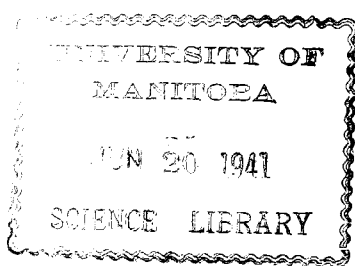


66 1) COLORADO
2) AGRICULTURAL EXPERIMENT STATION
3) 4) BULLETIN 466

APRIL 1941



Weeds of Colorado

B. J. THORNTON and L. W. DURRELL

COLORADO EXPERIMENT STATION
COLORADO STATE COLLEGE
FORT COLLINS

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Weeds of Colorado

B. J. THORNTON and L. W. DURRELL¹

ONE of the oldest problems in agriculture is that of the control of weeds. Indeed, it is as old as agriculture itself, for as long as man has been endeavoring to wrest his living from the soil he has had to contend with weeds. They are his natural enemies, yet he has become so accustomed to their presence that he has come to take them for granted and has permitted them to exact enormous tolls from his agricultural efforts. However, the weed-free farm has always been the mark of the good farmer, and the presence of numerous and troublesome weeds is, almost without exception, an indication of poor or indifferent farming methods.

In the Western States weed pests have been spreading at an alarming rate. The increasing demand for information on the identification and control of weeds is evidence of the awakening interest in the weed problem and the realization upon the part of farmers and landowners of its magnitude and increasing seriousness.²

Importance of Weeds

As early as 1915 the weed loss in Iowa was estimated to be \$25,000,000. During 1920 Indiana's estimated loss was \$44,000,000; Pennsylvania's loss during 1925 was estimated at \$24,000,000 and Wisconsin's during 1927 at \$47,000,000. A more recent report from California conservatively estimates that state's loss due to weeds to be \$60,000,000.

In 1930 the Agricultural Service Department of the United States Chamber of Commerce, after careful investigation, estimated the annual loss through weeds in the United States to be *3 billion dollars* and indicated this loss to be greater than the combined losses suffered from *plant diseases*, *insect pests*, and *animal diseases* over a similar period. The fact that this loss approximates one-third the value of all farm crops produced during that year furnishes startling evidence of the need for concerted effort in bringing about its reduction.

On the basis of the losses experienced by other states and in the United States as a whole, it must appear that a conservative estimate will place the weed loss in Colorado between \$10,000,000 and \$20,000,000, or up to \$400 per farm.

How Weeds Cause Losses

There are many ways in which weeds are injurious and in which they cause losses. While these losses cannot be entirely eliminated, a

This bulletin is based on Colo. Exp. Sta. Bul. 403, with revisions and additional material.

¹Associate professor and professor, respectively, of botany and plant pathology, Colorado Experiment Station.

²See appendix, page 114.

thorough knowledge of their causes and the application of this knowledge to farming practices will go a long way toward reducing them to a minimum.

Decrease Yields

Weeds decrease crop yields by the removal from the soil of vast amounts of water needed by the crop plants. Such weeds as gumweed, sunflower, lambsquarters, and ragweed require as much water to produce a pound of dry matter as do corn, wheat, barley, or oats, if not more. Weeds likewise compete with crop plants for sunlight and for the food material in the soil.

Impair Quality of Farm Products

The presence of weed seeds and weed pieces in grain, and weedy material in hay, greatly reduce the value of these products. Cockle-burs and similar weed impurities in wool decrease its market value, and the feeding of dairy animals upon such weeds as wild garlic, wild onion, mustard, fanweed, yarrow, chicory, ragweed, or giant marsh-elder imparts undesirable odors or flavors to dairy products and often renders them unmarketable.

In the production of vegetable seeds the presence of related weed species or escaped plants in the vicinity of the seed plots may seriously impair the quality of the seed as a result of cross-pollination.

Increase Cost of Farming

Where weeds are prevalent additional operations are necessary in preparation of the soil, in caring for the growing crop, and in harvesting. The presence of weeds increases the wear and tear on machinery used in growing and harvesting crops, and certain pieces of farm equipment are designed and must be maintained for the express purpose of controlling weeds. Serious infestations of noxious perennial weeds may necessitate modification of the entire farming program.

Irrigation costs are increased by weeds and weedy shrubs growing in and along the banks of irrigation ditches, not only as the result of the expense involved in removing the growth and the accumulated sediment, but also as a result of reduced efficiency of the water carriers. The efficiency of drains also is frequently impaired and the flow sometimes stopped entirely by the entrance of roots of perennial weeds and shrubs.

The unsightly appearance of a farm overrun with weeds at once reduces its value in the eyes of a prospective purchaser, regardless of its other desirable features. Noxious perennial weeds such as wild morning glory, Canada thistle, and others reach out in all directions year after year and actually remove more and more land from profitable cultivation. Weeds of this type are a serious menace to surrounding fields, and entire farms have been abandoned as the

result of their encroachment. The Federal Land Bank and many other banks and investment companies refuse to make loans, or limit loans materially, on land that is known to be so infested.

Harbor Plant Diseases and Insect Pests

Many weeds act as hosts to insect pests and to organisms which cause plant diseases. The elimination of weeds is an important step in the control of many crop pests.

Curly top of sugar beets, potato leaf roll and spindle tuber, tomato, cucumber, and melon mosaics, and black leg and club root of cabbage are examples of diseases whose causal agents may infect weeds related to the respective host plants and thus furnish sources of disease spread or means of carrying diseases over rotation periods designed to eliminate the causal agents. Weeds also have an important place in the life cycles of insects such as the Colorado potato beetle, the sugar beet web worm, and the nematode; the presence of weeds contributes to the spread and prevalence of such pests. Grasshoppers prefer to lay their eggs in the unplowed and weedy areas along fence rows, roadways, ditchbanks, and other waste places.

Cause Livestock Losses

Millions of dollars are lost annually by the injury or death of livestock from eating poisonous or otherwise injurious plants. Larkspur, lupine, loco, whorled milkweed, deathcamas, and other poisonous plants are found on Colorado's ranges and in many instances have become so predominant, largely as a result of overgrazing and poor range management, as to prevent or limit the use of otherwise valuable grazing areas. The control of these plants is usually difficult because of the conditions of their growth and may involve such labor and expense as to render the effort unpractical.

Certain poisonous plants may be found growing in cultivated areas, where they constitute a source of livestock poisoning in the field or in the crops harvested. Whorled milkweed is a persistent pest in cultivated fields, in orchards, and along fence rows and ditchbanks. Poison hemlock may be found along ditches and in other moist places. The seedlings of cocklebur are at times very poisonous, especially to young pigs, and the young, succulent plants of pigweed may cause severe bloating and perhaps death when eaten in excess by cattle. Johnson grass may be extremely poisonous if grazed after being wilted or stunted by drought or after being frosted.

Plants such as sandbur, three-awned grass, porcupine grass, downy brome grass, and wild barley possess spines and barbed awns which cause injury to the feet, mouths, and eyes of animals, sometimes with serious results. The accumulation in the digestive tract of these and other indigestible plant fibers, substances such as are found in the Colorado rubber plant, may, if excessive, cause death.

Nor are the victims of plant poisoning limited to livestock. Many instances are known where children and even mature persons have been made very ill or have lost their lives as a result of eating the roots, fruits, or other parts of poisonous weeds.

Water Weeds

Among the water weeds which are more or less common in Colorado may be mentioned cattails, tules or bulrushes, mannagrass, marsh grass, pondweeds, *Philotria*, watercress, and waterplantains. The harm which water weeds do in irrigation and drainage systems has already been mentioned. Members of this group and certain algae, sometimes called "scum weeds", "slimes", and "water moss", may become a serious nuisance in fish ponds, in private lakes and reservoirs, and in the lakes of parks and resorts, making them unattractive and impairing their usefulness. In some sections of the United States water weeds, such as the water-hyacinth, offer a serious obstacle to navigation.

Weeds Along Fences, Highways, and Railroads

Weeds growing along the fence rows and rolling weeds, such as tumbleweed, tumbling mustard, and Russian thistle, which lodge against fences in the Plains area, serve to catch and hold drifting sand and soil, with the result that fences and even adjacent highways may be entirely buried, necessitating digging out or rebuilding the fences and uncovering the highways. Considerable effort is also expended each year in mowing, burning, treating with chemicals, or otherwise destroying the weed growth along highways and railroad rights-of-way.

Other Undesirable Features

Weeds have been found of some value in returning organic matter to the soil, in holding snow and preventing erosion, and as a source of food for animals during times when other foods are scarce, but their undesirable features far outweigh any possible benefits.

In addition to being the direct cause of serious losses on the farm and elsewhere, weeds growing along the highways, on the banks of the streams, and in waste places are extremely unsightly. They mar the beauty of lawns, parks, and natural landscapes. The pollen from some weeds is a source of hay fever, and others, such as poison ivy, poison oak, and nettles, often cause severe skin poisoning.

Characteristics of Weeds

Weeds possess certain characteristics which enable them to live under adverse conditions and in competition with cultivated plants. Because of these characteristics they have come to present one of agriculture's most serious problems.

Natural Hardiness and Adaptability

Weeds for the most part are extremely hardy. They are capable of enduring severe extremes in their living conditions and will mature seed under the most adverse circumstances. They are capable of quickly adapting themselves to a new environment and frequently become much more troublesome pests in the new locality than in the regions from which they came.

Means of Propagation

The persistence and spread of weeds is not only due to their ability to endure as individuals but to an even greater extent to their remarkable capabilities for propagating themselves.

NUMBER AND SIZE OF SEEDS PRODUCED.—Many weeds produce enormous numbers of seeds and these are of the utmost importance in their establishment and spread. Small, inconspicuous seeds often escape notice and are a serious source of contamination in impure crop seed. The approximate numbers of seeds produced by representative plants, and their comparative size as indicated by the number per pound, are given in the following table.³ Alfalfa is included as a basis for comparison.

Name of plant	Approximate number of seeds per plant	Approximate number of seeds per pound
Tumbleweed	129,000	2,000,000
Tumbling mustard	80,500	2,500,000
Purslane	52,500	3,500,000
Lambsquarters	72,500	650,000
Russian thistle	24,700	260,000
Pigweed	117,500	1,200,000
Alfalfa	50,000	250,000

VIABILITY OF WEED SEEDS.—Seeds of many weed species retain their viability over a long period of time, especially when buried in the soil. It has been shown that many weed seeds will germinate after 30 or 40 or even more years. Seeds of this type will germinate when brought to the surface of the ground and may thus give rise to weeds on areas that have been kept free from such growth for a number of years. In contrast to weed seeds most crop seeds lose their viability within 1 year when buried in the soil. When buried in manure piles, practically all seeds, both weed and crop, lose their ability to germinate in from 1 to 6 months.

DORMANCY.—The seeds of most plants will germinate soon after maturity if placed under the proper conditions of temperature and moisture. There are, however, a few crop seeds and numerous weed

³O. A. Stevens, Amer. Jour. Bot. XIX:784-94, Nov. 1932.

seeds that will not germinate until considerable time has elapsed following maturity. This characteristic, which is known as dormancy, delays the germination of the newly matured seeds until the following spring when conditions are favorable to the growth and development of the young plants. This peculiarity also tends to lengthen the germination period and thus may serve in tiding weeds over unfavorable intervals.

WEED SEEDS IN THE SOIL.—The ability of weeds to produce large numbers of long-lived seeds results in the soil becoming filled with viable seeds of all descriptions. This is well illustrated in the following tables which are based upon the results of investigations carried on by the Department of Agriculture of the Dominion of Canada:

Number of Viable Weed Seeds in Surface Inch of Soil

Type of field	In 6 ounces of soil	In 1 square foot of soil	In 1 acre of soil
Field continuously cropped to grain for 8 years.....	134	2,250	98,010,000
Field in sod for 6 years.....	127	2,133	92,913,480
Field under good system of cultivation for 8 years.....	33	554	24,132,240

Number of Viable Weed Seeds in First Seven Inches of Soil

Type of field	In 6 ounces of soil	In 1 square foot of soil	In 1 acre of soil
Field continuously cropped to grain for 8 years.....	126	14,847	646,735,320
Field in sod for 6 years.....	71	8,386	365,294,160
Field under good system of cultivation for 8 years.....	24	2,863	124,712,280

From these tables it is evident that continually cropping a field to grain results in the soil becoming infested with great numbers of weed seeds. A good system of crop rotation and cultivation, however, greatly reduces the number of weed seeds in the soil, and the longer such a system is practiced the greater the benefits derived from it.

In planting 10 pounds of alfalfa seed to the acre of ground, about 60 seeds are distributed to the square foot. When this figure is compared to the occurrence of weed seeds in the surface inch of the soil as given in the foregoing tables, approximating 554 seeds per square foot under conditions of good farming, and 2,250 seeds per square foot under conditions of poor farming, the prevalence and extensive distribution of weed seeds in the soil becomes apparent. The presence of such vast numbers of seeds and their prolonged viability explains the sudden and surprising appearance of certain weeds after years of careful farming.

OTHER CHARACTERISTICS OF WEED SEEDS.—The ability to disseminate themselves by natural means, protective coverings, and the resemblance of certain weed seeds to crop seeds are other factors which aid in the growth and spread of weeds.

VEGETATIVE REPRODUCTION.—Efficient as weeds are in the production of seeds, many do not depend entirely upon seeds for their reproduction. Such plants are capable of propagating themselves by vegetative means such as bulbs, aerial bulbs or bulblets, corms, runners or stolons, creeping rootstocks (rhizomes or underground stems), and creeping horizontal roots. Plants possessing creeping roots or rootstocks are especially difficult to eradicate because of the extensive nature of these underground parts.

Introduction and Dissemination of Weeds

Lists of weedy plants of every civilized country show a large percentage of weeds to be foreigners. The United States has been especially subject to the immigration of foreign weeds because it has been populated by people from all corners of the earth and has always been a seed-importing nation. It may be safely said that the majority of our troublesome weeds are introduced plants, which have come largely from Europe. Within the United States the migration has been largely from east to west. However, the movement has not been all in one direction, for western weeds have been carried east and American plants have found their way to all parts of the globe.

Nor has this movement ceased. New weeds are constantly appearing in every section, having come in from neighboring farms, from neighboring states, or perhaps from distant countries. Natural agencies, agencies created by man, and man himself all have a part in the introduction and spread of weeds.

Natural Agencies

Many natural agencies are of considerable importance in assisting in the dissemination of weeds, and weeds themselves are often possessed of special adaptations enabling them to take full advantage of the opportunities offered.

ANIMALS AND BIRDS.—The seeds of many plants, such as burdock, cocklebur, sandbur, and beggar ticks, have hooks, barbs, or other mechanical means by which they may become attached to the wool or hair of animals and thus be transported long distances. The seeds of peppergrass, plantain, and certain mustards become mucilaginous when wet and may be carried away by the feet or any part of an animal with which they come in contact. Both animals and birds may eat numerous weed seeds, many of which pass through their digestive tracts without injury.

WIND.—Strong winds serve to disseminate seeds of almost all kinds, especially over frozen snow, but even breezes and air currents are effective in the dissemination of seeds which are equipped with special devices such as delicate parachutes, tufts of hairs, or membranous wings. It is estimated that the spread of weeds by wind is usually limited to 2 or 3 miles, and to 10 or 15 miles at the most, although there may be exceptional instances where seeds may be carried greater distances by wind.

WATER.—Seeds of weeds may be washed considerable distances from their place of origin by rains and melting snows. They may be carried into rivulets, thence into larger streams, and finally into rivers to be eventually washed ashore or deposited in the silt of flooded lands many miles away.

Russian thistle was introduced into Colorado near the upper waters of the Arkansas Valley in 1892 and by 1896 had been carried half way across Kansas by the Arkansas River. Not all weed seeds float, but many do, and many have special devices which enable them to stay on top of the water.

RUNNERS, ROOTSTOCKS, AND HORIZONTAL ROOTS.—Plants which possess runners, rootstocks, and horizontal roots are capable of spreading over rather large areas, regardless of their seed production. Such spread varies from a few feet to several feet each year. Investigations in Kansas indicate that bindweed patches double their area every 5 years under normal conditions. If pieces of the roots or rootstocks are broken off and dragged away, they may start new areas at considerable distances.

SEED-THROWING APPARATUS. — Some plants have mechanical means of projecting their seeds several feet, thus assisting the spread in a limited way.

Man-Made Agencies

Man has played a far greater part in the introduction and spread of weeds than have the natural agencies. He is almost entirely responsible for the introduction of new weeds and has greatly augmented the natural agencies in bringing about their establishment and local spread. Few new weeds have been introduced into an area before the advent of man and his herds.

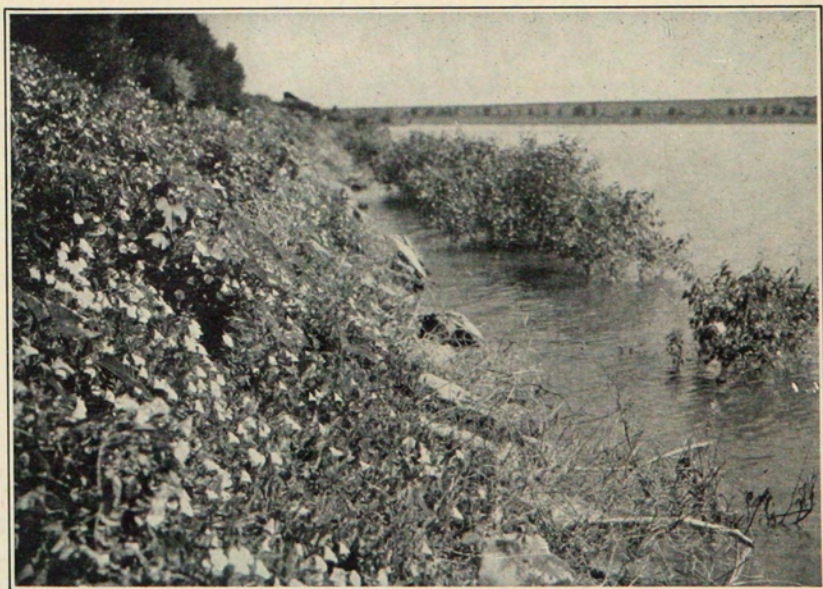
IMPURE FARM SEEDS.—Of all the various ways and means, both natural and artificial, by which weed seeds may be introduced and dispersed, impure farm seed is, without doubt, the most important. As early as 1672 many weed seeds were reported to have been introduced into this country from England in grass and other crop seeds. Foreign wheat seed, alfalfa and clover seed, and sugar beet seed, to-

gether with many other foreign crop seeds, have been responsible for the introduction of many of our most serious weed pests.

FORAGE CROPS AND GRAIN.—Hay is not as important in the distribution of weed seeds as it was in the days when horses were more generally used. However, it is still a factor on the farms and in sections where considerable livestock raising, feeding, and dairying are carried on.

The feeding of weedy grain may also result in the spread of weeds since many of the seeds may pass through the digestive tracts of animals without being injured and may then be scattered upon the fields in droppings or in manure. Weedy straw used for bedding may be a source of infestation in the fields in a similar manner.

IRRIGATION SYSTEMS.—Irrigation systems with their ditches and reservoirs for collecting and impounding water and distributing it over fertile farm lands provide an important agency for weed-seed distribution. Here a natural agent, water, has been made many times more effective as a result of man's enterprise. Seeds of weeds growing on the watersheds of the tributary streams, along the diversion canals, on the edges of the reservoirs, and on the banks of the distributing canals and laterals, as well as wind-blown seeds, fall into the water and eventually may be scattered over the fertile fields as the water is applied to the crops.



Bindweed on reservoir bank—a source of seed in irrigation water.

In a series of tests conducted by the Colorado Experiment Station, 81 different species of weed seeds were found to be carried by the irrigation water of the three ditches which were investigated, and it was estimated that the number of weed seeds passing a given point on a 12-foot ditch during a period of 24 hours may reach several millions. It was also stated, as a result of these investigations, that ditchbanks are more to be feared as a source of weeds than are roadsides and that early irrigation waters are the most heavily laden with weed seeds. Similar results were obtained in tests in Canada.

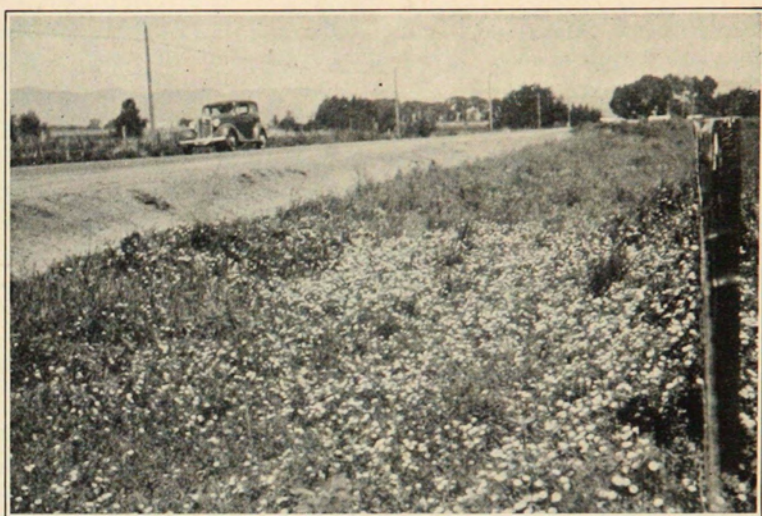
FARM MACHINERY.—All types of farm machinery may aid in the spread of weeds, especially in wet weather when the seeds become attached to implements and vehicles in mud or by the natural stickiness of the moist seeds. Wagons and trucks may scatter weed seeds from their beds. Plows, harrows, and cultivators may drag the roots or seed bearing portions of perennial plants to other parts of a field or into other fields. Threshing machines, combines, binders, and hay balers are especially serious offenders in spreading weeds, scattering the seeds from field to field and from farm to farm.

PACKING MATERIALS.—The material used in packing commercial goods such as glassware often contains weed seeds of various types. Woolly mullen was introduced into Kentucky from France in crockery packing, and downy brome grass and barren brome grass, both European grasses, were first found in Denver near a crockery store.

NURSERY STOCK AND USEFUL OR ORNAMENTAL PLANTS.—Many serious weeds have been introduced and distributed with nursery stock, being carried in the packing, in the soil around the roots, or as associated plants packed with the stock. Plants that have been brought from Europe for useful or ornamental purposes have escaped from cultivation to become some of the country's worst weed pests. Oxeye daisy, ribgrass, wild garlic, chicory, purslane, matrimony vine, dandelion, and bouncing-bet are examples. The dandelion was first introduced into the vicinity of Fort Collins as an ornamental plant and for greens.

MANURE AND REFUSE.—The manure and refuse from stockyards, feeding pens, and barnlots may carry numerous weed seeds as a result of feeding weedy hay or grain or bedding with weedy straw, and the application of this material to the land may result in the introduction and spread of weeds over wide areas.

COMMON CARRIERS.—Railroads and highway trucks, incident to transporting cargoes of grain, hay, livestock, and other farm commodities, scatter many weed seeds along rights-of-way and highways, which in turn become sources of infestation to the adjoining fields.



Roadside infested with bindweed.

Growth Habits of Weeds

The principles involved in the control of weeds are based upon their habits of growth and reproduction. Upon this basis weeds may be classified as follows:

- I. Annuals
 1. True annuals
 2. Winter annuals
- II. Biennials
- III. Perennials
 1. Simple perennials
 - (a) Perennials with root crowns
 - (b) Perennials with stolons or runners
 - (c) Bulbous perennials
 2. Creeping perennials
 - (a) Perennials with creeping roots
 - (b) Perennials with creeping rootstocks

Annuals

Annual plants depend entirely upon seed for their reproduction. They live for only 1 year and die after maturing seeds. Most common farm weeds fall in this group.

TRUE ANNUALS.—True annuals, which are also called summer annuals, germinate in the spring, develop and produce seeds during the summer, and die. The plants which germinate in the late summer or fall cannot survive the winter, and the growing season is therefore limited to the summer months. Examples are lambsquarters, pig-

weeds, Russian thistle, cocklebur, crabgrass, buffalo-bur, purslane, and many others.

WINTER ANNUALS.—Winter annuals are plants that germinate in the late summer or fall and live over winter as small tufts of leaves or rosettes. They resume growth in the spring and mature seeds early in the summer. These weeds are especially bad in grain fields where they mature seeds and reinfest the soil before harvest time. Many weeds grow both as summer annuals and winter annuals, especially where the winters are mild. Examples of winter annuals are shepherdspurse, peppergrass, prickly lettuce, wild barley, fanweed, and tumbling mustard.

Biennials

Biennial plants require two seasons to complete their growth. They grow from seeds in the spring and spend the first season in storing up food, usually in short, fleshy roots, the foliage being limited to clumps of leaves or, more often, typical rosettes. The following season the plant draws heavily upon the stored food and makes a vigorous growth, maturing seeds in the summer and fall. Then it dies. Biennial weeds make up a comparatively small group among which may be listed burdock, bull thistle, houndstongue, mullein, wild parsnip, and common mallow.

Perennials

Perennial weeds are weeds which live for more than 2 years. They not only produce seeds as do annuals and biennials but also come up from the roots year after year. Because of their persistent habits of growth and spread, perennials are our worst weed enemies.

SIMPLE PERENNIALS.—The majority of simple perennials possess *root crowns* which produce new plants year after year. The root crown is supported by a fleshy taproot or, as in the case of the bunchgrasses, by a mass of fibrous roots. Plants of this type depend upon the production of seed for their spread except in the few instances where pieces of the crown may be broken off and carried elsewhere. Examples are dandelion, chicory, dock, and plantain.

Some of these plants are capable of spreading to a limited extent by means of *stolons* or *runners* which are elongated stems that run along the surface of the ground and which give rise to new plants where the nodes touch the ground. The runners die during the winter, but the roots survive and produce new individual plants the following season. Silverweed and grapevine mesquite are examples.

The few weeds of the lily family such as field garlic or wild onion are known as *bulbous perennials* and reproduce by means of bulbs, bulblets, or aerial bulblets, seed production being distinctly limited.

CREEPING PERENNIALS.—Members of the creeping perennial group of weeds propagate themselves by means of seeds and creeping underground parts. They constitute Colorado's most serious and difficult weed problem, not only because of their ability to resist control but because of their persistent and relentless spread if left uncontrolled. The underground parts by which plants of this type spread through the soil may be either horizontal roots or rootstocks.

“Horizontal roots” are true roots, being characteristically irregular in their growth and lacking nodes and leaf structures. They give rise to adventitious aerial shoots and to lateral roots at any place along their length. In general, horizontal roots grow at deeper levels than do rootstocks, especially in cultivated ground where they may develop some distance below the plow depths. They may turn downward at any point and grow deep into the earth as thick, vertical roots. Aerial shoots usually arise at this point and lateral roots continue the horizontal growth. Field bindweed, Canada thistle, perennial sowthistle, leafy spurge, and whiteweed are examples of plants which spread by horizontal roots.



Extensive root system of a creeping perennial
(Whiteweed).

“Horizontal rootstocks” or “rhizomes”, as they are often called, are underground stems and possess typical stem structure although modified, almost beyond recognition in some instances, by the conditions of their subterranean growth. If not too old, they may be recognized by the presence of nodes or joints and small, scale-like leaves, although these structures tend to disappear with increasing age. Rootstocks ordinarily grow at shallower depths than do horizontal roots, and they may turn upward at any point, but never downward. The lateral roots, aerial shoots, and secondary branches always arise at the nodes and not adventitiously or irregularly as with the creeping roots.

Types of Weeds

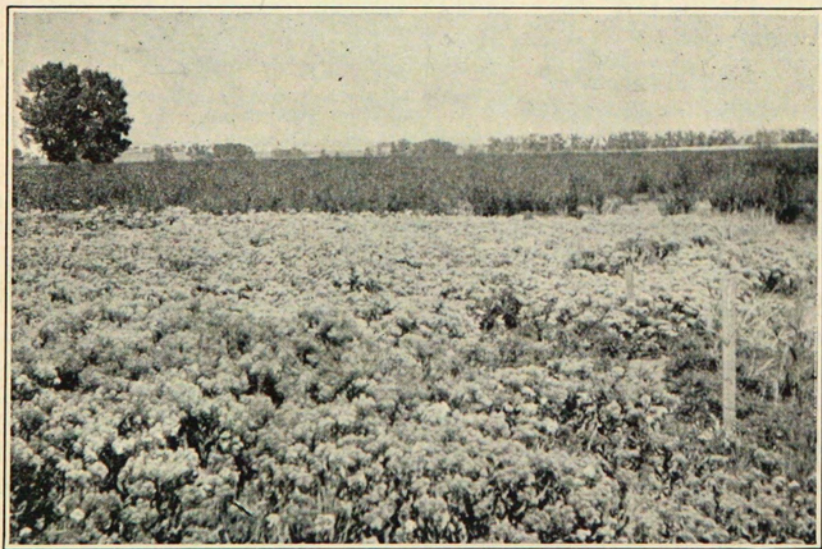
For convenience in the study of weeds and as an aid in considering the methods for their control, all types of weeds may be divided into two general groups: common weeds and noxious weeds.

Common Weeds

Annuals, biennials, and simple perennials which are more or less common to every farm but which are not exceptionally injurious and which are readily controlled by ordinary good farming practices are considered common weeds. This group includes the majority of our weedy plants.

Noxious Weeds

Noxious weeds are those which are particularly undesirable because of certain troublesome characteristics. The presence of an extensive perennial root system which enables a plant to resist all but the most determined efforts at control is responsible for the noxious character of most weeds, but weeds may also be noxious because of other characteristics. The term "noxious" is an arbitrary one, and the lists of noxious weeds vary greatly with different states. However, there are certain weeds such as bindweed, Canada thistle, Russian knapweed, whiteweed, and others which are recognized as noxious in practically every state in which they grow. Since the so-called noxious weeds may vary greatly in the degree of undesirability, many states have adopted primary and secondary noxious weed lists, each



An infestation of whiteweed.

subject to change as conditions may warrant. Colorado's recently revised lists, as recommended by a committee appointed for the purpose, are as follows:

Primary noxious weeds:

- Whiteweed (*Lepidium draba*), (*L. repens*)
(*Hymenophyssa pubescens*)
- Leafy spurge (*Euphorbia esula*), (*E. virgata*)
- Bindweed (*Convolvulus* spp.)
- White horse nettle (*Solanum elaeagnifolium*)
- Canada thistle (*Cirsium arvense*)
- Russian knapweed (*Centaurea picris*)
- Perennial sowthistle (*Sonchus arvensis*)

Secondary noxious weeds:

- Quackgrass (*Agropyron repens*)
- Wild oats (*Avena fatua*)
- Curled dock (*Rumex venosus*)
- Fanweed (*Thlaspi arvense*)
- Mustards (*Brassica* spp.)
- Austrian peaweed (*Succinosa salsula*)
- Puncturevine (*Tribulus terrestris*)
- Dodder (*Cuscuta* spp.)
- Purple-flowered groundcherry (*Quincula lobata*)
- Buckhorn plantain (*Plantago lanceolata*)
- Silverleaf povertyweed (*Franseria discolor*)
- Mouse-ear povertyweed (*Iva axillaris*)
- Woolly-leaved povertyweed (*Franseria tomentosa*)

It should be recognized that the foregoing lists are composed of weeds whose seeds are met with in seed traffic and that there are in the state numerous additional weeds that may be equally noxious.

CONTROL OF WEEDS

The control of weeds has always been and always will be an important phase of successful farm operation. Effective and efficient control is founded upon two basic principles: (1) Guarding against and eliminating the sources of weed seed, so far as possible; (2) destruction of weeds already established, especially those creeping perennials which are not dependent upon seeds for their spread.

Prevention of the Introduction of Weeds

As the first step in reducing the number of weeds on the farm, careful attention should be given to the prevention of the introduction and distribution of weed seeds from outside sources.

Impure Farm Seeds

Impure agricultural seed constitutes one of the most common and important sources of weed seeds. Local seed of this type will spread the weeds already present in a community, while seed shipped in from the outside may introduce serious weed pests not previously known. A survey of samples of wheat, oats, and barley taken from farmers' drills at planting time indicated that 65 percent of the seed was raised on the farm where being planted and 15 percent came from neighboring farms. Of this seed 80 percent was found to contain noxious weed seeds. That the farmer should thus be planting the very weeds that he and his neighbors must unceasingly fight is a paradox for which there is little excuse. The State maintains a seed laboratory for the express purpose of examining samples of farmers' seeds and advising them as to the weed seed content, purity otherwise, and germination. In addition the State Pure Seed Law requires that agricultural seed offered for sale be properly labeled as to the quality of the seed. However, too much confidence should not be placed in the information on such a label unless it is known to be that of a reputable dealer. Even then there may be noxious weed seeds present since the law does not require that they be declared unless in excess of 90 per pound. Of over 200 alfalfa seed samples, collected directly from dealers, only 20 percent were found to be free from noxious weeds. Fifty percent of the samples averaged 36 noxious weed seeds per pound, which would not be required to be shown on the label. The remaining 30 percent contained an average of 367 noxious weed seeds per pound although, in direct violation of the law, this information was also missing from the majority of the labels. Thus it appears that the safest way to insure against planting weeds is to have all seed tested before planting or to plant only such seed as is guaranteed by a reputable dealer or by the State Seed Registration Service to be free from noxious weeds.

Weed Seeds in Irrigation Water

Not much can be done by the individual in preventing the introduction of weed seeds in irrigation water. Machines have been made for the removal of these seeds but none has been entirely satisfactory. Irrigation companies can help by keeping the banks of the canals and laterals free from weeds or at least by preventing these weeds from maturing seeds.

Weed Seeds Carried By Farm Machinery

The careful farmer will insist that all types of community machinery, such as threshing machines, combines, and hay balers, and the equipment accompanying them, be thoroughly cleaned before being brought onto his premises and when being moved from field to



Cultivator carrying weed parts to clean ground.

field, whether or not such is required by law. He will also take care to see that his own implements, wagons, and trucks do not serve to distribute weed seeds over his land.

Weed Seeds in Manure

Weed seeds in manure may be largely eliminated by composting the manure for a period of 3 to 6 months before hauling it to the field. Sheep manure is much less likely to contain weed seeds than other forms of farm manure.

Control of Common Weeds

Although the common weeds are considered as being those which are more or less easily controlled by ordinary methods, this fact should not detract in the least from the necessity and importance of their control.

True Annuals

Annual plants live for one season and propagate only by seed. The prevention of seed formation is therefore the most effective means of reducing their numbers and bringing about their control. This is best accomplished by destroying the plants when they are young but may be successfully effected by removing the tops at any time previous to the flowering period. However, mowing or cutting later than this may prove ineffective since many plants will mature seed on the cut-off tops.

The prevention of seed production for a single season or even for several seasons cannot be expected to eliminate annual weeds entirely, for viable seeds in the soil will continue to germinate for several years as they are brought under favorable conditions by frequent cultivations and by plowing.

CULTIVATION.—The oldest, most effective, and most generally satisfactory method of controlling weeds is by cultivation. Cultivation of annual weeds may be done at any time during the growing season and is always destructive to weed growth. However, all weeds, whether they be annuals, biennials, or perennials, are most easily and economically killed when they are seedlings. Large areas can be easily gone over in the spring with such implements as the harrow or the weeder. These tools are effective in destroying seedlings and may be used after the crops have been planted and even after they have attained considerable size, the damage done being small compared to the beneficial results derived from the destruction of the weeds.



A weed-free fence row.

Cultivation of intertilled crops must be continued with suitable tools with such frequency as will prevent the weed growth interfering with development of the plants. Hand hoeing should be resorted to occasionally in order to destroy weeds which escape the cultivator. Planting in checkrows, where conditions will permit, makes it possible to cultivate in both directions and reduces the use of hand labor to a minimum.

MOWING.—Mowing is an effective method of quickly destroying and preventing the formation of seeds by weeds which have attained considerable size or which are growing on ditchbanks, roadsides, or other areas where cultivation is impractical or impossible. The plants should not be permitted to become too far advanced before mowing, for many weeds possess remarkable ability to mature seeds after they have been cut. In some instances branches will rise from the remaining stubs and produce seeds unless again cut off.

