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COLORADO WEEDS

By B. J. Thornton and L. W. Durrell

Colorado Agricultural College
Colorado Experiment Station
Fort Collins

The Colorado Agricultural College

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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, almost without exception, is an indication of poor or indifferent farming methods in the past.

In our 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 the farmers and landowners of its magnitude and increasing seriousness.[1]

If the farmer is to wage the battle against weeds successfully it is essential that he become better acquainted with them. He should know the weeds on his land and should become familiar with their habits and characteristics as the first step in formulating plans for their control. Any new weed should be viewed with suspicion and alarm, as a possible source of new difficulties, and its identity should be determined at once.

It is the object of this bulletin to provide such general information as will be of material assistance in combating the weed problem in Colorado. It is hoped that it will prove a serviceable guide on the farm and a useful reference in the agricultural classroom. The material, in the main, is not new, but is such as should be in the possession of every person interested in better farming and in improved farming conditions.

PART I.—CHARACTERISTICS AND HABITS OF WEEDS

Importance of Weeds

It has already been observed that weeds have been permitted to exact an enormous toll from our farms. In 1930 the Agricultural Service Department of the United States Chamber of Commerce, after careful investigation, estimated the annual loss thru 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

[1]See page 105 (Appendix).

this loss approximates one-third the value of all the farm crops produced during that year is startling evidence of the necessity of united efforts in bringing about its reduction.

As early as 1915 the weed loss in Iowa was estimated to be $25,000,000. In 1920 Indiana's estimated loss was $44,000,000; Pennsylvania's loss in 1925 was placed at $24,000,000 and Wisconsin's in 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.

On the basis of the losses experienced by these 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 and 20 million dollars. Whatever the exact amount may be it is far greater than is generally realized and will become larger as time goes on unless greater activity is evidenced in weed-control efforts.

How Weeds Cause Losses

There are many ways in which weeds are injurious and cause losses. While all of these losses cannot be entirely eliminated, a thoro knowledge of their causes and the application of this knowledge to farming practices will go a long way towards reducing them to the 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, lamb's quarters, and ragweed require as much, or more, water to produce a pound of dry matter as do corn, wheat, barley or oats. Weeds likewise compete with crop plants for the food material in the soil. Being very hardy they tend to shade, crowd out and take the place of desirable plants and the suppression of their growth is essential to satisfactory and profitable crop yields.

IMPAIR QUALITY OF FARM PRODUCTS.—The presence of weed seeds and small pieces of weeds in grain results in severe dockage at the market with the possibility of lowering the grade after the dockage is determined.

Weed impurities may cause grain to heat in storage, may render it unfit for milling, and may cause it to be worthless for seeding purposes. Alfalfa seed containing weed seeds is graded accordingly and is of reduced commercial value.

Weeds in hay may lower its grade materially with a consequent reduction in its market price. If the weeds are of a noxious or poisonous nature the hay may be almost unsalable.

Cockleburs and similar weed impurities in wool decrease its market value and may prevent its sale.

Dairy products, such as milk, butter and cheese, are often rendered unmarketable because of flavors or odors imparted to them as a result of the animal feeding upon certain weeds such as wild garlic, ragweed, wild onion, fanweed and giant marsh-elder.

INCREASE LABOR.—The presence of weeds necessitates additional operations in the preparation of the soil for planting and both time and soil moisture are lost as a result. Many cultivations are required during the growing season that are of no benefit other than to keep the weeds down. If it were not for weeds many of these operations could be profitably eliminated. Much extra labor and expense are incurred in the harvesting and handling of weedy crops as, for example, in binding, shocking and threshing weedy grain, in stacking weedy hay, in handling and hauling produce high in weed impurities, and in removing weed seeds from the small grains and crop seeds, preparatory to milling, sowing or selling for seed.

INCREASE COST OF EQUIPMENT.—Certain pieces of farm equipment must be designed for the express purpose of keeping down weeds. In many instances special weed machinery, designed to eradicate certain specific weeds or for the purpose of applying chemical weed killers, represents a considerable outlay of farm capital. The presence of weeds increases the wear and tear on the machinery used in growing and harvesting the crops and results in increased maintenance and replacement costs.

INCREASE IRRIGATION COSTS.—Weeds and weedy shrubs, such as the willow, growing along the banks and on the edges of irrigation canals and laterals may seriously impair the efficiency of these water carriers. The roots, stems and even the foliage may grow so far out into the water as to materially retard its flow and at the same time impede the movement of sand and silt to such an extent as to result in the narrowing of the channel and the consequent reduction of its carrying capacity. Certain water weeds are even worse because of their ability to grow further out into the streams and thus offer greater resistance to its flow. Water weeds may also become a source of trouble in irrigation reservoirs. Windblown weeds often accumulate in ditches, clog up headgates and diversion boxes and interefere with the distribution of water. Much labor and expense are involved every year in clearing ditches and removing the dirt deposited as a result of weed growth.

IMPAIR EFFICIENCY OF DRAINS.—Tile drains at various depths in the ground may become clogged with the roots of perennial weeds or shrubs and even the flow in open drains may be retarded and their efficiency impaired by weeds as in the case of irrigation canals.

DECREASE LAND VALUES.—The unsightly appearance of a farm over-run 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 the surrounding fields and entire farms have been abandoned as the result of their encroachment. Many banks and investment companies refuse to make loans on land that is known to be so infested.

HARBOR PLANT DISEASES AND INSECT PESTS.—Many of our weeds act as hosts to insect pests and to organisms causing plant diseases. The elimination of weeds is an important step in the control of many crop pests.

Curly top, a serious virus disease of the sugar beet, is peculiar to such weeds as common mallow, chickweed and lamb's quarters and is carried from these diseased plants to the sugar beet by an insect known as the sugar-beet leaf-hopper or "white fly" which breeds and hibernates upon these weeds. Other virus or mosaic diseases such as potato leaf-roll, spindle tuber, tomato, cucumber and melon mosaics may be transmitted from related weed species infected with the organism.

The Colorado potato-beetle lives on buffalo-bur, jimson-weed and the various nightshades, while the sugar-beet webworm prefers to deposit its eggs on lamb's quarters, Russian thistle and similar weeds. Grasshoppers seldom lay their eggs in cultivated fields but prefer the unplowed and weedy areas along fence rows, roadways, ditch banks, and other waste places. The dreaded nematode is capable of infesting the roots of many weeds and thus may be carried thru periods of crop rotations designed to bring about its destruction.

Blackleg and clubroot of cabbage, altho not common in Colorado, are caused by organisms which may also infect wild mustards. The organism which causes bean blight lives in certain wild legumes.

CAUSE LIVESTOCK LOSSES.—Millions of dollars are lost annually by the injury or death of livestock as a result of their eating poisonous or otherwise injurious plants. Larkspur, loco, whorled milkweed, death camas and other poisonous plants are found on certain of our 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 extremely difficult because of the conditions of their growth and, where practiced, involves considerable labor and expense.

Certain poisonous plants may be found growing in cultivated areas, in hay meadows, in tame pastures, in cultivated fields, in orchards, and along irrigation ditches and small streams, 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, orchards, and along fence rows and ditch banks. 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, its hybrids, and its cultivated relatives, the sorghums, may be extremely poisonous if grazed in a wilted or frosted condition or after being stunted by drouth.

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 digestive tracts of animals, sometimes with serious results. The accumulation in the digestive tract of these and similar plant parts, indigestible plant fibers and substances such as found in the Colorado rubber plant may, if excessive, cause death.

Nor are the victims of plant poisoning limited to livestock. Many instances have been related 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 cat-tails, tules or bulrushes, mana-grass, marsh-grass, pond weeds, Philotria, water cress and water plantains. 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 the fences in our plains area, serve to catch and hold the drifting sand and soil with the result that fences and even the adjacent highways may be entirely buried, necessitating digging out or rebuilding the fences and uncovering the highways. Enormous sums are spent each year in mowing, burning, treating with chemicals, or otherwise destroying the

weed growth along highways and railroad rights-of-way, which expense eventually falls upon the public in the form of taxes and increased transportation charges.

UNDESIRABLE FEATURES.—In addition to being the direct cause of serious losses on the farm and elsewhere, weeds are undesirable in many ways. Weeds growing along the highways, on the banks of the streams and in waste places are extremely unsightly. They mar the beauty of our lawns, our parks and our natural landscapes.

The pollen from some weeds is a source of hay fever. Coming in contact with such weeds as poison ivy, poison oak and nettles often results in severe poisoning. These maladies not only add to the discomfort of man but reduce his efficiency and in many instances necessitate medical attention and expense.

USES OF WEEDS.—Weeds may be considered as having some useful attributes. They have been found of some value in returning organic matter to the soil, in holding snow and preventing erosion in the winter months, and as a source of food for animals during times when other foods are scarce. However, the good weeds do is very slight and should be given little consideration as compared to the harm they do.

CHARACTERISTICS CONTRIBUTING TO THE SUCCESS OF WEEDS

Weeds, in the process of their development and in the battle for their existence, have acquired many characteristics peculiar to themselves which enable them to endure under adverse conditions and in competition with other weeds and cultivated plants. Cultivated plants, on the other hand, in the process of being developed by man, have been protected and nurtured to such an extent that they have lost many of the characteristics which would ordinarily enable them to live and propagate themselves in the face of adversity and competition. The majority of our crop plants would die out in a short time if left to shift for themselves, while weeds persist in spite of all our efforts to subdue them.

NATURAL HARDINESS AND ADAPTABILITY.—Weeds for the most part are extremely hardy. They are capable of enduring severe extremes in their living conditions both as to temperature and moisture and will mature seed under the most adverse circumstances. They are capable of quickly adapting themselves to a new environment even when introduced into sections distinctly different from their accustomed surroundings. We find many of the same weeds in all parts of the country, in high altitudes and in low altitudes, under dry conditions and under moist conditions, and while they may vary somewhat in their growth and appearance, as the result of their environment, they may still be recognized as the same plants.

SUCCESSFUL 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. It is evident that nature has made special provision for their rapid increase and growth under favorable conditions and for their continued existence over long periods of adversity.

Number and Size of Seeds Produced.—Many weeds produce enormous numbers of small seeds. The production of a large number of seeds is of the utmost importance in the establishment and spread of weeds. Small inconspicuous seeds often escape notice and are a serious source of contamination in impure crop seed. The numbers of seeds produced by representative plants and their comparative size, as indicated by the number per pound, is given in the following table. Alfalfa is included as a basis of comparison.

Name of Plant	Approximate number of seeds per plant	Approximate number of seeds per pound
Tumbleweed	6,000,000	2,000,000
Tumbling mustard	1,500,000	2,500,000
Purslane	1,250,000	2,000,000
Lamb's quarters	600,000	600,000
Russian thistle	150,000	260,000
Pigweed	100,000	1,200,000
Alfalfa	50,000	250,000

Viability of Weed Seeds.—The seeds of many species of weeds retain their viability over a long period of time, especially when buried in the soil. 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. When buried in moist sand 20 inches below the surface of the ground, seeds of shepherd's purse, peppergrass, mustard, purslane, chickweed, evening primrose, narrow-leaved dock and morning glory germinated after 30 years, while seeds of pigweeds, black mustard, curled dock and broad-leaved dock showed some germination after 40 years. In general the deeper seeds are buried the longer they retain their ability to grow, due, no doubt, to the lower temperature and the reduced supply of oxygen. 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

seeds that will not germinate for a considerable length of time after maturity. This characteristic is known as dormancy and is exhibited by wild oats, shepherd's purse, pigweed, peppergrass, cocklebur, ragweed and other plants. Dormancy does not permit the immediate germination of the matured seeds with their consequent destruction as seedlings at the approach of winter but delays their germination until the following spring when conditions are favorable to the growth and development of the young plants. This peculiarity also tends to extend the germination period over a considerable length of time, thus promoting a more or less continuous growth and assisting in tiding over unfavorable periods.

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 and is of the utmost importance in insuring the perpetual growth of weeds. This is well evidenced by 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	2250	98,010,000
Field in sod for 6 years	127	2133	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 or 2.5 million seeds to the

acre. When these figures are compared to the occurrence of weed seeds in the surface inch of the soil as given in the above tables, approximating 554 seeds per square foot or 24 million per acre under conditions of good farming, and 2,250 seeds per square foot or 98 million per acre under conditions of poor farming, we are able to appreciate the prevalence and extensive distribution of weed seeds in the soil. 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 cultivation and farming, a situation which, in the past, led farmers to believe in such impossible occurrences as wheat turning into cheat, or tame oats becoming wild oats, or even the spontaneous appearance of weeds from nowhere.

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 in the successful growth and spread of weeds.

Vegetative Reproduction.—Efficient as weeds are in the production of seeds, there are among their numbers those plants which do not depend entirely upon seeds for their reproduction. Such plants are capable of propagating themselves by vegetative means. Members of the lily family such as the field garlic, produce bulbs or aerial bulbs. Other plants such as silver-weed, Bermuda grass and grape-vine mesquite are characterized by runners or stolons which give rise to new plants wherever the joints come in contact with the ground as is characteristic of strawberry plants. A third type reproduces by means of root stocks (underground stems) or horizontal roots which grow out in all directions beneath the surface of the ground and give rise to new plants along their length. Because of the ability of the plants of this group to store enormous quantities of reserve food, they are for the most part, very difficult to eradicate and they constitute our worst weed enemies. Wild morning glory, Canada thistle and perennial peppergrass or whiteweed may be mentioned as being representative of this group.

INTRODUCTION AND DISSEMINATION OF WEEDS

Lists of weedy plants of every civilized country show a large percentage 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. Most of these plants have come from Europe. Within the United States the migration has been 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 and only eternal vigilance can prevent the addition of new weeds to those already present.

NATURAL AGENCIES.—Many of the activities and functions of nature are of considerable importance in assisting in the dissemination of weeds and the weeds themselves are often possessed of special adaptations enabling them to take full advantage of the opportunities offered.

Runners, Rootstocks and Horizontal Roots.—Plants which possess these structures are capable of spreading over rather large areas regardless of their seed production. Such spread is usually limited to a few feet each year but is very persistent. If pieces of the roots or rootstocks are broken off and carried away they may serve to start new areas at considerable distances.

Seed-Throwing Apparatus.—Some plants have mechanical means of projecting their seeds several feet from the plant, thus assisting the spread in a limited way. Certain spurges and vetches possess this characteristic.

Animals and Birds.—The seeds of many plants such as the 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 mucilagenous when wet and may be carried away by the feet or any part of the animal with which they come in contact. Both animals and birds may eat numerous weed seeds many of which pass thru 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 delicate parachutes such as the dandelion and prickly lettuce, or with a tuft of hairs as Canada thistle, milkweed and dogbane. Mature plants of Russian thistle, tumbleweed, tumbling mustard and other weeds may be broken loose and driven for miles before strong winds, scattering seeds along the way. 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, altho there may be exceptional instances where seeds may be carried greater distances by this agency.

Water.—Seeds of weeds may be washed considerable distances from the place of their 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 in 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.

MAN-MADE AGENCIES.—Man has played a far greater part in the introduction and spread of weeds than have the natural agencies, because his activities have been limited only by the limits of the earth. Man is almost entirely responsible for the introduction of new weeds and greatly augments the natural agencies in bringing about their establishment and local spread. Few new weeds have been introduced into a section 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 dispursed, impure farm seed is, without doubt, the most important. As early as 1672 such plants as shepherd's purse, quack-grass, dandelion, sow thistle, pigweeds, dog-fennel and burdock were reported as having been introduced into this country from England in grass and other crop seeds. The Russian thistle was first introduced into South Dakota in flax seed about 1873 and since then has spread into many states. Foreign wheat seed has been responsible for the introduction of weeds such as chess, cockle, mustard, wild oats and others. Alfalfa and clover seed have served to introduce weed seeds of smaller type such as sorrel, black bindweed, plantain, ragweed, Canada thistle and bull thistle. Perennial peppergrass or whiteweed, a native of central Europe and Asia, and Russian knapweed, a native of the Caspian Sea region of Southern Russia, two serious perennial weeds, have both been brought into Colorado in Turkestan alfalfa seed. Field bindweed, another serious perennial weed, has been distributed in sugar-beet seed imported from Europe, and is especially well established in the irrigated valleys where the sugar beet is grown.

Forage Crops and Grain.—Hay is not as important an agent 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 and feeding is carried on. History reports that Canada thistle was first introduced into the United States in hay brought from Canada to feed the horses of General Burgoyne's army. Canada thistle and other weeds may be found around old abandoned lumber camps. The railway construction camps of days gone by have been responsible for the wide distribution of many weeds thru the use of weedy hay. The feeding of weedy grain may also result in the spread of weeds since many

of the seeds may pass thru the digestive tracts of animals without injury and may then be scattered upon the fields in manure. Weedy straw used for bedding may be a source of contamination in the fields in a similar manner.

Irrigation Systems.—Irrigation systems with their developments for collecting and impounding water and distributing it over fertile farm lands, altho more limited in their scope, rank next to impure crop seeds as efficient means of weed-seed distribution. Here a natural agent, water, has been made many times more effective as a result of man's efforts. 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 are eventually scattered over the fertile fields as the water is applied to the crops.

In a series of tests carried on 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 weeds 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 ditch banks are more to be feared as a source of weeds than roadsides and that the early irrigation waters are the most heavily laden with weed seeds. Similar results were obtained in Canada in tests made to determine the number of weed seeds carried by irrigation water.

Farm Machinery.—All types of farm machinery may aid in the spread of weeds, especially in wet weather, when the seeds become attached to the implements and the 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 of perennial plants to other portions of the field or into other fields. Threshing machines, binders and hay balers may carry weed seeds from field to field and from farm to farm. Even automobiles are factors in weed distribution. In driving thru weedy fields or waste places weeds may become caught on the chassis and dragged for miles; numerous seeds are often collected by the running boards to be eventually scattered over great distances.

Packing Materials.—The material used in packing commercial goods such as crockery, glassware and china, 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 in the vicinity of 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 over from Europe for useful or ornamental purposes have escaped from cultivation to become some of the country's worst weed pests. Ox-eye daisy, rib-grass, 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. However, composting for 2 or 3 months will kill most weed seeds, altho 6 months may be required to kill all of them.

Common Carriers.—Railroads and highway trucks, incident to transporting cargoes of grain, hay, livestock and other farm commodities, scatter many weed seeds along the rights-of-way and the highways. Many unusual weeds are first found along the railroad tracks. Ships' cargoes carry weed seeds in the same manner and the ballast heaps around ocean and lake ports are always sources of new and interesting plants, some of which may become weeds.

HABITS OF GROWTH 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 of our 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: Lamb's quarters, pigweeds, Russian thistle, cocklebur, crab-grass, 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 before harvest time. Many weeds may grow both as summer annuals and winter annuals especially where the winters are mild. Examples of winter annuals are: Shepherd's purse, peppergrass, prickly lettuce, wild barley, fanweed, downy brome-grass, 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 after which it dies. Biennial weeds make up a comparatively small group among which may be listed burdock, bull thistle, hound's tongue, mullen, wild parsnip and common mallow.

PERENNIALS.—Perennial weeds are weeds which live for 3 or more years. They not only produce seeds as do annuals and biennials but also come up from the roots year after year. Our worst weed enemies are found in this group because of their persistent habits of growth and spread.

Simple Perennials.—The majority of simple perennials possess *root crowns* which produce new plants year after year, being supported by a fleshy taproot or, as in the case of the bunch grasses, 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.

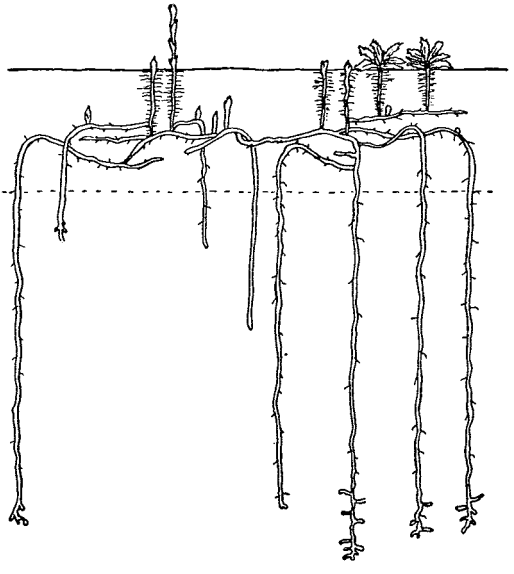
Some of these plants are capable of spreading to a limited extent by means of *stolons* or *runners* which are elongated stems that run along the surface of the ground and which give rise to new plants where the nodes touch the ground. The runners die during the winter but the roots survive and produce new individual plants the following season. Silver-weed and grape-vine 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.—The members of this group of weeds propagate themselves by means of seeds and creeping underground parts.

They are especially insidious and constitute our 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 thru the soil, may be either horizontal roots or rootstocks.

"Horizontal roots" are true roots and have the characteristic of roots, being 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 little 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 arising at the turning point and lateral roots continuing the horizontal growth. Field bindweed, Canada thistle, perennial sow thistle, leafy spurge, and sheep sorrel are examples of plants which spread by horizontal roots.



Diagramatic sketch of root system of a creeping perennial.

"Horizontal rootstocks" or "rhizomes," as they are often called, are underground stems and possess the typical stem structure altho 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, altho these structures tend to disappear with increasing age. The roots, aerial shoots and secondary branches always arise at the nodes and not adventitiously or irregularly as with horizontal roots. Rootstocks ordinarily grow at shallower depths than do horizontal roots and may turn upward at any time but never downward, any growth in that direction being made by roots arising at the nodes. Quack-grass, Johnson grass, salt-grass and western wheat-grass furnish excellent examples of underground stems or rootstocks.

Altho it is evident that the terms "root" and "rootstock" refer to distinctly different structures, there has been considerable con-

fusion in their use. Each term has been respectively applied to both types of structure without discrimination and the term "root-stock," especially, has been used to designate all forms of horizontal, spreading, underground growth. However, since there is a distinct difference in the two structures, and since this difference may account, in part at least, for the variation in the persistence of the different plants of this general type, and also have a direct bearing upon the specific methods best adapted to their individual control, it would appear advisable to recognize this difference and distinguish between the two types of structures in the use of the terms.

TYPES OF WEEDS

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

COMMON WEEDS.—The common weeds are considered as being those 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 the ordinary good farming practices. This group includes the majority of our weedy plants.

