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Fifty Important Weeds of Montana

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Fifty Important Weeds of Montana

Weeds are natural competitors with farm and garden crops. Often the same plants growing on uncropped land are thought of simply as wild plants—not as weeds. As competitors with crops they reduce the yield by taking moisture and food and by crowding the cultivated plants. The total reduction in yield is almost incalculable. Scarcely a cultivated field can be found anywhere in the world in which weeds are not more or less troublesome, and they sometimes take such complete possession of the land that there is no harvest. Some effort is usually made by the farmer to aid his crop in competing with the weeds, and the cost of such efforts must be charged to the losses caused by weeds. In some cases the weeds have distinctly objectionable properties in addition to competing with cultivated plants. Some are spiny, others are poisonous, while still others give a bad taste or odor to the foods with which they become mixed.

All things considered, the problem of combating weeds is one of the most serious with which a farmer has to contend, and the extent to which he succeeds in keeping them down is a good indication of his ability in his profession.

CLASSIFICATION

Various systems are used to classify plants, but the one that serves the most useful purpose in discussing weeds is that which classifies them on the basis of their length of life. On this basis they are classified as follows:

1. Annuals, that is, plants that produce seeds and die within twelve months—usually during one growing season.

2. Biennials, that is, plants that require two seasons to produce their seeds, after which they die.

3. Perennials, that is, plants that live for more than two years and usually for very many.

To know the normal span of life of any weed will enable us to work more intelligently in applying measures to keep it under control.

ANNUALS

Many plants produce seeds and die within a year from the time they start from seed. Such plants are called annuals. Generally such plants spend most of the summer making one crop of seeds but in a few cases they develop so rapidly that two or even three successive generations may be produced, if the newly formed seeds do not require a dormant period before germination. Under some conditions seeds may sprout so late in the season that they do not have time to mature a crop of seeds before cold weather sets in. Such plants, if rather tender, are killed by our northern winters. The wild oat is a good example. In the case of more hardy plants like the fanweed the young plants live through the winter and produce their seed early the next season. Such plants are termed "winter annuals," though if the seeds sprout in the spring and a new crop is produced before winter the same species is a regular annual.

BIENNIALS

If plants live through two seasons and then die they are called biennials. The common carrot is a good example. Most biennials do not produce seed the first summer but spend this time in growth and storage of food—usually in a fleshy root. The next season this stored food is added to that taken from soil and air for producing the crop of seeds.

PERENNIALS

If plants live on year after year for an indefinite period, they are called perennials. Some of them, like the Canada thistle and most of the lupines, die to the ground during the winter but the roots live over and send up new stems in the spring. Others, like most kinds of sage brush, are not killed back but the tops continue to grow indefinitely. Perennials usually produce seed each year excepting the first, but fortunately not in such abundance as do certain annuals, notably those of the mustard family.

The division of weeds into annuals, biennials, and perennials, while useful in a general way, is not sharp and definite. Some that are usually biennials may produce seed the first year and then die. Many gardeners have noticed this phenomenon occasionally in the beet. On the other hand, some plants that are usually biennials may under certain conditions live for several years. Gumweed behaves in this way. Squirrel-tail will under differing conditions live as an annual, a biennial, or a perennial.

Some perennials have underground stems called rootstocks, which increase greatly the difficulty of exterminating these weeds. They are discussed more fully under Methods of Propagation.

Following is a list of the weeds discussed in this bulletin, grouped according to their length of life.

Annuals

Chess, *Bromus secalinus* L. (winter annual)

Chickweed (common), *Stellaria media* (L.) Cyrill. (winter annual)

Cocklebur, *Xanthium echinatum* Murr.

Corn cockle, *Agrostemma Githago* L. (winter annual)

Cow cockle, *Saponaria Vaccaria* L.

Dodder, *Cuscuta epithymum* Murr.

False flax, *Camelina sativa* Crantz. (winter annual)

Fanweed, *Thlaspi arvense* L. (winter annual)

Foxtail (green), *Chaetochloa viridis* (L.) Scrib.

Kinghead, *Ambrosia trifida* L.

Knapweed, *Centaurea picris*

Lamb's-quarters, *Chenopodium album* L.

Marsh elder, *Iva xanthifolia* Nutt.

Military grass, *Bromus tectorum* L. (winter annual)

Mustard (common, wild), *Brassica arvensis* (L.) Ktze

Mustard (hare's ear), *Conringia orientalis* (L.) Dumort. (winter annual)

Mustard (tumbling), *Sisymbrium altissimum* L. (winter annual)

Peppergrass, *Lepidium apetalum* Willd. (winter annual)

Pigweed, *Amaranthus retroflexus* L.

Prickly lettuce, *Lactuca Scariola* L. (winter annual or biennial)

Ragweed (common), *Ambrosia artemisiaefolia* L.

Russian thistle, *Salsola pestifer* A. Nels.

Shepherd's purse, *Capsella bursa-pastoris* (L.) Med. (winter annual)

Sow thistle (annual), *Sonchus oleraceus* L.

Sunflower (wild), *Helianthus annuus* L.

Wild buckwheat, *Polygonum Convolvulus* L.

Wild oat, *Avena fatua* L.

Wild tomato, *Solanum triflorum* Nutt.

Yellow trefoil, *Medicago lupulina* L.

Biennials

Gumweed, *Grindelia squarrosa* (Pursh) Dunal (sometimes perennial)

Mustard (tansy), *Sophia incisa* (Engelm.) Greene

Squirrel-tail, *Hordeum jubatum* L. (sometimes annual or perennial)

Thistle (prairie), *Carduus undulatus* Nutt. (sometimes perennial)

Perennials

Blue lettuce, *Lactuca pulchella* (Pursh) DC.

Canada thistle, *Carduus arvensis* (L.) Robs.

Chickory, *Cichorium Intybus* L.

Chickweed (mouse-ear), *Cerastium vulgatum* L.

Dandelion, *Taraxicum officinale* Weber

Dock (curled), *Rumex crispus* L.

Dogbane, *Apocynum androsaemifolium* L.

Morning-glory (wild), *Convolvulus arvensis* L.

Plantain (common), *Plantago major* L.

Poverty weed, *Iva axillaris* Pursh

Quack grass, *Agropyron repens* (L.) Beauv.

Sheep sorrel, *Rumex acetosella* L.

Skeleton weed, *Lygodesmia juncea* Don.

Sow thistle (perennial), *Sonchus arvensis* L.

Toad flax, *Linaria Linaria* (L.) Karst.

Wild begonia, *Rumex venosus* Pursh

Wild licorice, *Glycyrrhiza lepidota* Pursh

From this list it may be seen that the biennials are relatively unimportant as weeds, there being only four of them in the fifty here considered, while there are twenty-nine annuals and seventeen perennials. It should not be understood that there are only fifty weeds in Montana, but these seem to be the most important either

from actual trouble they are giving or because of their likelihood of increase, as indicated by their spread in recent years or by the prevalence of their seeds among those of farm and garden crops.

METHODS OF PROPAGATION

Practically all of our flowering plants reproduce by seeds, even those like dodder that are parasites on other plants. In the case of nearly all annuals and biennials and most perennials this is the only method of reproduction. Some kinds produce relatively few seeds while others, like tumbling mustard, fanweed and prickly lettuce, may produce thousands to the plant. As a rule annuals seed more heavily than perennials. Some seeds will germinate as soon as ripe if they fall on suitable soil while others require a period of rest or dormancy before germination. Some lose their vitality in two or three years while others, if kept dry as in a warehouse, will live fifteen to twenty years or even more, and those of a few species will live several years in undisturbed soil.