GRAZING.—Grazing serves the same general purpose as does mowing, except that it may be made considerably more effective if there are enough animals to keep the weeds grazed down to the ground. Sheep are especially useful for this purpose and the farm which boasts a "farm flock" is always characterized by unusual freedom from weeds and by neatness in its general appearance.

BURNING.—Although weeds should never be permitted to mature seeds, wherever this has occurred the plants should be burned as they stand. Cutting and piling or raking in windrows may result in the shattering out of the seeds and their consequent escape from the flames. Weeds which collect in irrigation ditches, drains, fence corners, and waste places should be burned whenever possible in order to destroy the seeds.

CROP ROTATION.—Many weeds are more or less associated with certain crops, and the continuous growing of such crops makes the control of these associated weeds almost impossible.³ Such weeds as wild oats and the mustards are especially bad where land is continuously cropped to grain, because their seed is matured early and is scattered back on the land in the process of harvesting. Such weeds can be successfully controlled only by summer-fallowing or by introduction of a cultivated crop. A carefully planned rotation involving hay, grain, and intertilled crops is the most practical and efficient means of controlling most weeds, and but little extra effort is required to complete the control program.

Winter Annuals

Although the methods utilized in the control of annual weeds may in general apply to the control of winter annuals, certain modifications in keeping with the difference in growth habits must be observed. Winter annuals germinate in the late summer and fall and make a rapid growth the following spring. Weeds of this type are especially bad in small grain and may best be controlled by plowing or disking in the late fall or early spring. If the infestation becomes too severe, a carefully cultivated row crop or a season of summer fallow may be necessary to put the land in proper condition.

³See table, page 10.

Biennials

Although biennials require all of two seasons to complete their growth, they reproduce only by seed, and their control is essentially the same as for winter annuals.

Simple Perennials

Simple perennials differ from annuals and biennials in their ability to persist for a number of years. They depend entirely upon seed for their propagation, and their control is effected by the same general methods as are required for the control of winter annuals and biennials, except that cutting off below the crown may be necessary to bring about the plant's early destruction.

Control of Noxious Weeds

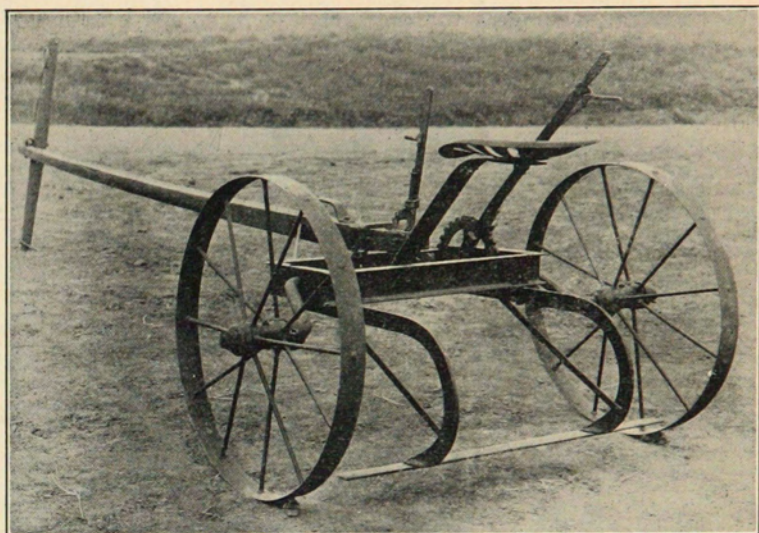
Annuals, Biennials, and Simple Perennials

Since "noxious" weeds may be any weeds which are especially troublesome or detrimental, they are not limited to any one group of plants. Those annuals, biennials, and simple perennials which are considered noxious do not differ fundamentally from other members of these groups. Their noxious characteristics may be due to the production of an enormous number of seeds; the seeds may remain viable in the soil for many years; the plants themselves may be very hardy, or they may be especially injurious to livestock or detrimental to growing crops or to finished farm products. They may have other characteristics which cause them to be noxious, but they all depend upon seed for their propagation and are therefore controlled by the same general methods that are utilized in the control of the common weeds of these groups. However, a most careful and persistent application of these methods will be required in most instances if the efforts are to meet with success.

Creeping Perennials

The most serious of Colorado's weed pests are creeping perennials. Farming methods should be such as to keep these pests under control. If at all possible their complete eradication should be brought about, since their presence is a constant menace to farming operations. Once eradicated these weeds need never again become a serious problem, since in the early stages of their growth they may be almost as easily destroyed as the common weeds. However, a sharp lookout should be maintained for their first appearance in order to prevent their becoming established.

Since creeping perennials propagate both by seeds and underground parts, their eradication depends not only upon the prevention of seed formation but also upon the far more difficult task of the destruction of the roots or rootstocks. This may be accomplished by starving the roots by periodic cultivations, by the application of



A simple type of two-horse knife weeder used in the control of perennial weeds. Attaching the blade so that the sharp edge may be tilted down as the blade becomes worn will greatly improve the efficiency of this implement. (Illustration courtesy Wash. Exp. Sta.)

chemicals, or by various other methods. Experimental efforts are in constant progress in an attempt to work out improved methods of weed control, and it is always advisable to obtain the latest information from the Experiment Station or the County Extension Agent before undertaking a weed eradication program. It should also be kept in mind that the success of any method will depend upon determined and persistent effort on the part of the operator.

CLEAN CULTIVATION.—Clean cultivation or bare fallow is at the present time probably the most practical and economical method of eradicating creeping perennial weeds on areas large enough to permit its use. Although the success of this method has been demonstrated time and again, it has been severely condemned because of many failures resulting from its improper application. The fault in these instances, however, is not with the method but with the individuals who, either through neglect or because of adverse circumstances, failed to carry out the eradication program properly.

The purpose of clean cultivation is gradually to starve the plants by continually cutting off the new shoots before they are able to replace the reserve food utilized in their development. These new shoots, which emerge following a cultivation, continue to draw upon the root reserves quite strongly for several days, after which the process slows down and they must again be cut off. Recent tests

indicate that cultivation about 6 or 8 days after the shoots emerge or approximately every 2 weeks gives best results in bringing about destruction of the plants.

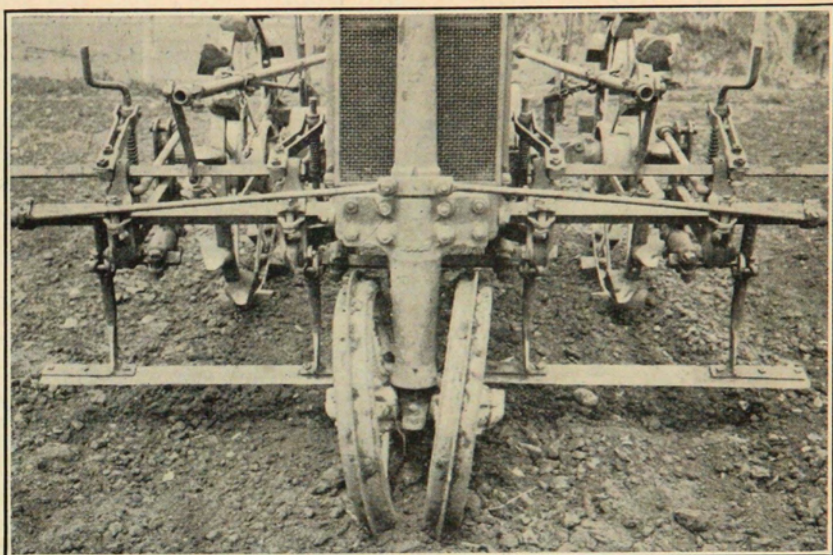
The cultivation program may be begun at any time, but best results are obtained by beginning in the early spring, preferably in May, at which time the root reserves are at a low point and the soil moisture is such as to provide the favorable growing conditions necessary for the most rapid exhaustion of the plants. Starting the program later in the season tends to prolong the total time required to eradicate the plants and to increase the number of cultivations necessary. If the soil becomes dry or the plants are permitted to make too heavy growth between cultivations, the effectiveness of the cultivations will be greatly decreased. When possible, proper soil moisture conditions should be maintained by the application of irrigation water.

Plowing and harrowing or levelling the ground as the first operation in preparation for subsequent cultivations may be desirable, although this may not be necessary if the soil is already in good tilth. Deep plowing the preceding fall also is recommended. As already indicated, the area should be cultivated every 2 weeks during the growing season, the cultivator being run at a depth of about 3 inches. Numerous tests have indicated that more frequent or deeper cultivations are of no particular advantage, merely serving to increase the cost of the work. Although the infestation is often reduced 75 percent or more the first year, 2 years' cultivation is required in most instances to destroy all the plants. This involves from 20 to 25 cultivations. Although the cost of such a program will vary under different conditions, it will, on the average, approximate from \$6 to \$10 per acre for the 2 years, exclusive of the plowing.

It is advisable to put the land into a row crop the third year in order to detect any surviving plants. If any such appear, they will be in limited numbers and may be dug with a shovel or treated individually with a small amount of sodium chlorate.

Any type of cultivating tool that will cut off the plants effectively at the proper depth may be utilized. The duckfoot cultivator has been widely used for this purpose and does excellent work when the duckfeet overlap not less than 3 or 4 inches and are kept fairly sharp. Many types of implements may be equipped with duckfeet at little cost. Wide duckfeet are more desirable than narrow ones.

In tests made at the Colorado Experiment Station, a straight blade set at right angles to the direction of the cultivating, with the front edge dipped slightly, proved to be the most effective weed cutting implement tested and also the most efficient from the standpoint of the power required to pull it. Such a blade may be attached to an old corn or potato cultivator, bean cutter, beet cultivator, lister,



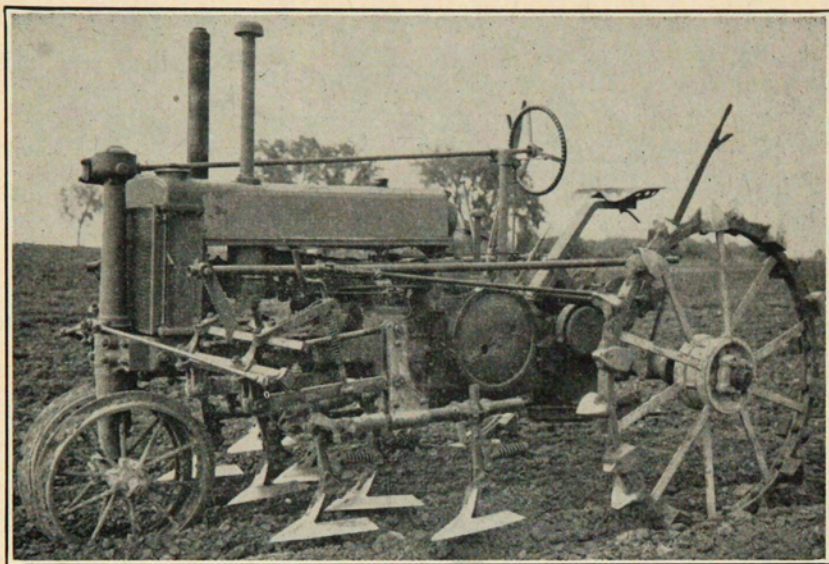
A 7-foot weed blade on tractor, used successfully by the Colorado Experiment Station for clean cultivation.

drill frame, or any one of a number of implements that may be found on the farm, or it may be adapted to the cultivator attachment of the utility tractor. If attached in such a way that it may be turned over when the edge becomes worn on the under side, it becomes virtually self-sharpening, a feature that results in considerable saving.

A "weeder sled" with the blade set at right angles to, and the proper depth below, the runners may be made at little cost and has proved very effective. "Stalk cutter" steel one-fourth inch thick and 4 inches wide, has been found to be excellent material for a weeder blade. It is high-carbon steel with great wear resistance and has one edge already sharpened. It may be purchased through the local blacksmith or hardware store in any length desired, costing about 30 cents a foot, which is little if any more than the cost of tapering and sharpening an ordinary blade. However, satisfactory blades may be made from tire iron, discarded grader blades, or similar material.

The shovel type cultivators, the disk harrow, and the spring-tooth harrow are ineffective as clean cultivation tools and are not recommended except in case of quackgrass and similar shallow-rooted plants where the use of the spring-tooth is of value in bringing the matted underground parts to the surface, where they dry out and die.

Although the principles involved in the eradication of weeds by clean cultivation are always the same, the exact plan or system will vary with the weed, the type of soil, and certain other factors, and



Tractor equipped with duckfeet for clean cultivation.

must be further modified to meet the individual farm practices and conditions. The purpose of clean cultivation must be kept clearly in mind with full realization of the importance of cultivating at the proper time and of the fact that lack of thoroughness will result in indefinite prolongation of the work and probably in ultimate failure.

HAND METHODS.—Hand methods are, of course, applicable only to small infestations of perennial weeds. Such patches may be eradicated by hand hoeing or by use of the push hoe, the latter being more efficient and permitting fewer misses. As with clean cultivation, the operation must be performed carefully every 2 weeks during the growing season until the roots are entirely exhausted and no new shoots appear. Another method is to dig up the area as deeply as possible with a spading fork and carefully remove all the roots and root-stocks, but care must be taken to dig up all subsequent growth as it appears.

WEED BURNERS.—Weed burners or torches of various types have been widely advertised and sold for the purpose of eradicating perennial weeds. Although the burner has its place on the farm, its use for destroying perennial weeds appears to be quite limited. In tests carried on at the Colorado Experiment Station, burning or “searing” the leaves of field bindweed served to destroy the foliage, but had no more effect on the roots than a shallow cultivation or hoeing. The cost of eradication by this method proved to be higher than chemical eradication with sodium chlorate. Recent work in other states indi-

cates "searing" to be effective in controlling whiteweed and possibly other weeds. There is need for considerably more information on the subject.

INTERTILLED CROPS.—An intertilled or row crop may sometimes be successfully included in the eradication program, provided the weeds being eradicated are kept down with the same thoroughness as with bare fallow. Such a practice necessitates the use of special tools, involves considerable hand labor, and materially increases the difficulties of the work. In most instances it will be advisable to practice clean cultivation without attempting to grow a crop.

SMOTHER CROPS.—Smother crops are so called because of their ability, by their rapid and dense growth, to shade and crowd out other plants. Their successful use in controlling weeds depends upon procuring and maintaining a thick, heavy stand.

Sudan grass and cane or sorghum as grown for hay have been found to be the most effective of the summer-planted smother crops in reducing perennial weeds. The ground should be plowed in the spring or the preceding fall and clean cultivated until about July 1, when a heavy seeding of the smother crop should be made or, if moisture conditions permit, the ground may be plowed just before seeding. In the case of Sudan grass the planting is sometimes made about June 1 with a view to cutting two crops of hay, the grass being cut about the time it begins to head.

Repeating the growing of a smother crop for several successive seasons has resulted in practically complete weed control in many instances. Some reduction in yield may be expected from the continued planting of the same crop. If the ground is given one season's clean cultivation prior to beginning the smother-crop program, better results are insured, and the total yield over the entire control period will usually more than make up for the loss of crop the first season.

In certain sections, delaying the planting of corn, beans, and similar crops a week or so beyond the normal seeding date and plowing the ground well just before planting has made possible the growing of these crops in infested areas with little or no interference from the perennial weeds present. Although this cannot be considered a control measure, it does permit farming despite these weeds and may serve to hold them somewhat in check.

Fall wheat and fall rye have proved to be very effective in some regions in smothering perennial weeds. Harvest is completed as quickly as possible each year and the land is clean cultivated until time for fall planting. Where the growing season is short this method may not be entirely effective, but it will serve to hold the weeds in check. It also offers a much better chance of producing a crop on weed-infested land than does use of spring-planted grain. As in the

case of the summer-planted smother crops, a season of clean cultivation at the beginning of the program is to be recommended, both from the standpoint of control results obtained and total crop production.

Alfalfa has been widely used as a smother crop. While its use has met with varying degrees of success in controlling weeds, it does serve to prevent their rapid spread and will produce a satisfactory yield on badly infested land where other crops usually fail. The failure of alfalfa to give satisfactory control is frequently due to the failure to obtain and hold a thick stand. To get best results the land should be plowed deeply about the first of August and irrigated in order to establish a firm, moist seedbed; then the alfalfa seed should be heavily sown. Because of wilt, alfalfa seldom lives more than three crop seasons, and at the first indication of thinning the field should be broken out and planted to a carefully cultivated row crop.

SMOTHERING WITH NONLIVING MATERIALS.—Small patches of perennial creeping weeds may be killed by covering the areas with materials that will exclude sunlight and prevent development of the tops. The area covered must extend several feet beyond the outermost plants to prevent shoots appearing around the edges. Tar paper, building paper, metal roofing, old boards, straw, manure, and similar materials have been used for this purpose. Two years may be required to kill the plants.

In using heavy paper to smother weeds, care must be taken to see that the edges overlap sufficiently to prevent shoots growing between the edges. Dirt may be used to cover these overlapping edges and should be thrown upon the outer edges to hold the covering in place. Shoots will appear through any holes in the covering. For this reason it must be watched carefully and if necessary should be protected against livestock by fencing. The same general suggestions apply to the use of metal roofing, boards, and other materials of this nature.

The use of straw and manure as smothering material is seldom satisfactory, because of the difficulty encountered in making the covering sufficiently compact to prevent the growth of the underlying plants. Layers 2 to 4 feet thick are recommended and wetting with water and tramping may be necessary. Additional material should be added if needed.

MOWING.—Mowing is applicable only to erect weeds, such as Canada thistle, Russian knapweed, and similar plants. It is chiefly effective in preventing seed formation, although continuous mowing has been reported to have killed out certain perennial weeds. The best results are obtained by frequent and close cutting. The success of alfalfa as a smother crop is in part due to the successive mowings.

PASTURING.—Pasturing weed areas with hogs, sheep, poultry, or other forms of livestock is effective to whatever degree top growth is prevented. Plowing the ground is an advantage where hogs are used. If satisfactory eradication is to be obtained, the animals must be closely confined to the weed area and considerably underfed. This results in poor gains and makes the method more costly than it would at first appear. Pasturing more moderately may be effective in weakening the weeds to a point where they may be more readily eradicated by cultivation.

FLOODING.—Perennial weeds may be drowned by flooding if the plants are kept completely submerged for a period of from 2 to 4 months. If growth appears at the end of that time, the area must again be put under water. The method is practical only where there is an abundant supply of water and the nature of the soil is such as to prevent too rapid seepage.

USE OF CHEMICALS.—The use of chemicals may be advisable for eradication of perennial weeds on small areas, on areas which are inaccessible to cultivating tools, where the cost is not too serious a consideration, and where it is felt that satisfactory results cannot be obtained through cultural methods.

Thus far the chlorates have proved to be the most effective chemicals for killing creeping perennial weeds. However, chemical treatments of any kind will produce varying results, even under apparently similar conditions, and cannot be considered entirely dependable and satisfactory.

Chemical Weed Killers

For many years attempts have been made to use chemicals in the control and eradication of weeds. The use of chemicals has been prompted either by the desire to find a cheaper and less laborious means of controlling weeds, especially the creeping perennials, or by the necessity of discovering some method for the treatment of weeds under conditions which render the use of cultural methods impractical, if not impossible.

Treatment of weeds with chemicals involves use of more or less technical methods and the observance of certain definite details. A certain degree of risk may also be entailed. For these reasons and because methods for the use of chemicals are constantly changing, only a brief discussion of each of the more useful chemicals will be given here. It is assumed that anyone contemplating chemical weed control will obtain full information on the subject from the proper source before undertaking the operation.

Sodium Chlorate

Sodium chlorate is at present the most popular and generally successful herbicide. However, its use in Colorado is accompanied by considerable variation in results obtained. The number of applications and the amount of chemical required to produce satisfactory results vary greatly under different conditions and may make the cost prohibitive. At least 2 years are required to complete eradication with sodium chlorate, and the soil will be rendered more or less unproductive for one or more additional years, depending upon the type of soil, rainfall, amount of irrigation, and other factors. The use of sodium chlorate as a spray is attended by a certain fire hazard which may cause serious and even fatal results unless the proper precautions are taken.

This danger may be almost entirely eliminated by applying the chemical in the dry state, and since the investigations of recent years have shown dry applications to be practically as effective as spray applications there is no necessity, except under special conditions, for incurring the risk and added expense involved in applying the chlorate in solution.

Extensive work carried on at the Colorado Experiment Station indicates that chlorate may be applied any time after July 1 up to November and that an initial application of 3 pounds per square rod gives optimum results under most conditions. However, amounts up to 6 pounds are often recommended and, while the heavier treatment will usually produce but little more kill and may involve some additional cost, this added cost may not be too great, since the excess chlorate tends to remain in the soil and to exert some effect the following year. Regardless of the amount applied it should be put on in a single application. Dividing it into several lighter applications and putting them on at intervals of several weeks is of no pronounced advantage, merely serving to add to the labor involved. However, it is advisable to treat any missed spots at a later date. The same general directions apply to the treatment the second year, the amount of chlorate to be applied depending upon the amount of regrowth. This can best be determined by waiting until fairly late in the season.

The dry chlorate may be broadcast by hand, care being taken to assure an even distribution. Mechanical spreaders are available and are recommended for community efforts since they may be set to give an even distribution of a definite poundage of the chlorate and since they materially lessen the labor involved. Disking or harrowing the chlorate into the soil is advisable where there is danger of washing or blowing.

In the case of steep slopes, such as along railroads, highways, and ditches, and under certain other conditions, applying the chlorate as a spray may be desirable. For this purpose the chemical may be dis-

solved in water at the rate of from 1 to 3 pounds per gallon, the concentration being of little importance so long as the proper amount of chlorate is applied per square rod. *Extreme caution must be exerted to avoid getting the solution on shoes, clothing, wooden floors of buildings, wagons or trucks, or any organic materials since such materials become highly combustible when dried out after being impregnated with the chlorate. Rubber boots should be worn during the spraying operation, and any clothing that may have come in contact with the spray solution should be washed.*

Commercial products which combine sodium chlorate with certain substances which act to reduce the fire hazard are available and are recommended where spray application is desirable. Although reduced, the fire hazard is not entirely eliminated, and the same precautions should be observed in handling these materials as in the case of the straight sodium chlorate. Tests indicate that they are not as effective as the straight chlorate, and heavier applications must be made to produce the same results.

Another commercial product combines limestone with sodium chlorate to facilitate dry application by preventing the chlorate becoming lumpy; it is also less effective than the undiluted chlorate. Another combines an arsenic compound with the chlorate; this combination may be of some value where it is desired to sterilize the soil against both annual and deep-rooted perennial weeds.

The cost of eradicating weeds with chlorate will vary greatly under different conditions in accordance with the amount of material required, but in general it will run from 50 cents to \$1 per square rod.

Common Salt

Common salt has been used for many years in destroying undesirable vegetation. It is usually applied in a dry state in the form of crushed rock or ice-cream salt at the rate of 1 to 2 pounds per square foot, or 20 to 30 tons per acre. With salt at \$10 per ton, the cost per acre for this material will be between \$200 and \$400, which is prohibitive except on small areas. Application of salt to western soils renders them sterile and unproductive. The permanency of the effect of salt favors its use on driveways, tennis courts, and other places where no vegetation is desired.

Arsenicals

Sodium arsenite has had considerable use as a herbicide, the majority of the commercial weed killers being made up in part or wholly of this arsenical compound. Sodium arsenite, as a by-product of the smelting industry, may be purchased in solution form, usually containing the equivalent of about 4 pounds of arsenic trioxide (white arsenic) per gallon. A stock solution containing the equivalent of 8 pounds of arsenic trioxide per gallon or 50 percent by weight may be

made by mixing four parts by weight of arsenic trioxide powder with one part of sodium hydroxide and adding three parts of water. Half the water is added first and the mixture stirred constantly, the remaining water being added slowly as required by the resultant boiling until all the arsenic has gone into solution as sodium arsenite. Sodium arsenite is also available as a white powder which contains the equivalent of 80 percent arsenic trioxide and as a gray powder which contains the equivalent of 75 percent arsenic trioxide. These materials are readily soluble in water and are convenient to handle. Other arsenical compounds which are sometimes used in controlling weeds are arsenic pentoxide and arsenic trichloride.

In general the arsenicals have not proved successful against creeping perennials under Colorado conditions. The acid arsenical method (one-half percent sodium arsenite and 5 percent sulphuric acid by weight) which was developed by the California Experiment Station has at times been effective, especially against Russian knapweed and field bindweed. It has been subjected to exhaustive tests in Colorado because of its low cost, but the results have been too varied to warrant its general recommendation.

Considerable use has been made of sodium arsenite as a soil sterilizer. For this purpose the equivalent of 4 pounds of arsenic trioxide, which amounts to 1 gallon of the commercial solution, one-half gallon of the stock solution, or 5 pounds of the dry material, is applied per square rod. For convenient application the solutions may be diluted to 2 or 3 gallons and the dry material dissolved in a like amount of water. This treatment renders the soil sterile for a number of years and is used on tennis courts, along driveways, ditchbanks, and similar places where it is desired to prohibit all plant growth. Deep-rooted perennial weeds may not be greatly affected, and where they are present the application of chlorate in addition to the arsenical is recommended.

An arsenic solution of the strength of 1 pound of arsenic trioxide equivalent to 4 gallons of water may be used to kill trees. The tree is first "frilled" (overlapping downward cuts with an ax around the circumference), and the poison solution is then poured into the frilling. August is probably the best month for this treatment.

For destroying annuals a spray solution of 1 percent arsenic is generally recommended. This is made by adding 1 gallon of the commercial sodium arsenite solution, one-half gallon of the stock solution, or 5 pounds of the dry material to 50 gallons of water.

Arsenicals are very poisonous and great care must be employed to avoid taking them internally, inhaling the vapor or dust, or getting the poison into cuts or open places in the skin.⁴ Children should

⁴Antidote: Send for a doctor; keep patient quiet; give milk, raw egg, sweet oil, lime water, or flour and water. Induce vomiting.

be kept away from places where arsenicals have been used, and the material should be stored out of their reach. Animals and poultry should be kept away from treated areas because they apparently are attracted by the taste of the sprayed foliage.

Carbon Disulphide

Carbon disulphide is an ill-smelling, highly volatile, inflammable liquid which has been used with considerable success in killing weeds. The soil is treated directly with this material by means of holes 6 to 8 inches or less deep and 18 inches apart. Two ounces of the liquid are introduced into each hole and the top is tamped in with the heel. Mechanical applicators are also used. A tight surface seal, such as may be obtained by rolling the dampened soil, is essential to best results. If conditions are right the carbon disulphide will diffuse through the soil and kill all vegetation in the treated area. However, the results are influenced by the type of soil, the moisture content, and other factors not well understood. For this reason and because the method is costly, amounting to about \$200 per acre, the use of carbon disulphide is practicable only on small patches. New methods are being developed in the use of this material which may eventually increase its effectiveness and at the same time materially reduce the cost of application.

Iron Sulphate

Iron sulphate has been used to control wild mustard and broad-leaved plants in grain fields in eastern and middle western states and in Europe. Various concentrations have been used, but a 20-percent solution is ordinarily recommended, 100 pounds of iron sulphate being dissolved in 50 gallons of water. This is best effected by placing the sulphate in a sack and suspending it in the water.

The solution is applied as a fine mist, with 100 to 150 pounds pressure, at the rate of 50 gallons per acre when the weeds are small, having four to six leaves. The spraying should be done on warm, humid days when there is little chance of rain. The injury to the young grain plants is negligible. Spraying equipment with brass fittings should be used, and the solution should not be kept in tin, galvanized, or iron vessels.

Frequent applications of iron-sulphate solution are also effective in controlling lawn weeds. (See page 39.)

Copper Sulphate

Copper sulphate may be used in the same manner and for the same purposes as iron sulphate. The spray solution is made by dissolving 10 to 12 pounds of copper sulphate in 50 gallons of water. Copper sulphate is not as generally employed in weed control as is iron sulphate, and its use is somewhat more expensive.

Sulphuric Acid

In experiments in Sweden a 4-percent solution of sulphuric acid was found to be more effective than iron sulphate in killing weeds in grain fields. Work done at the Arizona Experiment Station indicates that a 5-percent solution will kill the majority of the weeds encountered on the farm, including dodder. The California Experiment Station found a 10-percent solution to be productive of best results in treating weeds in grain fields. From 100 to 200 gallons of the solution are required to cover an acre of weed growth that is 4 to 6 inches high. Its effectiveness is favored by low humidity and high temperatures.

In concentrated form sulphuric acid does not materially corrode sheet metal or cast iron. The dilute acid is more active and will dissolve the zinc coating on galvanized metal in a short time. Either the dilute or the concentrated acid will attack the clothing and the flesh and must be handled with great care. In preparing the dilute solutions the acid is slowly poured into the water. *Never add water to the concentrated acid.* An explosion may result.

Since sulphuric acid is a by-product of the smelting industry, it is usually obtainable at a very reasonable cost and is an inexpensive weed killer, especially when applied to young plants and in dilute solution.

Petroleum Oils

Kerosene and other petroleum oils have been used in controlling weeds. The oils are chiefly top-killers and may be of value in killing weeds along highways, fence rows, ditchbanks, and other places inaccessible to cultivation. Stovetop oil and Diesel oil are reported as being the most widely used oils in California. Diesel oil may ordinarily be emulsified with an equal amount of water without materially decreasing its effectiveness. Oils capable of penetrating the seed coats are of value in destroying the seeds of many weeds. Because of this characteristic, crude oil and Diesel oil are largely used in California in the control of puncturevine, a weed that is becoming a serious pest in Colorado and other states. Crankcase oil may be used in killing weeds but should be diluted with kerosene or Diesel oil. The practicability of using oils in weed control is largely dependent upon their being available at very low cost.

Ammonium Sulphate

Ammonium sulphate is chiefly used as a fertilizer but also may be used as a herbicide in controlling weeds in lawns.

Miscellaneous Chemicals

Ethylene dioxide, ammonium sulphocyanate, sodium sulphocyanate, carbolic acid, caustic soda, sodium nitrate, and copper nitrate may be mentioned among other chemicals which have given some pro-

mise or have been recommended for use in weed control but which have been found to be either of doubtful practical value or entirely ineffective.

Control of Weeds Under Special Conditions

Weeds on Noncultivated Areas

Weeds found on uncultivated areas such as roadsides, fence rows, ditchbanks, and waste places in general are essentially the same weeds that give trouble on cultivated fields. However, because of the importance of keeping them under control and preventing seed formation, special attention is called to weeds growing under these conditions. Control of weeds growing along ditchbanks is especially important. The types of weeds and the conditions under which they are growing should be studied and the most practical and economical method adopted for bringing about their control.

Weeds in Grain Fields

Weeds, other than creeping perennials, do not constitute a special problem in grain fields if it is possible to follow rotations common to good farming practices. However, where the land is continuously cropped to grain, as in many grain-growing sections, there are certain weeds which may cause considerable difficulty, even when the grain is fallowed on alternate years and especially if it is fall-planted. These weeds are, for the most part, annuals and winter annuals which characteristically mature and scatter their seeds before the grain is harvested. Wild oats, thistles, mustards, and fanweed are good examples. Control under such conditions requires cultural practices which will germinate and destroy as many weed seeds as possible during the cultivating period but which will avoid bringing additional viable seeds to the surface at planting time, since they will serve to infest the growing crop.

In some places in America, and especially in Europe, control of broad-leaved weeds in grain fields has been effected by spraying with solutions of iron sulphate, copper sulphate, and sulphuric acid. In recent investigations in California a proprietary product developed in France, consisting principally of sodium dinitro-ortho-cresylate, a basic dye, has proved quite effective, being applied by means of power sprayers and airplanes. It is apparent that the practicability of chemical methods of control in grain fields will depend upon many factors.

Weeds in Pasture

Broadleaved weeds in pastures where grasses make up the chief forage plants may be treated with dilute solutions of iron sulphate or sulphuric acid as used in the control of weeds of this type in young

grain fields. Weeds of the grass type or with narrow leaves will not be greatly affected. Mowing with such frequency as will prevent seed formation is of value in controlling erect annual and biennial weeds of all types. If the pasture is badly infested, it will probably be advisable to plow the land, encourage the germination of weed seeds by frequent cultivation, and then reseed. Putting the land into cultivated crops for a period will be even more effective, if such is possible. Creeping perennial weeds must be treated the same as when found elsewhere.

Weeds in Orchards

The control of perennial weeds in orchards presents a special problem. Clean cultivation may be recommended as the safest method, although in some instances it may necessitate a considerable departure from the local orchard practices and may be detrimental to older trees. Acid arsenical may be used without injury to the trees if properly applied to the weeds; it has given very good results in the substation orchard. Its use is accompanied by certain disadvantages already pointed out in the discussion under chemical control. Sodium chlorate has been reported to have been used with success in orchards if applied moderately and with caution, but its presence in the soil always endangers the health and even the life of the trees in the treated area. Young trees are especially susceptible, and shallow-rooted trees such as cherry, peach, plum, and apricot are more susceptible than the deeper-rooted apples and pears. In general, the use of sodium chlorate for controlling weeds in orchards is considered too dangerous to be advisable.

These suggestions will also apply to the treatment of perennial weeds in raspberry and currant patches or similar situations and in the vicinity of ornamental trees and shrubs.

Lawn Weeds

The best defense against weeds in lawns is a firm, healthy turf in which weeds will have difficulty in establishing themselves. Such a turf may be established by planting the highest grade seed on rich, well-fertilized soil and may be maintained or developed through proper care which involves thorough but not too frequent watering, seasonal application of fertilizer, and mowing at a height of not less than $1\frac{1}{2}$ to 2 inches.

The application of ammonium sulphate to the lawn in the spring and again in the late summer at the rate of 3 to 4 pounds per 1,000 square feet invigorates the grass and discourages weed growth. Several commercial fertilizers and "weed discouragers" function in this manner.

If a lawn is badly infested with weeds it is better to spade or plow it up and start a new lawn than to attempt to build up the old sod.

The dandelion is undoubtedly the most common and troublesome weed in Colorado lawns. Where the lawn is small and the plants are not too numerous, digging very deeply is a successful but laborious method. Shallow digging does little good as the remaining portion of the root will immediately send up new shoots. The individual plants may be killed by pouring a small amount of gasoline, kerosene, or other toxic substance into the crown. Dipping an ice pick into concentrated sulphuric acid and jabbing into the crown is reported to be very effective, but care must be taken not to get the acid on the flesh or clothing.

Iron sulphate is probably the most widely used herbicide for killing dandelions on large areas. One and one-fourth pounds of the material is dissolved in a gallon of water and applied thoroughly but not excessively as a fine mist. A gallon of the solution should cover approximately 150 square feet. From three to five applications may be necessary at intervals of about 2 weeks. The solution produces an undesirable stain on clothes, sidewalks, buildings, or other materials with which it comes in contact. The previous discussion of iron sulphate as a herbicide gives further suggestions as to its use. (See page 35).

Ammonium sulphate has been more recently recommended for controlling dandelions in lawns, the material being applied in the same manner as iron sulphate. Placing about one-fourth teaspoonful, the amount varying with the size of the plant, of ammonium sulphate on the crown of each plant when the lawn is fairly dry and withholding water for 48 hours has also been recommended. After functioning as a herbicide this chemical is beneficial as a fertilizer.

Water white kerosene has been used successfully in controlling dandelions in Iowa by spraying the lawn in the early fall at the rate of 2 quarts per 100 square feet. To avoid grass injury, application should be uniform and not excessive and should be made several weeks before frost.