NOXIOUS WEEDS.—Noxious weeds are those weeds which are particularly undesirable because of certain troublesome characteristics. They may be unusually detrimental to crop production or they may be extremely difficult to control as a result of their prolific seed production, the extremely high viability and longevity of their seeds, the persistence of the individual plants, or their ability to spread by means of underground structures. The term "noxious" is an arbitrary one and the lists of noxious weeds vary greatly in different states. However, there are certain weeds such as bindweed, Canada thistle and others of this type which are recognized as being noxious in practically every state in which they occur. Weeds which may well be considered as noxious in Colorado are:

Annuals.—Wild oats, wild mustards, puncture vine, crab-grass, Fanweed, cocklebur, dodder.

Biennials.—Burdock.

Simple Perennials.—Dandelion, plantain, curled dock.

Creeping Perennials.—Bindweed (wild morning glory), poverty weeds, perennial peppergrass (whiteweed), Canada thistle, Russian knapweed, perennial sow thistle, leafy spurge, quack-grass, Johnson grass, perennial ragweed, blue lettuce, poison milkweed, wild licorice.

Other weeds which propagate by creeping underground parts and may at times prove troublesome are: Showy milkweed, Swainsonia, bouncing-bet, sheep sorrel, cypress spurge, Syrian bean-caper, yarrow.

PART II.—THE CONTROL OF WEEDS

Weeds will always be with us. They can never be entirely eliminated and their effective control will always require the expenditure of considerable time and effort as well as careful study and intelligent planning. Successful control of weeds is based upon the observance of two essential principles: (1) Guarding against and elimination of the sources of weed seeds, as far as possible. (2) The destruction of weeds already established, especially those creeping perennials which are not dependent upon seeds for their reproduction.

THE 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.—As we have already learned, impure farm seeds constitute a most important source of weed seeds and are often the means of introducing serious weeds not previously known to a section. Great care should be exercised in the selection of seed. It is never necessary to plant seed of unknown quality in Colorado. The state maintains a *seed laboratory*[1] which examines samples of seed sent in by the farmer and furnishes him, without charge, a full report as to the kind and number of weed seeds present and also as to the germination of the crop seed. In addition the Colorado Pure Seed Law[2] requires that all farm seed which is sold or offered for sale shall be fully labelled as to its percentage purity and as to the name and number of the noxious weed seeds in excess of 90 per pound. However, the planting of crop seeds with as many as 90 noxious weed seeds per pound or even considerably less than this number might result in the wide-spread introduction of some very undesirable weeds. For this reason only seed of the very highest purity should be purchased regardless of whether or not the presence of noxious weed seeds is shown on the label. The safest way in all cases is to have the seed tested before planting. Another safeguard is to buy seed from a qualified dealer who knows seeds and who has been found to be reliable in the past. Seed that is guaranteed to be free from noxious weed seed, such as the registered seed of Colorado and other states, is a profitable investment, not only because of its freedom from impurities but also because of the increased yields obtained by planting seed of this type.

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

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[1]Address: Colorado Seed Laboratory, Fort Collins, Colo.

[2]See page 105 (Appendix).

the situation to a considerable extent 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, haybalers and the equipment accompanying them, be thoroly cleaned before being brought onto his premises and when being moved from field to field. 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.—This source of weed seed may be largely taken care of by composting the manure for a period of 2 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.

THE CONTROL OF COMMON WEEDS

Altho the common weeds are considered as being those weeds 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. If permitted to grow they may be just as injurious and just as great a source of losses as weeds ordinarily considered more serious. The destruction of weeds pays immediate dividends in the benefits received by the growing crops and deferred dividends in the reduction of future control costs resulting from the prevention of seed formation.

TRUE ANNUALS.—Annual plants live for one season and propagate only by seed. The prevention of seed formation is therefore at once 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 produce new plants thruout the summer and for several years as they are brought under favorable conditions by frequent cultivations and by plowing. In fact, the cultural practices should be such as to encourage germination of these seeds in order to reduce this source of weeds as rapidly as possible. New weeds will also be brought in from outside sources and must be continually guarded against. The following general methods of controlling the common weeds are utilized in the control of biennials and perennials as well as annuals.

Cultivation.—The oldest, the most effective, and the most generally satisfactory method of controlling weeds is by cultivation. Cultivation of annual weeds may be practiced 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. For this reason the greatest good is accomplished by frequent cultivations in the spring. Repeated surface tillage kills the seedlings that have developed, and stirring up the soil causes the germination of others with their subsequent destruction. Large areas can be easily gone over with such implements as the harrow or the weeder which are effective in destroying seedlings but of little value after the plants have become established. These tools may be used effectively after the crops have been planted and even after they have attained considerable size, the slight damage done being small as compared to the beneficial results derived from the destruction of the seedling weeds.

When the growing crops become too large to permit further tillage of this kind, the cultivation of inter-tilled crops must be continued with different type tools with such frequency as will prevent the weed growth interfering with the development of the cultivated plants. Hand-hoeing should be resorted to occasionally in order to destroy those weeds which escape the cultivator and which, if not destroyed, will become a source of enormous numbers of weed seeds. Planting in checkrows, where the 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 obtained considerable size or which are growing on areas where cultivation is too costly, impractical or impossible. Care should be taken, however, not to allow the plants 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 arise from the remaining stubs and produce seeds unless again cut off. The frequent mowing of weeds growing in waste places, along ditch banks and roadsides, is of value in the elimination of these sources of weed seed.

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.—Altho weeds should never be permitted to mature seeds, wherever such has occurred the plants should be burned as they stand. Cutting and piling or raking in windrows is not to be desired because of the shattering out of the seed 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.

Weed burners of all sizes are available on the market and have been used extensively by the railroads in keeping their rights-of-way free from weeds. Smaller types may be of value in destroying weeds along fence rows, ditches, and in other inaccessible places. They are effective in killing ordinary plants in all stages, but are most economically operated when the weeds are small. Weed burners are no more effective in killing perennial weeds than mowing, hoeing or cultivating.

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. Such weeds as wild oat and the mustards are especially bad where land is continuously cropped to grain because their seed is matured early and scattered back on the land in the process of harvesting. Such weeds can only be successfully controlled by summer-fallowing or by the introduction of a cultivated crop. A carefully planned rotation involving inter-tilled, hay and grain crops is at once the most practical and efficient means of controlling most weeds and but little extra effort is required to complete the control program. The other advantages of crop rotation need not be mentioned.

WINTER ANNUALS.—Altho 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 frequent shallow cultivations are valuable at that time in destroying the seedlings and young plants. The over-wintered plants start a vigorous growth in the early spring and a somewhat more severe cultivation is required for their destruction than in the case of the seedlings of annuals. As a result of their strong start, winter annuals grow very rapidly and reach maturity early in the season. For this reason they must be cut down at an earlier date than many of the annual weeds, if seed formation is to be prevented, and unless they are watched closely they may be producing seed before one is aware of the fact.

The control of weeds in general and of winter annuals especially is extremely difficult where land is continuously cropped to the small grains. Harrowing or discing the stubble immediately after harvest may encourage the germination of many seedlings which may be

killed by subsequent cultivations or by fall or spring plowing. Spring cultivations before the crop is planted and repeated harrowing afterwards will destroy many weeds. In some sections repeated spring harrowing of the fall-sown grains has been successfully employed in reducing the weed growth. When the weeds become too bad under such conditions it is often necessary to put in a carefully cultivated row crop or resort to summer fallowing in order to put the land in shape for profitable production.

BIENNIALS.—Altho biennials require all of two seasons to complete their growth, they reproduce only by seed and their control is essentially the same as for annuals and winter annuals. The first season's growth may be treated as an annual and the second season's growth as a winter annual. However, mowing is not as effective as in the case of annuals or winter annuals because the crowns of biennials may send up new shoots, which, unless cut off repeatedly, will eventually produce seed. Cutting off below the crown is much more effective than mowing in that it prevents this regrowth.

SIMPLE PERENNIALS.—Simple perennials differ from annuals and biennials only 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 annuals and biennials. Mowing and similar operations may be somewhat unsatisfactory because of the ability of the roots to produce new tops over a period of years and in some instances deep root cutting may be required to bring about the plant's destruction.

The members of this group that develop stolons do not depend entirely upon seed for their reproduction and may even be considered as creeping plants. However, the surface runners die out each winter and comparatively little difficulty is experienced in destroying the individual plants that remain.

THE 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 as being noxious do not differ greatly 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. 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.

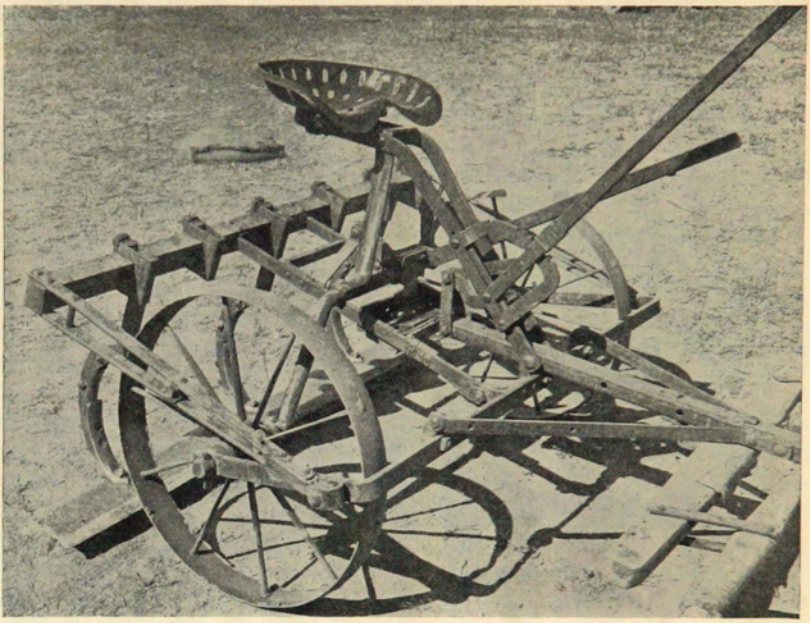
CREEPING PERENNIALS.—Our most serious weed pests and the ones which are by far the most troublesome are the creeping perennials. They not only reproduce by means of seeds but also by means of creeping underground parts which enable them to spread out in all directions and take complete possession of more and more ground each year.

We are satisfied with the "control" of most weeds which implies the reduction of their numbers to a point where they do not seriously interfere with crop production. However, complete elimination or "eradication" should be the objective in the case of creeping perennials, if at all possible, since their presence stands as a constant menace to farming operations. Once these weeds are eradicated they need never again become a serious problem since they may be almost as easily destroyed in the early stages of their growth as the common weeds. However, a sharp lookout should always be maintained for their first appearance and their destruction brought about before they have had time to become established.

There are instances where weeds of this kind have become so generally established that the use of special methods designed to keep them under control has been more practicable and economical than attempting their eradication. Farming under such conditions involves considerable additional labor and expense and is far from satisfactory if not entirely discouraging. Since creeping perennials propagate both by seeds and underground parts, their successful eradication depends upon the prevention of seed production and the destruction of the roots or rootstocks. This may be accomplished by the application of special methods which may involve digging up and destroying the underground parts, starving out the plants by preventing the development of any top growth, or poisoning thru the use of chemicals. Sometimes a combination of methods may be utilized to advantage.

Experimental efforts are in constant progress in an attempt to work out new and improved methods for the control and the eradication of weeds. In view of this fact it is always advisable, before undertaking a weed-eradication program, to write to the State Experiment Station for the latest information on the subject. However, it should be kept in mind that whatever method of eradication is adopted its successful culmination will require determined and persevering effort. There is no panacea for our weed troubles.

Hand Methods.—Hand methods are, of course, only applicable to small infestations of weeds. In one method the whole weed area, and for some distance beyond the margin, is carefully dug up with



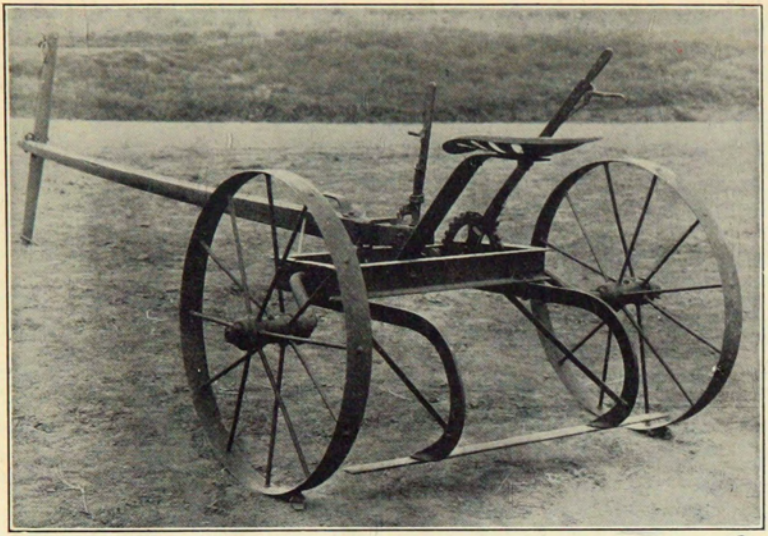
Two-horse knife weeder used in the control of perennial weeds. The blade can be raised from the seat. (Courtesy of California Exp. Sta.)

a spading fork and all underground parts carefully removed to a depth determined by their abundant occurrence. The roots and rootstocks thus removed are placed where they will dry out and die or, better yet, are destroyed by burning. The weed area must be watched carefully and subsequent growth dug out as it appears.

Small patches of creeping perennial weeds may be eradicated by hand-hoeing or by the use of the garden push hoe, provided the areas are thus kept free from any top growth for a sufficient length of time to starve out the underground parts, a requirement that is essential in all methods involving clean cultivation.

Clean Cultivation.—Clean cultivation 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. Altho 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 farmers who, either thru neglect or because of adverse circumstances, failed to carry out the provisions of the eradication program.

The object of clean cultivation is to exhaust gradually the supply of stored food and starve out the plants by continually cutting off the



Another type of two-horse weeder used in the control of perennial weeds. (Courtesy of Washington Exp. Sta.)

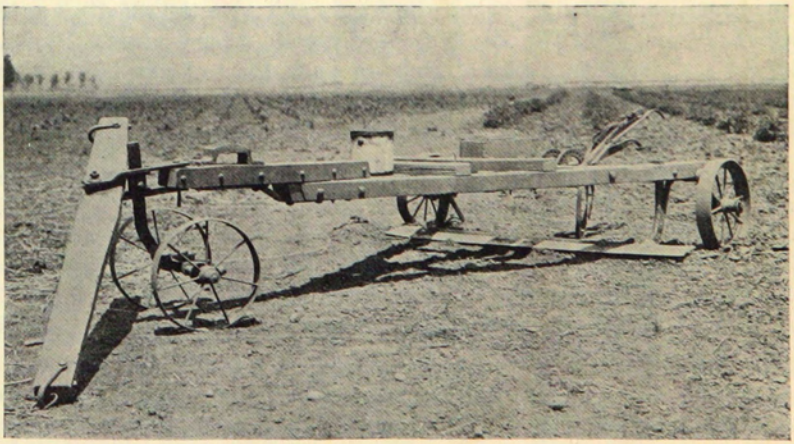
new shoots and preventing the formation of green leaves. The operation may be begun early in the spring, before extensive weed growth has appeared or later in the summer when the plants have come into bloom. The argument in favor of the latter method is that the plants are then in their most depleted state of food storage, have less reserve to draw on, and therefore are more easily eradicated. On the other hand, spring growth is more rapid than summer growth and the reserve food may be exhausted more rapidly. Both methods are recommended and both have been used successfully, the final results in either case depending upon the thoroness with which the work is done.

The weed area should be carefully plowed, care being taken to include the ground for some little distance beyond the limits of the evident plants. If eradication is delayed until midsummer it may be advantageous to mow and remove or burn the top growth. After being plowed the weed area must be cultivated with such frequency as will prevent the appearance of all weed growth, the breaking thru of new shoots being the signal for the next cultivation. Cultivating regularly once a week is to be recommended in preference to waiting for sprouts to appear, since following a definite schedule is usually productive of best results. Cultivating at a depth of 3 inches appears to be as effective as cutting off the plants at greater depths altho the most desirable depth may vary under different conditions. It may also be necessary to plow the area occasionally during

the eradication period in order to facilitate the cultivating operations. Care should be taken not to drag pieces of the roots into areas which are free from the weed.

Almost any type of cultivating tool that will cut off the plants effectively may be used in eradicating perennial weeds. Shovel and similar type cultivators are not desirable as they are not efficient in this respect. An ordinary duck-foot cultivator with knives overlapping so as to prevent any shoots slipping around them, may be used. Implements with a single long blade, set straight or at an angle, or with several such blades, have been devised and used successfully. An efficient instrument is one that will cut a wide swath with the least effort. The disc harrow may be used but is discriminated against because of its heavier draft and its tendency to pulverize the soil on certain types of land. The one-way disc tiller has been successfully used without plowing in eradicating sod-forming weeds such as quackgrass. A combination of tools is often desirable. The use of the spring-tooth harrow immediately after plowing and occasionally during the eradication period is of value in bringing the matted underground parts of quackgrass and similar shallow-rooted weeds to the surface where they will dry out and die. This implement, the shovel-type cultivator, and the plow are also valuable at times in breaking up the hardpan formed by the cultivator knives and in keeping the soil in the proper condition for satisfactory cultivation.

The exact plan or system best adapted to the eradication of weeds by clean cultivation or any other method, will vary in accordance



Three-horse weeder used in the control of perennial weeds.
(Courtesy of California Exp. Sta.)

with the weed being treated, the type of soil, the environmental conditions and other factors, and must be modified to meet the individual farm practices and conditions. However, the principles involved are always the same. The object of clean cultivation must be kept clearly in mind with the realization that each failure to cultivate at the proper time extends the total time required to bring about complete eradication and that carelessness in this respect and lack of thoroness will result in indefinite prolongation of the work and ultimate failure.

Inter-tilled Crops.—An inter-tilled or row crop may sometimes be successfully included in the eradication program, provided the weeds are kept down with the same thoroness 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. No attempt should be made to grow a crop in connection with the cultivation efforts unless the weeds have been materially weakened and thinned out by previous cultivations.

Smother Crops.—Smother crops are so called because of their ability, by their rapid and dense growth, to shade and crowd out other plants.

Alfalfa is probably the best crop for this purpose, where it can be successfully grown, because of its dense foliage and its vigorous regrowth after each cutting. Alfalfa may be planted in the spring or in the late summer. The latter practice is usually productive of somewhat better results in that there is less weed competition in the fall and the young alfalfa plants make a much quicker start the following spring. In either case a period of clean cultivation preceding the sowing will materially weaken the weeds and give the alfalfa a much better chance. A firm, moist seedbed should be prepared. Plowing deeply and irrigating immediately to pack the soil has been recommended. The seed should be sown rather heavily in order to insure the heavy stand of alfalfa essential to its success as a smother crop.

Other plants that may be grown as smother crops are sweet clover, cow peas, millet, sorghums, sudan grass, corn planted closely for fodder, and Russian sunflower. Any fast-growing crop that produces a dense shade may be utilized for this purpose. As in the case of alfalfa, best results will be attained by weakening the weed growth as much as possible by numerous cultivations before planting and by preparing a good seedbed.

Smother crops may be incorporated in the eradication program. So doing may increase the total eradication period but will give a return from the land. Fall wheat may be planted following a summer of clean cultivation and, by making a quick start in the spring, will

hold the weeds in check. After harvest clean cultivation must again be practiced until time to plant fall grain again. Or, if desired, the cultivation may be continued until frost and again the following spring until time to plant a spring crop which may either be in the nature of a row crop or a smother crop. As has been suggested, any system of eradication will have to be modified in accordance with the conditions and the farming practices, the ultimate success of the efforts depending upon the degree to which the weed growth is kept down.

Altho instances are on record where such weeds as wild morning glory and Canada thistle have been killed out by alfalfa and other smother crops, such results are seldom obtained, except where the weeds have first been materially weakened by cultivation. In the main, smother crops are only effective in checking weed growth and the spread of weeds where immediate eradication is not contemplated. They cannot be recommended as an eradication measure except in combination with other eradication efforts and even then their use involves some risk and may be of doubtful value as compared to continuous clean cultivation.

Smothering With Non-Living Materials.—Small patches of perennial creeping weeds may be killed by covering the areas with materials that will exclude the sunlight and prevent the development of the tops. The area covered must extend several feet beyond the outermost plants in order 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 completely 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. This was best accomplished in Colorado experiments by tacking the overlapping edges to strips of wood. Dirt may be used to cover these overlapping edges and should be thrown upon the outer edges in order to hold the covering in place. Shoots will appear thru 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 due to 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 of considerable advantage. 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 altho continuous mowing has been reported to have killed out certain perennial weeds. The success of alfalfa as a smother crop in killing out Canada thistle is in part due to the successive mowings. When alfalfa is not used the best results are obtained by frequent and close cutting.

Pasturing.—Pasturing weed areas with hogs, sheep, poultry or other forms of livestock is effective to the degree that 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.

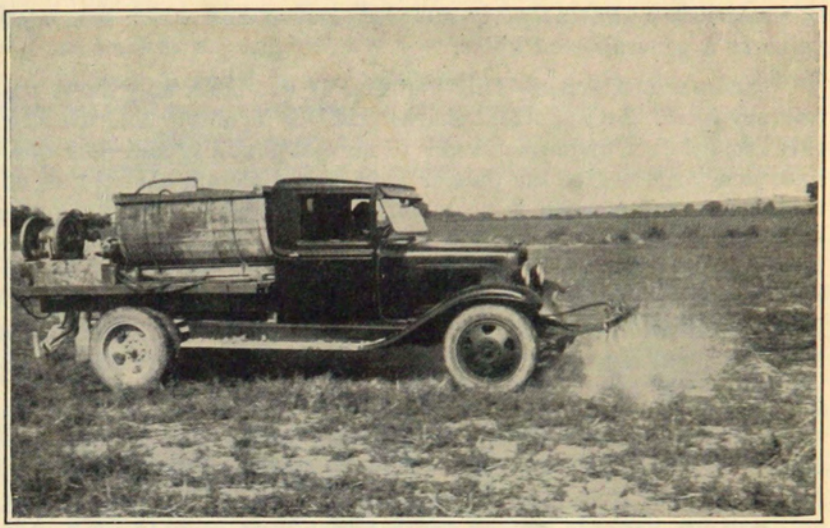
Flooding.—Perennial weeds may be drowned by flooding if the plants are kept completely submerged for a period of from 2 to 4 months. If growth appears at the end of that time, the area must again be put under water. The method is practical only where there is an abundant supply of water and the nature 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 thru 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 are still productive of varying results, even under apparently similar conditions, and cannot be considered as being 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. Among the chemicals which have been used with more or less success in the treatment of weeds may be mentioned sodium chlorate, calcium chlorate, magnesium chlorate, common salt, sodium arsenite, carbon disulfide, iron sulphate, copper



Applying chemical to a weed area by means of a power sprayer with boom attachment.

sulphate, sulphuric acid and petroleum oils. Chemicals which have been used less successfully are carbolic acid, mercuric chlorate, caustic soda, sodium nitrate and copper nitrate. Ethylene dioxide and ammonium sulphocyanate are two new chemicals which have attracted some attention as herbicides.

