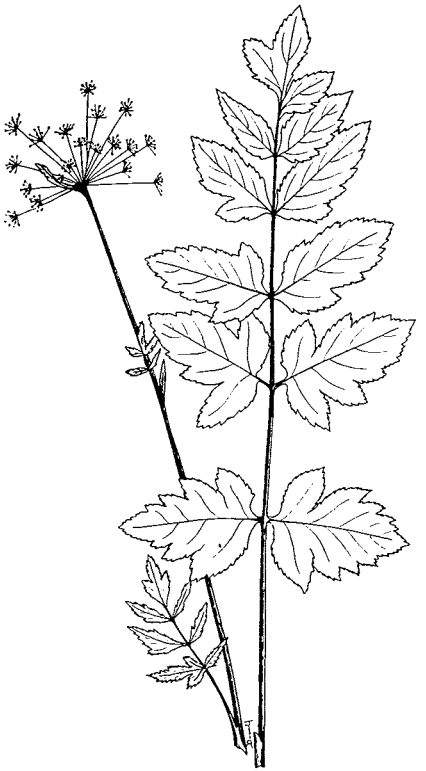

Figure 63.—Parsnip

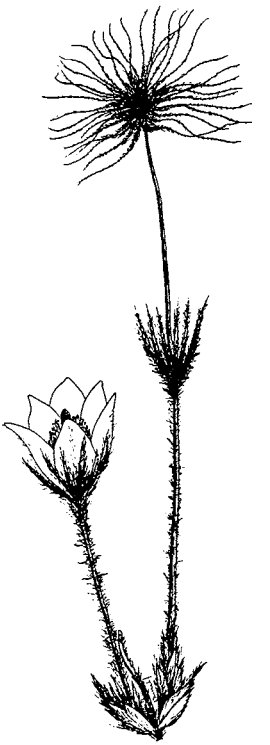

Figure 64.—Pasqueflower

PASQUEFLOWER, *Pulsatilla hirsutissima* (fig. 64).—This is one of the earliest flowers of spring and is commonly found in canons, foothills, and prairies. The pale-blue flowers are quite conspicuous, as are also the spherical, hairy seed heads that are produced later. The plant contains an acrid, irritating substance, "anemonine," that may cause irritation and blistering of the skin. It is considered poisonous. The leaves and stems are very hairy; sheep sometimes eat them, with the result that they develop hair balls in their stomachs.

PIGWEED, green amaranth, redroot, *Amaranthus retroflexus* (fig. 65).—Pigweed is a tall annual weed common to fields and waste places. The roots and lower parts of the stems are usually

red. The seeds are hard, shiny, and black, and they become widely scattered. The plant is relished by cattle and contains no poison. However, animals have been known to die from eating it in large amounts. The plants are very succulent and may cause severe bloat.

POISON-IVY, poison sumac, *Rhus rydbergii* (fig. 66).—This plant is commonly found along ditch banks, rocky hillsides, fence rows, and waste places. It is sometimes called three-leaf ivy. It is a low shrub 1 to 3 feet high, with three-parted leaves and clusters of small berries that are white when ripe.

This plant has a milky, acrid sap and is poisonous to the touch. It is of no significance as a stock-poisoning plant, but frequently it poisons human beings.

Figure 65.—Pigweed

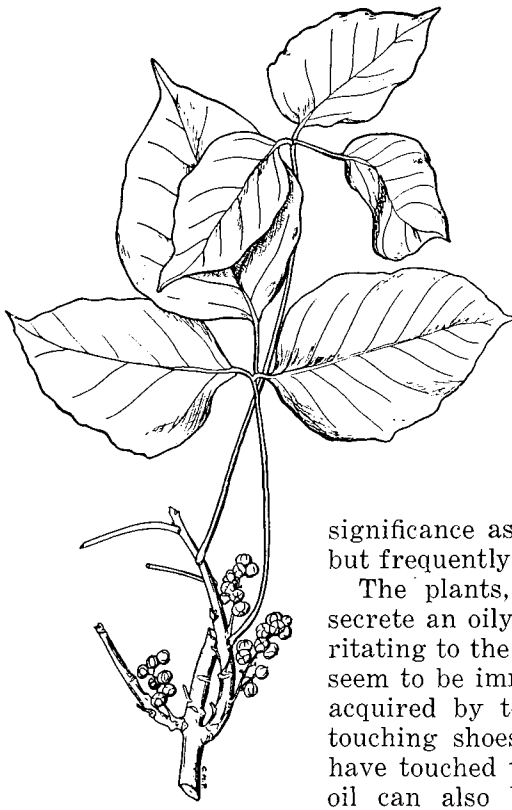

Figure 66.—Poison-ivy

The plants, particularly the leaves, secrete an oily, toxic substance very irritating to the skin, though some people seem to be immune. The poison can be acquired by touching the plant or by touching shoes, clothing, or tools that have touched the plant. The poisonous oil can also be transferred to other parts of the body by touch.

If one has touched ivy, he should avoid touching his face or rubbing his eyes. The hands should be thoroughly washed in a lather of strong soap. Do not put greasy salve or any lotion, such as witch hazel, on affected parts, as this only spreads the poison.

A solution of common baking soda is an effective first aid. A solution of 8 grams of ferric chloride dissolved in 50 cc of one-half water and one-half glycerine rubbed on the hands is a good preventive where one has to mow or hoe in poison-ivy. The solution, while not a cure, is of benefit after exposure to the poison. In cases of severe poisoning a physician should be called. Poison-ivy can be killed by salt or by spraying with caustic soda or with chlorates.

POPPY, common garden poppy, *Papaver somniferum.*—The poppy is a conspicuous, bright-colored flower of the gardens which occasionally escapes into waste places. It contains a number of injurious alkaloids.

POTATOES.—Poisoning of horses running on potato fields has frequently been reported from the San Luis Valley, where it is most prevalent in the fall after the culled potatoes have had a chance to undergo freezing and thawing. There may be some recurrence in the spring at the time the ground is thawing out.

The symptoms are usually incoordination of gait and paralysis of the throat; while the animal attempts to eat and drink, it may be unable to swallow. Usually constipation is associated with the disease. The weakness continues until the animal goes down and dies in a short time thereafter. There is no rise in temperature. There are no cerebral symptoms such as are shown in encephalomyelitis.

It is dangerous to drench animals in this condition on account of the paralysis of the throat. When medicaments are administered, they must be given through the stomach tube. The promotion of elimination, both from the bowels and kidneys, is desirable. Some animals recover under treatment.

Potato plants contain the same poisonous substance as the nightshades and other solanums, the alkaloid "solanin," which occurs in dangerous amounts in unripe and green potatoes and may develop in tubers left on the ground after digging and exposed to the sun. Wilted, green stems and leaves also contain the poison.