Crabgrass is an annual which does not grow in the shade. It reproduces only by seed and its control is a matter of prevention of seed formation. A thick, heavy turf, developed through the proper use of fertilizer and water, and mowing with the cutter bar set $1\frac{1}{2}$ to 2 inches high is the best protection against this pest. Where the plants are not too numerous they may be hand pulled, the best time being in July when they first become noticeable. If the infestation is more severe, the lawn may be sprayed lightly but uniformly when fairly dry with one-fourth to one-half percent sodium arsenite solution (see page 33) during August at the rate of 3 to 4 gallons per 1,000 square feet. Sodium chlorate solution, made by dissolving one-half pound in a gallon of water, may be applied at the same rate. Iron sulphate and ammonium sulphate, as recommended for

dandelions, and the preparation containing sodium dinitro-ortho-cresylate mentioned previously (page 37), have also been reported to be effective sprays. Dry lead arsenate broadcast uniformly in the spring in amounts of from 20 to 25 pounds per 1,000 square feet gave control in the East with but little injury to the bluegrass, but tests indicate that less effectiveness may be expected on the alkaline soils of the West. Searing or scorching the infested lawn with a weed torch will destroy the top growth and is effective against crabgrass. Recent investigations have shown that crabgrass seed does not germinate unless fully mature and that any treatment that will set the plants back materially will tend to prevent the development of viable seeds. However, treatments will be required for several successive seasons, since plants may continue to arise from seed deposited in the soil in the years preceding treatment.

Broadleaved and narrowleaved plantains, the chickweeds, ground-ivy, heal-all, sheep sorrel, wild millet, and many other lawn weeds may be controlled by much the same methods as are recommended for the dandelion or by the one-half percent sodium arsenite solution as described for the control of crabgrass. Sodium nitrate has also been recommended for chickweed, as has been dusting with dry ammonium sulphate or calcium arsenate when the foliage is wet with dew or after sprinkling.

Most of the selective sprays used for controlling lawn weeds will discolor and injure the bluegrass as well as the weeds, but the grass will ordinarily recover. However, to minimize the injury, the lawn should not be too dry and the spray solution should be applied judiciously. Where ammonium sulphate was not used in the treatment, its application at the rate of 3 pounds per 1,000 square feet will assist the bluegrass in recovering. Reseeding later in the fall or the following spring to replace the destroyed weed growth and injured grass may also be advisable. Young lawns and bentgrass lawns are more susceptible to injury than is well-established bluegrass and they may be seriously damaged by chemical treatment.

Water Weeds

A very limited amount of experimental work has been done on the control of water weeds. The most effective way to kill weeds growing in water and rooted to the bottom is to drain off the water. The drying out of the soil will result in the death of many of the plants, and the others may be grubbed out, plowed under, or otherwise destroyed. Running sheep on the drained area is an effective way of cleaning up the weed growth. Draining the water in the fall results in the destruction of many plants by freezing during the winter months. Cattails may be destroyed by keeping them cut off under water and severing the connections which they have with the land shoots by means of a trench along the edge of the water. The

shoots on the land should be kept plowed up. The annual scraping and cleaning of irrigation ditches and canals is of great value in retarding the growth and spread of water weeds.

More often than not the water weeds are growing in running streams or bodies of water where it is impracticable or impossible to draw off the water. Mechanical devices such as steel cables or heavy wires equipped with clips or other devices are often recommended as means of pulling the plants out by the roots or cutting them off. Patented weed saws and weed cutters which may be operated by hand or attached to boats are available. In sections where water weeds present a serious problem, power weed-cutting machines are used.

The use of herbicides in the control of soil-rooted water weeds has not been very successful. Much more information on the subject is needed. California reports that repeated sprayings with oil have given results which warrant further investigation of the method, and arsenicals and other chemicals might prove effective if properly applied.

Floating weeds have been more successfully treated with herbicides than have the water weeds which are attached to the bottom of lakes and streams. Weeds of this type, such as the water-hyacinth and the duckweed, have been effectively controlled by spraying with a one-half of 1 percent solution of sodium arsenite, a gallon of the solution being sufficient for about 100 square feet of floating weeds.

The water weeds which are known as "slimes," "scums," or "water moss" are forms of algae and have been successfully controlled in many instances with copper sulphate. The material is placed in bags and dragged behind boats or suspended in the water on sticks. A concentration of 1 to 2 pounds of copper sulphate per million gallons of water is said to be effective in practically eliminating most forms of algae encountered as water weeds. Concentrations up to 6 pounds of copper sulphate per million gallons of water may be used without injury to fish. The approximate number of gallons to be treated may be calculated by multiplying the product of the average length, breadth, and depth of the body of water in feet by 6.25.

Parasitic Weeds

The only parasitic weeds that give trouble in Colorado are alfalfa dodder and clover dodder. Their eradication is accomplished by prevention of seed formation. In small patches dodder may be destroyed by means of a blow torch or weed burner before the flowers open. Larger infestations may be mowed closely and burned as soon as dry or, even better, covered with straw or sprayed with oil and burned at once. Various chemical sprays such as iron sulphate, 5-percent sulphuric acid, dilute sodium arsenite, and other solutions have been used in the control of dodder, but in most cases they are more costly

and not as practicable as other methods. Control efforts must be continued as long as new plants appear, since dodder seeds will remain alive in the soil for 4 or 5 years. If an area is badly infested, it will be advisable to adopt a crop rotation for this length of time that will involve crops not attacked by dodder. Alfalfa or clover hay infested with dodder should be fed on the field and seed from such fields should never be planted.

Plants Poisonous and Injurious to Livestock

Those weeds which are poisonous or otherwise cause injury to livestock are discussed in a separate bulletin⁵ and need not be considered in detail here. The increasing losses resulting from animals eating plants of this type are largely the result of improper range management and too-heavy grazing. Most of the injurious plants are distasteful to livestock and are eaten in harmful amounts only when other forage is lacking. The prevention of such losses is very largely a matter of better and more intelligent utilization of range resources. A list of the plants of this type which are troublesome in Colorado follows:

More Important Poisonous Plants

PLANT SPECIES	ANIMALS AFFECTED
Aconite (<i>Aconitum columbianum</i> spp.)	Sheep and horses
Arrowgrass (<i>Triglochin</i> spp.)	Sheep and cattle
Cocklebur seedlings (<i>Xanthium</i> spp.)	Hogs chiefly; cattle and sheep at times
Deathcamas (<i>Zygadenus</i> spp.)	Chiefly sheep; cattle and horses at times
Brake fern (<i>Pteridium aquilinum</i>)	Cattle, horses, and sheep, when fed in hay
Greasewood (<i>Sarcobatus vermiculatus</i>)	Cattle, sheep
Waterhemlock (<i>Cicuta occidentalis</i>)	All classes of livestock
Horsetail (<i>Equisetum arvense</i>)	Chiefly young horses
Indian hemp (<i>Apocynum cannabinum</i>)	Generally poisonous in large quantities
Timber milkvetch (<i>Astragalus hylophilus</i>)	Chiefly cattle and sheep
Jimsonweed (<i>Datura stramonium</i>)	Generally poisonous in large quantities
White loco (<i>Aragallus albiflora</i>)	Chiefly horses
Purple loco (<i>Aragallus lambertii</i>)	Chiefly horses
Woolly loco (<i>Astragalus mollissimus</i>)	Chiefly horses
Low larkspurs (<i>Delphinium</i> spp.)	Chiefly cattle, horses at times
Tall larkspurs (<i>Delphinium</i> spp.)	Chiefly cattle, horses at times
Lupines (<i>Lupinus</i> spp.)	Chiefly sheep, other animals at times

⁵Colo. Exp. Sta. Bul. 455, "Colorado's Poisonous and Injurious Plants."

Milkvetch (<i>Astragalus bisulcatus</i>)	Chiefly sheep, cattle at times
Whorled milkweed (<i>Asclepias galioides</i>)	Sheep, cattle, horses
Sneezeweed (<i>Helenium hoopesii</i>)	Chiefly sheep, cattle at times
Suckleya (<i>Suckleya suckleyana</i>)	Cattle

Plants Causing Mechanical Injury

Mechanical injuries caused by plants are usually due to the presence of sharp awns, burs, heavy spines, or similar structures and may be in the form of injury to the eyes, the mouth, the tongue, the feet, or the hide. Lumpy jaw, perforated alimentary tracts or other internal organs, and impacted alimentary tracts are other forms of distress caused by eating these plants. Such injuries result in loss of weight by the animals affected and in some instances prove fatal, either as a direct result of the injury or through starvation. The following plants cause mechanical injury to livestock:

Sandbur	(<i>Cenchrus tribuloides</i>)
Three-awned grass	(<i>Aristida longiseta</i>)
Porcupine grass	(<i>Stipa spartea</i>)
Needlegrass	(<i>Stipa</i> spp.)
Wild oats	(<i>Avena fatua</i>)
Downy brome grass	(<i>Bromus tectorum</i>)
Squirreltail grass	(<i>Hordeum jubatum</i>)
Cocklebur	(<i>Xanthium commune</i>)
Colorado rubber plant	(<i>Hymenoxys</i> spp.)
Russian thistle	(<i>Salsola pestifer</i>)

Identification of Weeds

The farmer should be familiar with and able to recognize all the weed species on his land. *Any new or unfamiliar plant should be investigated immediately and sent in for identification.* If it proves to be a dangerous weed, it may be easily eradicated before it becomes a serious source of trouble. Neglect in this respect may result in a serious noxious weed becoming well established before its dangerous character is recognized. Too much emphasis cannot be placed upon the importance of stamping out serious weeds before they get started.

Sending in Weeds for Identification

Since there are hundreds of individual weed species in the State, and since many of them are quite similar, it is often very difficult to make a positive identification from a fragment of a plant or from an incomplete or partially destroyed specimen. *In sending in a weed specimen for identification, care should be taken to obtain as nearly a complete plant as possible, including the roots, the foliage, and the flowering or seed-bearing parts.*

The plant should be immediately wrapped in moist paper, cloth, or moss, surrounded by dry paper and enclosed in a cardboard box or heavy paper for mailing. If the specimen is mailed with out such precautions, it may be so dry and broken upon its arrival as to make identification impossible. The package should be addressed to the Botany and Plant Pathology Section, Colorado Experiment Station, Fort Collins, Colo.

Descriptions and Illustrations of Weeds

On the following pages are descriptions and illustrations of the weeds which are of the greatest economic importance in Colorado. Those which are generally considered to be "noxious" (see page 18.) in the State are so designated.

Additional Information

Information pertaining to the Colorado Pure Seed Law and also to the Pest Law and the supplemental Weed Law is given in the Appendix beginning on page 114.

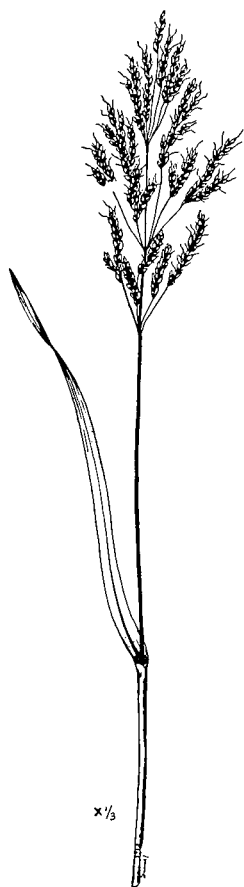
DESCRIPTIONS AND ILLUSTRATIONS

JOHNSON GRASS (*Holcus halapense*)

DESCRIPTION.—Grass family. Introduced from Southern Europe and Asia. Perennial. Propagates by seeds and by heavy creeping rootstocks. Erect, 5 to 6 feet tall. Stems smooth, pithy, stout. Leaves 12 to 18 inches long, narrow, smooth, flat. Flowers and fruit (seeds) in large, loose, purplish panicles. Found in fields and waste places. Limited to southern part of State, winter-killing farther north.

Poisonous to livestock under certain conditions.

CONTROL.—Clean cultivation, chlorates. See control of creeping perennials, also chemical control.



Johnson Grass



Crabgrass

CRABGRASS (*Syntherisma sanguinalis*) (*Digitaria sanguinalis*)

OTHER NAMES.—Purple crabgrass, fingergrass, crowfootgrass.

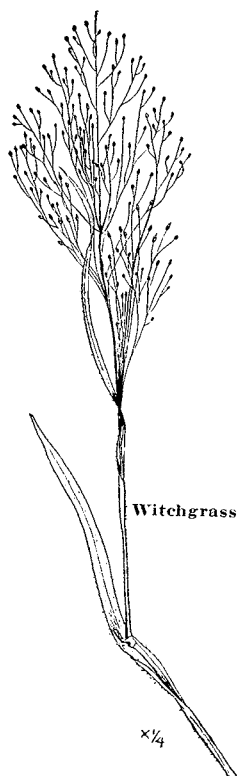
DESCRIPTION.—Grass family. Introduced from Europe. Annual. Propagates by seeds and by rooting at the lower joints. Stem erect or decumbent, spreading, 1 to 3 feet long. Leaves 3 to 6 inches long, narrow. Leaves and leaf sheaths more or less hairy. Flowers and fruit (seeds) on long, narrow spikes, branching out like fingers on hand, generally purplish to reddish-brown. Serious pest in lawns throughout the world, becoming evident in late summer and autumn.

CONTROL.—See control of lawn weeds.

SMALL CRABGRASS (*Syntherisma ischaemum*)

DESCRIPTION.—Similar to crabgrass but smaller and brighter green. Leaf sheaths not hairy. Stem $\frac{1}{2}$ to 2 feet long. Leaves 1 to 3 inches long.

Note:—In describing individual plant species briefly and concisely, certain more or less technical botanical terms cannot entirely be avoided. A list of such terms and their definitions may be found on page 112.



Witchgrass

Panicle large, composed of 5 to 15 sessile, erect or spreading branches. Spikelets one-flowered, green or purple, densely crowded in two to four irregular rows on one side of the rachis, sometimes long awned, bristly hairy.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annuals.

YELLOW FOXTAIL (*Chaetochloa glauca*) (*Setaria glauca*)

OTHER NAMES.—Summergrass, pigeongrass, wild millet.

DESCRIPTION.—Grass family. Introduced from Europe. Annual. Propagates by seeds. Stem branching from the base, usually erect, 1 to 4 feet tall. Leaf sheaths smooth; blades 2 to 6 inches long, $\frac{1}{2}$ inch wide, flat, smooth. Spikes 1 to 4 inches long, blunt. Spikelets crowded, each spikelet subtended by 6 to 10 long yellowish-brown or orange bristles, giving spike fuzzy appearance. Grows in all cultivated soils.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annuals.

WITCHGRASS (*Panicum capillare*)

OTHER NAMES.—Ticklegrass, tumbleweedgrass, panicgrass.

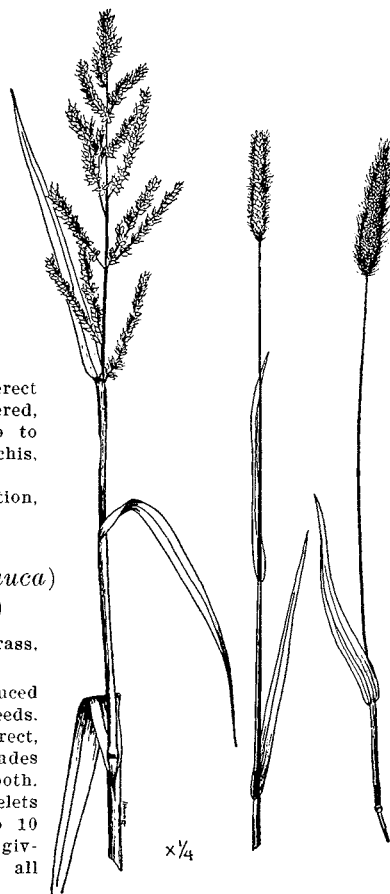
DESCRIPTION.—Grass family. Native. Annual. Propagates by seeds. Stem stout, erect or with decumbent base, 1 to 2 feet tall. Leaf sheaths very hairy, blades less so, 6 to 12 inches long, panicle spreading, 8 to 14 inches long, breaks off at maturity and acts as a tumbleweed. Spikelets one-flowered. Common weed in cultivated land, grain fields, waste places, on dry and sandy soil.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annuals.

BARNYARDGRASS (*Echinochloa crus-galli*)

OTHER NAMES.—Watergrass, barngrass.

DESCRIPTION.—Grass family. Introduced from Europe. Annual. Propagates by seeds. Stem stout, smooth, 2 to 5 feet high, often branching at the base. Leaf sheaths compressed, smooth; blades 6 to 24 inches long, $\frac{1}{4}$ to 1 inch wide, smooth.

Barnyard-
grassYellow
FoxtailGreen
Foxtail

GREEN FOXTAIL (*Chaetochloa viridis*)
(*Setaria viridis*)

OTHER NAMES.—Bottlegrass, summergrass, pigeongrass, wild millet.

DESCRIPTION.—Grass family. Introduced from Europe. Annual. Stem erect, 1 to 3 feet tall, simple or branched. Leaf sheaths smooth; blades 3 to 10 inches long, rough on margins. Spikes 1 to 4 inches long, thick; spikelets crowded, each spikelet subtended by 2 to 6 green or yellowish bristles each nearly $\frac{1}{2}$ inch long, giving spike fuzzy appearance. Grows in cultivated soils throughout the United States.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annuals.



SANDBUR (*Cenchrus tribuloides*)
(*Cenchrus carolinianus*)

OTHER NAMES.—Burggrass, sandspur, cockspurgrass

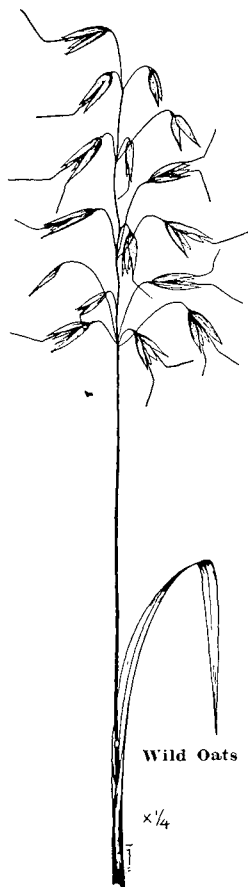
DESCRIPTION.—Grass family. Native. Annual. Propagates by seeds. Stem at first erect, later trailing and much branched, 1 to 2 feet in length. Leaf sheaths somewhat flattened, very loose, smooth, with hairy margins; blades flat, smooth, 2 to 6 inches long, $\frac{1}{4}$ to $\frac{1}{2}$ inch wide, round on margins, dark-green. Spikes 1 to 2 inches long, bearing clusters of 10 to 30 burs; burs about $\frac{1}{4}$ inch in diameter and thickly set with stiff, barbed spines. Grows in sandy fields and waste places, pastures. Wide distribution. Sometimes a noxious weed. Very bad in sheep wool.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annuals.

WILD OATS (*Avena fatua*) (Noxious)

DESCRIPTION.—Grass family. Introduced from Europe or Asia. Annual. Propagates by seeds which may remain viable in the soil for several years, making it difficult to eradicate. Similar to tame oats but usually grows taller and has a more open panicle. 4 to 12 inches long. Seed distinguished from tame oat by twisted awn which bends at right angles and a horseshoe-shaped scar or "sucker-mouth" at the base which is surrounded by a stiff ring of brown hairs. Grows in waste places and cultivated fields. Especially troublesome in grain crops. Found in all grain-growing sections.

CONTROL.—Prevention of seed formation. Pulling and burning. Crop rotation involving row crops and alfalfa. Surface cultivation immediately after removing grain crop. Summer fallow on non-irrigated land. See control of annual weeds.



STINKGRASS (*Eragrostis megastachya*)

OTHER NAMES.—Snakegrass, candygrass.

DESCRIPTION.—Grass family. Introduced from Europe. Annual. Propagates by seeds. Stem erect or decumbent at the base, 1 to 3 feet high, smooth, usually branched. Leaf

sheaths shorter than the internode, smooth; blades 2 to 8 inches long, about $\frac{1}{4}$ inch wide, flat, smooth beneath, rough above. Panicles 2 to 6 inches long, the branches spreading or ascending, 1 to 2 inches long, densely flowered, grayish-green. Spikelets 8- to 35-flowered, florets closely imbricated. Grows in fields and waste places in most parts of the United States.

Offensive to livestock both as green forage and hay.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annuals.



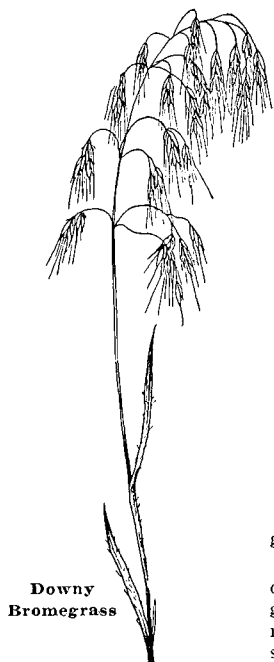
DOWNY BROMEGRASS (*Bromus tectorum*)

OTHER NAMES.—Junegrass, slender chess, early chess.

DESCRIPTION.—Grass family. Introduced from Europe. Annual or winter annual. Stem smooth, slender, erect, 1 to 2 feet tall. Sheaths and blades softly downy, the latter flat, 2 to 6 inches long. Panicle 2 to 6 inches in length; branches slender and drooping to one side. Spikelets numerous, five- to eight-flowered with slender, straight awns $\frac{1}{2}$ to $\frac{3}{4}$ inch long. Mature plants brownish in color. Grows in fields and waste places over wide range.

Often injurious to livestock.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annuals and winter annuals.



**Downy
Bromegrass**

Seed borne in heads or spikes 3 to 7 inches long resembling slender heads of wheat. Grows on all types of soil in waste places, along ditch banks and roadsides, and in cultivated fields. Generally distributed throughout the United States excepting the South.

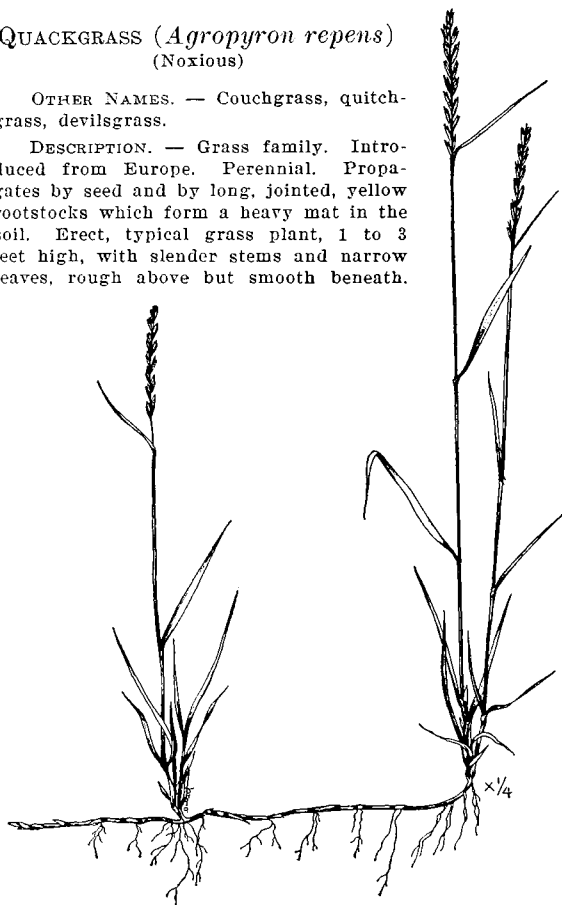
Makes good pasture and may be used for hay, but under most conditions it becomes a very bad weed because of its persistence.

CONTROL. — Clean cultivation, chlorates. See control of creeping perennials, also chemical control.

QUACKGRASS (*Agropyron repens*) (Noxious)

OTHER NAMES. — Couchgrass, quitchgrass, devilsgrass.

DESCRIPTION. — Grass family. Introduced from Europe. Perennial. Propagates by seed and by long, jointed, yellow rootstocks which form a heavy mat in the soil. Erect, typical grass plant, 1 to 3 feet high, with slender stems and narrow leaves, rough above but smooth beneath.



Quackgrass

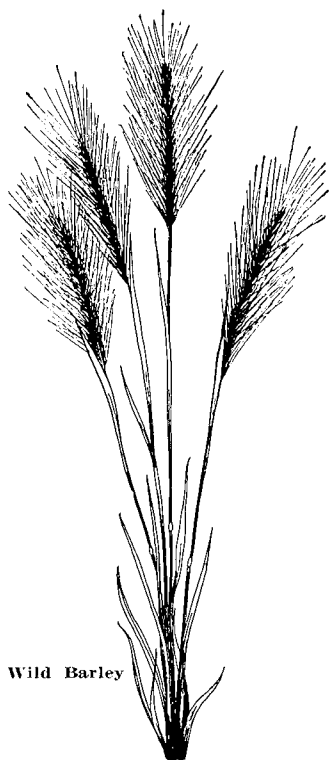
WILD BARLEY (*Hordeum jubatum*)

OTHER NAMES.—Squirreltailgrass, skunktailgrass, ticklegrass.

DESCRIPTION.—Grass family. Native. Winter annual, biennial, or short-lived perennial. Grows in thick tufts from fibrous and clustered roots. Stems 1 to 2 feet tall, smooth, erect or sometimes decumbent at base. Leaf sheaths loose, shorter than the internodes, smooth; blades 2 to 5 inches long, narrow, flat, rough, erect, grayish-green. Spikes 2 to 4 inches long, nodding, with spreading, slender, rough awns 1 to 1½ inches long. Grows on any soil in fields, meadows, pastures, and waste places, wet or dry. Mostly in the West.

The plant is injurious to livestock, the sharp, brittle awns and hard, sharp spikelet parts piercing the gums and the tongue, causing ulcerations and swellings.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annuals and biennials.



Wild Barley

SHEEP SORREL (*Rumex acetosella*)

OTHER NAMES.—Field sorrel, redtop sorrel, horse sorrel, louseweed, sour dock.

DESCRIPTION. — Buckwheat family. Introduced from Europe. Native of Asia. Perennial. Propagates by seeds and by creeping, yellowish roots. Stem erect, smooth, red, slender, 3 to 12 inches high, simple or branched. Leaves narrow, arrowhead shaped, 1 to 4 inches long, smooth, light green, with basal lobes spreading. Flowers in erect, branching racemes, the staminate (male) flowers yellowish-green, the pistillate (female) flowers reddish-green. Seed brown, three-cornered. Grows in old lawns, meadows, pastures, and waste places in most parts of the United States.

Reported to be somewhat poisonous to horses and sheep.

CONTROL.—Not as difficult as most creeping perennials. Cultivation, crop rotation. Chemicals. See control of perennials; also chemical control.

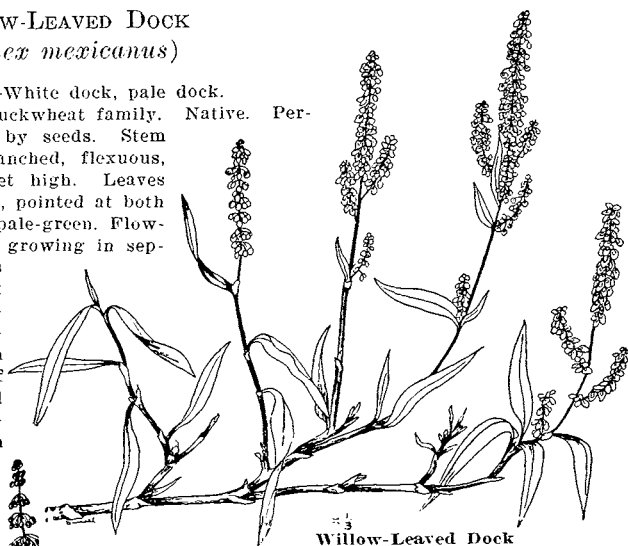


Sheep Sorrel

WILLOW-LEAVED DOCK (*Rumex mexicanus*)

OTHER NAMES.—White dock, pale dock.

DESCRIPTION.—Buckwheat family. Native. Perennial. Propagates by seeds. Stem erect, simple or branched, flexuous, grooved, 1 to 3 feet high. Leaves narrow, lance-shaped, pointed at both ends. Entire plant pale-green. Flowers in erect racemes growing in separated, dense whorls or clusters on short pedicels. Seed dark-red, shiny, three-cornered. Grows in moist, rich soil of fields, meadows, and waste places in northern and western states.



Willow-Leaved Dock

CONTROL.—Deep and frequent hoe-cutting. Application of gasoline, salt, etc., after cutting, to prevent sprouting. Pulling when soil is moist. Cultivation and crop rotation. See control of simple perennials.

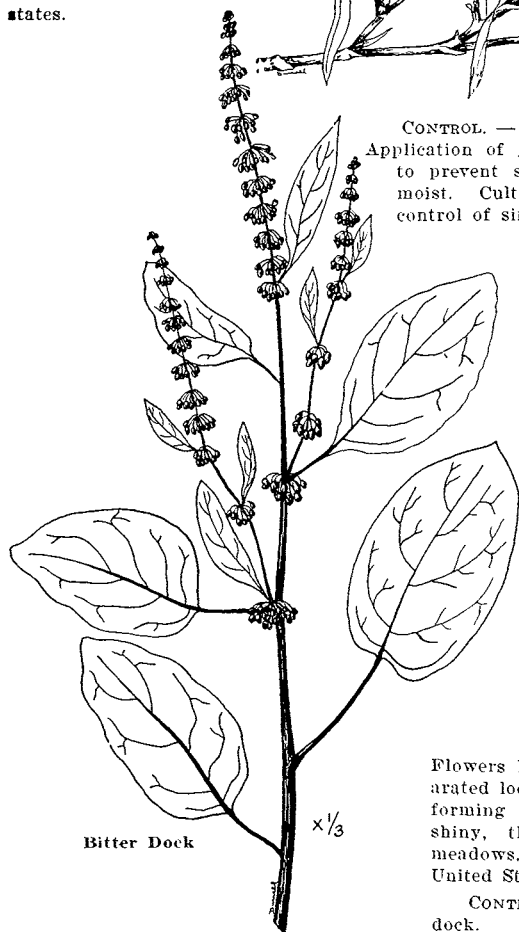
BITTER DOCK (*Rumex obtusifolius*)

OTHER NAMES.—Broad-leaved dock, blunt-leaved dock.

DESCRIPTION.—Buckwheat family. Introduced from Europe. Native also of Asia. Perennial. Propagates by seeds. Plant smooth, dark-green. Stem stout, erect, grooved, simple or sparingly branched. Lower leaves 6 to 14 inches long, half as broad, heart-shaped, with rounded or bluntly pointed tips, the veins somewhat hairy underneath. Upper leaves narrower, more pointed.

Flowers borne on slender pedicels in separated loose whorls or clusters, or racemes forming open panicle. Seed dark-red, shiny, three-cornered. Grows in fields, meadows, and waste places throughout the United States.

CONTROL.—Same as for willow-leaved dock.



Bitter Dock



CURLED DOCK (*Rumex crispus*)
(Noxious)

OTHER NAMES.—Yellow dock, narrow-leaved dock.

DESCRIPTION.—Buckwheat family. Introduced from Europe. Perennial from long taproot. Propagates by seeds and by shoots from the crown. Grows erect with slender, grooved stems, 1 to 4 feet tall, simple or with a few branches at the top. Leaves 6 inches to 1 foot in length, crisp with wavy margin. Small greenish flowers borne in long cylindrical clusters. Fruit winged. Seeds three-cornered. Common in fields and waste places, vigorous on moist soil. Found throughout the United States and Canada.

A bad pest in clover and alfalfa fields grown for seed.

CONTROL.—Prevention of seed formation. Deep and frequent hoe-cutting. Application of salt, gasoline, etc., after cutting, to prevent sprouting. Pulling in moist soil. Cultivation and crop rotation. See control of simple perennials.

VEINED DOCK (*Rumex venosus*)

OTHER NAMES. — Winged dock, wild begonia, wild hydrangea.

DESCRIPTION.—Buckwheat family. Introduced from Europe. Perennial from creeping rootstocks. Stem rather stout, erect, 6 to 15 inches high. Leaves oval to oblong, 1 to 5 inches long, rather leathery. Flower inconspicuous. In fruit the plant is characterized by numerous showy red calyxes with conspicuous wings, $\frac{1}{2}$ to $1\frac{1}{2}$ inches broad, veiny, with deep cleft at base, which gives a striking appearance to the large, erect flower clusters. Fruit an achene, $\frac{1}{4}$ inch long, smooth, shiny with concave faces. Grows along railroad embankments, roadsides, and waste places.



Veined Dock

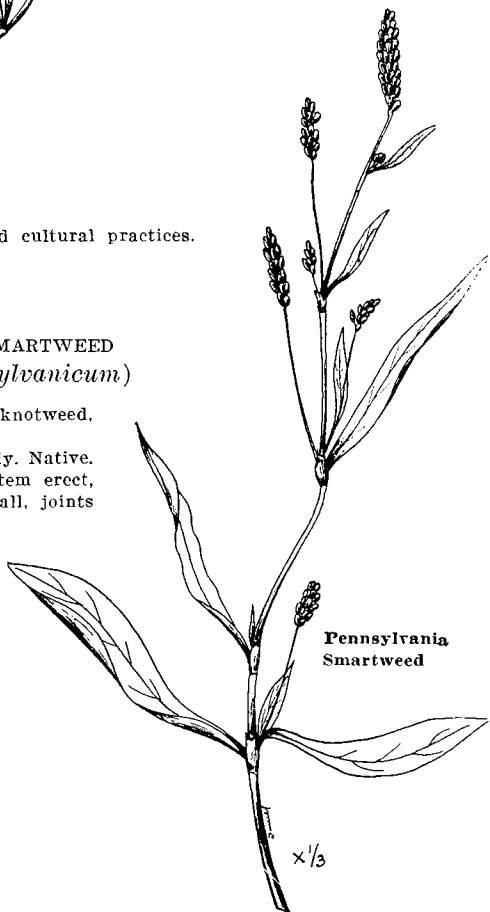
CONTROL.—Cultivation and good cultural practices.

PENNSYLVANIA SMARTWEED (*Polygonum pennsylvanicum*)

OTHER NAMES.—Pennsylvania knotweed, purpleweed.

DESCRIPTION.—Buckwheat family. Native. Annual. Propagates by seeds. Stem erect, simple or branched, 1 to 3 feet tall, joints surrounded by papery sheaths. Leaves lance-shaped, 2 to 11 inches long, with pointed tips and short stems (petioles). Flowers bright rose color in erect, short, crowded, cylindric or oblong, usually blunt spikes, 1 to 2 inches long. Seeds small, black, smooth, shiny. Grows in moist soil in fields, pastures, meadows, and waste places in many sections of the United States.

CONTROL.—Thorough cultivation, hand-hoeing, draining wet lands. See control of annuals.



Pennsylvania
Smartweed



Prostrate Knotweed

PROSTRATE KNOTWEED
(*Polygonum aviculare*)

OTHER NAMES.—Knotweed, doorweed, matgrass.

DESCRIPTION.—Buckwheat family. Native. Annual. Propagates by seeds. Stem pale-green, slender, usually prostrate, sometimes ascending, 4 inches to 2 feet long, growing in all directions from the root, much branched, the joints or "knots" pale under papery sheathing stipules. Leaves bluish-green, small, oval or oblong, usually somewhat pointed, $\frac{1}{4}$ to 1 inch long. Flowers very small, solitary or in clusters, in the leaf axils; sepals white with pink or purplish borders. Seed dull-brown, three-cornered. Grows in cultivated fields, yards, and waste places throughout the United States and elsewhere.

CONTROL.—Hoe-cutting or hand-pulling. Cultivation. See control of annual weeds.

BLACK BINDWEED
(*Polygonum convolvulus*)
(*Bilderdykia convolvulus*)

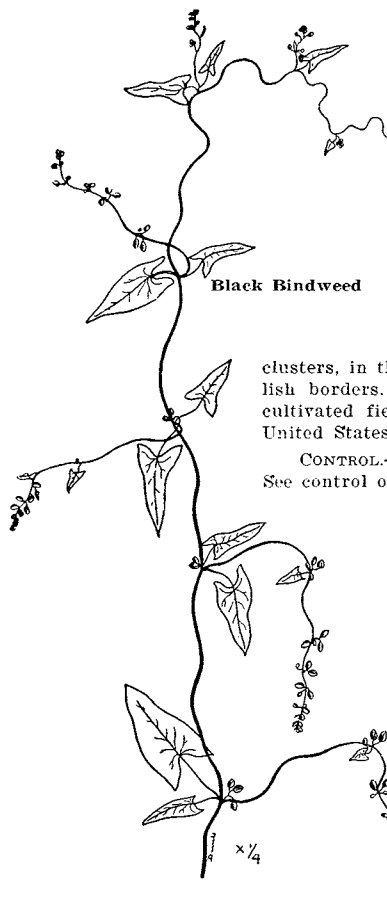
OTHER NAMES.—Wild buckwheat, knot bindweed, cornbind.