The treatment of weeds with chemicals, involves the 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. It is assumed that anyone contemplating chemical weed control will secure full information on the subject from the proper source before undertaking the operation.

SODIUM CHLORATE.—Sodium chlorate is at the present time the most popular and generally successful herbicide. However, its use in Colorado is accompanied by great variation in the 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 an additional year or so, depending upon the rainfall, amount of irrigation and other factors. The use of sodium chlorate is attended by a certain fire hazard which may re-

sult seriously unless properly guarded against and which lessens its value as a general weed killer.

CALCIUM CHLORATE.—This material is available only in a proprietary form. An important characteristic is its ability to draw moisture from the air under conditions of normal humidity and thus eliminate to a large degree the danger from fire. Calcium chlorate, as obtainable on the market, is not as effective, pound for pound, under Colorado conditions, as sodium chlorate, but equivalent results may be obtained by using additional material. Since the prices of the two compounds are practically the same, the use of calcium chlorate will involve somewhat more expense than the use of sodium chlorate but the additional cost may be justified by the lessened fire hazard, especially in the hands of untrained or inexperienced operators.

MAGNESIUM CHLORATE.—This material is also available only in a proprietary form and is very similar to calcium chlorate in all respects.

COMMON SALT.—Common salt has been used in destroying undesirable vegetation for many years. 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 $10.00 per ton, the cost per acre for this material will be between $200 and $400 which is prohibitive except on small areas. The application of salt to our western soils renders them sterile and unproductive. The soil thus treated puddles when wet and forms hard, unbreakable clods when dry. This condition may be overcome in some instances by frequent heavy irrigations and the use of fertilizers. In other instances the damage appears to be almost permanent. The permanency of the effect of salt favors its use on driveways, tennis courts and other places where no vegetation is desired and its non-poisonous character is a decided advantage under some conditions. The larger quantities of salt required to produce the desired results may make it more expensive to use than some of the more toxic substances.

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 stock solution form, usually containing about 4 pounds of the equivalent of white arsenic per gallon. A gallon of this is added to 100 gallons of water to form the .5 percent solution which is ordinarily recommended. About 500 gallons of the spray solution are required to cover thoroly an acre of weed growth. However, much higher concentrations may be used, depending upon the weed being treated, the purpose of the spray, the conditions of application, and other factors. In treat-

ing weeds along railroad rights-of-way, from 50 to 500 pounds of sodium arsenite are applied per acre of weed area.

Sodium arsenite is also available in a white, dry, powdered form which has an equivalent of 80 percent white arsenic and in a gray, dry, powdered form which has an equivalent of 75 percent white arsenic. This material is readily soluble in water and is convenient to handle.

If desired, a sodium-arsenite stock solution may be prepared by mixing 4 pounds of white arsenic (arsenic trioxide) with 2 pounds of caustic soda (sodium hydroxide) in an iron container and adding slowly 1 gallon of water. The mixture should be stirred continuously because of the evolution of heat. Eight pounds of sal soda (sodium carbonate) may be substituted for the 2 pounds of caustic soda, if the latter is not available, and the mixture boiled to get the arsenic into solution. The stock solution thus made contains 4 pounds of arsenic trioxide and gives a .5-percent solution when added to 100 gallons of water. Great caution must be observed in the preparation of this mixture to avoid overheating and in the general handling of the material because of the dangerous and poisonous characteristics. In most instances it will be advisable to purchase the sodium arsenite in a commercial form.

When applied at the rate of about 4 pounds of the equivalent of white arsenic per square rod, which would require 1 gallon of either of the above stock solutions or 5 pounds of the dry powdered material, sodium arsenite renders the soil more or less permanently sterile and will prevent ordinary vegetative growth for a considerable period. For convenient application the stock solution may be diluted to 2 to 3 gallons per square rod and the dry material dissolved in a like amount of water. Sodium arsenite is used in this manner on tennis courts, along driveways, and in similar places.

When diluted in the proportion of 1 pound of white arsenic to 4 gallons of water the arsenic solution may be used to kill trees. The tree is first "frilled" (overlapping downward cuts with an axe around the circumference) and the poison solution then poured into the frilling. August is probably the best month for this treatment.

Other arsenical compounds which are used in controlling weeds are arsenic acid and arsenic trichloride. A 1-percent solution of arsenic acid is effective on annuals. It may be obtained in the solid form (arsenic pentoxide) or in a solution containing 60 percent arsenic pentoxide. Arsenic trichloride is the chief toxic agent in one commercial weed spray.

Arsenicals are very poisonous and great care must be employed in using them, whether in the liquid or powder form, not to take them internally or inhale any of the vapor or dust. Children should be kept away from places where arsenicals have been used and the

material should be stored out of their reach. Animals and poultry must be kept from treated areas as they are apparently attracted by the taste and a small amount of the poison is fatal.

Humid conditions are favorable to the increased effectiveness of the arsenical sprays but a rain following the application may be very detrimental to the results.

In general the arsenicals have not proved successful against creeping perennial weeds under the conditions common in Colorado, altho a new acid-arsenical method, recently developed in California, is giving considerable promise. The attractive feature of arsenical sprays is their low cost, usually amounting to but a few dollars per acre.

CARBON DISULFIDE.—Carbon disulfide is an ill smelling, highly volatile, inflammable liquid which has been used to kill weeds with considerable success. This material is not sprayed on the weeds, but is introduced into the soil in holes about 18 inches deep and 2 feet apart. Two ounces of the liquid are poured into each hole and the top tamped in with the heel. If the conditions are right the carbon disulphide will diffuse thru the soil and kill all vegetation in the 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, running around $200.00 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.—This chemical 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 danger 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.

COPPER SULPHATE.—Copper sulphate may be used in the same manner and for the same purposes as iron sulphate. The spray solu-

tion 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 iron sulphate and its use is somewhat more expensive.

SULPHURIC ACID.—In experiments carried on in Sweden a 4-percent solution of sulphuric acid was found to be more effective in killing weeds in grain fields than iron sulphate. 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. From 50 to 200 gallons of the solution is required to cover an acre of weed growth when it is from 4 to 6 inches high. Its effectiveness is favored by conditions of low humidity and high temperature.

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* as 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, ditch banks, and other places inaccessible to cultivation. Stovetop oil and Diesel oil are reported as being the most widely used oils in California. The latter 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 puncture vine, 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.—This chemical is chiefly used as a herbicide in controlling weeds in lawns.

ETHYLENE OXIDE.—Ethylene oxide is a highly inflammable and poisonous liquid which is so volatile that it must be kept under a pressure of from 8 to 20 pounds at ordinary temperatures or chilled with ice. Its use as a herbicide is similar to that of carbon disul-

phide except that it is much more difficult to introduce into the soil because of the manner in which it must be handled. It is supposed to present an advantage over carbon disulphide in that it is miscible with water. However, no practical method has been evolved for its application.

AMMONIUM SULPHOCYANATE.—Ammonium sulphocyanate (thiocyanate) is a compound which may be applied to weed growth in a manner similar to the chlorates. It is claimed that it presents certain distinct advantages over the chlorates in that it is not inflammable and has a toxic effect on the soil for a much shorter period which is followed by a beneficial effect due to the available nitrogen. However, ammonium sulphocyanate has not proved as effective in the treatment of creeping perennial weeds under Colorado conditions as have the chlorates.

THE CONTROL OF WEEDS UNDER SPECIAL CONDITIONS

WEEDS ON NON-CULTIVATED AREAS.—The weeds found on uncultivated areas such as roadsides, fence rows, ditch banks and waste places in general are essentially the same weeds that give trouble on cultivated fields. However, special attention is called to weeds growing under these conditions because of the importance of keeping them under control and preventing seed formation. This is especially true of weeds growing along ditch banks. The types of weeds and the situation under which they are growing should be studied and the most practical and economical method adopted for bringing about their control.

WEEDS IN PASTURE.—Broad-leaved 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. Inasmuch as the use of chemicals in the control of pasture weeds has been very limited, it is advisable to treat a small area first and await results before undertaking the treatment of large areas. 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 cultivations, 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.

LAWN WEEDS.—The best defense against weeds in lawns is a rich, well-fertilized soil which is free from weed seeds and on which is planted the highest grade of grass seed. If such a lawn is properly

cared for and fertilized, a healthy, firm turf will be maintained and weeds will have difficulty in establishing themselves.

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 as being very effective but care must be taken not to get the acid on the flesh or clothing. Placing a pinch of ammonium sulphate on each individual crown has also been recommended.

Iron sulphate is probably the most widely used herbicide for killing dandelions on larger areas. One and one-fourth pounds of the material is dissolved in a gallon of water and applied thoroly but not excessively as a fine mist. A gallon of solution should cover approximately 150 square feet. Applications on cloudy damp days are best, provided rain does not follow within 24 hours. From three to five applications may be necessary at intervals of about 2 weeks. The grass will be discolored by the treatment but will soon become green again. However, too-frequent or too-heavy applications may injure the grass. Altho the lawn should be somewhat dried out before applying the spray, grass that is well irrigated and vigorous appears to be the least susceptible to injury. The solution should not be allowed to come in contact with the clothes, sidewalks or buildings as it produces an undesirable stain. The general suggestions given under the previous discussion of iron sulphate as a herbicide should be followed in applying the chemical to lawn weeds.

Ammonium sulphate has been more recently recommended for controlling dandelions in lawns, the material being applied at the same rate as iron sulphate, in the same manner, or in the dry state. In addition to being a herbicide it has a beneficial effect on the soil as a fertilizer.

Broad-leaved and narrow-leaved plantains, the chickweeds and sheep sorrel may be controlled by much the same methods as are recommended for the dandelion. Scattered plants may be dug or treated individually. Large areas may be sprayed with iron sulphate or ammonium sulphate solutions, using, however, 2 pounds of chemical per gallon of water. Sodium nitrate has also been recommended for chickweed at the same rate. The application of lime is recommended for the control of sheep sorrel, since it is usually trouble-

some on run-down and acid soils. So doing, however, may encourage the growth of other undesirable weeds, most of which are not acid-loving.

Crab-grass can probably best be gotten rid of by digging out the plants when they first appear, which is about midsummer. This is not a difficult process, if the plants are not too numerous, for it is an annual with a shallow root system. Altho many authorities state that removing the plants bodily is the only satisfactory method of controlling crabgrass in lawns, a New York worker recommends the application of 6 pounds of ammonium sulphate to each 1,000 square feet of lawn, either as a dry dust or in solution, after which the area must not be watered for 24 hours. Iron sulphate and Diesel oil have also been reported as being effective in controlling this weed.

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. In order to avoid getting the material on unevenly with the consequent danger of burning in spots, it is advisable to mix the material with top dressing or fine sand or to put it on in solution.

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. 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 a 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 there is reason to believe that the 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 the lakes and streams. Weeds of this type, such as the water hyacinth and the duckweed, have been effectively controlled by spraying with a .5-percent solution of sodium arsenite, a gallon of the solution being sufficient for about 100 square feet of floating weeds.

Those 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 from 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 the alfalfa and clover dodders. Their eradication is accomplished by the 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 treated in a separate bulletin[1] and need not be discussed in detail here. The increasing losses resulting from animals eating plants of this type are largely the results of improper range management and too-heavy grazing. Most of the injurious plants are disliked by livestock and are only eaten in harmful amounts when other forage is lacking. The prevention of such losses is very largely a mat-

[1]Colorado Experiment Station Bulletin No. 316, "Poisonous Plants of Colorado."

ter of better and more intelligent utilization of our range resources. A list of the plants of this type which are troublesome in Colorado follows:

PLANTS CAUSING INJURY BY POISONING

Plant Species	Animals Affected
Aconite (**Aconitum columbianum** spp.)	Sheep and horses
Arrow-grass (**Triglochin** spp.)	Sheep and cattle
Death Camas (**Zygadenus** spp.)	Chiefly sheep. Cattle and horses at times
Cocklebur seedlings (**Xanthium** spp.)	Hogs chiefly, cattle and sheep sometimes
Brake Fern (**Pteridium aquilinum**)	Cattle, horses and sheep, when fed in hay
Fetid Marigold (**Dyssodia papposa**)	Probably all types if taken in sufficient quantities
Horsetail (**Equisetum arvense**)	Chiefly young horses
Indian Hemp (**Apocynum cannabinum**)	Generally poisonous in large quantities
Jimson-weed (**Datura stramonium**)	Generally poisonous in large quantities
Johnson Grass (**Holcus halapense**) (especially when frosted or stunted)	Chiefly cattle and sheep
White Loco (**Aragallus albiflora**)	Chiefly horses
Purple Loco (**Aragallus lambertii**)	Chiefly horses
Woolly Loco (**Astragalus mollissimus**)	Chiefly horses
Lupines (**Lupinus** spp.)	Chiefly sheep, other animals at times
Low Larkspurs (**Delphinium** spp.)	Chiefly cattle, horses at times
Tall Larkspurs (**Delphinium** spp.)	Chiefly cattle, horses at times
Common Milkweed (**Asclepias speciosa**)	Chiefly sheep. Seldom eaten
Whorled Milkweed (**Asclepias galioides**)	Sheep, cattle, horses
Low Whorled Milkweed (**Asclepias pumila**)	Sheep, cattle, horses
Milk Vetch (**Astragalus bisulcatus**)	Chiefly sheep, cattle at times
Psoralea (**Psoralea tenuifolia**)	Seldom eaten in sufficient quantity
Sneezeweed (**Helenium Hoopesii**)	Chiefly sheep, cattle at times
Silky Sophora (**Sophora sericea**)	Seldom eaten in sufficient quantity
Water Hemlock (**Cicuta occidentalis**)	All classes of livestock
Wild Tobacco (**Nicotiana atennuata**)	Cattle, horses and sheep
White Hellebore (**Veratrum speciosum**)	Generally poisonous

PLANTS CAUSING MECHANICAL INJURY.—The injuries caused by plants of this type 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 thru starvation.

PLANTS CAUSING MECHANICAL INJURY TO LIVESTOCK

Sandbur	**(Cenchrus tribuloides)**
Three-awned Grass	**(Aristida longiseta)**
Porcupine-grass	**(Stipa spartea)**
Needle-grass	**(Stipa** spp.)
Wild Oats	**(Avena fatua)**
Downy Brome-grass	**(Bromus tectorum)**
Squirreltail-grass	**(Hordeum jubatum)**
Cocklebur	**(Xanthium commune)**
Colorado Rubber Plant	**(Hymenoxys spp.)**
Greasewood	**(Sarcobatus vermiculatus)**
Russian Thistle	**(Salsola pestifer)**

THE IDENTIFICATION OF WEEDS

The farmer should be familiar with and able to recognize all the weeds on his land. Any new or unfamiliar plant should be investigated as soon as noticed 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 without 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 Department, Colorado Agricultural College, Fort Collins, Colorado.

PART III.—WEEDS OF COLORADO

DESCRIBED AND ILLUSTRATED

GROUP I.—NOXIOUS WEEDS

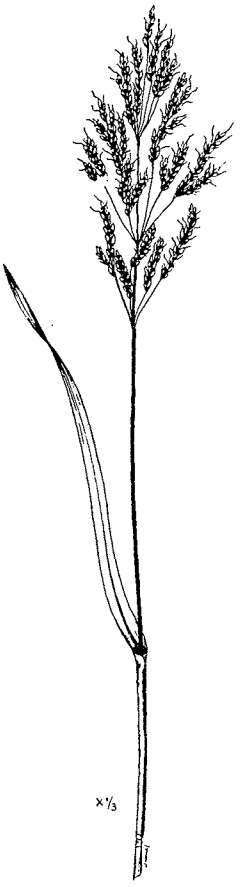
In this group of weeds are included those weeds that are extremely difficult to control, or that are especially injurious to crop, man or animal, and that therefore may be considered as being "noxious." The use of the term "noxious" in this connection is more or less arbitrary and it is not to be supposed that all the weeds so designated are equally injurious or undesirable. Some are much worse than others but all are considered as being more than ordinarily troublesome. *Those plants which are noxious solely because of their poisonous qualities are not included in these descriptions.*

GROUP II.—COMMON WEEDS

As distinguished from the "noxious weeds" the list of "common weeds" includes those weeds that are commonly found thruout the state but that are not especially difficult to control and not especially damaging under ordinary conditions. Members of this group, however, will do considerable harm unless they are kept under control and it is important that they be recognized and their habits understood if they are to be distinguished from the more injurious types and controlled by the most practical and economical methods.

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 103.

GROUP I.—NOXIOUS WEEDS



Johnson Grass

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.

Crab-grass

CRAB-GRASS *(Syntherisma sanguinalis)*

OTHER NAMES.—Purple Crab-grass, Finger-grass, Crowfoot-grass.

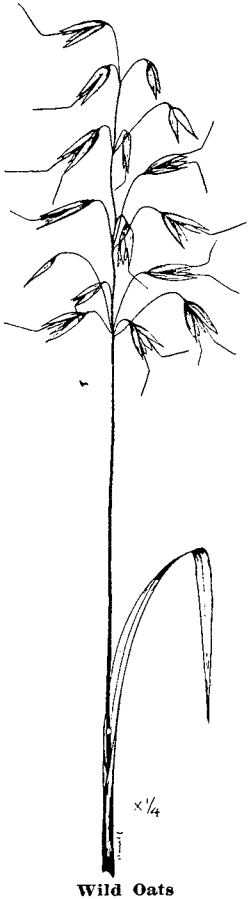
DESCRIPTION.— Grass family. Introduced from Europe. Annual. Propagates by seeds and by rooting at the lower joints. Stem erect or decumbent, spreading, 1 to 3 feet long. Leaves 3 to 6 inches long, narrow. Leaf sheaths hairy. Flowers and fruit (seeds) on long, narrow spikes, branching out like fingers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

CONTROL.—See control of lawn weeds.

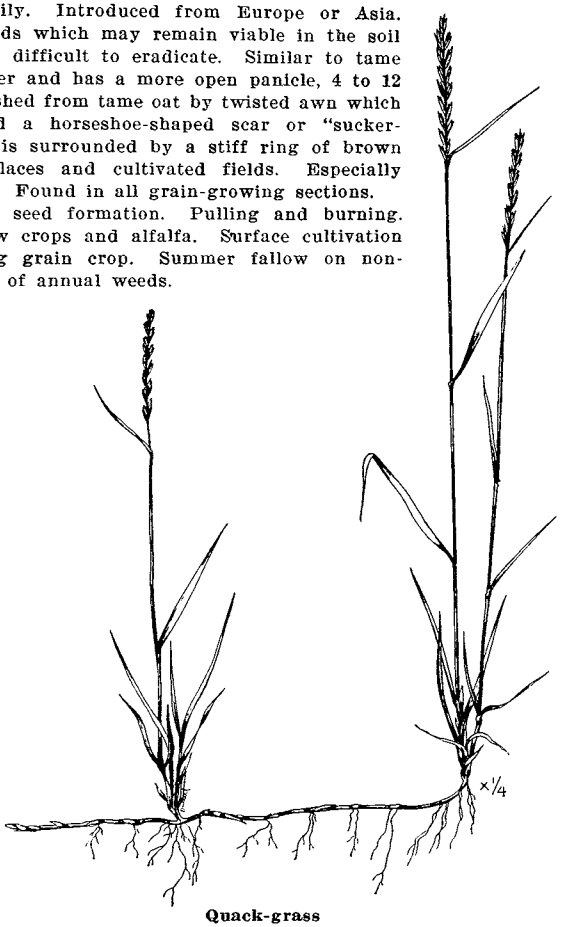
WILD OATS *(Avena fatua)*

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.



Wild Oats



Quack-grass

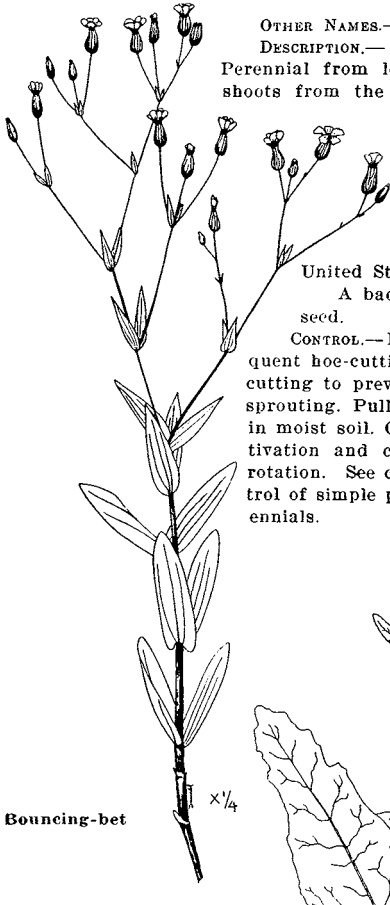
QUACK-GRASS *(Agropyron repens)*

OTHER NAMES.—Couch-grass, Quitch-grass, Devil's Grass.

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. 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 thruout 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.



Bouncing-bet

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.