SEED DISPERSAL

The pods or capsules of a few plants, when dry, snap open and throw the seeds for a short distance. For the most part, however, weeds are dependent upon other agencies to spread their seeds about. Winds are especially effective in carrying seeds like those of the dandelion, thistle, and prickly lettuce, that have a feathery plume or down. Water may carry seeds to some extent, especially those that are light for their size and do not readily become water-soaked. Sunflower is a good example. Distribution by water is most important on irrigated lands. Animals carry seeds in various ways. The mud on the feet of domestic animals often contains seeds of many kinds. The seeds of some weeds, as the cocklebur, wild licorice, and some grasses, are covered with hooks or barbed spines which cling to the hair of animals and are thus carried about. Some seeds with resistant seed coats pass through the digestive tracts of birds and other animals without losing their vitality. Man himself has a heavy responsibility in carrying weed seed about. Farm machinery, wagons, threshers, etc., carry seeds from field to field. In a newly settled territory new weeds often appear first along railroad tracks, being carried there by the trucks of passing trains and in the hay in stock cars. For this reason tumbling mustard is called "Jim Hill" mustard in some sections of the Northwest.

It is in connection with farm and garden seed, however, that man has most aided these weed pests to spread about. Sometimes little or no attempt is made in the threshing to separate the weed seed from the grain. Indeed we have known instances in which threshing crews have objected to screening out mustard seed, giving as their reason that there would be too great a loss in weight of the threshed product.

Artificial cleaning of foul seed is at best, however, imperfect. It is quite impracticable to separate lamb's-quarters from alfalfa seed on a large scale, and difficult to remove some other small seeds such as fanweed and mustard. It is very difficult to make a **perfect** separation of these small seeds from grain, especially oats, though the greater portion may easily be removed. If the weed in question is well established in a particular locality, a good cleaning with a fanning mill may be sufficient; but in case of a bad weed, new to that locality, only seed grown on land absolutely free from it is good enough, if such can be secured. A dozen fanweed seeds to the bushel of oats or a dozen quack-grass seeds to the pound of timothy are enough to give these pests a start.

Most of our weeds are self-fertile and produce seed on every plant, even though they are growing alone with no chance for pollination from neighboring plants. Fortunately this is not true of Canada thistle, which is self-sterile and requires both male and female plants for seed production. Solitary patches of either kind will not produce seed though the down may blow about and give the impression of carrying seed.

ROOTSTOCKS

In addition to seed some perennial weeds are propagated by rootstocks. These are stems that run under ground and send up new shoots a short distance from the mother plants. They may be told from true roots by the presence of tiny scale-like leaves. On quack grass these scales are quite conspicuous. Rootstocks usually send out fibrous roots which give them the appearance of being roots themselves. If these rootstocks are left undisturbed they serve the purpose of increasing the size and density of the weed patch. If they are dug up and scattered about they often start new patches. These rootstocks also serve to store food manufac-

tured by the leaves and sent down to them, and this makes the weeds more difficult to kill by cultivation and starvation.

METHODS OF INTRODUCTION

Before man began to cultivate the land in any given section of the country there were few weeds there of importance. Most of our native vegetation is composed of plants that are easily destroyed. Of the fifty weeds here discussed, about a dozen are probably native to Montana and nineteen to the United States and most of these are among the less important. Most of our serious weeds are introduced either from some other part of America or more often from Europe.

While wind, water, farm machinery, and the hair and feet of animals are of importance in spreading weed seeds from place to place over short distances, they are insignificant in carrying them over long distances. When weed seeds are carried into America from Europe or into Montana from the eastern or the Pacific states, man is responsible. The introduction is accomplished principally through the shipment of farm products, chiefly hay, grain, and farm and garden seeds. In baled hay one may find quack grass, wild barley, military grass, and many other noxious weeds. Grain seeds are likely to contain wild oats, wild buckwheat, lamb's-quarters, sunflower, and various members of the mustard family; timothy seed is likely to contain that of other grasses and is frequently infested with lamb's-quarters, Russian thistle, and various members of the mustard family; and knapweed will often be found in imported seed of Turkestan alfalfa. While the mixtures just named are quite common, there are, of course, many others also.

METHODS OF CONTROL

It must be recognized that the struggle against weeds is a warfare—a series of battles, some of them long drawn out. To carry on such a warfare successfully at a minimum cost requires skill and a thorough knowledge of the strong and weak points of these enemies of agriculture. At the present time much effort is expended in fruitless endeavor to keep weeds down while many opportunities to accomplish much in weed control by a little timely effort are overlooked. The effects of soil and climate on weeds often determine to a large extent where they will be troublesome. Certain ones, like fanweed, do best where it is cool and the soil is moist

and rich; others, like Russian thistle, are of greatest importance on hot, dry lands. This is partly due to a direct effect of these conditions on the weeds and partly to the fact that in semi-arid lands grasses and other plants do not grow well enough to compete with them.

The fact that some weeds are annuals and others perennials is one of fundamental importance in applying control measures. As annuals die as soon as they have produced one crop of seeds, we are not so much concerned with killing the plants themselves as with preventing their seeding. Next year they will all be dead whether we attack them or not. Our purpose in taking the trouble to destroy them is to save the crop they are growing with and to prevent their propagation. As a rule annual plants are especially easy to destroy, a single stroke with hoe or cultivator being sufficient.

Perennials, on the other hand, are more tenacious of life, growing up from the root when cut off and continuing to give trouble year after year. Some merely have a large, deep root while others spread by horizontal roots or rootstocks (underground stems). Most of them produce only a few seeds as compared with annuals, and the methods of control are directed more especially at destroying the parent plants. However, the fact must not be overlooked that even perennials do produce some seeds and that these, even though few, serve to start new plants that are difficult to exterminate.

Nearly a dozen really useful methods have been devised for combating weed pests and there are many others that have not been found practical.

CLEAN SEED

Many of our worst weeds are carried into new territory with the seeds of farm and garden crops. If a weed is already established in a piece of land, a few more of its seeds planted there with the crop are of small importance, but the greatest care should be exercised to prevent the introduction of new kinds. A rigid system of seed inspection will do much to this end, but even such a system can not be perfect and serves to retard rather than wholly prevent the spread of weed seed.

MOWING

Comparatively few plants can withstand frequent cutting close to the ground, though white clover and most of the perennial grasses endure it well. For this reason well-clipped lawns have fewer weeds

than cultivated land and grain fields. Annuals are particularly susceptible to injury by cutting and newly seeded alfalfa fields and meadows are often mowed before the crop has grown enough to save for hay if such weeds are making a strong growth. Unfortunately dandelion, Canada thistle, quack grass, and a few others are not readily destroyed by cutting.

PASTURING

Pasturing has much the same effect as mowing, provided the weeds to be destroyed are of a kind that stock will eat. The trampling has some effect also. A large number of weeds, including dandelion, pigweed, lamb's-quarters, and even such perennials as quack grass, wild morning glory, and Canada thistle, may be destroyed in this way. Such weeds, however, require continuous close pasturing for one or two full seasons. In general, sheep are preferable to cattle and horses for pasturing weeds, as they graze closer and eat a greater variety of plants.

CULTIVATION

Cultivation must be looked upon as the most important method of aiding farm and garden crops in their competition with weeds. This cultivation may be done in summer-fallow or with intertilled crops and gives the double benefit of improving the condition of the soil and destroying the weeds.

In the case of certain perennials, as Canada thistle, cultivation is almost the only method of eradication, but a moderate amount of cultivation is not sufficient. Cultivation must be so frequent that the plants are never allowed to show above the ground. Plowing a field four times a year for five years will not kill Canada thistle; quack grass, or morning glory, but twenty times in one year will have the desired effect. It has been abundantly demonstrated that this kind of treatment will destroy any weed if properly carried out. As many farmers think some weeds can not be killed by cultivation it is well to consider the usual causes of failure.

(1) Cultivation is not done often enough. It must be remembered that this method is based on the fact that all green plants must have sunlight. If the periods of cultivation are so far apart that the weeds begin to show above the ground between cultivations, they will thereby get a new lease on life. Each cultivation must

be done just before the time when the plants would begin to show life above the ground if left undisturbed.

(2) Cultivation is not thorough enough. To save time and expense the cultivation is sometimes done with a harrow, which misses a few plants here and there, especially those with tough, wiry stems. In an intertilled crop like potatoes the spaces between the rows are cultivated but weeds are allowed to grow in the rows themselves. Such practices serve to keep the weeds thinned out somewhat but can not be expected to exterminate them.