It is unsafe to run horses on potato fields after the potatoes have been dug. Keeping horses off potato fields and preventing them from eating spoiled potatoes which are sometimes thrown out of cellars in the spring will prevent the development of the disease.

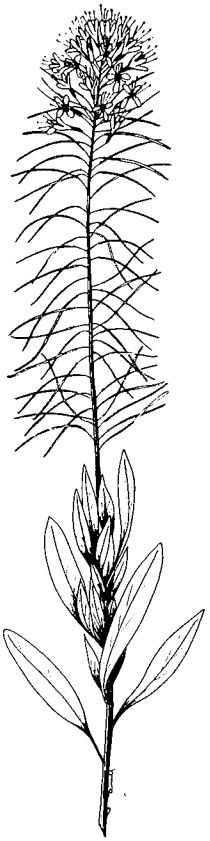

Figure 67.
Princesplume

PRINCESPLUME, *Stanleya bipinnata* (fig. 67), is among plants which are reported as containing selenium if grown on shale soils bearing that element (see "Selenium-Bearing Plants").

PSILOSTROPHE, paperflower, *Psilostrophe tagetina*.—This plant has been reported from Texas as causing extensive sheep losses. It occurs in Southern Colorado, and while it has not been known to cause losses in this state, it is mentioned as a possible sheep-poisoning plant.

The plant is a low-branched, woolly herb, with alternate linear leaves and small heads of yellow flowers. Animals eating this plant develop a weakness in the legs, and they stumble when running. They regurgitate their food. The symptoms do not appear until about 3 weeks after the sheep begin to eat the plant. Death may result.

No remedy is known. Changing animals to pastures free of the weed is recommended.

PSORALEA, *Psoralea tenuiflora* (fig. 68).—Psoralea is a common plant of the plains and foothills. The plants grow singly, about a foot tall. They are slender and branched, with small leaves covered with minute dots. The flowers are small, blue, and pea-like.

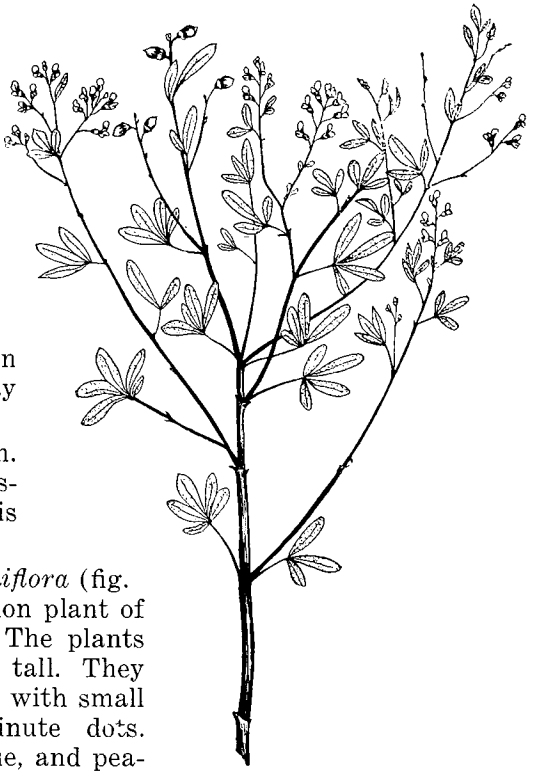

Figure 68.—Psoralea

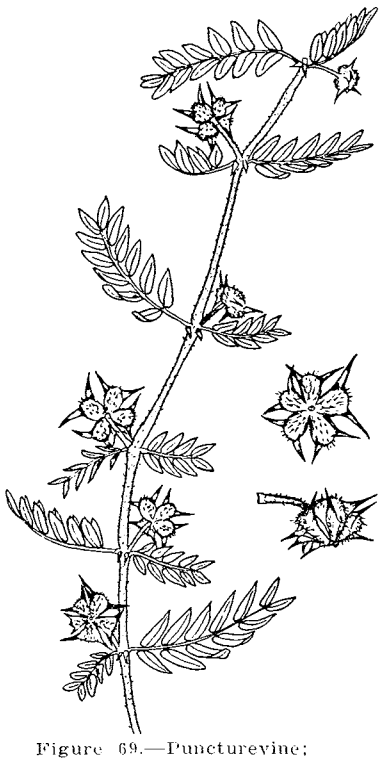

Figure 69.—Puncturevine; *right*, burs

Psoralea is reputed to be poisonous, but stock seldom eat it, and it cannot be considered as of importance.

PUNCTUREVINE, *Tribulus terrestris* (fig. 69).—This is an introduced weed usually found growing in sandy soil. It has become very common in this state and is a troublesome weed. In cultivated fields the sharp spines on the seed pods are an annoyance during cultivation and harvesting.

In South Africa the plant is considered poisonous to stock, and it is reported to be a cause of bighead and photosensitization (see "Bighead or Photosensitization").

RED SORREL, sheep sorrel, *Rumex acetosella* (fig. 70).—Red sorrel is a low-growing, perennial plant sometimes found in pastures, fields, and waste places. It is not as common in Colorado as in the acid soils of the East. The plant contains large quantities of oxalates that may be poisonous to stock if eaten in large quantities.

Figure 70.—Red Sorrel

RHUBARB, *Rheum rhaponticum.*—The leaves of this common garden plant contain large quantities of oxalates that are poisonous to animals eating them.

SAGE, *Artemisia* sp. (fig. 71).—Several species of artemisia grow in Colorado. They are generally browsed by stock. One species, *Artemisia filifolia,* is reported as causing "sage sickness" in horses. The disease develops in a few days when horses are first put on sage pasture. They show nervousness and unsteadiness on their legs, the front legs seeming partly paralyzed. With change of feed they recover, or in time they develop a tolerance to the weed and recover. The poisoning is most evident where horses not accustomed to sage are put on poor pastures where sage is the chief forage.

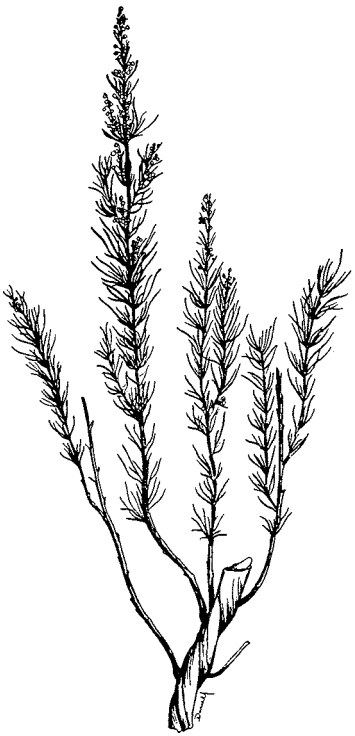

Figure 71.—Sage

Figure 72.—Saltbush, *Atriplex nuttallii; left,* male flowers; *right,* seed pods

SALTBUSH, *Atriplex* sp. (fig. 72).—A number of species of saltbush grow in the state. They are generally considered good forage for sheep. *Atriplex nuttallii,* however, is reported from Wyoming as a selenium-bearing plant if grown on soils containing that element.

