

AGRICULTURAL EXPERIMENT STATION

KANSAS STATE AGRICULTURAL COLLEGE
MANHATTAN, KANSAS

PRINCIPAL POISONOUS PLANTS IN KANSAS



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PRINCIPAL POISONOUS PLANTS IN KANSAS¹

FRANK C. GATES

INTRODUCTION

With the increasing attention that has been paid to feed and feed products, together with the increasing congestion on farms and ranches, the subject of poisonous plants has been attracting more and more attention. Since the war there has been considerable experimental work in the field of poisonous plants, particularly by the Bureau of Animal Industry, United States Department of Agriculture, under C. D. Marsh and by certain agricultural experiment stations, especially Nevada, Colorado, and Montana. The most complete single source of information in this subject is a book by L. H. Pammel, entitled "Manual of Poisonous Plants." The increased activities along this line of work, however, have brought out many new and interesting facts that were not known at the time of its publication. This, taken together with the increasing number of requests for information, made it seem worth while to prepare a bulletin on the principal poisonous plants of this state. Acknowledgment is made of the use of Pammel's book and other sources of information in its preparation. However, all of the drawings in this publication were made expressly for it. Figures Nos. 1, 2, 14, 16 to 23, 51, 55 and 56 were made by S. Fred Prince; the rest by the author.

It should be clearly recognized that the treatment of poisoned animals can be more wisely undertaken by a veterinarian than by the average person without experience, but there are many points relative to the subject that will assist the average stockman in handling his animals to better advantage. In many cases even limited information may enable him to entirely avoid having his animals exposed to poisonous plants.

While some of the things that can be done are indicated in this bulletin, its primary purpose is to enable one to recognize, at sight, plants which are known to be important poisonous plants and to have some knowledge of those additional plants which, under certain conditions, cause trouble.

1. Contribution No. 298 from the Department of Botany.

DEFINITION

A poison may be defined as any substance which, when taken into the system, acts injuriously, in a manner neither thermal nor mechanical, tending to cause death or serious detriment to health.

While a poisonous substance is usually thought of as being eaten directly, this is not necessarily so, as there are certain substances which are not poisons, but in the process of digestion break up into different substances, one or more of which may be poisonous.

CLASSES OF POISONS FROM A BOTANICAL STANDPOINT

Most of the larger groups of plants have within them certain species which are poisonous in varying degrees to different animals or to all animals. It is only possible to learn by experience just what plants are poisonous, as there is no way to tell by looking at a plant whether it will be harmful to any particular animal. After one has acquired experience it is often possible to direct suspicion judiciously towards a certain plant, or certain groups of plants, but in every case experiments are necessary to determine whether it really is poisonous or not.

The following table will give a broad general view of the plant kingdom with some indication of the relative importance of the larger groups from a plant poisoning standpoint.

THALLOPHYTES:

Algae Some are poisonous; obtained in drinking water.

Fungi Some are poisonous.

BRYOPHYTES:

Liverworts None are recorded as poisonous.

Mosses None are recorded as poisonous.

PTERIDOPHYTES:

Ferns A small number are poisonous; some important, but not in Kansas.

Equisetum Poisonous.

Lepidophytes Not recorded as poisonous.

SPERMATOPHYTES:

Cycads Not recorded as poisonous.

Conifers A small number are somewhat poisonous.

Flowering plants..... Many are poisonous; in fact, taking the subject as a whole, this group is most important from the poisoning standpoint.

The algae that cause poisoning are almost without exception those that are found in stagnant water. The normally offensive odor may

be sufficient to indicate their presence, but only a microscopic examination can determine just what the forms of algæ present may be. Blue-green algæ, as a group, are perhaps the most pronounced in their effect.

Several fungi will cause poisoning, both among those frequently likely to be eaten and among those seldom or never available for consumption. Toxic poisoning from pathogenic bacteria is an important source of loss, but as the organisms are microscopic they are not within the scope of this bulletin.

FORAGE POISONING

There are many cases of poisoning through eating feeds which are unclean or have been damaged, particularly with the growth of molds, such as musty hay, molding corn, decomposing potatoes, as well as stagnant water. All of these may produce a gastrointestinal catarrh, which in severe cases may lead to gastroenteritis. Poisoning from this cause is not communicable, but may be brought on only by eating feed in the condition referred to above. Horses seem to be most susceptible, although mules are also affected, and in ordinary cases the trouble terminates fatally. The disease is characterized by lesions in the central nervous system and also oftentimes by ulcers in the intestinal tract. Trouble of this sort may occur anywhere where animals are either fed on such fodder or have access to pasture where the grass has become fermented or moldy. Acute attacks usually cause death, but it may be warded off sometimes by the administration of purges.

SILAGE POISONING

In some cases where the silo is improperly filled or the surface layer is exposed, certain molds may develop instead of the proper bacteria, and poisonous products are sometimes formed which when eaten by animals cause poisoning. Horses are perhaps most frequently affected. Death may occur, or if insufficient quantity is taken the animal will recover.

ERGOTISM

The ingestion of considerable quantities of feed containing ergot, especially by cattle and less so by horses, is sometimes the cause of serious losses. Ergot is normally found as a parasite on different species of both native and cultivated grasses, and perhaps most frequently on rye. It flourishes in rich soil and during warm, damp seasons. A poisonous substance in it acts on the central nervous system, causing convulsions, disintegrates the red corpuscles, and

in addition may produce inflammation of serous and mucous membranes. As a general rule the poison is taken in small amounts, but by accumulating over a period of days produces a chronic condition. Under such conditions there may be nausea, vomiting, colic, diarrhea or constipation. In the spasmodic type of the disease there is contraction of the muscles, producing spasms and delirium, and death may result either directly or indirectly. In this case pregnant animals usually abort. In the gangrenous type there is a constriction of the little blood vessels, which results in degeneration of the tissues, a coldness and numbness of the extremities, followed by dry gangrene, which if persistent leads to the sloughing off of the feet, tips of ears, and tail, and shedding of the hair and teeth; death takes place from exhaustion. If the trouble is noticed in its early stages, the animal may be removed from access to ergot, and the use, under proper directions, of tannic acid will neutralize the unabsorbed part of the poison. Treatment should be under the direction of a veterinarian, but if a chronic case is well developed little or nothing can be done for it.

ASPERGILLOSUS

Poisoning from species of *Aspergillus*, principally by inhaling the spores, followed by the production of lung lesions, is sometimes a moderately serious matter. Ordinarily if the spores are swallowed no serious results are observed, but feed that is badly infested when eaten usually gives off enough spores so that many are taken into the lungs. An animal affected usually can have nothing done for it beyond preventing further access to such moldy feed.

POISONING FROM OTHER FUNGI

Moldy corn may cause some scouring in animals eating it, but usually is not responsible for serious injury.

The smuts of corn and other grains may be responsible for some injury, but in the case of corn smut large quantities can be eaten without serious injury.

DERMATITIS: SKIN DISEASE

Besides causing trouble internally, a few fungi may grow on or in the skin and cause skin diseases, which may be very troublesome and may predispose the animal to more serious trouble. Treatment of such diseases is local. Effort is made to kill the fungi and thorough cleanliness is extremely essential.

POISONING FROM HIGHER PLANTS

Among the higher plants there are a large number which contain poisonous substances, and may, therefore, be able to poison if consumed. It is with these plants that this bulletin is largely concerned.

CLASSES OF POISONS FROM A CHEMICAL STANDPOINT

Taking up the poisonous substances from a chemical standpoint, the following classifications, based on Thatcher's "Chemistry of Plant Life," may be useful.

GLUCOSIDES

Glucosides are compounds which when hydrolyzed yield a sugar as one of the products of hydrolysis. There are many classes of glucosides, among which a few will be mentioned. The phenol glucosides, such as iridin and baptisin, are used in small quantities as medicines, but if taken in sufficiently large quantities act as cathartics, diuretics or purgatives. Alcohol glucosides are exemplified in salicin, coniferin and populin, found respectively in willows, conifers and poplars. They are seldom serious poisons to stock.

Another group is known as the acid glucosides, such as gaultherin, jalapin and convolvulin, which are cathartic and purgative.

Another group comprises the oxycumarin glucosides, of which aesculin in horse chestnut and buckeye, daphnin in daphne, and fraxin in the ash tree, are examples. These may assume considerable importance in poisoning in Kansas, particularly in the case of the first.

By all odds the most important group from the standpoint of this publication are the cyanophore glucosides, also frequently known as the cyanogenetic glucosides, of which amygdalin is perhaps the commonest example. It occurs particularly in various members of the Rosacæ and related families, especially the Prunacæ. Others include dhurrin in certain millets and sorghums, vicianin in vetch, phaseolunatin in certain varieties of lima beans, and lotusin in certain legumes. These are of very great importance because of the fact that when taken into the stomachs of certain animals the action of the proper enzyme results in the liberation of hydrocyanic acid from them. This extremely poisonous substance usually causes death within thirty minutes if lethal quantities are formed. In this connection it is well to emphasize the point that these glucosides

are present only when the plant is growing under a deficient water balance; at another time, even on the same day, they may not be present and the plant may serve as a harmless feed plant.

Another group of glucosides includes sinigrin in black mustard seeds and sinalbin in white mustard seeds. These glucosides in small quantities are often used as relishes to give a pungent taste. but serious poisoning can result if eaten in large quantities over too long a period of time.

Digitalis contains a group of glucosides which are frequently known as the digitalis glucosides, among which the five following are best known: digitoxin, digitalin, digitonin, gitonin, gitalin. Another very similar one, known as cymarín, is found in *Apocynum cannabinum*. These glucosides are commonly used as heart stimulants. Danger from them to stock is more likely to be from the administration of the drug, since the plants containing them are usually grown only as garden plants.

The last group of glucosides that are important as poisons are known as saponins. They are found in many kinds of plants in many plant groups. When agitated with water they produce a soapy foam. They are particularly poisonous to certain animals, especially to frogs and fishes. To the higher animals they have an unpleasant acrid taste, but if eaten, particularly as plants in hay, the saponin hydrolyzes into sugars and saponinins, the latter dissolving the hemoglobin from the red blood corpuscles.

THE TANNINS

The tannins are a group of substances most of which are glucosides, but which have certain distinctive characteristics. First, they are noncrystalline, forming colloidal solutions with water, and acid in reaction and with a sharp astringent taste. Second, with gelatin-containing tissues they unite to form insoluble compounds, advantage of which is taken in the conversion of hide to leather. Third, they form soluble bluish or greenish-black compounds with ferric salts, which is taken advantage of in the manufacture of certain common inks. Fourth, they are precipitated from solution by many metallic salts, such as lead acetate. Fifth, they precipitate, out of solution, albumins, alkaloids and basic organic coloring matters, advantage of which is taken in the administration of tannin as an antidote in cases of alkaloidal poisoning. Sixth, most of the tannins, when in alkaline solution, absorb oxygen from the air and become dark brown or black in color.

Tannins occur quite widely in plants and in a few cases in rather large quantities. Tannins may act deleteriously if taken in sufficient quantity. Generally, however, the quantity is large and the effects are temporary, more or less severe gastric disturbance. If, however, the consumption is continued over a sufficient period of time, as in the consumption of certain oak leaves in the Southwest, serious trouble may be expected.

ORGANIC ACIDS

Organic acids, either as free acids or partly neutralized as salts, especially of calcium, potassium and sodium, or combined with certain alcohols as esters, are frequent in fleshy tissues. Poisoning rarely exceeds digestive disturbances, and large quantities normally have to be consumed to effect this.

ESSENTIAL OILS AND RESINS

These substances have quite a varied composition and belong to widely separated chemical groups, but all possess the characteristic of a rather strong odor. These compounds may be either secretions or excretions of the plant and may occur either in healthy or in injured or diseased tissue.

VEGETABLE BASES

Substances known as vegetable bases contain nitrogen in addition to hydrogen, carbon and oxygen. These are divided into amines, alkaloids and purine bases. Among these are several important poisonous substances. Among plants, trimethylamine is found in the flowers of many members of the rose and closely related families, and in the leaves of certain weeds, giving them their fetid odor. Muscarin and neurin are amines which are violent poisons occurring in certain mushrooms. Hydroxyphenylethylamine is one that is found in ergot and has marked medicinal properties, or, in excess, poisonous properties.

The alkaloids are a very common group of strong vegetable bases, which, as a rule, are colorless crystalline solids, although a few may be liquids at ordinary temperatures. They are generally insoluble in water, but easily soluble in organic solvents. They readily form salts with acids, and these salts are usually soluble in water. Nicotin and conin and a few others have strong characteristic odors, but ordinarily alkaloids are odorless. The taste is normally bitter. A large number of them have very striking physiological effects upon animals, in consequence of which they are frequently used as nar-

cotics, stimulants, and for other medicinal purposes. At the same time larger quantities produce poisoning and excessive quantities produce fatal results. In view of this fact the names of several alkaloids are given here with an idea of their medicinal use in certain cases: conin, nicotin, atropin (to reduce temperature), hyoscyamin, cocain (local anaesthetic), quinin (against malaria), strychnin (stimulant), brucin, curarin, morphin (narcotic, to deaden pain), codein, and solanin.

The bitter taste of alkaloids is often in itself a sufficient protection against stock eating plants containing them, except in the unusual cases of very hungry animals, or in some instances animals, having become accustomed to the eating of occasional small quantities of a plant containing an alkaloid, take a liking to it and consume dangerously large quantities.

The third class of vegetable bases are known as the purin bases, and are derivatives of the compound known as purin. Nucleoproteins form the major portion of the nucleus and play an important part in growth. They always have purin bases. Some purin bases, such as xanthin, occur both in animals and plants. Caffein, theophyllin and theobromin are not present in animals, but are widely distributed in plants. Caffein and theobromin are the active constituents of tea leaves and coffee seeds, and are found also in cocoa beans and cola nuts. These substances in small doses are often used as stimulants, but in excessive quantities become poisonous.

PHYTOTOXINS

Proteins are complex organic substances of large molecules which are important in the nutrition of organisms. In a few cases proteins are poisonous substances of a serious nature. This is particularly so in cases of the so-called toxalbumins. Three are perhaps more frequent than others in stock poisoning. These are ricin in the seeds of the castor-oil plant and in the fresh uncooked cake from which oil has been expressed; robin, particularly in the bark and roots of black locust; and crotin, from the seeds of *Croton tiglium*.

CLASSES OF POISONS FROM A PHYSIOLOGICAL STANDPOINT

In previous chapters we have taken up briefly the classification of poisons from the botanical and from the chemical standpoint. There remains now the consideration from the standpoint of effect upon the animal organism. From this standpoint poisons may be classified in several different ways. For instance, the animal may

be merely irritated, or it may be stupefied, sickened, or killed. The poisonous substances may cause gross anatomical changes (burning by acids, alkalis or other substances). Such effects are not necessarily local, because lead and phosphorus produce anatomical changes in other parts of the body than where they are applied. The poison may act upon the blood both physically (as hydrogen peroxid and ricin) and chemically. The chemical effect may involve hemolyzing or laking the blood corpuscles (saponins); or by so changing the hemoglobin of the blood, without laking, that it will not function as an oxygen carrier (carbon monoxid); or some other less understood effect, such as produced by hydrogen cyanid and other cyanids. Other poisons may kill without producing gross anatomical changes, simply through their action on nerves (chloroform, ether, conin, chloral, strychnin), or by stopping the heart (digitalis alkaloids).

Poisons are usually eaten directly, but in certain cases poisons may be produced within the animal.

The following physiological classification of poisons by Bernhard H. Smith is cited by Pammel:

**POISONS ACTING ON THE BRAIN: NARCOTICS, DELIRIANTS,
INEBRIANTS**

Narcotics are substances the symptoms of which are usually giddiness, dimness of sight, contracted pupils, headache, noises in the ears, confusion of ideas and drowsiness, passing into insensibility.

Poppy (*Papaver somniferum*) is a plant producing poisons that act on the brain as narcotics.

Deliriantes are substances producing spectral illusions, delirium, dilated pupils, thirst and dryness of the mouth, and incoordination. Occasionally, though rarely, paralysis and tetanoid spasms are produced.

Plants furnishing poisons that act as deliriantes are: Jimson weed (*Datura stramonium*), black nightshade (*Solanum nigrum*), hemp (*Cannabis sativa*), darnel (*Lolium temulentum*), and several fungi, such as fly agaric (*Amanita muscaria*).

Inebriants or intoxicants are substances the symptoms of which are usually excitement of cerebral functions and of the circulation, loss of power of coordination and of muscular movements with double vision, leading to profound sleep and deep coma.

The following are plants furnishing poisons that act on the brain

as inebriants: Wormwood (*Artemisia absinthium*), Jamaica dogwood (*Piscidia erythrina*).

POISONS ACTING ON THE SPINAL CORD: CONVULSIVES

Convulsives are substances the symptoms of which are usually clonic (intermittent) spasms, extending from above downwards. The body may be violently bent backwards, but is normally without locked jaw. Swallowing is spasmodic. Death occurs in less than three hours or there is rapid recovery.

Examples of plants furnishing poisons that act upon the spinal cord as convulsives are: Nux vomica (*Strychnos nux vomica*), St. Ignatius's bean (*Strychnos ignatii*).

POISONS ACTING ON THE HEART: DEPRESSANTS, ASTHENICS

Depressants are substances which produce vertigo (dizziness), vomiting, abdominal pain, confused vision, convulsions, occasional delirium, paralysis, syncope (loss of consciousness), and sometimes asphyxia.

The following plants produce poisons that act on the heart as depressants: Tobacco (*Nicotiana tabacum*), poison hemlock (*Conium maculatum*), Indian tobacco (*Lobelia inflata*).

Asthenics (debility or weakness) are substances which produce the following symptoms: Numbness; tingling in the mouth, abdominal pain, vertigo, vomiting, purging, tremor, occasional delirium, paralysis, and difficulty of breathing, ending in syncope.

Among plants in which poisons that act on the heart as asthenics are found may be mentioned: Lima bean (*Phaseolus lunatus*), tapioca (*Manihot* spp.), aconite (*Aconitum napellus*), cohosh (*Cimicifuga racemosa*), oleander (*Nerium oleander*), foxglove (*Digitalis purpurea*), white hellebore (*Veratrum album*), green hellebore (*Veratrum viride*).

VEGETABLE IRRITANTS: PURGATIVES, ABORTIVES, IRRITANTS WITH NERVOUS SYMPTOMS, SIMPLE IRRITANTS

Purgatives are usually accompanied by the following symptoms: Abdominal pain, vomiting, purging, cramps, strangury, and tenesmus, followed by collapse, and sometimes accompanied by drowsiness and slight nervous symptoms.

The following plants produce poisons that act as purgatives: Castor-oil plant (*Ricinus communis*), green hellebore (*Helleborus viridis*), May apple (*Podophyllum peltatum*), marsh marigold (*Caltha palustris*).

Abortives are substances producing nausea, vomiting, stupor, polyuria and coma, sometimes tenesmus, and abortion may or may not occur.

Plants producing poisons that act as abortives are: Ergot (*Claviceps purpurea*), herb of grace (*Ruta graveolens*), cotton root (*Gossypium herbaceum*), and pulsatilla (*Anemone patens*, and its variety).

The symptoms accompanying irritants which also produce nervous symptoms are: Usually abdominal pain, vomiting, purging, dilated pupils, headache, tetanic spasms, occasional convulsions, and sometimes rapid coma.

Among the plants furnishing poisons that act as irritants, causing also nervous symptoms, may be mentioned: Indian pink (*Spigelia marilandica*), cut-leaved water parsnip (*Berula erecta*), fool's parsley (*Æthusa cynapium*).