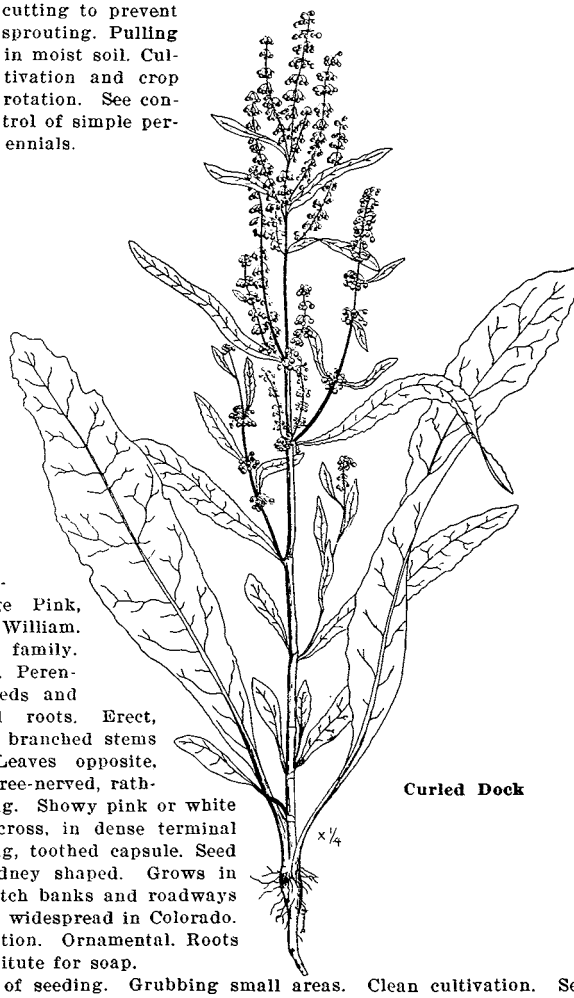
CURLED DOCK *(Rumex crispus)*

OTHER NAMES.—Yellow Dock, Narrow-leaved Dock.

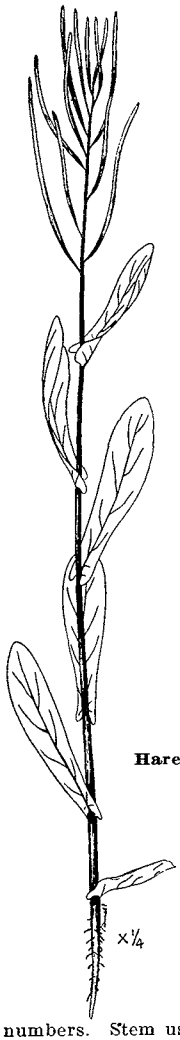
DESCRIPTION.— Buckwheat family. Introduced from Europe. Perennial from long taproot. Propagates by seeds and by shoots from the crown. Grows erect with slender grooved stems, 1 to 4 feet tall, simple or with a few branches at the top. Leaves 6 inches to a foot in length, crisp with wavy margin. Small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



Curled Dock



Hare's Ear Mustard

HARE'S EAR MUSTARD *(Conringia orientalis)*

OTHER NAMES.—Rabbit-ears, Hare's 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, 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 Fanweed. See control of annuals and winter annuals.

PERENNIAL PEPPERGRASS *(Lepidium draba)*

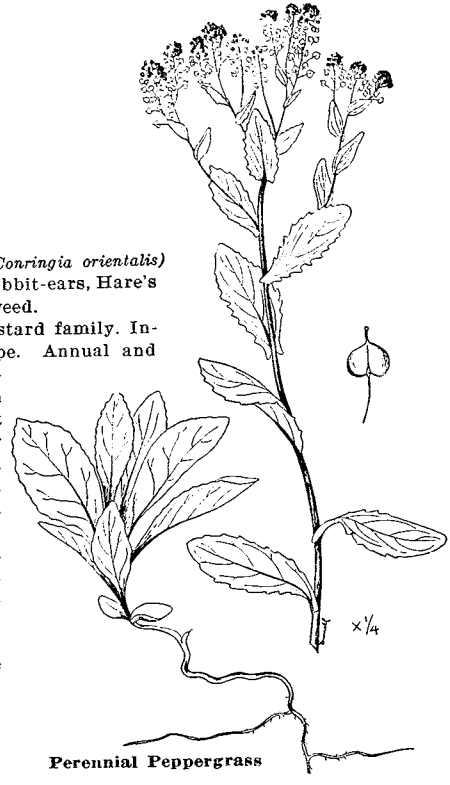
OTHER NAMES.—Whiteweed, Hoary Cress.

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, ½ to 2 inches long with blunt ends. Flowers numerous, white, about ⅛ 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. Is a serious problem in the San Luis Valley and in certain sections of the Western Slope in Colorado.

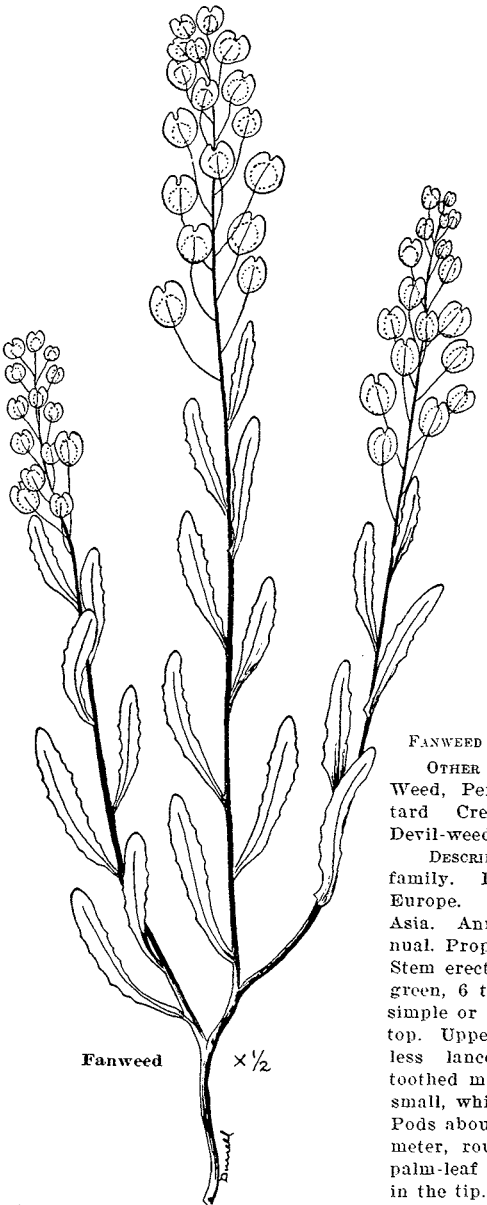
A very persistent weed and especially resistant to chemical eradication.

Lepidium repens and *Hymenophysa pubescens.*—Very similar to above and grow under same conditions. Go by same common names. May be distinguished by their round pods. The last named is further characterized by somewhat shorter and more refined growth, smaller pods and narrower leaves.

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



Perennial Peppergrass



FANWEED *(Thlaspi arvense)*

OTHER NAMES.— French Weed, Penny Cress, Bastard Cress, Stink-weed, 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 4 petals. Pods about ½ 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.

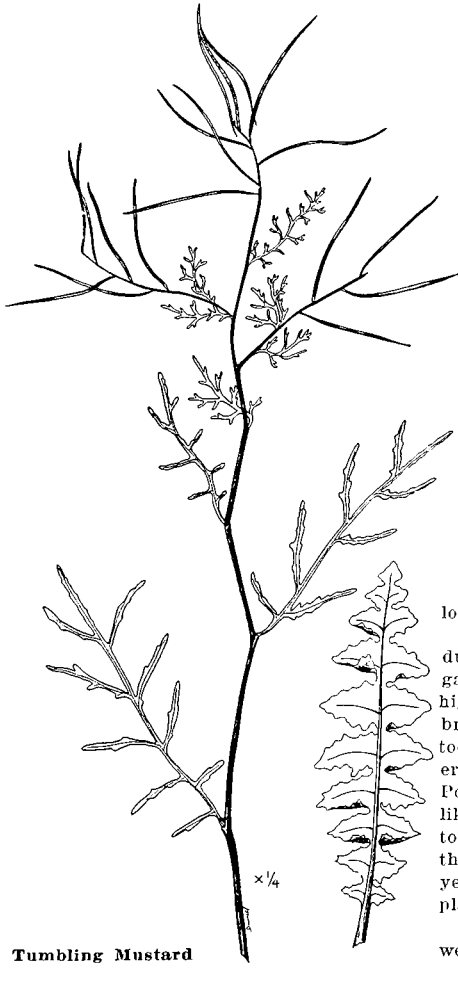
CONTROL.—Prevention of seeding. Frequent cultivation and crop rotation. Summer fallow on non-irrigated land. See control of annuals and winter annuals.

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

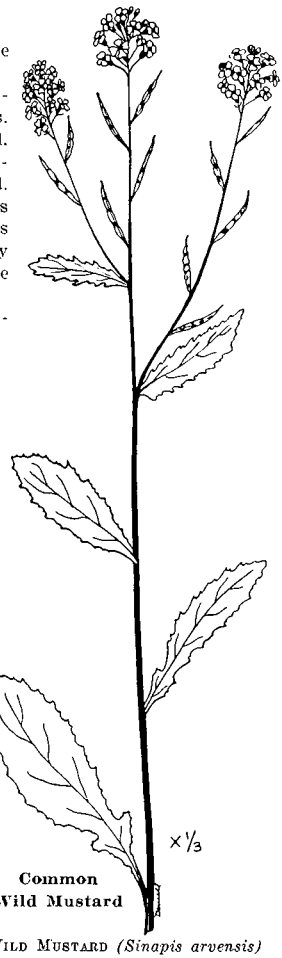
OTHER NAMES.—Jim Hill Mustard, Tall Mustard, Hedge Mustard, Tall Sisymbrium.

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 ¼ inch across. Numerous slender pods 2 to 4 inches long. Produces an enormous number of seeds. Seeds small, brown, oblong, usually with a single groove. Grows in grain fields and waste places. Widely distributed, especially in the Northwest.

CONTROL.—Same as for Fanweed. See control of annuals and winter annuals.



Tumbling Mustard



Common Wild Mustard

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

OTHER NAMES.—Corn Mustard, Charlock, Field Kale.

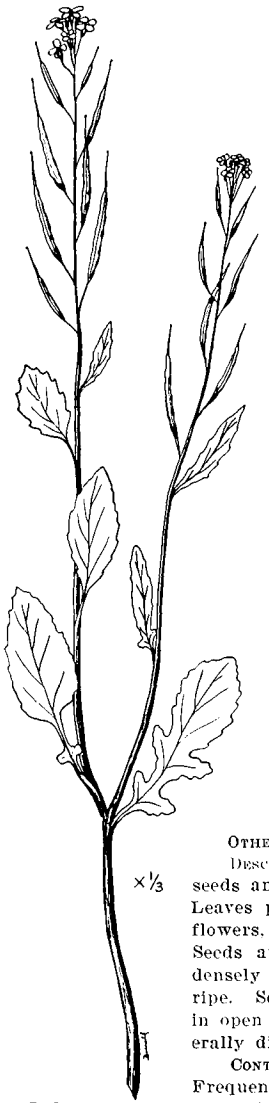
DESCRIPTION.—Mustard family. Introduced from Europe. Annual. Propagates by seeds. Stem erect 1 to 3 feet high, smooth or with scattered stiff hairs, branching above. Leaves irregularly toothed or lobed to varying degree. Flowers bright yellow about ⅜ inch across. Pods 1 to 2 inches long tipped with beak-like 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 thruout United States.

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

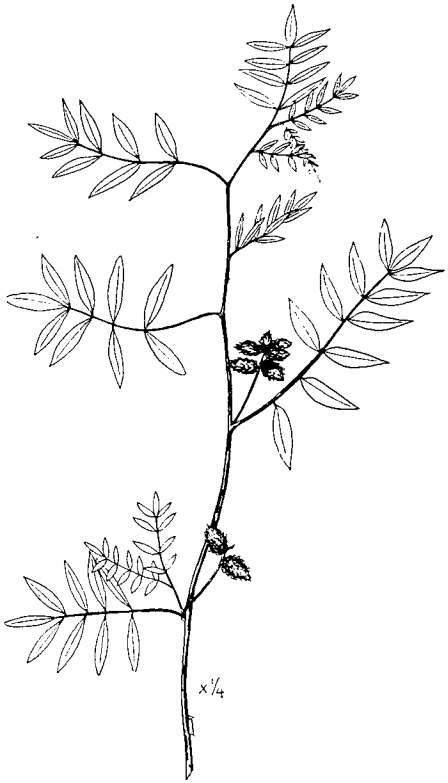
INDIAN MUSTARD *(Brassica juncea)*

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 ½ to ¾ 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 the northeastern states.

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



Indian Mustard



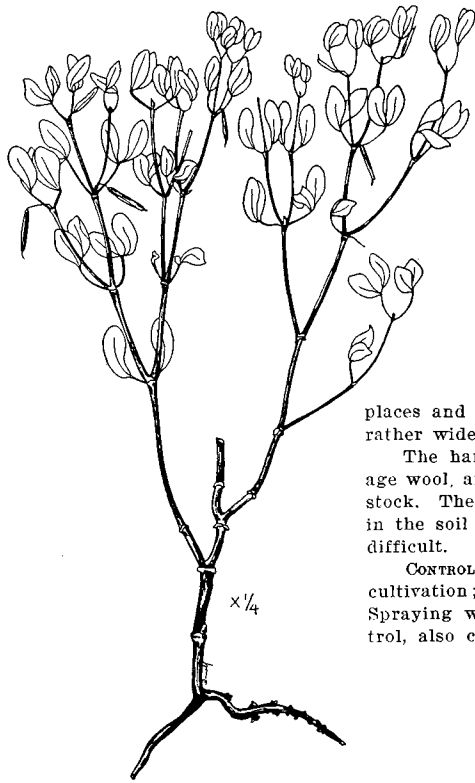
Wild Licorice

WILD LICORICE *(Glycyrrhiza lepidota)*

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 are borne in oblong, bur-like pods about ½ 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.



Syrian Bean-caper

SYRIAN BEAN-CAPER *(Zygophyllum fabago)*

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 over 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.

PUNCTURE VINE *(Tribulus terrestris)*

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 4 to 8 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 4 or 5 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.

Puncture Vine

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

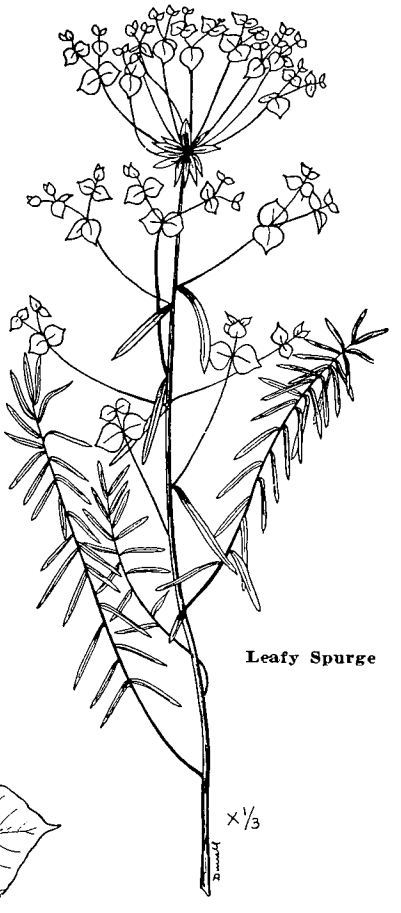
OTHER NAMES.—Tithymal, Faitour's Grass.

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 thruout the United States.

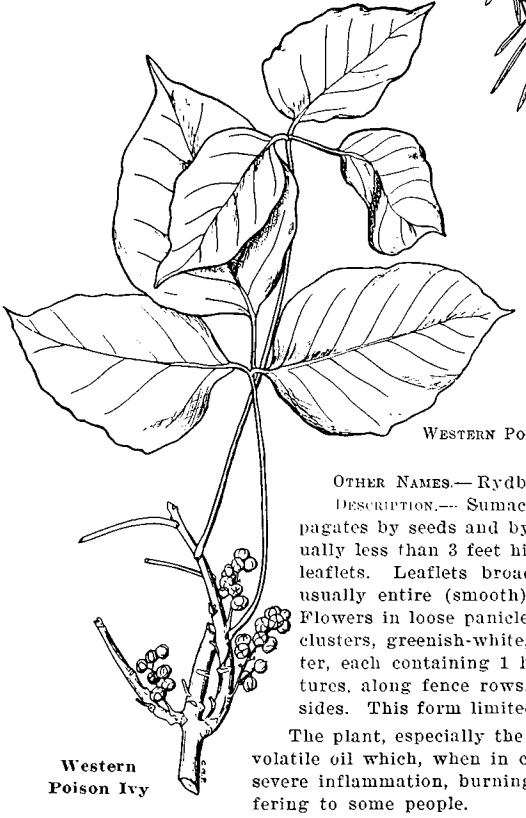
This plant is barely known in Colorado but its invasions from other states, where it is a serious pest, should be guarded against.

Euphorbia esula.—This name, which has apparently been applied to the above plant at times, refers to a slightly different species.

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



Leafy Spurge ×1/3



Western Poison Ivy

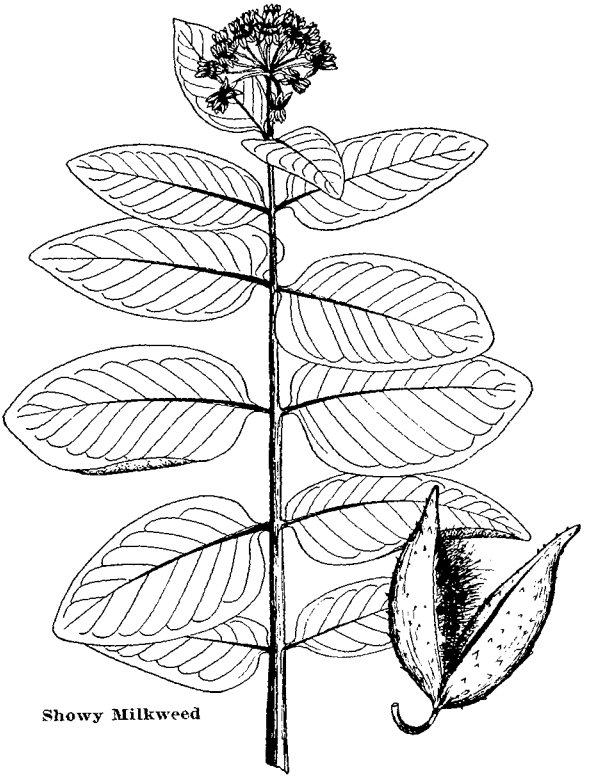
WESTERN POISON IVY *(Toxicodendron Rydbergii)*
(Rhus Rydbergii)

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, ¼ inch in diameter, each containing 1 hard seed. Grows in wooded pastures, along fence rows, in mountain canons 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.



Showy Milkweed

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)*

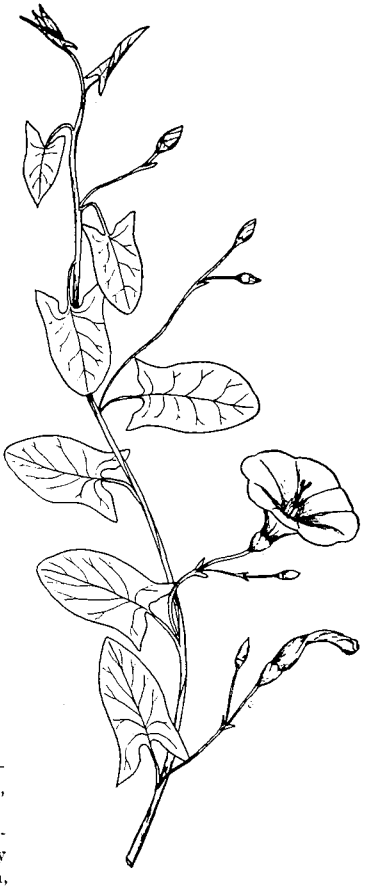
OTHER NAMES.—Whorled Milkweed, Bedstraw Milkweed.

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 ⅜ inch wide, growing in whorls of from 3 to 4 leaves from each joint. Flowers greenish white in clusters or umbels not unlike onion blossoms. Pods or follicles are erect, 2½ 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 ditch-banks, roadsides, fence rows, in orchards, pastures and dry hillsides. Native to Rocky Mountain section.

Extremely poisonous to livestock causing large losses each year. Also a pernicious weed due to its persistent spreading roots.

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

Poison Milkweed



Field Bindweed

FIELD BINDWEED *(Convolvulus arvensis)*

OTHER NAMES.—Wild Morning Glory, Small-flowered Morning Glory, European Bindweed, Creeping Jenny, Green-vine.

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 1¾ 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 thruout the United States and, in fact, the world.

Probably the best known and widest spread 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.

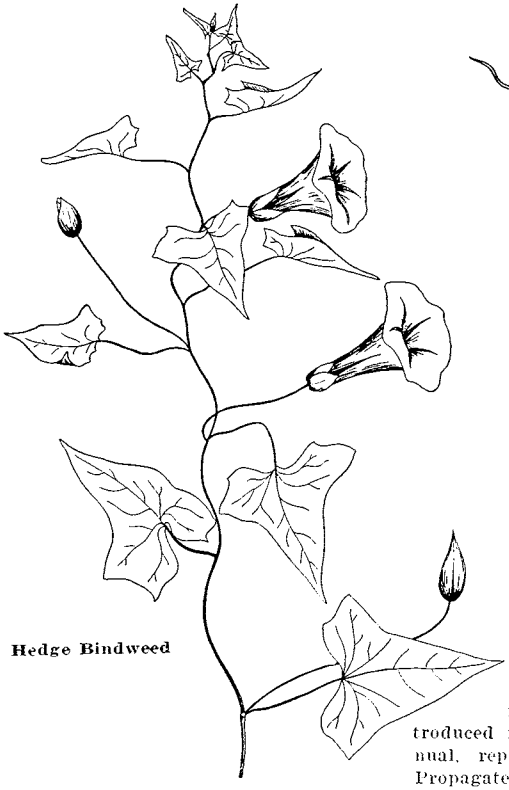
HEDGE BINDWEED *(Convolvulus americanus)*
(Convolvulus sepium)

OTHER NAMES.—Wild Morning Glory, Large-flowered Morning Glory, Great Bindweed, Bracted Bindweed.