SILKY SOPHORA, *Sophora sericea* (fig. 73).—This plant is common to the Plains region. It is a low-growing plant belonging to the pea family. It blooms in early summer, and the flowers are white and pea-like. The plants contain a poisonous alkaloid and are suspected of causing stock poisoning.

SKELETONWEED, prairie pink. *Lygodesmia juncea* (fig. 74).—Skeletonweed is a slender, smooth, perennial weed common to the prairies. The leaves are very narrow and rigid, and pink or purplish flowers are borne at the ends of the branches. Round insect galls commonly occur on the stems. The plant contains a bitter, milky juice, and is reported as poisonous.

Figure 73.—Silky Sophora; *right*, seed pod

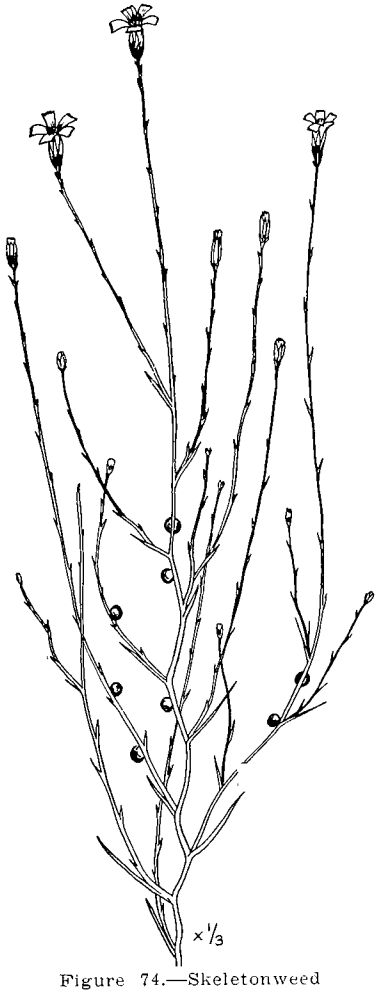

Figure 74.—Skeletonweed

SLEEPY GRASS, *Stipa vaseyi*.—This is a tall bunch-grass common to foothills and prairies. It is eaten by stock in the spring when tender. It is reported as containing a narcotic

substance that affects animals when large quantities are eaten (see also "Mechanical Injury").

SNEEZEWEED, western sneezeweed, yellow weed, *Helenium hoopesii* (fig. 75), *H. autumnale.*—Both of these species occur in Colorado. *H. hoopesii* is the important one that grows on the high-altitude ranges. It is a perennial growing 1 to 3 feet high, with one to several stems. When it is young the plant is often hairy, but later it becomes smooth. The composite flowers are borne in clusters of one to several, orange-colored with darker centers. The seeds are numerous and hairy. All parts of the plant are poisonous. Dried plants are less poisonous than green ones.

The poison is accumulative; approximately 2 pounds per day for 20 days is necessary to produce illness. The poisonous principle is "dugalin," a toxic glucoside cumulative in its action.

Figure 75.—Sneezewood, *Helenium hoopesii*

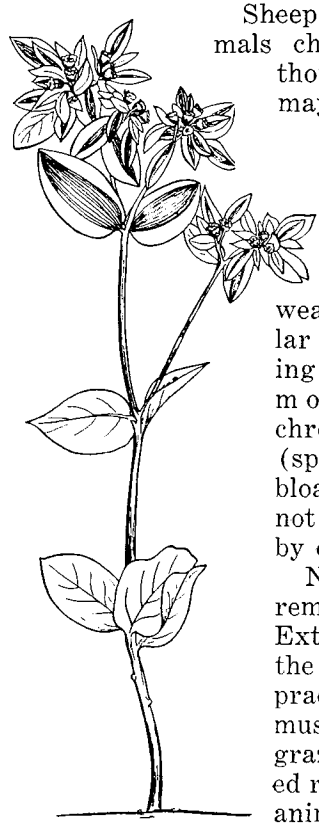

Figure 76.—Snow-on-the-Mountain, *Euphorbia marginata*

Sheep are the animals chiefly affected, though cattle also may be affected. The most prominent symptoms are general depression, coughing, weakness, irregular pulse, frothing at the mouth, more or less chronic vomiting (spewing), and bloating. Death is not accompanied by convulsions.

No medical remedy is known. Extermination of the plant is not practicable. Care must be used in grazing on infested range, keeping animals from eating the plants. Move animals to a lower altitude.

SNOW-ON-THE-MOUNTAIN, spurge, *Euphorbia marginata* (fig. 76).—This is a bright-green, erect annual 1 to 4 feet high. The upper leaves have white margins. The plant contains a milky acrid, irritating juice. It is frequently found in overgrazed pastures, along roadsides, and at waste places. Usually it is considered poisonous. Other species of spurge, as *Euphorbia cyparissias* (fig. 77), occur in the state as weeds in pastures, and along roadsides and ditch banks. Generally they have an acrid, irritating juice which will produce blistering of the skin.