Simple irritants are substances the symptoms of which are usually burning pain in the throat and stomach, thirst, nausea, vomiting, tenesmus, purging, dysuria, difficulty of breathing, and occasionally coughing. Death through shock, convulsions, exhaustion, or starvation due to injury to throat or stomach may result.

Some few plants (the nettles) cause smarting pain on the merest contact with the secretions of the plant, quickly followed by erythema and urticarial rash, which slowly subsides.

Plants producing poisons that cause these last-mentioned symptoms are: Arrowroot (*Arum maculatum*), wood anemone (*Anemone nemorosa*), cursed crowfoot (*Ranunculus sceleratus*), buttercup (*Ranunculus acris*), bouncing bet (*Saponaria officinalis*), bearberry (*Arctostaphylos uva-ursi*), sundew (*Drosera rotundifolia*), poison ivy (*Rhus radicans*), nettle (*Urtica dioica* and *U. gracilis*), wood nettle (*Urticastrum divaricatum*), bull nettle (*Jatropha stimulosa*).

Simple irritants when taken in large quantities are substances which produce usually burning pain in throat and stomach, vomiting, purging, and difficulty in swallowing. Recovery is usual.

Some plants which contain poisons that act as simple irritants when taken in large quantities only are: White mustard (*Brassica alba*), black mustard (*B. nigra*), black pepper (*Piper nigrum*), common ginger (*Zingiber officinalis*), Cayenne pepper (*Capsicum annum*).

GENERAL STATEMENTS REGARDING THE CARE OF ANIMALS FROM A POISONOUS-PLANT STANDPOINT

In the following paragraphs suggestions are made in regard to the handling of stock from the standpoint of poisonous plants, many of which will of course suggest themselves at once as desirable practices.

In the majority of cases where animals are poisoned a certain measure of blame can be attached to the owner or caretaker of the stock. Stock take to eating poisonous plants as a general thing only when they do not have sufficient satisfactory feed. This may mean that the area is overgrazed, or it may mean that the animals were turned into a pasture containing poisonous plants when the animals were tired or hungry. Rustling for themselves, they took whatever happened to be nearest. Many cases of poisoning occur where animals are driven from one area to another and must locate new grazing areas. Under such conditions they are not likely to be sufficiently discriminating. In such cases it is much safer to feed the animals at first until they have had an opportunity to get acquainted with the new pasture. In a very few cases the animal that eats a poisonous plant learns to like it, and if there is danger of consuming too much either at one time or to obtain a cumulative effect by taking it over a long period, it is wise to prevent the animal's having access to the plant. Loco poisoning is a typical example of this. In years that are usually dry or hot the amount of suitable feed available in areas that are normally pastured close to their limit becomes deficient. Under such conditions either the number of animals pastured should be reduced, or they should be fed extra if the owner wants to minimize the dangers of poisoning.

A most fruitful time for poisoning is in the early spring when certain plants come up or when certain types of plants remain green and succulent during the winter and consequently appear attractive to the animals at a time when the grasses that they ordinarily would prefer are not available. Animals that have been on dry feed are especially susceptible. At such times certain plants are sometimes eaten in large quantities and many cases of death may result therefrom. The death camas and larkspur are examples of poisoning restricted almost entirely to spring. Occasionally such points as lack of available water and the effort of the animal to get it by eating succulent plants, or a lack of salt, leading to efforts of the

animal to get enough by eating certain plants, may need to be taken into consideration.

From the standpoint of the animal, those animals that are in perfect condition are much less likely to eat poisonous plants than are animals which are sick or unduly tired or overworked. Animals placed in a new pasture need time to get acquainted with the new situation and allowances should be made for this if the new area is radically different from that which they have been accustomed to.

Nowadays it is unusual for animals to be purposely poisoned by exposing poisons where they may get them, but this sometimes needs to be taken into consideration. Such cases may arise from consuming poisoned feed or poisoned water. Likewise, an animal exposed to unusually severe weather is more likely to be poisoned if eating poisonous plants than under ordinary circumstances.

The situation may be summed up by saying, if stock in good condition have plenty of proper feeds it is unlikely that they will eat sufficient quantities of poisonous plants to give serious trouble, but as conditions of stock become poorer and desirable feed scarcer, the risk of poisoning increases.

TREATMENT OF ANIMALS THAT HAVE BEEN POISONED²

It is exceedingly difficult when animals die to state positively that it is the result of consuming a poisonous plant. The fact that death results in a pasture or lot is not by any means conclusive evidence that the lethal agent is a poisonous plant in that lot.

A few years ago a large number of letters were received from various parts of the state claiming that animals had died as a result of having been placed on wheat pastures, the writer wishing to convey the impression that in his opinion death was due to consumption of the green wheat plant. A few investigating trips were made by members of the veterinary staff of the Agricultural Experiment Station and in no instance was conclusive evidence found involving the wheat plant as a causative factor. In one instance the animals had undoubtedly died when placed on the wheat pasture, but there was no question at all that the real cause of death was blackleg. Many animals die in a barn, but we do not therefore speak of it as "barn disease."

Furthermore, when death follows after an animal has consumed a certain plant it, is not conclusive evidence that the plant is at fault.

2. Contributed by Dr. R. R. Dykstra, dean, Division of Veterinary Medicine.

It may be a harmful mold on the plant, or, in the case of stored feed such as ensilage, it is frequently due to a germ, frequently the bacterium *Clostridium botulinum*.

In order, therefore, to make a positive diagnosis that death is the result of consuming a certain plant we must establish, if it has not already been done, that the plant in question contains poisonous elements; and second, that the animal has actually consumed enough of the plant to produce fatal results. Another point to be borne in mind is that certain plants produce harmful effects only after they have been consumed over a long period of time. This is exemplified in the so-called cottonseed poisoning. Animals receiving an excessive amount of cottonseed cake over a long period of time will frequently show rather characteristic symptoms of poisoning, with fatal results.

If plant poisoning is suspected, the plant being either in the green or cured stage, the first and most important step is to withhold the suspected material from the animals until definite conclusions regarding their possible harmful effects can be reached. During this interval the animal should be fed on material of unquestioned wholesomeness.

Furthermore, it is occasionally imperative that animals suspected of having been poisoned by consuming certain plants be immediately treated. The owner does not, as a rule, have the least idea of the nature of the poisonous principle. It has been our custom in cases of this kind to advise the administration of large doses of tannic acid mixed with water. The theory of this treatment is that if an animal has actually been poisoned by consuming a plant, there is a strong probability that the poisonous agent is in the nature of a vegetable base or alkaloid. These alkaloids can produce their harmful effects only by going into solution in the stomach and being absorbed in the dissolved or liquid state. Tannic acid combines chemically with most alkaloids to form insoluble compounds. If, therefore, tannic acid can be administered before the suspected alkaloid has been absorbed, it will prevent absorption. Tannic acid is without value after absorption has once taken place.

Treatment of poisoning following the consumption of loco weeds, the sorghums and cockleburrs, the poisonous nature of which has been established definitely, is presented on the following pages.

1. POISONING BY LOCO

Poisoning by loco occurs in horses, cattle and sheep. There are two varieties of the loco plant that cause the poisoning. They are known as white and purple loco. The more prominent symptoms

are a staggering and uncertain gait, or there may be complete loss of control of the limbs. If the loco is not taken away from the animals they eat more and more of it and become so fond of it that they practically discontinue the eating of other feed, and sooner or later lose flesh and die of starvation.

The condition may be treated quite successfully by taking the animals from the pasture containing the loco and feeding them on a laxative diet. Alfalfa is unusually good for this purpose, and if in addition a handful of flaxseed meal be added to the grain ration the animal's bowels will be kept in a relaxed state.

Frequently this is sufficient to effect a cure, but in other cases medicine must be given. For horses, from one-half to two-thirds of an ounce of Fowler's solution of arsenic in the drinking water or sprinkled on the feed is very efficient. For cattle, a hypodermic injection daily of one-sixth to one-fifth grain of strychnine sulphate and six grains of sodium cacodylate has given the best results. The Fowler's solution should be colorless and odorless. If you simply tell the pharmacist that you do not want any color or odor in the Fowler's solution he can then prepare it for you in that way.

Recovery will be slow, but care will bring the animal to a practical cure in the majority of cases. It is best not to subject the animal to temptation by placing it in a pasture that contains loco after a cure has been obtained.

2. POISONING AS THE RESULT OF EATING SORGHUMS

This affects cattle particularly, and is due to the fact that these plants, especially when they have been stunted, frost bitten, or the second growth, contain the elements which in the animal's stomach form prussic acid (hydrocyanic acid). This latter is a deadly poison and usually kills very quickly.

There is no practical method by means of which the presence of these poisonous principles can be detected outside of a chemical analysis. Such a chemical analysis would in many cases be negative, as it seems that fodder of this kind does not always contain the same proportion of prussic acid.

As a general rule, the recommendation has been made that one or two animals only be turned into a field for a few days and note the effect upon them. If they are not poisoned it is then quite safe to turn in the remainder of the animals.

In the early stages of poisoning, before the animal goes down, it is claimed that large doses of ordinary molasses diluted with water

will prevent the formation of prussic acid in the animal's stomach. There is no known method of treatment after absorption takes place.

3. POISONING BY COCKLEBURS

For many years there have been rather persistent reports that young swine have died as a result of eating cocklebur. Veterinarians were of the opinion that cockleburs were harmful only in that when ripe they mechanically obstruct or irritate the digestive tract. The reports of poisonous effects were so insistent, however, that it could no longer be ignored. The writer was called to one farm where the hogs were apparently in perfect health in the evening, there had been no change in the feed or care they were receiving, and still the following morning more than forty animals, practically all young ones, averaging about sixty pounds, were dead. A post-mortem examination revealed no changes characteristic of any disease. The stomachs of all of the animals were filled with green, newly sprouted cockleburs.

Careful experiments have demonstrated conclusively that during the time the cocklebur is germinating, or during the development of the cotyledons, the plant is poisonous. Farmers sometimes speak of this as the two-leaved stage. Probably the plant is most poisonous shortly before the two-leaved stage is reached. In this stage the plant is most harmful to pigs up to two months of age. It is also harmful during this stage if consumed in sufficient quantities by cattle and sheep. Animals must consume a certain quantity before harmful effects are produced. It is generally believed to be true that an animal weighing 100 pounds must consume at least 1½ pounds of the green plant before it becomes harmful to the animal.

The obvious thing to do is to keep animals out of those pastures or lots where the young cocklebur is sprouting. After they have become of a definite size they are harmless.

Medicinal treatment has not yet been very carefully worked out. Reports indicate that if animals suspected of having consumed enough of the cocklebur to be dangerous are given relatively large doses of a fatty substance it may stop the absorption of the poisonous principle. Such fatty substances as milk, bacon grease, raw linseed oil and lard have apparently resulted in controlling the poisonous effects.

PROCEDURE IN CASE OF POISONING BY PLANTS³

In case poisoning by plants is suspected the first thing to do is to call a competent graduate veterinarian for the purpose of treating the diseased animal and also to identify the poisonous agent. If the investigation points rather strongly to a certain plant or agent, the easiest way to determine this positively is to feed the suspected material in relatively large quantities to an animal of the same species as the one suspected of having died from eating the plant.

If a certain plant is suspected it is a simple matter to have it identified by a botanist. In this instance the suspected plant should be forwarded to the Agricultural Experiment Station with the request that it be identified. The Division of Veterinary Medicine may be in position to assist the Department of Botany in establishing the harmful or harmless properties of the plant.

If it is not possible to collect a single poisonous plant, and if it is believed that the poisonous agent is included in the forage that the animal is consuming, the question is far more difficult to solve. Here again it is probably best to forward some of the suspected material to the botanist with the request that he identify any poisonous plants that he may find. Not finding any, it of course leaves the question unsolved. It is manifestly impossible to divide suspected forage into its component parts, including various molds and bacterial organisms, and test each one out separately. Work of this latter character in order to be exhaustive would be far too expensive, and take so much time that even in those cases where the poisonous principle was finally definitely established, it would be too late to be of any value to the owner of the animals originally poisoned.

Finally, post-mortem examinations, especially of stomach contents, are sometimes of value in determining the nature of a poisonous agent. It is not to be forgotten that animals are just as likely to contract contagious diseases on certain pastures and die as the result thereof as if the death was due to a poisonous plant. A post-mortem examination will frequently disclose evidence of a contagious disease where the owner was firmly under the conviction that a poisonous plant was the real cause of the trouble.

3. Contributed by Dr. R. R. Dykstra, dean, Division of Veterinary Medicine.

PRINCIPAL POISONOUS PLANTS, BY FAMILIES

EQUISETACEÆ

Equisetum arvense L. (Fig. 1)

Equisetum, Horsetail

Equisetum præaltum Raf. (Fig. 2)

Equisetum, Scouring Rush

Description of the Plants.—In the genus *Equisetum* are two well-marked types of plants, the most important one, *Equisetum arvense*, produces vegetative growth in the form of slender, bushy stalks with small scalelike leaves. It may frequently cover sandy banks to the exclusion of other vegetation. The spores are borne in little cones on a separate plant, coming out early in the spring and appearing as a straw-colored scale-bearing single stalk, seldom over about 12 cm. high. Plants of the second type, exemplified by *Equisetum præaltum*, are known as scouring rushes, as they were used as scouring agents by the housewives of a few generations ago. Scouring rushes in Kansas are more likely to be found in wet wooded areas throughout the year. They may form a dense vegetation of dark-green jointed stalks with tiny scale leaves at the joints. The spores are borne in little cones at the tips of some of these stalks.

Effect on Animals.—The plant fresh or more usually dry in hay is poisonous, particularly to horses (most frequently to colts), and to a lesser degree to sheep, but apparently not to cattle. The effect appears in two or three weeks, depending upon the age of the animal and the amount of hay eaten. The animal usually appears unthrifty, weak and emaciated, and prefers to eat *Equisetum* rather than wholesome feed. As the disease progresses the muscular weakness becomes more pronounced and control of the muscles is lost. Pulse and temperature are depressed and mucous membranes are pale. Although the appetite remains good, the animal finally falls under a nervous excitement. Convulsions with higher temperature and pulse appear, and death results from exhaustion.

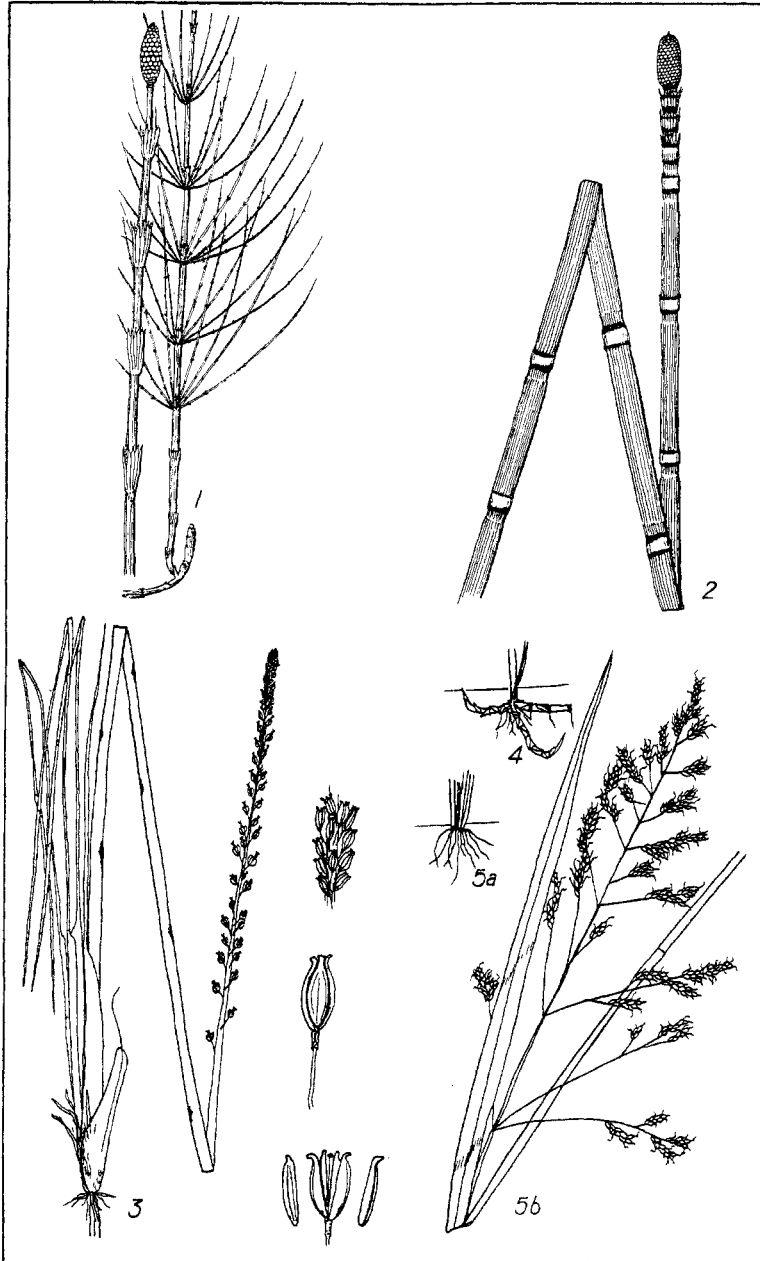
Remedial Measures.—Preventive measures are best, but if a case is not too far advanced it is possible to combat it first by removing access to *Equisetum* either as a fresh plant or in hay, and then in administering cathartics and nerve and heart stimulants. If the animal cannot stand it is usually desirable to give it support. Other diseases may complicate the situation.

SCHEUCHZERIACEÆ

Triglochin maritima L. (Fig. 3)

Salt Marsh Arrow Grass

Description of the Plant.—A grasslike marsh plant of fresh or salt marshes, not ordinarily distinguished from a grass until the flowering stalk is in evidence. Leaves basal. In July a flower stalk shoots up 25-50 cm., bearing small flowers in a terminal raceme. Perianth 6-parted, stamens 6, pistil of 6 united carpels ripening into an oblong fruit 5-6 mm. long with 6 recurved points at the summit. Carpels separating at maturity from the hexagonal axis.



FIGS. 1 TO 5.—(1) *Equisetum arvense*, showing the early fruiting stem and the later branched stem. (2) *Equisetum praealtum*, showing evergreen stem. (3) *Triglochin maritima*, showing the flowering plant and enlargements of the fruit. (4) *Holcus halepensis*, showing the perennial root system. (5) *Holcus sudanensis*. (a) The annual root system. (b) The inflorescence with a leaf.

Effect on Animals.—A cyanogenetic poison to sheep and cattle particularly. A fairly large amount is necessary at one time, but it may be obtained from any part of the plant, either fresh or dried—particularly likely to poison when occurring in hay. The effect produced is sudden prostration, abnormal breathing, and convulsions and death is likely to ensue.

Remedial Measures.—There is no treatment for the poisoned individual. Keep stock away from area where the plant is abundant and do not cut hay containing any quantity of the plant.

LILIACEÆ

Zygadenus nuttallii S. Wats. (Fig. 6)

Nuttall's Death Camas

Description of the Plant.—An herb, the light green leaves of which appear on the prairie or borders of open woods and on rocky hillsides early in spring. The aerial plant develops from a large coated bulb somewhat resembling an onion, but without any trace of onion odor or taste. The leaves are long, narrow, strongly folded lengthwise. Flowers appear in May in racemes (rarely paniculate) about 50 cm. high. Perianth 6-parted, about 12 mm. broad, hypogynous, bearing near the base a roundish, spotlike gland. Capsule 8-12 mm. long.