(3) Good intentions are not carried out. It is frequently the case that a man lays a careful plan for exterminating certain bad weed patches, the plan being to cultivate so thoroughly and often that the weeds will all be killed out in a single season. The work is begun but other matters interfere at times and it is not done just when and as it should be. Often in the press of other work the farmer is not even aware that the hired man has not given proper attention to the weed patches. These illustrations are given to show how the impression has arisen that some weeds can not be killed by cultivation.

SMOTHERING

As already stated, green plants deprived of light will die. To bring about this condition weeds may be covered in various ways. Some have advocated building paper or tar paper coverings, but these are too expensive and too easily torn; and the plants find light between the strips, even when they overlap considerably. Straw and manure are about the only materials available here for covering weeds, and they must be piled very deep, several feet in some cases, for some weeds have a remarkable tendency to grow up through such coverings. Practically the only use made of this method is to build straw or hay stacks on small patches of Canada thistle and other perennial weeds.

SEEDING TO RANK-GROWING CROPS

In the competition that goes on in nature between different plants, those that make a strong, rapid growth tend to smother and crowd out the less vigorous species. We take advantage of this fact in weed control. A good stand of millet, alfalfa, clover, or timothy will crowd out most weeds, though a few kinds can not be subdued in this way. The method is usually supplemented by

mowing, which is more injurious to the weeds than to the perennial forage plants. Quack grass, however, does not yield to this treatment.

CROP ROTATION

It is characteristic of some weeds that they are found most frequently associated with certain crops. Field mustard and wild oats seldom give trouble excepting in grain fields, fanweed is especially bad in winter wheat, false flax in flax fields, dandelion in lawns and meadows, and pigweed and Russian thistle in cultivated land. For this reason continuous cropping makes weed control difficult. Where it is practicable to carry on a rotation, especially if it includes an intertilled crop, grain, and hay, the control of most weeds requires but little especial effort. The weeds are unable to hold their own against these varied conditions. In countries that have long been settled where intensive diversified farming with regular crop rotation is the rule, the weed problem is a much simpler one than in most parts of America.

POISONOUS CHEMICALS, (HERBICIDES)

Many chemical substances are known that will kill any form of plant life. Those used to kill weeds are called herbicides. In selecting a chemical for a weed killer we must keep in mind effectiveness, cost, and the danger or difficulty of application. If stock is allowed to feed on the dead plants the chemical must be non-poisonous to it. If a crop is to be grown on the treated land later, the effect of the chemical must not be so lasting as to seriously injure it. Sometimes, indeed, it is desirable to find a poison that will have a selective action and kill the weeds but do little injury to the crop when both are growing in the same field.

In a few places such as walks, drives, and tennis courts where all vegetation is to be kept down, salt, sodium arsenite, iron sulphate, or sulphuric acid may be used. If stock is to feed over the treated areas sodium arsenite must not be used. Where the chemicals must have a selective action between weeds and crop plants, much difficulty is encountered. The use of iron sulphate to kill mustard in growing grain has received the most attention but even this practice seems to be declining rather than gaining in favor, and we do not recommend it under Montana conditions. As a general rule plants

of the grass family are less injured by poisonous sprays than other plants.

CONTROL vs. ERADICATION

As a business proposition one will often have to decide whether it is best to go to the trouble and expense of totally eradicating a weed or keeping it so reduced in numbers that a crop may be profitably grown along with it. Local conditions will govern, and experience will show which is best in each case; but as a rule perennials that grow so thickly as to take complete possession of the land but spread by seed rather slowly, as poverty weed, morning glory, and Canada thistle, call for complete eradication even at considerable expense; while many annuals that spread rapidly by seed, such as mustards, sunflowers, and lamb's-quarters, can best be handled by keeping them reduced to a few scattering plants. The cost of keeping these out may be more than the damage they will do.

While the reduction in yield of crops due to weeds will vary much with different weeds and in different localities, a conservative estimate of it is an average of one per cent.

WEED LEGISLATION

It is most exasperating to farmers to spend time and money freeing their land from weeds and have the seed from a careless neighbor's field come in and undo their work. It is indeed almost impossible for a man to keep his land free from certain weeds, such as dandelion and Russian thistle, unless there is concerted effort to the same end by all farmers in the immediate neighborhood. Unfortunately almost every community has some farmers who will not do their part and, thereby, discourage the efforts of those who would do better.

The natural remedy that has suggested itself is to force the abatement of weed nuisances by legislation. The Federal government has not thought it wise to pass national weed laws, preferring to leave the matter to the states. More than half of the states of the Union have enacted legislation of this kind, some of which has been on the statute books for a quarter of a century. Many of these laws are extremely faulty, either attempting more than is practicable, or being indefinite in certain essentials, or failing to provide suitable machinery for their execution. Some, like the Montana thistle law passed in 1895, have never been enforced;

others were enforced for a time but have since been neglected, while a few are still being carried out. On the whole it may be said that the results of weed legislation, both in the United States and in Canada, have been disappointing, though some good has been accomplished in checking the spread of certain weeds. In recent years there has been much talk of a new weed law for Montana. Such legislation, in our judgment, should have two essentials: (1) It should not include too much. To attempt to force the destruction of all fanweed, Russian thistle, or dandelion would be impracticable, as the expense would be so great that public sentiment would not support it. Also there are many weeds, such as sunflowers, that have such a slight tendency to spread that a man can control them on his own land regardless of the neglect of his neighbors. (2) There must be some official charged with the execution of the law who has a live interest in its success and who will not be biased by the fear of neighborhood controversies.

With this machinery provided, any local community could, if organized for the purpose, prevent or materially delay the spread of certain weeds. The Canada thistle, the blue lettuce, and the perennial sow thistle should at least be prevented from coming into bloom in every locality. There may be other weeds that should be suppressed in some localities, but experience in weed control legislation makes it questionable whether more than this can be accomplished.

DESCRIPTION OF WEEDS

There are hundreds of weeds that in one part of the world or another are detrimental to crop production. Fortunately not all have reached this part of the country and not all would thrive under our conditions. Of the hundreds, fifty have been selected for discussion here. Two factors have been considered in making this choice—whether the weeds are capable of doing serious damage here, and the prevalence of their seeds in those of farm and garden crops. For convenience they are arranged in the text alphabetically by common names.

BLUE LETTUCE, *Lactuca pulchella* (Pursh) DC.

Other names.—Wild lettuce; showy lettuce; milkweed.

Description of plant.—A perennial milkweed growing in dense patches after it becomes well established. Two or three feet high

with smooth leaves covered with a thin white coating or bloom. Flowers, several to the plant, about $\frac{3}{4}$ to 1 inch in diameter, shaped like those of a small dandelion but pale blue or purplish in color (Fig. 1.) The plants produce many rootstocks which extend horizontally underground and send up numerous shoots. In this way patches are formed so dense as to crowd out other vegetation.

Time of flowering.—July and August.