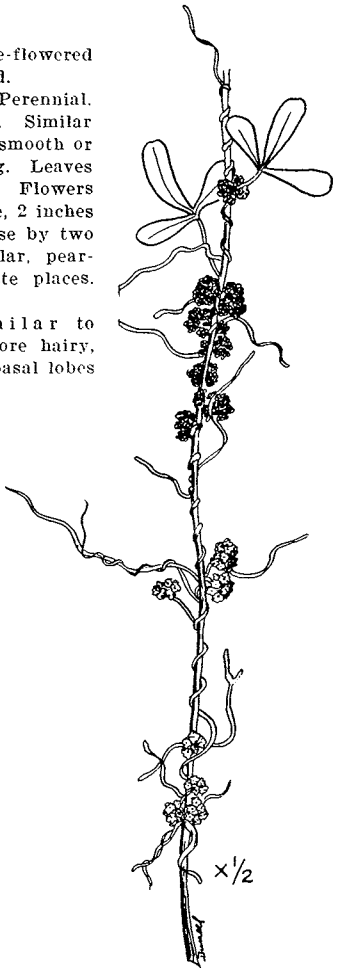
DESCRIPTION.— Morning Glory family. Native. Perennial. Propagates by seeds and by horizontal rootstocks. Similar to Field Bindweed but larger in all respects. Stem smooth or slightly hairy, trailing or twining, 3 to 10 feet long. Leaves triangular in outline, tip and basal lobes pointed. Flowers white or pink with white stripes, bell-shaped, large, 2 inches long and 1½ to 2 inches broad, enclosed at the base by two large, clasping bracts. Seeds dark brown, angular, pear-shaped, ⅛ inch long. Grows in fields and waste places. Widely distributed.

TRAILING BINDWEED *(Convolvulus repens)*.—Very similar to above. 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

DODDER *(Cuscuta spp.)*

OTHER NAMES.—Love-vine, Strangle-weed, Devil's 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 parasites, 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.

Common Plantain

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 thruout 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.—Red Stem, Plantain, 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, in shaded yards and lawns. Widely distributed.

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

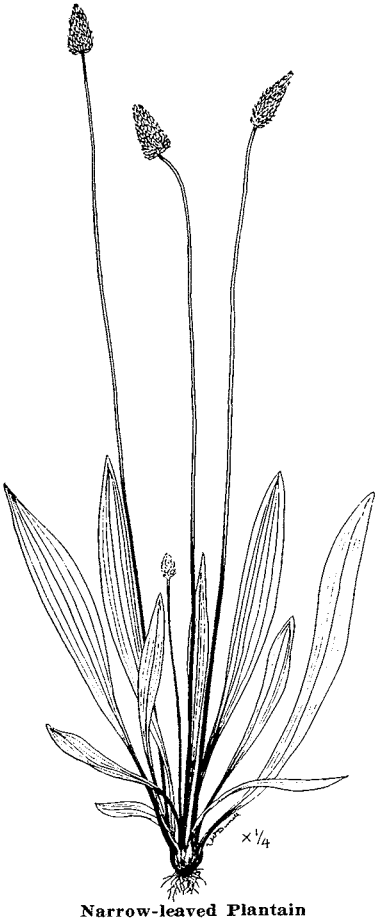
NARROW-LEAVED PLANTAIN *(Plantago lanceolata)*

OTHER NAMES.—Buckhorn, Rib-grass, English Plantain, Rat-tail.

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, ½ 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 Ripple-grass.

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, ½ 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.

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

Mouse-ear Poverty-weed

MOUSE-EAR POVERTY-WEED *(Iva axillaris)*

OTHER NAMES.—Marsh-elder, Small-flowered Marsh-elder.

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, ½ to 1½ 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, 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.

Silver-leaf Poverty Weed

SILVER-LEAF POVERTY WEED *(Franseria discolor)*
(Gaertneria discolor)

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.

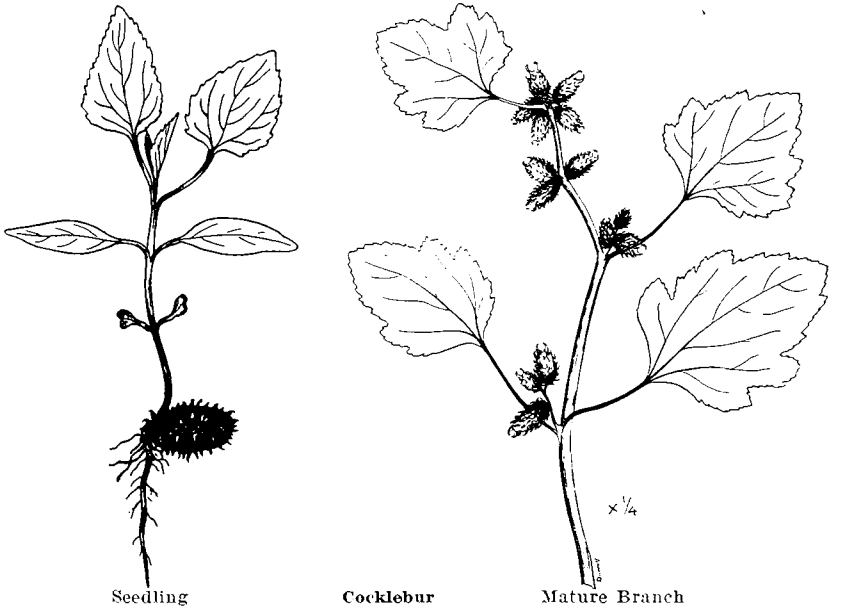
CONTROL.— Clean cultivation. Chlorates. See control of creeping perennials, also chemical control.

Woolly-leaved Poverty-weed *(Franseria tomentosa)*
(Gaertneria tomentosa)

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 thruout. Leaves white-woolly on both sides or grayish above, usually 3 to 7 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 ¼ 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. (Not illustrated)



Seedling **Cocklebur** Mature Branch

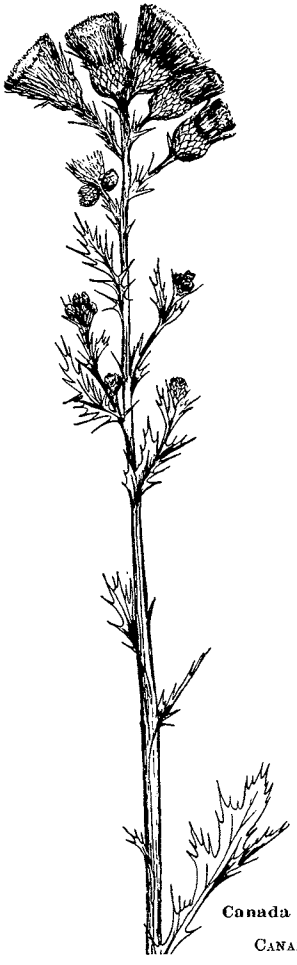
COCKLEBUR *(Xanthium commune)*

OTHER NAMES.—Clotbur, Sheepbur, Ditchbur.

DESCRIPTION.— Ragweed family. Native. Annual. Large, rough, branched plant, 2 to 4 feet high, having thick, coarse stems with brown spots. 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.

Is a bad weed any place but is especially bad in a sheep country where the burs do great damage to the wool. Seedlings poisonous to livestock, especially hogs.

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



Canada Thistle

Variety *vestitum*

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

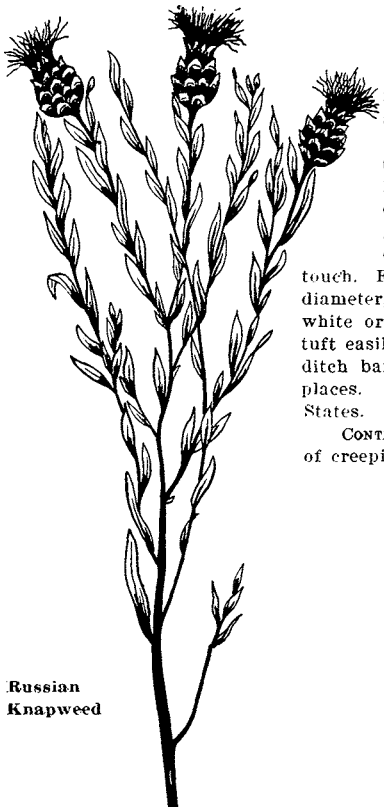
OTHER NAMES.—Field Thistle, Cursed Thistle, Small-flowered Thistle, Perennial Thistle, Hard Thistle.

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 ½ inch broad and ¾ 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 ⅛ inch long, slightly flattened and curved, with white, downy tuft, easily detached. Grows in cultivated fields, pastures, meadows, roadsides and waste places. Widely distributed in northern half of United States. A very persistent and noxious 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.



Russian Knapweed

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

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 ⅛ 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. Is a troublesome pest, difficult to eradicate.

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

PERENNIAL SOW THISTLE *(Sonchus arvensis)*

OTHER NAMES.—Field Sow Thistle, Creeping Sow Thistle, 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, ⅛ 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.

Perennial Sow Thistle

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 blow-balls. Seeds light to dark brown, ⅛ inch long, ridged, oblong, bearing silky white parachute (pappus). Grows in fields, pastures, meadows, waste places and lawns. Distributed thruout the civilized world.

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

NOXIOUS WEEDS NOT ILLUSTRATED

COMMON BARBERRY *(Berberis vulgaris)*

OTHER NAMES.—European Barberry.

DESCRIPTION.—Barberry family. Introduced from Europe. Perennial. Propagates by seeds. Tall, erect growing shrub with grayish bark and bright-yellow roots. Leaves smooth, green or purple, with sawtoothed edges, growing in the axils of three-forked spines. Small yellow flowers in clusters. Fruit an oblong scarlet berry. Grows along fence rows, in thickets, in pastures and waste places. Distributed over the eastern and middle United States.

Escaped from cultivation. Harbors the fungus which causes the black stem rust of wheat and other cereals and is a serious menace to these crops.

Should not be confused with Japanese Barberry which is harmless.

CONTROL.—Heavy applications of crushed rock salt or kerosene to the crown. Digging, if attempted, must be very thoro because of the ability of small root pieces to produce new plants.

PERENNIAL RAGWEED *(Ambrosia psilostachya)*

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.

BLUE LETTUCE *(Lactuca pulchella)*

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 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 leave 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. Is 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.

GROUP II.—COMMON WEEDS

Witch-grass

WITCH-GRASS *(Panicum capillare)*

OTHER NAMES.—Tickle-grass, Tumbleweed-grass, Panic-grass.

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.

BARNYARD-GRASS *(Echinochloa crus-galli)*

OTHER NAMES.—Water-grass, Barn-grass.

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, ¼ to 1 inch wide, smooth. 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.

Barnyard-grass **Yellow Foxtail** **Green Foxtail**

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

OTHER NAMES.—Summer-grass, Pigeon-grass, 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, ½ 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.

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

OTHER NAMES.—Bottle-grass, Summer-grass, Pigeon-grass, 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 ½ inch long, giving spike fuzzy appearance. Grows in cultivated soils thruout the United States.

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

SANDBUR *(Cenchrus carolinianus)*
(Cenchrus tribuloides)

OTHER NAMES.— Bur-grass, Sandspur, Cockspur-grass.

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, ¼ to ½ inch wide, round on margins, dark green. Spikes 1 to 2 inches long bearing clusters of 10 to 30 burs; burs about ¼ 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.

STINK-GRASS *(Eragrostis megastachya)*

OTHER NAMES.— Snake-grass, Candy-grass.

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 ¼ 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.

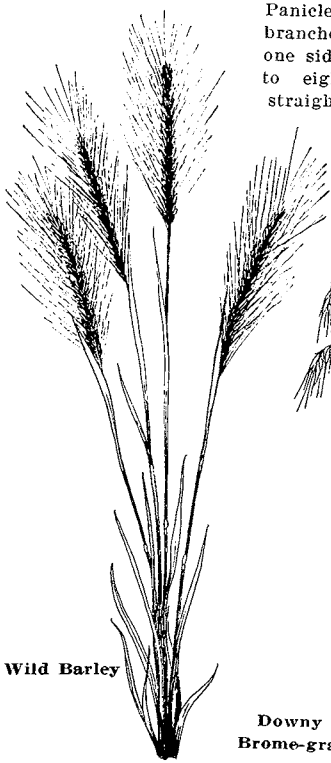
×1/3

Stink-grass

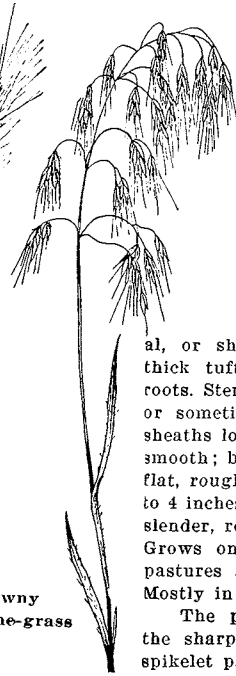
DOWNY BROME-GRASS *(Bromus tectorum)*

OTHER NAMES.—June-grass, 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 ½ to ¾ inch long. Mature plants brownish in color. Grows in fields and waste places over wide range.



Wild Barley



Downy Brome-grass

This grass is often injurious to livestock.

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

WILD BARLEY *(Hordeum jubatum)*

OTHER NAMES.— Squirreltail-grass, Skunktail-grass, Tickle-grass.

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.

SHEEP SORREL *(Rumex acetosella)*

OTHER NAMES.— Field Sorrel, Redtop Sorrel, Horse Sorrel, Louse-weed, 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 arrow-head 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.

This plant is 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.

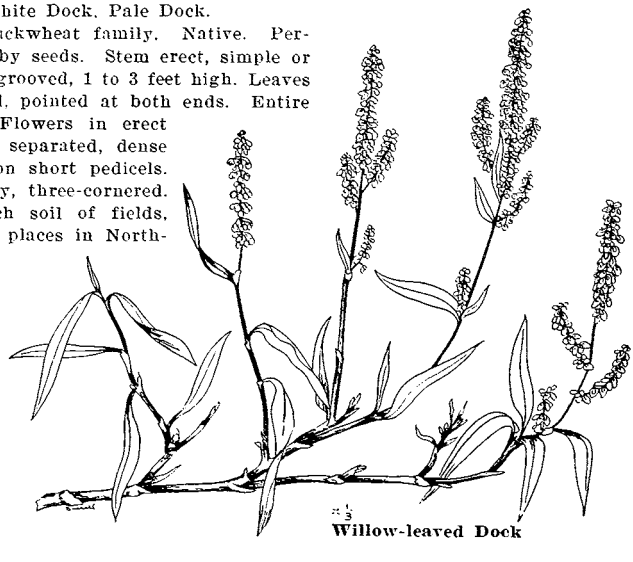
Sheep Sorrel

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.

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.



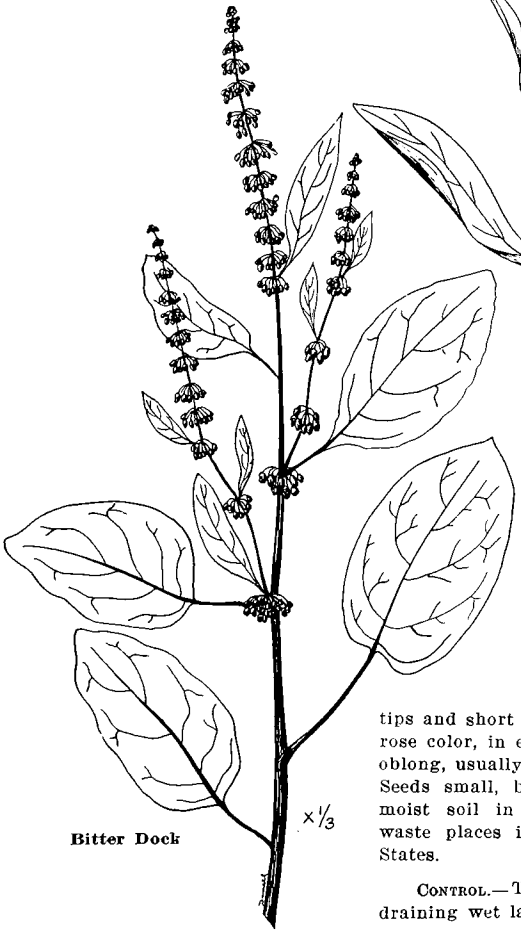
Willow-leaved Dock

BITTER DOCK *(Rumex obtusifolius)*

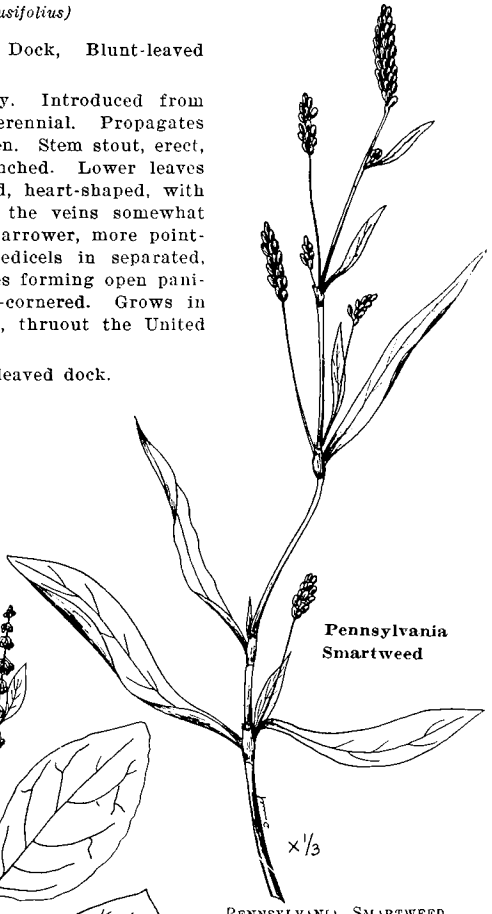
OTHER NAMES.—Broad-leaved Dock, Blunt-leaved Dock.

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, thruout the United States.

CONTROL.—Same as for Willow-leaved dock.



Bitter Dock



Pennsylvania Smartweed

PENNSYLVANIA SMARTWEED *(Polygonum pennsylvanicum)*

OTHER NAMES.— Pennsylvania Knotweed, Purple-weed.

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.

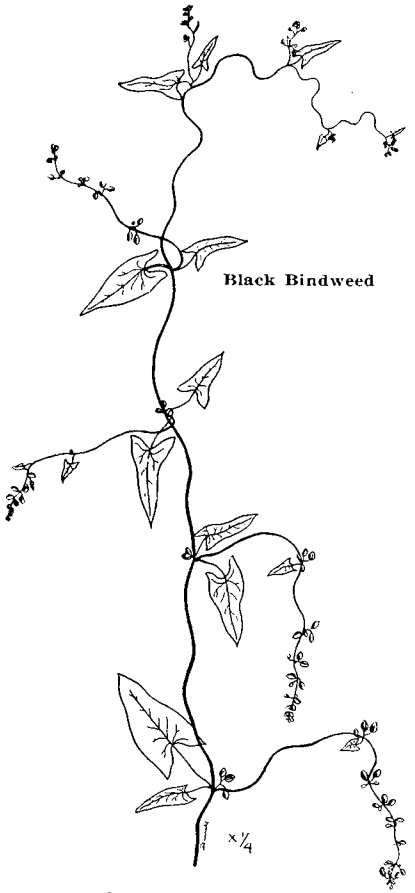
CONTROL.—Thoro cultivation, hand-hoeing, draining wet lands. See control of annuals.

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, ¼ 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 thruout the United States and elsewhere.

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



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

OTHER NAMES.—Wild buckwheat, Knot Bindweed.

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 ½ 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 thruout the United States.

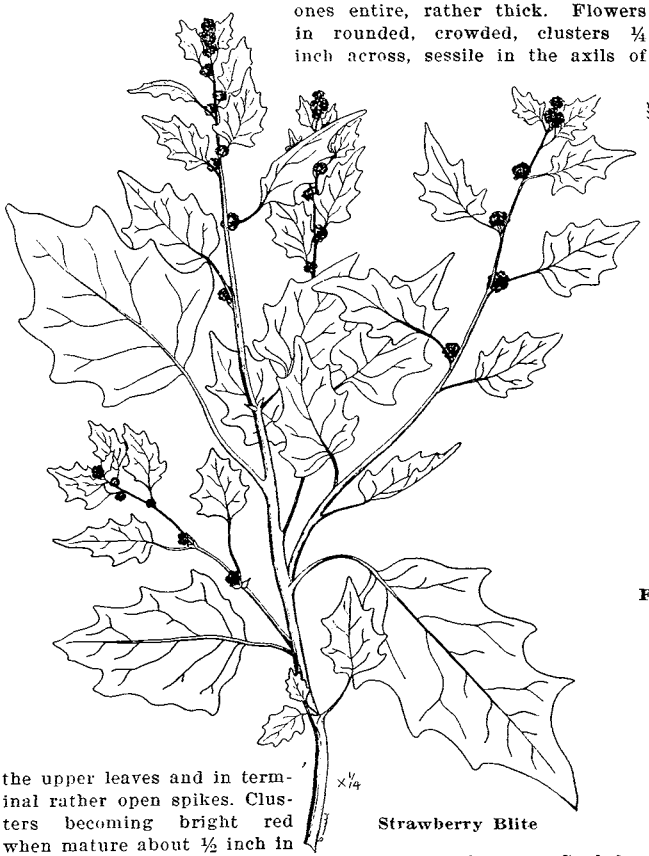
The plant resembles Field Bindweed or Wild Morning Glory in the shape of its leaves and its twining habits. Can always be distinguished by its flower and single taproot.

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

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 ¼ inch across, sessile in the axils of the upper leaves and in terminal rather open spikes. Clusters becoming bright red when mature about ½ 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.



Strawberry Blite

Fireweed

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. Grows 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.

LAMB'S QUARTERS *(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 thruout the world.

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

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

Lamb's Quarters ×1/4

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. The first leaves dark green, needle-shaped, 1 to 2 inches long, drop off; later leaves being awl-like, spiny-tipped, not over ½ 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.

Russian Thistle ×1/3

At maturity breaks off at base and because of its round shape becomes an excellent tumbleweed, scattering seeds for long distances before the wind.

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

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 thruout the United States.

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

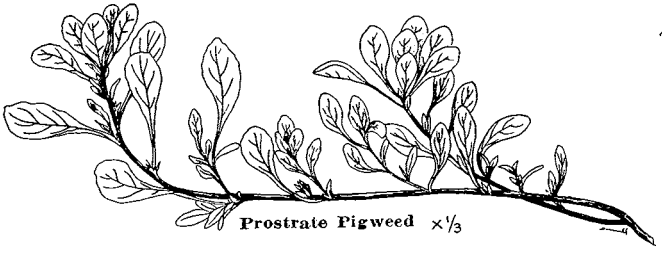
Redroot Pigweed

PROSTRATE PIGWEED *(Amaranthus blitoides)*

OTHER NAMES.—Matted Pigweed, Low Pigweed.

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.