DESCRIPTION.—Buckwheat family. Introduced from Europe. Native of Asia. Annual. Propagates by seeds. Stem slightly angular, smooth or somewhat scaly, slender, branching, trailing or twining, 1 to 3 feet long. Leaves $\frac{1}{2}$ to 3 inches long, arrow-shaped, pointed, smooth, dark-green, with somewhat hairy margin, slender stems (petioles). Flowers small, greenish-white, in axillary clusters or

slender, loosely flowered racemes. Seed black, pointed, three-cornered. Grows in fields and waste places throughout the United States.

The plant resembles field bindweed or wild morning glory in the shape of its leaves and its twining habits. Can always be distinguished by its flower and single taproot.

CONTROL.—Seed prevention. Hand-pulling or hoeing. Cultivation. See control of annuals.

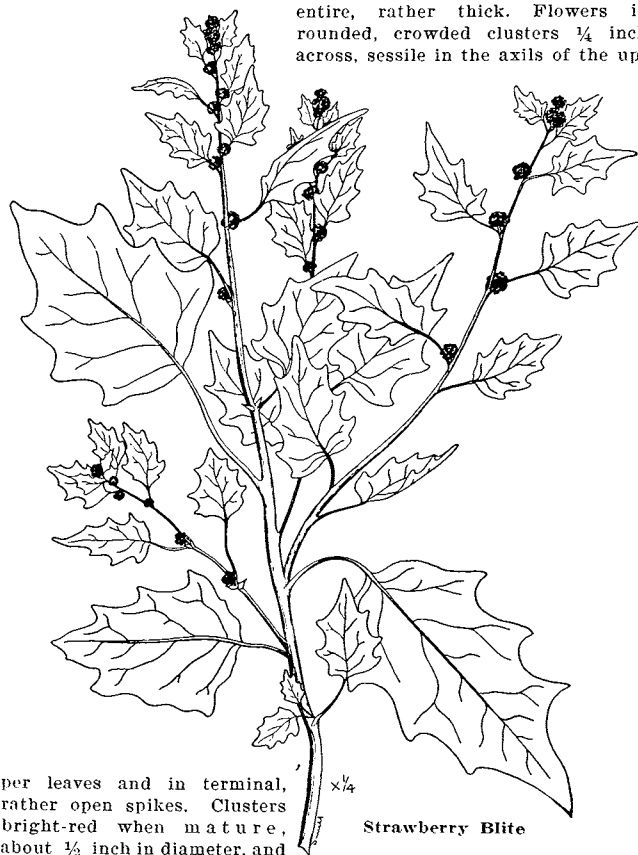


Black Bindweed

STRAWBERRY BLITE (*Blitum capitatum*)

OTHER NAMES.—Strawberry pigweed, blite mulberry.

DESCRIPTION.—Goosefoot family. Native. Annual. Propagates by seeds. Stem slender, pale-green, erect, ascending or prostrate, 6 to 24 inches long, with numerous ascending branches. Leaves triangular or somewhat arrow-shaped, 1 to 3 inches long, pale-green, lower ones irregularly and coarsely toothed, upper ones entire, rather thick. Flowers in rounded, crowded clusters $\frac{1}{4}$ inch across, sessile in the axils of the up-



per leaves and in terminal, rather open spikes. Clusters bright-red when mature, about $\frac{1}{2}$ inch in diameter, and resembling raspberries or strawberries. Seed lens-shaped, flattened, smooth, dull black. Grows in dry soil, fields, and waste places in several western and northeastern states.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annual weeds.

FIREWEED (*Kochia scoparia*)

OTHER NAMES.—Kochia, fireball, Mexican fireweed, firebush.

DESCRIPTION.—Goosefoot family. Introduced from Europe. Native also of Asia. Annual. Propagates by seeds. Stems erect, round, slender, pale-green, much branching, 1 to 3 feet high. Leaves lance-shaped or linear with marginal hairs, upper ones extremely narrow. Flowers sessile in the axils of the upper leaves, forming short, dense, bracted spikes. Seeds small, wedge-shaped, dull-brown, slightly ribbed.

In autumn the plants usually become red in color, later turning brown. Grow in cultivated fields and waste places. Widely distributed. Most common in the Middle West.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annual weeds.



BASSIA (*Bassia hyssopifolia*)

DESCRIPTION.—Goosefoot family. A comparatively recent introduction from Caspian Sea region in Europe. Annual. Propagates by seeds. Resembles fireweed or kochia. Flowers and fruit are sessile in the axils of the upper bract-like leaves in a narrow panicle made up of elongated, slender, woolly spikes. Seeds are small, flattened, brownish, and are encased in a thin covering (utricule) or all remaining in the woolly calyx which is characterized by a curved hook on each segment. Grows well in alkaline soil of cultivated fields and waste places in the West. Becoming quite widely distributed in Colorado.

CONTROL.—Same as fireweed.



Bassia

SALTBUSH (*Atriplex argentea*)

OTHER NAMES.—Saltweed, silvery orache.

DESCRIPTION.—Goosefoot family. Native. Annual. Propagates by seeds. Stem erect, bushy-branched, 6 to 20 inches high. Leaves triangular, mostly pointed at apex, $\frac{1}{2}$ to 1 inch long. Female flowers in axillary clusters, male flowers in dense spikes. Fruiting bractlets with sharply toothed margins. Grows in alkaline flats and waste places.

CONTROL.—Seed prevention. Good cultural practices. See control of annuals.



Saltbush

(tip)

(base)

LAMBSQUARTERS (*Chenopodium album*)

OTHER NAMES.—White goosefoot, fat hen, smooth pigweed.

DESCRIPTION.—Goosefoot family. Introduced from Europe. Native of Asia. Annual. Propagates by seeds. Stem erect, stout, smooth, grooved, often striped with pink or purple, much-branched. Lower leaves ovate or goosefoot-shaped, upper ones becoming narrower, all white-mealy underneath, or sometimes green on both sides. Flowers small, greenish, crowded on spiked panicles in the axils and at the tips of stems and branches. Seed lens-shaped, small and black, may be dormant in soil for years. Grows in cultivated fields, gardens, waste places throughout the world.

A succulent, fast-growing plant which rapidly removes moisture from the soil.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annual weeds.



Lambs-
quarters

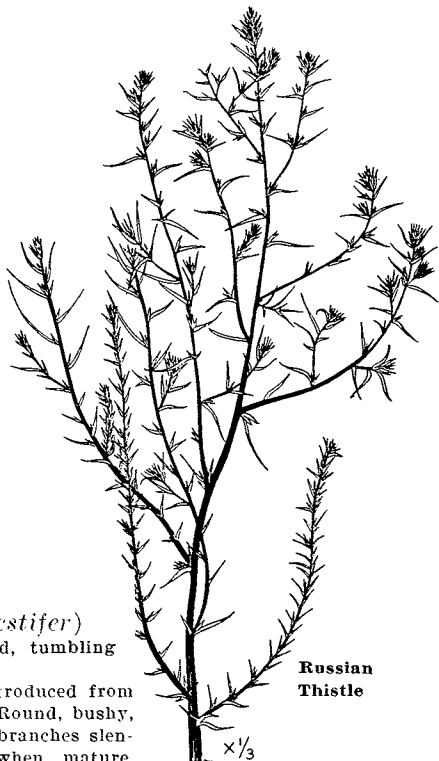
RUSSIAN THISTLE (*Salsola pestifer*)

OTHER NAMES.—Russian tumbleweed, tumbling thistle, saltwort.

DESCRIPTION.—Goosefoot family. Introduced from Russia. Annual. Propagates by seeds. Round, bushy, much-branched plant, 2 to 3 feet high; branches slender, succulent when young, woody when mature. First leaves dark-green, needle-shaped, 1 to 2 inches long, drop off; later leaves awl-like, spiny-tipped, not over $\frac{1}{2}$ inch long, with two sharp-pointed bracts at the base. Flowers very small, inconspicuous, greenish-white or pink, usually solitary in the leaf axils. Seeds small, top-shaped, reddish in color. Grows in dry soil in cultivated fields and waste places, chiefly in grain-growing sections. The green succulent plants are often utilized for hay or forage.

At maturity breaks off at base and because of its round shape becomes an excellent tumbleweed, scattering seeds for long distances before the wind. A taller, more erect form, apparently *Salsola tragus*, is coming to be somewhat prevalent east of the mountains.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annual weeds.



Russian
Thistle

REDROOT PIGWEED (*Amaranthus retroflexus*)

OTHER NAMES.—Rough pigweed, green amaranth, redroot.

DESCRIPTION.—Amaranth family. Introduced from Europe or tropical America. Annual. Propagates by seeds. Stem light-green, erect, stout, tough, rough-hairy, much branched, 1 to 6 feet tall, with long, fleshy, red taproot. Lower leaves ovate, 3 to 6 inches long, pointed at the tip, dull-green, rough-hairy, with prominent ribs and veins. Upper leaves smaller, narrower, more lance-shaped. Flowers small, greenish, densely crowded in large, bristly, irregular, simple or branched, terminal or axillary clusters. Seeds numerous, small, oval, shiny, jet-black, remain viable for many years. Grows in fields and waste places throughout the United States.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annuals.



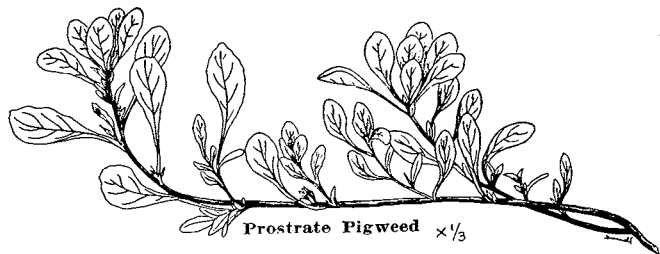
Redroot
Pigweed

PROSTRATE PIGWEED (*Amaranthus blitoides*)

OTHER NAMES.—Matted pigweed, low pigweed, spreading amaranth.

DESCRIPTION.—Amaranth family. Native to Western States. Annual. Propagates by seeds. Smooth, pale-green. Stem much branched, prostrate, spreading on the ground, mat-forming, 6 to 24 inches long. Leaves small, spatulate, round or acute, bristle-tipped, narrowing into slender stems (petioles). Flowers small, greenish, with short bracts, in small clusters in the leaf axils. Seeds numerous, oval, shiny, jet-black, much larger than those of redroot pigweed. Grows in waste places and fields over much of the United States.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annuals.



Prostrate Pigweed $\times \frac{1}{3}$

PURSLANE (*Portulaca oleracea*)

OTHER NAMES.—Wild portulaca, pussley, pursley, duckweed.

DESCRIPTION.—Purslane family. Introduced from Europe. Annual. Propagates by seeds. Stem 4 to 12 inches in length, fleshy, round, smooth, freely branching from a deep central root. Leaves alternate, obovate, or wedge-shaped with rounded tips, small, smooth, fleshy, $\frac{1}{4}$ to $\frac{3}{4}$ inch long, mostly clustered at the ends of the branches. Entire plant often has reddish tinge. Flowers yellow, about $\frac{1}{4}$ inch broad, solitary at the ends of the branches, open only in brightest sunshine. Many very small black seeds produced. Grows in fields and waste places throughout most of the United States.

CONTROL.—Seed prevention. Hand-hoeing or pulling. Cultivation and crop rotation. See control of annuals. (Illustration next page.)

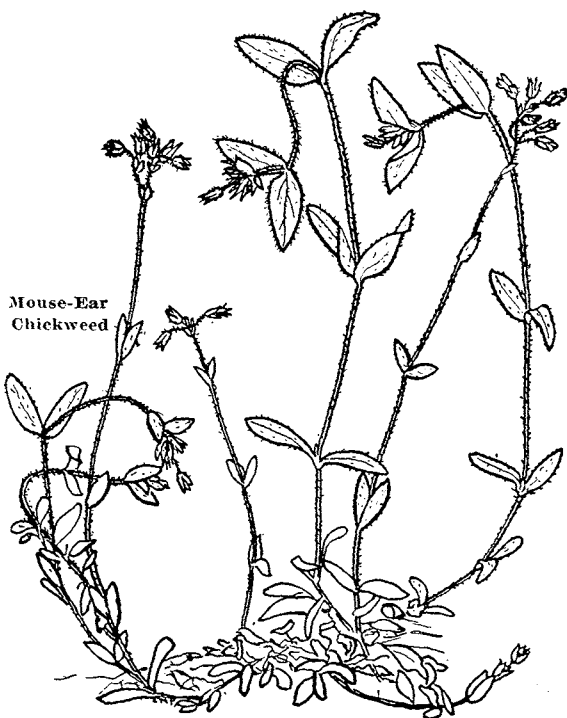


MOUSE-EAR CHICKWEED (*Cerastium vulgatum*)

OTHER NAMES.—Larger mouse-ear chickweed.

DESCRIPTION.—Chickweed family. Introduced from Europe. Perennial. Propagates by seeds. Stem tufted, some prostrate, others ascending, bright-green, sticky-hairy, 6 to 18 inches long. Leaves opposite, sessile, small, oblong, entire, pointed, $\frac{1}{2}$ to 1 inch long. Flowers small, white, in loose terminal clusters. Very numerous, small, rough (tuberculate), brown seeds. Grows in fields, lawns, gardens, and waste places throughout the United States. Especially troublesome in lawns that are excessively shaded or watered.

CONTROL.—Seed prevention. Cultivation. See control of simple perennials, also control of lawn weeds.



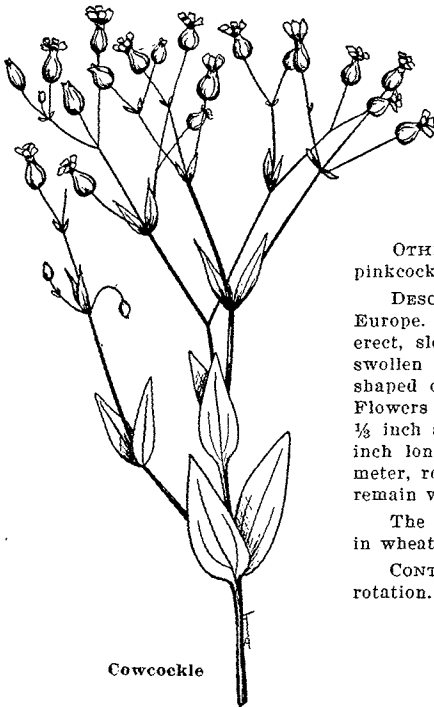
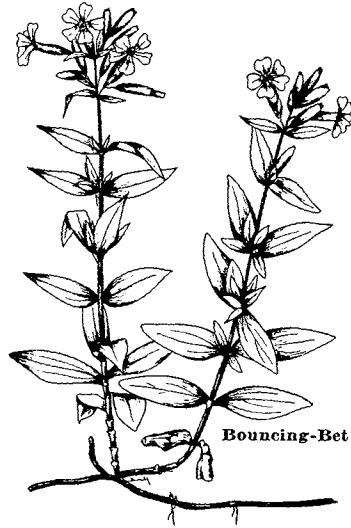
BOUNCING-BET
(*Saponaria officinalis*)

OTHER NAMES.—Soapwort, scourwort, hedge pink, sweet-betty, wild sweet-william.

DESCRIPTION.—Pink family. Introduced from Europe. Perennial. Propagates by seeds and by creeping horizontal roots. Erect, smooth, stout, sparingly branched stems with swollen nodes. Leaves opposite, ovate or oval, pointed, three-nerved, rather thick, 2 to 3 inches long. Showy pink or white flowers, about 1 inch across, in dense terminal clusters. Fruit an oblong, toothed capsule. Seed dull-blackish, rough, kidney-shaped. Grows in yards, pastures, along ditch banks and roadways and in waste places. Not widespread in Colorado.

Escaped from cultivation. Ornamental. Roots formerly used as a substitute for soap.

CONTROL.—Prevention of seeding. Grubbing small areas. Clean cultivation. See control of creeping perennials.



COWCOCKLE
(*Vaccaria vaccaria*)
(*Saponaria vaccaria*)

OTHER NAMES.—Wheatcockle, springcockle, pinkcockle, cow-herb.

DESCRIPTION.—Pink family. Introduced from Europe. Annual. Propagates by seeds. Stem erect, slender, round, 1 to 3 feet high, smooth, swollen at the joints, branched. Leaves lance-shaped or long ovate, pointed, smooth, opposite. Flowers in loose open clusters, deep-pink, $\frac{1}{4}$ to $\frac{1}{2}$ inch across, with five petals. Calyx about $\frac{1}{2}$ inch long, five-ribbed. Seeds $\frac{1}{10}$ inch in diameter, round, black. When in the soil they may remain viable for several years.

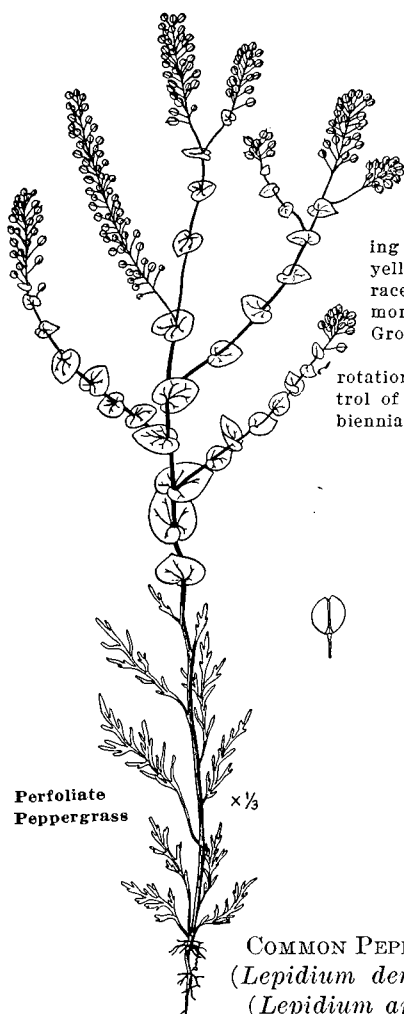
The seeds of this plant are very undesirable in wheat that is to be used for flour.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annuals.

PERFOLIATE PEPPERGRASS (*Lepidium perfoliatum*)

DESCRIPTION.—Mustard family. Introduced from Europe. Annual or biennial. Propagates by seeds. Stem slender, erect, 6 to 18 inches high, branched at the top, more or less hairy. Lower leaves bipinnatifid into linear divisions. Upper leaves heart-shaped, smooth, $\frac{1}{2}$ to $\frac{3}{4}$ inch across, deeply cleft, the rounded basal lobes clasping the stem, overlapping behind it. Flowers yellow with slender pedicels, on elongating racemes 2 to 4 inches long when mature. Pods more or less round, flattened, notched at top. Grows in waste places in a few western states.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annuals and biennials.



Perfoliate
Peppergrass

COMMON PEPPERGRASS
(*Lepidium densiflorum*)
(*Lepidium apetalum*)

Common
Peppergrass

OTHER NAMES.—Apetalous peppergrass, green-flowered peppergrass, wild tonguegrass.

DESCRIPTION. — Mustard family. Introduced from Europe. Native also of Asia. Annual or biennial. Propagates by seeds. Stem erect, 6 to 18 inches tall, with short hairs, branching above. Basal leaves pinnately lobed or pinnatifid, minutely hairy; stem leaves mostly sharply toothed. Flowers in elongating racemes, petals rudimentary or lacking. Pods flattened, about $\frac{1}{8}$ inch across, notched at top. Grows in plains, prairies, and waste places. When mature, may become a tumbleweed. Found chiefly in western states.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annuals and biennials.



WHITEWEED (*Lepidium draba*)
(Noxious)

OTHER NAMES.—Perennial peppergrass, hoary cress.

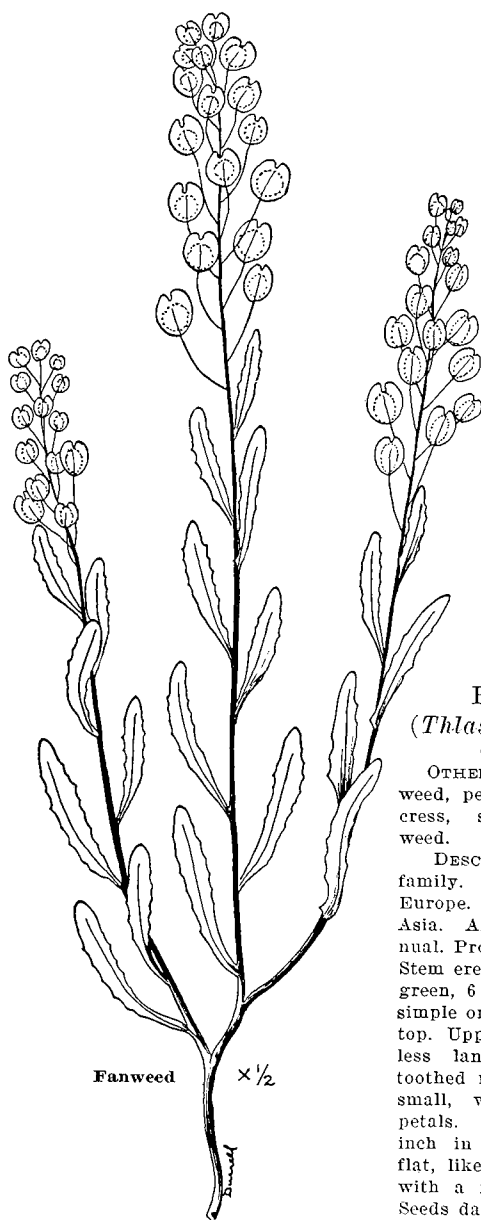
DESCRIPTION.—Mustard family. Introduced from Europe, largely in alfalfa seed. Also native of Asia. Perennial. Propagates by seeds and by creeping roots. Erect, 10 to 18 inches high, hoary (grayish-white). Leaves clasping the stem, oval or oblong with toothed or almost smooth margins, $\frac{1}{2}$ to 2 inches long with blunt ends. Flowers numerous, white, about $\frac{1}{8}$ inch broad. Seed pods heart-shaped. Seeds small, about the size of alfalfa seed, reddish-brown. Grows in waste places and cultivated fields. Makes vigorous growth on irrigated, alkaline soils of the West. Is found in several sections of the United States but is especially bad in the Rocky Mountain region and on the West Coast. A serious problem in the San Luis Valley and in certain sections of the Western Slope in Colorado.

A very persistent weed especially resistant to chemical eradication.

Lepidium repens and *Hymenophyssa pubescens*.—Very similar to above and grow under same conditions. Go by same common names. The first-named may be distinguished by its lens-shaped pods and the second-named by its round pods, somewhat shorter and more refined growth, smaller pods, and narrower leaves.

Lepidium latifolium.—(Tall perennial peppergrass). Grows taller than above described plants. Has similar root system but as yet has not become widely spread.

CONTROL.—Clean cultivation. See control of creeping perennials.



FANWEED
(*Thlaspi arvense*)
(Noxious)

OTHER NAMES.—French weed, pennycress, bastard cress, stinkweed, devil-weed.

DESCRIPTION.—Mustard family. Introduced from Europe. Native also of Asia. Annual, winter annual. Propagates by seeds. Stem erect, smooth, bright-green, 6 to 24 inches tall, simple or branching at the top. Upper leaves more or less lance-shaped with toothed margins. Flowers small, white, with four petals. Pods about $\frac{1}{2}$ inch in diameter, round, flat, like a palm-leaf fan, with a notch in the tip. Seeds dark reddish-brown,

small, flattened egg-shaped, with fine ridges. Grows in grain fields, along roadsides, and in waste places. Especially prevalent in northwestern states.

Gives a bad flavor to milk when eaten by cows, and the presence of the seeds in wheat spoils flour. Difficult to control because of the enormous number of seeds produced and their prolonged viability in the soil.

CONTROL.—Prevention of seeding. Frequent cultivation and crop rotation. Summer fallow on non-irrigated land. See control of annuals and winter annuals.

SHEPHERDS-PURSE (*Bursa bursa-pastoris*)
(*Capsella bursa-pastoris*)

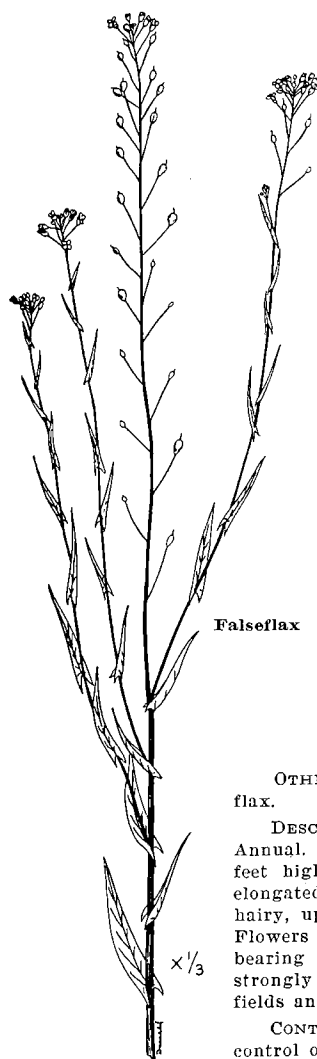
OTHER NAMES.—Shepherds-bag, caseweed.

DESCRIPTION.—Mustard family. Introduced from Europe. Annual or winter annual. Propagates by seeds. Erect, branching, 6 to 20 inches tall, hairy below, smooth above. Stem slender. Basal leaves usually more or less lobed or pinnatifid, forming a rosette; upper leaves few, lance-shaped, clasping, with small, pointed lobes at base, dentate or entire. Flowers white, very small, at the ends of elongated racemes; pods flattened, triangular, more or less heart-shaped, about $\frac{1}{2}$ inch long, on slender pedicels. Seeds very small, golden-brown. Grows in fields and waste places throughout the world. Very common.

CONTROL. — Seed prevention. Cultivation and crop rotation. See control of annuals and winter annuals.



Shepherds-
Purse



Falseflax

FALSEFLAX (*Camelina microcarpa*)

OTHER NAMES.—Small-fruited falseflax, little-seed falseflax.

DESCRIPTION.—Mustard family. Introduced from Europe. Annual. Propagates by seeds. Slender, erect plants, 1 to 3 feet high, stem hairy, at least below, simple or with few elongated branches. Lower leaves lance-shaped, more or less hairy, upper leaves with pointed lobes at the base, clasping. Flowers very small, yellow. Racemes a foot or more long, bearing small, pear-shaped pods, about $\frac{1}{4}$ inch long and strongly margined. Seeds small, brownish-yellow. Grows in fields and waste places.

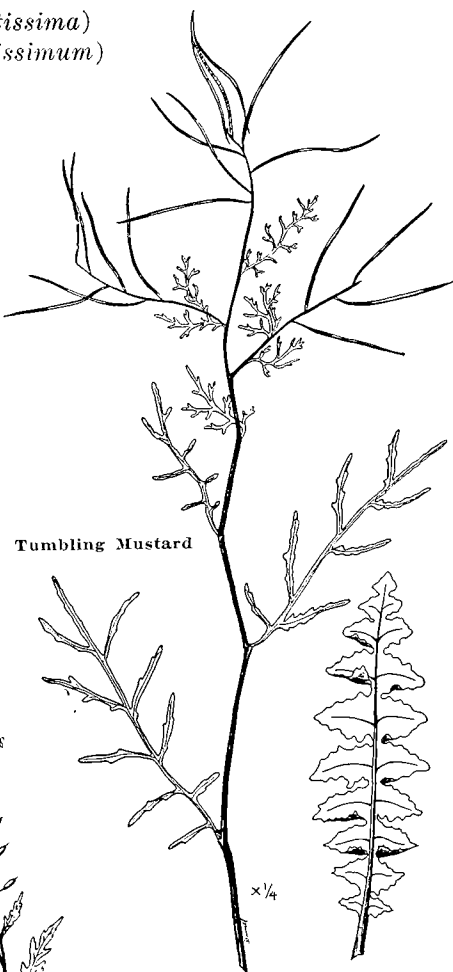
CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annual weeds.

TUMBLING MUSTARD (*Norta altissima*)
(*Sisymbrium altissimum*)

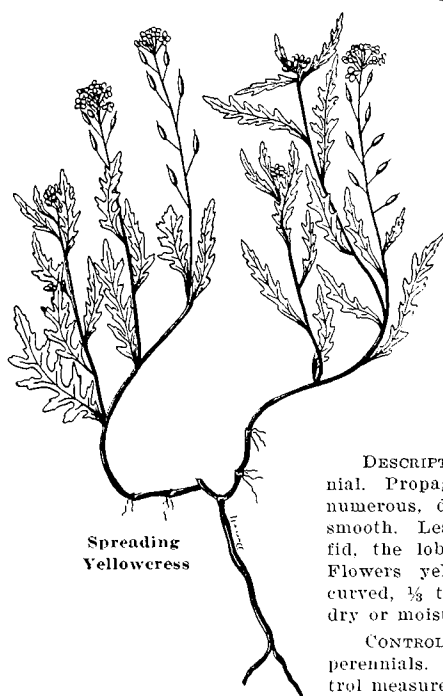
OTHER NAMES.—Jim Hill mustard, tall mustard, hedge mustard, tall *sisymbrium*.

DESCRIPTION.—Mustard family. Introduced from Europe. Annual and winter annual. Propagates by seeds. Erect, smooth, freely branching plant, 2 to 4 feet tall. Makes bushy growth and may break off at ground to become a tumble-weed. Lower leaves long and deeply lobed. Flowers pale-yellow, about $\frac{1}{4}$ inch across. Numerous slender pods 2 to 4 inches long. Produces an enormous number of seeds. Seeds small, brown, oblong, usually with single groove. Grows in grain fields and waste places. Widely distributed, especially in the Northwest.

CONTROL. — Prevention of seeding. Cultivation, crop rotation. Summer fallow on non-irrigated land. See control of annuals and winter annuals.



Tumbling Mustard



Spreading
Yellowcress

SPREADING YELLOWCRESS
(*Radicula sinuata*)
(*Roripa sinuata*)

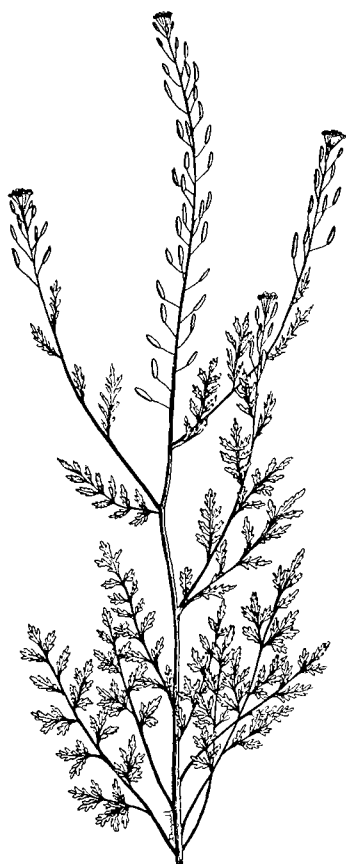
DESCRIPTION.—Mustard family. Native. Perennial. Propagates by seeds and creeping roots. Stems numerous, diffuse, branched, 8 to 12 inches long, smooth. Leaves 2 to 3 inches long, oblong, pinnatifid, the lobes obtuse or acute, entire or toothed. Flowers yellow, small. Pods slender, sometimes curved, $\frac{1}{3}$ to $\frac{1}{2}$ inch long, on slender pedicels. In dry or moist soil in fields and waste places.

CONTROL.—Not as difficult as with most creeping perennials. Cultivation, crop rotation. General control measures.

TANSY MUSTARD (*Sophia pinnata*)
(*Sisymbrium canascens*)

DESCRIPTION.—Mustard family. Native. Annual. Propagates by seeds. Covered with fine hairs. Stem erect, branched, 8 to 24 inches high. Leaves 2 to 4 inches long, twice divided into numerous small toothed or entire segments. Flowers small, pale-yellow. Pods oblong, compressed, $\frac{1}{4}$ inch long. Seeds small, in two rows in pod. Widely distributed.

CONTROL.—Same as for tumbling mustard.



Tansy Mustard

HARES-EAR-MUSTARD (*Conringia orientalis*)

OTHER NAMES.—Rabbit-ears, hares-ear-cabbage, klinkweed.

DESCRIPTION.—Mustard family. Introduced from Europe. Annual and winter annual. Propagates by seeds which are produced in great numbers. Stem usually erect, simple or somewhat branching, 1 to 3 feet high, covered with a whitish bloom as on cabbage. Leaves alternate, light-green, 2 to 5 inches long, blunt at apex. Small, pale-yellow flowers. Numerous slender, four-angled pods, 3 to 5 inches long. Seeds reddish-brown, oval, $\frac{1}{10}$ inch long, marked with shallow, minute pits. Grows in grain fields and waste places. Widely distributed, especially in the Northwest.

Control. —Same as for tumbling mustard. See control of annuals and winter annuals.



Hares-Ear-Mustard

BLUE MUSTARD (*Chorispora tenella*)

DESCRIPTION.—Mustard family. Introduced. Annual. Propagates by seeds. Erect-growing, stems branching from crown, 1 to 2 feet high. Leaves alternate, narrow, 1 to 2 inches long with toothed margins. Flowers small, purplish-blue. Pods slender, pointed, upcurved, 1 to 1½ inches long. Seeds small, tannish-brown. Grows in cultivated fields and waste places.

CONTROL. — Prevention of seeding. Good cultural practices. See control of annuals.

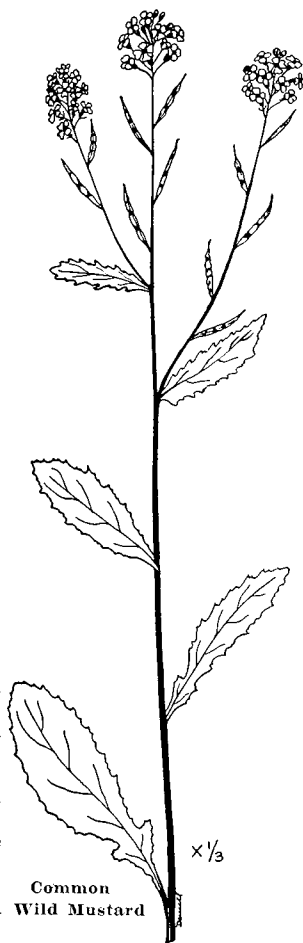


COMMON WILD MUSTARD (*Sinapis arvensis*) (*Brassica arvensis*) (Noxious)

OTHER NAMES.—Corn mustard, charlock, field kale.

DESCRIPTION.—Mustard family. Introduced from Europe. Annual. Propagates by seeds. Stem erect, 1 to 3 feet high, smooth or with scattered stiff hairs, branching above. Leaves irregularly toothed or lobed to varying degree. Flowers bright-yellow, about ⅜ inch across. Pods 1 to 2 inches long, tipped with beak-like structure. Seeds small, slate-black to black, smooth, spherical. Seeds retain their viability in the soil for several years. Grows in grain fields and waste places. Distributed throughout United States.

CONTROL.—Much the same as for tumbling mustard. See control of annuals.



INDIAN MUSTARD (*Brassica juncea*)

(Noxious)

DESCRIPTION.—Mustard family. Introduced from Asia. Annual or biennial. Propagates by seeds. Erect, 1 to 4 feet high, smooth or slightly hairy with few branches. Leaves pale-green, the lower ones large and irregular, the upper ones smaller and lance-shaped. A light, cabbage-like bloom may cover the plant. Flowers bright-yellow, $\frac{1}{2}$ to $\frac{3}{4}$ inch across. Pods erect, 1 to 2 inches long, with a slim, empty beak. Seeds small, round, reddish to brown, surface netted. Grows in grain fields and waste places. Rather widely distributed. More prevalent in northeastern states.

CONTROL.—Same as for fanweed. See control of annuals and biennials.