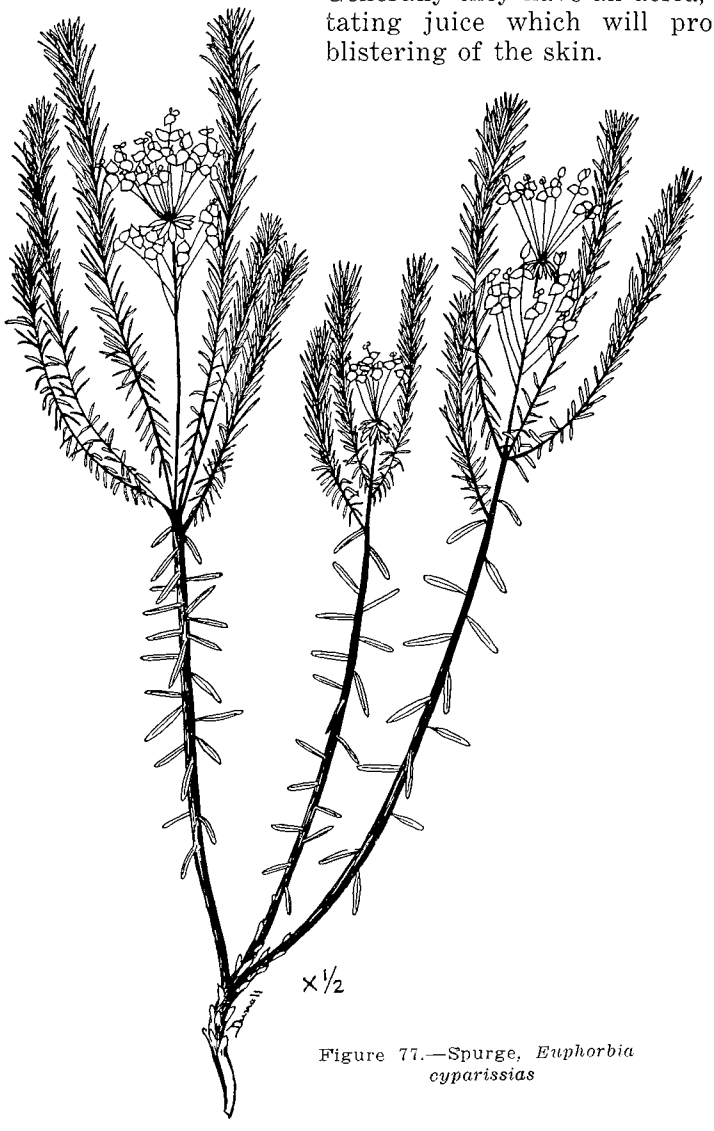

Figure 77.—Spurge, *Euphorbia cyparissias*

TIMBER MILKVETCH, *Astragalus hylophilus* (fig. 78).—Vetch is a short, bushy plant 8 to 16 inches tall, with numerous slender stems arising from the crown of a perennial root. The leaves are compound, with narrow leaflets. The flowers are small, pea-like, and bluish; and they develop into short, brownish pods containing bean-like seeds.

The plant occurs in the northern part of Colorado, being very common in the northwest corner of the state. Its range extends north into Canada. Horses, cattle, and sheep eating this plant become poisoned.

Symptoms in cattle are best known, and as described by Bruce in British Columbia they consist of incoordination, difficulty in respiration, and wheezing or roaring, especially when driven. The weakness is particularly confined to the hind legs, so that when pushed the animals weave from side to side. In dragging one hind foot past the other, the fetlock is struck with the dewclaw, making a crackling noise and giving the disease the stockman's name "cracker heels." Emaciation develops, the animals stop eating, and death may follow after a period of several weeks.

Sometimes the animals are affected during the late summer and are carried through the winter with improvement, but come down again the following year. Vomiting is occasionally seen in badly-affected animals. The acute type is not often seen on the range, but in experimental cases it is associated with a particularly rapid and weak heart. Animals, on being driven, go down and sometimes die rather suddenly of dilation of the heart. Incoordination is also noted in the acute cases.

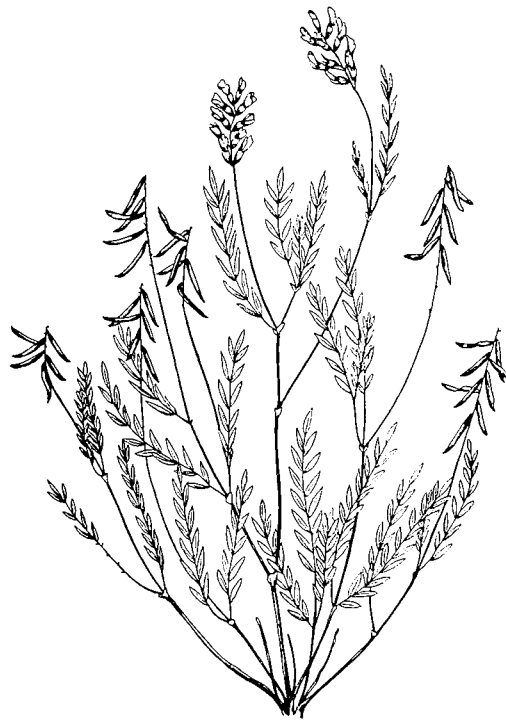

Figure 78.—Timber Milkvetch

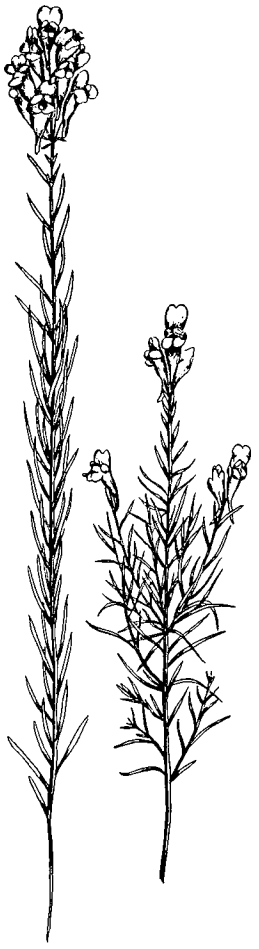

Figure 79.—Toadflax

One peculiarity of the disease is that under natural conditions it affects only female animals during the period of lactation. Bulls, steers, and dry cows are not affected. No satisfactory explanation has been given for this peculiarity. The disease in Colorado appears to be confined to the northwestern counties.

No treatment seems to be of any particular value. Removal from the offending forage and providing good nutrition are sometimes helpful in recoveries; but many of the animals remain worthless, even though they do not die.

Keeping the animals from the range where the plants are especially prevalent is the only satisfactory means of prevention. No satisfactory means of eradication of the plant has been discovered. More-detailed information regarding timber milkvetch is available in Colorado Experiment Station Bulletin 425, "Timber Milkvetch as a Poisonous Plant in Colorado."

TOADFLAX, butter-and-eggs, *Linaria vulgaris* (fig. 79).—Toadflax is a small, tufted herb with yellow flowers borne in slender clusters. The flower has a spur at the base. These plants are rare in the state but occasionally are found growing in waste places. They are native to Europe. They contain a poisonous glucoside and may be regarded with suspicion.

Figure 80.—Tobacco

TOBACCO, *Nicotiana attenuata* (fig. 80).—Wild tobacco is occasionally found in Colorado. It is a slender weed 1 to

1½ feet tall, with narrow leaves and whitish, tubular flowers. The plant is considered poisonous if it is eaten in sufficient amounts. Cattle, horses, and sheep may be affected, though cattle are most susceptible. When it is eaten in small amounts, it gives odor and taste to milk.

WATERPARSNIP, *Sium cicutaefolium* (fig. 81).—This is a stout, smooth, perennial plant growing 2 to 6 feet tall, with compound leaves having toothed edges and umbrella-like clusters of white flowers. It is reported as poisonous.

WILD LETTUCE, blue lettuce, *Lactuca pulchella* (fig. 82).—This is a tall perennial lettuce with slender, erect, unbranched stem 1 to 3 feet tall. Its leaves are deeply lobed or toothed, and the flowers are blue. The juice is milky. Wild lettuce is eaten by sheep. It contains a narcotic substance and is considered slightly poisonous.

WOODSORREL, *Oxalis violacea* (fig. 83).—Woodsorrel is a low, perennial herb, with three-parted leaves resembling those of a clover. The flowers are pink-to-violet and in loose clusters. The sap of these plants is very sour and contains oxalates. Woodsorrel

Figure 81.—Waterparsnip

Figure 82.
Wild Lettuce

is not common in the state, and is not generally eaten by animals. The plant is reported to be poisonous.