Effect on Animals.—The poisonous material is found in all parts of the plant, but probably somewhat more in the bulb than elsewhere. All classes of stock may be poisoned, but cattle and sheep are more likely to be affected. A toxic dose is small—for sheep about one per cent of their weight, for cattle somewhat larger. Sick animals almost universally show frothing at the mouth, followed by nausea, and frequently accompanied by vomiting. Vomiting is present more frequently in cattle than in sheep and in many cases occurs repeatedly. In milder cases animals are depressed and stagger, particularly in the hind legs. In severe cases coma may continue for a long while before recovery or death. The temperature of a sick animal is below normal. The quantity of the plant required to poison is small, but the lethal dose is fairly large, hence many animals will appear sick for a day or two, but will recover.

Remedial Measures.—The only remedy is to keep the animals away from the somewhat limited areas at the time of year in which this death camas may be exceedingly abundant, as there are no effective medicinal remedies. If sick animals are kept quiet and fed, if they desire to eat, there is a fair chance of their recovery.

Remarks.—The plant comes up very early in the spring, long before the grasses, and the bright green leaves are easily visible for considerable distances. Poisonous also to humans.

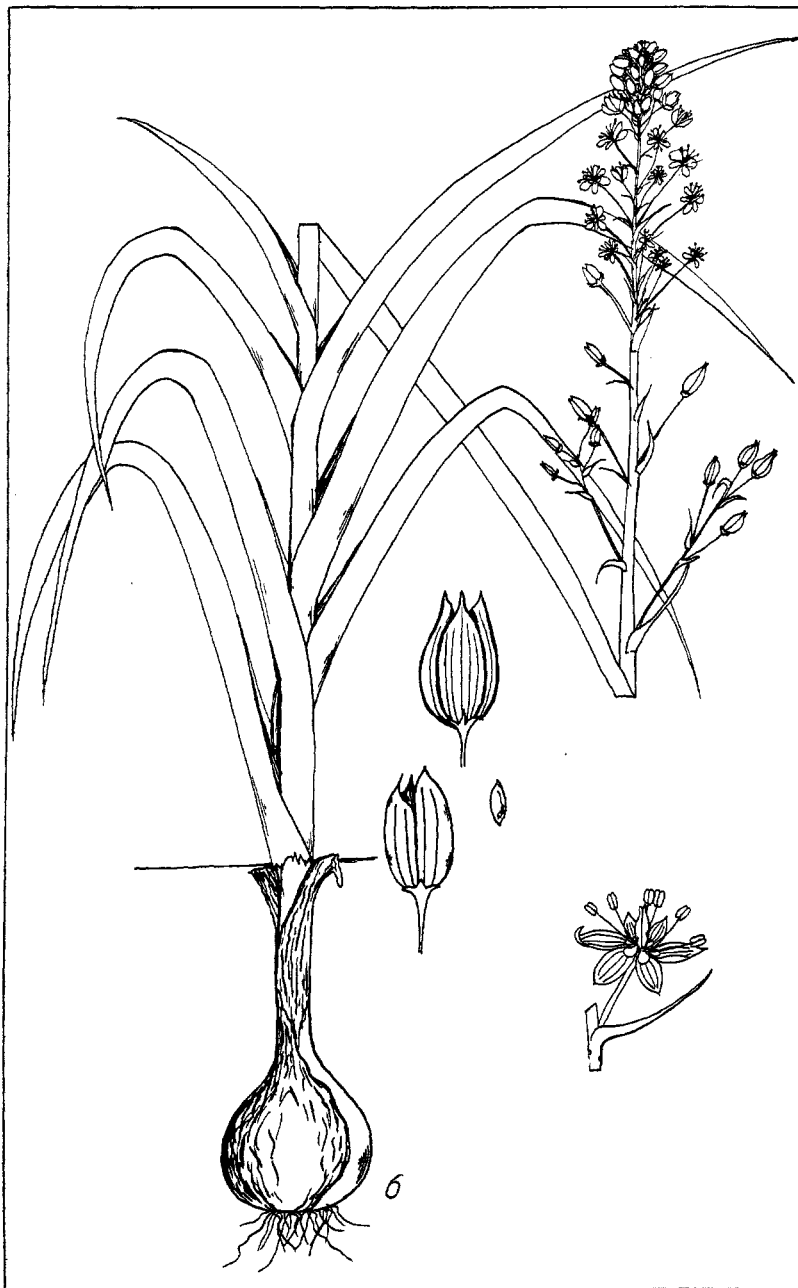


FIG. 6.—*Zygadenus nuttallii*. The plant, one-half life size, and enlargements of flower, fruits, and seed.

POACEÆ

Holcus sorghum L.

Sorghum

Holcus halepensis L. (Fig. 4)

Johnson Grass

Holcus sudanensis Piper. (Fig. 5)

Sudan Grass

Description of the Plants.—Tall cultivated grasses occasionally escaping along roads. Leaves large and often wide. Seed heads panicles of various sizes, shapes, and colors in different cultivated varieties.

Johnson grass and Sudan grass resemble each other in most particulars, but differ in that Sudan grass is an annual without the vigorous perennial root-stocks of Johnson grass. The leaves of Sudan grass are broader and more numerous and the loose, open panicle is a little larger and a trifle less open, while the seeds are somewhat larger and plumper than is the case of Johnson grass.

Effect on Animals.—Cyanogenetic. A comparatively small quantity of the poisonous glucoside is necessary to poison. This may be obtained from leaves which have been injured by drough or are growing under a deficient water balance (especially noticed in second-growth sorghum) or have been recently frosted. At other times the leaves are safe to eat. Cattle are most susceptible to the poison, horses and sheep less so, while hogs may ordinarily be pastured in safety. Small doses cause dilation of the pupils, excessive saliva, muscular twitching and paralysis. The breath has the odor of almonds.

Remedial Measures.—It is absolutely necessary to keep the animals away from the plants when the glucoside is being formed. Ordinarily the animals die so rapidly that there is nothing to do for them after they have once eaten sufficient material to poison. If medical treatment is deemed possible, glucose (corn syrup) may relieve the animal in some cases, or soda in dilute vinegar may be used as a drench while the mixture is foaming, or quantities of milk may be given and the animal given plenty of fresh air. However, the poison acts quickly.

Remarks.—Johnson grass is undesirable to plant—at least below the 38th parallel—because of its capacity to become a weed, which, owing to the vigorous rootstocks, is exceedingly difficult to exterminate.

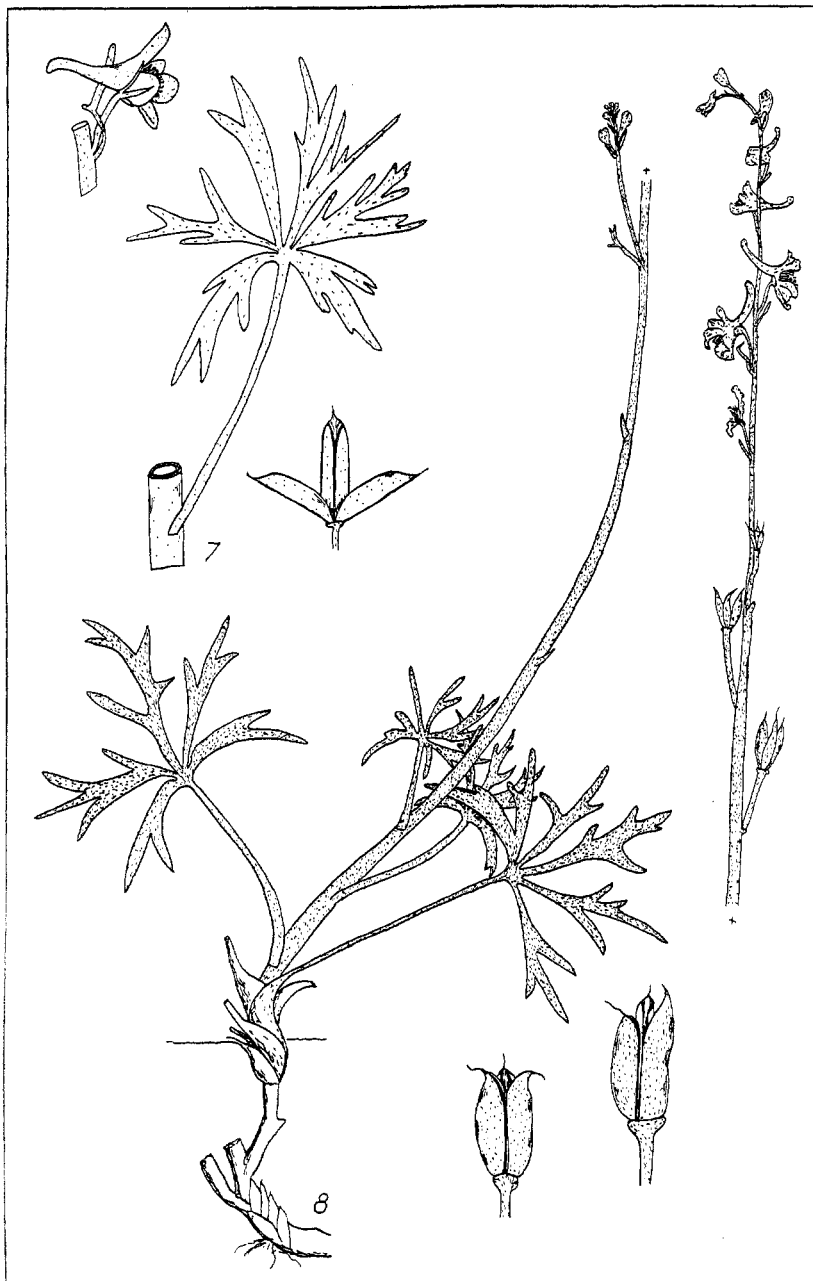
Setaria italica L. (Fig. 9)

Hungarian or German Millet

Description of the Plant.—A cultivated grass grown for the seeds, which are borne in thick, compound spikes 5-18 cm. long.

Effect on Animals.—While millet may be used as feed for animals, if horses are fed more than half their diet on millet continuously, the kidneys are first affected, followed by suffusion of blood into the joints, a loosening of the tendons, and softening of the bones.

Remedial Measures.—Where millet, is used as horse feed, it should be used intermittently and with plenty of other suitable feed in addition.



FIGS. 7 AND 8.—(7) *Delphinium tricorne*, showing flower, leaf, and fruit. (8) *Delphinium virescens*, showing flowering plant, one-half life size, with enlargements of the fruit.

RANUNCULACEÆ*Delphinium tricorne* Michx. (Fig. 7.)**Dwarf Larkspur***Delphinium virescens* Nutt. (Fig. 8)**Prairie Larkspur**

Description of the Plants.—*Delphinium tricorne* is a perennial, stout, glabrous or pubescent simple herb, 0.3-1 meter high, locally abundant in prairie and thickets in the eastern half of the state. Leaves slender, petioled, deeply palmately 5-7 cleft or divided, the divisions linear or wider, entire or again cleft and toothed. Flowers, April-June, blue or white in a loose raceme 10-12 cm. long, the spur generally slightly bent, ascending, about 2.5 cm. long; follicles 3, widely spreading, about 12 mm. long, tipped with a short beak. Roots tuberous and fascicled.

Delphinium virescens is a perennial, pubescent, often somewhat glandular herb with widely branching woody roots, in plains and prairies, especially in northern and western Kansas, where it may be locally abundant. Stems stout, 0.3-1 meter high, leaves palmately cleft, segments linear. Flowers, May-July, white or bluish-white, finely pubescent, narrow, rather densely flowered racemes, the lower pedicels sometimes 5 cm. long, but the upper much shorter, spur horizontal or ascending, 12-16 mm. long, straight or slightly curved upwards. Follicles 12-18 mm. long, erect, pubescent.

Effect on Animals.—Larkspurs contain several alkaloids which occur particularly abundantly in the seeds and to a lesser extent in the green parts of the plant. In most cases the animal needs to eat at least the equivalent of 3 per cent of its weight before being affected, and in the average case has probably eaten as high as 8 to 9 per cent of its weight. Cattle are most likely to be affected, and losses from this plant have been serious, second only to loco. Horses and sheep are in general not so likely to be affected, and ordinarily can be allowed to graze on a larkspur area irrespective of its quantity. The effect is fairly rapid after eating. The symptoms are stiffness and irregularity of gait and great difficulty in walking. The animal continually falls, and gets up and down with difficulty, exhibiting lack of coordination. Pulse and respiration are lowered, but become rapid just before death. The skin is sensitive, and usually twitches, particularly on the sides and legs. The twitching may penetrate the muscles, and in severe cases goes into convulsions with vomiting and frothing at the mouth, ending in spasms with death. The essential symptoms are of cerebral excitement, but the direct cause of death is most likely the failure of respiration. The lungs are very congested and dark colored. The appetite of the animal remains excellent to almost the death point. As stated above, mortality in animals having eaten sufficient quantity to be seriously poisoned is likely to be very high, but with plenty of suitable feed available, stock are not likely to eat sufficient quantities to be seriously poisoned.

Remedial Measures.—Atropin sulfate is frequently given hypodermically with beneficial results in cases where the animal has not gotten too large a quantity of larkspur, or a hypodermic injection of physostigmin salicylate, 1 gr., pilocarpin hydrochlorid, 2 gr., strychnin, ½ grain. In the convulsive stage inhalation of ammonia may give good results. The animal must be given

complete rest and freedom from excitement until entirely recovered, as exercise or fright may bring on fatal spasms.

Efforts to exterminate the plant have been carried on, particularly with species of the taller larkspurs. This usually demands a cutting off of the plant below the crown and burning of the material so taken off. This must be repeated for a year or two until the plant is pretty well eliminated. The plant may be pulled up, which, of course, is more certain, but care should always be taken to burn all parts of the plant.

Remarks.—Losses from larkspur are irregular in this state and occur only in springs when it is unusually abundant.

Ranunculus sceleratus L. (Fig. 10)

Celery-leaved Crowfoot, Cursed Crowfoot

Description of the Plant.—An annual, stout, essentially glabrous, freely branching, hollow-stemmed herb, 15-60 cm. high, in fresh or alkaline swamps and wet ditches, where it may be exceedingly abundant, even constituting the whole vegetation. Basal leaves thick, 3-5 lobed on long, broad petioles; the blade 2.5-5 cm. broad, kidney-shaped, those of the stem petioled, the upper sessile deeply lobed or divided, the lobes several toothed or entire; the flowers yellow, numerous, 6-8 mm. broad, the petals about as long as the calyx; head of fruit cylindrical, 8-12 mm. long, akenes 1 mm. long, very numerous, with a tiny point.

Effect on Animals.—The acrid poisons, anemonol and anemonic acid, are present in considerable quantities and give the plant a very acrid, biting, burning taste, which ordinarily will prevent it from being eaten in sufficient quantity to poison. Nevertheless, as the plant appears abundantly in wet places along streams, the plant is sometimes eaten along with other plants, especially by cattle, in quantities sufficient to poison.

Remedial Measures.—If areas of the plant are present cattle should be kept away from them.

BERBERIDACEÆ

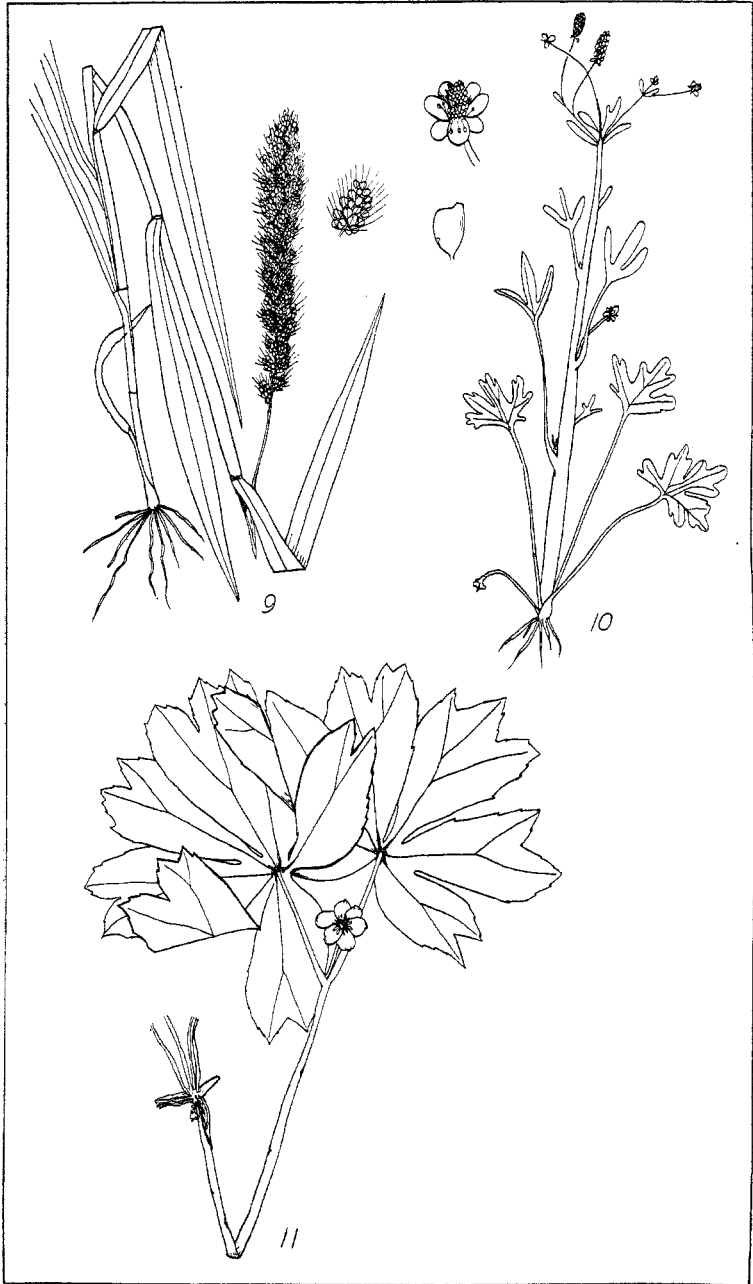
Podophyllum peltatum L. (Fig. 11)

Mayapple, Mandrake

Description of the Plant.—A low, erect woods plant in the eastern fourth of Kansas. Basal leaves centrally peltate, 20-30 cm. in diameter, long petioled, deeply lobed, the lobes cleft; flowering stems appearing from different rootstocks, bearing 1-3 similar but smaller leaves with a nodding, stout, peduncled white flower, 5 cm. broad, appearing generally from between the two leaves. May. Fruit ovoid, yellowish, 2.5 cm. long, edible.

Effect on Animals.—A resinous substance, decidedly purgative in action, is present in the rootstocks and to a lesser degree in the leaves. The plant may be eaten by cattle, in which cases the milk is rendered unfit for consumption, although it may not seriously affect the cow itself.

Remedial Measures.—Should cattle take to eating the plant they should be kept away from it. Ordinarily, however, it is left alone on account of the taste.



FIGS. 9 TO 11.—(9) *Setaria italica*. The plant, one-fourth life size, with enlargement of a part of the spike. (10) *Ranunculus sceleratus*. The plant, one-half life size, with an enlargement of a flower and a fruit. (11) *Podophyllum peltatum*. The flowering plant, one-third life size.

MENISPERMACEÆ

Menispermum canadense L. (Fig. 12)

Moonseed

Description of the Plant.—A climbing vine in woods along streams in eastern half of the state, with slender petioled, broadly ovate leaves which are more or less cordate or peltate at the base and bluntly or sharply pointed at the apex, entire or with 3-7 lobes. Flowers small, white, developing into panicles of drupes resembling wild grapes, but with a spirally curved or somewhat moonshaped seed within.