ROCKY MOUNTAIN BEE PLANT

(*Peritoma serrulata*)

(*Cleome serrulata*)

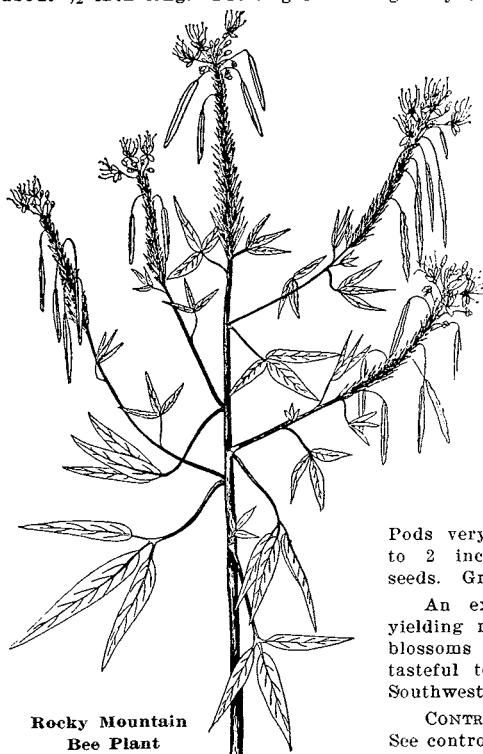
OTHER NAMES.—Pink cleome, stinking clover, stinkweed.

DESCRIPTION.—Caper family. Native. Annual. Propagates by seeds. Erect, smooth stem, 2 to 3 feet high, branching above. Leaves three-parted; leaflets oblong and pointed. Flowers numerous, reddish-purple, sometimes pinkish or white, very showy, with four petals each about $\frac{1}{2}$ inch long. Fruiting racemes greatly elongated.



Indian Mustard

$\times \frac{1}{3}$

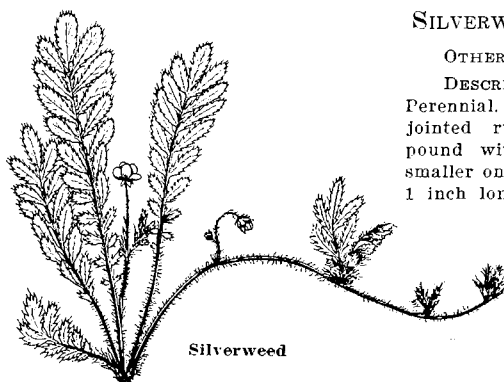


Rocky Mountain
Bee Plant

Pods very slender, drooping at maturity, 1 to 2 inches long, pointed, crowded with seeds. Grows in dry soil in waste places.

An excellent honey plant, the flowers yielding much nectar at a time when other blossoms are not so plentiful. Foliage distasteful to cattle. Used by Indians of the Southwest in making pottery paint.

CONTROL.—General weed-control methods. See control of annuals.



SILVERWEED (*Argentina argentea*)

OTHER NAMES.—Goose tansy, wild tansy.

DESCRIPTION. — Rose family. Native. Perennial. Propagates by seeds and many-jointed runners. Leaves pinnately compound with 11 to 25 large leaflets, and smaller ones interposed; larger leaflets $\frac{1}{2}$ to 1 inch long, ovate, sharply toothed, white-silky on both sides or slightly greener above. Flowers yellow. Usually on moist soil in waste places.

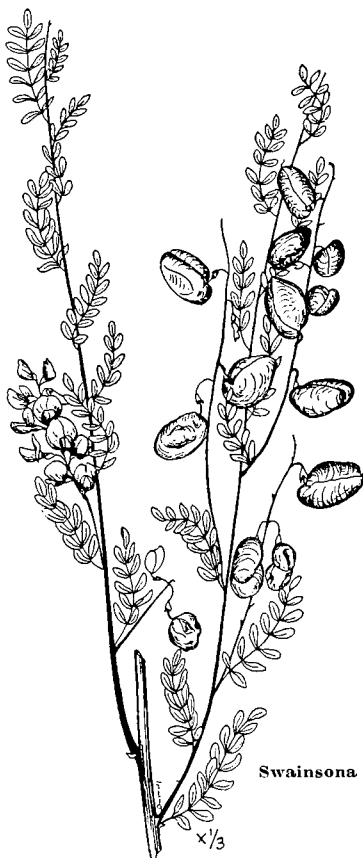
CONTROL. — General control methods. Cultivation. Pulling and burning all parts.

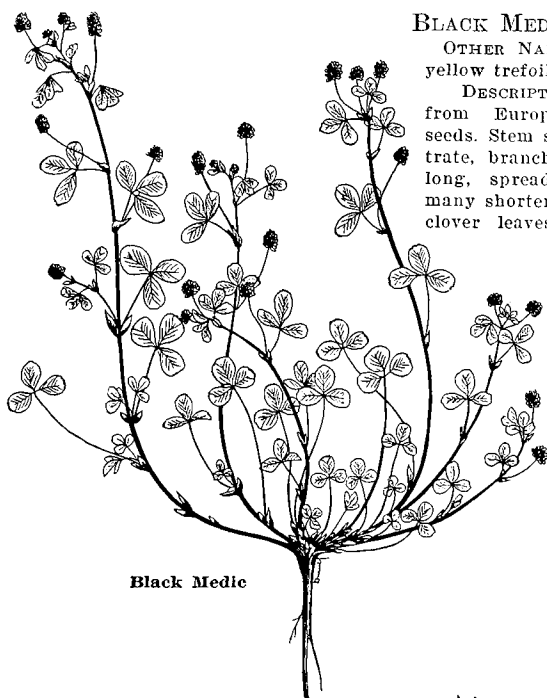
SWAINSONA (*Swainsona salsula*) (*Sphaerophysa salsula*) (Noxious)

DESCRIPTION. — Pea family. Introduced from Europe. Native also of Asia. Perennial. Propagates by seeds and by creeping roots. Plants grow in patches from the creeping root system. Stem erect, 2 to 3 feet high, freely branching at the base, the main stems with smaller ascending secondary branches, round, finely ridged longitudinally, sparsely hairy above. Leaves pinnately compound, 2 to 3 inches long, with about 19 leaflets; leaflets oval, round-pointed at apex, somewhat narrowed at base, $\frac{1}{4}$ to $\frac{1}{2}$ inch long, short white-hairy underneath. Typical pea flowers, red, purple when dry, $\frac{3}{8}$ inch long, in racemose clusters $1\frac{1}{2}$ to 2 inches long. Pods large, membranous, bladder-like, grooved on one side, $\frac{3}{4}$ inch long, bright-red, later becoming pale green. Seeds small, roundish, indented at point of attachment, olive-green; about 30 seeds to a pod. Reported only from the San Luis Valley in Colorado where it was introduced in Turkestan alfalfa seed.

This plant is not widely spread but the nature of its growth warrants keeping it under close observation.

CONTROL.—See control of creeping perennials.





Black Medic

BLACK MEDIC (*Medicago lupulina*)

OTHER NAMES.—Hop medic, hop clover, yellow trefoil.

DESCRIPTION.—Pea family. Introduced from Europe. Annual. Propagates by seeds. Stem slender, somewhat hairy, prostrate, branching at the base, 1 to 2 feet long, spreading in all directions, with many shorter ascending branches. Typical clover leaves, small, three-foliate, finely hairy. Flowers yellow, in small dense racemes. Pods thin-walled, kidney-shaped, slightly twisted, black when mature. Grows in lawns, fields, meadows, and waste places throughout the world.

Not always a weed, since grazing animals eat the plant readily, and it is of value in irrigated pastures.

CONTROL.—Cultivation and crop rotation. Hand-pulling before blooming in lawns.

WILD LICORICE
(*Glycyrrhiza lepidota*)

(Noxious)

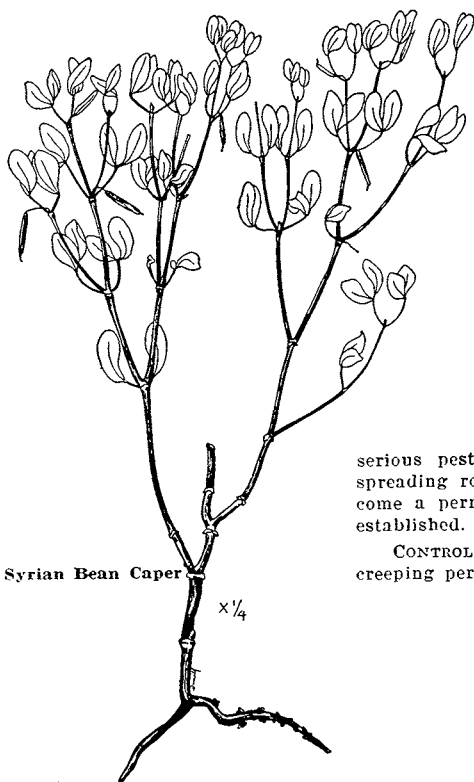
OTHER NAMES.—Sweetroot, American licorice.

DESCRIPTION. — Pea family. Native. Perennial. Propagates by seeds and by creeping roots. Erect, branching, 1 to 3 feet high. Leaves pinnate with 11 to 19 leaflets. Yellowish-white, pea-like flowers borne close together at the ends of long axillary stems. Seeds borne in oblong, bur-like pods about $\frac{1}{2}$ inch long, densely covered with hooked prickles and brown in color when ripe. Seeds black, nearly spherical, with a deep notch. Grows in open prairies, fields, meadows, and waste places. Rather generally distributed in northern and western United States.

CONTROL.—Not as difficult as many plants with creeping roots. Frequent mowing, clean cultivation. See control of creeping perennials.



Wild Licorice



Syrian Bean Caper

x 1/4

PUNCTUREVINE (*Tribulus terrestris*)
(Noxious)

OTHER NAMES.—Tackweed, ground bur-nut, land caltrop.

DESCRIPTION.—Caltrop family. Introduced from Europe. Annual. Propagates by seeds. Prostrate, mat-forming plant, with trailing stems 1 to 8 feet long, somewhat hairy. Leaves pinnate, 1½ to 2 inches long, with four to eight pairs of leaflets, each leaflet about ¼ inch long, oval in form. Flowers yellow, about ½ inch broad with five petals. Fruit a spiny bur about ½ inch broad, which at maturity breaks up into four or five tack-like structures with sharp, sometimes curving spines. Grows in pastures and waste places and invades cultivated lands. Distributed rather widely over the United States.

The hard, spiny burs are bad in hay, damage wool, and may otherwise be injurious to livestock. They also enable the seeds to lie dormant in the soil for several years, making eradication difficult.

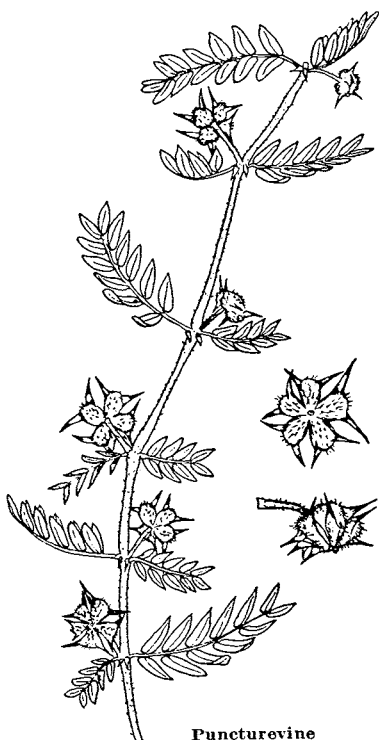
CONTROL.—Seed prevention. Hand hoeing or cultivation; tops bearing burs should be burned. Spraying with petroleum oil. See chemical control, also control of annuals.

SYRIAN BEAN CAPER
(*Zygophyllum fabago*)
(Noxious)

DESCRIPTION.—Caltrop family. Introduced from Russia. Perennial. Propagates by seeds and by creeping roots. Stem thick, smooth, branching from the bottom to form bush-like plant, 12 to 18 inches high. Leaves succulent, bifoliate, with rounded leaflets, ½ to more than 1 inch long. Flowers bright salmon-colored. Pods five-angled, ribbed, 1 to 2 inches long. Grows in fields and waste places. Distribution very limited. Reported only from Alamosa and Delta Counties in Colorado. Excellent honey plant.

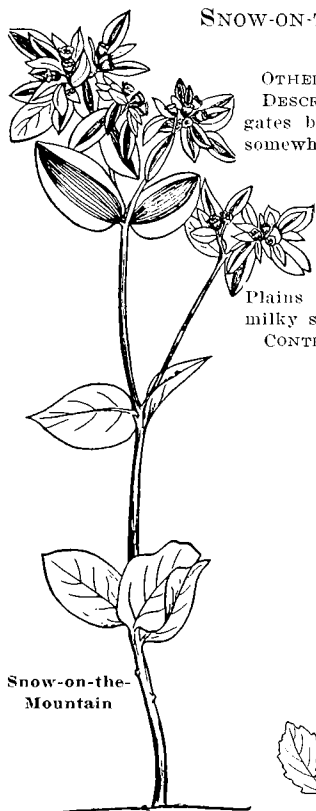
This plant is not known to be a serious pest in any section, but its extensive, spreading root system indicates that it may become a pernicious weed if permitted to become established.

CONTROL.—Clean cultivation. See control of creeping perennials.



Puncturevine

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



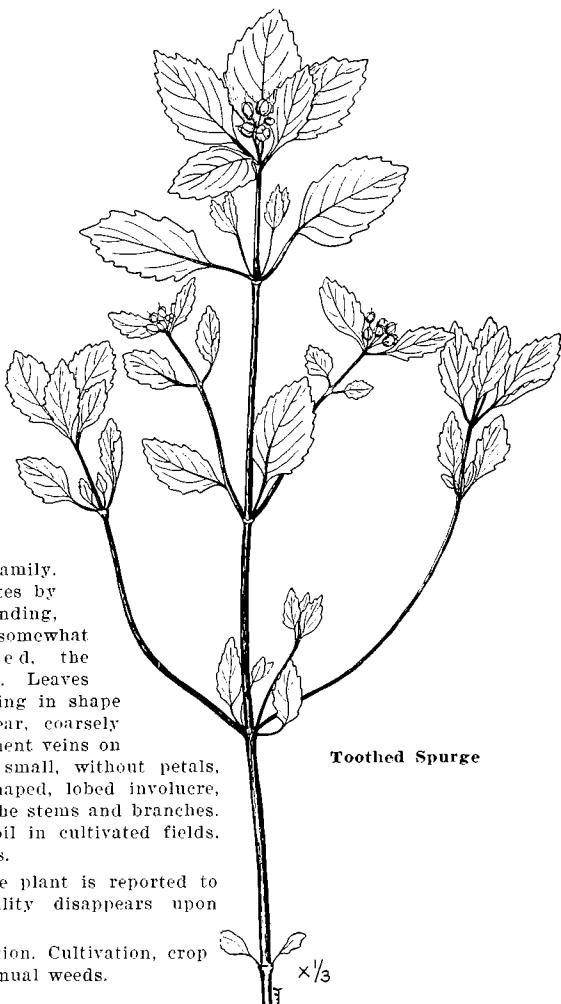
Snow-on-the-Mountain

TOOTHED SPURGE
(*Euphorbia dentata*)
(*Poinsettia dentata*)

DESCRIPTION.—Spurge family. Native. Annual. Propagates by seeds. Stem erect or ascending, 8 to 15 inches high, somewhat woody below, branched, the branches mostly ascending. Leaves 2 to 3½ inches long, varying in shape from ovate to nearly linear, coarsely toothed, hairy, with prominent veins on the under sides. Flowers small, without petals, each enclosed in a bell-shaped, lobed involucre, in clusters at the ends of the stems and branches. Grows in dry or moist soil in cultivated fields, meadows, and waste places.

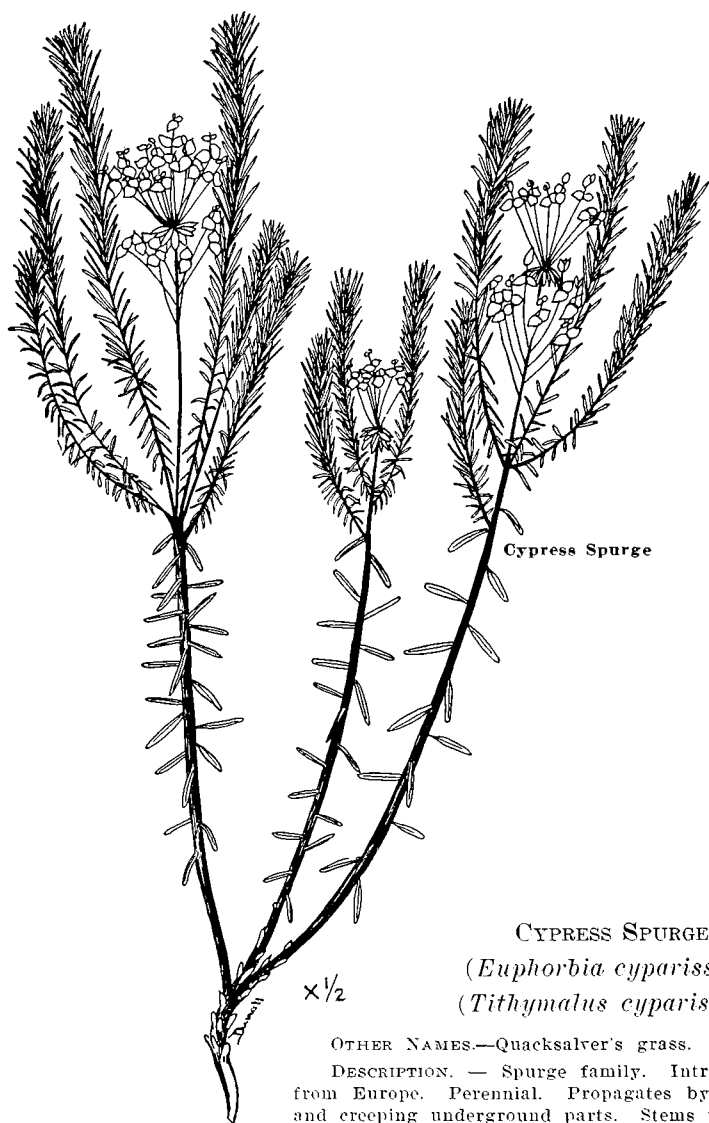
The milky juice of the plant is reported to be poisonous, which quality disappears upon drying.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annual weeds.



Toothed Spurge

$\times \frac{1}{3}$



CYPRESS SPURGE

*(Euphorbia cyparissias)**(Tithymalus cyparissias)*

OTHER NAMES.—Quacksalver's grass.

DESCRIPTION. — Spurge family. Introduced from Europe. Perennial. Propagates by seeds and creeping underground parts. Stems thickly clustered, scaly below, very leafy above, 6 to 12 inches high, with few branches, the branches terminated by a many-stemmed, umbrella-shaped umbel. Leaves linear, very narrow, $\frac{1}{2}$ to 1 inch long, deep-green, smooth, numerous, those at the base of the umbels in whorls, the others alternate. Flowers small, without petals, forming the terminal clusters, each flower enclosed in a top-shaped involucre subtended by pale-green, heart-shaped bracts. The plant has a milky sap. Grows in fields and waste places and around dwellings. Mostly in eastern states.

The plant often grows in large patches and chokes out other vegetation. It is said to be injurious to cattle.

CONTROL.—Cultivation, crop rotation. See control of creeping perennials.

LEAFY SPURGE (*Euphorbia virgata*)
(*Tithymalus virgata*)
(Noxious)

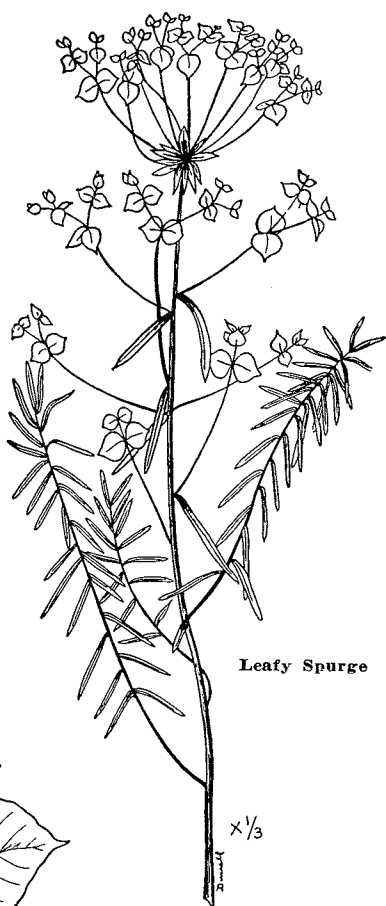
OTHER NAMES.—Tithymal, faitour's grass.

DESCRIPTION.—Spurge family. Introduced from Europe. Perennial. Propagates by seed and by creeping roots. Erect, pale-green, 1 to 3 feet high, unbranched except for flower clusters. Leaves long and narrow with smooth margin. Flowers small, greenish-yellow, in small umbrella-like cluster at top of stem. Seeds light-gray, smooth, twice as large as alfalfa. Pods three-seeded. Plant characterized by milky sap. Grows in fields and waste places. Rather widely scattered throughout the United States.

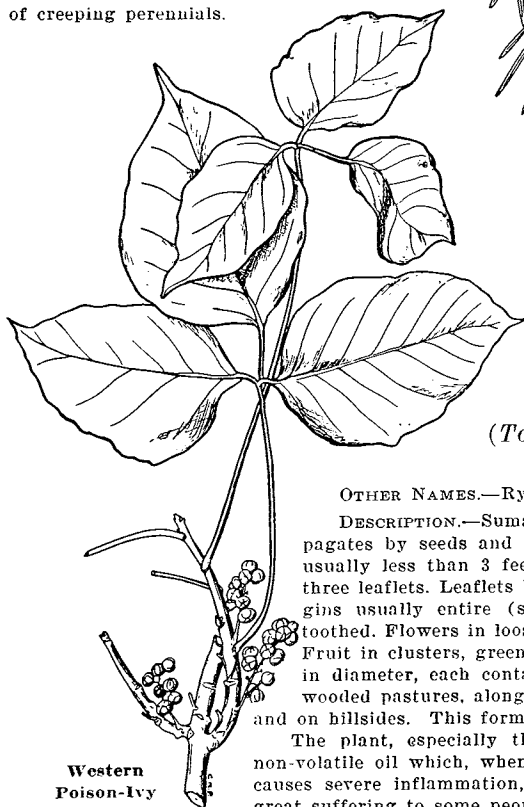
This plant is barely known in Colorado but its invasion from other states, where it is a serious pest, should be guarded against.

Euphorbia esula.—This name, which has been applied to leafy spurge at times, refers to a slightly different species.

CONTROL.—Clean cultivation. See control of creeping perennials.



Leafy Spurge



Western
Poison-Ivy

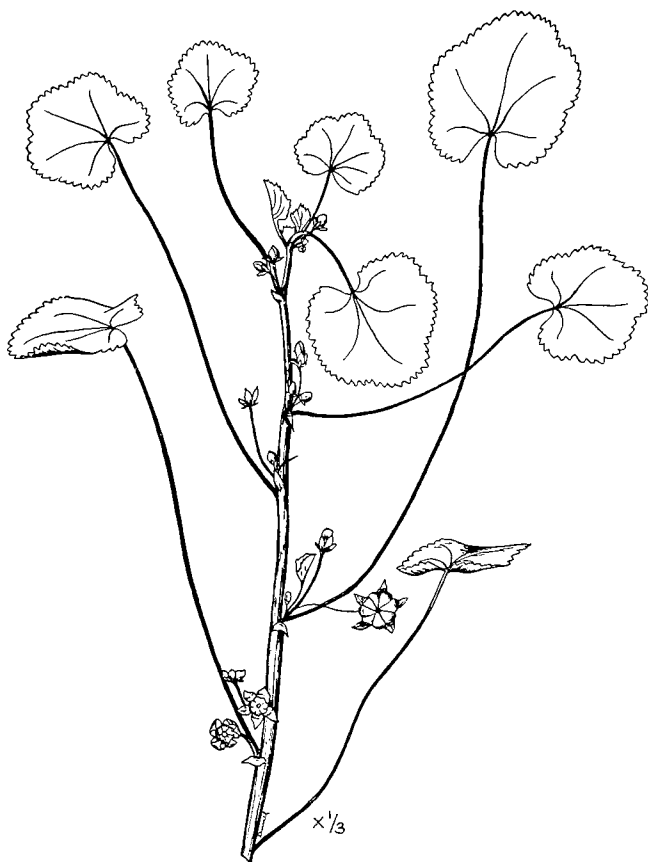
WESTERN POISON-IVY
(*Toxicodendron rydbergii*)
(*Rhus rydbergii*)

OTHER NAMES.—Rydberg's poison-oak.

DESCRIPTION.—Sumac family. Native. Perennial. Propagates by seeds and by underground parts. A shrub usually less than 3 feet high. Leaves compound, with three leaflets. Leaflets broad oval, pointed at ends, margins usually entire (smooth), sometimes scalloped or toothed. Flowers in loose panicles, small, greenish-white. Fruit in clusters, greenish-white, smooth, waxy, $\frac{1}{4}$ inch in diameter, each containing one hard seed. Grows in wooded pastures, along fence rows, in mountain canyons, and on hillsides. This form limited to western states.

The plant, especially the leaves, contains a poisonous, non-volatile oil which, when in contact with the skin, often causes severe inflammation, burning, and swelling, causing great suffering to some people.

CONTROL.—Grubbing. Clean cultivation where practical. Chlorates. See control of creeping perennials; also chemical control.



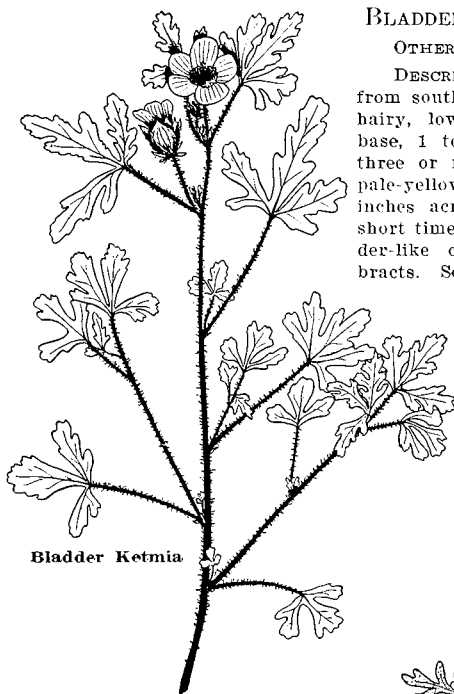
Common Mallow

COMMON MALLOW (*Malva rotundifolia*)

OTHER NAMES.—Cheeses, dwarf mallow, running mallow, round dock.

DESCRIPTION.—Mallow family. Introduced from Europe. Native also of Asia. Annual or biennial. Propagates by seeds. Stems round, smooth, prostrate, spreading over the ground in all directions from a deep root, 6 inches to 2 feet long. Leaves round or kidney-shaped, 1 to 3 inches across, slightly lobed with scalloped and toothed edges, borne on slender stems (petioles) 3 to 6 inches long. Flowers clustered in the leaf axils, pale-blue to whitish, sometimes pinkish, $\frac{1}{3}$ to $\frac{1}{2}$ inch broad. Fruit is composed of about 15 kidney-shaped segments (carpels) arranged in a circle, resembling an old-fashioned cheese, mucilaginous and sweet when green. Grows in cultivated ground, gardens, yards, and waste places throughout the United States.

CONTROL.—Seed prevention. Deep hoe-cutting or pulling. Cultivation, crop rotation. See control of annuals and biennials.



Bladder Ketmia

BLADDER KETMIA (*Hibiscus trionum*)

OTHER NAMES.—Flower-of-an-hour, shoofly.

DESCRIPTION. — Mallow family. Introduced from southern Europe. Propagates by seeds. A hairy, low-growing plant, branching from the base, 1 to 1½ feet high. Leaves divided into three or more toothed or cleft lobes. Flowers pale-yellow with purple center or eye, 1 to 2 inches across, each one remaining open but a short time. Fruit enclosed in membranous, bladder-like calyx envelope subtended by narrow bracts. Seeds grayish-black, with rough surface.

Grows in cultivated fields and waste places.

CONTROL.—Prevention of seed formation. Good cultural practices. See control of annuals.

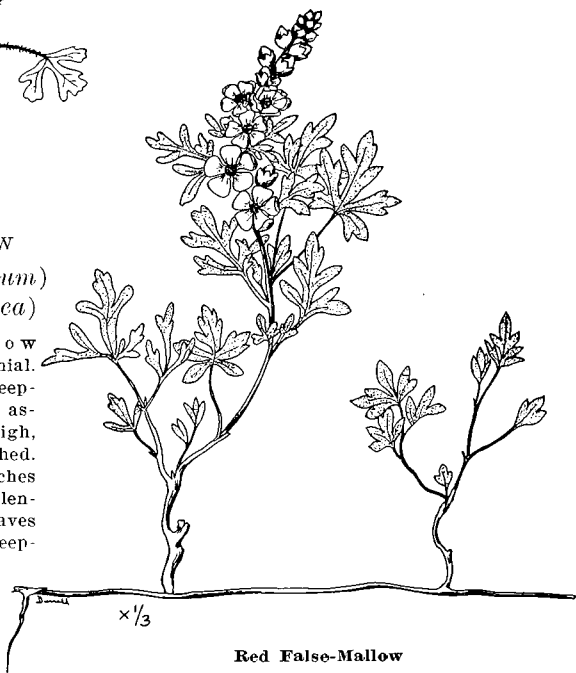
RED FALSE-MALLOW
(*Malvastrum coccineum*)
(*Sphaeralcea coccinea*)

DESCRIPTION.— Mallow family. Native. Perennial. Propagates by seed and creeping roots. Stems erect or ascending, 6 to 12 inches high, in tufts, freely branched. Lower leaves 1 to 2 inches wide, rounded-oval, on slender stems (petioles). Leaves rounded-oval in outline, deeply three- to five-lobed, the lobes more or less wedge-shaped and cut rather deeply and irregularly. The whole plant is silver gray with star-shaped hairs.

Flowers red, ½ to ¾ inch across with five petals, clustered in short terminal racemes. Fruit is composed of 10 to 15 segments (carpels) arranged in a circle, outwardly rough. Common to prairies, roadsides, and waste places in western states.

The plant is said to be somewhat injurious to cattle and horses.

CONTROL.—Seed prevention. Cultivation and crop rotation. See control of simple perennials.



Red False-Mallow

STIFF MENTZELIA (*Nuttallia nuda*)
(*Mentzelia nuda*)

OTHER NAMES.—Bractless mentzelia, stiff nuttallia, branched mentzelia, blazing-star, stickleaf, evening-star.

DESCRIPTION.—Loasa family. Native. Perennial. Propagates by seeds. Rough with minute hairs, slender, 1 to 5 feet high, often widely branched, stem light-colored. Leaves sessile, lance-shaped, sharply and deeply toothed, with pointed apex; upper ones sometimes pinnatifid. Flowers yellowish-white, $1\frac{1}{2}$ to 2 inches broad with 10 petals, opening in the evening. Fruit an oblong capsule $\frac{3}{4}$ to 1 inch long, about $\frac{1}{4}$ inch thick. Seed numerous, wing-margined. Grows in dry soil on plains in western states.

CONTROL.—General control methods. See control of simple perennials.



Stiff Mentzelia

CUT-LEAVED EVENING-PRIMROSE
(*Anogra coronopifolia*)

DESCRIPTION.—Evening-primrose family. Native. Perennial. Propagates by seeds. More or less hairy, erect, branched, $\frac{1}{2}$ to 2 feet high. Leaves $\frac{1}{2}$ to 2 inches long, deeply cut or cleft into narrow lobes. Flowers white, turning pink, 1 inch across. Capsules hairy, oblong, constricted at top, $\frac{1}{4}$ to 1 inch long. Grows on plains and prairies of the West.

CONTROL.—Good cultural practices. See control of simple perennials.



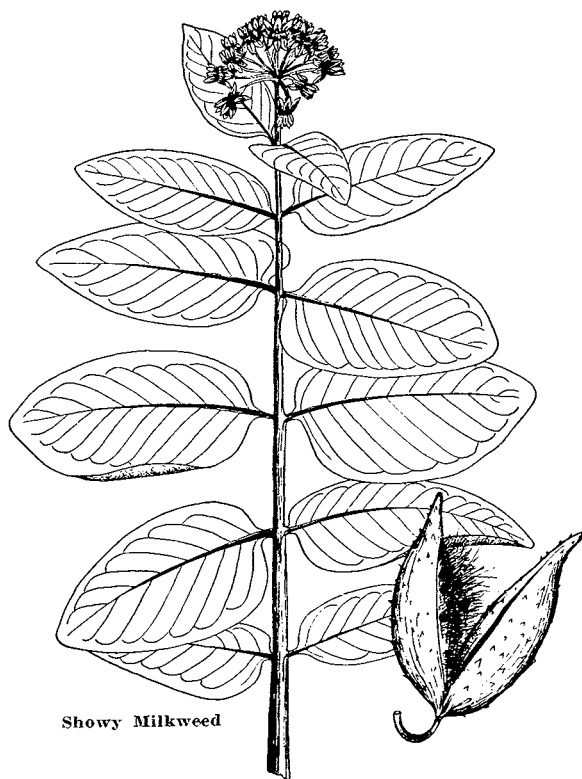
Cut-Leaved
Evening-Primrose

VELVETWEED (*Gaura parviflora*)

OTHER NAMES.—*Gaura*, butterflyweed.

DESCRIPTION.—Evening-primrose family. Native. Annual. Propagates by seeds. Stem erect, somewhat branched, 2 to 5 feet tall, covered with soft, white hairs. Leaves alternate, narrow-ovate, more or less pointed, $1\frac{1}{2}$ to 4 inches long, $\frac{1}{3}$ to $1\frac{1}{2}$ inches wide, softly hairy, sometimes wavy margined. Flowers white or pink to reddish, small, borne on a dense, elongated spike, terminating the stem. Fruit a smooth, four-angled capsule, $\frac{1}{4}$ to $\frac{1}{2}$ inch long, narrowed at both ends and enclosing three or four seeds. In dry soil in fields, cultivated land, and waste places, mostly in western states.

CONTROL.—Seed prevention. Cultivation and crop rotation. See control of annuals.



Showy Milkweed



Velvetweed

SHOWY MILKWEED (*Asclepias speciosa*)

DESCRIPTION.—Milkweed family. Native. Perennial. Propagates by seeds and by creeping roots. Stem erect, unbranching, stout, 1 to 3 feet high; plant usually white-woolly all over. Leaves opposite, thick, oval, 3 to 6 inches long, grayish-green. Flowers greenish-purple or pinkish, borne in large, head-like clusters or umbels. Fruit in the form of large, spindle-shaped pods or follicles, 3 to 11 inches long, white-woolly, covered with soft, spinous processes, and containing many flat, brown seeds, each tipped with tuft of silky hairs. Grows in fields, pastures, and waste places. Prevalent in northern and western United States.

CONTROL.—Clean cultivation. Crop rotation. See control of creeping perennials.

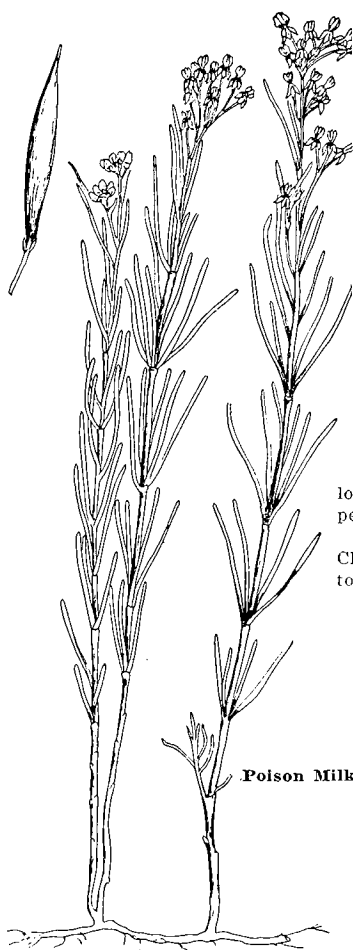
POISON MILKWEED
(*Asclepias galioides*)
(Noxious)

OTHER NAMES.—Whorled milkweed, bedstraw milkweed.

