STOCK-POISONING PLANTS OF THE BRITISH COLUMBIA RANGES

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STOCK-POISONING PLANTS OF THE BRITISH COLUMBIA RANGES

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Poisonous plants are frequently the cause of heavy losses among range livestock. It is difficult to estimate the extent of such losses since the troublesome plants frequently go unrecognized or the animals are not found for some time after poisoning. In addition, although in some cases poisoning is acute and the loss can be estimated directly, in others it is more or less chronic, and the loss indirect, being reflected in loss of weight, unthrifty conditions, calving problems, etc. Such losses are particularly serious to the smaller ranchers since a relatively large proportion of their herds may be affected.

The most harmful poisonous plants occur throughout the range areas of the province and are to be found in nearly every ranching district. The principal reason that losses are not greater than they are is that most poisonous plants are rather unpalatable to livestock. Animals seldom eat any appreciable quantity of these weeds except on overgrazed ranges or under unusual circumstances.

Under most range conditions, treatment of poisoned animals is generally difficult. Even if the cause of death is attributed to a poisonous plant there is frequently no known antidote or none that can be given under prevailing conditions. In most cases, the first intimation of poisoning is the discovery of the dead animal, often in remote areas. The best means of avoiding losses is for the rancher to become familiar with the common poisonous plants. The plants discussed in this bulletin are grouped according to their importance.

It is always wise to consult a veterinarian when stock losses are encountered so that the source of the trouble may be established and further losses prevented. If you suspect any plants on your range of being poisonous, take or send specimens to your District Agriculturist or nearest Experimental Farm, where a positive identification can be made and control measures suggested.

Many people have generously contributed information and suggestions for this bulletin. The authors' very sincere thanks go to Dr. B. L. Stovell and Dr. R. J. Avery, animal pathologists of the Canada Department of Agriculture, for their detailed contribution to the veterinary aspects of the poisonous plants discussed, to the District Agriculturists throughout the interior of the province and the Grazing Division of the B.C. Forest Service at Kamloops and Nelson for their help in reporting trouble areas and offering other observations; to N. F. Putnam, Fields Crop Commissioner, E. R. Smith, Grazing Division of the B.C. Forest Service and Dr. A. J. Renney, Department of Agronomy U.B.C., for a detailed review of the bulletin. The drawings were done by Mrs. M. L. Florian and her interest in the work has been greatly appreciated.

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MANAGEMENT OF INFESTED AREAS

The two general methods of preventing losses from poisonous plants are weed control and grazing control.

Weed Control

Cultivation and reseeding to grass where practical will provide almost complete control of most poisonous plants. Such methods are practical only in a limited number of cases on depleted range, where the density of toxic species is fairly high, and topography and other factors permit reseeding. Where highly poisonous species, such as water hemlock, occur in dense, local patches, it may be necessary to grub out by hand and burn the plants. Weed control by herbicides is sometimes possible. Perennial species are fairly resistant to herbicides and more than one application, although costly, may be necessary. However, the use of certain herbicides, such as 2,4-D and sodium chlorate, quite often increases the palatability of poisonous weeds.

Grazing Control

Generally speaking, grazing control offers the greatest possibilities for handling areas infested with poisonous plants. Sometimes the class of livestock has to be changed to one that is less susceptible to a particular species. For example, sheep may almost entirely eliminate larkspur from spring range and thus make it safe for cattle. Changing the grazing rotation to avoid infested ranges at a time when the plants are toxic may be successful as in the case of death camas and larkspur. Spring turn-out of stock should be delayed in areas where the poisonous plants reach grazing height before the native grasses. If the danger period is short, adequate control may be obtained by extra riding to keep the stock away from infested areas.

Overgrazing frequently heightens the danger from poisonous plants as most of these plants are relatively unpalatable and are avoided by stock whenever good forage is available. Hungry stock should not be turned out on infested areas since they are less selective in their grazing. In the case of sheep, trailing through danger areas should be avoided when the animals are hungry. If good feed is abundant the animals should not be hurried. The salt supply is frequently an important factor since salt-hungry animals tend to be less discriminating in their grazing and may eat relatively unpalatable plants. This danger is particularly great from arrowgrass which is frequently sought after for its salty taste.

Local areas must sometimes be fenced off in order to exclude animals from danger spots. Such control is common in the case of patches of water hemlock and arrowgrass.

MAJOR TROUBLEMAKERS

ARROWGRASS *Triglochin maritima* L.

Description—Arrowgrass is an erect, rush- or grass-like perennial marsh herb, 6 to 30 inches tall. It is clumped and unbranched. The leaves are basal, shorter than the flower stalks and arise from a base covered with sheaths of old leaves. They are rush-like, thick, flat on one side and rounded on the other, spongy inside, smooth, shiny, and bright green. The flowers are small, greenish, and are clustered along spike-like flower stalks. The seed pods are three-sided, about one-quarter inch long, lobed and oblong.

Distribution and Habitat—Locally common in salt marshes and alkaline sloughs throughout most of the province. It is found with sedges, rushes, and slough grasses.

Figure 1 Arrowgrass

Conditions of Poisoning—This plant starts growth somewhat earlier in the spring than associated grasses and has a more rapid regrowth after mowing. Consequently it is more dangerous at these times, although stock may eat it readily at other times for its salt content. It is toxic both as green forage and in the dry condition in hay. Cattle are most frequently affected, but sheep are also susceptible.

Toxic Principle—Hydrocyanic acid or prussic acid is produced from the fresh or dried leaves in certain groups of plants (cyanogenetic) by the mixing of two non-poisonous substances, the glucoside (amygdalin) and an enzyme, normally found separately in these plants. When the normal growth of these plants has been retarded or stopped by drought, frost, mowing or other causes, these two substances are permitted to mix because of breakdown of the plant cells releasing hydrocyanic acid. Older parts of the plants (stems and dried portions) generally contain much less potential acid than the active young leaves, but they frequently retain toxic amounts. The poison is not cumulative.

Symptoms and Lethal Dose—The symptoms are rapid or deep breathing, muscular spasms and convulsions at short intervals. Death follows from asphyxia or, where the dosage is heavy, from respiratory paralysis.

There is no specific information on the quantities necessary to cause poisoning, but with a plant containing 0.02 per cent potential hydrocyanic acid, as little as 5 pounds of it could be fatal. Many hydrocyanic-bearing plants contain 10 to 20 times more than the example given.

Treatment—The poisoning effect is usually too rapid for treatment. Good results have been obtained in cattle and sheep by intraperitoneal injections of sodium nitrate and sodium thiosulphate. (10)

Reported Poisonings—Reported poisonings have been widespread in the dry belt and there have been several from the Kamloops and Ashcroft regions. A case of poisoning from hay was observed in the North Thompson area. SMALL ARROWGRASS (*Triglochin palustris*) has been found in abundance in the lower Cariboo and losses have been attributed to it there.