Effect on Animals.—Poisonous substances are present and poisonous effects are occasional, more frequently to humans, because animals seldom if ever eat the plant.

MALVACEÆ

Gossypium herbaceum L.

Cotton

Description of the Plant.—A cultivated annual or perennial $\frac{1}{3}$ to $\frac{1}{2}$ meters high, leaf blades with 3-5 triangular lobes, mostly shorter than the body of the blade. Flowers white, turning pink or purple with monodelphous stamens; capsules subglobose containing white cotton and seeds.

Effect on Animals.—Rooting up of harvested cotton fields may lead to abortion in pregnant sows. The more usual case of poisoning, however, is from the feeding of the cotton seed or cottonseed meal, cottonseed oil or cottonseed cake in excessive quantities for too long a period. The poisonous effect is an acidosis which may be severe enough to cause death, particularly to horses, hogs, and especially to the young animals.

Remedial Measures.—The situation calls for judicious feeding of cottonseed products, starting in with small amounts after the animal is four or five months old or older, with special care when horses or hogs are concerned. If stock show bad effects a prompt change to other diet, either eliminating cottonseed products or including an abundance of green stuff, will usually be sufficient to clear up ordinary disturbances.

MORACEÆ

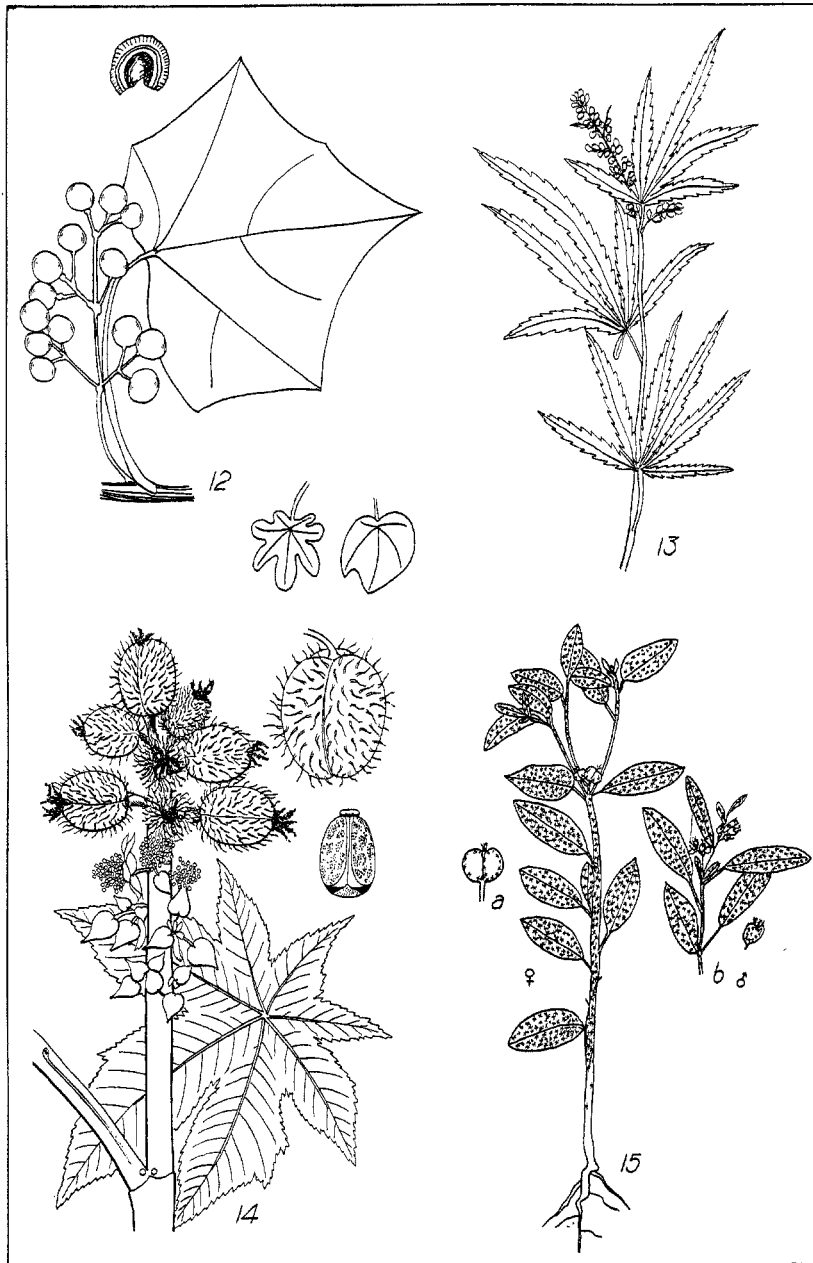
Cannabis sativa L. (Fig. 13)

Cannabis, Indian Hemp, Marihuana

Description of the Plant.—An annual branching herb, 1-3 meters high. Leaves petioled, thin, palmately 5-11 divided, the segments narrow, tapering at both ends, coarsely serrate, 7-15 cm. long. Plants dioecious, the flowers small and greenish, producing a small akene.

Effect on Animals.—The narcotic substance, cannabin, depresses the nervous system and rather easily leads to dependence on the drug. Animals are less likely to acquire the taste than human beings.

Remedial Measures.—Persistently cutting the plants before flowering will eliminate them in a year or two.



FIGS. 12 TO 15.—(12) *Menispermum canadense*. A portion of fruiting branch, one-half life size, with an enlarged seed and reduced leaves to show some variations. (13) *Cannabis sativa*. A portion of the upper part of a plant, one-fourth life size. (14) *Ricinus communis*. A portion of a fruiting branch with further details of a capsule and seed. (15) *Croton texensis*. (a) A pistillate plant and (b) a portion of a staminate plant, one-fourth life size, and enlargements of the flowers.

EUPHORBIACEÆ

Ricinus communis L. (Fig. 14)

Castor-oil Plant, Castor Bean

Description of the Plant.—A tall (1-3 meters), stout, more or less branched, glabrous, glaucous, monœcious herb freely planted for ornament and occasionally escaping from cultivation. Leaves alternate, large (10-60 cm.), peltate, 6-11 palmately lobed, on a long petiol. Flowers from June to frost in terminal racemes. Capsule 12-20 mm. in diameter, usually spiny, containing 3 shining, smooth, black, variegated or mottled gray or brown seeds.

Effect on Animals.—In various parts of the plant, but particularly in the seed, is an acrid albuminous substance known as ricin, which is extremely poisonous to all classes of stock, but particularly to horses, sheep and humans. The symptoms include nausea, vomiting, gastric pain, bloody diarrhea, thirst, hot skin, frequent pulse, sweats, headache, dullness of vision and jaundice, and if sufficient quantity be taken leads to death in convulsions or from exhaustion. As few as six seeds have killed horses and as few as two have caused the death of children.

Remedial Measures.—Animals should not be allowed to eat the seeds of castor-oil plant at any time. The castor-oil cake, which is often fed to stock, is dangerous only if it is fresh from cold-press. If the cake has been heated before pressing, or if the cold cake is allowed to stand for a sufficiently long long time it will be free from ricin.

Croton texensis (Klotzsch) Muell. Arg. (Fig. 15)

Texas Croton

Description of the Plant.—The crotons are plants of dry soil of various places in the state. They are annual, herbaceous, either monœcious or diœcious, often covered with branched hairs. Stems are rather slender, erect, usually less than 60 cm. high and variously branched. The flowers are small, without petals and give rise to small capsules with small seeds similar to the castor-oil plant.

Effect on Animals.—Within the plant are substances which redden the skin, or if taken internally usually act as a drastic cathartic. The taste, however, is so disagreeable that cases of poisoning are uncommon.

Remedial Measures.—It is just as well to prevent too much croton from getting into hay, for under these circumstances it is more likely to be eaten.

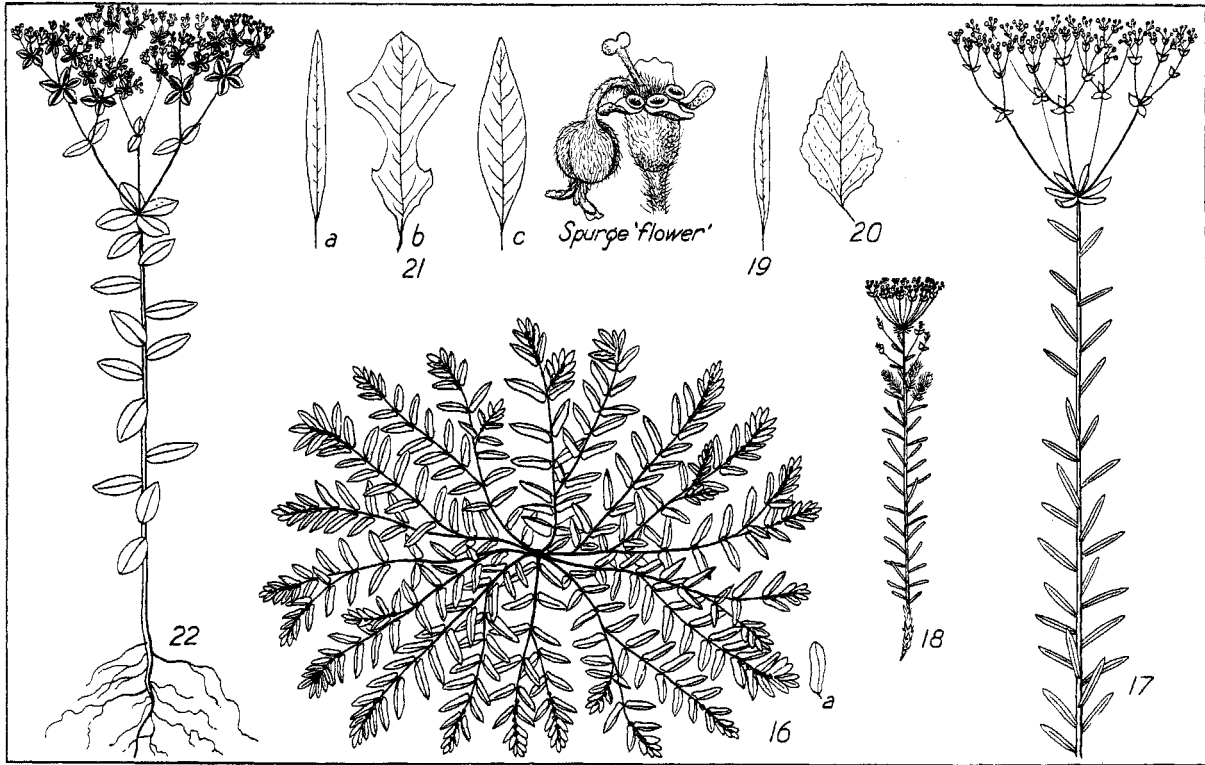
Remarks.—The same statements to a lesser degree apply to other members of the genus in the state.

Chamæsyce maculata (L.) Small. (Fig. 16)

Chamæsyce preslii (Guss.) Arthur

Spurges

Description of the Plants.—The chamæsyces are dry-soil plants, frequent in fields and thickets throughout the state. For the most part they are prostrate herbs with glabrous or hairy much-branched stems, which radiate from a common center, in *Chamæsyce preslii* more or less erect. The stems



Figs. 16 to 22.—(16) *Chamæsyce maculata*. A mat-forming spurge plant somewhat reduced, with a single leaf (a) enlarged. (17) *Tithymalopsis corollata*. A plant, reduced. (18) *Tithymalus cyparissias*. A plant, reduced. (19) *Zygo-phyllidium hexagonum*. A single typical leaf. (20) *Poinsettia dentata*. A typical leaf. (21) *Poinsettia heterophylla*, (a), (b) and (c), showing variations in the leaf shapes. (22) *Dichrophyllum marginatum*. A plant, considerably reduced.

have milky juice; the leaves are small, more or less oblong, more or less serrate, oblique at the base, sometimes blotched; flowers tiny in cuplike structures, giving rise to a large number of very small seeds, which may be variously angled, pitted or ridged.

Effect on Animals.—The milky juice is an acrid, blistering poison which is thought to cause slobbering in horses when taken internally. The bitter taste, however, is not conducive to free consumption and poisoning is of rare occurrence.

Remedial Measures.—Preventive if necessary.

Remarks.—Other species of the same genus may occasionally be similarly poisonous.

Tithymalopsis corollata (L.) Kl. & Garcke. (Fig. 17)

Flowering Spurge

Description of the Plant.—A herbaceous perennial in dry soil in the eastern half of the state, bright green and usually smooth. Stem erect, 0.3-1 meter high, bearing at the top an umbel or a panicle of flowers from April to frost. The leaves are more or less oblong, entire and alternate, except that the uppermost may be in a whorl. Flowers small with white petallike appendages; capsule about 3-5 mm. thick, with ovoid, smooth, sparingly pitted seeds.

Effect on Animals.—Similar to *Chamæsyce*.

Remarks.—Closely related spurges, as *Tithymalus obtusatus* (Pursh.) Kl. & Garcke, somewhat similar in appearance, but with more obtuse leaves, and *Tithymalus cyparissius* (L.) Hill, the cypress spurge (fig. 18), often planted in cemeteries; *Zygophyllum hexagonum* (Nutt.) Small (fig. 19), *Poinsettia dentata* (Michx.) Small (fig. 20), with ovate, dentate leaves, and *Poinsettia heterophylla* (L.) Kl. & Garcke (fig. 21), with leaves variously and irregularly lobed, are similarly poisonous, but poisoning, except to young animals, is not of frequent occurrence.

Dichrophyllum marginatum (Pursh.) Kl. & Garcke. (Fig. 22.)
 (*Euphorbia marginata*)

Snow-on-the-Mountain, Spurge

Description of the Plant.—An annual, bright green, glabrous or pubescent herb in dry soil, some years often locally very abundant. Stem rather stout, erect, 0.3-1 meter high, topped mostly by a 3-rayed umbel. Leaves, except the upper, scattered, ovate, about 2.5-9 cm. long, entire, sessil; the upper leaves, appearing as bracts subtending the umbel, are large and white margined. The flowers small in involucre—a typical spurge flower. Capsule depressed, globose, 6 mm. in diameter, usually hairy, containing three ovoid-globose dark ash-colored seeds about 4 mm. long.

Effect on Animals.—Usually the plant is not relished, as the milky juice is an acrid, blistering poison, but when eaten produces sickness. The honey which bees make from the plant is also poisonous. The milky juice may produce a dermatitis in the skin of susceptible animals.

Remedial Measures.—In case of susceptibility animals should not have access to the plant in places where it is very abundant.

BRASSICACEÆ

The mustard family, which is easily recognized by the 4 sepals, 4 yellow, white or rose-colored petals, 6 stamens and one compound pistil ripening into a globular or slender elongated pod, contains in most or all of its members small quantities of pungent substances, which if taken persistently in quantities over sufficiently long time will cause serious poisoning. In this state none of them are expected to give trouble, but attention might be called to the fact that hens eating extremely large quantities of shepherd's purse (*Bursa bursa-pastoris* [L.] Britton) (fig. 23) in the spring develop eggs in which the yolk is greenish-yellow. Such eggs are often called grass eggs. They are not normally poisonous.

PHYTOLACCACEÆ

Phytolacca americana L. (Fig. 24)

Pokeweed

Description of the Plant.—A glabrous, strong-smelling, succulent, branching herb, 1-4 meters high, from a large perennial root, in various situations, but especially in low ground along streams in the eastern half of the state. Often abundant. The leaves ovate, lanceolate, pinnately veined, acute at both ends 20-30 cm. long, on petioles 1-4 cm. long. Flowers August to October in pedunculate racemes, elongating greatly in fruit. Calyx white, stamens 10, ovary green, about 10-celled, developing into a dark purple berry about 12 mm. in diameter and 3-4 mm. high, its 10 carpels conspicuous when dry.

Effect on Animals.—Pokeweed contains poisonous substances in all parts, but particularly in the roots and seeds. This substance is quite poisonous, and if taken in even moderately small quantities causes very serious symptoms, beginning in about two hours as a violent emetic and further affecting the nerves and bringing on muscle spasms, severe purging, and gradually a paralysis of respiration and death. The taste, however, is not particularly agreeable, in consequence of which sufficient quantity to seriously poison is not ordinarily eaten.

Remedial Measures.—Preventive measures if necessary.

Remarks.—The leaves are used as greens after being boiled.

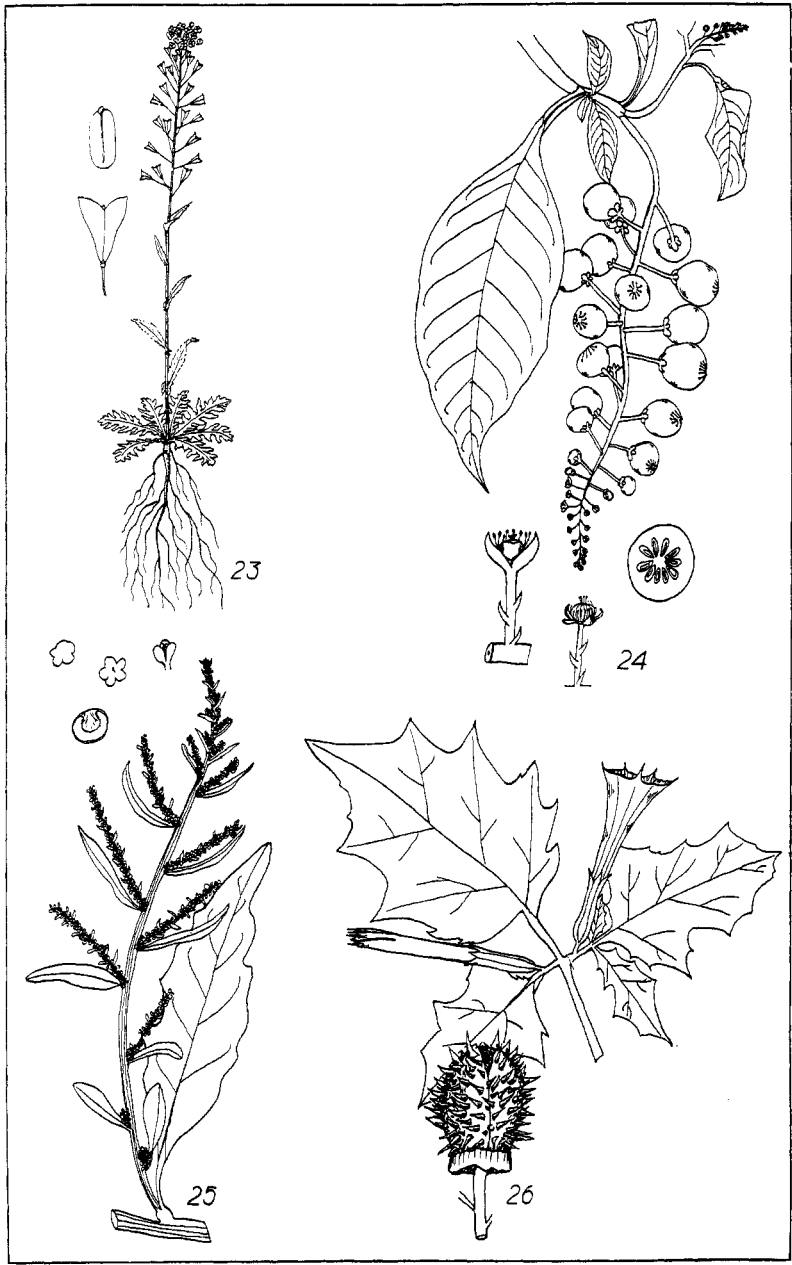
SOLANACEÆ

In the family Solanaceæ are a number of poisonous plants, the taste of which, as a rule, is so objectionable that they are not eaten. This is particularly so of all but *Solanum nigrum*. All of these plants may be recognized by their potatolike flowers and by the potatolike odor when fresh.