WOODY ASTER, *Xylorrhiza parryi* (fig. 84).—This is a daisy-like plant growing 3 to 6 inches tall, bearing white flowers with yellow centers. The plant grows from a strong, woody root more or less branched at the surface of the ground, giving the plant a tufted appearance. It is found in Northern Colorado in denuded or saline soils, and frequently it is found about lakes and ponds.

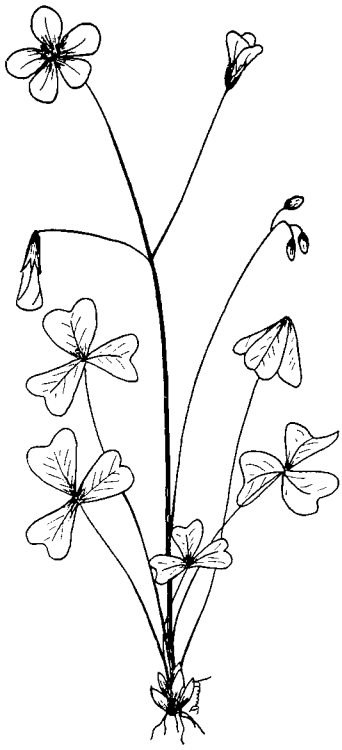

Figure 83.—Woodsorrel

Figure 84.—Woody Aster

The plant begins to leaf out about the first of May, and it blossoms about the first of June. All parts above the ground are poisonous. The poisonous period is from the showing of the first leaves to the end of the blossoming period. The aster is most poisonous during the early growing period. During growth it is always poisonous. The presence of moisture increases the toxic action. Sheep are chiefly affected.

The symptoms of aster poisoning include weakening of the muscles of the legs to the extent that the animal may fall. The muscles of the neck also weaken. The pulse quickens for a time and later becomes weak, with the temperature rising. The breathing becomes labored. Usually the animal is bloated. Frequently there is bloody frothing from the mouth and nose. Before death there is complete prostration and unconsciousness. Death ensues in from 4 hours to 3 or 4 days (see also "Selenium-Bearing Plants").

No specific remedy is known. Keep the animals away from patches of asters.

YARROW, millefoil, nosebleed, *Achillea millefolium* (fig. 85).—Yarrow is a common, perennial weed of pastures and waste places. The stems are erect and 1 to 2 feet tall; the leaves are finely divided; the flowers are white and in dense, flat-topped clusters. The plant is strong-scented and has a bitter taste. It is astringent and contains an alkaloid, "achillein," that has a decided action on the blood-vessels. It is seldom eaten and apparently is not poisonous to stock.

Figure 85.—Yarrow

YELLOW BEAN, *Thermoposis* sp. (fig. 86).—The yellow bean is a tall, perennial legume with three-parted leaves and clusters


Figure 86.—Yellow Bean

of large, yellow, pea-like flowers. The plant is found growing in patches throughout the foothills and mountains, and along streams. It blooms in spring and early summer. The yellow bean is suspected of being poisonous.

YELLOW SWEETCLOVER, *Melilotus indica.*—Yellow sweetclover may cause hemorrhages in cattle and sheep. Although a great deal of work has been done to determine what the poisonous principle actually is, the result so far has been quite negative. It does not seem to be oxalic acid nor cumarin. It can be boiled for long periods of time and still not be destroyed.

There is no evidence that green plants are ever injurious nor that bright, clean, properly-cured hay is toxic. Most of the damaged hay with which investigators have worked has been moldy, although there is no evidence that the mold in itself contains the active principle. Apparently the injury takes place in the curing process, since sweetclover is usually quite fibrous and is not readily cured.

Cattle, sheep, and rabbits have been injured experimentally, but under natural conditions only cattle seem to be affected.

After eating damaged sweetclover for at least 3 weeks, hemorrhages take place in various parts of the body; the animals become very weak and anemic, and die as a result of the loss of blood. If these hemorrhages take place near the surface of the body, large swellings are seen. There is no pre-existing anemia, and the work done so far gives no evidence as to the cause of the hemorrhage. Undoubtedly the coagulation time of the blood is greatly delayed, but there is no lack of calcium nor loss of platelets to explain the phenomenon. Occasionally an animal will suffer from several hemorrhages in succession before death takes place. Not infrequently the disease is only known to occur by hemorrhages following minor cuts or operations. Serious losses have occurred following dehorning and castrating of cattle that had previously been fed sweetclover hay.

Feeding only undamaged sweetclover hay is believed always to prevent the disease. However, some hay which appeared perfectly sound has been shown to be moldy inside the stems and, as a consequence, toxic. Sweetclover hay can be alternated with alfalfa, either by mixing the two together or by feeding sweetclover one week and alfalfa the next; usually this will be effective in preventing the disease. Before attempting any operations on cattle being fed sweetclover, they should be removed from the forage for at least 3 weeks, and given other hay.

YUCCA, soapweed, *Yucca* sp.—Yucca is a perennial plant common to plains and foothills. Its leaves are fibrous, narrow, rigid, and erect, arising in a tuft from a thick, short stem and

root at the groundline. The flowers are large and white and are borne in clusters on stout stems 1 to 3 feet tall. The leaves contain salicylic acid, and the roots contain saponin. (See also "Mechanical Injury.")

Mechanical Injury

There are several plants common to Colorado which, though not poisonous, cause considerable injury to stock. These plants have spines, beards, or fibers that produce hair balls or get into and tongue or gums, or even into eyes or skin, of animals. There they cause inflammation or ulcers, often with serious results.

WILD BARLEY, squirreltail grass, *Hordeum jubatum* (fig. 87).—This grass is an annual or a short-lived perennial. It grows 6 inches to 2 feet tall, in bunches that become purple or silvery at maturity. It is common in low, wet places at the edges of ponds or swamps. It is found throughout the state up to 9,000-feet elevation. The flowering head is about 4 inches long and equipped with long awns (fig. 88-*B*). The green plant can be eaten by stock, but when mature the long beards cause injury to the mouth and may result in lumpy jaw. Mowing several times a season is necessary to prevent seeding. Immature heads left on the ground after cutting may mature.

Figure 87.—Grasses causing mechanical injury; *left*, wild barley, or squirreltail grass; *right*, downy bromegrass

PORCUPINE GRASS, needle grass, *Stipa* sp.—These grasses are common to many sections of Colorado. They are tufted perennials. Each grain bears a long beard or awn (fig. 88-*C*) which is twisted at the end and is very hydroscopic, twisting up in dry weather and untwisting in wet weather. At the base this grain is sharp-pointed and covered with barbs.

The seeds of these grasses often work into the mouth parts of animals, causing ulceration; they also work into the hair or wool, and the skin, producing irritation. Hides punctured by these seeds are damaged. The seeds often get into the eyes of sheep, causing blindness.