Description of seed.—The seeds are borne in numerous small

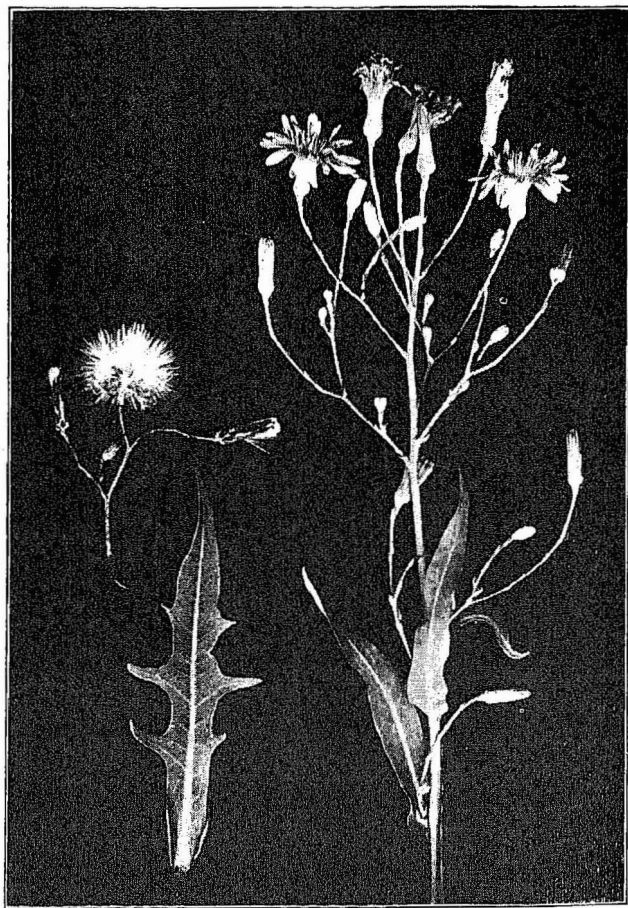


FIG. 1. Blue lettuce. Seed head, basal leaf, and tip of stem. One-half natural size. Original.

heads on the tips of the branches. They are about $\frac{1}{4}$ inch long, bottle shaped, red when immature, grayish to purplish when ripe, flattened, ridges running lengthwise down each face making the whole seed look dull and rough. (Pl. III, fig. 77.) The tip of the seed bears a long white pappus or plume which is usually absent when found in commercial grain.

Propagation.—By seeds that blow with the wind and by underground rootstocks, by which patches steadily enlarge. The seed may be scattered about the field by farm machinery and start new patches.

Occurrence.—Native to Montana and many other states but not very abundant until the land is cultivated, as the seeds have difficulty in getting a start in native sod. At the present time it is increasing rather rapidly and it will continue to do so until a more determined effort is made to control it.

Source.—The seeds of blue lettuce are not often found as impurities in those of agricultural crops. The new patches that appear in cultivated land usually start from scattering seeds that have blown from older patches a short distance away.

Importance.—We have received complaints from nearly all parts of the state. It takes possession of the land regardless of the crop grown, and when well established chokes out all kinds of cultivated plants. There are few weeds in the state that have such serious possibilities as blue lettuce for it spreads readily from the seed, is very difficult to exterminate, and takes complete possession of the land.

Control.—Blue lettuce produces an abundance of seed, and continued cutting along streams, ditches, and waste places should be practiced as soon as it comes in bloom to prevent it from distributing its seed. Established patches should be starved by persistent cutting of all leaf growth throughout the season. Where land is badly infested, methods similar to those recommended for Canada thistle should be adopted.

We have noted that where patches of blue lettuce appear in newly seeded lawns, frequent clipping with the lawn mower, combined with the choking effect of a vigorous growth of blue-grass and white clover, will kill it in a season. This suggests that plowing infested fields, seeding to alfalfa, and cutting frequently the first year, will probably subdue it.

CANADA THISTLE, *Carduus arvensis* (L.) Robs.

Other names.—Creeping thistle; small-flowered thistle; cursed thistle.

Description of plant.—Perennial, growing 3 to 6 feet high and covered with sharp spines. Usually found in clumps and patches

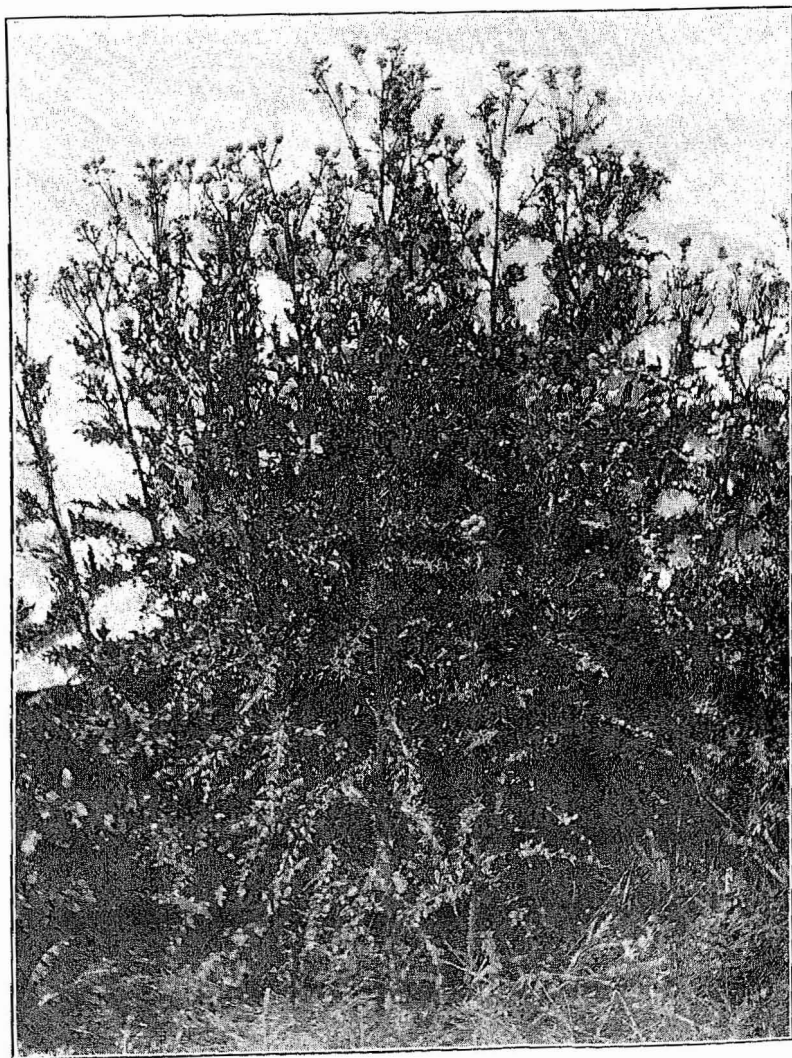


FIG. 2. Canada thistle. One-eighth natural size. Original.

(fig. 2), varying in extent from a few square feet to an acre or more. On rich irrigated land these patches are inconceivably dense so that no other plant can grow there; and spiny as the plants are it would be almost impossible for man or domestic animals to pass through. The thistles branch freely at the top and are covered with flowers much smaller than the prairie thistle.

The plants are of two kinds, one bearing male flowers $\frac{3}{4}$ to 1 inch in diameter and the other bearing female flowers $\frac{5}{8}$ to $\frac{3}{4}$ inch in diameter. The flowers of both are purple, and except for their size it is difficult for an untrained observer to distinguish between them. Unless patches of both kinds are quite close together no seed will be set. The pollination is effected by insects, principally bees.

The plants produce an abundance of long rootstocks (fig. 3) which are deep in the ground—8 inches to 1 foot or more. From

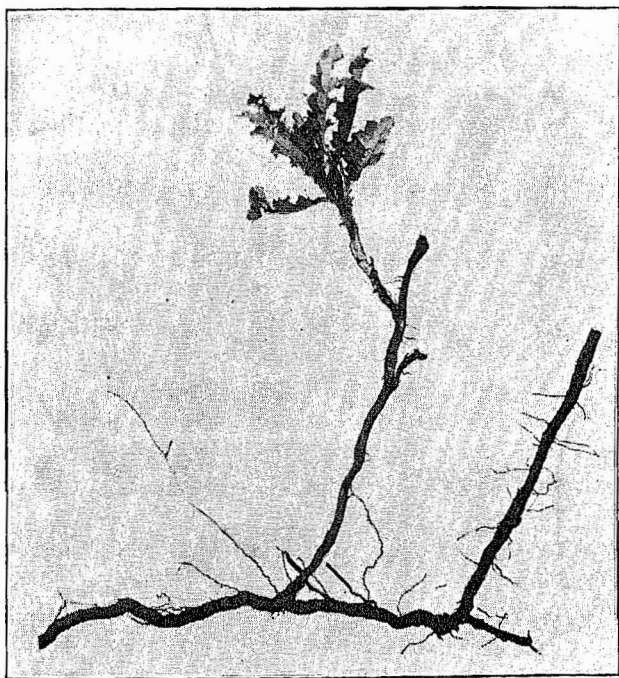


FIG. 3. Canada thistle. Underground rootstock. One-fourth natural size. Original.

these rootstocks new shoots are sent up, thus enlarging the patches.