DESCRIPTION.—Milkweed family. Native. Perennial. Propagates by seeds and by creeping roots. Erect, 1 to 3 feet high, with slender, smooth, unbranched stems growing singly or in clumps. Leaves narrow, 2 to 4 inches long, not over $\frac{3}{8}$ inch wide, growing in whorls of from three to four leaves from each joint. Flowers greenish-white in clusters or umbels not unlike onion blossoms. Pods or follicles erect $2\frac{1}{2}$ to 4 inches long, rather slender, long-pointed above and short-pointed below, each containing many flat, brown seeds, each tipped with a tuft of silky hairs. Grows in fields, along ditchbanks, roadsides, fence rows, in orchards, pastures, and on dry hillsides. Native to Rocky Mountain section.

Extremely poisonous to livestock, causing large losses each year. A pernicious weed because of its persistent, spreading roots.

CONTROL.—Plowing in August and in the fall. Clean cultivation beginning in spring not satisfactory. Spraying with chlorates. See chemical control.



Poison Milkweed

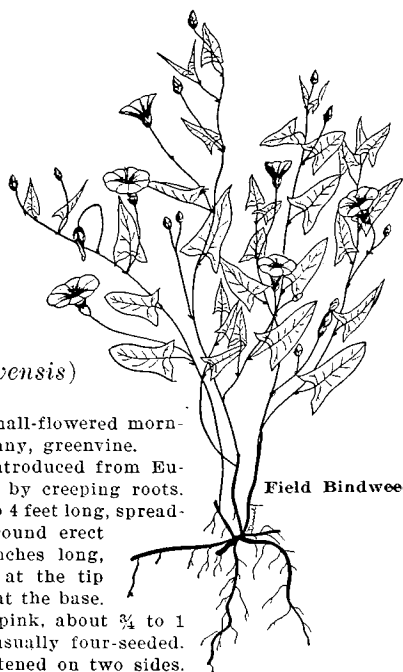
FIELD BINDWEED (*Convolvulus arvensis*)
(Noxious)

OTHER NAMES.—Wild morning glory, small-flowered morning glory, European bindweed, creeping Jenny, greenvine.

DESCRIPTION.—Morning glory family. Introduced from Europe. Perennial. Propagates by seeds and by creeping roots. Stems smooth, slender, slightly angled, 1 to 4 feet long, spreading thickly over the ground or twining around erect plants or other objects. Leaves 1 to 2 inches long, more or less arrow-shaped, round-pointed at the tip and with spreading, pointed or blunt lobes at the base. Flowers bell- or trumpet-shaped, white or pink, about $\frac{3}{4}$ to 1 inch broad. Fruit small, round capsules, usually four-seeded. Seeds dark-brown, rough, pear-shaped, flattened on two sides. Grows in fields and waste places. Distributed throughout the United States and the world.

Probably the best known and most widely distributed of the noxious weeds. Spreads rapidly, causes heavy losses, and is very persistent.

CONTROL.—Clean cultivation. Chlorates. See control of creeping perennials, also chemical control.



Field Bindweed

HEDGE BINDWEED (*Convolvulus americanus*)
(*Convolvulus sepium*)
(Noxious)

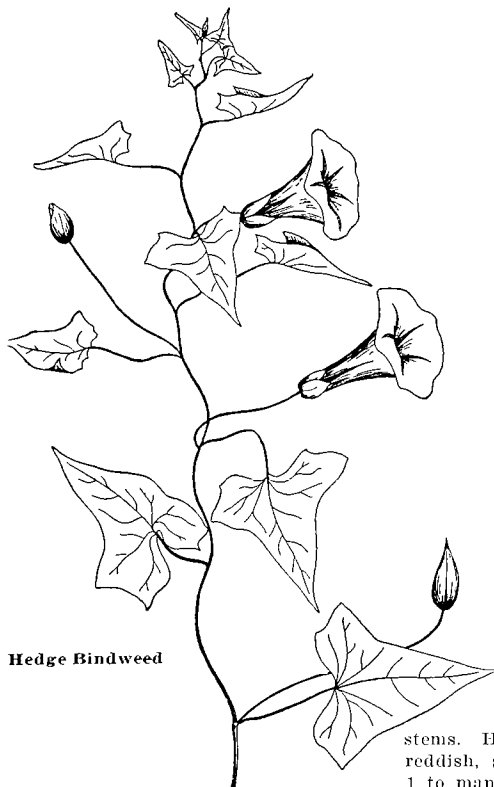
OTHER NAMES.—Wild morning glory, large-flowered morning glory, great bindweed, bracted bindweed.

DESCRIPTION.—Morning glory family. Native. Perennial. Propagates by seeds and by horizontal rootstocks. Similar to field bindweed but larger in all respects. Stem smooth or slightly hairy, trailing or twining, 3 to 10 feet long. Leaves triangular in outline, tip and basal lobes pointed. Flowers white or pink with white stripes, bell-shaped, large, 2 inches long and $1\frac{1}{2}$ to 2 inches broad, enclosed at the base by two large, clasping bracts. Seeds dark-brown, angular, pear-shaped, $\frac{1}{8}$ inch long. Grows in fields and waste places. Widely distributed.

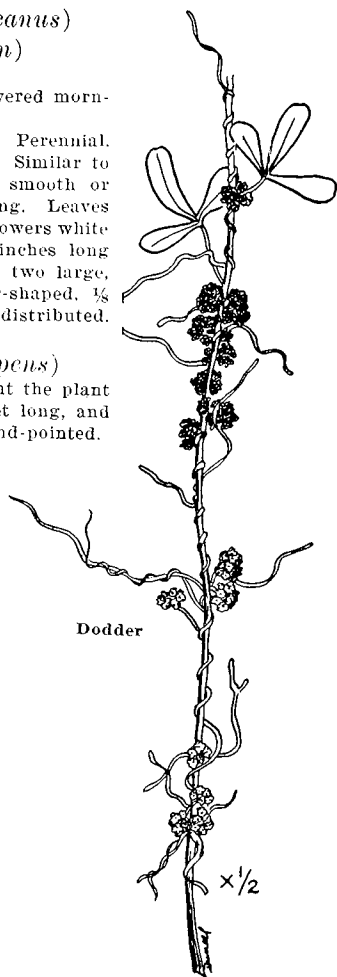
TRAILING BINDWEED (*Convolvulus repens*)

Very similar to hedge bindweed. Differs in that the plant is somewhat more hairy, stems are only 1 to 3 feet long, and leaf tips and basal lobes are less acute, being round-pointed.

CONTROL.—Same as for field bindweed.



Hedge Bindweed



Dodder

$\times \frac{1}{2}$

DODDER (*Cuscuta* spp.)
(Noxious)

OTHER NAMES.—Love vine, strangleweed, devils-gut, hellbind.

DESCRIPTION.—Dodder family. Native, some species introduced from Europe and Asia. Annual; reported also to be perennial.

Propagates by seeds and broken stems. Herbaceous parasite, with yellow to reddish, slender, thread-like twining stems, 1 to many feet long, bearing small sucking

discs which become attached to the host plant. Leaves reduced to minute scales. Flowers small, white to pinkish, in clusters along the stems. Seeds small, greenish-yellow to brown, remain viable for several years.

The dodder seeds germinate in the ground, but the twining stems soon become attached to the host plants from which they receive their nourishment, the ground stems quickly breaking away. Especially bad in alfalfa- and clover-seed-growing sections.

CONTROL.—See control of parasitic weeds.



NYCTELEA (*Macrocalyx nyctelea*)

DESCRIPTION.—Waterleaf family. Native. Annual. Propagates by seeds. Stem several times forked, 4 to 12 inches high. Leaves 2 to 4 inches long, pinnately divided, the segments entire or toothed or lobed. The whole plant is rough-hairy and has a disagreeable odor. Flowers solitary on slender peduncles; corolla five-lobed, nearly cylindrical; calyx enlarges as fruit matures, forming a five-pointed star an inch across, with a small, round, two-celled capsule in the center. Grows in grain fields and waste places. Most troublesome in grain sections of the Northwest.

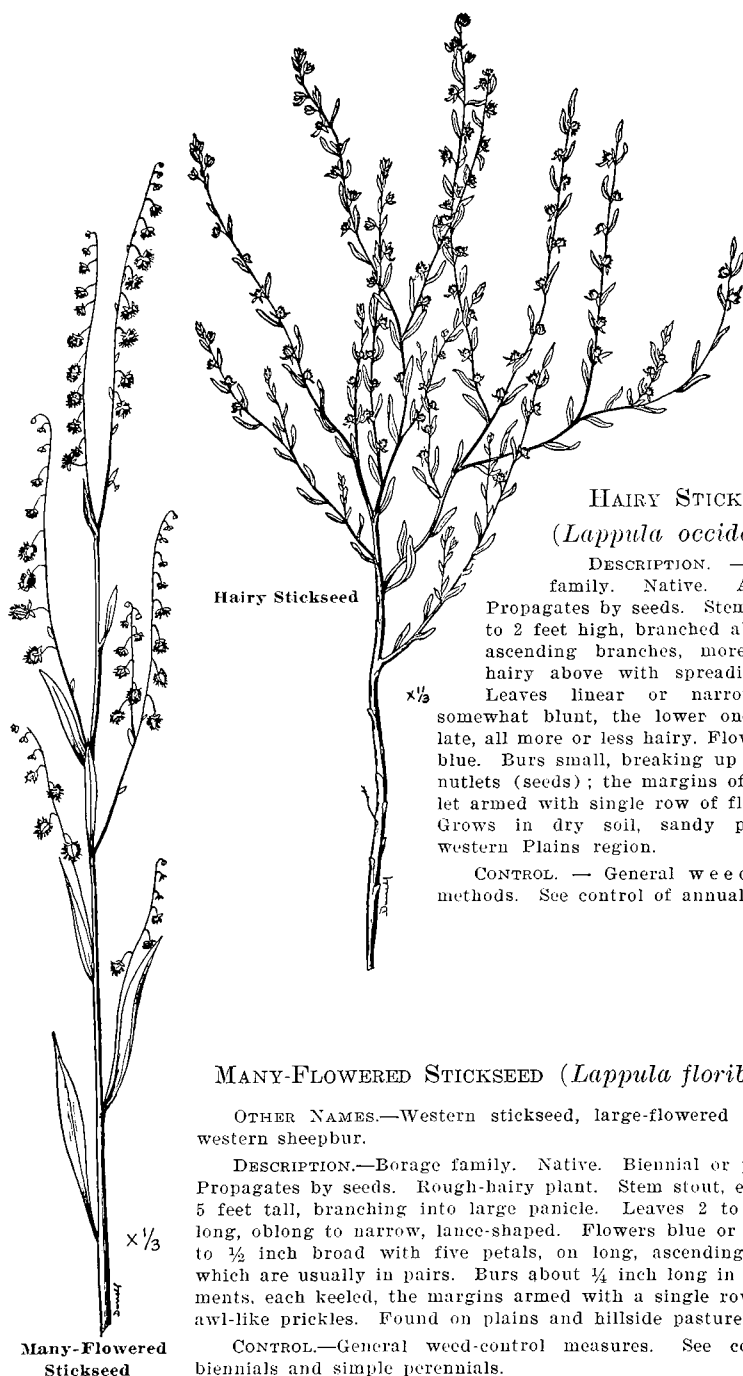
CONTROL.—Seed prevention. Destruction of young plants, harrowing young grain crops. Cultivation, crop rotation. See control of annuals.

HOUNDSTONGUE (*Cynoglossum officinale*)

OTHER NAMES.—Dogstongue, dogbur, gypsy flower.

DESCRIPTION.—Borage family. Introduced from Europe. Native of Asia. Biennial. Propagates by seeds. Stem erect, stout, heavy, $1\frac{1}{2}$ to 3 feet high, usually branched above. Basal and lower leaves broad, lance-shaped, more or less blunt, 6 to 12 inches long, 1 to 3 inches wide; upper leaves narrower, pointed, almost clasping. The whole plant covered with soft, white hairs. Flowers reddish-purple, rarely white, in long, sometimes branched, terminal clusters. Fruit consists of four burs, each about $\frac{1}{4}$ inch long, with short, barbed prickles, compressed to form a pyramid but readily breaking apart at maturity. Grows in fields, pastures, along roadsides, and in waste places. Appears only as a leafy rosette the first year.

CONTROL.—General control methods. See control of annuals and biennials.



Hairy Stickseed

HAIRY STICKSEED (*Lappula occidentalis*)

DESCRIPTION. — Boraginaceae family. Native. Annual. Propagates by seeds. Stem 6 inches to 2 feet high, branched above with ascending branches, more or less hairy above with spreading hairs. Leaves linear or narrow-oblong, somewhat blunt, the lower ones spatulate, all more or less hairy. Flowers tiny, blue. Burs small, breaking up into four nutlets (seeds); the margins of the nutlet armed with single row of flat spines. Grows in dry soil, sandy places, in western Plains region.

CONTROL. — General weed-control methods. See control of annual weeds.

MANY-FLOWERED STICKSEED (*Lappula floribunda*)

OTHER NAMES.—Western stickseed, large-flowered stickseed, western sheepbur.

DESCRIPTION.—Boraginaceae family. Native. Biennial or perennial. Propagates by seeds. Rough-hairy plant. Stem stout, erect, 2 to 5 feet tall, branching into large panicle. Leaves 2 to 4 inches long, oblong to narrow, lance-shaped. Flowers blue or white, $\frac{1}{4}$ to $\frac{1}{2}$ inch broad with five petals, on long, ascending racemes which are usually in pairs. Burs about $\frac{1}{4}$ inch long in four segments, each keeled, the margins armed with a single row of flat, awl-like prickles. Found on plains and hillside pastures.

CONTROL.—General weed-control measures. See control of biennials and simple perennials.

BLUE VERVAIN (*Verbena hastata*)

OTHER NAMES.—Fake vervain, wild hyssop, wild verbena, ironweed.

DESCRIPTION.—Vervain family. Native. Perennial. Propagates by seeds. Stem erect, four-sided, 3 to 7 feet tall, finely rough-hairy, coarsely grooved, branching near the top. Leaves 3 to 6 inches long, oblong, lance-shaped, long-pointed, narrow at the base, finely rough-hairy with heavy veins and short, grooved petiole. Flowers small, purplish-blue, tubular, five-lobed, on numerous spikes in panicle. Each spike with green buds above the flowers and maturing fruit below, 2 to 6 inches long. Fruit small, dry, crowded upon the spike, composed of four nutlets (seeds). Grows in moist places, fields, meadows, roadsides, and waste places. Rather wide distribution.

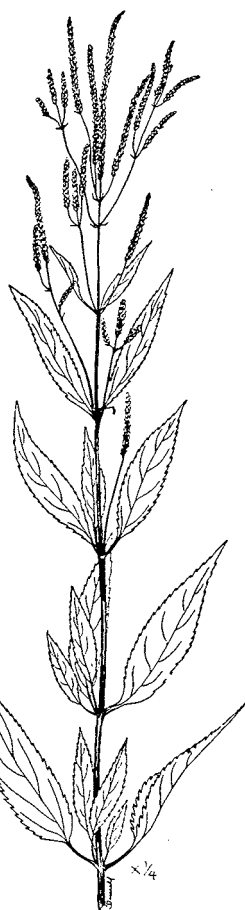
CONTROL.—Deep hoe-cutting or pulling. Cultivation, crop rotation. See control of simple perennials.

LARGE-BRACTED VERVAIN (*Verbena bracteosa*)

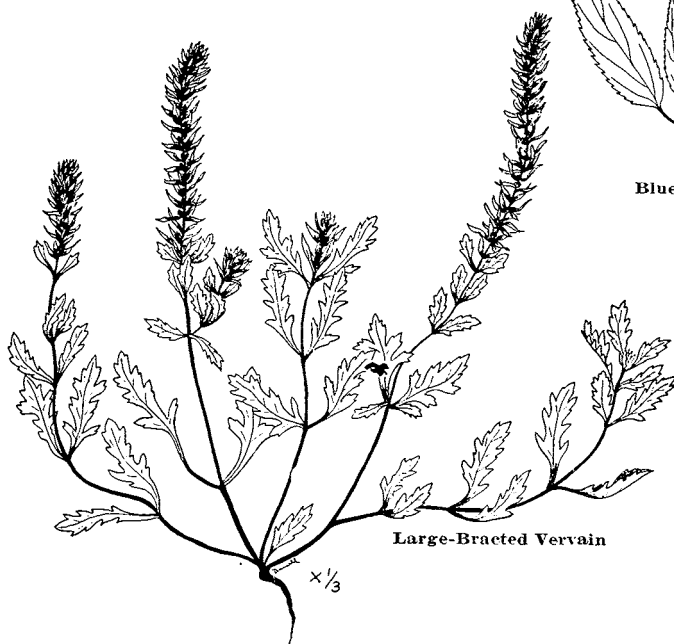
OTHER NAMES.—Prostrate vervain.

DESCRIPTION.—Vervain family. Native. Annual or perennial. Propagates by seeds. Stem four-sided, much branched from the base, some branches prostrate, some ascending, slender, 6 to 15 inches long, rough, hairy. Leaves 1 to 3 inches long, pinnatifid, the lobes toothed, basal pair spreading. Flowers purplish-blue, on single stout spikes, almost concealed by long, pointed, stiff, hairy bracts which subtend them. Fruit small, dry, separating into four small, brown nutlets (seeds), netted on back. Grows on plains and prairies, in waste places.

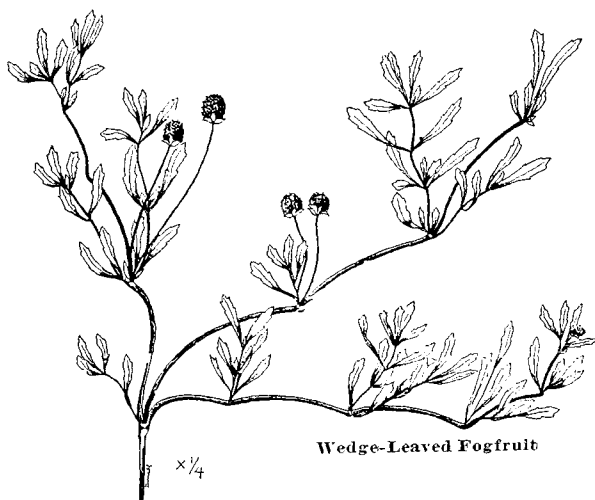
CONTROL.—General control methods. See control of annuals and simple perennials.



Blue Vervain



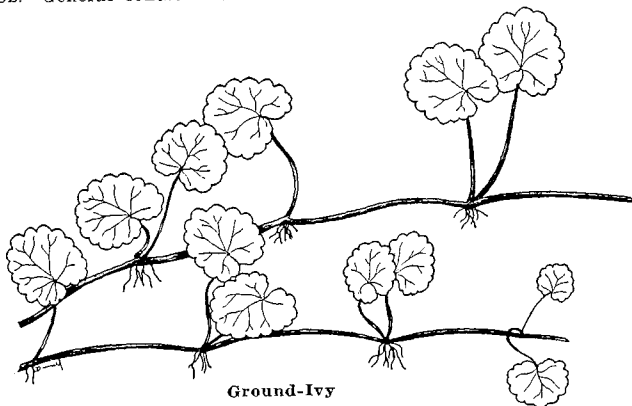
Large-Bracted Vervain



WEDGE-LEAVED FOGFRUIT (*Phyla cuneifolia*)
(*Lippia cuneifolia*)

DESCRIPTION.—Vervain family. Native. Perennial. Propagates by seeds. Stem branched at the woody base, prostrate, somewhat zig-zag, 6 inches to 3 feet long, rigid, with short erect branches at the joints. Leaves opposite, sessile, wedge-shaped, 1 to 1½ inches long, with two to eight sharp teeth above the middle, rarely entire, somewhat pointed. Flowers purplish or white in dense, head-like clusters, borne on axillary stems. Fruit small, dry, separating into two small, light-brown to tan nutlets (seeds). Grows on plains and prairies, waste places.

CONTROL.—General control methods. See control of simple perennials.



GROUND-IVY (*Glechoma hederacea*)
(*Nepeta hederacea*)

OTHER NAMES.—Gill-over-the-ground, cats-foot.

DESCRIPTION.—Mint family. Introduced from Europe. Perennial. Propagates by seeds and creeping stems, the branches ascending. Leaves rounded or kidney-shaped with scalloped edges, green on both sides. Flowers in small axillary clusters, pale-purple, with tubular five-toothed calyx. Grows under moist conditions in lawns and waste places.

CONTROL.—Cultivation and good cultural practices. In lawns a spray of iron sulphate, dilute sodium chlorate, etc. See control of lawn weeds.

LANCE-LEAVED SAGE (*Salvia lanceolata*)

OTHER NAMES.—Blue sage.

DESCRIPTION.—Mint family. Native.

Annual. Propagates by seeds. Stem four-sided, leafy, usually much branched, erect or spreading, 6 to 18 inches high. Leaves lance-shaped or oblong, mostly blunt at the apex and narrowed at the base, margins toothed or entire, 1 to 2 inches long. Flowers blue, about $\frac{1}{2}$ inch long, lower lips narrow, twice as long as the upper, mostly opposite but sometimes three or four together in terminal raceme. Fruit dry, separating into four light-brown nutlets (seeds) with darker-brown markings. Common in Plains region.

CONTROL.—Good cultural practices. See control of annuals.

DRAGONHEAD

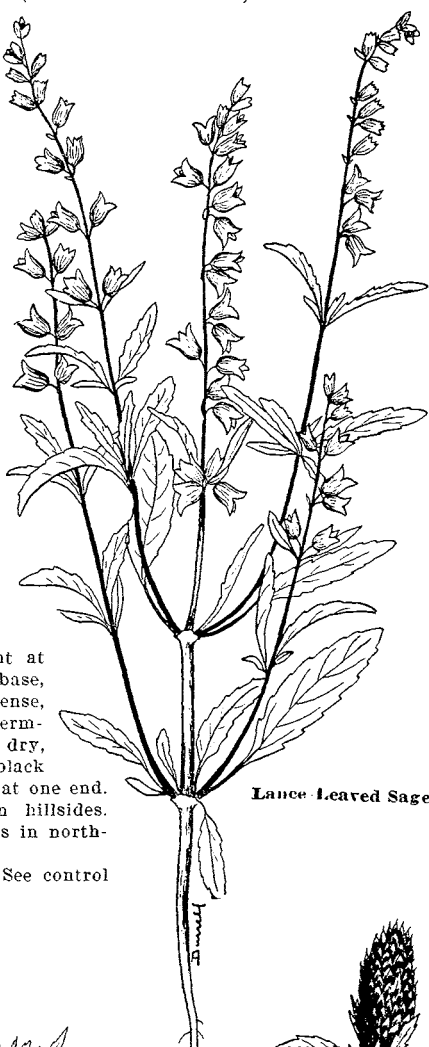
(*Moldavica parviflora*)

(*Dracocephalum parviflorum*)

OTHER NAMES.—American dragon-head.

DESCRIPTION.—Mint family. Native. Annual or biennial. Propagates by seeds. Rather stout, somewhat hairy, 6 inches to 2½ feet high. Stem four-sided, usually branched. Leaves thin, 1 to 3 inches long, lance-shaped or oblong, pointed or blunt at the apex, rounded or narrowed at the base, margins toothed. Flowers light-blue in dense, leafy-bracted clusters or heads, usually terminal, sometimes in upper leaf axils. Fruit dry, separating into four smooth, oval, dull-black nutlets (seeds) with mouth-like marking at one end. Grows in dry, gravelly, rocky soil, on hillsides. Rather wide range. Occasionally in fields in north-western Colorado.

CONTROL.—General control methods. See control of annuals and perennials.



Lance-leaved Sage

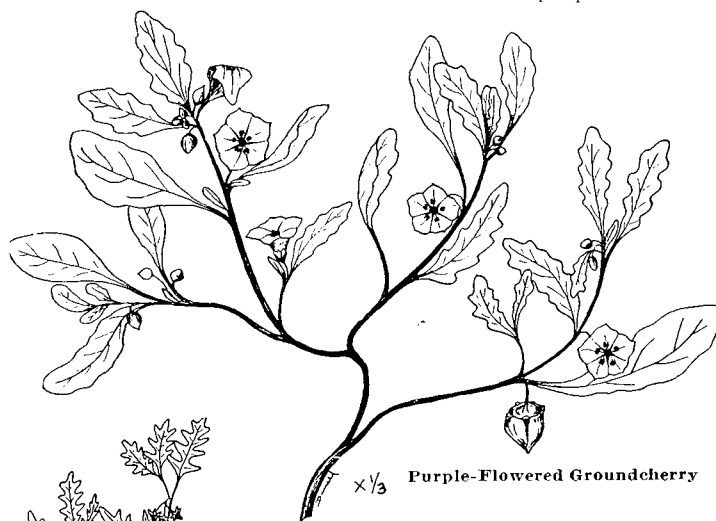


Dragonhead

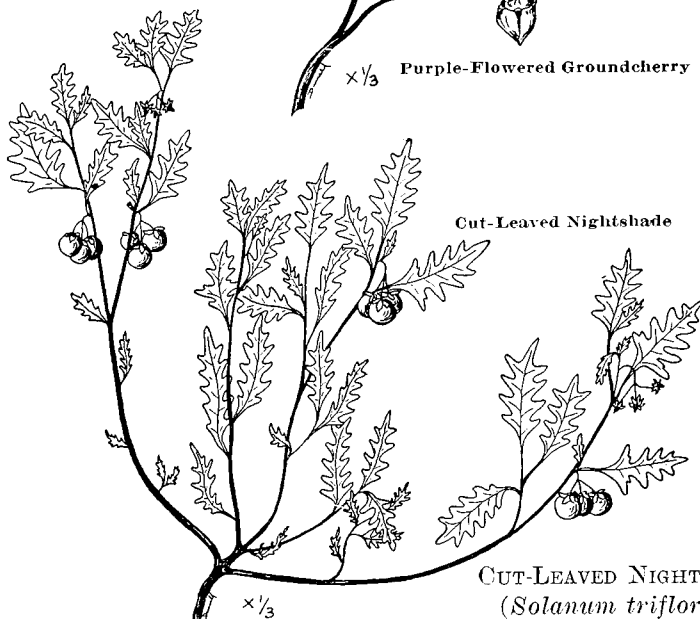
PURPLE-FLOWERED GROUNDCHERRY (*Quincula lobata*)

DESCRIPTION.—Potato family. Native. Perennial. Propagates by seeds. Low, spreading or prostrate, diffusely branched. Leaves oblong or spatulate, wavy-lobed, thick, veins prominent. Flowers violet or purplish, bell-shaped, about 1 inch across, center white. Fruit about as wide as long, sharply five-angled, sunken at the base. Seeds few, flattened, kidney-shaped, light-colored, rough-pitted. Common along roadsides, in fields and waste places in Plains region.

CONTROL.—General control methods. See control of simple perennials.



$\times \frac{1}{3}$ Purple-Flowered Groundcherry



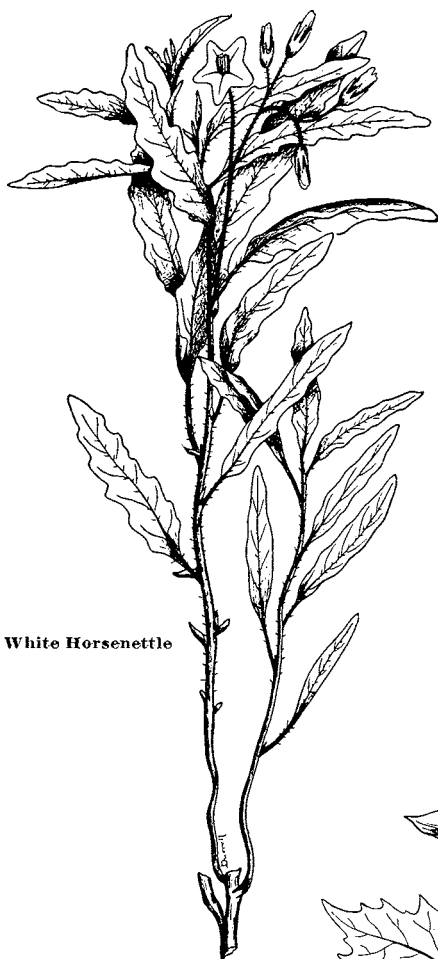
Cut-Leaved Nightshade

CUT-LEAVED NIGHTSHADE
(*Solanum triflorum*)

OTHER NAMES.—Wild tomato.

DESCRIPTION.—Potato family. Native. Annual. Propagates by seeds. Slightly hairy or smooth. Stem branched 1 to 3 feet high. Leaves 2 to 4 inches long, pinnatifid or pinnately lobed, pointed at the apex, the lobes somewhat pointed, seven to nine in number. Flowers white, $\frac{1}{2}$ to $\frac{1}{2}$ inch across, one to three flowers in a group. Fruit in the form of round, smooth berries, about $\frac{1}{2}$ inch in diameter. Seeds ovate, much flattened, light-brown, finely pitted. Grows on prairies and waste places and in cultivated land.

CONTROL.—General control methods. See control of annuals.



White Horsenettle

WHITE HORSENETTLE (*Solanum elaeagnifolium*)

(Noxious)

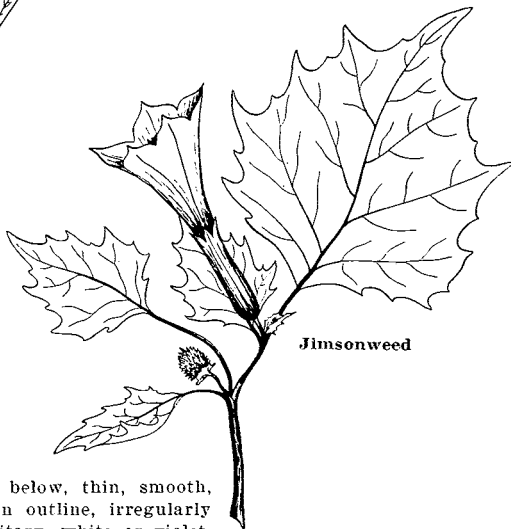
OTHER NAMES. — Silverleaf nightshade, prickly nightshade.

DESCRIPTION.—Potato family. Native. Perennial. Propagates by seeds and creeping roots. Entire plant silvery-white with a dense covering of very fine star-shaped hairs. Stems erect, slender, branching, 1 to 3 feet high, usually but not always armed with slender, sharp prickles. Leaves oblong to lance-shaped, 1 to 4 inches long. Flowers in clusters, violet or blue, five-lobed, about 1 inch across. Fruit a round yellow berry $\frac{1}{8}$ to $\frac{1}{2}$ inch in diameter. Grows on prairies, in waste places, and in cultivated fields, where it may become very troublesome.

CONTROL.—Clean cultivation. Sodium chlorate. See control of creeping perennials.

JIMSONWEED (*Datura stramonium*)

OTHER NAMES. — Jamestownweed, devils-apple, thornapple, stinkwort.



Jimsonweed

DESCRIPTION.—Potato family. Introduced from Asia. Annual. Propagates by seed. Stem green to purple, smooth or hairy when young, stout, 1 to 5 feet high, simple or branched. Leaves 3 to 8 inches long, dark-green above, lighter below, thin, smooth, with large veins, pointed-oval in outline, irregularly and sharply lobed. Flowers solitary, white or violet, five-lobed, trumpet-shaped, 4 inches long and 2 inches broad. Fruit a capsule, egg-shaped, about 2 inches long, densely prickly, enclosing many dark-brown, wrinkled, flattened seeds. Grows in fields and waste places and along roadsides.

Children have been poisoned by eating the seeds of this plant and by putting the flowers in their mouths. Also poisonous to livestock but seldom eaten.

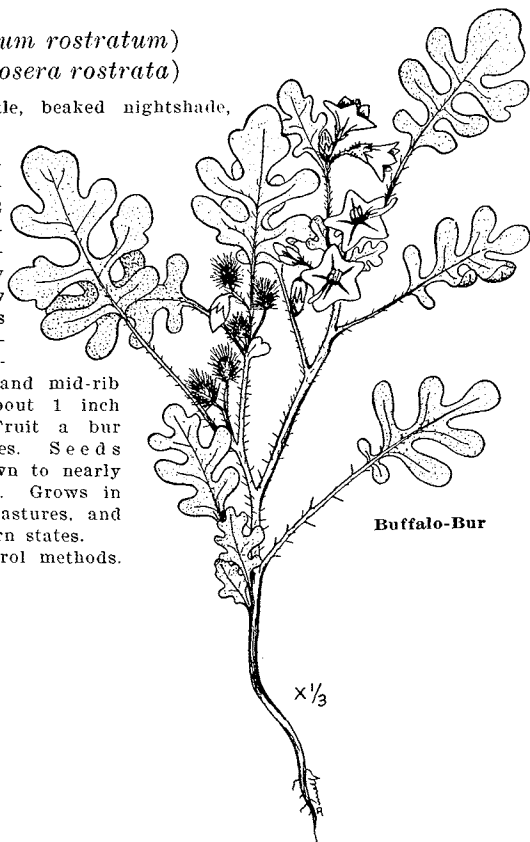
CONTROL.—Seed prevention. Cultivation and crop rotation. See control of annuals.

BUFFALO-BUR (*Solanum rostratum*)
(*Androsera rostrata*)

OTHER NAMES.—Horsenettle, beaked nightshade, Texas thistle, prickly potato.

DESCRIPTION.—Potato family. Native. Annual. Propagates by seeds. Stem 1 to 2 feet high, much branched, covered with yellowish, star-shaped hairs and strongly armed with slender yellow spines. Leaves 2 to 5 inches long with five to seven irregular lobes, covered with star-shaped hairs, the leaf stem and mid-rib prickly. Flowers yellow, about 1 inch broad, in open clusters. Fruit a bur armed with long, sharp spines. Seeds roundish, flattened, dark-brown to nearly black, wrinkled, rough-pitted. Grows in cultivated fields, meadows, pastures, and waste places, mostly in western states.

CONTROL. — General control methods. See control of annuals.



Buffalo-Bur



Matrimony-Vine

MATRIMONY-VINE (*Lycium vulgare*)
(*Lycium halimifolium*)

OTHER NAMES.—Boxthorn.

DESCRIPTION.—Potato family. Introduced from Europe. Tall climbing or trailing shrub sometimes forming dense thickets. Stems 6 to 25 feet long, sometimes spiny. Leaves narrow, oblong, $\frac{1}{2}$ to $1\frac{1}{2}$ inches long. Flowers purplish, turning greenish, $\frac{1}{4}$ to $\frac{1}{2}$ inch across. Fruit an orange-red oval berry. An ornamental escaped from cultivation. Grows along roadsides and in waste places, where it may become very troublesome.

CONTROL.—Cultivation. Sodium chlorate. See control of perennial weeds.

COMMON MULLEN (*Verbascum thapsus*)

OTHER NAMES.—Great mullen, velvet dock, woolly mullen, Jacobs-staff.

DESCRIPTION.—Figwort family. Introduced from Europe. Native of Asia. Biennial. Propagates by seeds. Stem 2 to 7 feet tall, stout, erect, simple or with one or two erect branches. Basal leaves oblong, 4 to 12 inches long, thick, light-green, densely woolly, narrowing to the base, forming a large, thick rosette on the ground. Upper leaves smaller, narrow, more pointed. Flowers yellow, $\frac{3}{4}$ to 1 inch broad, sessile, crowded on long, dense, cylindrical spikes. Fruit a capsule about $\frac{1}{4}$ inch long, cylindrical, filled with very many small brown seeds. Grows in meadows, pastures, and waste places. Livestock will not eat it.