Solanum nigrum L. (Fig. 27)

Garden Nightshade, Black Nightshade

Description of the Plant.—Annual, glabrous, or with a few hairs, erect, branched, 0.3-0.7 meter high in waste places, often very common in cultivated soil in the vicinity of buildings. Leaves ovate, petioled, more or less inequilateral, 2.5-7 cm. long, variously margined, thin, pointed at the apex, narrowed or rounded at the base, bearing in some of the axile a peduncle on which are 3-10 small white flowers. July to frost. Berries black when ripe, smooth and glabrous, spherical, about 8-9 mm. in diameter, on nodding peduncles.



FIGS. 23 TO 26.—(23) *Bursa bursa-pastoris*. A whole plant, reduced, with enlargements of the capsule as seen in different views. (24) *Phytolacca americana*. A portion of a flowering and fruiting branch with enlargements of single flowers and a section of a fruit. (25) *Chenopodium ambrosioides*. A portion of a flowering branch with details of the flower and fruit structure, one-half life size. (26) *Datura stramonium*. A portion of a flowering branch, one-fourth life size, and a fruit (capsule), one-half life size.

Effect on Animals.—This plant may or may not contain moderate quantities of solanin and other organic chemicals, particularly in the green parts of the plant. If poison is present, calves, sheep, goats, hogs and chickens are likely to be poisoned. The berries while green also poison humans as well. The symptoms are distress, followed by elimination, but when excessive quantities are eaten nausea and giddiness may follow. If death should occur it is usually as a result of paralysis of the lungs.

Remedial Measures.—Sufficient amounts to poison are most likely to be in the plant when growing in the sun without sufficient moisture; consequently it is usually safe to ignore the plant if growing in the shade or if no cases of poisoning have developed. Because of the fact that it may contain so little poisonous material, the plant is one that should be known for what it can do under proper circumstances.

Remarks.—Many other species of *Solanum* are present in the state and may be recognized by the difference in their leaves. They are similarly poisonous, but except for *Solanum triflorum* Nutt. (fig. 28), with small lobed leaves, in the western part of the state, usually are less available in quantity to animals. One, *Solanum carolinense* L (fig. 30) (horse nettle), has prickles on the veins of the leaves; *Solanum elaeagnifolium* Cav. (fig. 29) has undulate leaves covered with stellate hairs; and another, *Solanum rostratum* Dunal (fig. 31), the prickly nightshade or buffalo bur, has a very prickly fruit. The green parts of potatoes (*Solanum tuberosum* L.) and any of the tubers which might have become green through exposure to the light are sources of occasional poisoning, green tubers more frequently to human beings.

Datura stramonium L. (Fig. 26)

Jimson Weed

Description of the Plant.—An annual glabrous herb in fields and waste places, often abundant in barnyards and pastures. The stems green to purple, stout, 30-150 cm. high; leaves thin, ovate in outline, sharp-pointed at the apex, narrow at the base, from 7-20 cm. long, irregularly lobed on petioles 2.5-10 cm. long. Flowers white or violet, about 10 cm. long, the spreading limb 3-5 cm. broad; calyx prismatic, less than one-half the length of the corolla, Capsule ovoid, densely prickly, about 5 cm. high.

Effect on Animals.—The plant contains poisonous alkaloides, including atropin and hyoscyamin, and is poisonous to all classes of stock when eaten. The taste of the fresh plant is objectionable, but the dried plant in hay no longer has the repellent odor and disagreeable taste of the fresh plant. The seeds are the most poisonous part. Cows are affected more frequently than other classes of stock. Children are occasionally poisoned.

Remedial Measures.—In case of necessity, a jimson-weed area should be fenced off, the jimson weeds cut and burned. In cutting hay some care should be taken not to include jimson weed.

APOCYNACEÆ

Apocynum cannabinum L. (Fig. 32)

Dogbane, Indian Hemp

Description of the Plant.—A perennial, branching, nearly or quite glabrous herb with milky juice, in fields and thickets, sometimes abundant. Root deep, vertical, branching; leaves opposite, entire, oblong, usually acute at the apex, narrowed or rounded at the base, glabrous above, sometimes pubescent beneath, 5-15 cm. long with or without a short petiole. Flowers in June-September, small, greenish-white, bell-shaped, exceeded by slender elongated follicles inclosing numerous small seeds with a long tuft of hairs.

Effect on Animals.—In the milky juice of these plants are poisonous substances which if taken in sufficient quantities may lead to disastrous results. Usually the bitter taste is not relished by stock, but in hay the taste is no longer present.

Remedial Measures.—Preventive if necessary.

Remarks.—Additional species in the state include *Apocynum androsæmifolium* L. (fig. 33) with pink flowers and *Apocynum sibiricum* Jacq. (fig. 34) with leaves with cordate bases.

ASCLEPIADACEÆ

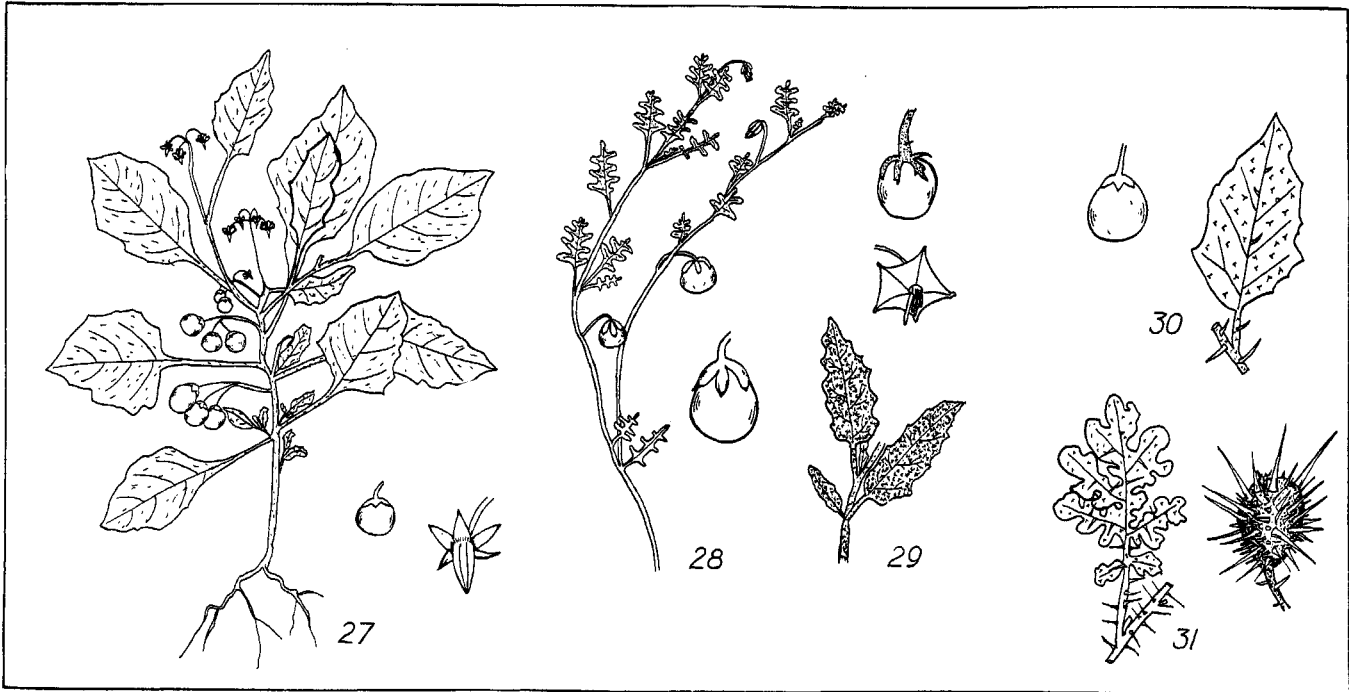
Asclepias spp. (Figs. 35-37)

Milkweeds

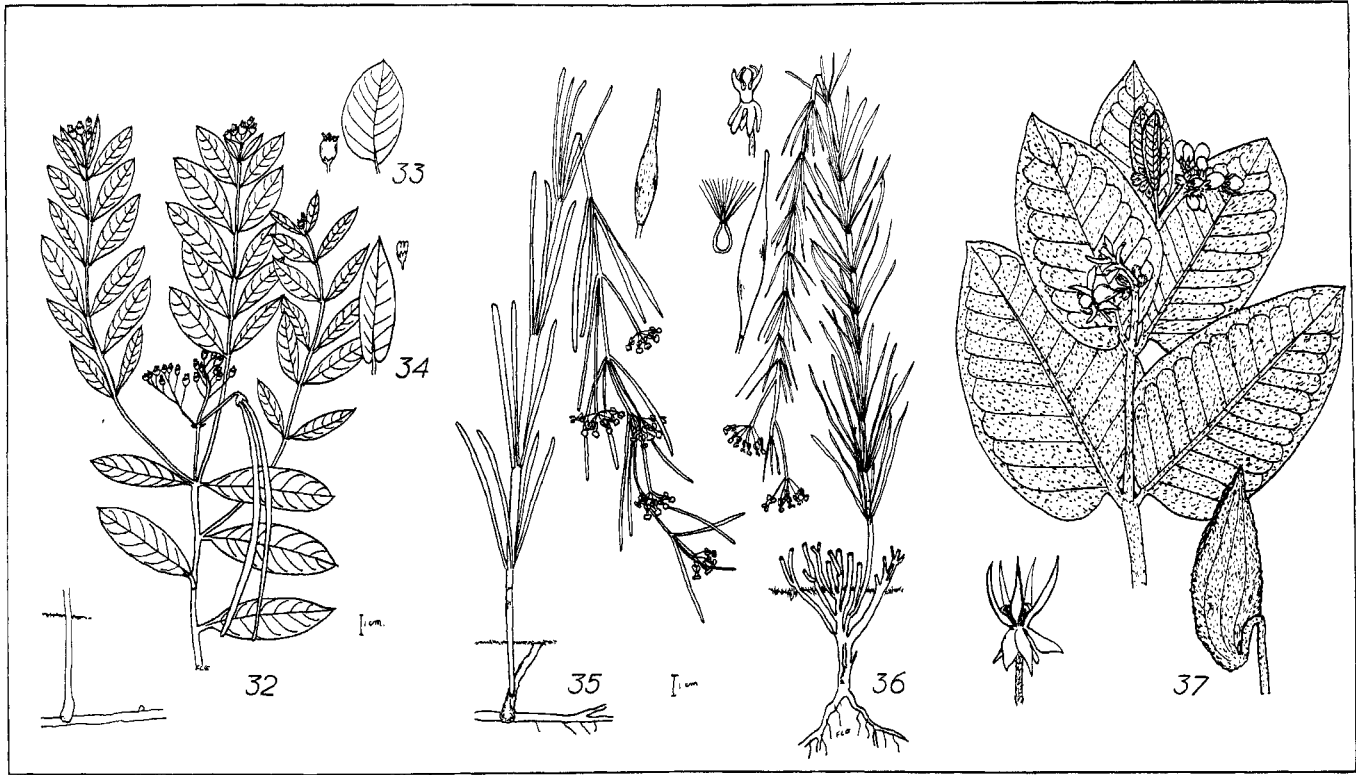
Description of the Plants.—The genus *Asclepias* includes a number of species of milkweed in the state of Kansas. These plants are perennial, erect or decumbent herbs, with opposite, verticillate or rarely alternate entire leaves, and medium-sized or small flowers in terminal or axillary umbels. When open the corolla lobes are reflexed, hiding the sepals, while a corona bearing slender incurved horns projects upward. Pollen in waxy masses. Seeds with hairy tufts in follicles.

The milkweeds that have proved to be the most poisonous are those with very narrow leaves, usually verticillate in 3's to 6's to which larger quantities are more freely eaten. Of these, *Asclepias verticillata* L. (fig. 36), in the eastern three-fourths of the state, has a bunch of long fibrous roots and smooth pods; *Asclepias pumila* (A. Gray) Vail, in the western two-thirds of the state, is a low tufted plant with densely crowded leaves; and *Asclepias galioides* H. B. K. (fig. 35), recorded from the western part of the state, has horizontal main roots and hairy pods. Among the broad-leaved milkweeds, *Asclepias speciosa* Torr. (fig. 37) is known to be poisonous, but under Kansas conditions is unlikely to cause any trouble.

Effect on Animals.—Although all milkweeds contain poisonous substances and should be held in suspicion, most of them are not eaten unless they are in hay and consequently will rarely give trouble. This is not the case, however, with narrow-leaved milkweeds, particularly the whorled milkweed, *Asclepias galioides*, which is eaten by sheep (although at first only when hungry) and to a much lesser extent by cattle and horses. The toxic and lethal doses for cattle are not far from 0.5 pound per 100 pounds of animal; for horses about 0.2 lbs., and for sheep between 0.138 and 0.22 pounds. All



FIGS. 27 TO 31.—(27) *Solanum nigrum*. A plant, about one-third life size, and enlargements of a flower and fruit. (28) *Solanum triflorum*. A portion of a fruiting branch one-fourth life size, with enlargements of a single fruit. (29) *Solanum elaeagnifolium*. Details of fruit, flowers and leaves, one-fourth life size. (30) *Solanum carolinense*. Fruit and leaf, about one-fourth life size. (31) *Solanum rostratum*. A leaf, about one-fourth life size, and a fruit somewhat enlarged.



FIGS. 32 TO 37.—(32) *Apocynum cannabinum*. A plant, showing also a running rootstock. (33) *Apocynum androsæmifolium*. A flower, enlarged, and a leaf, reduced. (34) *Apocynum sibiricum*. A flower, enlarged, and a leaf, reduced. (35) *Asclepias galioides*. A plant with typical fruit, one-half life size. (36) *Asclepias verticillata*. A plant with detail of flower, fruit and seed; the plant, one-half life size. (37) *Asclepias speciosa*. A portion of a fruiting branch, one-fourth life size, a flower, enlarged, and a fruit reduced.

of these figures are computed on the basis of the green plant for a 100-pound animal. The effects may appear in two or three hours or not for a day. The most characteristic symptoms are the violent spasms, which may exhibit as many as four stages:

1. A period of partial paralysis, with staggering movements and falling.
2. A short period of violent spasms.
3. A period of spasms accompanied with running movements.
4. A period when spasms are of less intensity until death comes by respiratory paralysis.

Autopsy usually reveals an abnormal quantity of gas in the alimentary canal and lesions in the kidneys and the central nervous system.

Remedial Measures.—Preventive, by exterminating the plant, or by making certain that the animals are well fed when in milkweed areas. Especial care needs to be taken in driving animals through it or bedding them in or near it. Extermination is a difficult matter unless the plant can be shaded. Frequent cutting off the tops may prevent seeding and so further spread. Plowing merely breaks up the rootstocks, from each piece of which a new plant can grow.

PRUNACEÆ

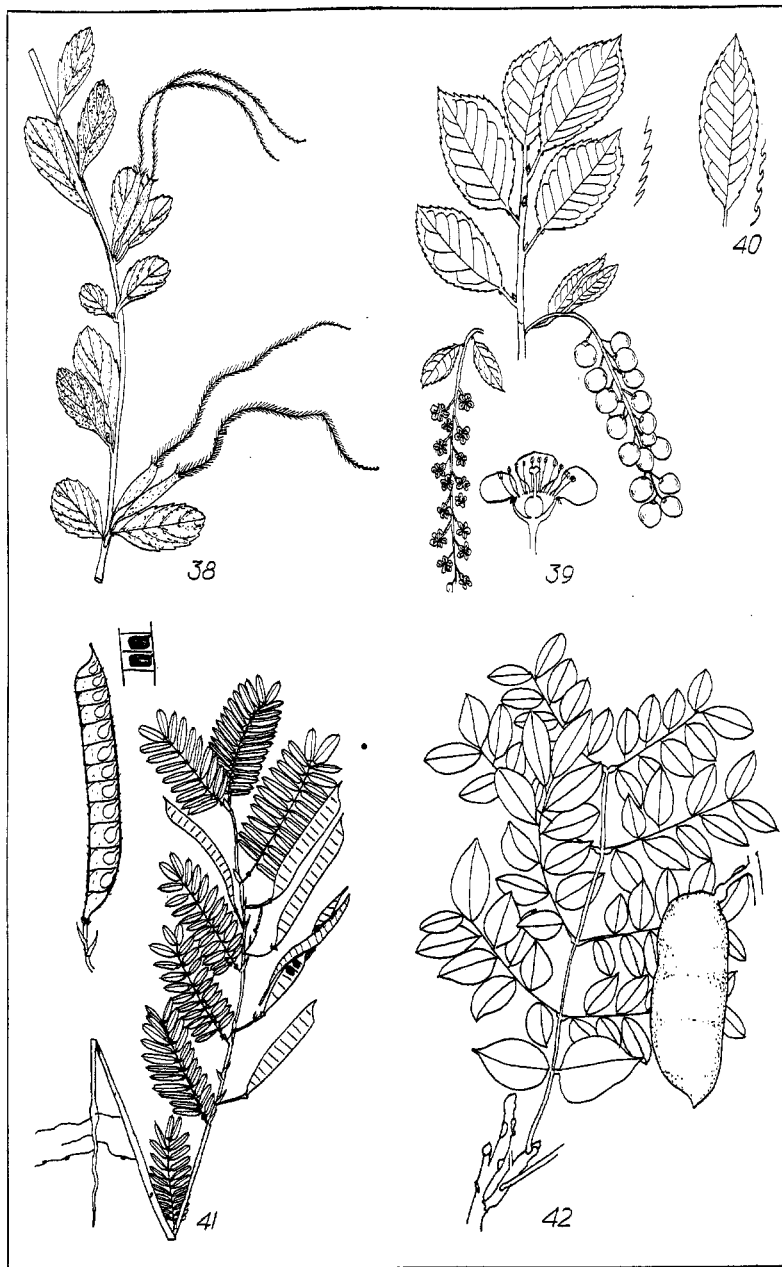
Prunus spp.

Cherries, Plums, Etc.

Description of the Plants.—The genus *Prunus* contains many shrubs and trees, mostly with edible fruits and white or pink flowers in umbels or corymbs. The leaves frequently are folded lengthwise; petals spreading, quickly falling; stamens 15-20; the fruit with a stone of various shapes and surfaces, covered over with an edible flesh and a smooth or hairy skin. Many species occur in the state, but the following are those which are most likely to cause poisoning:

Prunus besseyi Bailey, western sand cherry, Bessey's cherry, is a shrub 0.3-1.5 meters in height on the plains, flowering in early spring. *P. virginiana* L., the choke cherry, is a shrub 0.5-3 meters high, or rarely a small gray-barked tree, with leaves broadest above the middle and usually abruptly acute or acuminate at the apex, with flowers in spreading, somewhat loosely flowered racemes, which elongate in fruit and bear red to nearly black or rarely yellow globular drupes about 8-10 mm. in diameter. *P. virginiana melanocarpa* Sarg. (fig. 39), another choke cherry, more frequently becomes a tree similar to *P. virginiana*, but with thicker and less acute leaves and shorter teeth with the flesh of the drupe less astringent, 6-8 mm. in diameter; flowering in early summer. *P. serotina* Ehrh. (fig. 40), black cherry, is a tree with rough black bark, leaves which are narrowed at the base and widest about the middle, with flowers similar to the two just mentioned, as is also the fruit. Flowers in May. *Prunus persica* Batsch., peach, is a small tree with green and purplish-brown smooth twigs, pink flowers, and large subglobular grooved drupe with a soft, velvety skin.