MEADOW DEATH CAMAS *Zygadenus venenosus* S. Wats.

Description—Death Camas is a member of the Lily family. It is a rather small, (8 to 16 inches tall), slender, perennial herb with smooth, basal yellowish green, grass-like leaves, $\frac{1}{8}$ to $\frac{1}{3}$ inch wide, V-shaped in cross section, and thicker than those of grasses. The many creamy yellow flowers are about $\frac{1}{4}$ inch across, lily-like and borne on short stalks along the main spike-like stem. Three upright capsules, ($\frac{1}{4}$ to $\frac{3}{4}$ inch long) per flower bear the numerous seeds and are joined together at the base and open lengthwise to permit the seed to escape. The plant grows from a dark-coated bulb which resembles that of an onion and is from 1 to $1\frac{1}{2}$ inches long. The bulb is generally from 2 to 4 inches below ground. The plant reaches grazing height early in the spring, before most of the grasses. It generally flowers in May and early June. Seeds are formed in 3-lobed capsules about $\frac{1}{3}$ to $\frac{1}{2}$ inch long during the latter part of June and early July after which the plants quickly die back and disappear. It may be confused with the wild onion, which, however, has pink flowers and a round head.

Figure 2 Meadow Death Camas

MOUNTAIN DEATH CAMAS (*Zygadenus elegans* Pursh) resembles meadow death camas in general appearance but is considerably taller (up to 2 feet) and more robust. The leaves are $\frac{1}{4}$ to $\frac{1}{2}$ inch broad and bluish green. The flowers are larger ($\frac{1}{2}$ inch across), greenish or whitish cream, more scattered along the main stem, and frequently on branched stalks.

This plant occurs at higher elevations and under more favorable moisture conditions generally than the meadow death camas. It is found principally in the Rockies, in or close to timbered areas, and prefers moist locations in rich, well-drained soils.

The conditions of poisoning and effects on stock are similar to those of meadow death camas.

Distribution and Habitat—Meadow Death Camas occurs widely from Vancouver Island to the Rockies. In the interior range areas it is found principally on moist, grassy hillsides and draws in the upper grassland zone, in fairly rich, well-drained soil. The plant is commonly found with low larkspur, rough fescue, Kentucky blue grass, and wild onion. Death camas is generally scattered over the range but may become especially abundant in draws and slight depressions. It seldom, if ever, occurs to the exclusion of other species, a feature which makes control of the plant virtually impossible.

Condition of Poisoning—Since the plants reach grazable height before most grasses, they are most dangerous during the spring. All parts of the plant are poisonous but the bulbs especially so. Consequently, the plant is particularly dangerous when the soil is wet since the bulbs may be pulled up. Cattle may be poisoned early in the spring before green grass is available and the soil is wet, but most poisonings are confined to sheep.

Toxic Principle—The poisonous principle is an alkaloid. The active substance is probably identical with or related to the veratrine or civadine alkaloids. (10)

Symptoms and Lethal Dose—Symptoms of death camas poisoning include increased rate of breathing, excessive salivation and nausea which often leads to vomiting. This is followed by staggering and finally prostration. Animals may remain in a coma for hours or even days before death. Body temperature is increased during initial stages but drops to below normal upon onset of the comatose state and remains there until death occurs.

A lethal dose is considered to be from 2 to 2.5 pounds of the green weight of the plant per 100 pounds of body weight. The seeds are especially poisonous, 0.10 pound being sufficient to cause death. The plant is also toxic in the dried state and thus is poisonous in hay.

Treatment—Since the active principle is less soluble in alkaline solutions, the administration of common baking soda in tablespoon doses has sometimes been recommended. Subcutaneous administration of atropine sulphate and pictrotoxin has been recommended. To be effective, all treatments should be started early in the poisoning stage. The most effective treatment is in the ability of the herder to recognize the plant and keep sheep away from it. (2)

Reported Poisonings—Cases of poisoning in sheep have been reported from the Kamloops and Nicola areas.

Description—Low larkspur is a member of the Buttercup family. It is a beautiful, somewhat pubescent native perennial forb with stems up to about 18 inches in height. The leaves are mostly basal, alternate, deeply divided into a number of linear segments, up to 2 inches in diameter and round in outline. The flowers are up to 1 inch across, blue to purple with a long ($\frac{1}{2}$ to $\frac{3}{4}$ inch) spur at the bottom. There are from a few to 15 flowers in short stalks along the main flowering stem. The fruit is covered with short fine hairs and composed of three upright compartments each opening lengthwise to allow the many seeds to escape. The plant has a cluster of woody-fibrous roots at the base. The plant starts growth in early spring, generally before most of the grasses. Blossoms appear in May and early June and seeds are formed in the latter part of June or early July, after which the plants quickly die back and disappear. *D. menziesii* DC is a similar species but occurs principally west of the Coast Mountains.

Distribution and Habitat—This plant is widespread in the upper grasslands of the interior dry belt, generally from about 2,600 to 3,000 feet elevation. It is found on open hillsides in full sunlight, generally not far from timber. It requires a fairly moist, well-drained soil and is generally found with rough fescue, bluebunch wheat grass, Columbia needle grass and sticky geranium. It seldom, if ever, occurs to the exclusion of other species, a feature that makes local control virtually impossible.

Conditions of Poisoning—Since the plants reach grazable height before most grasses, they are dangerous during the spring. All parts of the plant are poisonous. Larkspur is grazed readily by both cattle and sheep. Since sheep are seldom poisoned by the plant, they can be grazed to good advantage on infested areas and may be used to reduce the incidence of the weed on the range.

Toxic Principle—The alkaloid dephinine which has a paralytic action on the heart and respiratory organs, is the chief poison. Other related alkaloids such as delphisine, delphincidine, and stophicagroine are also present.

Symptoms and Lethal Dose—The symptoms of poisoning are nausea, weakness, muscular twitching and convulsions with drooling at the mouth. Animals fall repeatedly. Death or recovery usually occurs rapidly.

Generally 3 per cent of the body weight in plants must be eaten to cause death, but very immature plants are more toxic. Cured plants usually are not toxic, except for the seeds which are seldom eaten in sufficient quantity to cause trouble. (8)

Treatment—Medicinal treatment can be used but to be effective should be started early in poisoning. Affected animals should be kept quiet with their heads up hill. A solution containing the following material injected subcutaneously appears to be beneficial: Physostigmin Salicylate, Pilocarpin Hydrochloride, Strychnine Sulphate. (2)

Reported Poisonings—Deaths have been reported from numerous grassland areas in interior British Columbia. Losses have been heavy at times on upper grassland ranges in the Kamloops and Nicola districts.