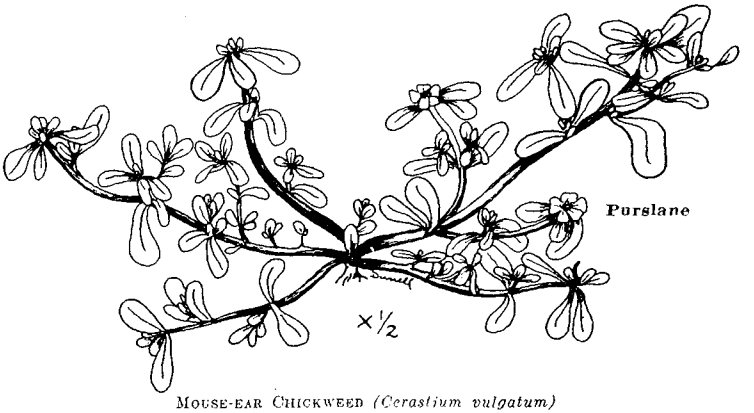

Prostrate Pigweed ×⅓

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, ¼ to ¾ inch long, mostly clustered at the ends of the branches. Entire plant often has reddish tinge. Flowers yellow, about ¼ 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 thruout most of the United States.

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

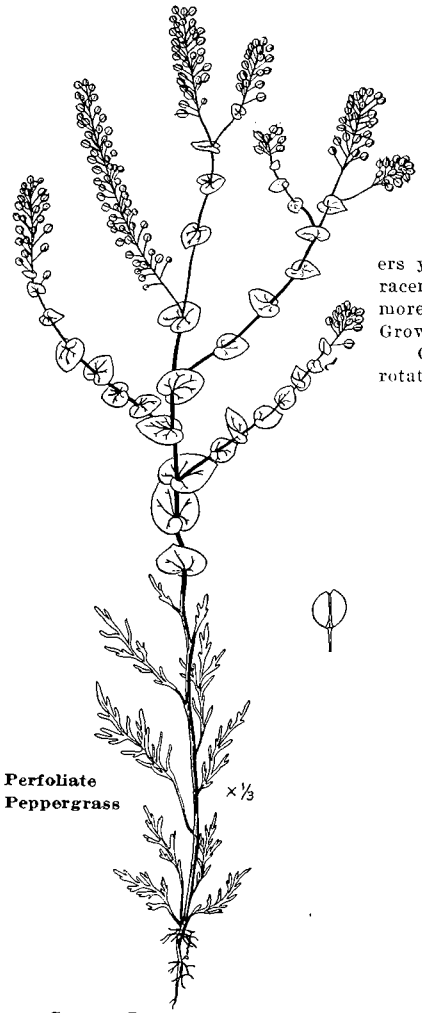


MOUSE-EAR CHICKWEED *(Cerastium vulgatum)*

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, ½ 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 thruout 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.

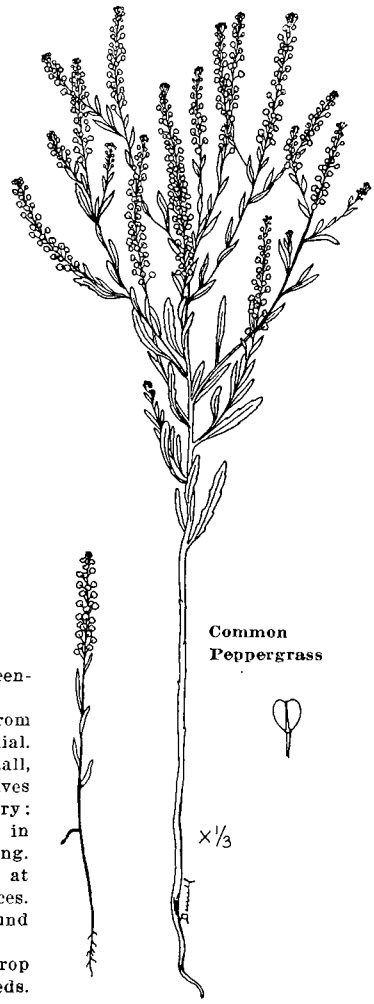


Perfoliate Peppergrass ×⅓

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, ½ to ¾ 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.



Common Peppergrass ×⅓

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

OTHER NAMES.—Apetalous Peppergrass, Green-flowered Peppergrass, Wild Tongue-grass.

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 ⅛ inch across, notched at top. Grows in plains, prairies and waste places. When mature, may become a tumbleweed. Found chiefly in Western States.

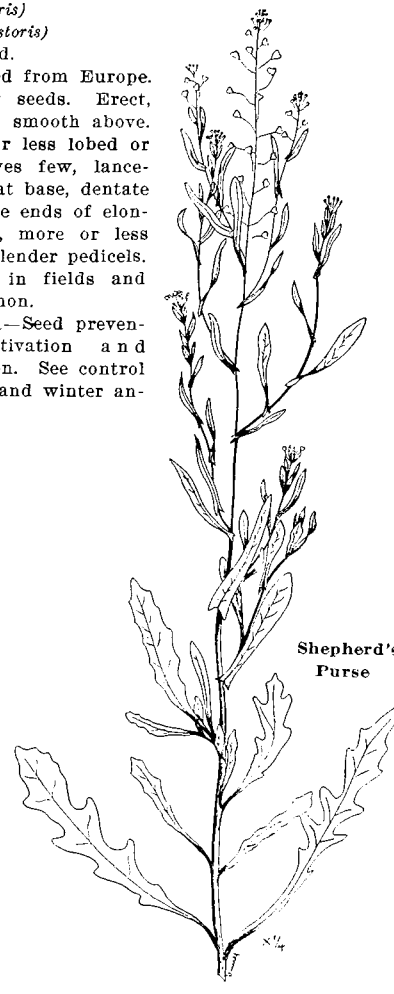
CONTROL.—Seed prevention. Cultivation, crop rotation. See control of annual and biennial weeds.

SHEPHERD'S PURSE *(Bursa bursa-pastoris)*
(Capsella bursa-pastoris)

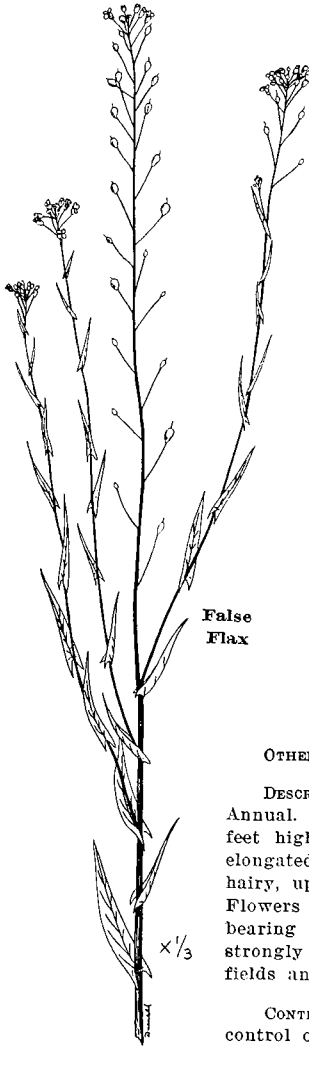
OTHER NAMES.—Shepherd's Bag, Caseweed.

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 elongating racemes, pods flattened, triangular, more or less heart-shaped, about ⅓ of an inch long, on slender pedicels. Seeds very small, golden brown. Grows in fields and waste places thruout the world. Very common.

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



Shepherd's Purse



False Flax

FALSE FLAX *(Camelina microcarpa)*

OTHER NAMES.—Small-fruited False Flax.

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 ¼ 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.

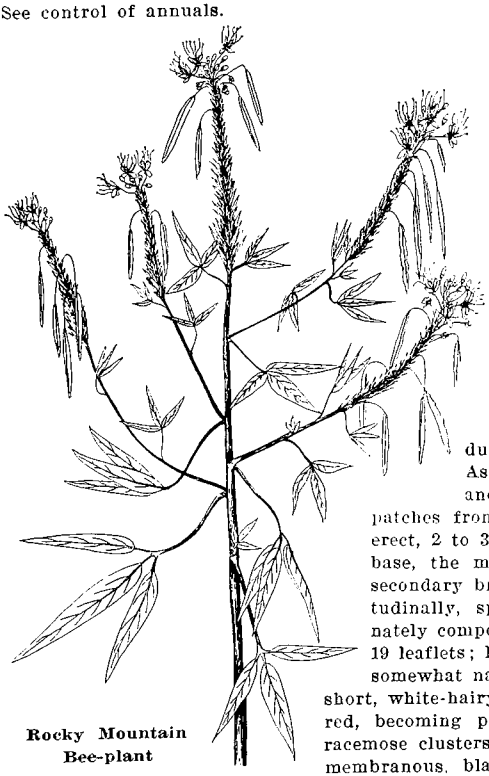
ROCKY MOUNTAIN BEE-PLANT *(Peritoma serrulata)*
(Cleome serrulata)

OTHER NAMES.—Pink Cleome, Stinking Clover, Stink-weed.

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 4 petals each about ½ inch long. Fruiting racemes greatly elongated. 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.



Rocky Mountain Bee-plant

Swainsonia ×⅓

SWAINSONIA *(Swainsonia salsula)*
(Sphaerophysa salsula)

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, ¼ to ½ inch long, short, white-hairy underneath. Typical pea flowers, red, becoming purple when dry, ⅜ inch long, in racemose clusters 1½ to 2 inches long. Pods large, membranous, bladder-like, grooved on one side, ¾ 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.

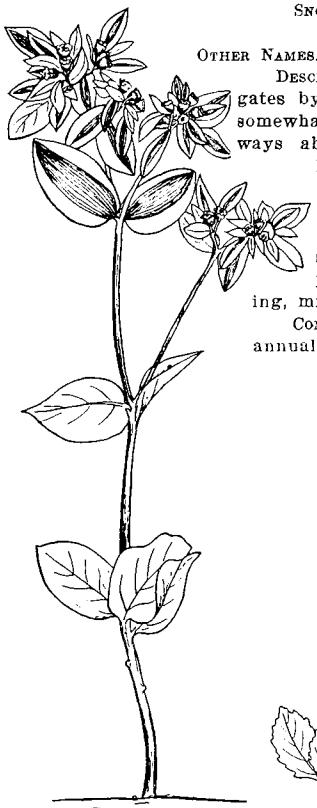
CONTROL.—See control of creeping perennials.

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

OTHER NAMES.—White-margined Spurge, Variegated Spurge.

DESCRIPTION.—Spurge family. Native. Annual. Propagates by seeds. Stem rather stout, erect, 1 to 3 feet tall, somewhat grooved, usually slightly hairy, branching three ways above to form an umbrella-shaped top or umbel. Leaves ovate, pointed, entire, 1 to 3 inches long. Upper leaves margined with white, making a very showy plant. Flowers small, without petals, each enclosed in a bell-shaped involucre. Grows in dry soil, fields, pastures, waste places. Common to the plains region. This plant has a rather acrid, irritating, milky sap, and is considered somewhat poisonous.

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



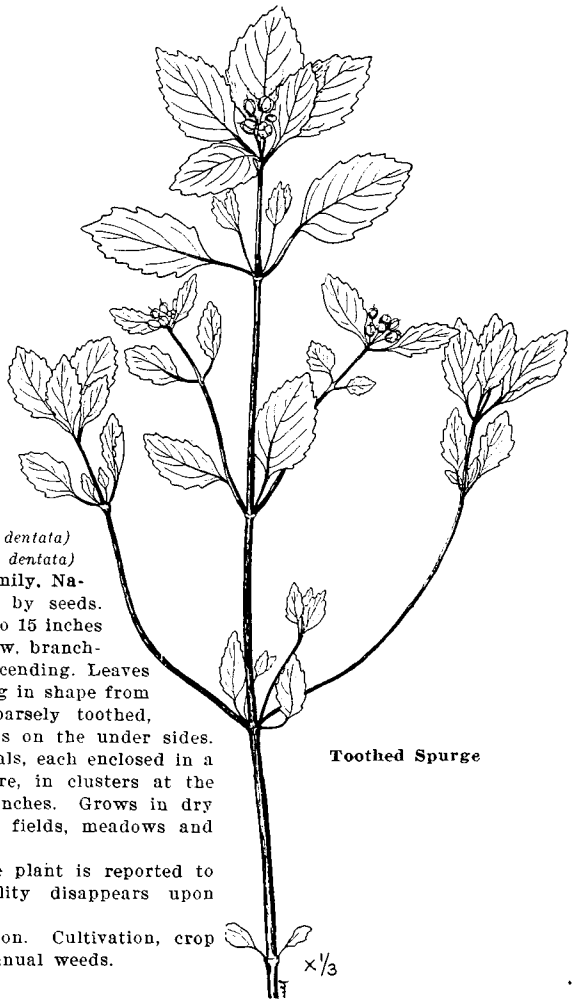
Snow-on-the-mountain

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

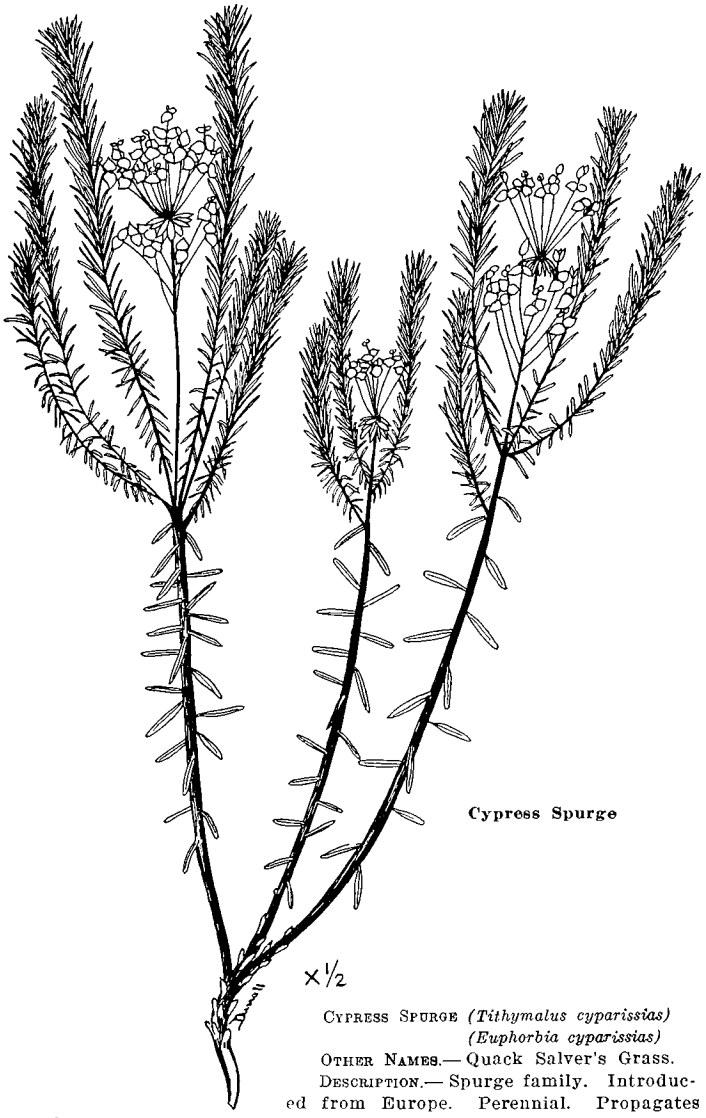
DESCRIPTION.—Spurge family. Native. Annual. Propagates by seeds. Stem erect or ascending, 8 to 15 inches high, somewhat woody below, branched, the branches mostly ascending. Leaves 2 to 3½ inches long, varying in shape from ovate to nearly linear, coarsely toothed, hairy, with prominent veins on the 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



Cypress Spurge

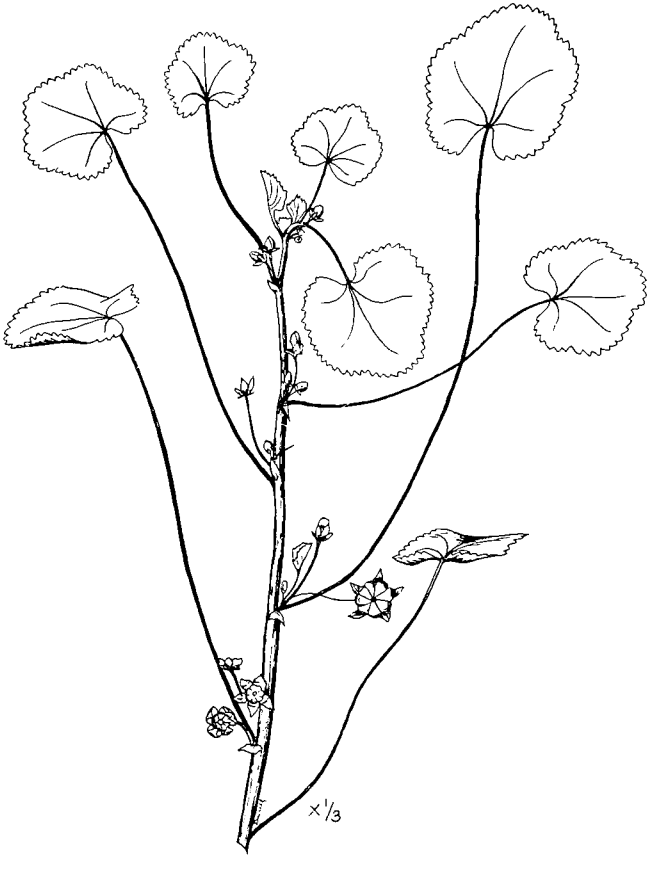
CYPRESS SPURGE *(Tithymalus cyparissias)*
(Euphorbia cyparissias)

OTHER NAMES.— Quack Salver'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, ½ 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.



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, ⅛ to ½ 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 thruout the United States.

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

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

DESCRIPTION.— Mallow family. Native. Perennial. Propagates by seed. 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.

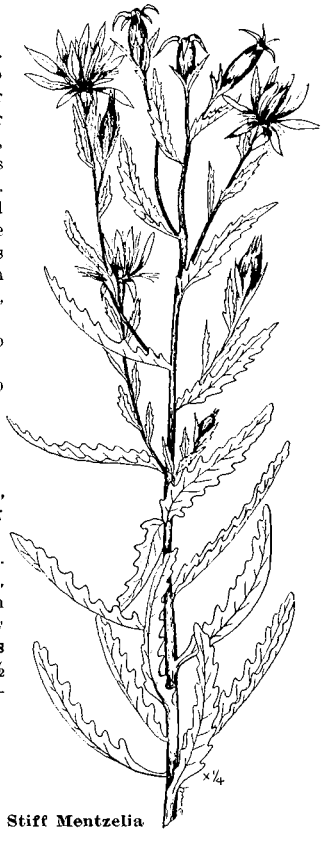
CONTROL.— Seed prevention. Cultivation and crop rotation. See control of simple perennials.

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

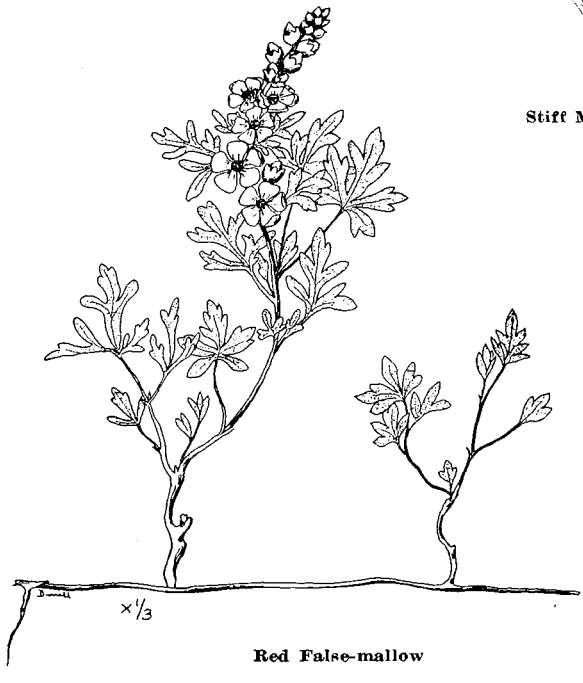
OTHER NAMES.—Bractless Mentzelia, Stiff Nuttallia, Branched Nuttallia, Blazing Star, Stickleaf, Evening Star.

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, 1½ to 2 inches broad with 10 petals, opening in the evening. Fruit an oblong capsule ¾ to 1 inch long, about ¼ 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



Red False-mallow

Velvet-weed

VELVET-WEED *(Gaura parviflora)*

OTHER NAMES.—Gaura, Butterfly-weed.

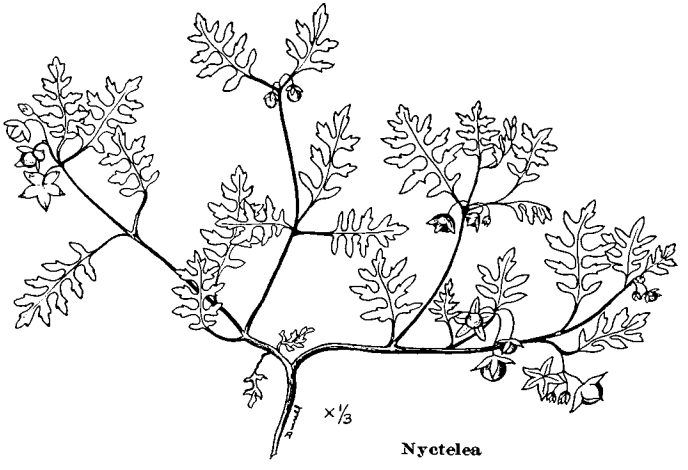
DESCRIPTION.— Evening Primrose family. Native. Annual. Propagates by seeds. Stem erect, somewhat branched, 2 to 5 feet tall, covered with soft white hairs. Leaves alternate, narrow-ovate, more or less pointed, 1½ to 4 inches long, ⅓ to 1½ inches wide, softly hairy, sometimes wavy margined. Flowers white or pink to reddish, small, borne on a dense, elongated spike, terminating the stem. Fruit a smooth four-angled capsule, ¼ to ⅓ 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.