Effect on Animals.—The various species of *Prunus* may contain varying quantities of the cyanophoric glucoside, amygdalin, which, with the proper enzyme, breaks up in the stomach of the animal, yielding hydrocyanic acid—a well-known violent poison. The glucoside is present in largest quantities in



FIGS. 38 to 42.—(38) *Cercocarpus montanus*. A portion of a fruiting branch, one-half life size. (39) *Prunus virginiana melanocarpa*. Portions of flowering and fruiting branches, one-fourth life size, and enlargements of a single flower and leaf edge. (40) *Prunus serotina*. A leaf with enlargement of its edge. (41) *Chamaecrista fasciculata*. A fruiting plant, one-fourth life size, with enlargements of a single fruit and seeds in position. (42) *Gymnocladus dioica*. A leaf, one-sixteenth life size, and fruit, one-fourth life size.

the wilted leaves and in the seeds; sometimes in fresh, succulent leaves, and may be present in the dried leaves and bark. It is not, however, present in the pulp of the fruit, however astringent that may taste. Poisoning may result from the consumption of but a small quantity of leaves, and the poisoned animal is usually dead before anything can be done about it.

Remedial Measures.—Preventing access to the plants is the only sure method, as there is no certain way of readily telling whether the glucoside, amygdalin, is present. In its absence the leaves may be eaten without injury.

CASSIACEÆ

Chamæcrista fasciculata. (Michx.) Greene. (Fig. 41)

Partridge Pea, Sensitive Pea

Description of the Plant.—An annual, erect or spreading, widely branched, pubescent or nearly glabrous herb, 0.3-0.8 meter high in dry soil. Leaves pinnately compound, sensitive, with 20-30 oblong inequilateral leaflets; flowers 2-4 together in the axils, 2.5-4 cm. broad with long acuminate calyx lobes, 5 irregular petals, 10 separate perfect stamens, 4 of which have yellow anthers and 6 with purple. The pod linear, flat, somewhat hairy, 4-7 cm. long, containing flattened rhombic black seeds. Flowers July-September.

Effect on Animals.—A cathartic substance is present in the seeds, which if taken in considerable quantities may cause the animal distress. The plant is effective either fresh or dried in hay.

Remedial Measures.—Keep the animal away from the plant and avoid hay containing quantities of it.

Gymnocladus dioica (L.) Koch. (Fig. 42)

Coffee Tree

Description of the Plant.—A large forest tree with rough bark. Leaves very large, two-pinnately compound; leaflets 7-15 on a pinna, ovate, pointed at the apex, rounded at the base, glabrous or pubescent on the veins beneath. ciliate on the margin, 2.5-8 cm. long; flowers nearly white in racemes, followed by an oblong, thick, flat pod about 10-20 cm. long and 3-4 cm. wide, with thick, leathery valves and a sweetish, sticky pulp between the large, dark, olive-colored seeds.

Effect on Animals.—The leaves contain the alkaloid cytisin, which is also present in the sweetish pulp around the seeds. A moderate quantity of this is sufficient to disturb the animal eating it, but cases of poisoning are not frequent. The symptoms are narcotic.

Remedial Measures.—Preventive, if necessary. Emetics and stimulants. Since poisoning occasionally happens where pods have fallen into pools or tanks from which the animals drink, it is wise to remove the pods, especially if they are broken, and to prevent animals from drinking the water until it has been changed.

FABACEÆ

Sophora sericea Nutt. (Fig. 45)

Silky Sophora

Description of the Plant.—A herbaceous prairie and plains plant of the western half of the state, often woody at the base, silky or silvery pubescent with appressed hairs, 15-30 cm. high. Leaves short, petioled, pinnately compound with 7-25 leaflets; flowers white, nearly sessil, in a rather loosely flowered peduncled raceme; the pod dry and leathery, 2.5-5 cm. long, about 4 cm. thick, hairy with but few seeds.

Effect on Animals.—The seeds in particular contain a powerful alkaloid, which if taken in sufficient quantities causes serious effects, but it is not relished by stock.

Remedial Measures.—Preventive, if necessary.

Baptisia spp. (Figs. 43, 44)

False Indigo

Description of the Plants.—The baptisias are smooth or hairy, erect or ascending herbs with trifoliolate short-petioled compound leaves. The flowers blue, white or yellow, usually in elongated racemes, either erect or horizontal, with ten separate stamens, giving place to a leathery, much-swollen, short pod, long-stalked in calyx and tipped with the style, inside of which the seeds rattle when detached. The principal species in Kansas are *Baptisia australis* (L.) R. Br. (fig. 43), a smooth plant with indigo-blue flowers; *Baptisia bracteata* Ell. (fig. 44), a hairy plant with white or cream-colored, very showy flowers; and *Baptisia leucantha* T. & G., a glabrous plant with white flowers.

Effect on Animals.—These plants contain certain emetic and cathartic substances which may be distressing to the animals in case sufficiently large doses are taken. Ordinarily, however, the taste is so disagreeable that there would not be much chance for an animal to get enough to affect it. Animals poisoned are usually young, and ponies are perhaps more frequently poisoned than other animals.

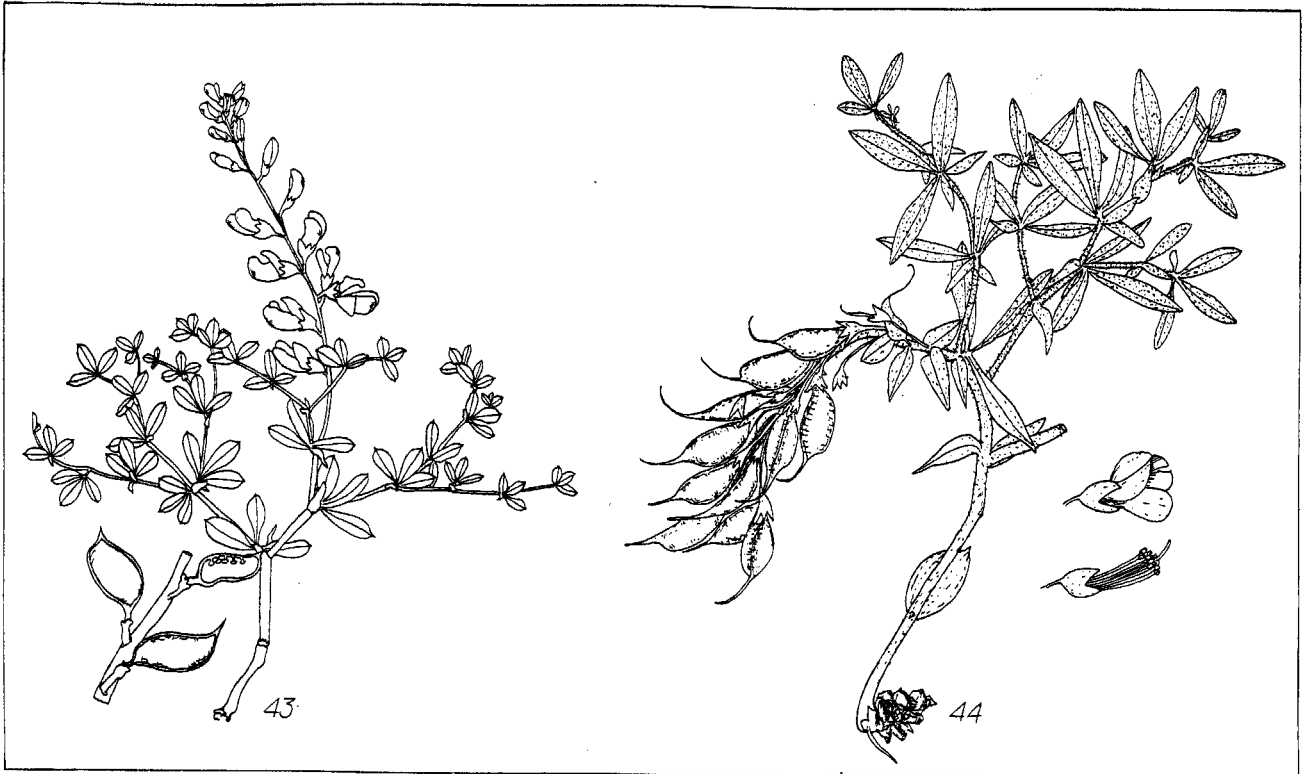
Remedial Measures.—Preventive, if necessary.

Crotalaria sagittalis L. (Fig. 46)

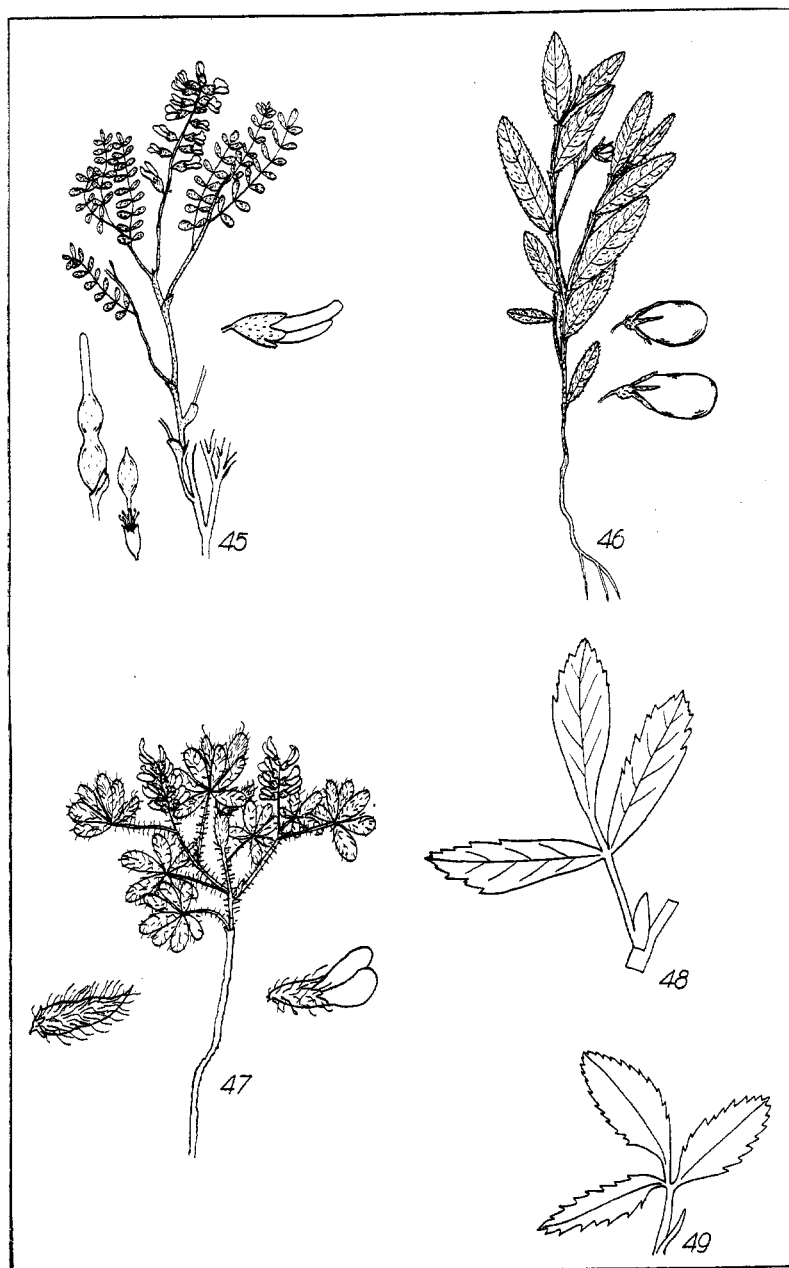
Rattlebox

Description of the Plant.—A low annual, erect or decumbent, hairy, branching herb, rarely over 30 cm. high, which differs from most legumes in having simple leaves. The leaves are more or less oval, entire margined, nearly sessil, 2.5-7 cm. long and 4-16 mm. wide, with united, persistent stipules running down the stem. Flowers yellow, about 10 mm. long, the calyx about as long as the corolla; June-September. The pod oblong, smooth, nearly sessil in the calyx, 2.5 cm. long, 8-10 mm. thick, much inflated, becoming nearly black, the seeds within loose and shining.

Effect on Animals.—Injurious alkaloids are contained in various parts of the plant, but particularly in the seeds. Poisoning has been most serious along sandy river beds of the Missouri river in northeastern Kansas, mostly with horses, but also with cattle. The progress of the disease is very slow. It is



FIGS. 43 AND 44.—(43) *Baptisia australis*. A flowering plant and seed pods, one-fourth life size. (44) *Baptisia bracteata*. A fruiting plant, one-fourth life size, with details of flowers, one-half life size.



FIGS. 45 TO 49.—(45) *Sophora sericea*. A flowering plant, one-half life size, with details of the flower and fruit life size. (46) *Crotalaria sagittalis*. A flowering plant, one-fourth life size, with fruits, about one-half life size. (47) *Lupinus pusillus*. A flowering plant, one-fourth life size, with details of the flower and fruit about life size. (48) *Medicago sativa*. A leaf, life size. (49) *Melilotus alba*. A leaf, life size.

evidenced by a general decline in bodily vigor, so that the animals become thin and weak; they may also be very sleepy. Death usually occurs after a number of weeks, or even months, from eating either sufficient quantities of the fresh or the dried plant.

Remedial Measures.—In areas where *Crotalaria* forms virtually the total vegetation, horses and cattle should be kept off.

Remarks.—This trouble is often called the Missouri bottom disease.

Lupinus pusillus Pursh. (Fig. 47)

Low Lupine

Description of the Plant.—Usually an annual herb on dry plains of western part of state, hairy, 10-20 cm. high, from a deep, much-branched root. The petiolar leaves palmately compound, the usual 5 (rarely 7) leaflets more or less oblanceolate, smooth or nearly so above, with long, scattered hairs beneath. Flowers papilionaceous in numerous racemes, 2.5-7.5 cm. long, densely few-flowered, blue, pod oblong, very hairy, about 2 cm. long and 4-6 mm. broad, frequently two seeded.

Effect on Animals.—Sheep are the animals most frequently and most seriously affected, while horses, cattle, goats and pigs may often be apparently unharmed, although eating rather large quantities. The symptoms of the disease consist of frenzied actions of the animal, which rather frequently lead to death. The poisonous substance is found most abundantly in the seeds and varies greatly under different conditions. Animals may be poisoned either on the range or from hay containing lupine seeds. The trouble, often known as lupinosis, is characterized by jaundice, acute yellow atrophy of the liver and a parenchymous inflammation of other internal organs. The disease usually lasts four or five days, although death may occur within 24 hours. The immediate cause of death is rapid emaciation and extreme weakness. The bodies of animals dying from lupinosis decompose very rapidly. Sheep may be seriously poisoned after eating as little as one per cent of their weight of lupine, but horses require from 7 to 24 per cent of their weight.

Remedial Measures.—It is safest to always regard lupines as poisonous, particularly so if seeds are present, but at the same time to recognize that much greater quantities of leaves are required to poison in the absence of seeds than with them. One should avoid turning young sheep into pastures where lupines are abundant or in seed, and they should not be driven distances along trails through lupine areas nor fed lupine hay. If any medication is resorted to, alkalis should be strictly avoided. For purging, oil should be used.

Medicago sativa L. (Fig. 48)

Alfalfa

Description of the Plant.—The alfalfa is a well-known economic plant with compound leaves, the leaflets of which are usually obvate and dentate, particularly towards the apex. A small quantity of injurious substances is present in alfalfa, and when taken in very large quantities unmixed with other feed, especially by animals not yet accustomed to green feed, may cause bloat, which in extreme cases leads to death.

Remedial Measures.—Trocar to relieve pressure, but in general, preventive measures.

Remarks.—The value of alfalfa under proper conditions far outweighs the occasional ill effects.

Melilotus alba Desv. (Fig. 49)

White Sweet Clover

Description of the Plant.—This annual or biennial herb, with pinnately compound leaves and sweet-smelling flowers and numerous racemes, is frequently grown as food for animals, as is also its near relative, *Melilotus officinalis* (L.) Lam., which differs in having yellow flowers. Under conditions of cultivation these plants are not usually likely to cause any poisoning, even though they do contain small quantities of coumarin. The wild plants contain a higher percentage of coumarin and it occasionally happens that animals having little or nothing else to eat get poisoned.

Remarks.—These plants are well-known forage plants and are important honey plants, but are undesirable in grain fields on account of the foul odor imparted to flour.

Robinia pseudoacacia L. (Fig. 53)

Black Locust

Description of the Plant.—A large tree with very rough bark, frequently planted in the eastern part of the state. The twigs and foliage nearly smooth, but stipules often spiny. Leaves pinnately compound with 9-19 stalked, oval, entire leaflets 2.5-5 cm. long. Flowers white, in drooping racemes, fragrant, in May or June. Pod glabrous, 5-10 cm. long, about 14 mm. wide, 4-7 seeded.

Effect on Animals.—A poisonous substance, robin, is present in all parts of the plant, but particularly in the roots, bark and leaves, especially on sprouts and new growth. While the taste is not pleasant, poisoning is not infrequent. Horses are most subject to poisoning, but cattle and humans are also poisoned. The symptoms of poisoning include colicky pains, with irregular pulse and purging; exhausted condition, with nausea, and attempts to vomit, followed by nervous depression and collapse. The heart beats are very violent and may be heard some distance from the animal.

Remedial Measures.—The animals should not be allowed to come in contact with black locust. The use of digitalis subcutaneously has assisted, but the case should be in the hands of a veterinarian.

Astragalus mollissimus Torr. (Fig. 50)

Woolly Loco or Stemmed Loco

Oxytropis lamberti Pursh. (Fig. 51)

Stemless Loco

Description of the Plants.—*Astragalus mollissimus* is a decumbent or ascending, stout, bushy, densely hairy herb of the western half of Kansas. Stem very short, stipules membranaceous, ovate, pointed, 6-10 mm. long, joined to the petiole. Leaves pinnately compound with 19-27 oval leaflets, 8-12x4-6 mm. Flowers in June, violet purple, 2-2.5 cm. long, in dense spikes, standing 30-60 cm. high, usually above the leaves, the keel blunt. Pod oblong, dry,

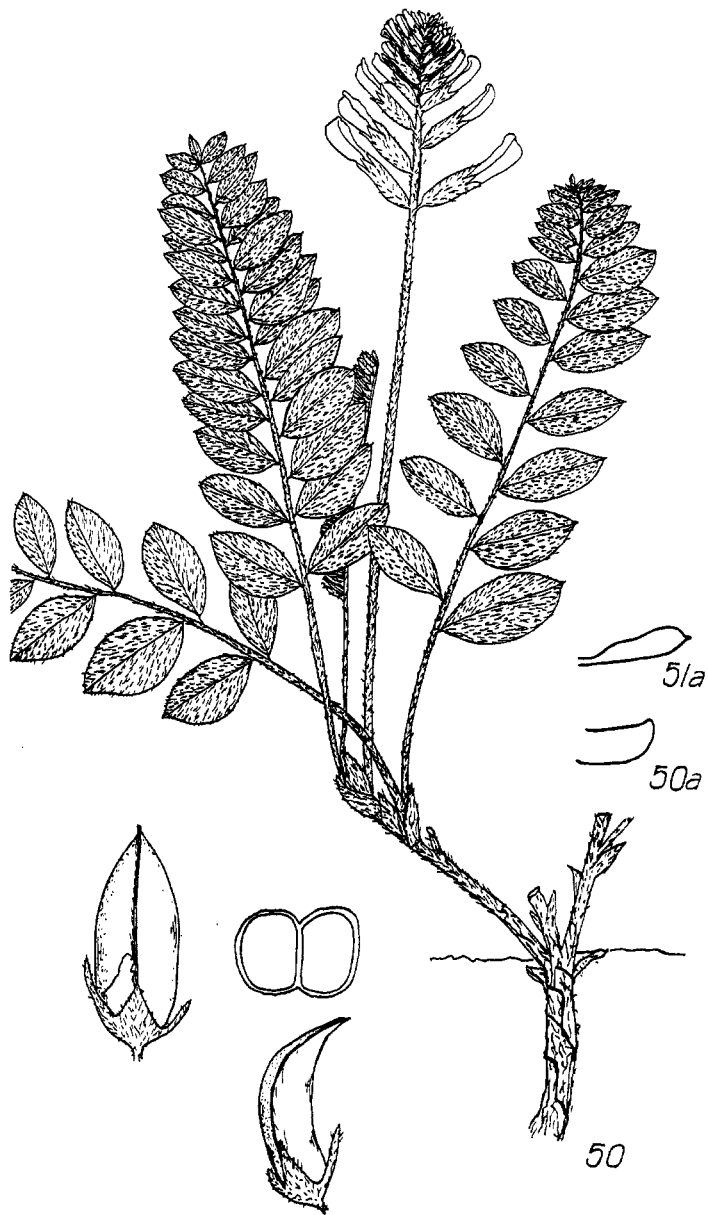


FIG. 50.—*Astragalus mollissimus*. A flowering plant, one-half life size, with enlargements of the fruit and its section; (a) the outer end of the keel petal.

smooth, compressed, sessil, breaking into two slightly curved valves at maturity, 2-celled, about 10-20 x 6 mm.