Figure 3 Low Larkspur

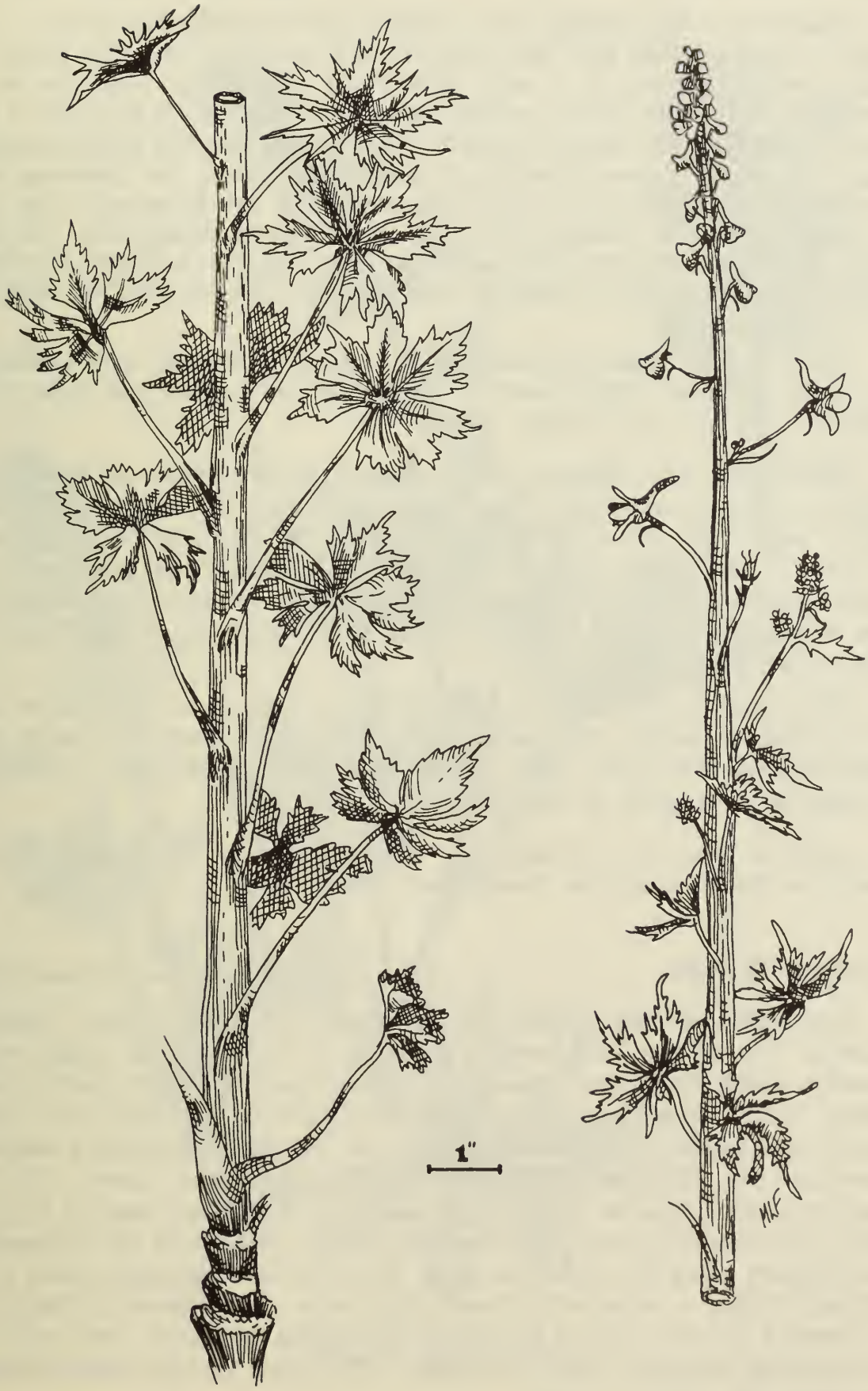

Figure 4 Tall Larkspur

TALL LARKSPUR — *Delphinium scopulorum* var *glaucum* (Wats.) Gray

Description—Tall larkspur is a member of the Buttercup family. It is a tall stately perennial forb with stems from 2 to 6 feet tall. The leaves are deeply cleft into from 3 to 5 main lobes which are toothed, alternate on the stem, with short hairs on one or both sides; the lower leaves are from 3 to 6 inches in diameter and round in outline. The flowers are pale blue to purplish, larger than those of low larkspur and have more flowers per flowering stem. The fruit is similar to that of low larkspur but is not pubescent. The roots are long, fibrous and woody. The plant starts growth shortly after the snow melts. It flowers and sets seed later than low larkspur because of different habitat. It starts to dry up after the seed is set but does not generally disappear until after fall frost.

Before flowers appear tall larkspur is frequently confused with monkshood and sticky geranium. The flowers of the former are hooded and those of the latter are pink and not on long stalks.

Distribution and Habitat—Tall larkspur grows mainly in the central interior in more humid regions than the low larkspur. It ranges farther north and at higher elevations in the mountains within the moist forest zones to sub-alpine areas, and is generally found in moist Douglas-fir, spruce—fir, and cedar—hemlock zones. The plants grow in clumps in moist draws and hillsides at higher elevations. They generally require some shade and fairly rich, moist, well-drained soil.

The conditions of poisoning and effects on animals are similar to those of low larkspur, except that tall larkspur frequently causes trouble in midsummer rather than early spring, either as a result of lateness of growth in that area or as a result of overgrazing.*

Reported Poisonings—Poisonings are common in the central interior notably in the district from Vanderhoof to Smithers.

SILVERY LUPINE — *Lupinus sericeus* Pursh

Description—Silvery lupine is a beautiful, rather stout, taprooted perennial forb of the Pea family. It grows up to 2 feet in height and is somewhat bushy in general appearance. The foliage is silvery green in color because of the dense covering of short, fine hairs on the stems and leaves. Five to eight leaflets arise from the top of the leaf-stem presenting a palm-like appearance since they are fairly long (up to 2 inches) and narrow. The leaf-stems are alternate on the stalk. The many flowers are blue, about $\frac{1}{4}$ to $\frac{1}{2}$ inch across, and distinctly pea-like. They have short stalks and are arranged in dense clusters along the spike-like stem. The fruit is pea-shaped, about 1 inch long and densely covered with short, silky hairs. The taproot is fairly long and forms a crown much as in alfalfa. The plant blooms in June and July and the seeds mature in July and August. The plant remains green, however, throughout the growing season.

*W. T. Burns, Supt. Experimental Farm, Prince George, personal correspondence.

Figure 5 Silvery Lupine

Distribution and Habitat—The plant occurs widely in the upper grasslands and yellow pine zone in the interior of the province. It is found on open, grassy hillsides, generally in fairly rich, light, well-drained soils. Its principal associates are rough fescue and bluebunch wheat grass. It is common to abundant and scattered over large areas which makes local control difficult.