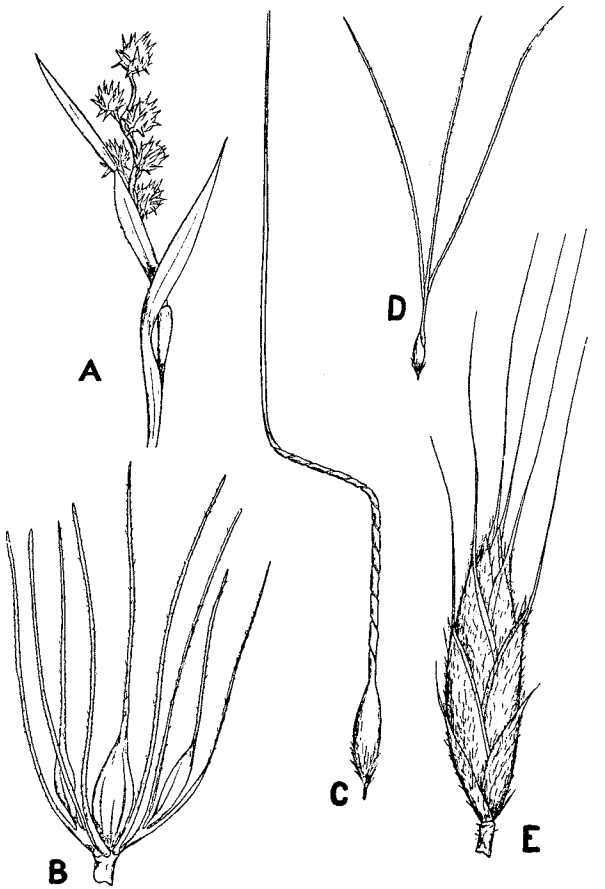

Figure 88.—Grass parts causing mechanical injury; *A*, fruit of sandbur; *B*, spikelet of wild barley, or squirreltail grass; *C*, seed of needlegrass; *D*, seed of poverty grass; *E*, spikelet of downy bromegrass

WILD OATS, *Avena fatua.*—This is an annual plant resembling cultivated oats. It has long, slender stems and is usually taller than cultivated oats, with which it may be found growing. The grain is tipped with long, bent awn, and covered with barb-like hairs at the base. Its action is like that of needle grass and porcupine grass.

DOWNY BROMEGRASS, *Bromus tectorum* (fig. 87). — This grass is a short annual, usually growing about 1 foot tall. The leaves are soft and hairy, and the heads are slender and drooping. At maturity the plant becomes purplish in color. It is an introduced plant, growing along roads and fences and in waste places; it is rapidly spreading to native pastures. The long beards (fig. 88-*E*) frequently cause serious injury by getting into the mouths of animals, causing inflammation and even loss of teeth.

SANDBUR, *Cenchrus tribuloides* (fig. 88-*A*).—The common sandbur is an annual grass with long, prostrate stems. The characteristic feature of the plant is the spiny covering surrounding the seeds. The spines of this bur-like structure are stout and barbed. The plant is found growing in sandy places throughout the lower altitudes in Colorado. The seed matures in the period from July to September. It causes irritation around hoofs of animals.

POVERTY GRASS, three-awned grass, *Aristida longiseta* (fig. 88-*D*).—This is a tufted grass common to plains regions, growing about 1 foot tall. It is one of the chief grasses of the Eastern Plains Section of the state, and is prevalent in overgrazed areas. The chief characteristic of this grass is the three-pointed beard or awn that tips the end of the mature seed. It may cause mechanical injuries such as those caused by other previously-mentioned grasses.

COCKLEBURS, CLOTBURS, and BURDOCKBURS sometimes cause injury, and even death. They occasionally become lodged in the stomach or intestines of animals, where they ball up. Cocklebburs, when sprouting, produce a definite poison that is particularly poisonous to pigs (see "Cocklebur").

The fibers of cactus and yucca may produce hair balls when these plants are eaten under stress of drouth and shortage of feed. The hairs of the leaves of red clover or crimson clover, and beards of barley, may do the same.

The coarse fibers of oak and woody shrubs may result in irritation or impaction when too-extensively browsed without supplementary feed. Pingue, or Colorado rubber plant, contains considerable rubber in its leaves, and may ball up with injurious results if eaten extensively.

Cottonseed Meal Poisoning

Cattle and swine sometimes become poisoned from eating cottonseed meal. Some years ago this poisoning was thought to be due to the substance "gossypol," but more recent investigation

indicates that that was an error. Suspicion is now cast upon a deficiency of vitamin A, rather than upon any actually poisonous substance in the cottonseed itself.

Mature cattle can eat as much as 9 or 10 pounds of cottonseed meal per day if on a green pasture or on plenty of green alfalfa hay, whereas as low as 1 pound per day has caused symptoms in animals on a ration in which vitamin A was deficient. The Oklahoma Experiment Station has shown that calves could be safely allowed to eat all they would naturally take when the meal was placed before them, if at the same time they were receiving a good quality of wild hay, whole milk, and cod-liver oil. When, however, amounts from 1/10 up to 4/10 pound were added to the milk and thus force-fed, disaster overtook many of the calves in 20 to 60 days. This occurred despite the feeding of wild hay and cod-liver oil along with the cottonseed meal.

Pigs can safely be allowed to follow steers that are receiving cottoncake or cottonseed meal, provided the pigs do not have access to the meal itself. In case either the meal or the cake spills out of the trough and the pigs eat it directly, losses frequently occur.

In cattle in the feedyards on rations of 2 to 4 pounds per day of cottonseed meal, symptoms rarely develop unless there be an extreme shortage of vitamin A, and even then usually not short of about 100 days of feeding. A recent experience at this station is somewhat enlightening on this subject. In lots of steers receiving varying amounts of cottoncake along with cane fodder and oat straw for roughage, similar animals showed symptoms in the lots receiving 2, 1½, and even as low as 1 pound of cake—this despite an experience of the previous year in which exactly the same rations had been fed with no untoward results.

The difference was that, in the particular year under consideration, drought was extreme, and the vitamin-A content of oat straw and cane fodder was undoubtedly impaired. Animals receiving the same amounts, and with alfalfa hay as a roughage, showed no evidence of disease.

All things considered, there is no question that green pasture, alfalfa hay, and wild hay are highly protective against the injury caused by cottonseed meal, but there is still some doubt whether vitamin A alone is the protective substance. It appears to the writers that the symptoms of cottonseed poisoning and vitamin-A deficiency, although similar, are not identical.

Young animals, being particularly susceptible, frequently

die in convulsions without other premonitory symptoms. Mature cattle develop symptoms only after 3 months or more on cottonseed products, and then the first evidence is in the eye. Animals otherwise normal and eating well are suddenly found to be stone blind. If the pupil is examined it will be found to be enormously dilated, so that the lens is visible. Being blind, the animals run into fences and into other animals in the yard. There is no inflammation at this time, and no discharge from the eye.