Time of flowering.—July and August.

Description of seed.—The seeds are borne in the thistle heads of the female plants. They are about $\frac{1}{8}$ inch long, light brown, curved or straight, elongated oblong, smooth, somewhat flattened, marked with longitudinal lines; the top is cup-shaped, having a narrow rim with small cone-shaped points in the center. (Pl. III, fig. 78.) The white pappus or "down" borne on the tip of the seed breaks off very easily and is very seldom present when the seed is found in commercial grain.

Propagation.—When seeds are formed they are carried by the wind for considerable distances. The long, underground rootstocks enlarge the patches rapidly and if broken off and scattered over the field take root and start new patches.

Occurrence.—Canada thistle has been introduced from Europe into Canada and the United States, where it has become widely scattered. It has gained a foothold in various parts of Montana. In the Gallatin, Bitter Root, and Flathead valleys there are many large and small patches, and the spread is alarming. It will probably be less serious on the dry lands east of the continental divide.

Source.—Through relatively short distances the seeds are carried by the wind so that a farmer often gets the pest from his neighbor, but it finds its way into newly settled territory well isolated from any thistle patches through impure crop seed. It is rather rare to find Canada thistle in farm seeds but if there were a single one in every sack it would suffice to give it a start. There can be little doubt that this is the usual way of getting it established in newly settled valleys.

Importance.—Where Canada thistle is well established and both male and female plants are abundant, it is the worst of all weed pests. It does not spread as rapidly as many annuals but its increase is steady and once it gets possession of the ground nothing else can grow there and it is exceedingly difficult to exterminate. Furthermore, the rank growth and prickly character of the plant make it a great nuisance in farm operations and a source of constant irritation. Everywhere it grows this is rated as one of the worst weeds, but in the rich irrigated valleys of Montana it grows with unusual vigor.

Control.—Many methods have been devised and advocated for

the eradication of Canada thistle. The success of any method depends largely upon soil and weather conditions, and a successful method in one locality may prove a failure under somewhat different conditions. A few very successful methods may be used economically on small patches but will prove too costly for large areas.

The common source of introduction is by the seed. After the plant is established it spreads mainly by running rootstocks. However, if male and female plants are present some seed is formed, and while under our climatic conditions seed is not produced in abundance there is enough to keep new patches appearing each year. The mature seeds are carried by wind, water, or as an impurity in grass seed and widely disseminated.

Eradication by fallowing.—This method is very successful under all conditions if the work is well done. The field should be plowed in the spring as soon as the soil is in good working condition. It is important that all of the land be cut and turned in the operation of plowing as poor plowing leaves some of the green parts of many plants exposed and growth is continued without interruption. A plow equipped with a properly adjusted jointer makes it possible to turn under all of the green parts of the thistles, and many plants die from lack of air. After plowing, the field should be thoroughly worked by disking and harrowing. From then on to the end of the season, at intervals of two or three weeks, the land should be shallowly worked with a cultivator provided with blades that will cut off all growing plants two or three inches below the ground. The blades of the cultivator must be sharp in order to cut off the plants, otherwise they will just be dragged down and will soon revive. In this method careful work is the key to success, because it is necessary to prevent any surface growth and thus starve the plant. Plowing, followed by disking and harrowing, may be profitably done just after the removal of the crop in the fall previous to clean fallowing. The first crop succeeding the fallow should be an intertilled crop in order that any stray plants may be destroyed if they appear.

Under ordinary circumstances this method, if the work is thorough, will destroy the thistles in a single year. The method is practicable, having been applied with good success by farmers in many places under varying climatic conditions.

Under circumstances where it is not advisable to fallow the

land, the ground should be plowed the preceding autumn, the earlier the better, and thoroughly cultivated until the end of the season. In the spring replot the land and cultivate it thoroughly until the seeding of an intertilled crop. The crop should be cultivated thoroughly throughout the season, and hand hoeing should be practiced to destroy any plants missed by the cultivator.

Smothering with alfalfa.—In fields adapted to the growth of alfalfa, the following procedure will give good success. Prepare the land for a crop of alfalfa by plowing and harrowing just before seeding time. Plowing is necessary to destroy the thistle stalks and roots in the upper layer of the soil. Usually the alfalfa will come up in advance of the thistles but by the time it is ready to cut for hay there will be considerable of both. The resulting hay crop will be readily eaten by sheep. If conditions are favorable, the alfalfa will now come on rapidly and the thistles slowly, and the second cutting will be nearly free from them.

Covering the patch.—Canada thistles in small patches can sometimes be economically killed by covering with tar or other heavy building paper. The plants should be cut off close to the ground and then covered over. The strips of paper should overlap sufficiently to prevent the plants from coming up between them and extend far enough beyond the patch so that no plant will reach the sunlight. The paper must be weighted down with stones, dirt, or other material, and the method is successful only on comparatively smooth ground where the paper can be held close to the surface. Usually sixty to ninety days are sufficient to kill the weeds.

Stacking hay, straw, or manure on a small patch of thistles accomplishes the same results and can be done without inconvenience or extra cost. It is necessary to keep close watch around the stacks and destroy any plants that may appear.

Chemical treatment.—This method is advocated only for isolated plants. While it is in bloom cut the thistle off just below the surface of the ground. Then apply to the cut portion a half pint of strong salt brine, a handful of salt, or a small quantity of gasoline. The use of chemical sprays for eradicating Canada thistle has not generally proved successful.

Rotation.—A rotation of crops adapted to local conditions is one of the best methods of weed control and is very beneficial in controlling the Canada thistle.

CHESS, *Bromus secalinus* L.

Other names.—Cheat; wheat thief; Williard's brome grass.

Description of plant.—An annual or winter annual grass, 2 or 3 feet high. The heads are branching and bear several spikelets, each about an inch long. (Fig. 4.)

Time of flowering.—Late June and July.

Description of seed.—Each spikelet produces about a dozen seeds. These are about $\frac{1}{3}$ inch long, straw colored, sometimes greenish or brown when found in the chaff; the short awn at the apex often breaks away; the club-shaped form of the base segment dis-



FIG. 4. Chess. Seed head. Natural size. Original.

tinguishes this form from the cultivated brome grass seed; floral glume rounded on the back, seven-nerved; the palea covering the concave side, each ridge bearing a single row of stiff hairs; glume and palea closely adhering to the grain. (Pl. VI, fig. 101.)

Propagation.—By seeds, distributed principally by man.

Occurrence.—Chess was introduced into this country from Europe by the early settlers. It is now scattered widely wherever grain, especially winter wheat, is grown.

Source.—Chess is introduced to new land almost exclusively with wheat and other grain seed. There are still a few people who believe that wheat changes into chess, which of course is absurd.

Importance.—A few years ago chess was rated as one of the more important weeds of grain fields. It is hardy and a vigorous grower, and it tends to crowd out the crop and reduce the yield. Its presence also reduces the value of the grain, either for milling or for use as seed. Special screens are necessary to separate it from wheat. Seed inspection, however, has done much to reduce the losses.

Control.—The seeds of chess are easily detected and it is of first importance to see that it does not occur as an impurity in grain, alfalfa, clovers, and flax. Where it has become established, it must be kept from seeding. Where practicable a four-year rotation not including winter wheat should be followed on badly infested fields. Simply seeding down to a hay crop and mowing before the chess that springs up can form seeds will usually give good results on irrigated land. Where the land is too dry to grow clover or alfalfa, it may be necessary to fallow one summer and the next spring sow oats to cut green for hay before the chess seeds form. The stubble should be fallowed the rest of that season.

CHICKWEED (COMMON) *Stellaria media* (L.) Cyrill.

Other names.—Garden chickweed; birdweed.

Description of plant.—A slender branching annual or winter annual, sometimes virtually a biennial, as plants that start in mid-summer and produce some seeds before winter sets in may live over and produce more the next year. The succulent vine-like stems grow very rapidly and form a mat on the ground or climb upon surrounding vegetation. The leaves are about $\frac{1}{2}$ inch long and more than half as wide, the upper ones without stalks. (Fig. 5.)