Conditions of Poisoning—The seeds and pods of lupine are most poisonous. The leaves may, however, cause trouble if large quantities are eaten at one time. Most poisonings are confined to sheep and occur most frequently when hungry stock are turned on to infested areas.

Toxic Principle—The poisonous principles are alkaloids of the lupanine group. The poison is not cumulative and is excreted by the kidneys if a lethal dose is not ingested at one time. The quantity of alkaloids present varies considerably according to soil type, climatic conditions, fertility, etc.

Symptoms and Lethal Dose—Symptoms of poisoning are frenzy, frothing at the mouth and violent spasms. Sheep will butt anything in their way when poisoned by lupine. There is a great deal of cerebral congestion evident in this poisoning.

Sheep can safely consume 1 to 20 pounds of the leaves but ½ to 1½ pounds of the seed pods and seeds are likely to cause death. This plant is also toxic when present in hay and care should be exercised in feeding such material.

Treatment—No specific remedy is known. If used early, potassium permanganate may be useful as a chemical antidote. The daily dose for a horse is 2 to 4 grams, the amount for a cow is 3 to 6 grams, and for a sheep 0.4 to 0.8 grams in a 2 per cent solution administered orally.* Morphine and other sedatives are useful in treating poisoned animals.

Reported Poisonings—There have been occasional, widespread reports of poisoning especially in the Similkameen, Shuswap, and Nicola Valley districts. More common in fall when sheep return to lower altitudes, probably due to the presence of seed heads.

TIMBER MILK-VETCH

Astragalus decumbens var. *serotinus* (Gray) Jones

Description—This species is a member of the Pea family. It is a long-lived, attractive, fragile, tap-rooted plant that grows in tufts from 8 to 16 inches tall. It is fine stemmed with compound pinnate leaves, carrying 7 to 13 small (½ to ¾ inch) oval-shaped leaflets that are slightly hairy. The flower is generally from ¼ to ½ inch long and pea-like, pinkish mauve in color, with few to many along the flower stalk. The pod is also pea-like and from ¾ to 1 inch long. The seeds are small and black or greenish. Flowering generally occurs in June.

Distribution and Habitat—Timber milk-vetch is confined to the interior dry belt, being widespread in the Cariboo, Chilcotin, Thompson, Nicola, Okanagan, Similkameen, and Upper Columbia valleys. It is confined to the upper grasslands, yellow pine savannah, and the Douglas-fir—pine-grass zone, generally between 2,000 and 4,000 feet elevation. The species is found on most upland soil types except those with poor drainage. It appears to prefer the lighter soils, however, and is not shade tolerant. It is generally associated with

*Dr. B. L. Stovell, Animal Pathology Division, Canada Department of Agriculture, Vancouver, B.C. Personal correspondence.

Figure 6 Timber Milk-Vetch

such species as yellow pine, lodgepole pine, pine grass, creamy peavine, American vetch, and bluebunch wheat grass. It is generally found scattered over the range rather than in dense clumps. It is common throughout its range but is most abundant on burned-over and cut-over areas and seems to be associated with such disturbances.

Conditions of Poisoning—Observations at the Range Experimental Farm in Kamloops, indicate that the species has a medium palatability for all classes of stock when in association with pine. grass but appears to be medium or low when occurring on the grasslands. The plant produces grazable growth earlier in the spring than do most range grasses, which increases the hazard from early spring turn-outs. It also remains green throughout most of the growing season, until some time after the seed is shed, and appears to be poisonous throughout this period.

Toxic Principle—The toxic principle is unknown. Selenium was suspected for some time but now appears not to be the causative agent (1). Tests at the Range Experimental Farm have confirmed this conclusion.

Symptoms and Lethal Dose—Symptoms are in-co-ordination of hind legs; difficulty in respiration accompanied by a protruding tongue, nasal discharge and a roaring or wheezing sound. Frequent urination is a common symptom (5).

Animals fed milk-vetch as the sole source of nutrients at the Range Experimental Farm, Kamloops, showed signs of poisoning after consuming 425 pounds. Cured plants do not appear to be toxic.

Treatment—The only treatment available is to remove affected animals to lower altitudes where milk-vetch is not prevalent. Areas where the plant is abundant should be grazed with male and dry female stock since these classes of animals are much less susceptible to poisoning than lactating females. Poisoned animals should be moved slowly and quietly to avoid undue excitement. In the event that affected animals are too weak to travel, if possible good forage and fresh water should be provided for them until they gain sufficient strength to be removed to lower altitudes where other feed is available.

Reported Poisonings—Reports of poisoning have been frequent and widespread, principally from the Similkameen, Okanagan, Chilcotin, Cariboo, Kamloops, Nicola, and Clinton districts. Considerable trouble has also been reported from southeastern British Columbia. Death does not usually follow poisoning; most animals recover slowly. Average annual death losses of 3 to 5 per cent are not uncommon, while losses in weight of 20 to 30 per cent or reduction in rate of gain have been reported and are of considerable economic importance.

WATER HEMLOCK *Cicuta douglasii* (DC.) C.R.

Description—Water hemlock is a tall (2 to 6 feet), rather pale green, branching, smooth, perennial forb of the Carrot family. The stems are stout, hollow and jointed, often with purplish spots. The leaves are generally doubly compound and alternate, with the leaf-stem bearing a number of smaller leaf-stems carrying oval leaflets arranged along each side. The leaflets generally have saw-toothed edges. The flowers are small, white, in compound umbrella-like heads. The fruit is small, round, splitting when mature, and dill-like, with prominent corky ribs. The plant blooms during June and July

Figure 7 Water Hemlock

but the fruits do not mature until late in the season. The rootstocks are short, tuberous and exude a yellowish, aromatic, extremely poisonous oil. The base of the stem is generally somewhat enlarged and characterized by hollow chambers divided by horizontal cross portions. Water hemlock is probably the most poisonous plant of the region.

Distribution and Habitat—Water hemlock is locally common to abundant in sloughs, meadows, moist draws, and stream banks, in grasslands and forested areas throughout most of the province.

Conditions of Poisoning—Although the bulk of the poisonous oil is concentrated in the tuberous roots, there may be sufficient accumulation in the leaves and stems, especially in the spring, to cause trouble. In addition, the tubers are more likely to be pulled out and eaten while the ground is soft. For this reason, cattle, because of the pulling action of their grazing, are most likely to be affected. All classes of stock, however, and even humans have been poisoned. The dried tops are not generally considered toxic.

Toxic Principle—The toxic principle is a resinous substance called cicutoxin. This clear, brown, sticky substance has an acid reaction, is soluble in alcohol, chloroform, ether, and dilute alkalis.

Symptoms and Lethal Dose—The symptoms are frothing at the mouth, followed by uneasiness and pain. This is followed by violent convulsions in which the animal kicks, bellows, and groans as though in great pain.