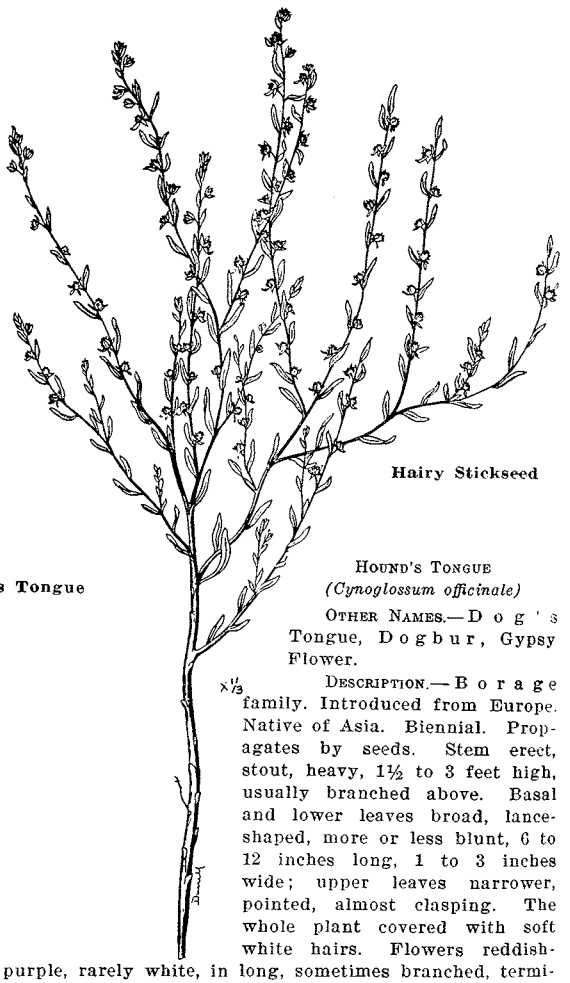
NYCTELEA *(Macrocalyx Nyctelea)*

DESCRIPTION.— Water-leaf 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.



Nyctelea



HOUND'S TONGUE
(Cynoglossum officinale)

OTHER NAMES.—Dog's Tongue, Dogbur, Gypsy Flower.

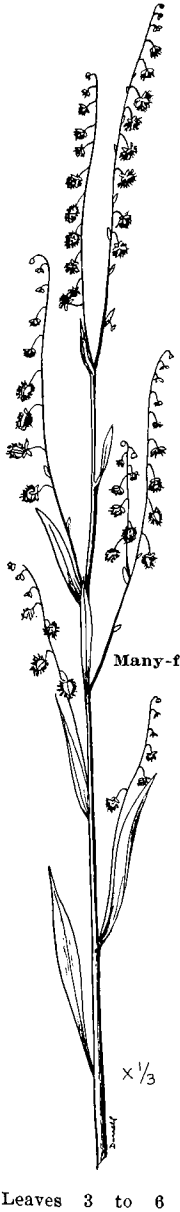
DESCRIPTION.—Borage family. Introduced from Europe. Native of Asia. Biennial. Propagates by seeds. Stem erect, stout, heavy, 1½ to 3 feet high, usually branched above. Basal and lower leaves broad, lance-shaped, more or less blunt, 6 to 12 inches long, 1 to 3 inches wide; upper leaves narrower, pointed, 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 ¼ 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 *(Lappula occidentalis)*

DESCRIPTION.—Borage 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 4 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.



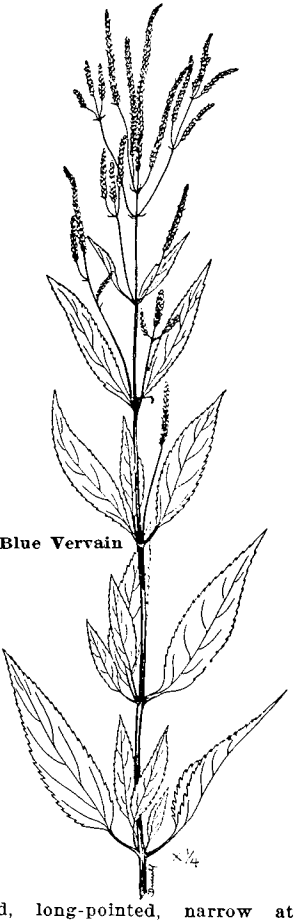
Many-flowered Stickseed

MANY-FLOWERED STICKSEED *(Lappula floribunda)*

OTHER NAMES.—Western Stickseed, Large-flowered Stickseed, Western Sheepbur.

DESCRIPTION.— Borage 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, ¼ to ½ inch broad, with five petals, on long, ascending, racemes, which are usually in pairs. Burs about ¼ 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

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 4 nutlets (seeds). Grows in moist places, fields, meadows, roadsides and waste places. Rather wide distribution.

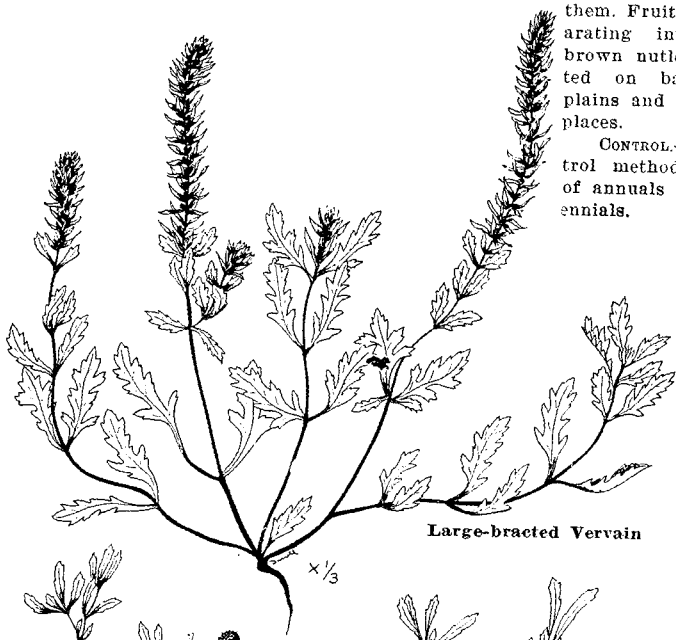
CONTROL.—Deep hoe-cutting or pulling. Cultivation, crop rotation. See control of simple perennials.

LARGE-BRACTED VERVAIN *(Verbena bracteosa)*

OTHER NAMES.—Prostrate Vervain.

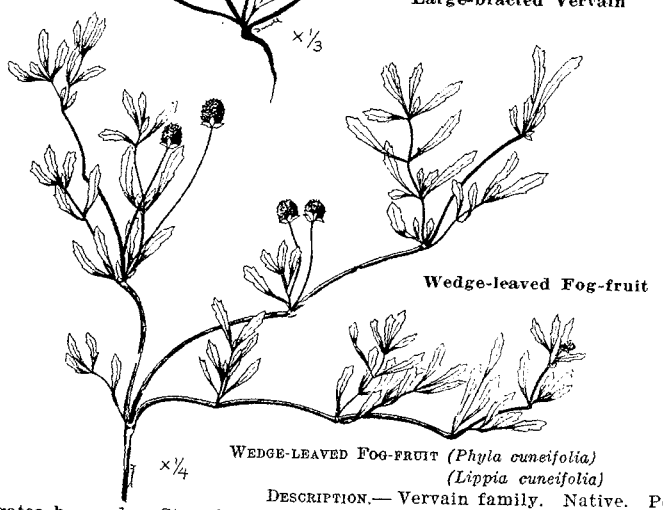
DESCRIPTION.— Vervain family. Native. Annual or perennial. Propagates by seeds. Stem four-sided, much branched from the base, some branches prostrate, some ascending, slender, 6 to 15 inches long, rough, hairy. Leaves 1 to 3 inches long, pinnatifid, the lobes toothed, basal pair spreading. Flowers purplish 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.



Large-bracted Vervain

×⅓



Wedge-leaved Fog-fruit

×¼

WEDGE-LEAVED FOG-FRUIT *(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.

LANCE-LEAVED SAGE *(Salvia lanceolata)*

OTHER NAMES.—Blue Sage.

DESCRIPTION.— Mint family. Native. Perennial. 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 ⅓ 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.

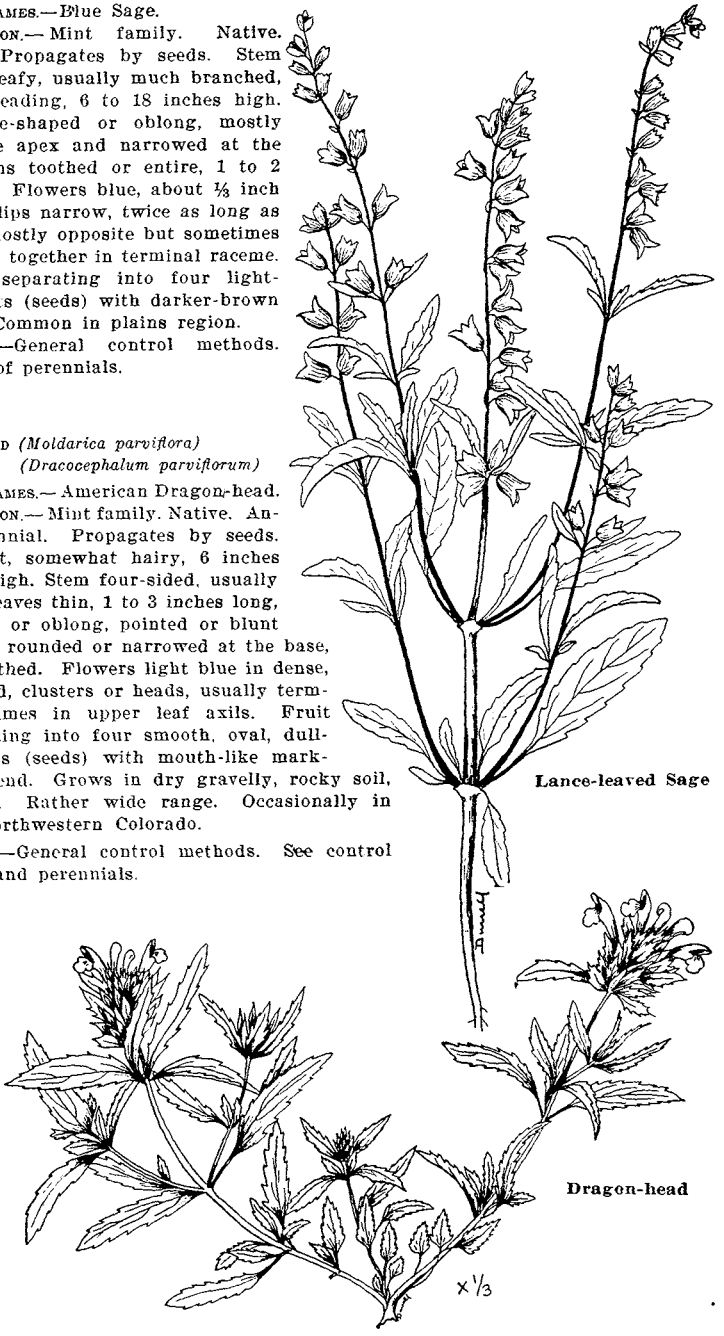
CONTROL.—General control methods. See control of perennials.

DRAGON-HEAD *(Moldarica 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 Northwestern Colorado.

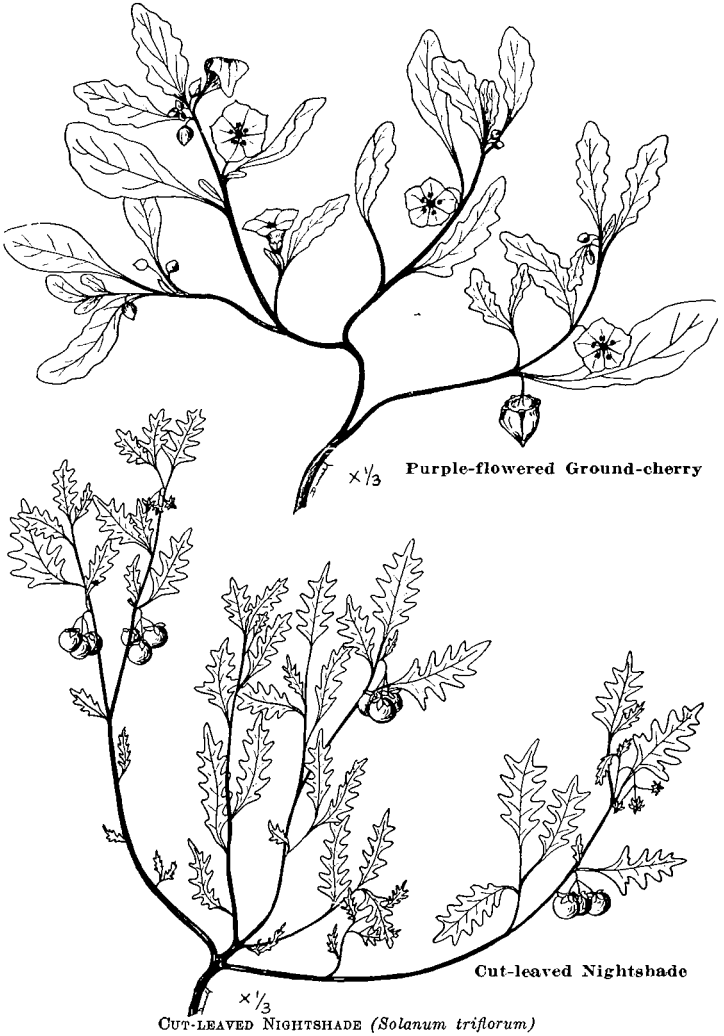
CONTROL.—General control methods. See control of annuals and perennials.



PURPLE-FLOWERED GROUND-CHERRY *(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, cream-colored, rough-pitted. Common along roadsides, in fields and waste places in plains region.

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



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, ⅛ to ½ inch across, one to three flowers in a group. Fruit in the form of round, smooth, berries, about ½ 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.

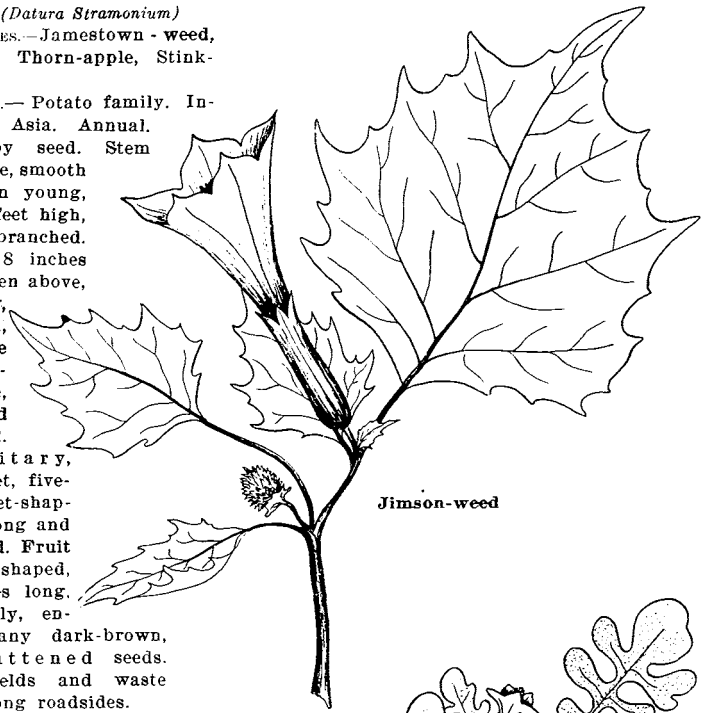
JIMSON-WEED *(Datura Stramonium)*

OTHER NAMES.—Jamestown-weed, Devil's Apple, Thorn-apple, Stinkwort.

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 putting the flowers in their mouths. Also poisonous to livestock but seldom eaten.

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



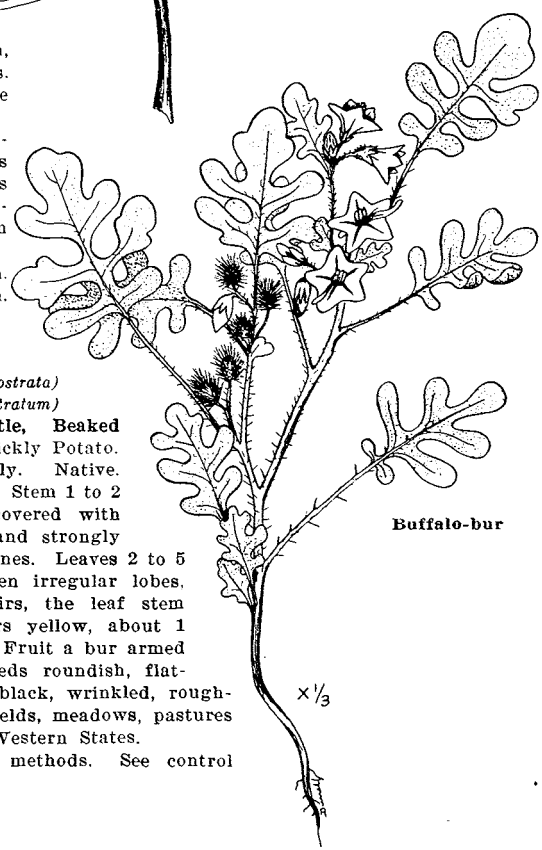
Jimson-weed

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

OTHER NAMES.—Horse Nettle, Beaked Nightshade, Texas Thistle, Prickly Potato.

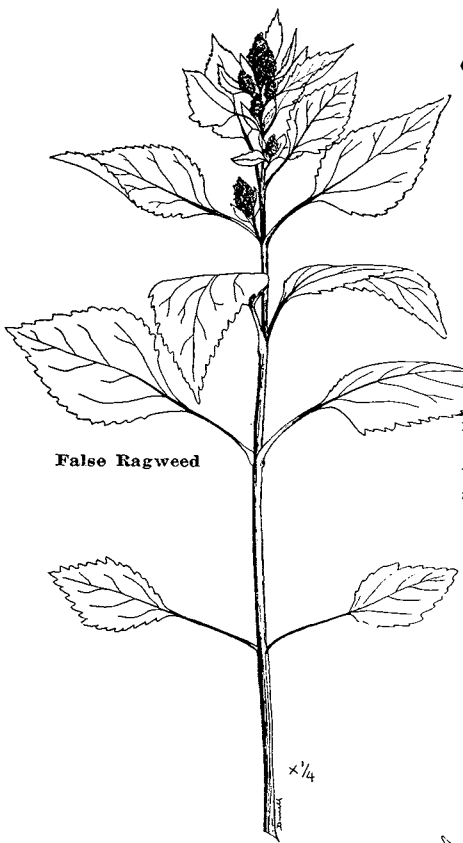
DESCRIPTION.— Potato family. Native. Annual. Propagates by seeds. Stem 1 to 2 feet high, much branched, covered with yellowish star-shaped hairs, and strongly armed with slender yellow spines. Leaves 2 to 5 inches long with five to seven irregular lobes, covered with star-shaped hairs, the leaf stem 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

X 1/3



False Ragweed

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

OTHER NAMES.— False Sunflower, Giant Marsh-elder.

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 ⅛ inch broad in large, terminal panicles and smaller clusters in the axils. Seeds usually five in each head, about ⅛ 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.

Great 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 involucres, 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 ¼ inch long with a beaked crown. Common in fields and waste places, roadsides. Wide spread.

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

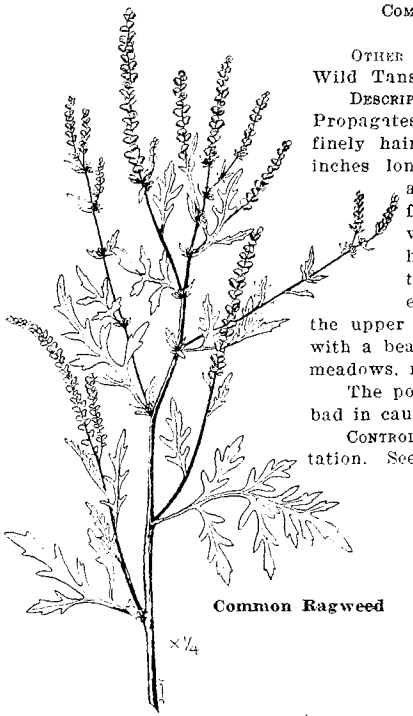
COMMON RAGWEED *(Ambrosia elatior)*
(Ambrosia artemisiaefolia)

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 involucres, 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 ⅛ inch long with a beaked crown. Common in cultivated fields, meadows, roadsides, waste places. Wide spread.

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.



Common Ragweed

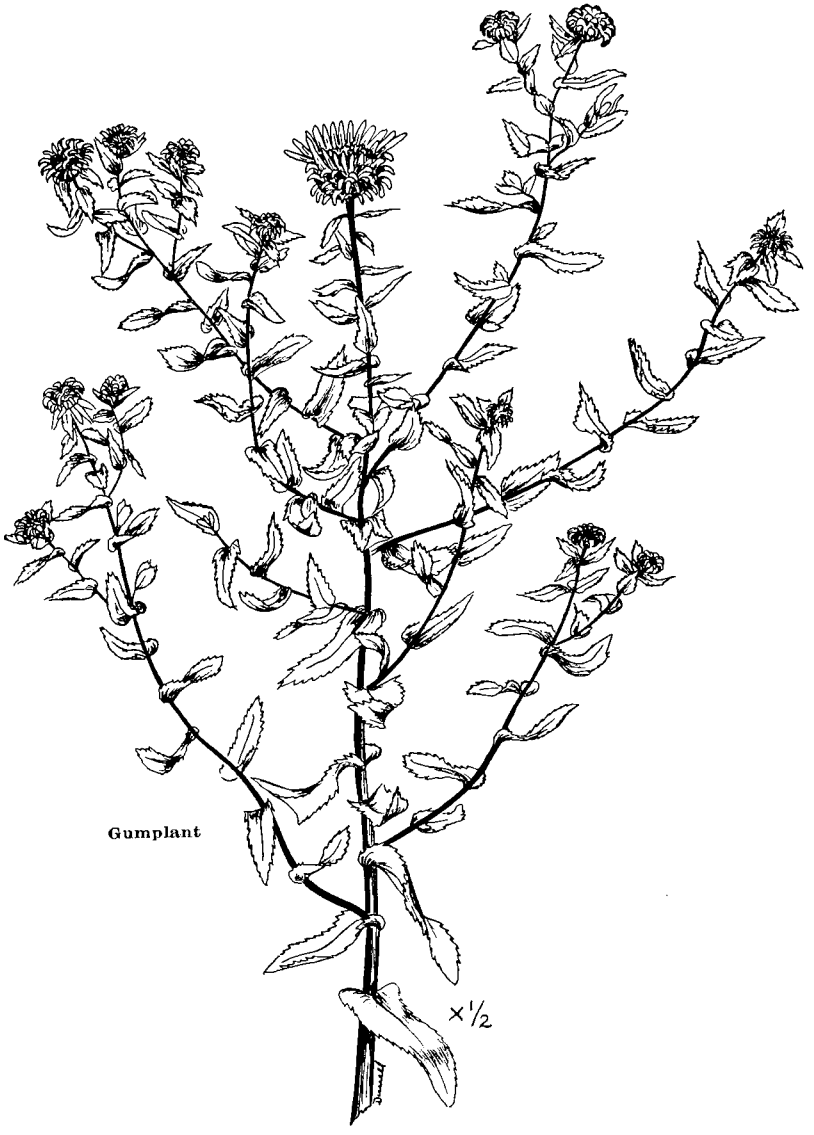
RAYLESS ASTER *(Brachyactis angusta)*
(Aster angustus)

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, ⅓ to ½ 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.