Oxytropis lamberti is a silky, pubescent, acaluescent, tufted herb of the western two-thirds of Kansas, similar to the preceding, but with a crown instead of a short aboveground stem and shorter leaves with from 9-19 oblong leaflets; peduncles longer than the leaves, 15-30 cm. high; bearing from April to August, in dense heads or spikes, purple, yellow or purplish flowers, 15-30 mm. long, the keel with a short projection or spur at the end. Pod incompletely 2-celled, leathery, sessil, erect, ovoid cylindric, densely hairy, long acuminate, 12-25 mm. long, exceeding the calyx.

Effect on Animals.—The loco weeds contain some substance or substances which, if eaten by animals over a period of time sufficiently long, lead to a locoed or erratic condition of frenzy, rendering the animals nondependable and unfit for many uses. The animals may not be injured by eating moderate quantities of loco mixed in with other feeds, but if too great a quantity is eaten, animals, particularly horses, begin to specialize on loco and refuse suitable feed. Either dried or fresh plants have the same effect. The locoed animal is more or less emaciated, and death, except where it is accidental in a frenzy, seems to be a result of slow starvation. Horses are most liable to be affected by loco, and will eat either kind readily. Cattle and sheep may also be locoed, but find the woolly loco (*Astragalus mollissimus*) distasteful.

Remedial Measures.—If it is noticed that an animal is eating a good deal of loco, the removal from access to it before any symptoms are noted is normally sufficient. In early stages of the disease, maintaining animals on laxative feeds with alfalfa, grain and oil meals may restore a good deal of the value of the animal. If the loco effects show, unless the animal is a valuable one, there is nothing that can be done that will be worth while. If the animal is a very important one, treatment under a veterinarian with Fowler's solution for more than a month, or for cattle, the injection of strychnin sulphate in very small doses for a month, may bring the animal to a very slow recovery.

Since animals acquire the loco habit in lean pastures, often during the winter season, at such times sufficient care should be taken to see that the animals do not begin to concentrate on eating loco, for if they do the loco condition is certain to follow.

The loco plants may be exterminated from fields if cut off four or five inches below the surface of the ground repeatedly two or three times at intervals of a half year. The parts aboveground must be burned. Thus it may take two or three years to clean up a field, but the results that have been obtained on a number of ranches would justify the expense. Reseeding in dangerous quantities from adjacent areas would probably take ten to eleven years before enough loco to cause alarm would develop.

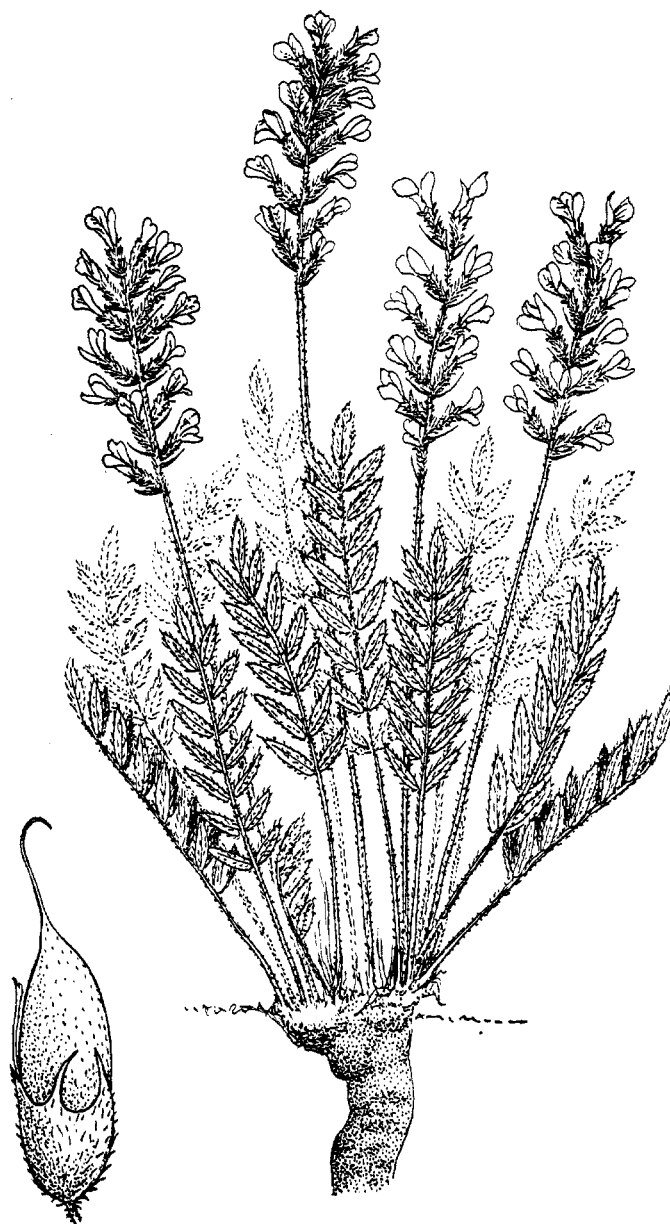


FIG. 51.—*Oxytropis lamberti*. A flowering plant one-fifth life size, with a pod twice life size. The outer end of the keel petal is shown on the preceding page (51a).

ÆSCULACEÆ

Æsculus arguta Buckl. (Fig. 52)

Shrubby or Western Buckeye

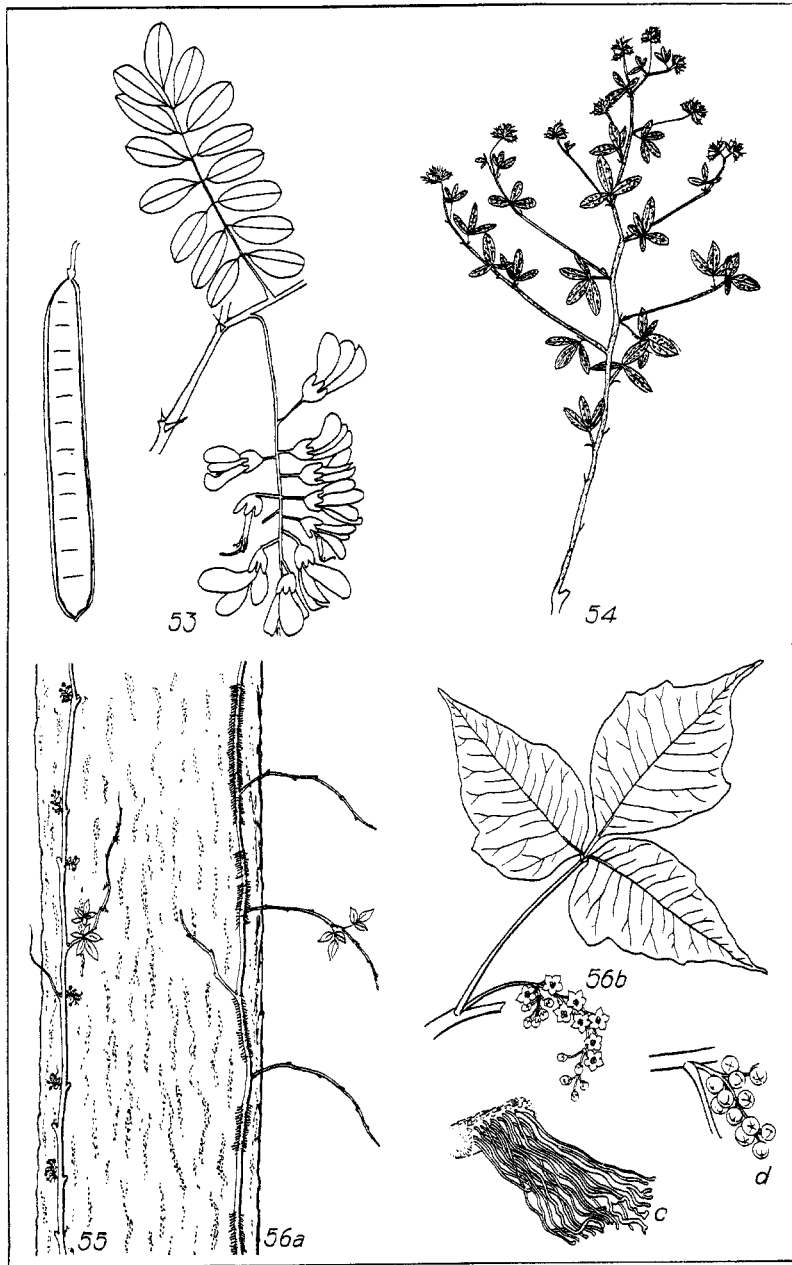
Æsculus glabra Willd.

Fetid Buckeye, Ohio Buckeye

Description of the Plants.—*Æsculus arguta*, a shrub 1-3 meters high, with smooth bark and opposite, palmately compound leaves, with 7-9 narrow, long, acuminate, unequally serrate leaflets about 7-10 cm. long. Young growth somewhat pubescent, becoming glabrate. Flowers in March and April, in dense clusters, yellow, with reddish center. Fruit very spiny when young, the seed with a very large scar, hence the name "buckeye."



FIG. 52.—*Æsculus arguta*. A flowering branch with details of the seed, fruit, and young fruit, all one-half life size.



FIGS. 53 TO 56.—(53) *Robinia pseudoacacia*. A flowering branch and fruit, one-half life size. (54) *Psoralea argophylla*. A plant, one-half life size. (55) *Parthenocissus quinquefolia*, showing habit of climbing (tendrils ending in discs) and the compound leaves with five leaflets. (56) *Rhus toxicodendron radicans*. (a) The climbing habit, showing aerial roots along the stem and projecting branches with compound leaves of three leaflets; (b) a flowering branch; (c) aerial roots; and (d) fruits, one-half life size.

Æsculus glabra, similar, but a tree with rough, fetid bark, 5 (rarely 7) leaflets, 7-14 cm. long, finely and sharply serrate, generally glabrous. Flowers pale yellow in April and May.

Effect on Animals.—Especially the seeds, but also the young shoots, contain the poisonous substance æsculin, which acts as a cerebrospinal irritant, which in large quantities may cause death. The mucous membranes become inflamed and may be followed by violent vomiting. Cattle are generally affected in spring from the young herbage and hogs in the fall from the seeds.

Remedial Measures.—Ordinarily the buckeye will give no trouble, but in springs with late frosts, which keep the grass from developing until the young shoots of the buckeye have come out in the woods, poisoning is to be expected if the animals are given opportunity to graze on the buckeye. Fencing at that time or feeding should normally be ample protection, for later the buckeye will not attract.

Remarks.—Poisoning from the buckeye of late years has been more frequent than in the past.

ANACARDIACEÆ

Rhus toxicodendron radicans Torr. (Fig. 56)

Poison Ivy

Description of the Plant.—Poison ivy occurs in two well-marked forms. The first is the less common in this state and consists of a low bush, usually not over 40 or 50 cm. in height. The ordinary appearance of the plant in this state is a woody climber, climbing on fences, stone walls, trees or other means of support by means of multitudes of small adventitious roots which come out from along the stem. If examined closely these roots will be found to end in a point, and never in a flattened disc as is the case with the native forms of Virginia creeper (*Parthenocissus quinquefolia* Planch.) (Fig. 55). If cut or broken the stem exudes a milky juice. The leaves are alternate, compound, with three leaflets (instead of five, as in the nonpoisonous Virginia creeper). The leaflets may have an entire margin, or not infrequently, especially in woods, be more or less lobed towards the base. The flowers are small and yellowish, occur in late May or June, and are succeeded in late fall by a panicle of whitish drupes. From the standpoint of recognition, the three leaflets of the compound leaf on a woody stem, climbing by aerial roots, are the simplest points of identification.

Effect on Animals.—On stock there is seldom if any effect due to poison ivy, but upon human beings poisoning is very well marked and may occur frequently. Poisoning is due to an oily, resinous substance, which may be gotten directly from the plant by contact, or during time of flowering from the pollen in the air, or indirectly by contact with something that has just previously been in contact with the poison ivy, such as clothing after walking through a patch of poison ivy. In a slight attack there may be nothing more than a few watery blisters, which swell up and burst and dry up. Itching may be present, and may be very severe during the time of formation of these watery blisters. In a more severe case hundreds of these blisters may appear, not only on the part which had been in contact with the ivy, but also over most of the body. These blisters develop and coalesce. The formation of

them may be accompanied by considerable swelling and pain and be followed by watery or serous sloughing off, which may last a week or more. Some of the related species, not occurring in this state, may give rise to very severe conditions or even death of the individual.

Remedial Measures.—If there has been exposure to poison ivy and the person is susceptible (nearly everyone is susceptible, although many are much more so than others), the simplest treatment is thorough washing with soap of the part exposed, particularly strong alkali soaps, such as laundry soaps, and plenty of water, followed by thorough prolonged rinsing. If soap is not available, prolonged washing in water may be sufficient. Substances such as alcohol, turpentine, benzine, gasoline or kerosene will dissolve the poison, but must be very thoroughly rinsed off if used, as otherwise they may merely spread the poison over a greater area. It is probably safe to say that any cure depends on nature, and all one can do is to alleviate the pain if the itching is severe enough to bother. Various things are used for that purpose, among which the most beneficial are perhaps calamine lotion and fluid extract of grindelia. If the blisters are unbroken, lead acetate may be used, but it is most unwise to use it if any broken blisters are present. The affected part may also be painted with potassium permanganate solution, preferably hot, just previous to which blisters may be opened. The potassium permanganate quickly oxidizes any poisonous substances with which it comes in contact and may be applied two or three times a day if necessary. It will stain a deep reddish brown, which, however, will wear off in time. Solutions of iron salts, particularly ferric chlorid,⁴ are also painted on and covered over with very good results. This substance, however, stains clothing badly. In many severe cases, especially if they are systemic, extracts of "Rhus tox" may be injected at intervals of twenty-four hours until abatement is noticed, when they must be stopped. Recovery from a severe case is a matter of weeks and may be attended with several relapses, which, however, are usually not severe. A simple case may be cleared up in a week or two at most. An attack does not confer immunity to subsequent attacks.

APIACEÆ

Cicuta maculata L. (Fig. 57)

Cicuta, Cowbane

Description of the Plant.—A stout, erect, glabrous perennial herb of marshes, along streams and along drainage ditches, usually scattering, but may be locally very abundant. Stem marked with purple lines, 1-2 meters high, branching, the lower part thickened with chambers within. Roots several, tuberlike, oblong. Leaves compound or decomposed, often 30 cm. long, on long petioles, which are dilated at the base; upper leaves smaller, leaf segments more or less lanceolate, usually coarsely serrate. Flowers in compound umbels, white, from June to August. Fruit oval, about 2 mm. long, smooth, slightly flattened, laterally spreading into two halves. The plant is most easily recognized from other umbeliferous plants of similar situations by the fascicled tuberous roots and chambered base of stems.

4. Five per cent ferric chlorid in a half-and-half mixture of ethyl alcohol and water or glycerine and water.



FIG. 57.—*Cicuta maculata*. (a) A fruiting and flowering branch, one-half life size; (b) leaf, one-fourth life size; (c) a leaf base, one-half life size; (d) a fruit and its half section, about three times life size; (e) the base of the stem, showing the chambers and the tuberous roots, one-half life size; (f) the overwintering base, one-half life size.

Effect on Animals.—The fresh or the dried roots are extremely poisonous, containing conin and the very poisonous substance, cicutoxin. Poisoning is more frequent in the spring than later in the season. About 2-3 ounces of the roots for sheep, or 8-12 ounces for cattle is sufficient to cause the death of the animal in from a quarter to half an hour. The symptoms generally begin with frothing at the mouth, followed by uneasiness and pain, and later by violent, intermittent convulsions, with bellowing and groaning, which may become more violent to death. The leaves and seeds have much less of the poisonous substance in them or seem to be nearly free of it in some cases.

Remedial Measures.—As the plants often grow abundantly around watering places, such areas can be fenced off or the plants may be pulled up, or, better, dug up and burned. An effective emetic, followed by a cathartic, given early, may be effective with human beings.

Conium maculatum L. (Fig. 58)

Poison Hemlock

Description of the Plant.—A poisonous biennial herb (1-2 meters high), with spotted branched stems, large decomposed leaves with lanceolate pinnatifid leaflets. Flowers in umbels, white. Fruit small, somewhat flattened at the sides, smooth with prominent wavy ribs, without oil tubes; the face of the seed deeply and narrowly concave.

Effect on Animals.—This poisonous plant has been well known since the early Greeks, by whom it was used to inflict the death penalty upon criminals and philosophers. All parts of the plant contain the poisonous substance, conin, but the seeds and leaves are the parts quite likely to be eaten. In this state, where the plant is grown as an ornamental plant, from which it may escape along roads close by, poisoning is usually limited to chickens, but elsewhere all classes of animals become poisoned and die from it.

Remedial Measures.—If grown as an ornamental, under the wholly inapplicable name "California fern," animals should not be permitted access to the plant or any of its parts.