A piece of the rootstock the size of a walnut is large enough to cause death to a cow. The stems and leaves are much less poisonous. (9)

Treatment—Treatment is not usually possible. Morphine injections may be used to aid in controlling the convulsions and a purgative may help in eliminating the poison.

Reported Poisonings—Widespread reports have been made from most grazing districts where cattle graze in meadows and along water courses and particularly from the central interior.

Water hemlock is frequently confused with the non-poisonous WATER PARSNIP (*Sium suave* Walt.) which it resembles. It can generally be distinguished from the latter by the tuberous, very oily rootstocks and enlarged, more distinctly chambered stem base. Also, the leaves are more compound, with a greater number of leaflets on the branched leaf stems. Water parsnip does not have tuberous rootstocks, the base of the stem is not enlarged, although it may be somewhat chambered, and the leaves consist of an unbranched leaf-stem with only one series of elongated leaflets arising from it. A small amount of oil may exude from a cut stem base.

It may at times be confused with POISON HEMLOCK (*Conium maculatum* L.) and with the non-poisonous COW PARSNIP (*Heracleum lanatum* Michx.). The latter, however, is generally more robust, with much broader, hairy leaflets, and much larger flower heads. On the other hand, poison hemlock is a tall (2 to 6 feet) smooth, branching biennial. The stems are stout, hollow, and smooth with distinct purple spots. The leaves are doubly compound, alternate, and deeply cut giving them a parsley-like appearance. The fresh leaves have a strong parsnip-like odor when crushed and a nauseating taste. The flowers are small, white, in compound umbrella-like heads. The fruit is small, round, dill-like in appearance and splits when mature. The taproot is large, white and parsnip-like, and non-chambered.

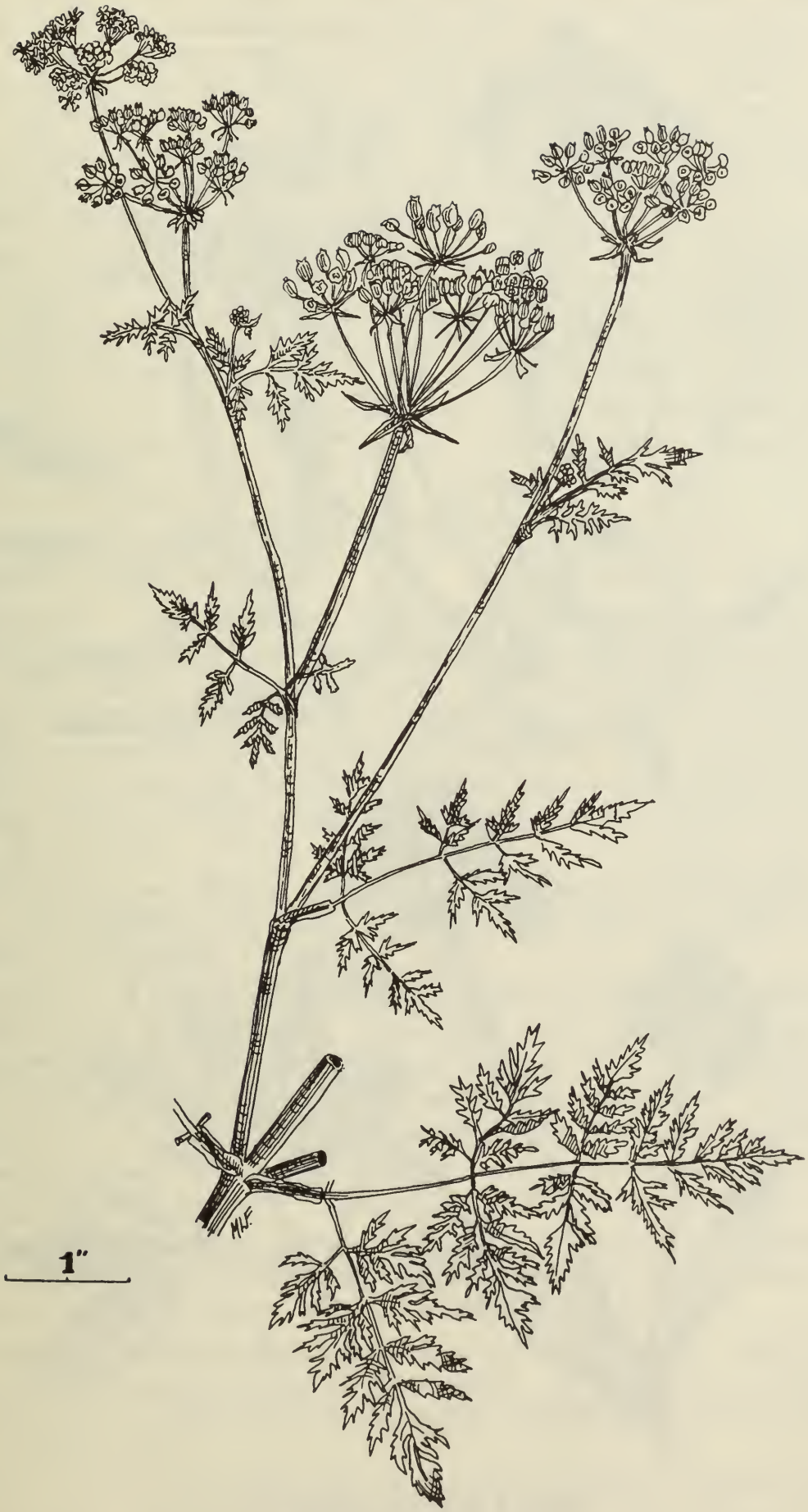

Figure 8 Poison Hemlock

Figure 9 (Upper) Water Parsnip
(Lower) Angelica

The plant occurs largely in waste places in areas where moisture is adequate. It is not, however, semi-aquatic like water hemlock. As far as is known, the plant occurs only in the vicinity of Victoria and Salmon Arm. It should be watched for, however, and if found specimens should be sent to the nearest Experimental Farm or District Agriculturist for checking.

The most common symptoms are loss of appetite, excessive salivation, followed by bloating, much bodily pain, and rapid feeble pulse. There are no convulsions as occur in water hemlock poisoning.

Water hemlock also closely resembles the non-poisonous ANGELICA (*Angelica arguta* Nutt.) Probably the best field character for distinguishing the two plants is that, in Angelica the veins end in the tip of the teeth, whereas in water hemlock they end near the notches of the leaflets. The flowers of Angelica may be white or yellow. The roots or stem bases are frequently not so enlarged as those of water hemlock and have a more prominent taproot. They may have small chambers, however, and exude a small amount of oil.

SECONDARY TROUBLEMAKERS

WESTERN CHOKECHERRY *Prunus demissa* (Nutt.) Walp.