They are borne opposite on the stem. The flowers are white but so tiny that they are generally overlooked, especially as they close in cloudy weather.

Time of flowering.—Throughout the season.

Description of seed.—The seeds are produced in long ovoid capsules, many in each. They are very small, about $1/24$ inch in diameter, reddish yellow to dark brown, wedge kidney shaped, somewhat flattened, having each side covered with 5 or 6 curved rows of tubercles, and 3 or 4 on the edge. (Pl. VI, fig. 100.)

Propagation.—By seeds, some of which remain alive in the ground for several years.

Occurrence.—This chickweed has been introduced from Europe and distributed widely over this country. It is found to some extent

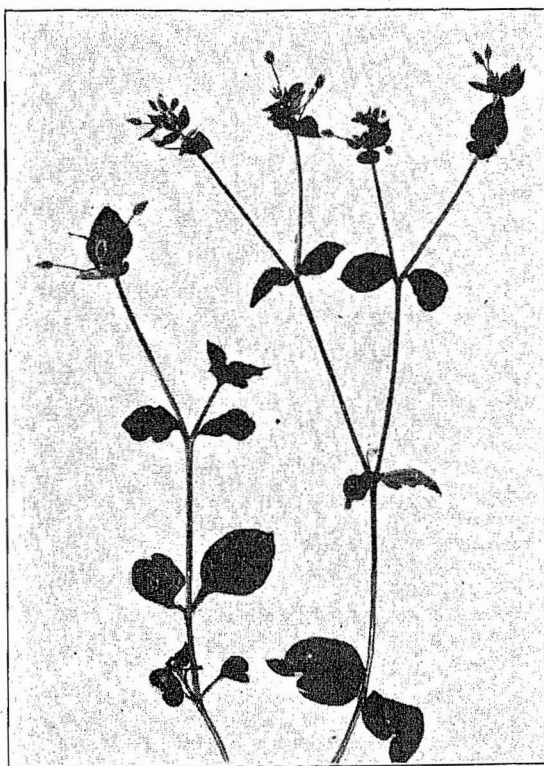


FIG. 5. Common chickweed. Tips of stems. Two-thirds natural size. Original.

in lawns and gardens in all the older settled parts of Montana and is spreading into new territory.

Source.—Introduced with grass, clover, and garden seeds. Scattered more or less with manure in city gardens.

Importance.—It competes strongly with lawn grass unless the soil is very rich and a good stand is secured. When it gets a start in gardens, new plants come on as fast as the old ones are killed unless unusual care is taken.

Control.—In lawns where this chickweed occurs, growth of the grass should be stimulated by top dressings and water; and if no white clover is present, seed of this vigorous growing plant should be raked into the sod for it will do much to choke out the weed. The lawn should be closely clipped to prevent any seeding.

In gardens chickweed holds its own with remarkable tenacity. Where vegetables are grown year after year it is seldom entirely stamped out, for late in the summer after cultivation has ceased this weed continues to grow and seed, and the plants living over as winter annuals may produce seed very early in the spring before the garden is plowed. Where practicable the old garden spot should be seeded down and a new one started. In town, however, where this can not be done, dependence must be put on keeping the weeds down by cultivation and hand pulling. It is especially important to prevent manure containing chickweed seed from being spread on a garden free from this pest.

CHICKWEED (MOUSE-EAR) *Cerastium vulgatum* L.

Other names.—Common mouse-ear chickweed.

Description of plant.—This is a perennial plant that differs in appearance from common chickweed (which see) in being much more hairy, having larger flowers, and being a little stouter. (Fig. 6.)

Time of flowering.—June until frost.

Description of seed.—The seed capsules of this chickweed are elongated and curved. The seeds are about one-half the size of the common chickweed, more angular, tubercles fewer and not as prominent or as regularly arranged. (Pl. VI, fig. 102.)

Propagation.—By seeds.

Occurrence.—Introduced from Europe and scattered over the United States but not so abundant as common garden chickweed. In Montana we have had complaints from only a few localities.

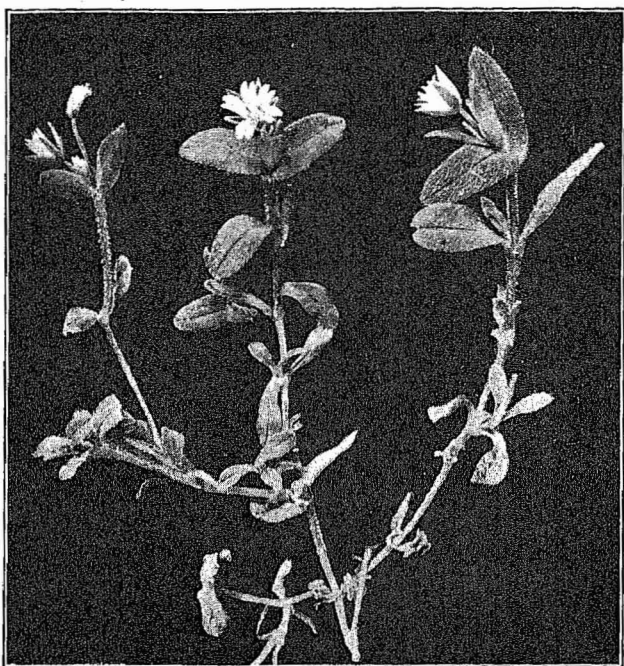


FIG. 6. Mouse-ear chickweed. Tip of stem. Three-fourths natural size. Original.

Source.—As an intruder in grass and clover seed; occasionally in grain.

Importance.—It is chiefly a pest of lawns. When it gets started it chokes out the lawn grass and virtually takes possession of the land.

Control.—Generally this weed is not serious because the usual tillage methods destroy it. However, in grain fields where rotation of crops is not practiced it does considerable damage. Summer fallowing for a year, the use of an intertilled crop, or sowing the land to hay is usually sufficient to destroy the pest. In lawns the control is the same as for common chickweed (page 26).

CHICORY, *Cichorium Intybus* L.

Other names.—Wild succory; blue sailors.

Description of plant.—A perennial milkweed 2 or 3 feet high, with coarse, hairy stems. The flowers are bright blue, somewhat

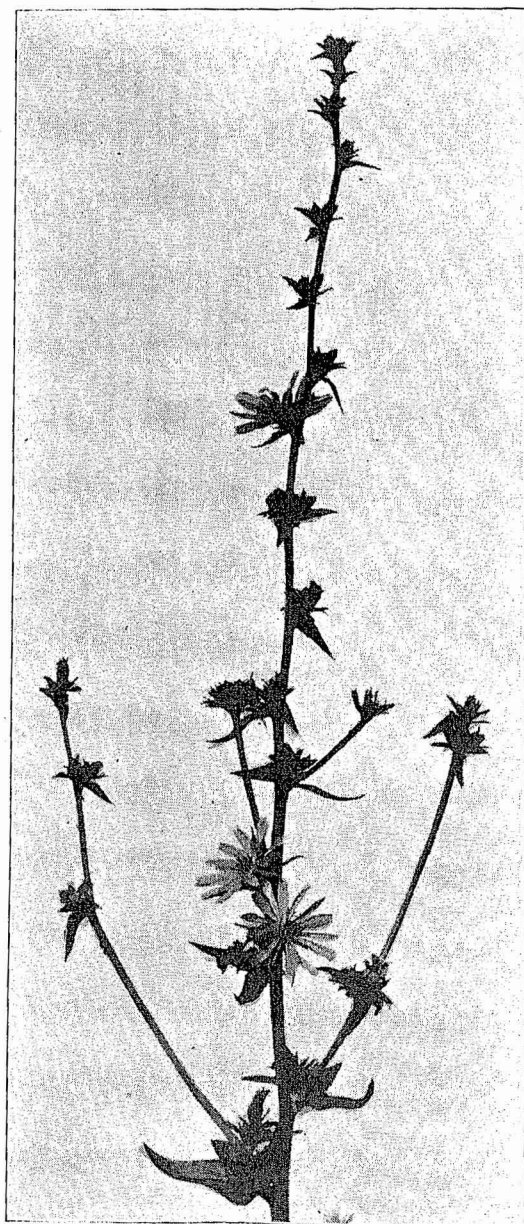


FIG. 7. Chicory. Tip of stem. One-half natural size. Original.

resembling blue lettuce but larger— $1\frac{1}{2}$ to 2 inches in diameter, borne without stalks of their own on the sides of the branching stem. (Fig. 7.) The root is deep and somewhat fleshy.