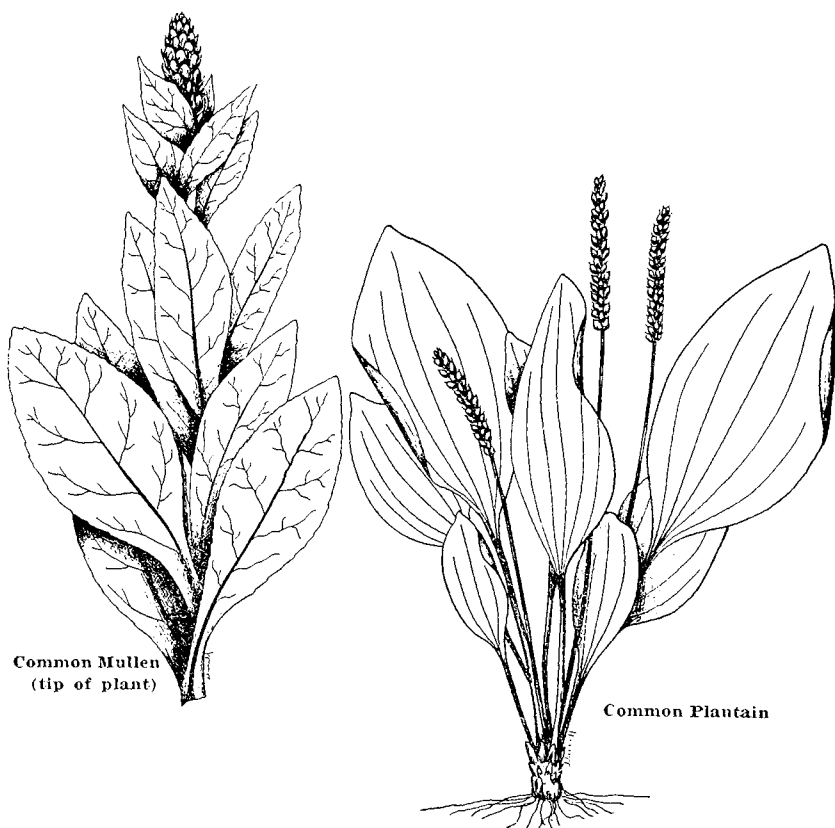
CONTROL.—Seed prevention. Hoe-cutting the fall rosettes. Cultivation. See control of biennials. (Illustration next page.)

COMMON PLANTAIN (*Plantago major*)

OTHER NAMES.—Broad-leaved plantain, greater plantain, dooryard plantain.

DESCRIPTION.—Plantain family. Introduced from Europe. Perennial. Propagates by seeds. Smooth or somewhat hairy. Leaves all basal, with long stems (petioles), firm in texture, blades oval, 1 to 10 inches long, with smooth or toothed margins. Flowers small, closely clustered on erect, slender, blunt spikes, 3 to 12 inches long. Seeds very small, dark-brown, irregular in shape. Grows in waste places and lawns throughout America. Chiefly injurious in lawns.

CONTROL.—Prevention of seeding. See control of simple perennials, also control of lawn weeds.

BROAD-LEAVED PLANTAIN (*Plantago rugelii*)

OTHER NAMES.—Redstem, plaintain, pale plantain.

DESCRIPTION.—Plantain family. Native. Perennial. Propagates by seeds. Similar to common plantain *plantago major* from which it differs in having longer, very slender flower spikes, which taper to a point and are crimson at the base; flowers not crowded. Leaves also larger, thinner, pale-green, with long, slender stems (petioles), crimson at the base. Seed small, dull, mostly black, usually oblong but irregular. Grows in fields, woods, and waste places, and in shaded yards and lawns. Widely distributed.

CONTROL.—Prevention of seeding. See control of simple perennials, also control of lawn weeds.
(Not illustrated)

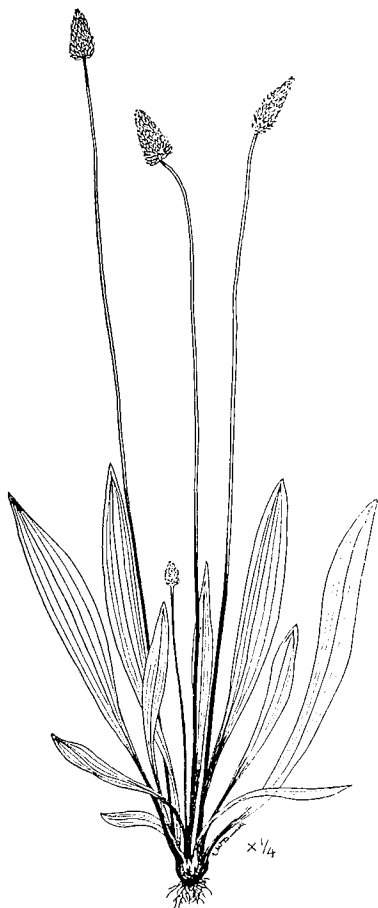
NARROW-LEAVED PLANTAIN (*Plantago lanceolata*)
(Noxious)

OTHER NAMES.—Buckhorn, ribgrass, English plantain, rattail.

DESCRIPTION.—Plantain family. Introduced. Perennial or biennial. Propagates by seeds. Numerous leaves growing directly from crown, 2 to 12 inches long, narrow, lance-shaped, slightly hairy with tufts of hairs at the base. Blade 3 to 4 inches long, ribbed, $\frac{1}{2}$ to 1 inch wide. Spikes very dense, cylindric, on slender, channeled stems, 6 to 24 inches long. Seeds shiny, brown, oblong, concave on one side, rounded on the other, very mucilaginous when wet. Grows in fields and waste places. Not widely distributed in Colorado.

A more pernicious weed than the broad-leaved plantains. Bad in lawns, red clover, and alfalfa. Invades meadows and pastures. Impairs quality of dairy products.

CONTROL.—Prevention of seeding. See control of simple perennials, also control of lawn weeds.



Narrow-Leaved Plantain



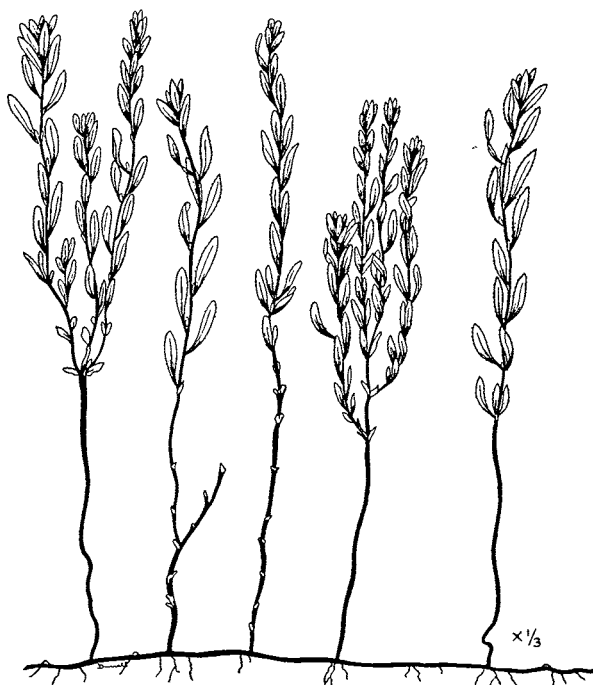
Large-Bracted Plantain

LARGE-BRACTED PLANTAIN (*Plantago aristata*)

OTHER NAMES.—Western buckhorn, bristly buckhorn, western ripplegrass.

DESCRIPTION.—Plantain family. Native. Annual and winter annual. Propagates by seeds. Leaves numerous, narrow, long, grass-like, dark-green, growing from a thickened root. Spikes densely flowered, 1 to 6 inches long, distinguished by prominent bracts, $\frac{1}{2}$ to 1 inch long, which subtend the flowers, supported by stout erect stems, 6 to 18 inches tall. Seeds dull, brown, narrow, boat-shaped, whitish on concave side. Grows in fields, meadows, and pastures, on dry plains and prairies. Generally distributed. (Illustration preceding page.)

CONTROL.—Prevention of seeding. See control of annuals and biennials.



Mouse-Ear Povertyweed

MOUSE-EAR POVERTYWEED (*Iva axillaris*)

(Noxious)

OTHER NAMES.—Marsh-elder, small-flowered marsh-elder, sumpweed.

DESCRIPTION.—Ragweed family. Native. Perennial. Propagates by seeds and by creeping roots. Erect or ascending, much branched, 6 to 18 inches high, smooth or slightly hairy. Leaves numerous, sessile, entire, rather thick, narrowly oblong, $\frac{1}{2}$ to $1\frac{1}{2}$ inches long, rough-hairy, harsh and stiff to the touch. Flowers in small heads which hang down upon short stalks from the axils of the upper leaves. Seeds deep-gray to almost black, wedge-shaped, $\frac{1}{10}$ inch long. Grows in cultivated fields, meadows, and waste places, in saline and alkaline soils. Distributed largely in western states.

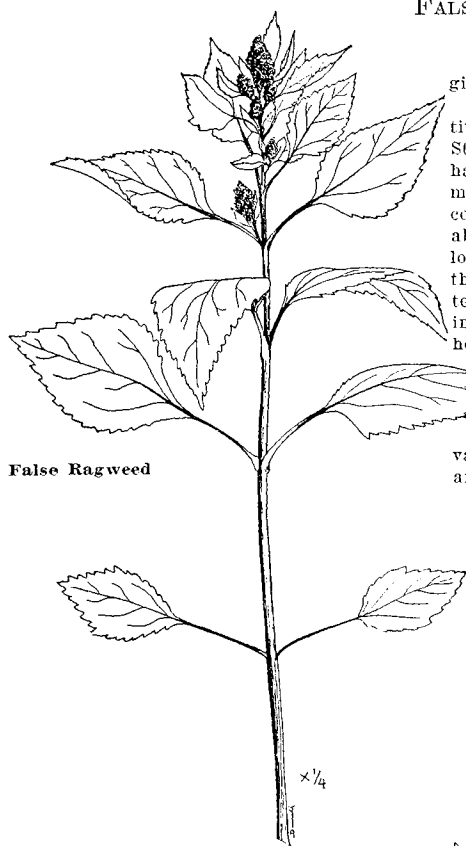
CONTROL.—Clean cultivation. Chlorates. See control of creeping perennials, also chemical control.

FALSE RAGWEED (*Iva xanthifolia*)
(Cyclachaena xanthifolia)

OTHER NAMES.—False sunflower, giant marsh-elder, bigleaf sumpweed.

DESCRIPTION.—Ragweed family. Native. Annual. Propagates by seeds. Stem stout, woody, much branched, hairy above, smooth below. Leaves mostly opposite, broadly ovate, pointed, coarsely and irregularly toothed, rough above, the lower ones often 6 inches long. Flowers in small, greenish heads; the heads about $\frac{1}{8}$ inch broad in large, terminal panicles and smaller clusters in the axils. Seeds usually five in each head, about $\frac{1}{8}$ inch long, light-brown to nearly black. Common to roadsides and waste places in western states.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annual weeds.



False Ragweed

GREAT RAGWEED
(Ambrosia trifida)

OTHER NAMES.—Horseweed, tall ambrosia, big bitterweed, kinghead.

DESCRIPTION.—Ragweed family. Native. Annual. Propagates by seeds. Stem stout, ridged, tough, woody, widely branched, 3 to 15 feet high. Leaves opposite, rough, hairy, usually deeply divided into three to five large, pointed, coarsely toothed lobes, or sometimes undivided, toothed or the upper ones entire. Staminate (male) flowers small, greenish, in saucer-shaped involucre, forming numerous drooping heads, more or less crowded in long racemes 6 to 12 inches in length. Pistillate (female) flowers clustered in the axils of the upper leaves. Fruit (seed) about $\frac{1}{4}$ inch long with a beaked crown. Common in fields and waste places, roadsides. Widespread.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annual weeds.



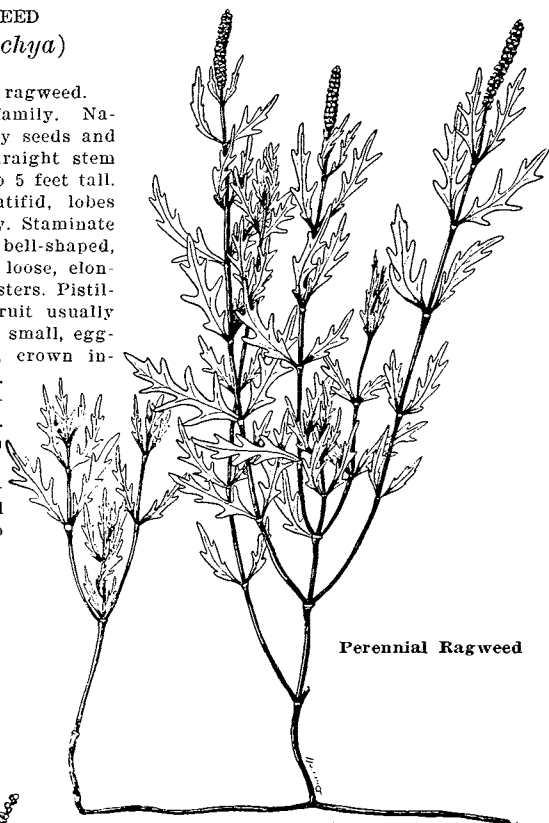
Great Ragweed

PERENNIAL RAGWEED
(*Ambrosia psilostachya*)
(Noxious)

OTHER NAMES.—Western ragweed.

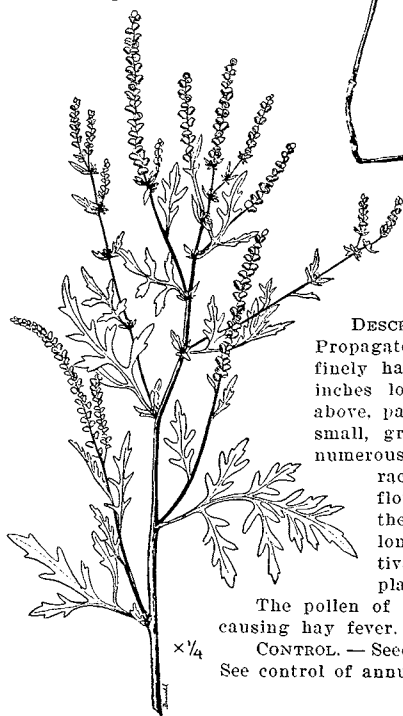
DESCRIPTION.—Ragweed family. Native. Perennial. Propagates by seeds and by creeping roots. Erect, straight stem with numerous branches, 1 to 5 feet tall. Leaves once or twice pinnatifid, lobes acute, rather thick, stiff-hairy. Staminate (male) flowers in small, bell-shaped, drooping heads, arranged in loose, elongated terminal or axillary clusters. Pistillate (female) flowers and fruit usually solitary in axils below. Seeds small, egg-shaped, hairy, short-pointed, crown inconspicuous or wanting. Grows in fields, along roadsides, and in waste places. Prefers moist fertile soil. In western states.

CONTROL.—Clean cultivation. Chlorates. See control of creeping perennials, also chemical control.



Perennial Ragweed

Common Ragweed



COMMON RAGWEED
(*Ambrosia elatior*)

(*Ambrosia artemisiaefolia*)

OTHER NAMES.—Bitterweed, Roman wormwood, wild tansy.

DESCRIPTION.—Ragweed family. Native. Annual. Propagates by seeds. Stem 1 to 6 feet tall, erect, finely hairy, much branched. Leaves thin, 2 to 4 inches long, once or twice pinnatifid, dark-green above, paler underneath. Staminate (male) flowers small, greenish, in cup-shaped involucre, forming numerous drooping heads, more or less crowded in racemes 1 to 5 inches long. Pistillate (female) flowers solitary or in clusters in the axils of the upper leaves. Fruit (seed) about $\frac{1}{8}$ inch long with a beaked crown. Common in cultivated fields, meadows, roadsides, waste places. Widespread.

The pollen of this plant is said to be especially bad in causing hay fever.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annuals.



Silverleaf Povertyweed

SILVERLEAF POVERTYWEED (*Franseria discolor*)
(*Gaertneria discolor*)

(Noxious)

OTHER NAMES.—White-leaved franseria, creeping ragweed.

DESCRIPTION.—Ragweed family. Native. Perennial. Propagates by seeds and by creeping roots. Erect or ascending, branched, 6 to 12 inches high. Leaves smooth, green above, whitish beneath with minute hairs, 2 to 5 inches long, bipinnatifid with narrow irregular lobes. Staminate (male) flowers in small drooping heads, usually in solitary, loose, elongated, terminal clusters. Pistillate (female) or fruiting flowers usually in pairs in axils below. Fruit (seed) a small bur armed with conical spines. Grows in dry soil, prairies, pastures, waste places, also in cultivated and irrigated fields. Common to Plains region of the West.

CONTROL.—Clean cultivation. Chlorates. See control of creeping perennials, also chemical control.

WOOLLY-LEAVED POVERTYWEED

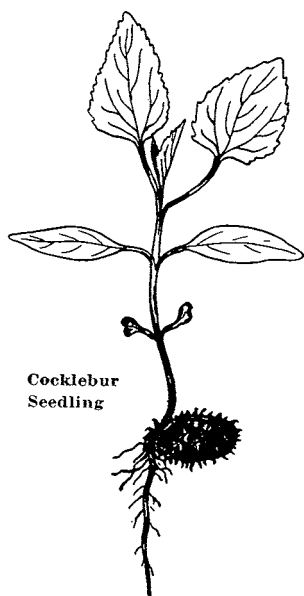
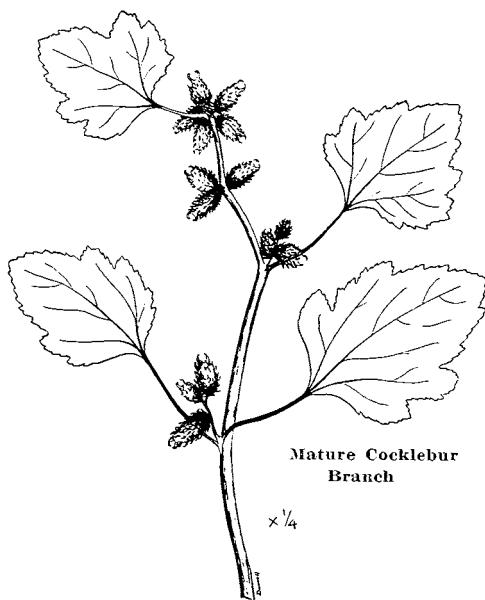
*(Franseria tomentosa)**(Gaertneria tomentosa)*

(Noxious)

OTHER NAMES.—Woolly franseria.

DESCRIPTION.—Ragweed family. Native. Perennial. Propagates by seeds and by creeping roots. Erect or ascending 1 to 3 feet high, branching from the base, white-woolly throughout. Leaves white-woolly on both sides or grayish above, usually three- to seven-lobed; lobes lance-shaped, usually toothed, the middle or terminal lobe much the largest. Staminate (male) flowers in small, drooping heads usually in solitary, loose, elongated, terminal clusters. Pistillate (female) or fruiting flowers usually solitary in the leaf axils immediately below. Fruit (seed) a small bur about $\frac{1}{4}$ inch long, awned with sharp, sometimes curved or hooked spines. Grows in moist, fertile soil, in cultivated fields, meadows, and waste places. Western Plains region.

CONTROL.—Clean cultivation. Chlorates. See control of creeping perennials, also chemical control.

Cocklebur
SeedlingMature Cocklebur
Branch

COCKLEBUR (*Xanthium commune*)

OTHER NAMES.—Clotbur, sheepbur, ditchbur.

DESCRIPTION.—Ragweed family. Native. Annual. Large, rough, branched plant, 2 to 4 feet high, having thick, coarse stems spotted with brown. Leaves rough and large, broadly ovate, with more or less wavy, toothed or lobed margins. Staminate (male) flowers in small, greenish, inconspicuous heads, in loose clusters at the ends of the branches. Pistillate (female) flowers below in dense clusters in the axils which develop into clusters of oblong burs, each about 1 inch long covered with coarse, hooked spines with two heavier hooks at the end. Each bur contains two seeds, one of which usually germinates the first year, the other the second year. Seeds black, slightly ridged, oblong, slightly flattened. Seeds may remain viable in soil for several years. Grows in cultivated fields, waste places, and along roadsides. Widely distributed.

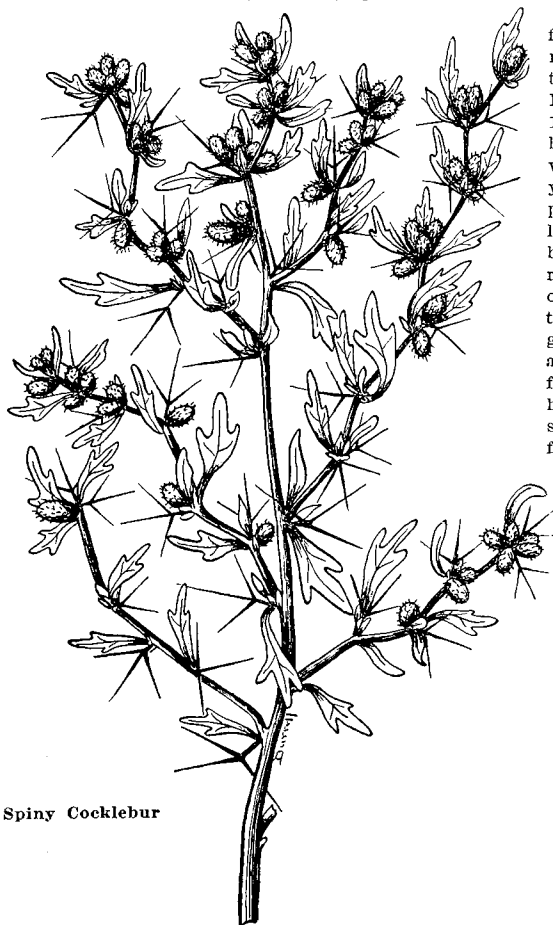
A bad weed anywhere but especially bad in sheep country, where the burs do great damage to wool. Seedlings poisonous to livestock, especially hogs.

CONTROL.—Seed prevention, cultivation. See control of annual weeds.

(Illustrations preceding page.)

SPINY COCKLEBUR (*Xanthium spinosum*)

OTHER NAMES.—Spiny clotbur, Spanish thistle.



Spiny Cocklebur

DESCRIPTION. — Ragweed family. Introduced from Europe or Asia. Common in tropical America. Annual. Propagates by seeds. Stems 1 to 3 feet high, much branched, covered with fine white hairs and armed with yellow, shortstalked, three-pronged spines, $\frac{1}{2}$ to 1 inch long, arising at the leaf bases. Leaves alternate, narrow, 2 to 5 inches long, lower ones lobed, upper ones entire, white-woolly underneath, green with white-hairy veins above. Staminate (male) flowers in small greenish heads forming short terminal spikes. Pistillate (female) flowers in axils below, each developing into a bur, $\frac{1}{2}$ inch long, covered with smooth hooked spines and with two short beaks at apex. Each bur contains two dark-brown, flattened seeds. Grows in cultivated fields and waste places.

CONTROL. — Same as for cocklebur.

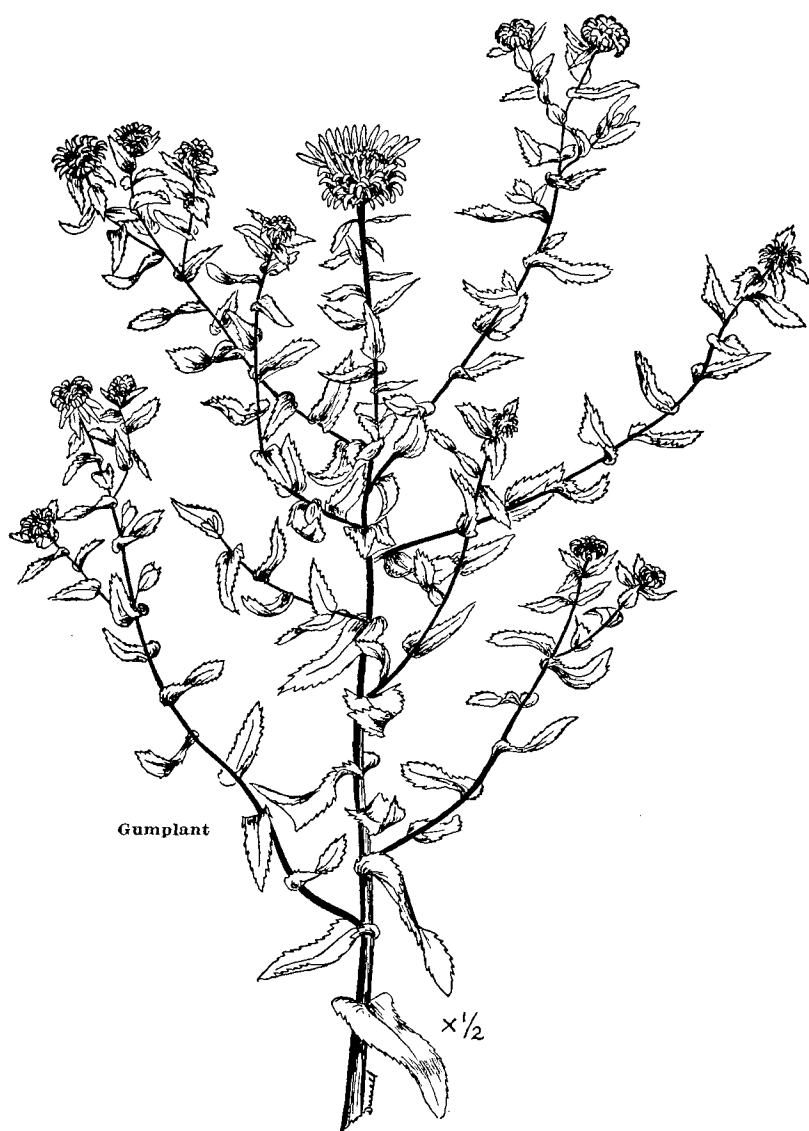


RAYLESS ASTER (*Brachyactis angusta*)
(*Aster angustus*)

DESCRIPTION.—Thistle family. Native. Annual. Propagates by seeds. Stem 6 to 24 inches high, freely branching, leafy, usually slightly hairy. Leaves narrowly linear, 1 to 4 inches long, pointed, somewhat hairy on the margins. Flower heads purplish, $\frac{1}{8}$ to $\frac{1}{2}$ inch across, erect, attached by short stems to the ascending branches, rays absent or rudimentary. Seed small, slender, with white hairy pappus.

Grows in wet, alkaline places, chiefly in western and northern states.

CONTROL.—General control methods. See control of annuals.



GUMPLANT (*Grindelia squarrosa*)

OTHER NAMES.—Broad-leaved gumplant, gumweed, rosinweed, tarweed, scaly grindelia.

DESCRIPTION.—Thistle family. Native. Perennial. Propagates by seeds. Stem smooth, erect, 1 to 2 feet high, freely branching. Leaves $\frac{1}{2}$ to $1\frac{1}{2}$ inches long, oblong to spatulate, somewhat blunt, spiny toothed. Flower heads bright-yellow, 1 to 2 inches across, resinously sticky. Seeds cream-color, oblong, rather deeply ridged, $\frac{1}{8}$ inch long. Grows in fields, meadows, roadsides, and waste places, mostly in western states.

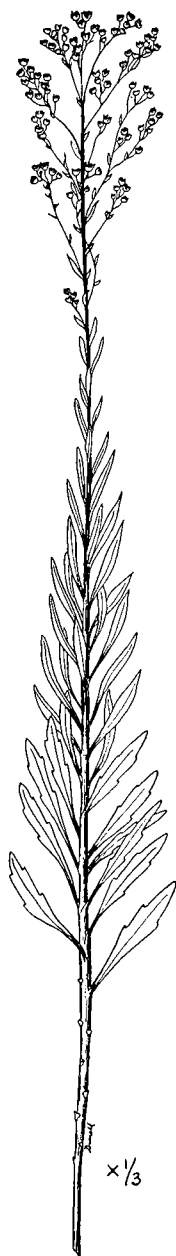
CONTROL.—Seed prevention. Cultivation, crop rotation. See control of simple perennials.

CANADA FLEABANE (*Leptilon canadense*)

OTHER NAMES.—Horseweed, marestail, bloodstanch.

DESCRIPTION.—Thistle family. Native. Annual or winter annual. Propagates by seeds. Stem erect, 1 to 10 feet tall, usually simple, sometimes branching at the base. Basal and lower leaves spatulate, sometimes sparingly and coarsely toothed; upper leaves lance-shaped to linear. Flowers numerous, small, about 1/6 inch across, in paniced clusters, the rays white, almost concealed by bell-shaped involucre. Seeds numerous, very small, flattened, with tannish, bristly pappus. Grows in fields, meadows, and waste places throughout the United States.

CONTROL.—General methods of control. Cultivation, crop rotation. See control of annuals and winter annuals.



Canada Fleabane



Common Sunflower

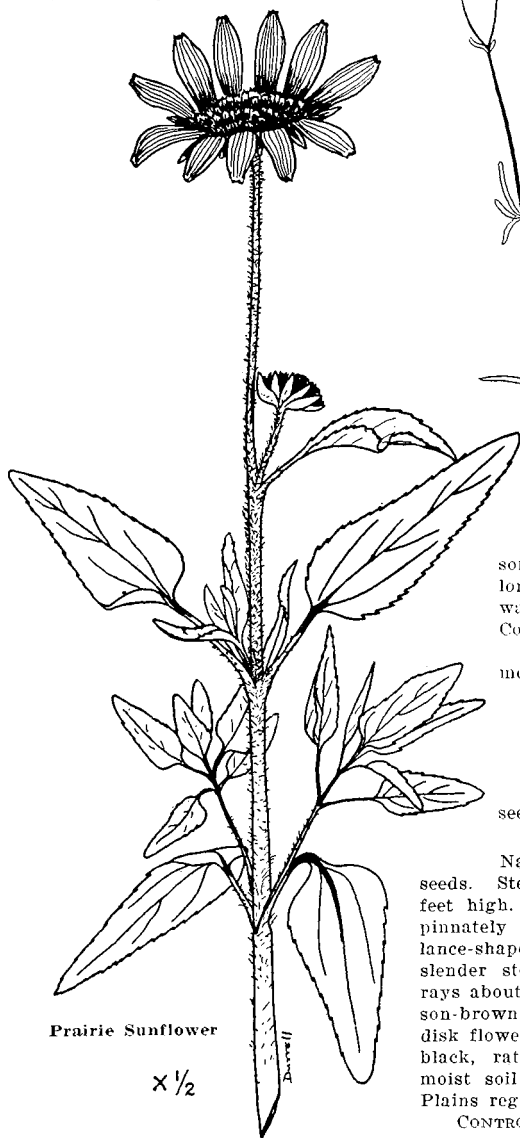
COMMON SUNFLOWER (*Helianthus lenticularis*) (*Helianthus annuus*)

DESCRIPTION.—Thistle family. Native. Annual. Propagates by seeds. Stem rough with stiff hairs, erect, stout, branched above, 3 to 6 feet high, sometimes much higher. Leaves mostly alternate, broadly oval, 3 to 12 inches long, somewhat pointed, margin toothed, rough on both sides. Flower heads 3 to 6 inches across with large, bright-yellow rays, central disk dark-purple or brown, made up of fertile florets. Seeds large, oblong, nearly smooth, grayish-brown. Grows in fields, meadows, waste places, and along roadsides. Common in the Plains region.

CONTROL.—General control methods. See control of annual weeds.

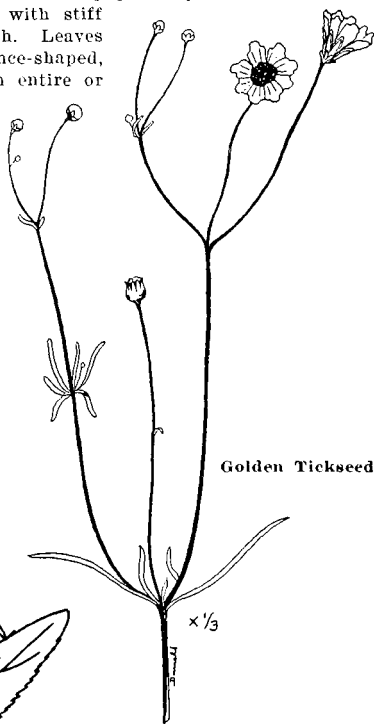
PRAIRIE SUNFLOWER (*Helianthus petiolaris*)

DESCRIPTION.—Thistle family. Native. Annual. Propagates by seeds. Similar to common sunflower but smaller. Stem rough with stiff hairs, erect, branched above, 1 to 3 feet high. Leaves mostly alternate, broadly oval, or broadly lance-shaped, 1 to 3 inches long, somewhat pointed, margin entire or sparingly toothed, rough on both sides. Flower heads $1\frac{1}{2}$ to 3 inches broad, with yellow rays; central disk brown, $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter, made up of fertile florets. Seeds



Prairie Sunflower

$\times \frac{1}{2}$



Golden Tickseed

$\times \frac{1}{3}$

somewhat hairy, about $\frac{3}{8}$ inch long. Grows in fields, meadows, waste places, and along roadsides. Common in the Plains region.

CONTROL.—General control methods. See control of annuals.

GOLDEN TICKSEED (*Coreopsis tinctoria*)

OTHER NAMES.—Garden tickseed, golden coreopsis.

DESCRIPTION.—Thistle family. Native. Annual. Propagates by seeds. Stem smooth, branched, 1 to $3\frac{1}{2}$ feet high. Leaves smooth, once or twice pinnately divided into narrow, linear, or lance-shaped divisions. Flower heads on slender stems, about 1 inch across; the rays about $\frac{1}{2}$ inch long, yellow with crimson-brown base or all crimson-brown; the disk flowers dark-purple or brown. Seeds black, rather slender, small. Grows in moist soil in fields and waste places in Plains region.

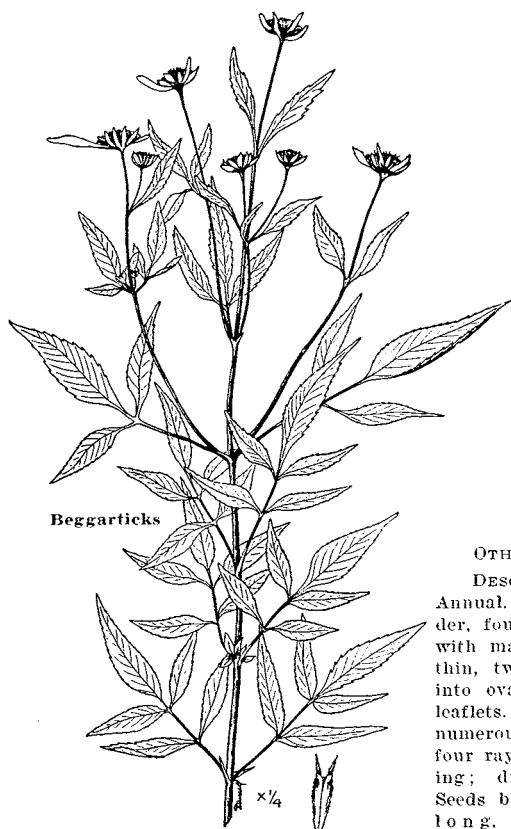
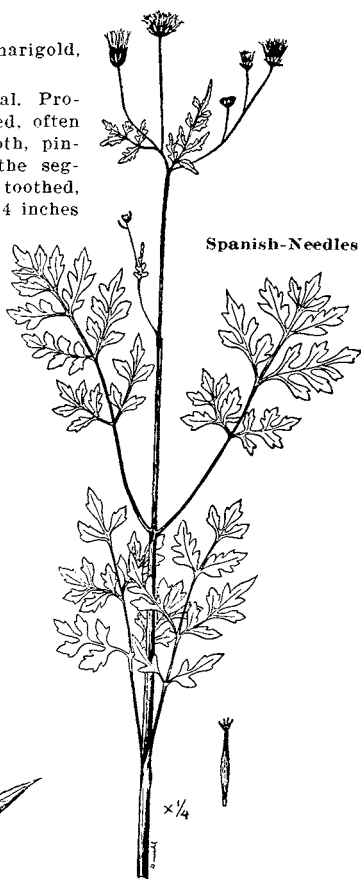
CONTROL.—General control methods. See control of annuals.

BEGGARTICKS (*Bidens frondosa*)

OTHER NAMES.—Bur marigold, rayless marigold, pitchfork weed, devils-bootjack, beggars-lice.