Description—The chokecherry is a tall (up to 30 feet), deciduous shrub of the Rose family. The flowers are small, white, growing thickly in terminal clusters. The leaves are smooth, simple, tooth-edged and cherry-like. The fruits are small, cherry-like, red or purplish, and have a bitter, astringent taste and a stone-like seed. Flowering generally occurs in May and June, while the fruit persists on the shrub until late fall. A very similar species *P. emarginata* (Dougl.) Walp. is probably the most common one in the southern part of the province.

Distribution and Habitat—The shrub is common in moist draws, creek banks, and frequently the drier slopes in open timber at lower altitudes throughout the interior.

Conditions of Poisoning—The plant is rather unpalatable to stock and is taken only when other forage is unavailable. It is poisonous at all growth stages but most so in the spring and early summer. The toxicity of the plant varies considerably depending on the conditions under which the animals are grazing and the amount of poison that has accumulated in the leaves.

Toxic Principle—Hydrocyanic (prussic) acid is the toxic substance. (See arrowgrass for a discussion of the toxic principle and its action.)

Symptoms and Lethal Dose—Uneasiness, staggering, convulsions, and difficulty in breathing are the first symptoms. Death usually follows within an hour of eating the leaves and is preceded by bloating.

Treatment—Death is so rapid following consumption that treatment cannot usually be given. Drenches of potassium permanganate or glucose may have some merit. Sodium nitrate and sodium thiosulphate therapy should be tried if there is time.

Reported Poisonings—Poisonings are not too common in British Columbia and are usually reported in animals that are hungry, such as sheep on drives, or in animals that are grazing badly depleted ranges.

Figure 10 (Upper left) Western Chokecherry
(Lower left) Bracken
(Upper right) Horsetail
(Lower right) Monkshood

BRACKEN FERN *Pteridium aquilinum* (L.) Kuhn

Description—Bracken is a tall (1 to 4 feet), coarse perennial herb of the fern family. The above-ground part of the plant (the frond) has the appearance of a large, finely divided, broadly triangular leaf with a strong, somewhat woody central stem. The underside of the frond is covered with rather coarse brown hairs. The margins of the leaf are rolled under and lined with tiny, rust-colored spore cases. The plant reproduces by means of stout, black, woody rootstocks and from spores. As the fronds emerge from the soil they unroll like the head of a violin.

Distribution and Habitat—Locally common to abundant in upland pastures, abandoned fields, forested and burned-over areas in high-rainfall regions, chiefly on gravelly or sandy soils. It is generally associated with western red cedar and western hemlock.

Condition of Poisoning—The plant is equally poisonous as green forage or in dry condition and therefore may be a problem in hay. Bracken is not palatable and generally will not be taken by preference unless other forage is scarce. Cattle and horses are frequently affected, especially from eating hay high in bracken.

Toxic Principle—Poisoning is thought to be due to pteritannic acid, a substance similar to, and probably identical with the filicic acid found in male shield fern. (4) In addition, the thiaminase activity in the leaves and rhizomes of the plant varies in amount according to the season. In the horse the blood thiamine level drops, and the blood pyruvic acid level rises with the onset of poisoning. The mechanism of poisoning is not understood in the cow. Subcutaneous thiamine therapy is effective in the horse but not in cattle.*

Symptoms and Lethal Dose—Cattle eating bracken fern often develop internal hemorrhages and other complications. Death is caused by severe hemorrhage or secondary infection in lesions caused by consumption of the plant. Horses develop a somewhat stupefied, timid, and sleepy condition. No specific amounts are recorded for lethal dosage.

Treatment—A saline cathartic may assist in eliminating the poison. Give poisoned animals good feed and attempt to keep them quiet. Provide bulky feed when pasture is short.

Reported Poisonings—There were numerous reports of poisoning among horses in the Fraser Valley especially in the past when there were more horses on the farms. Most cases have been reported in horses. Poisonings may also occur in the interior wet belt, notably in areas where horse logging is common.

HORSETAILS, SCOURING RUSHES *Equisetum arvense* L. (and others)

Description—The horsetails are well-known, non-flowering perennial herbs. The aerial stems are rush-like, ridged, jointed, generally hollow, single, ending in a cone or with whorls of 4-angled, fine, green branches and are from 8 to 24 inches tall. They contain a rather large amount of silica which makes them

*Dr. B. L. Stovell, personal correspondence.

very harsh. The leaves are very small and scale-like, forming a cylindrical sheath at the nodes or joints of the stems. The plants reproduce by means of deep, creeping rootstocks and by spores which are borne in cone-like bodies at the stem tips.

Distribution and Habitat—Common in moist fields, swales, and meadows throughout most of the province, especially in flood plains and sandy soil. It is a common component of native meadow hays.

Conditions of Poisoning—Most of the trouble is caused when native hay high in horsetail is fed to horses (one-quarter of the bulk). It seldom, if ever, seems to cause trouble when present in pasture.

Toxic Principle—Aconitic acid and an alkaloid, equisetin, are suspected as the toxic principles.

Symptoms and Lethal Dose—Symptoms of the poisoning are unthriftiness, loss of weight, and a gradual weakening of the animal. After two to five weeks on horsetail, animals lose muscular control, fall down and struggle violently to get up. The horse is usually willing to eat but is unable to rise and finally dies of exhaustion. Grain-fed animals are able to resist the action of the poison better than animals not fed grain. The symptoms are slow to develop depending upon the age of the animal and the amount of horsetail present in the hay. Younger horses appear to be more susceptible than older ones. (9)

Treatment—Immediately stop feeding hay containing horsetail. Give a purgative and feed bran mashes to assist in removing the poisonous plant from the digestive tract.

Since horsetail most commonly occurs in poorly drained fields, a drainage program, followed if possible by cultivation and reseeding, will eliminate or reduce the hazard.

Reported Poisonings—A few poisonings have been reported resulting from the feeding of native hay high in horsetail in the interior of British Columbia, specifically the Clinton and North Thompson districts.

MONKSHOOD *Aconitum columbianum* Nutt.

Description—This plant belongs to the Buttercup family and is closely related to the larkspur which it closely resembles. It has the same general appearance as tall larkspur from which it can be distinguished by the hood or helmet formed by one petal over the rest of the flower, in place of the spur. The roots of the monkshood are short and tuber-like, with yellowish rootlets, while those of the tall larkspur are long and fibrous. The stem of the monkshood is pithy whereas that of the larkspur is hollow. The upper leaves of the monkshood are close to the stem; those of the larkspur have petioles or stalks.

Distribution and Habitat—The plant has much the same distribution and habitat as that of tall larkspur, and the two are frequently found growing together, although monkshood is much less common than the larkspur.

Conditions of Poisoning—The plant appears to be most poisonous before flowering but may cause poisoning at all times. The toxic principle is most abundant in the roots and seeds. Monkshood seldom appears to cause trouble on the range, probably because it is so seldom abundant.