If the animals are continued on the cottonseed they later become stiff, their appetites are impaired, their coats stare, discharge develops from the eyes, and there may be drooling from the mouth. Finally convulsions will take place, and the animals will die in spasms.

The younger the animal the less cottonseed meal can be taken without injury. Usually, however, if taken at will and in the presence of the protective substances, the animals will not eat too much. This statement probably does not apply to pigs. When fed with good-quality alfalfa or wild hay, or with green pasture, apparently large quantities may be given. When symptoms develop, if the cottonseed is removed from the ration the animals usually show improvement, although if blindness has occurred they may never be able to see again. In drought years less cottonseed meal can be fed than at other times. No medicinal treatment has been found effective.

Prussic Acid Poisoning

Several plants are known to contain prussic acid under some conditions. Wild cherry (fig. 12) and arrowgrass (fig. 3) may contain this poison, but sorghum, or cane, more commonly poisons from this cause. Sorghum *(Andropogon sorghum)* is an annual cultivated grass growing 4 to 8 feet tall and bearing large, dense seed heads. Johnson grass *(A. halapense)* and sudan grass *(Holcus sudanensis)* are closely-related species. Sudan crosses readily with sorghum, and the resulting plants carry the same poisonous properties as sorghum. All plants of this group should be fed with caution.

Prussic or hydrocyanic acid is a very violent poison. Plants may develop from 0.02 to 0.2 percent of this toxic substance. It is not believed that prussic acid is present as such in the plant, but that it occurs as a glucoside which is changed into the acid by means of a ferment already present. Moisture seems to be essential to this change, which probably accounts for the fact that at times animals may eat considerable quantities of dangerous plants without immediately developing symptoms. In some instances symptoms have occurred some hours later when the

animals gained access to water. This accounts for the general belief that certain waterholes are poisonous. In one instance known to the writers, sheep consumed large quantities of chokecherry leaves early in the morning and did not show symptoms of poisoning until noon, at which time they were watered at a small stream.

It is well known that at certain times plants may be consumed with impunity, whereas under other conditions they are highly toxic. The sorghums, especially, store hydrocyanic acid if for any reason the plants are stunted. During drought plants become dangerous, also when the growth is retarded by frost. It is generally believed that the plants must be in the green condition in order to be toxic. However, feeding of dried sorghums has in several instances been followed by such serious losses as to cast suspicion upon them. There was no definite proof that the dried plants associated with these outbreaks contained prussic acid, and until that evidence is forthcoming dried forage should be considered safe.

Careful workers have estimated that, measured in terms of potassium cyanide, approximately 2 milligrams per kilogram of body weight are required to produce death. Estimating the average sheep at 100 pounds and a cow at 800, this would mean 100 milligrams as the fatal dose for sheep, or 800 milligrams for cattle. If plants contain 0.02 percent, this would mean 5 pounds of the forage for poisoning horses or cattle, or a little over 1 pound for sheep. Since it is known that plants sometimes contain 10 times this amount, it can be seen that corresponding reductions could be made in the amount of plants to be consumed.

Symptoms develop in from a few minutes after eating the plants to several hours, dependent upon the action of the enzyme and the release of the prussic acid. The first symptoms are rapid, difficult breathing and accelerated, weak heart action. These may be followed by muscular spasms that finally become so severe that the animal is thrown to the ground. These spasms may continue at intervals until death takes place. Death is caused by paralysis of respiration, the heart always beating for a considerable time after breathing stops. Death may take place in from a few minutes to some hours after symptoms develop. There are no lesions that are diagnostic of this condition.

Recent investigation indicates that certain antidotes are effective if administered either intravenously or intraperitoneally. The two which show the most promise are sodium nitrite and sodium thiosulfate (hypo). Either of these will protect cattle and sheep against as much as 1½ lethal doses of potas-

sium cyanide. When combined, protection may be had against as much as 2 lethal doses for cattle or 2¾ doses for sheep. Sodium nitrite may be harmful in itself, and consequently not more than 1 gram should be given to sheep nor 3 grams to cattle. Both substances are used in 10-percent solution.

Bunyea, of the United States Bureau of Animal Industry, recommends a dose of 10 cc of a 10-percent aqueous solution of sodium nitrite and 30 cc of a 10-percent aqueous solution of sodium thiosulfate. These are given intraperitoneally to sheep and can be given together. The cattle dose of the 10-percent solution of sodium nitrite is 20 to 30 cc, and of the sodium thiosulfate 100 to 200 cc. These may be given intravenously. Their value in any particular case will depend upon the rapidity with which they are given and the amount of prussic acid contained in the forage eaten by the animal.

The best method of prevention obviously consists of keeping the animals from grazing the dangerous forage. In drought years or late in the fall it is better not to attempt to feed the sorghums green, but only after they have been cut and dried. In driving animals, they should not be held in the neighborhood of wild-cherry bushes, especially when hungry. Steyn, in South Africa, has found that the administration of sulfur is very helpful in preventing poisoning from cyanogenetic plants. It may be administered by drench or capsule, or in the feed, but the easiest and most effective way is by the addition of sulfur to the salt lick. He found that the addition of sulfur to salt in the proportion of 1 to 12 was quite effecive in the prevention of the poisoning, even when the animals were grazing highly toxic forage. The action of the sulfur is to change the prussic acid to a nonpoisonous compound.

Weeds Affecting Flavor of Milk

Several plants found in our pastures and ranges cause strong, disagreeable flavor in milk from cattle eating them. The following are known to act in this manner: Wild tobacco, wild onion, sneezeweed, and giant marsh-elder.

Selenium-Bearing Plants

Beath believes that the diseases which have been variously termed by stockmen as "alkali disease" and "blind staggers" in horses, cattle, and sheep are in reality due to plants which bear a high content of selenium. Several such plants, milkvetch (*Astragalus bisulcatus,* fig. 54), princesplume (*Stanleya bipinnata,* fig. 67), saltbush (*Atriplex nuttallii,* fig. 72), stickleaf (*Mentzelia decapetala,* fig. 53), and woody aster (*Xylorrhiza*

parryi, fig. 84), are reported as containing large amounts of selenium if grown on shale soils bearing that element.

In the more-acute cases of selenium poisoning the animals walk aimlessly; and the vision is apparently impaired, as they run into fences and posts. The digestive system is said to be inactive. At this time the appetite is also depraved, the animal being noted to chew on fence rails, pieces of bone, or any metallic object. Finally paralysis results; the animal grits its teeth and drools from the mouth. Schoening observed the more-chronic conditions as they appear in horses and cattle. He mentions the abnormal growth of the hoofs, with the formation of deep rings. There is considerable stiffness and emaciation on the part of the animal. The hair falls out, particularly the hair of the mane and the tail in horses. On post mortem there are erosions in the articular surfaces. The conditions which he describes may prevail for several months, or even years; and the animals may recover when placed on good food.