Rayless Aster

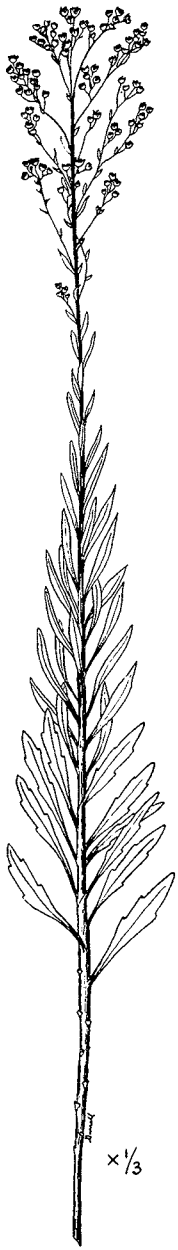


GUMPLANT *(Grindelia squarrosa)*

OTHER NAMES.—Broad-leaved Gumplant, Gumweed, Rosin-weed, Tarweed, Scaly Grindelia.

DESCRIPTION.— Thistle family. Native. Perennial. Propagates by seeds. Stem smooth, erect, 1 to 2 feet high, freely branching. Leaves ½ to 1½ 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, ⅛ inch long. Grows in fields, meadows, roadsides and waste places, mostly in the Western States.

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



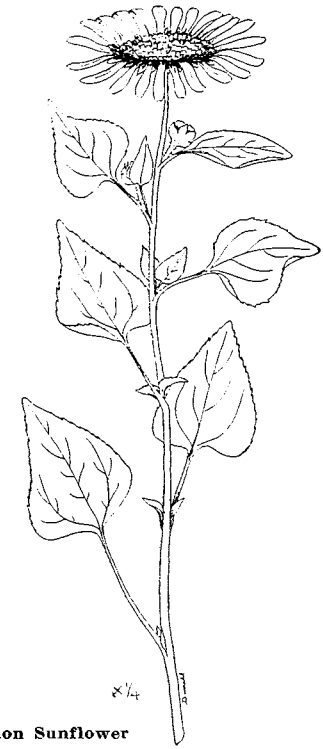
Canada Fleabane

CANADA FLEABANE *(Leptilon canadense)*

OTHER NAMES.—Horseweed, Mare's Tail, 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 panicled clusters, the rays white, almost concealed by bell-shaped involucres. Seeds numerous, very small, flattened, with tannish bristly pappus. Grows in fields, meadows and waste places thruout the United States.

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



Common Sunflower

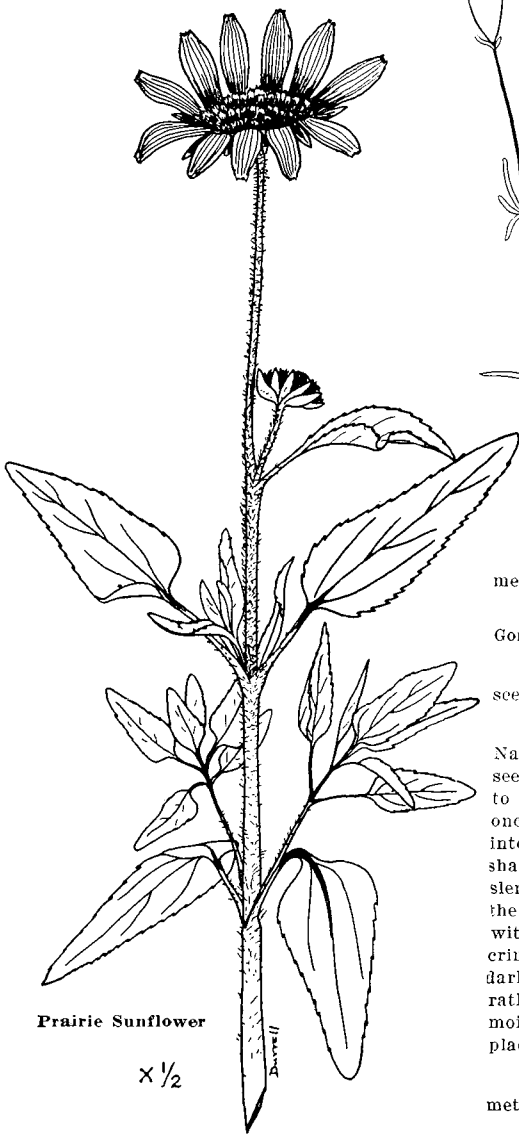
COMMON SUNFLOWER *(Helianthus lenticularis)*
(Helianthus annuus)

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.

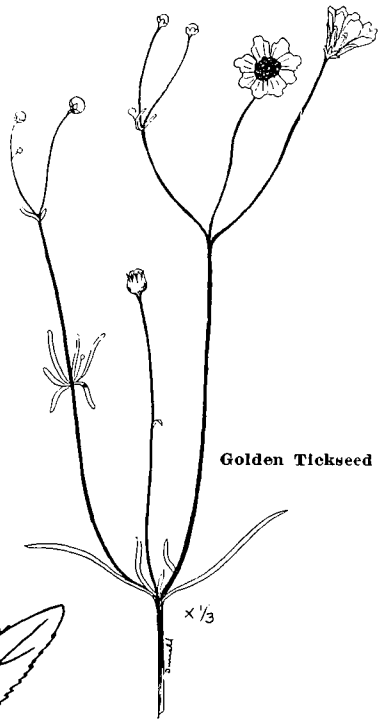
PRAIRIE SUNFLOWER *(Helianthus petiolaris)*

DESCRIPTION.—Thistle family. Native. Annual. Propagates by seeds. Similar to preceding species 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 1½ to 3 inches broad, with yellow rays, central disk brown, ½ to ¾ inch in diameter, made up of fertile florets. Seeds somewhat hairy about ⅜ inch long. Grows in fields, meadows, waste places and along roadsides. Common in the plains region.



Prairie Sunflower

× ½



Golden Tickseed

× ⅓

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 3½ 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 ½ 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.

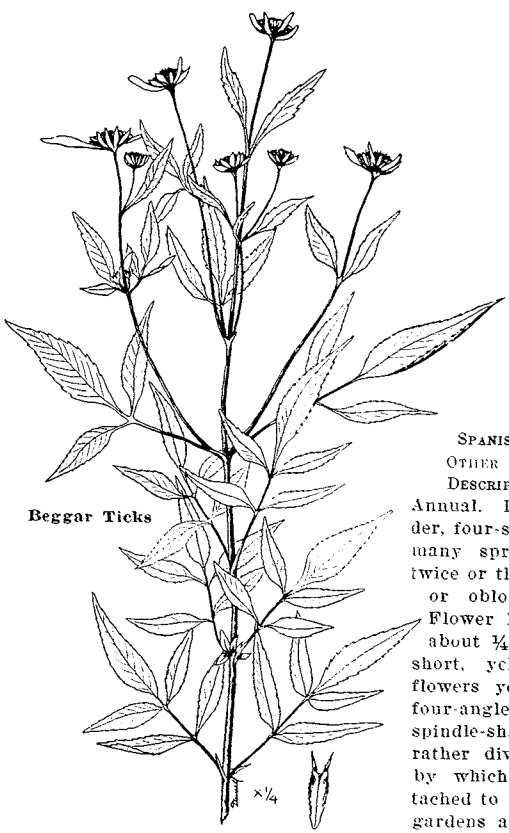
CONTROL.—General control methods. See control of annuals.

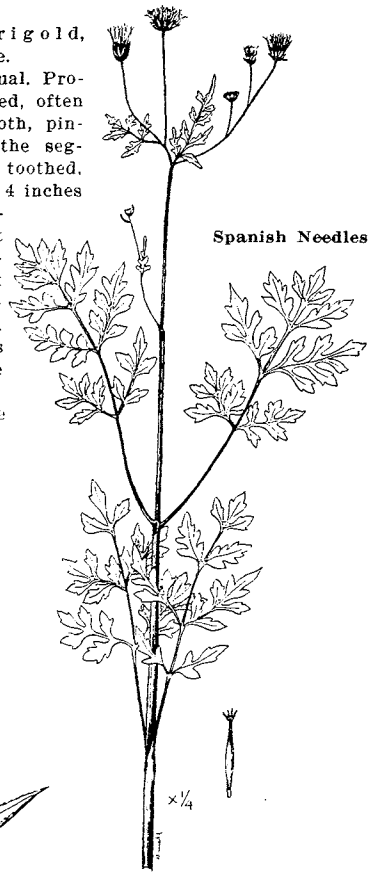
BEGGAR TICKS *(Bidens frondosa)*

OTHER NAMES.—Bur Marigold, Rayless Marigold, Pitchfork Weed, Devil's 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, ½ to 1 inch wide. Flower heads numerous, about ½ 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, ¼ to ½ 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.



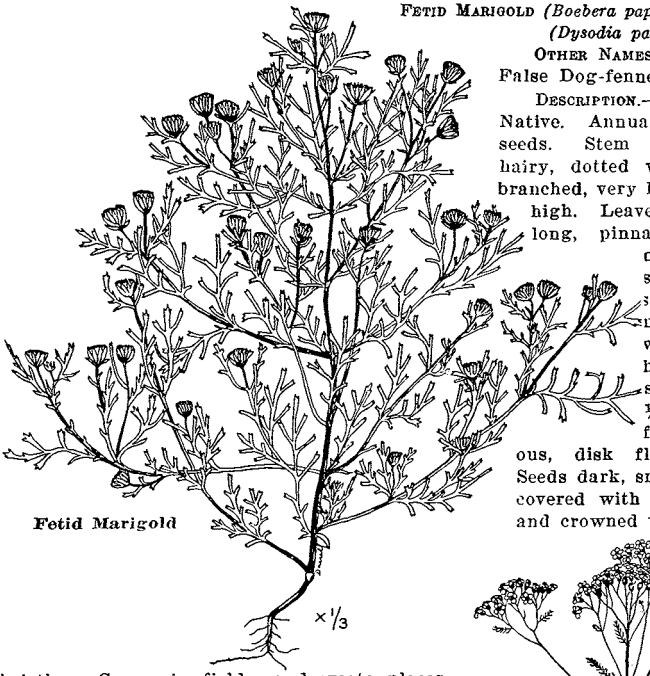


SPANISH NEEDLES *(Bidens bipinnata)*

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 ¼ inch broad; three to four rays, short, yellow, sometimes lacking; disk flowers yellow, five-lobed. Seeds brown, four-angled ½ to ¾ 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

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

OTHER NAMES.—False Mayweed, False Dog-fennel, Stink-weed.

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 ½ to 1½ inches long, pinnately divided into narrow, linear, or slightly spatulate, sharply toothed segments, also dotted with glands. Flower heads numerous, on short stems, ¼ to ½ 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 wide spread.

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

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

Yarrow

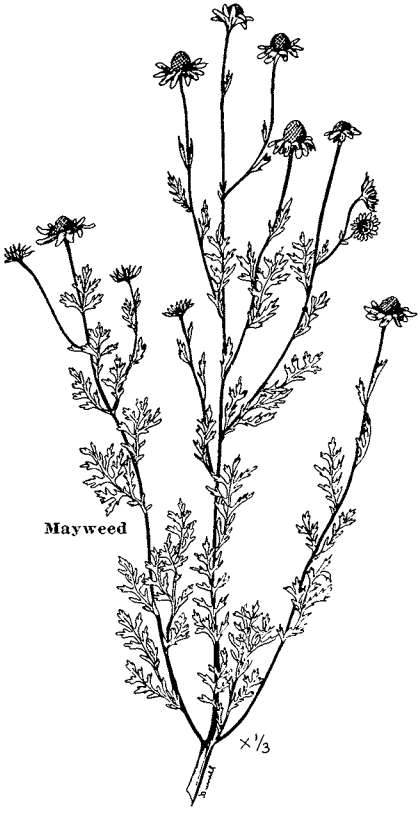
YARROW *(Achillea millefolium)*

OTHER NAMES.—Milfoil, Thousand-leaf, 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.



MAYWEED *(Maruta cotula)*
(Anthemis cotula)

OTHER NAMES.—Dog-fennel, 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 thruout 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.

BULL THISTLE *(Cirsium lanceolatum)*
(Carduus lanceolatus)

OTHER NAMES.—Common Thistle, Spear Thistle, Plume Thistle.

DESCRIPTION.—Thistle family. Introduced from Europe. Native also of Asia. Biennial. Propagates by seeds. Stem, stout, erect, branched, more or less hairy, 3 to 5 feet high, leafy to the heads. Leaves alternate, stiff, hairy above, densely woolly-hairy beneath, more or less lance-shaped, 3 to 6 inches long, deeply pinnatifid, the triangular to lance-shaped lobes tipped with stout needle-like spines, the margins bristly. Flower heads 1½ to 2 inches broad, 1½ to 2 inches long, solitary on the ends of the branches, bright-purple, fragrant. Involucre bracts long, pointed, tipped with slender, needle-like spines. Seeds light-colored, oblong, somewhat flattened, sometimes curved, with long, white, hairy plume, easily detached.

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

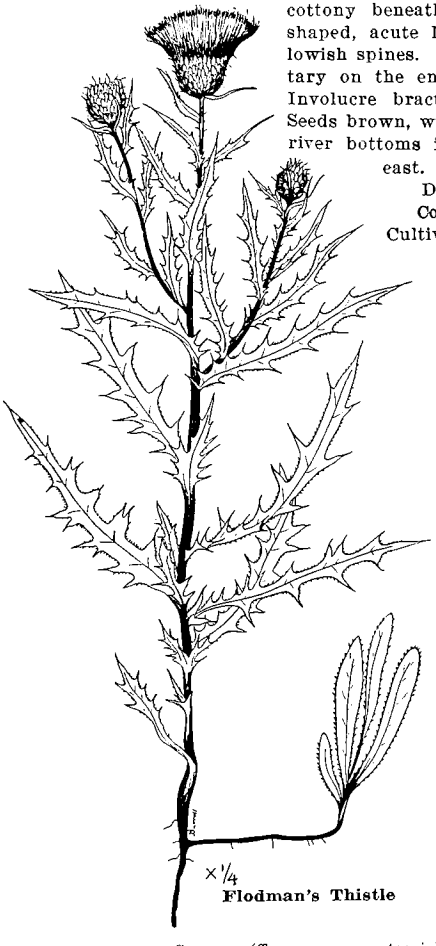
CONTROL.—Deep cutting first-year rosettes. Seed prevention. Cultivation. See control of biennials.

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.



×¼
Flodman's Thistle

SALSIFY *(Tragopogon pratensis)*

OTHER NAMES.—Meadow Salsify, Yellow Goat's Beard, Wild Oyster-Plant, Noon Flower.

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 ⅛ inch long, rough with funnel-formed parachutes which at maturity are in large, conspicuous, tawny-colored blow-balls. Grows in fields, meadows, in waste places and along roadsides. The flowers open at sunrise and are closed by noon.

Salsify
×¼

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

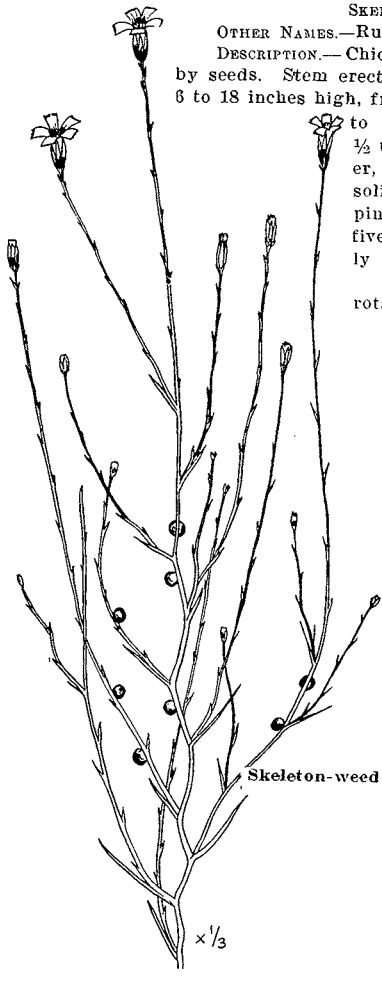
CHICORY *(Cichorium Intybus)*

OTHER NAMES.—Succory, Blue Sailors, Bunk, Coffee-weed.

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.

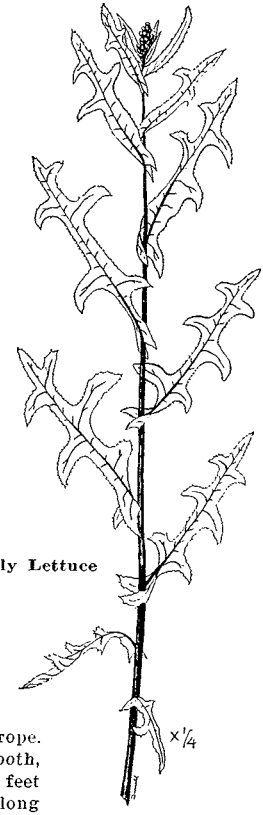


SKELETON-WEED *(Lygodesmia juncea)*

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, ½ to 2 inches long; upper leaves becoming smaller, the top ones mere scales. Flower heads erect, solitary and terminal, ½ to ¾ inch broad, rosy-pink to light-purple, usually five-flowered, the rays five-notched at the tips. Seeds very slender, nearly ¼ inch long, with light-brown, hairy plume.

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



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 underside. Flower heads numerous, in large, open panicles, pale-yellow, ¼ to ½ inch broad, on very short stems (pedicels), only a few opening at a time. Seeds brown, ridged, with white, silk-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."

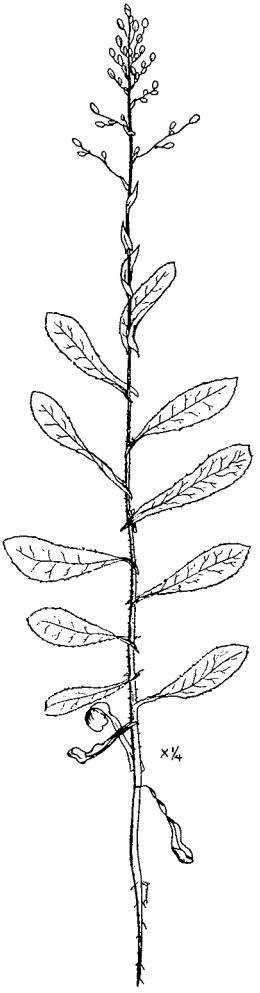
CONTROL.—Seed prevention. Clean cultivation. Crop rotation See control of biennials.

PRICKLY LETTUCE *(Lactuca virosa)*
(Lactuca integrata)

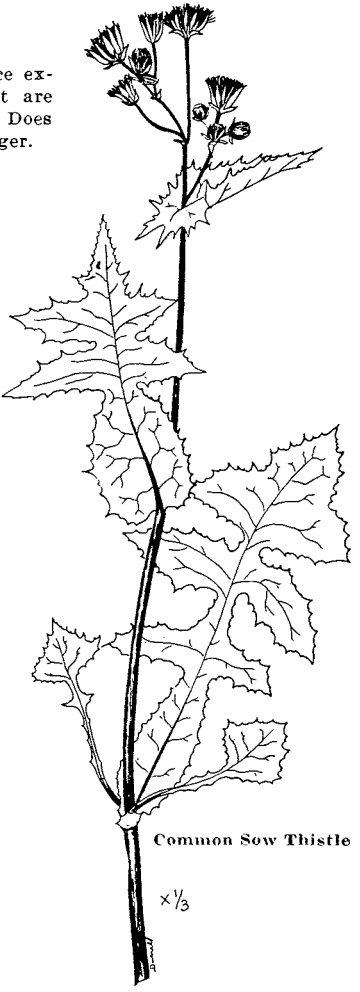
OTHER NAMES.—Compass Plant, Milk Thistle.

DESCRIPTION.— Same as for True Prickly Lettuce except that leaves are not pinnatifid or lobed but are characterized by wavy, prickly-toothed margins. Does not grow quite as tall and heads are slightly larger.

CONTROL.—Same as for True Prickly Lettuce.



Prickly Lettuce



Common Sow Thistle

COMMON SOW THISTLE *(Sonchus oleraceous)*

OTHER NAMES.—Hare's 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 thruout the United States.

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

COMMON WEEDS NOT ILLUSTRATED

COW-COCKLE *(Vaccaria Vaccaria)* *(Saponaria Vaccaria)*

OTHER NAMES.—Wheat-cockle, Spring-cockle, Pink-cockle, 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, ¼ to ⅓ inch across, with five petals. Calyx about ½ inch long, five-ribbed. Seeds 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.

SPREADING YELLOW-CRESS *(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 ⅛ to ½ 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.

SILVER-WEED *(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 ½ 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.

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 thruout 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.

COMMON MULLEN *(Verbascum Thapsus)*

OTHER NAMES.—Great Mullen, Velvet Dock, Woolly Mullen, Jacob's 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, ¾ to 1 inch broad, sessile, crowded on long, dense cylindrical spikes. Fruit a capsule about ¼ 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.

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 year's 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 a single flower.

PERENNIAL.—Of more than 2 year's 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 or rootstock.

ROOTSTOCK.—A horizontal underground stem; 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 seed 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, bindweed 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 subdivision 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 ex-

termination 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 ($25.00) or more than Three Hundred Dollars ($300.00) for each failure to comply with the provisions of the act or orders given under the provisions of the act.

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