Toxic Principle—Toxicity is due to the alkaloids aconitine and aconine. The amounts of these present depend largely upon conditions of growth.

Symptoms and Lethal Dose—Symptoms of poisoning are muscular weakness, irregular and labored breathing, weak pulse, bloating and belching, constant attempts at swallowing and contraction or dilation of the pupil of the eye. No specific information is available on amounts necessary to cause poisoning. (10)

Treatment—No specific antidote is known. The use of drugs such as digitalin or atropine are indicated to stimulate breathing and overcome depression of heart activity.

Reported Poisonings—No cases of poisoning have been reported for British Columbia, although this species is frequently confused with tall larkspur and poisoning could be attributed to it. Monkshood has been observed in sufficient quantity in the Kettle River and Boundary Creek districts to cause trouble if grazed.

HEATHS — *Ericaceae*

Rustyleaf	*Menziesia ferruginea* Sm.
White rhododendron	*Rhododendron albiflorum* Hook
Labrador tea	*Ledum glandulosum* Nutt.
Swamp laurel	*Kalmia polifolia* Wang.

A number of shrubs of the heath family are poisonous to livestock. They are treated together here since they have somewhat similar growth habits, distributions, toxic principles, and symptoms.

Descriptions

RUSTYLEAF is a medium sized (3 to 15 feet), branching shrub with thin, alternate leaves, which have scattered rusty hairs on the upper surface. The flowers are greenish purple, rather small, and borne in terminal clusters.

WHITE RHODODENDRON is also a medium-sized shrub with thin, clustered leaves. The flowers are showy, pale yellow in color, bell shaped, and about 1 inch across, with from one to three in a cluster.

LABRADOR TEA is a low shrub with rather thick leaves that are resin-dotted underneath making the herbage fragrant when bruised. The flowers are small, yellowish white, and borne in terminal clusters.

SWAMP LAUREL is a somewhat smaller (1 to 2 feet), branching, evergreen shrub, with oblong, leathery, opposite leaves that are a dark glossy green above and whitish beneath. The leaf margins are rolled under. The flowers are small, lilac colored and borne in terminal clusters.

Conditions of Poisoning—Sheep are most commonly affected since the plants are seldom grazed by cattle except when other feed is short and since most of the localities where these plants are found is used as sheep range. Since the leaves of most of these species are leathery or bitter their palatability is rather low.

Distribution—The above poisonous species all occur commonly in British Columbia. They all have similar distributions and are to be found in the moist forest zones of the interior. Swamp laurel and Labrador tea are found principally in wet meadows and bogs, while rustyleaf and white rhododendron occur more on the uplands, in moist woods.

Toxic Principle—The toxic principles of these plants are not too well known, but the substance andromedotoxin is suspected of causing poisoning. (9)

Figure 11 (Upper left) Rustyleaf
(Lower left) White Rhododendron
(Upper right) Labrador Tea
(Lower right) Swamp Laurel

Symptoms and Lethal Dose—Symptoms are salivation, an increased flow of secretions from the nose, followed by convulsions and paralysis of the limbs, plus emesis possibly bile stained, and dehydration.*

Treatment—Animals should be removed from infested areas, and laxatives, demulcents, and nerve stimulants should be tried.

Reported Poisonings—Reports of poisonings attributed to this group of plants have been recorded for sheep ranges especially in the Shuswap district.

MUSHROOMS AND TOADSTOOLS

Livestock may be poisoned by certain mushrooms. These plants are, in general, too familiar to require description here. Only a relatively few species are poisonous, but since it is generally difficult to distinguish between them, all should be looked on with suspicion.

Distribution and Habitat—Mushrooms occur throughout the province in moist grasslands or more commonly in moist woods. Their abundance varies greatly depending on the wetness of the season. They generally last only a relatively short period and disappear shortly after the woods dry out.

Symptoms and Lethal Dose—Symptoms generally appear rapidly after the plants are consumed. Breathing becomes difficult, loss of balance, lockjaw, cramps, and convulsions all may occur. Symptoms will vary, however, depending on the particular species of mushroom involved.

Treatment—If livestock are observed eating them and there are other poisoned animals in the area, the stock should be moved to another area until the mushrooms have disappeared, since they last only a short while.

Reported Poisonings—Frequent poisonings have been reported, especially from the Cariboo. Trouble is experienced most frequently during the wet seasons. When mushrooms are present in abundance stock often develop a taste for them and eat considerable quantities. Observations from the Cariboo indicate that, at times, no poisonous principle may be involved but rather emaciation may occur through general starvation because of the tendency to eat them to the exclusion of other feed.†

WESTERN YELLOW PINE *Pinus ponderosa* Laws.

Western yellow pine is a handsome component of the sub-humid, savannah-like grasslands of the southern interior, south of Clinton, Vavenby, and Canal Flats. Under average range conditions it grows to a height of 70 to 80 feet. The needles are generally from 7 to 11 inches long, dark green in color and occur in bundles of from 2 to 5 needles, 3 being the most common. The tree has a characteristic platy bark which is often reddish orange in color.

For a number of years ranchers in the range areas of the province have claimed that yellow pine needles and buds cause nutritional or mechanical abortion in range cattle.

The problem areas have been confined to the yellow pine belt of the southern interior valleys of the Fraser, Thompson, Nicola, Similkameen, Okanagan, eastward along the international border to Nelson and the southern portion of the Rocky Mountain Trench.

The Range Experimental Farm, Kamloops, has undertaken a series of studies to determine whether or not pine needles cause abortion. Results to date though inconclusive point strongly to the fact that they will do so under certain conditions. Apparently the relationship is not simple and depends on

*Dr. B. L. Stovell, personal correspondence.
† M. J. Walsh, District Agriculturist, Williams Lake, personal correspondence.

the stage of pregnancy (7 to 8 months pregnant cows appear to be most susceptible), the level of feed intake, and the time of year when the needles are eaten, as well as the amount consumed.

It is suggested that the bred cow herd be wintered in areas free of yellow pine. If this is impossible, the lower branches of the trees should be pruned and the pasture kept under observation after storms for fallen trees. Logging operations should be discontinued in pastures where bred cows are grazed since cows will nibble on the slash even though adequately fed.

MECHANICALLY INJURIOUS PLANTS

Cheat grass or downy brome	*Bromus tectorum* L.
Needle grass or spear grass	*Stipa comata* T. & R.
Three-awned grass	*Aristida longiseta* Steud.
Wild barley or wild foxtail	*Hordeum jubatum* L.
Wild oats	*Avena fatua* L.
Burdock	*Arctium minus* Bernh.
Cactus	*Opuntia fragilis* Haw.