Time of flowering.—July to September.

Description of seed.—The seeds are borne in heads. They are about $\frac{1}{8}$ inch long, light brown, more or less mottled or spotted, wedge shaped, 4- or 5-angled, straight or curved, apex crowned with a double row of minute white scales or bristles. (Pl. II, fig. 72.)

Propagation.—By seeds.

Occurrence.—Introduced into the United States from Europe where it is cultivated in gardens. The leaves are used for forage and the roots are dried and serve as an adulterant or substitute for coffee. Rare in Montana.

Source.—Chicory has occasionally been found in timothy and brome grass seed in this state.

Importance.—Does not spread rapidly but is rather hard to exterminate. Does little damage here at present.

Control.—As chicory is perennial with a large, fleshy root, deep cutting below the crown will usually kill it. A rotation of crops which are frequently hoed, or crops like alfalfa which are cut several times during the season, will soon suppress it. Individual plants may be destroyed by cutting closely and applying salt to the root in hot, dry weather, or hand-pulling them when the ground is sufficiently moist. Chicory is not often seen where good farming is practiced.

COCKLEBUR, *Xanthium echinatum* Murr.

Other names.—Clotbur; burweed.

Description of plant.—A coarse, rough, branching annual 1 to 3 feet high. The leaves are broad and simple. (Fig. 8.) The flowers are so inconspicuous as to be easily overlooked. The seeds are borne in burs nearly an inch long and covered with hooks. At the tip of each bur are two hooks larger than the others. The burs are at first green but turn brown when ripe. The only weed in this state that cocklebur is likely to be confused with is wild licorice. See figures 53 and 54.

Time of flowering.—July and August.

Description of seed.—The burs are from $\frac{3}{4}$ to $1\frac{1}{4}$ inches long, reddish brown, oblong, flattened, leathery, two-beaked, covered with

thick, stout, hairy, hooked prickles. Each bur contains two seeds lying side by side with a partition between. (Fig. 54b.) The seeds are $\frac{1}{2}$ to $\frac{3}{4}$ inch long, flat, pointed at both ends, with wavy longitudinal ridges, dark greenish gray in color. (Pl. VII, fig. 107.) They rarely escape from the burs but ordinarily germinate inside and send the sprout through the wall.

Propagation.—By seed.

Occurrence.—Common throughout the Middle West and now found in many places in Montana.

Source.—Owing to the fact that the seeds do not readily come out of the burs they do not often become mixed with threshed seed of grain, etc. The spread is mostly by animals carrying the burs about in their hair. Over long distances sheep and dogs shipped from one state to another seem to be the chief carriers.

Importance.—In cultivated fields of the Middle West cocklebur

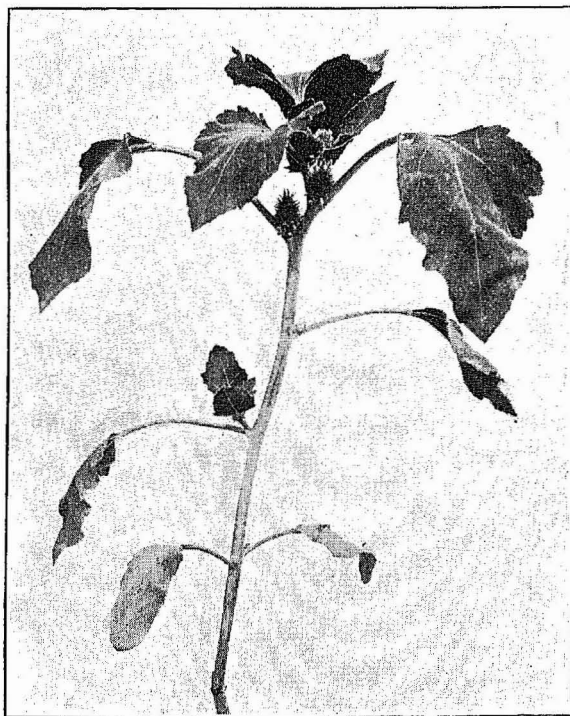


FIG. 8. Cocklebur. Young plant. One-third natural size. Original.

is rated as one of the worst weeds; for while it is not especially difficult to destroy, the large size of the plant and the hooked burs make it very objectionable. It is an especial nuisance where sheep are raised, owing to the burs getting caught in the wool.

Control.—As cocklebur is not yet found on most of the cultivated land in this state, it is worth while to make considerable effort to stamp it out, both where it occurs now and in new places as it appears. As the weeds are rather conspicuous but not very deeply rooted, hand-pulling is advisable when they are not too numerous. Where it has become well established in cultivated land, seeding down to a hay crop or a thorough summer fallow will dispose of it except along the fences where it must be pulled or cut. In waste places mowing and burning are the best remedies. Particular care must be used to prevent its seeding along streams and irrigation ditches.

CORN COCKLE, *Agrostemma Githago* L.

Other names.—Purple cockle; corn rose.

Description of plant.—An annual and winter annual about 2 feet high, covered with long, silky hairs. The leaves are 3 to 4 inches long, very narrow, and have an opposite arrangement on the stem. The flowers are quite showy, about $1\frac{1}{2}$ inches in diameter, with 5 purple petals. (Fig. 9.)

Time of flowering.—July and early August.

Description of seed.—The seeds are black, rounded, triangular, $\frac{1}{12}$ to $\frac{1}{8}$ inch in diameter, somewhat flattened, one edge notched by the scar of attachment, entire surface covered with curved rows of teeth. (Pl. II, fig. 69.)

Propagation.—By seeds.

Occurrence.—Introduced from Europe. Now found in all parts of the United States and Canada where wheat is grown. At present less abundant in Montana than in the states that have been longer settled.

Source.—From field to field it is carried by farm machinery, wagons, threshers, etc. Over long distances it is carried with grain seed.

Importance.—Corn cockle does its greatest damage in lowering the grade of the crop with which it is harvested. It is difficult to separate it from wheat, and if the two are ground into flour this is



FIG. 9. Corn cockle. Tips of stems. One-half natural size. Bul. 267, Mich. Exp. Sta.

dark colored and disagreeable in taste. The seeds are not suitable for stock feed because if eaten in large quantity they are somewhat poisonous.

Control.—Clean seed is the first requirement in keeping free from this weed. Where it has gotten a strong start, a four-year

rotation (not including winter wheat) or a one-year summer fallow will destroy most of the seed in the soil. If summer fallow is used, the land should be disked or harrowed in the fall just after harvest and again in the spring. In June the land should be plowed and then harrowed several times at intervals of three or four weeks. The land may be seeded to wheat the following autumn.

COW COCKLE, *Saponaria Vaccaria* L.

Other names.—Cow herb; China cockle; pink cockle.

Description of plant.—A smooth, grayish green annual 1 to 2



FIG. 10. Cow cockle. One-third natural size. Bul. 30, Mont. Exp. Sta.

feet high. The leaves are 2 or 3 inches long and $\frac{1}{2}$ to $\frac{3}{4}$ inch wide, without stalks, and have an opposite arrangement on the stem. The flowers are light pink, about $\frac{1}{2}$ inch in diameter, rather flat on top, with 5 petals. (Fig. 10.)

Time of flowering.—July.

Description of seed.—The seeds are borne in numerous smooth roundish capsules, 20 to 30 in each. They are nearly spherical, $\frac{1}{12}$ inch in diameter, hard, black, reddish when immature, surface roughened by a great number of minute points. (Pl. IV, fig. 90.)