DESCRIPTION.—Thistle family. Native. Annual. Propagates by seeds. Stem smooth, erect, branched, often purplish, 2 to 3 feet high. Leaves thin, smooth, pinnately divided into three to five segments; the segments lance-shaped or oblong lance-shaped, toothed, pointed at the apex, narrowed at the base, 2 to 4 inches long, $\frac{1}{2}$ to 1 inch wide. Flower heads numerous, about $\frac{1}{2}$ inch high, usually somewhat broader; rays none or rudimentary, when present, very small and inconspicuous, yellow. Disk flowers tubular, orange-yellow. Seeds wedge-shaped, flattened, nearly black, $\frac{1}{4}$ to $\frac{1}{2}$ inch long, bearing two long, downward-barbed awns at one end by which they may readily become attached to passing objects.

CONTROL.—Seed prevention. Cultivation. See control of annuals.

**Beggarticks****Spanish-Needles****SPANISH-NEEDLES (*Bidens bipinnata*)**

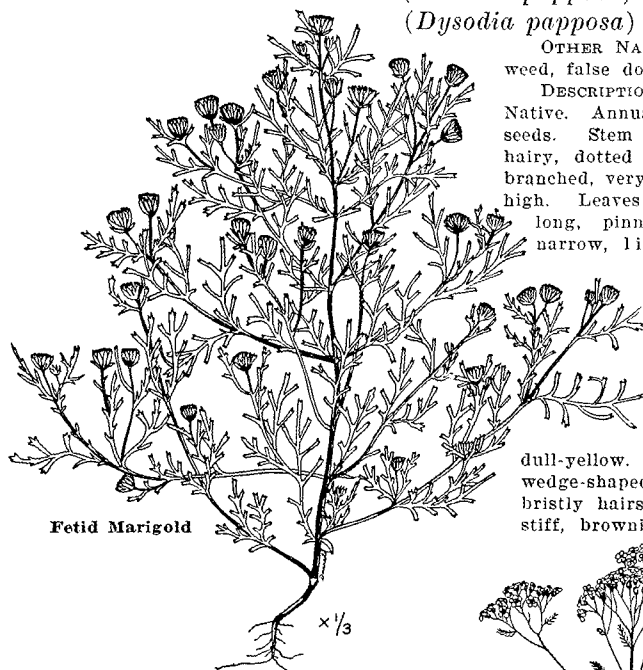
OTHER NAMES.—Cuckolds.

DESCRIPTION.—Thistle family. Native. Annual. Propagates by seeds. Stem slender, four-sided, erect, 1 to 5 feet high, with many spreading branches. Leaves thin, twice or thrice pinnately divided into ovate or oblong, toothed or lobed leaflets. Flower heads on long stems, numerous about $\frac{1}{4}$ inch broad; three to four rays, short, yellow, sometimes lacking; disk flowers yellow, five-lobed. Seeds brown, four-angled, $\frac{1}{2}$ to $\frac{3}{4}$ inch long, slender, spindle-shaped, usually

tipped with four rather diverging awns barbed downward by which they may readily become attached to passing objects. Grows in fields, gardens, and waste places.

CONTROL.—Seed prevention. Cultivation. See control of annuals.

FETID MARIGOLD (*Boebera papposa*)
(*Dysodia papposa*)



Fetid Marigold

OTHER NAMES. — False may-weed, false dogfennel, stinkweed.

DESCRIPTION. — Thistle family. Native. Annual. Propagates by seeds. Stem smooth or finely hairy, dotted with glands, much branched, very leafy, 6 to 18 inches high. Leaves $\frac{1}{2}$ to $1\frac{1}{2}$ inches long, pinnately divided into narrow, linear, or slightly spatulate, sharply toothed segments, also dotted with glands. Flower heads numerous, on short stems, $\frac{1}{4}$ to $\frac{1}{2}$ inch broad; rays few and inconspicuous; disk flowers dull-yellow. Seeds dark, small, wedge-shaped, covered with fine, bristly hairs and crowned with stiff, brownish bristles. Grows

in fields and waste places. Rather widespread.

The plant is strong-scented from the numerous glands on the leaves and stems.

CONTROL. — Seed prevention. Cultivation. See control of annuals.

YARROW (*Achillea millefolium*)

OTHER NAMES. — Milfoil, thousandleaf, bloodwort, sanguinary.

DESCRIPTION. — Thistle family. Native. Perennial. Propagates by seeds and spreading underground parts. Stem erect, simple or branched at top, smooth or somewhat hairy, 1 to 2 feet tall. Lower leaves narrowly oblong, sometimes 10 inches long, feathery, being finely dissected into numerous pinnatifid segments, hairy or smooth; upper leaves less divided and smaller. Flower heads small, numerous, in dense, flat-topped cluster; four to six rays, white, sometimes pink or purple; disk flowers tubular, yellowish. Seeds flattened, oblong, without crown of bristles.

The foliage of this plant is strong-scented, bitter to the taste. When eaten by cows it damages the quality of dairy products.

CONTROL. — Not as persistent as most creeping perennials. Cultivation. See control of perennials.



Yarrow

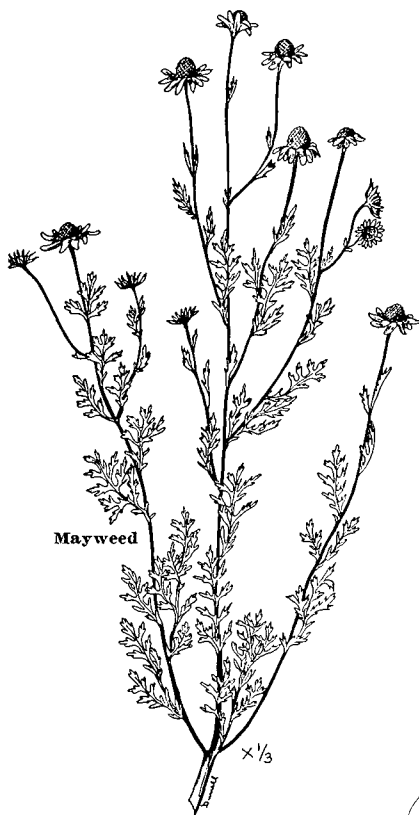
MAYWEED (*Maruta cotula*)
(*Anthemis cotula*)

OTHER NAMES. — Dogfennel, dillweed, fetid chamomile, stinking daisy.

DESCRIPTION.—Thistle family. Introduced from Europe. Annual or winter annual. Propagates by seeds. Stem smooth below but glandular and somewhat hairy above, erect, much branched and spreading. Leaves 1 to 2 inches long, finely twice or thrice divided into narrow, linear, almost thread-like, pointed segments. Flower heads numerous, solitary, terminal on the stalks; rays 10 to 18 in number, white, three-toothed, spreading; disk flowers tubular, yellow; disks hemispheric to cone-like. Seeds oblong, 10-ribbed, roughened with glandular tubercles, without crown of bristles. Grows in fields, gardens, and waste places throughout the United States.

This plant has a rank odor and an acrid taste.

CONTROL. — General control methods. Cultivation. See control of annuals and winter annuals.



Mayweed

COMMON BURDOCK
(*Arctium minus*)

DESCRIPTION.—Thistle family. Introduced from Europe. Biennial. Propagates by seeds. Stem erect, stout, grooved, rough-hairy, much branched, 2 to 6 feet high. Leaves dark-green, smooth above, light-green and woolly-hairy beneath, broadly ovate, blunt, more or less heart-shaped, with somewhat wavy margins. Flowers purple or white in numerous heads, on short stalks or sessile in the upper leaf axils or at the ends of branches. Involucre forming a prickly bur with numerous smooth or slightly woolly bracts tipped with hooked spines. Seeds (achenes) oblong, about 3/16 inch long, flattened, slightly curved.

Grows in moist fertile soil in neglected orchards, waste places, and along roadsides. A serious pest in sheep countries, where the burs are very damaging to the quality of the wool. Readily eaten by cows and imparts a bad flavor to the milk.

CONTROL.—Cultivation, seed prevention. See control of biennial weeds.



Common Burdock



Bull Thistle

x 1/2

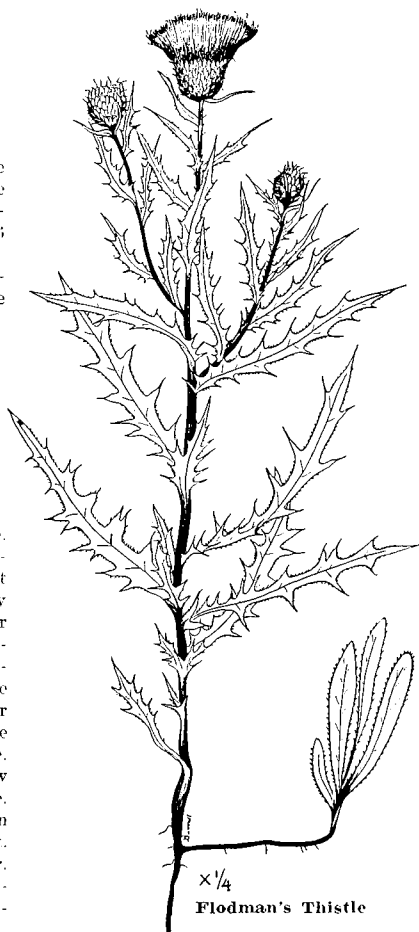
During the first year of growth the plant develops a deep taproot with a large spreading rosette made up of spiny, lance-shaped, deeply pinnatifid leaves, 3 to 6 inches long or longer.

CONTROL—Deep cutting first-year rosettes. Seed prevention. Cultivation. See control of biennials.

FLODMAN'S THISTLE
(*Cirsium flodmanii*)
(*Carduus filipendulus*)

DESCRIPTION.—Thistle family. Native. Biennial. Propagates by seeds. Stem rather slender, 1½ to 3 feet high, somewhat angled, more or less covered with cottony hairs. Leaves 3 to 6 inches long, more or less soft-hairy tufted above, densely white-cottony beneath, deeply divided into narrowly lance-shaped, acute lobes which are tipped with short, yellowish spines. Flower heads 1½ to 2 inches broad, solitary on the ends of branches, rose to reddish-purple. Involucre bracts linear, tipped with yellow prickles. Seeds brown, with hairy plume. Grows in meadows and river bottoms in western Plains region and somewhat east. Develops a rosette of leaves the first year.

CONTROL.—Seed prevention. Deep cutting. Cultivation. See control of biennials.



x 1/4

Flodman's Thistle



Canada Thistle
(Variety *vestitum*)



CANADA THISTLE (*Cirsium arvense*)
(*Carduus arvensis*)
(Noxious)

OTHER NAMES.—Field thistle, cursed thistle, small-flowered thistle, perennial thistle, hard thistle.

DESCRIPTION.—Thistle family. Introduced from Europe. Perennial. Reproduces by seeds and creeping roots. Stem erect, hollow, smooth to slightly hairy, 1 to 4 feet tall, simple, branched at top. Leaves set close on stem, slightly clasping, very variable, typically green on both sides, sometimes white-hairy, especially beneath, deeply and irregularly cut or pinnatifid into lobes or segments tipped with sharp spines, or sometimes entire or nearly so. Typical thistle flowers in numerous heads about $\frac{1}{2}$ inch broad and $\frac{3}{4}$ inch long, usually rose-purple, sometimes white, all flowers on a plant either male or female (dioecious), often resulting in little or no seed production. Seeds tan-color, about $\frac{1}{8}$ inch long, slightly flattened and curved, with white, downy tuft, easily detached. Grows in cultivated fields, pasture, meadows, roadsides, and waste places. Widely distributed in northern half of United States. A very persistent and troublesome weed.

Variety *integrifolium*.—Leaves smooth, margin entire, under surface white-hairy.

Variety *vestitum*.—Leaves somewhat pinnatifid, under surface white-hairy.

CONTROL.—Clean cultivation. Chlorates. See control of creeping perennials, also chemical control.

SALSIFY (*Tragopogon pratensis*)

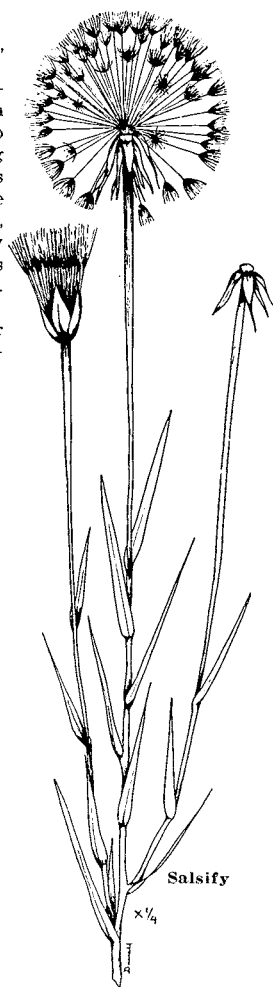
OTHER NAMES.—Meadow salsify, yellow goatsbeard, wild oysterplant, noonflower.

DESCRIPTION.—Chicory family. Introduced from Europe. Biennial or perennial. Propagates by seeds. Stem erect, slender, round, smooth, light-green, branched, 1 to 3 feet tall. Leaves alternate, linear, clasping, narrowing to long-pointed tips, 2 to 10 inches long. Flower heads 1 to 1½ inches broad, yellow, solitary and terminal; the rays five-notched at the tip. Seeds about ¼ inch long, rough with funnel-formed parachutes which at maturity are in large, conspicuous, tawny-colored blowballs. Grows in fields, meadows, waste places, and along roadsides. The flowers open at sunrise and are closed by noon.

CONTROL.—Prevention of seeding. Deep cutting or pulling. Cultivation. See control of biennials and perennials.



Russian
Knapweed



Salsify

x ¼

RUSSIAN KNAPWEED (*Centaurea picris*)
(*Centaurea repens*)
 (Noxious)

OTHER NAMES.—Turkestan thistle.

DESCRIPTION.—Thistle family. Introduced from Europe. Perennial. Propagates by seeds and black creeping roots. Erect, rather stiff, branched, 1 to 3 feet high. Young stems covered with soft gray hairs or nap. Lower leaves 1 to 2 inches long with toothed margins, becoming narrower, smaller, and with entire margins as they approach the top of

the plant, covered with short, stiff hairs, rough to the touch. Flowers in heads, like thistles, about ½ inch in diameter, lavender to whitish in color. Seeds chalky-white or grayish, oblong, about ⅓ inch long, bristly tuft, easily detached. Grows in cultivated fields, along ditch banks, fence rows and roadsides, and in waste places. Becoming generally distributed in western states. A troublesome pest, difficult to eradicate.

CONTROL.—Clean cultivation. Chlorates. See control of creeping perennials; also chemical control.



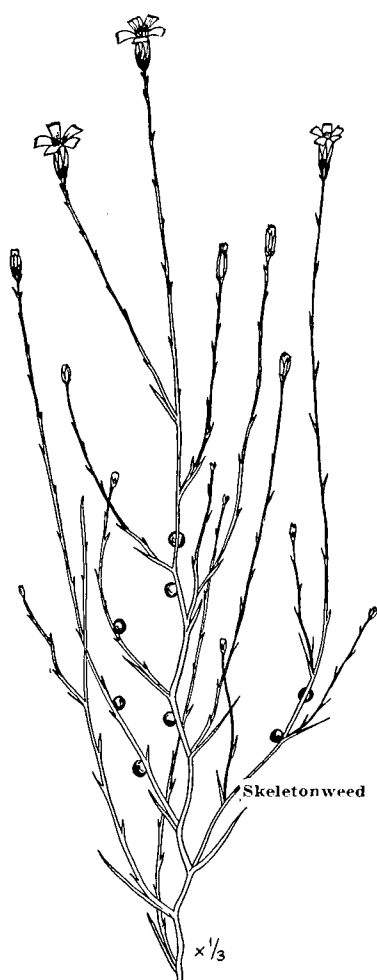
CHICORY (*Cichorium intybus*)

OTHER NAMES.—Succory, blue sailors, bunk, coffeeweed.

DESCRIPTION.—Chicory family. Introduced from Europe. Perennial. Propagates by seeds. Stem erect, round, hollow, sparsely hairy, much branched, and becoming purplish red and woody. Basal leaves tufted, spreading on the ground, 4 to 8 inches long, spatulate, coarsely toothed or lobed, narrowed into a long stem (petiole). Upper leaves much smaller, oblong or lance-shaped, lobed or entire, clasping. Flower heads numerous, one to four together, set very close on the nearly naked or bracted branches, 1 to 1½ inches broad, deep sky-blue, sometimes white, the rays five-notched at the tip. Seeds brown, five-ribbed, crowned with a row of pointed scales.

This is also a cultivated plant, the leaves being used in salads in America and Europe and as forage for animals in Europe. The long tap-roots serve as a substitute for coffee, or as an adulterant.

CONTROL.—Deep cutting or pulling. Cultivation. See control of simple perennials.



SKELETONWEED (*Lygodesmia juncea*)

OTHER NAMES.—Rush-like lygodesmia, skeleton pink.

DESCRIPTION.—Chicory family. Native. Perennial. Propagates by seeds. Stem erect, stiff, round, finely grooved, much branched, 6 to 18 inches high, from a tough, woody root. Lower leaves linear to narrowly lance-shaped, rigid, entire, pointed, $\frac{1}{2}$ to 2 inches long; upper leaves becoming smaller, the top ones mere scales. Flower heads erect, solitary and terminal, $\frac{1}{2}$ to $\frac{3}{4}$ inch broad, rosy-pink to light-purple, usually five-flowered; the rays five-notched at the tips. Seeds very slender, nearly $\frac{1}{4}$ inch long, with light-brown, hairy plume.

CONTROL.—Seed prevention. Cultivation. Crop rotation. See control of simple perennials.



Dandelion

DANDELION (*Leontodon taraxacum*)
(*Taraxacum officinale*)

OTHER NAMES.—Blowball, cankerwort, yellow gowan.

DESCRIPTION.—Chicory family. Introduced from Europe. Perennial. Propagates by seeds. Strong, fleshy taproot. Leaves basal, 3 to 13 inches long, sometimes forming a flattened rosette, other times more or less erect, oblong to spatulate, deeply and irregularly cut, the lobes or divisions somewhat acute, rarely nearly entire. Flower-heads bright golden-yellow, 1 to 2 inches broad, containing 150 to 200 flowers, borne on hollow stalks 2 to 18 inches high, maturing to form white, fluffy blowballs. Seeds light to dark-brown, $\frac{1}{8}$ inch long, ridged, oblong, bearing silky white parachute (pappus). Grows in fields, pastures, meadows, waste places, and lawns. Distributed throughout the civilized world.

CONTROL.—Seed prevention. Cultivation and crop rotation in fields. See control of simple perennials, also control of lawn weeds.

TRUE PRICKLY LETTUCE (*Lactuca scariola*)

OTHER NAMES.—Compass plant, milk thistle.

DESCRIPTION.—Chicory family. Introduced from Europe. Biennial. Propagates by seeds. Stem erect, round, smooth, or sparingly prickly at the base, leafy, branched, 2 to 5 feet tall. Leaves alternate, usually clasping, oblong or oblong lance-shaped, 1 to 10 inches long, pinnatifid or lobed with wavy, prickly-toothed margins, light-green with whitish midrib closely set with spines on the under side. Flower heads numerous, in large, open panicles, pale-yellow, $\frac{1}{4}$ to $\frac{1}{2}$ inch broad, on very short stems (pedicels), only a few opening at a time. Seeds brown, ridged, with white, silky-hairy pappus. Grows in fields and waste places. Widely spread.

When growing in the open, the leaves twist so that their edges point north and south; hence "Compass Plant."

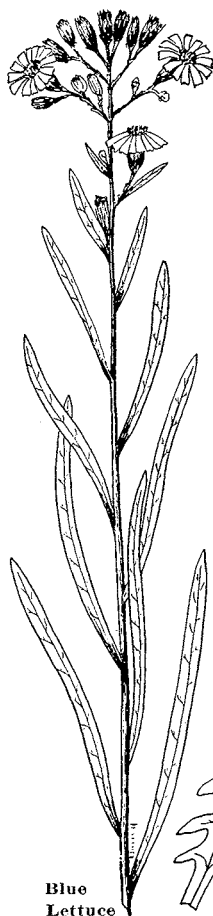
PRICKLY LETTUCE (*Lactuca virosa*)

(*Lactuca integrata*)

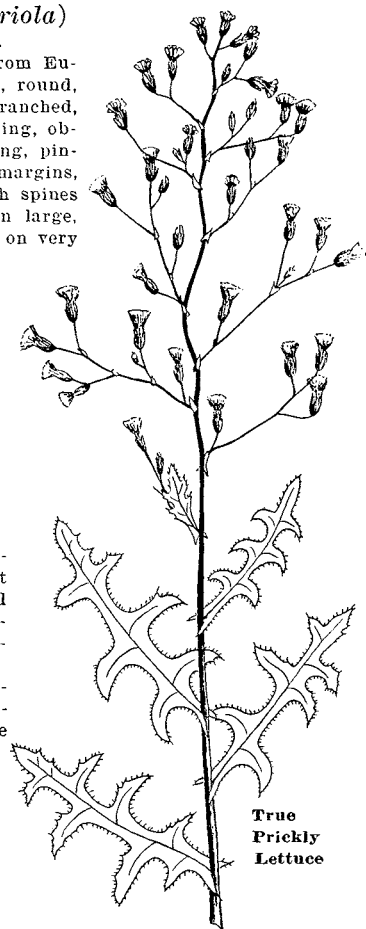
Similar to true prickly lettuce except that leaves are not pinnatifid or lobed but are characterized by wavy, prickly-toothed margins.

CONTROL.—Seed prevention. Clean cultivation. Crop rotation. See control of biennials.

(Not illustrated.)



Blue
Lettuce



True
Prickly
Lettuce

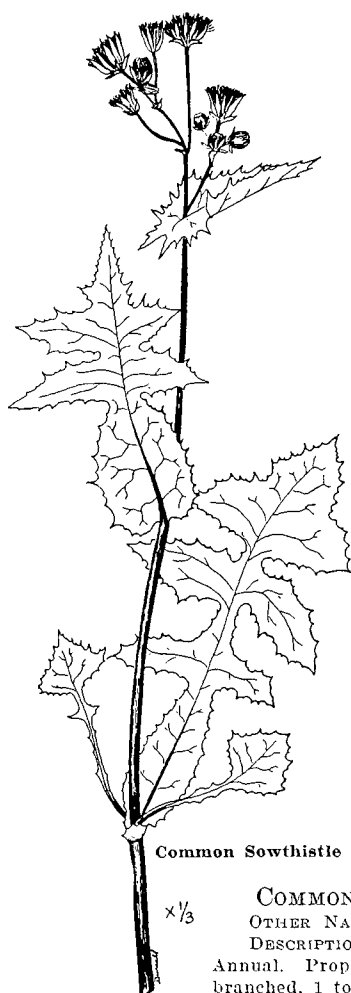
BLUE LETTUCE (*Lactuca pulchella*)

(Noxious)

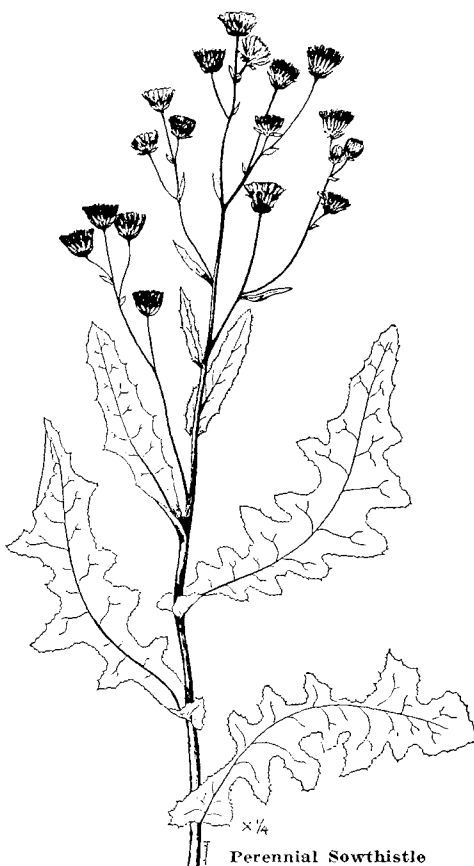
OTHER NAMES.—Showy lettuce, large-flowered blue lettuce.

DESCRIPTION.—Chicory family. Native. Perennial. Propagates by seeds and creeping roots. Stem erect, smooth, slender, unbranched except at top, 1 to 3 feet high. Leaves variable, 2 to 8 inches long, larger near base, being deeply lobed or pinnatifid, oblong to lance-shaped, becoming slightly toothed or entire, smaller, narrower toward top, all smooth and covered with light, powdery bloom. All parts of plant filled with milky juice. Flower heads about 1 inch broad, bright-blue or violet, rays toothed at tip. Seeds flattened, club-shaped, with ridged margins and finely grooved sides, bearing a white, silky parachute (pappus). Grows in grain fields, meadows, roadsides and waste places. Scattered in northern and western sections of United States.

CONTROL.—Seed prevention. Clean cultivation. Crop rotation. See control of perennial weeds.



Common Sowthistle



Perennial Sowthistle

COMMON SOWTHISTLE (*Sonchus oleraceus*)

OTHER NAMES.—Hares-lettuce, colewort, milk thistle.

DESCRIPTION.—Chicory family. Introduced from Europe.

Annual. Propagates by seeds. Stem smooth, green, somewhat branched, 1 to 6 feet tall, with milky juice. Leaves pinnatifid, 4 to 10 inches long, the terminal lobe large and triangular, the other lobes becoming smaller toward the base, the margins toothed with small, weak spines, upper leaves clasping, sometimes becoming lance-shaped, entire. Flower heads several or numerous, pale-yellow, about 1 inch broad, in more or less flat-topped clusters. Seed brown, slightly flattened, roughly ribbed, with white, silky pappus. Grows in fields, roadsides, and waste places throughout the United States.

CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annuals.

PERENNIAL SOWTHISTLE (*Sonchus arvensis*)

(Noxious)

OTHER NAMES.—Field sowthistle, creeping sowthistle, milk thistle, swine thistle.

DESCRIPTION.—Chicory family. Introduced from Europe. Perennial. Propagates by seeds and creeping roots. Stem erect, stout, smooth, 2 to 5 feet high, unbranched except at top. Leaves light-green, lower ones 6 to 12 inches long, deeply cut, side lobes pointing backward, upper leaves smaller, clasping, margins slightly toothed, prickly. All parts filled with milky juice. Flower heads resemble dandelion, bright-yellow, 1 to 2 inches broad. Seeds small, $\frac{1}{8}$ inch long, brown, flattened, ridged, crowned with tuft of fine white hairs (pappus). Grows in cultivated fields, meadows, along roadsides, in waste places. In eastern and western states.

CONTROL.—Clean cultivation. Chlorates. See control of creeping perennials, also chemical control.

DEFINITION OF TERMS

ACHENE.—A small, dry, hard, one-seeded fruit with a tightly fitting covering (ovary wall), resembling naked seed: buckwheat, sunflower, dandelion.

ACUTE.—Sharp pointed.

ANGLED.—Sides meeting to form angles or more or less pronounced edges.

ANNUAL.—A plant which is of only 1 year's duration.

APEX.—The tip.

APICAL.—At the apex.

ASCENDING.—Growing upward or up-curved.

AWN.—A slender, bristle-like appendage or attachment.

AXIL.—The upper angle where a leaf or a branch joins the stem.

AXILLARY.—Situated in an axil.

BIENNIAL.—Of 2 years' duration.

BIFOLIATE.—With two leaflets.

BIPINNATE.—Leaves twice divided into leaflets or segments along a common petiole (stalk).

BIPINNATIFID.—Twice pinnately cleft or divided to the middle.

BLADE.—The flat, expanded part of a leaf.

BLOOM.—Whitish, powdery coating as on cabbage or plums.

BRACT.—A more or less modified leaf subtending a flower, a flower cluster, or sometimes borne on the stem.

CALYX.—All the sepals together forming the outer floral envelope.

CARPEL.—A single ovary or one part of a compound ovary.

CLASPING.—The basal lobes of a leaf reaching partly or entirely around the stem.

COMPOUND.—Composed of several similar parts to form one whole.

COROLLA.—The floral leaves or petals forming the inner floral envelope; they may be distinct or more or less divided.

DECUMBENT.—Reclined on the ground but with the end ascending.

DENTATE.—Toothed.

FLORET.—A small flower, usually one of a head or cluster.

FOLLICLE.—A simple pod opening down the inner suture.

HOARY.—Grayish white, usually due to covering of fine, white hairs.

IMBRICATED.—Overlapping (as shingles on a roof).

INVOLUCRE.—A circle or whorl of bracts subtending a flower, a flower cluster, or a head.

LEAFLET.—A single division of a compound leaf.

LINEAR.—Long and narrow with sides nearly parallel.

LOBE.—A segment or division, especially if rounded, of a leaf or other organ.

LOBED.—Having lobes.

NERVE.—A vein or slender rib as in a leaf.

OVATE.—Egg-shaped in outline with broader end at the base.

PANICLE.—A somewhat loose and irregular, more or less spreading, compound flower cluster.

PAPPUS.—The bristles, awns, teeth, or scales which crown the achenes in the chicory and thistle families.

PEDICEL.—The stalk of one of the single flowers composing a flower cluster.

PEDUNCLE.—The stalk of a flower cluster or single flower.

PERENNIAL.—Of more than 2 years' duration, often lasting year after year.

PETAL.—One of the divisions of the inner floral envelope or corolla.

PETIOLE.—The stalk of a leaf.

PINNATE.—Compound with leaflets arranged along the sides of a common petiole or stalk.

PINNATIFID.—Pinnately cleft or divided to the middle.

PISTILLATE.—Having pistils; the female flower.

PROPAGATE.—To reproduce.

PROSTRATE.—Lying flat on the ground.

RACEME.—An elongated flower cluster, each flower attached to the single axis by a pedicel.

RACEMOSE.—Bearing racemes or raceme-like.

RACHIS.—An axis bearing close-set flowers; especially the axis of a spike as in a head of wheat.

RAY.—One of the flower stalks of an umbel; the strap-shaped marginal flowers in the thistle family.

RHIZOME.—A horizontal underground stem; a rootstock.

ROOTSTOCK.—A horizontal underground stem; a rhizome.

SEPAL.—One of the divisions of the outer floral envelope or calyx.

SESSILE.—Without a stalk of any kind.

SHEATH.—A tubular sheath; in grasses the lower part of the leaf which encloses the stem.

SPATULATE.—Narrowing gradually toward the base from a rounded apex; shaped like a spatula.

SPIKE.—An elongated flower cluster with flowers sessile or nearly so upon its axis (as a head of wheat).

SPIKELET.—Individual flowers or flower clusters which form the spike, especially in grasses.

STAMINATE.—Having stamens; the male flower.

STIPULE.—An appendage at the base of a leaf stem or on each side of the base.

TERMINAL.—At the top or at the end.

TRAILING.—Growing along the ground.

UMBEL.—An umbrella-shaped flower cluster having all the pedicels arising from the same point, as in the onion.

VIABLE.—Alive; especially with reference to seeds, capable of germinating.

APPENDIX

Colorado Pure Seed Law

The following extracts are from the Colorado Pure Seed Law :

Be it enacted by the General Assembly of the State of Colorado:

Section 1. The term "field seeds" as used in this Act shall be defined as the seeds used by farmers, and which include the seeds of red clover, sweet clover, white clover, alsike clover, alfalfa, Kentucky blue-grass, Canada blue-grass, timothy, brome-grass, orchard-grass, red-top, meadow fescue, oat-grass, rye-grass, and other grasses and forage plants, corn, flax, rape, wheat, oats, barley, rye, buckwheat and other cereals, field peas, grain sorghums and forage sorghums.

The term "vine seeds" shall include all varieties of cucumbers, cantaloupes, muskmelons, honeydews, casabas, pumpkins, squashes and watermelons.

Section 2. Every lot of field or vine seeds as defined in Section 1 of this act, except as herein otherwise provided, which is sold, or offered or exposed for sale within this State for seeding purposes in this State, and every lot of vine seeds held for export or exported from this state, either in bulk, packages or other containers of five pounds or more, shall have affixed thereto, in a conspicuous place on the exterior of the container of such field or vine seed, a plainly written or printed tag or label, in the English language, stating:

1. The commonly accepted name of such field or vine seed.
2. The name and full address of the person selling, or offering for sale, such seed.
3. The approximate percentage, which shall be within two percent by weight, of purity or freedom of such seeds from foreign matter, or from other seeds distinguishable by their appearance.
4. The name and approximate number per pound of each kind of the seed or bulblets or seed balls for the following named noxious weeds:

Any variety of the wild mustards, any variety of the clover and alfalfa dodders, or wild oats, any variety of the plantains, bind-weed or wild morning glory, any variety of the poverty weeds, crab grass, cheat, Canada thistle, cockle, sow-thistle, wild barley or squirrel-tail grass or hop clover, which are present in excess of one seed in five grams, or ninety seeds per pound of such field seeds.

5. The percentage of germination, which shall be within ten percent (10%), together with the date when such germination test was made.

6. The state or foreign country where the seed was grown and, if in Colorado, the locality, or plainly marked "Unknown."
7. All cantaloupe seed saved from the cull piles and melons left in the fields after shipping shall be plainly marked as "Cull Seeds."

Farmers and seed growers are exempt from the provisions of Section 2, with the exception of subdivisions 1, 2, and 7, when selling seed to dealers and under certain other circumstances, but must comply with the labelling law when selling seed to other farmers or growers for planting purposes. Growers or sellers of vine seeds are exempt from provisions of Section 2, with the exception of subdivisions 1, 2, and 7.

Colorado Pest Law

The following provisions appear in the Colorado Pest Law:

Section 3. Whenever the *majority* of the resident landowners within a township or a continuous territory desire to form a Pest Inspection District as hereinafter defined, they may file a petition for that purpose with the County Commissioners of the proper County. Said petition shall be addressed to the Board of County Commissioners of such county, and shall contain the boundaries of the proposed district, and a description of the land of each person signing such petition, and shall state that the said district proposed to be formed into a pest inspection district has been invaded or is in danger of being invaded by grasshoppers or other insects, *weeds* or plant diseases, or other pests except rodents, injurious to agricultural crops, trees, fruits or pasturage, naming the specific pests or diseases against which said petitioners desire to be protected. Such petition shall be signed by each landowner joining in the petition, by his own proper signature, and the date of the petition shall be the date of its filing in the office of the Board of County Commissioners. Any petitioner may revoke and cancel his signature to such petition at any time before filing the same, but not after such filing has been made.

Such petition must be filed with the County Commissioners during a regular or special session of the Board and must have the approval of the State Entomologist,

Such petition may, in addition to the matters hereinbefore set out, and if the signature of *two-thirds* of the resident landowners in such district be obtained thereto, but not otherwise, request the Board of County Commissioners, through its County Pest Inspector, to take charge of and supervise or do the work in connection with the control or extermination of the pest or pests named. The Board of County Commissioners shall pay all expenses as they occur, which shall include the actual cost of material, labor and other necessary expenses, but not any items of salary or expense of the deputies of the State Entomologist who shall supervise and direct such work.

The law further provides for the collection from the individual landowners of such sums as are expended by the Board of County

Commissioners in carrying on the work on such lands or, in the case of failure to collect, for the placing of the amount due upon the tax rolls to become a lien upon the property, and also, for a fine of not less than Twenty-five Dollars (\$25) or more than Three Hundred Dollars (\$300) for each failure to comply with the provisions of the act or orders given under the provisions of the act.

Colorado Weed Law

The Colorado Weed Law supplements the Pest Law in that it authorizes the Boards of County Commissioners to purchase materials and equipment, employ weed supervisors and other help, pay for such materials, equipment and services out of the general fund or a specially designated fund of the county, levy such taxes as are necessary to pay the obligations authorized not to exceed .5 mill in any one year, create "weed extermination areas", enter into contracts for controlling weeds within such areas, enter into cooperative agreements with state and federal agencies or departments, and classify land undergoing approved weed control treatment as grazing land for taxation purposes for a period not to exceed 3 years.

The law also provides that threshing machines and attending equipment operating in weed extermination areas shall be thoroughly cleaned in accordance with specified directions before moving from one farm to another within such area and before moving from the area.

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