The above common plants, although not poisonous, occasionally cause considerable injury to livestock. They have sharp, often barbed seeds, or spines that may work their way into the tongues, gums, eyes, noses, or skins of animals. Extreme discomfort or inflammation results and the animals go off feed and lose weight and condition. Sores, in addition to causing discomfort, may be the source through which pathogenic bacteria enter the tissues or circulation and cause local or general infections. The fibers of plants such as wild barley may ball-up and lodge in the stomach or intestines causing impaction.

NITRATE POISONING

Common forage plants can cause livestock poisoning. Under certain circumstances the nitrate content of plants, normally just a trace, will increase to dangerous levels. Oat hay is the most commonly known source of nitrate poisoning, but many other forage crops and weeds, notably lamb's-quarters, have been found to contain toxic quantities of nitrate.

Toxic Principle—When plants with a toxic amount of nitrate are consumed by livestock, a conversion of nitrate to nitrite takes place in the intestinal tract. This nitrite is absorbed into the blood stream and combines with the hemoglobin, the oxygen carrier in the blood, to form methemoglobin. This methemoglobin does not combine with oxygen and when large quantities of it are found, the oxygen-carrying capacity of the blood is reduced to the extent that the animal dies of anoxia, similar to death caused by carbon monoxide poisoning.

Because of this lack of oxygen in the blood and consequently in the organs, tissues, and fetal circulation, abortion may occur in animals that survive nitrate poisoning.

Nitrate poisoning in livestock because of the rapid course of the disease, may be confused with anthrax; clostridial disease, such as blackleg or malignant edema; or pasteurella infection, such as hemorrhagic septicemia.

Symptoms and Lethal Dose

Typical symptoms of nitrate poisoning in cattle include restlessness, frequent passing of urine, and extreme weakness. Finally the animals collapse, sink to the ground, roll on the side, and die quietly without struggle. On post mortem, hemorrhages and inflamed areas appear on the surface of the rumen and small intestines. The blood would be dark brownish and discolored. The lower toxic limit of nitrate in plants is considered to be 0.2 per cent, the minimum lethal dose for cattle has been shown to be about 25 grams of potassium nitrate per 100 pounds of body weight.

Treatment—It is dangerous to harvest forage crops from areas where manure has accumulated for long periods of time, such as feedlots and cattle yards.

Always use caution when feeding oat hay and straw. Weeds should also be fed with caution and certain ones like lamb's-quarters should never be fed.

Overfertilization with nitrogen fertilizers may cause trouble through excessive uptake by the plants. This condition, however, can frequently be alleviated through the application of a phosphate fertilizer or the use of one that is balanced.

Nitrate accumulation increases with increased shading so that in high-nitrogen soil care should be taken in harvesting hay from shady areas as may occur with cover crops in old orchards.

If nitrate poisoning is evident in animals, the most accepted treatment is methylene blue. Methemoglobin is readily converted back to hemoglobin by an intravenous injection of methylene blue. Because of its irritant properties, care must be taken that no solution escapes in the tissues surrounding the vein.

Reported Poisonings—In a case of the loss of 5 head near Barriere, hay that was being fed had the following analysis: brome grass 1.89 per cent and lamb's-quarters 10.47 per cent nitrate, both well above the toxic level. The hay had been grown on an old holding ground. There have been widely scattered reports of poisonings, especially as a result of feeding oat hay. The Fraser Valley seemed to be the district most frequently troubled.

POSSIBLE TROUBLEMAKERS

The following plant species which also occur commonly within the ranching areas of the province are reported to have caused poisoning among stock in other regions. Although no losses from these plants have been brought to the attention of the writers, they should be regarded with suspicion by the rancher and any losses reported so that they can be investigated by local authorities.

BLACK NIGHTSHADE (*Solanum nigrum* L.)—a much branched, somewhat spreading annual. The leaves are oval-shaped, with pointed tips and wavy margins. The flowers are clustered, whitish, and resemble those of a potato. The berries are round, smooth, green, turning black when mature. The plant is a weed of rather moist fields and waste places, including areas around corrals and barnyards, especially on the lighter soils. It does not normally grow on areas with a perennial plant cover.

CORYDALIS (*Corydalis* spp.)—a medium sized, yellow or rose colored biennial, with smooth, often silver-tinged, deeply cut leaves, and closely resembles bleeding heart (*Dicentra*).

It occurs commonly in moist, open woods and recent clearings throughout the interior. It seldom, if ever, occurs in concentrations sufficient to cause trouble.

DOGBANE (*Apocynum* spp.)—a smooth, perennial, creeping-rooted, erect, branching forb. It has broad, opposite leaves, and clusters of small, pink bell-shaped flowers that produce long, slender pods containing numerous seeds with tufts of silky hairs. The stems and leaves contain a milky juice.

It is commonly found on abandoned fields, waste places, dry meadows, and open wooded areas, especially with yellow pine. It generally occurs on sandy or gravelly soils.

FIELD BUTTERCUP (*Ranunculus* spp.)—a tall (1 to 3 feet) hairy, perennial, yellow-flowered buttercup with round, divided leaves.

It is common in pastures, meadows, along streams and waste places throughout the province where sufficient moisture is available.

ST. JOHN'S-WORT or GOATWEED (*Hypericum perforatum* L.)—an unpalatable perennial from 1 to 3 feet tall. It has small leaves pitted by small glands in the under surface. The yellow flowers occur in clusters and develop into many seeded, brown capsules. The plants spread by means of strong underground rootstocks and frequently invade even lightly grazed grassland ranges. The plant causes photosensitivity among white-skinned animals.

HORSEBRUSH (*Tetradymia canescens* D.C.)—a low, spreading, pale green to gray shrub with soft, needle-like leaves, and deep yellow flowers in clusters. It closely resembles and generally grows with rabbitbrush.

The plant occurs occasionally on moderately dry grasslands on the lighter soils and is frequently associated with rabbitbrush, yellow pine, or big sage. It seldom, if ever, occurs in sufficient abundance to cause trouble in British Columbia.

SHOWY MILKWEED (*Asclepias speciosa* Torr.)—an erect, showy, perennial herb arising from strong, creeping rootstocks. The leaves are generally wide, somewhat leathery, woolly, and contain a milky juice. The flowers are pinkish mauve in color and clustered in round heads at the stem tips. The fruits are large, with thick coats enclosing numerous reddish brown seeds, each with tufts of long silky hairs attached.

The plants may be locally common in moist locations, in pastures, abandoned fields, and similar areas.

WOOLLY LOCOWEED (*Oxytropis gracilis* (Nels.) Schum.)—a silvery white, perennial, tap-rooted forb, up to 10 inches in height with the flowering stems much exceeding the leaves. Each leaf has from about 10 to 30 leaflets densely covered with silky hairs. The flowers are yellow, somewhat pea-like, and are clustered toward the end of the flowering stalk. The seed pod is rather short and covered with silky hairs.

The plant occurs widely on the dry grasslands of the interior ranges and is most common in the yellow pine zone, generally on dry, open hillsides and gravelly and sandy soil.

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