CAPRIFOLIACEÆ

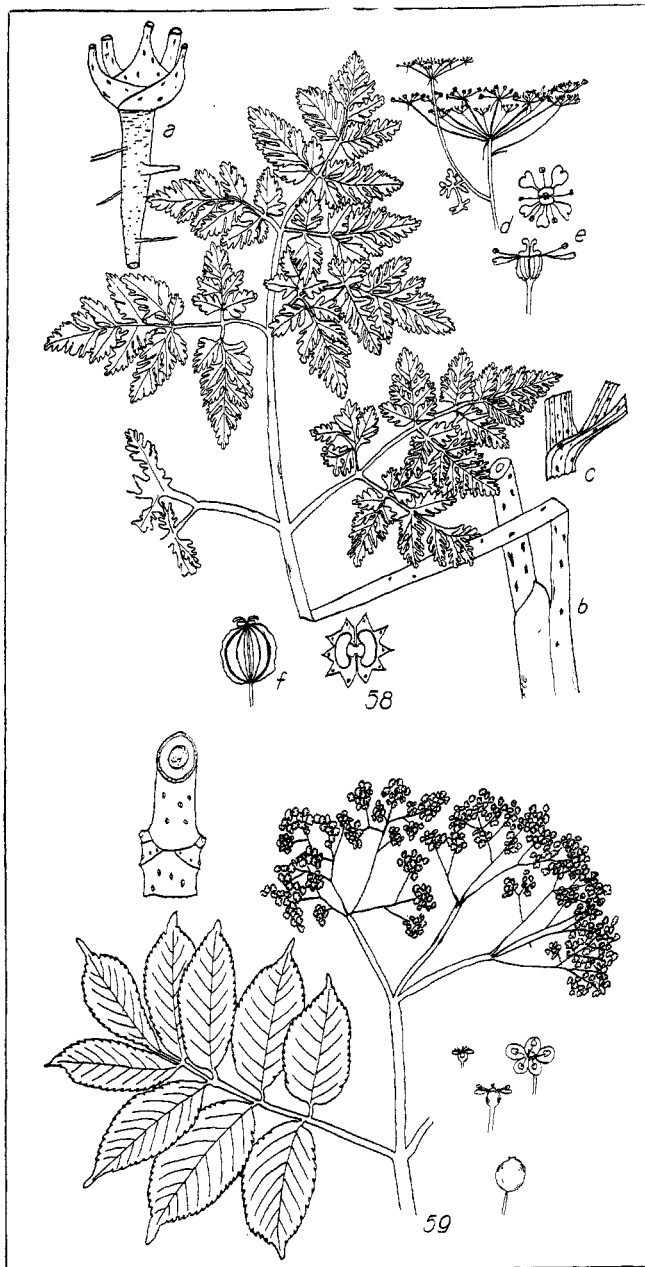
Sambucus canadensis L. (Fig. 59)

Elder, Elderberry

Description of the Plant.—A shrub, usually 3 meters high in moist soil in the eastern third of Kansas. Stems but little woody with large, white pith. Leaves opposite, compound, with 5-11, usually 7 leaflets, more or less oval, pointed; smooth above, sometimes hairy beneath; sharply serrate. Flowers small, white, in large convex cymes followed by deep purple or black drupes about 6 mm. in diameter.

Effect on Animals.—The elderberry contains in its fresh leaves, uncooked berries, flowers, and particularly the root, the substances which yield a small amount of hydrocyanic acid in the stomach of the animal. In addition alkaloids are present, which make the taste of the leaves and roots bitter, and consequently very little is likely to be eaten. In the case of the berries, cooking entirely breaks up the cyanogenetic glucosides. Children chewing the bark are most liable to be poisoned.

Remedial Measures.—Preventive, if necessary.



FIGS. 58 AND 59.—(58) *Conium maculatum*. (a) the root system; (b) a leaf; (c) insertion of a leaf; (d) a portion of the inflorescence, all one-half life size; (e) details of the flower; (f) details of the fruit, enlarged. (59) *Sambucus canadensis*. A portion of a twig in winter, one-half life size; a flowering branch, one-fourth life size, and details of a flower and fruit enlarged.

COMPOSITÆ

Xanthium spp. (Fig. 60)

Cockleburs

Description of the Plant.—Monœcious, annual, branched, coarse, rough herbs, with alternate lobed or dentate leaves, and rather small heads of greenish discoid flowers. The pistillate flowers ripen into an ovoid or oblong closed involucre covered with hooked spines and containing two akenes. Usually but one akene germinates the first year, bringing two long, narrow cotyledons (seedling leaves) into the air. Germination may take place continuously between mid-April and midsummer, often in progressive zones as ponds dry up.

Effect on Animals.—Seedlings with the cotyledons present are poisonous to cattle, sheep, and especially to young pigs and colts. The seedlings are rather freely consumed, especially by young pigs rooting in sandy soil along streams and around ponds. An average of about five pounds per 100 pounds of animal is necessary to poison, and poisoning in young pigs normally means death.

The symptoms of poisoning are “depression, nausea, accompanied with vomiting, rapid and weak pulse, and a low temperature. Before death there are, frequently, spasmodic movements, but animals sometimes die very quietly. The symptoms ordinarily appear within twenty-four hours after the plant is eaten and commonly continue for only a few hours.”

Autopsies show more or less inflammation and congestion of the alimentary canal and related parts, with an unusual quantity of serum in the abdominal cavity, and frequently a jellylike accumulation about the gall bladder and its ducts.

Remedial Measures.—As long as seedling leaves of the cocklebur are present, animals should be prevented from grazing or feeding in the area! especially if they are very young. To a poisoned animal may be given fats or oils, such as bacon grease, lard and raw linseed oil, often with beneficial results.

Helenium, spp. (Figs. 62, 63)

The Sneezeweeds

Description of the Plants.—Perennial herbs, except *H. tenuifolium*, with puberulent or glabrous stems, narrowly winged by the decurrent bases of the leaves. Leaves firm, oblong, lanceolate, dentate or entire, pointed at the apex and narrowed to the sessil base. Flowers in peduncled heads of tubular and drooping yellow or yellowish ray flowers. Pappus of 5-8 pointed scales. Three species occur in the eastern one-fourth of the state—*H. autumnale* L. (fig. 63), with oblong or ovate-lanceolate, dentate leaves and yellow disks; *H. nudiflorum* Nutt., with linear-lanceolate or lanceolate, mainly entire leaves and purple disks; and *H. tenuifolium* Nutt. (fig. 62), with linear-filiform, entire leaves.

Effect on Animals.—The poisonous principle (dugaldin, an accumulative toxic glucoside) occurs in all parts, but especially in the flowers, and more in the fresh than in the dried plant. It affects sheep, cattle, horses and mules, as a rule, only if they are unfamiliar with it and are hungry. Although the animal may be very sick for a day or two, recovery usually occurs. The symptoms



FIG. 60.—*Xanthium* spp. A portion of a fruiting branch and two seedling plants, one-half life size.

include tears, restlessness, soreness, labored breathing, nearly constant motion of the jaws, although not eating. Horses and mules succumb to the injurious effects of the poison more promptly and more completely than other animals. The animal loses control of its motions, and in plunging about may fall on its head and break its neck.

Under normal circumstances animals are not likely to eat sneezeweeds unless deprived of other green feed for too long a time, but having once partaken of it, some animals take a liking to it and are quickly killed by eating it in large quantity. In this state the plants are seldom numerous enough in any one place to make poisoning by it at all frequent.

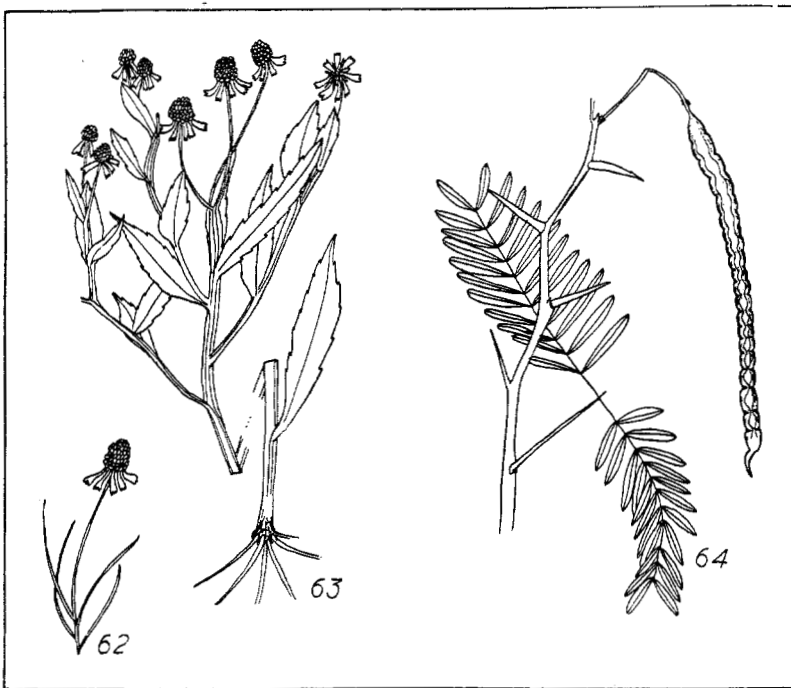


FIG. 61.—*Eupatorium urticaefolium*. A flowering plant, base of stem, one-half life size, and an enlargement of a single head of flowers.

Eupatorium urticaefolium Reichard. (Fig. 61)

White Snakeroot

Description of the Plant.—A perennial herb of rich woods in the eastern half of Kansas, often exceedingly abundant. From a snake-like root, a slender, usually fusely branched stem extends upward 0.3-1.5 m. Leaves set opposite, ovate, thin, pointed, rounded or abruptly narrowed at the base, toothed, 7-15 cm. long, half or less as wide, 3-nerved and veiny beneath. Flowers white, July-September, 10-30 in composite heads, the latter numerous in loose clusters, producing seed abundantly.



FIGS. 62 TO 64.—(62) *Helenium tenuifolium*. A flowering branch, one-fourth life size. (63) *Helenium autumnale*. A part of a flowering plan, one-fourth life size. (64) *Prosopis glandulosa*. A fruiting branch, one-fourth life size.

Effect on Animals.—White snakeroot contains alkaloids which, when taken in sufficient quantities at once, or over a period of time, cause trembling and general weakness, which may lead to the death of the animal. The effects are cumulative and more pronounced from eating the fresh plant, although they are produced by the plant in hay. The first effects are drooping head and ears, dull, no appetite, thirsty, lassitude and constipation, followed by lack of muscular control; often irregular and slow pulse and breathing, lowered temperature, glassy eyes, coma and death, with or without convulsions. Milk cows while giving milk may be without any of these symptoms, but the milk carries the poison to animals, including humans, that take it. Horses

and sheep show less resistance than cattle, while hogs usually seem immune. The fatal dose for sheep is about 6 per cent of their weight and for cattle about 10 per cent. Poisoning is most likely to occur in the late summer or autumn in lean years, when the animals lack sufficient suitable feed, due to deficiency of rainfall.

Remedial Measures.—Preventive, if possible. If poisoned, the animal should be given a dose of epsom salts (about 1 pound per 1,000 of animal) and then kept on laxative feeds. There is little chance of recovery unless treated very early. Extermination of the plant by pulling or grubbing and burning is advisable.

SUPPLEMENTARY LIST OF POISONOUS PLANTS

In addition to the plants described above, there are a number of plants that contain poisonous substances, but which are so distasteful as to be eaten only in rare instances, and some, of which such large amounts are necessary to poison, that they are of little or no importance as poisonous plants. Still others are so limited in distribution in the state as to be unimportant. Among such in this state are :

LILIACEÆ

Yucca glauca Nutt. (Yucca, Soapweed.) Rigid, narrow, sharp-pointed, plants with lilylike flowers, on sandy areas; contain saponin.

ARACEÆ

Arisæma triphyllum (L.) Torr. (Jack-in-the-Pulpit.)
Arisæma dracontium (L.) Schott. (Green Dragon.) The corms of these forest plants contain sharp crystals and a poisonous substance, making them very disagreeable in taste.

POACEÆ

Eragrostis cilianensis (All.) Link. (Stink Grass.) A common autumn weedy grass with panicles borne just above the ground, the spikelets very-many-flowered. Horses may be made sick by eating large quantities of the fresh plant or hay containing large quantities of it, over a period of time.

RANUNCULACEÆ

Clematis fremontii S. Wats. (Fremont's Clematis.) While it contains a cyanogenetic glucoside, the plant is neither common nor widely distributed.
Ranunculus abortivus L. (Small Buttercup.) A small spring plant in woods along streams, capable of producing abortion, but not usually eaten on account of the biting, bitter taste.
Anemone canadensis L. (Anemone.) A wet prairie plant with bitter, biting taste.

LINACEÆ

Linum rigidum Pursh. (Yellow Flax.) A small, yellow-flowered, very slender prairie annual or perennial. Although a cyanogenic glucoside is present in the wilted leaves, under Kansas conditions it is difficult to get enough of the plant to poison.

PAPAVERACEÆ

Argemone intermedia Sweet. (Prickly Poppy.) The prickly nature of this prairie plant makes it unlikely that enough to poison will be eaten except as the plant might occasionally get into hay in large quantities.

Bicuculla cucullaria (L.) Millsp. (Dutchman's Breeches.) A spring plant in rich woods, consumption of which in sufficient quantity is one of the causes of staggers, but too uncommon to be of importance in this state.

CHENOPODIACEÆ

Chenopodium ambrosioides L. (Mexican Tea.) (Fig. 25.) A glandular pubescent or glabrous green strongly and disagreeably scented annual; may be present along roadsides and in corrals, but is strictly avoided except as it may occasionally be included in hay. The oil it contains is an anthelmintic.

POLYGONACEÆ

Rumex acetosella L. (Sheep Sorrel.)

Rumex crispus L. (Curled Dock.)

Polygonum aviculare L. (Knotweed.)

Polygonum punctatum Ell. (Smartweed.)

Polygonum pennsylvanicum L. (Smartweed.)

Polygonum persicaria L. (Ladies' Thumb.)

Polygonum hydropiper L. (Water Pepper.)

Acrid smarting substances are contained in these weeds, which may cause dermatitis, or, if eaten in large quantities, gastric disturbances, from which the animal is normally expected to recover without any attention. Horses and sheep are the most frequently poisoned.

CONVOLVULACEÆ

Ipomœa spp. (Morning-glories.)

Convolvulus spp. (Bindweeds.) In the milky juice, particularly in the roots are small quantities of purgative substances which are seldom of a serious nature. Hogs are more frequently affected than other animals.

ROSACEÆ

Cercocarpus montanus Raf. (Mountain Mahogany.) (Fig. 38.) A low-branching shrub in dry, rocky soil, very sparingly in western Kansas, is capable of producing cyanogenetic poisoning from wilted leaves.

MIMOSACEÆ

Prosopis glandulosa Torr. (Mesquite.) (Fig. 64.) Farther south the mesquite is known occasionally to poison stock, and it is possible that it may do so in this state.

FABACEÆ

Psoralea tenuifolia Pursh and *P. argophylla* Pursh (Psoralea.) (Fig. 54.) The psoraleas are herbs with dotted, palmately compound leaves, with 3 to 5 leaflets, often very common on the prairie. In other states there are a few cases of poisoning on record, but stock do not ordinarily eat the plant unless little or nothing else is available. The seeds are the part most likely to poison.

RHAMNACEÆ

Rhamnus spp. (Buckthorns.) The cultivated and wild buckthorns contain purgative substances, but the bitter taste is not conducive to consumption in quantities sufficient, to be serious.

CELASTRACEÆ

Euonymus atropurpureus Jacq. (Wahoo.) A low tree or shrub in woods in the eastern part of the state, easily recognized by its 4-angled twigs. It contains substances which act as drastic purgatives, accompanied by nausea, prostration, cold sweat, and act on the heart, but the taste of the plant is so objectionable as to be very seldom eaten.

Celastrus scandens L. (Climbing Bittersweet.) A woody climber with decorative fruits containing euonymin in the leaves. This acts as a heart poison, affecting horses particularly, but as the plant is disagreeable to the taste, cases seldom occur.

SAPINDACEÆ

Sapindus drummondii H. & A. (Soapberry.) This small tree, occurring very locally in the state, has large quantities of saponin, which is objectionable to the taste, but which could poison severely if eaten.

RUBIACEÆ

Cephalanthus occidentalis L. (Buttonbush.) A bush with bitter-tasting whorled or opposite leaves, growing along watercourses. It is seldom eaten.

CAPRIFOLIACEÆ

Symphoricarpos symphoricarpos (L.) MacM. (Coral Berry, Buckbrush.) The plants of this genus have in them so little saponin in the leaves that such large quantities are necessary to cause acute poisoning that it very seldom happens, even in the cases when animals do eat the plant. Other species with white berries are called snowberries and have similar effects.

CAMPANULACEÆ

Lobelia cardinalis L. (Cardinal Flower.) Grows along watercourses.

Lobelia syphilitica L. (Blue Lobelia.) Found along watercourses.

Lobelia inflata L. (Indian Tobacco.) Found in upland woods.

A narcotic poison, as well as acrid substances that act on the pneumogastric nerve, causing exhaustion, dilation of the pupils, and finally insensibility, convulsions and death, is contained in these leafy, herbaceous plants. These plants, however, occur in such small numbers in this state as to virtually never cause poisoning.

COMPOSITEÆ

Rudbeckia laciniata. (Golden Glow.) A tall, yellow-flowered perennial herb in woods along rivers in the eastern part of the state; is disagreeable to taste and is seldom eaten, but in a recent case (Transactions Kansas Academy of Science, vol. 33) a number of hogs, which had access to nothing else, died in convulsions with general symptoms of belladonna poisoning.

- A feeding experiment in which this plant was used terminated with the death of the animal.
- Bæbera papposa* (Vent.) Rydb. (Bæbera.) This very disagreeable-smelling herb is normally left strictly alone, but is becoming more abundant and cases of poisoning to stock and domesticated fowls may be expected.
- Erigeron canadensis* L. (Horseweed, Mare's Tails.) This variable but common weed is irritating to the nostrils, but large quantities would have to be consumed before the terpene which it contains would produce any serious effect.
- Achillea* spp. (Yarrow.) Common perennial herbs on pasture land, containing glucosides and bitter alkaloids, eaten occasionally by sheep with resulting gastric and abdominal pains with diarrhea and enuresis.
- Arctium minus*. Schk. (Burdock.) This biennial weed is infrequent, and although the source of a drug, it is so seldom eaten as a fresh plant that it is not important.
- Lygodesmia juncea* (Pursh) D. Don. (Lygodesmia.) This plant contains bitter poisonous substances, but is eaten only when nothing else is available.

HAY FEVER PLANTS

In addition to the plants already mentioned, there are a few plants which cause hay fever to human beings. Those that are considered of importance in Kansas are listed below, with the months of blooming.

<i>Acnida tamariscina</i> (Nutt.) Wood (Acnida, Water Hemp),	July-Oct.
* <i>Agrostis palustris</i> Huds. (Redtop).....	June-Sept.
<i>Amaranthus retroflexus</i> L. (Redroot, Pigweed).....	July-Oct.
* <i>Ambrosia elatior</i> L. (Ragweed).....	July-Oct.
* <i>Ambrosia coronopifolia</i> T. & G. (<i>A. psilostachya</i> DC.)	
(Western Ragweed).....	Aug.-Oct.
* <i>Ambrosia trifida</i> L. (Giant Ragweed).....	Aug.-Oct.
<i>Chenopodium album</i> L. (Lamb's Quarters).....	June-Sept.
<i>Dactylis glomerata</i> L. (Orchard Grass).....	Apr.-July
<i>Iva ciliata</i> Willd. (Marsh Elder).....	Aug.-Oct.
<i>Juglans nigra</i> L. (Black Walnut).....	Mar.-May
<i>Kochia scoparia</i> (L.) Roth (Summer Cypress).....	July-Oct.
* <i>Phleum pratense</i> L. (Timothy).....	June-Aug.
* <i>Poa pratensis</i> L. (Blue or June Grass).....	May-June
<i>Populus</i> spp. (Cottonwoods).....	Mar.-May
<i>Rumex acetosella</i> L. (Sheep Sorrel).....	May-July
<i>Salsola pestifer</i> A. Nelson (Russian Thistle).....	July-Sept.
<i>Xanthium</i> spp. (Cocklebur).....	July-Sept.

* Indicates the most important pollens.