The only satisfactory prevention seems to be in the removal of animals from selenium-bearing shales. Beath is of the opinion that repeated injections of strychnine are of value in the treatment of the disease, especially when followed by good hay and a good quality of concentrate.

Bighead or Photosensitization

Many years ago it was recognized that buckwheat sensitized the white skin of cattle, so that sunlight produced in them a severe dermatitis. Since that time a number of plants have been suspected of producing similar conditions. Among them are clover, smartweed, St. Johnswort, sudan grass, coal-oil weed *(Tetradymia glabrata, T. inermis)*, and spineless horsebrush.

In South Africa a condition in sheep known as "geeldikkop" (bighead) has been shown to be due to the consumption of puncturevine *(Tribulus terrestris)*. While tribulus is widespread in this country, there is no evidence that it is responsible for any such disease. Extensive outbreaks of fagopyrism, or bighead, have been described in several of the western states. The disease usually develops following a hard drive in the heat of the summer. Sometimes the losses are quite severe. While no great loss has been reported in Colorado, the disease has appeared on several occasions, most commonly during the fall when lambs are brought in for feeding.

The disease is apparently more prevalent in young animals than in old. The symptoms are swelling of the skin, lips, eyelids, and ears, followed by an oozing of serum from these areas, and

the formation of scabs. Later edematous areas appear in the region of the throat. Sometimes, in the more acute cases, there is intense itching of various parts of the body. Occasionally death will result without the local symptoms. Frequently there is a yellowish discoloration of the mucous membranes.

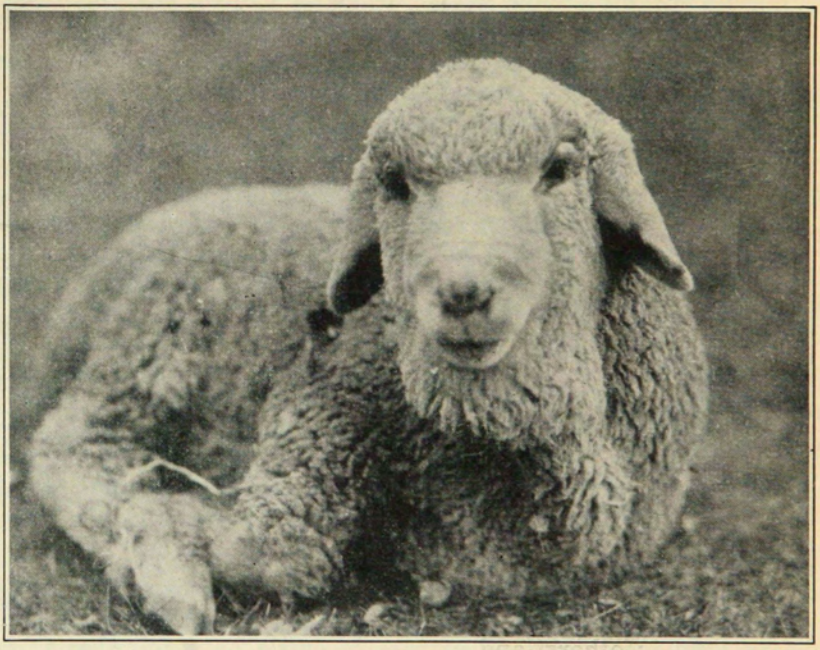

Figure 89.—Sheep afflicted with bighead or photosensitization. Note the puffed face and the thickening of ears and lips

The South African workers first showed that obstruction of the bile duct by means of a surgical operation would produce similar photosensitization. They then isolated a pigment from chlorophyll called "phylloerythrin," which they believe to be responsible for the condition in normal sheep, both when tribulus was fed and when the bile duct was obstructed. So far as our knowledge goes, no similar work has been done in this country. Consequently, there is no exact knowledge as to the causative factor. It is apparent, however, that several plants are responsible, and possibly others are still unknown.

As the plants producing bighead become better known, animals may be herded away from those that are most dangerous. Since bright sunlight seems necessary for development of the disease, keeping the animals in the shade as much as possible

is suggested as a means of handling. It is very doubtful if any medicinal treatment is available.

Cornstalk Disease

For at least 50 years a disease has been recognized under this name as affecting cattle and horses in a number of Mississippi Valley and Plains States. Usually it does not occur until after the animals have run on stalk fields for several weeks. Suddenly several animals may die in one day. Usually the remaining animals are immediately removed from the field, and the loss ceases. It is often possible some weeks later to feed off the same field without any recurrence of the disease.

While a great deal of attention has been given to the cause, it cannot be said that any real progress has been made. At one time it was thought that potassium nitrate was formed in the juice that exuded from the stalks, but this theory seems to have been exploded. Still later the disease was regarded as infectious and was called hemorrhagic septicemia. While hemorrhagic septicemia may exist in stalk fields, investigators do not now regard cornstalk disease as being identical with that malady. The rapidity with which it strikes would lead to a supposition of the formation of prussic acid, but most tests for that poison have been negative, and the conditions which generally prevail in plants producing prussic acid are not present in the cornstalks.

This disease usually occurs after the stalks are thoroughly dry, in the late fall and early winter. It is much worse in some years than in others, and owners of cattle have felt that these bad years were associated with a lack of maturity in the ears. After a certain time the rudimentary ear becomes moldy and is looked upon by some people as being especially dangerous. The chief objection to this theory is that molds have repeatedly been fed to livestock with no serious results. In fact, the only reliable report of a mold in corn causing a disease in domestic animals comes from South Africa. All the work in this country has been negative. Pending further work, it cannot be said positively that the stalks are responsible for the disease, but there is strong evidence to that effect.

Cattle with cornstalk disease usually die more quickly than horses. Suddenly they are seen to stop eating; the breathing increases in rapidity and becomes audible. The head is usually extended, and the mouth is frequently open. Sometimes animals remain in this condition for only a few minutes, and at other times for several hours. They finally go down, do more or less struggling, and then die.

Horses show more cerebral symptoms, sometimes walking in circles, and at times stumbling into objects as though blind. Incoordination is associated with a sleepy condition, staggering, and going down. Intermittent struggling after 1 to 3 days is terminated by death. The disease simulates encephalomyelitis, the so-called "sleepy sickness," except that there is no rise in temperature. Graham was unable to transmit this disease by brain inoculations as has been done in encephalomyelitis. Until we know more about the cause of the disease, treatment seems to be of little value.

It is not possible to distinguish the fields that cause trouble from those that do not, and consequently the dangerous ones are recognized only after animals have sickened. Still more disconcerting, these same dangerous fields may sometimes be grazed out later with impunity. It is, however, good practice to remove the animals from the field as soon as any evidence of sickness is seen.

PLANT INDEX