Propagation.—By seeds.

Occurrence.—Introduced from Europe and now found in all grain-growing sections. Rather common throughout Montana, particularly east of the divide. In some fields very abundant.

Source.—Mostly planted as an impurity in grain seed. It is claimed that the seeds are spread by irrigation water.

Importance.—This weed is so prevalent in some fields that it reduces the yield of grain considerably. The grade of the grain harvested from such fields is considerably lowered, unless it has been thoroughly cleaned. The seeds of cow cockle are said to be somewhat poisonous, though a few may be eaten without harmful effects.

Control.—The control of cow cockle is essentially the same as that of corn cockle (see page 32). When through carelessness of seed selection or preparation of infested soil many plants are found coming up in newly seeded grain fields, a good proportion of them may be killed by harrowing as thoroughly as can be done without injuring the grain. This must be done when the cockles are not over three or four inches high.

DANDELION, *Taraxacum officinale* Weber

Description of plant.—A perennial plant with deep fleshy root, short stem, tufted leaves, and bright yellow flowers well known to almost everyone. (Fig. 46A.)

Time of flowering.—Throughout the season, but mostly June in this state.

Description of seed.—The seeds are dull, light to dark brown, about $\frac{1}{8}$ inch long, spindle shaped, having 12 longitudinal barbed ridges, the barbs decreasing in size from the top to the base of the seed. (Pl. II, fig. 71.) At the top of the seed is a beak about $\frac{1}{3}$

inch long which carries a thin white pappus or plume. This plume is usually broken off when found in commercial seed.

Propagation.—The dandelion produces seeds freely and these, blowing about, start new plants wherever they settle on suitable raw ground. There are often several crowns on each large, fleshy root, and if these are broken apart and covered with a shallow layer of moist soil, as when the land is disked, each may start a new plant. However, as these pieces die readily unless kept moist, it is doubtful if this method of reproduction is of much importance.

Occurrence.—This weed has followed civilization the world over. Introduced into the United States from Europe. On soils that are poor or dry it makes little headway but in rich irrigated valleys it grows in great abundance. It is especially prevalent in lawns.

Source.—Through relatively short distances it is wind-borne. Through long distances it is shipped with seed and to some extent in baled hay.

Importance.—Dandelions are usually found in lawns. They are unsightly and prevent the formation of a good turf. In meadows and pastures dandelions usually occupy the thinly seeded portions. Their habit of growth makes them very troublesome in strawberry beds. They are valuable as producers of nectar and pollen for bees before most other honey plants come into bloom.

Control.—Complete eradication is probably an economic impossibility because of its wide distribution in waste places, whence the seeds are readily scattered to lawns, parks, and cultivated fields. Seed is produced during the entire growing season, especially in June, and widely scattered by the winds.

Many parks and lawns are kept comparatively free from this weed by repeated clipping with a mower, supplemented by hand-digging with a knife or spud. While more or less satisfactory, this method involves a large amount of labor; and if the spud is used too often, it disturbs the soil so much that a good turf is not formed and new seeds find favorable spots for growth. Heavy seeding and careful hand work until a good sod is formed usually result in a lawn comparatively free from the weed.

Hand-cutting the crowns from the roots of old plants will not kill this weed as it does many tap-rooted plants. Instead, the root usually sends up a number of shoots so that a cluster of new plants is formed.

Controlling this weed by means of chemicals known as herbicides has been tried with varying results for a number of years. The most suitable herbicide known is iron sulphate or copperas, as it apparently has no deleterious cumulative effect on the lawn. In fact, its application seems to stimulate a healthy growth of the grass after its immediate effects are passed. Iron sulphate is not poisonous and is cheap enough to be used for spraying purposes. It will stain light-colored objects and should be applied carefully around cement walks, curbing, and foundation walls.

The following recommendations are based upon experiments conducted at the Colorado Experiment Station and reported in their Bulletin No. 238.

The strength of the solution usually recommended is $1\frac{1}{4}$ pounds of iron sulphate to 1 gallon of water, applied as a fine mist, driving the solution down into the crowns of the plant. About three sprayings are necessary to eradicate the plant. These are given at intervals of from two to three weeks, beginning when the plants are starting to blossom. A good time to spray is the day following a rain or a thorough irrigation of the lawn. No irrigation should be given within thirty-six hours after spraying. Following this period, good care should be given to the lawn to encourage the growth of grass. The spray causes the foliage of the dandelion to turn black and wither and at the same time causes a darkening of the lawn grass and may even kill the tips of the leaves. Under suitable conditions the grass will recover in a week or ten days. Repeated spraying will kill the white clover but will not materially reduce Kentucky blue-grass, the foundation of most lawns.

Gasoline, kerosene, and creosote are effective herbicides, but the labor of applying them and their cost are prohibitive except for limited use. About $\frac{1}{2}$ to 1 teaspoonful of the liquid is applied to the center of the plant, the amount depending upon its size. A large-sized oilcan offers a convenient means for applying the liquid.

The foregoing statements apply to the dandelion as a weed of lawns and parks. As a field weed it is not a serious pest in the growing of grain and tilled crops. This is because it is a perennial and produces no seeds the first year. It is, therefore, destroyed by cultivation before seed production can occur. In irrigated meadows and pastures it gives considerable trouble by occupying the land and thus reducing the grass stand. If the land has been well pre-

pared so that all the old dandelion roots have been killed before seeding, there will be no damage for two or three years; but gradually the plants will increase and after a few years it is usually advisable to plow up the field. In alfalfa fields, if for any reason the alfalfa dies out, the dandelion soon takes its place. It is, therefore, necessary to maintain a good stand of alfalfa if it is to compete with the dandelion or other weeds. The appearance of weeds in an alfalfa field indicates that something is wrong and calls for careful study to determine the cause and the corrective measures to be employed. Timothy and clover do not compete with weeds as well as alfalfa. Even in those sections where dandelions are the worst, a short rotation that includes both grain and hay crops will keep them under good control.

DOCK (CURLED), *Rumex crispus* L.

Other names.—Yellow dock; narrow-leaved dock.

Description of plant.—Perennial with very long tap root. It grows from 2 to 3 feet high and has a general reddish color, especially on the stems and the under side of the leaves. The lower leaves are 8 to 12 inches long and about one-fourth as wide. (Fig. 11.) The flowers have no petals, the most conspicuous part being the papery wings in which the seeds are later enclosed. (Fig. 12.) The flower cluster is much like that of rhubarb, to which it is closely related.

Time of flowering.—July.

Description of seed.—Each seed is enclosed in a papery husk which extends outward at the angles of the seed into three wings. The seeds are about 1/12 inch long, 3-angled, both ends pointed, widest near the center with edges slightly margined, reddish brown to shiny. (Pl. I, fig. 59.)

Propagation.—By winged seeds.

Occurrence.—Introduced from Europe and now found in cultivated ground, roadsides, and waste places throughout the country.

Source.—Impure seed, especially of clover, alfalfa, timothy, and lawn grasses.

Importance.—It is not important except in cleared land, especially if that is wet. It depreciates the value of hay and often occurs as an impurity in alfalfa and clover seed.

Control.—Curled dock is introduced commonly in agricultural



FIG. 11. Curled dock. One-sixth natural size. Original.



FIG. 12. Curled dock. Seed clusters. One-half natural size. Original.

seeds; therefore, clean seed should be sown. In badly infested land the growing of intertilled crops for a year or two, practicing good cultivation, will easily control the weed. If only scattered plants are present, hand-pulling when the ground is moist is effective. As it is principally a weed of wet lands it will give less trouble if irrigation water is not applied too freely. Where there is considerable seepage water, drainage will accomplish the double purpose of making the land more fit for crop growing and less favorable to the growth of dock.

DODDER (ALFALFA AND CLOVER), *Cuscuta epithymum* Murr.

Other names.—Strangle weed; love-vine.

Description of plant.—An annual vine with very slender, reddish yellow stems. The tiny seeds take root in the ground and send up shoots which twine round the alfalfa plants and push

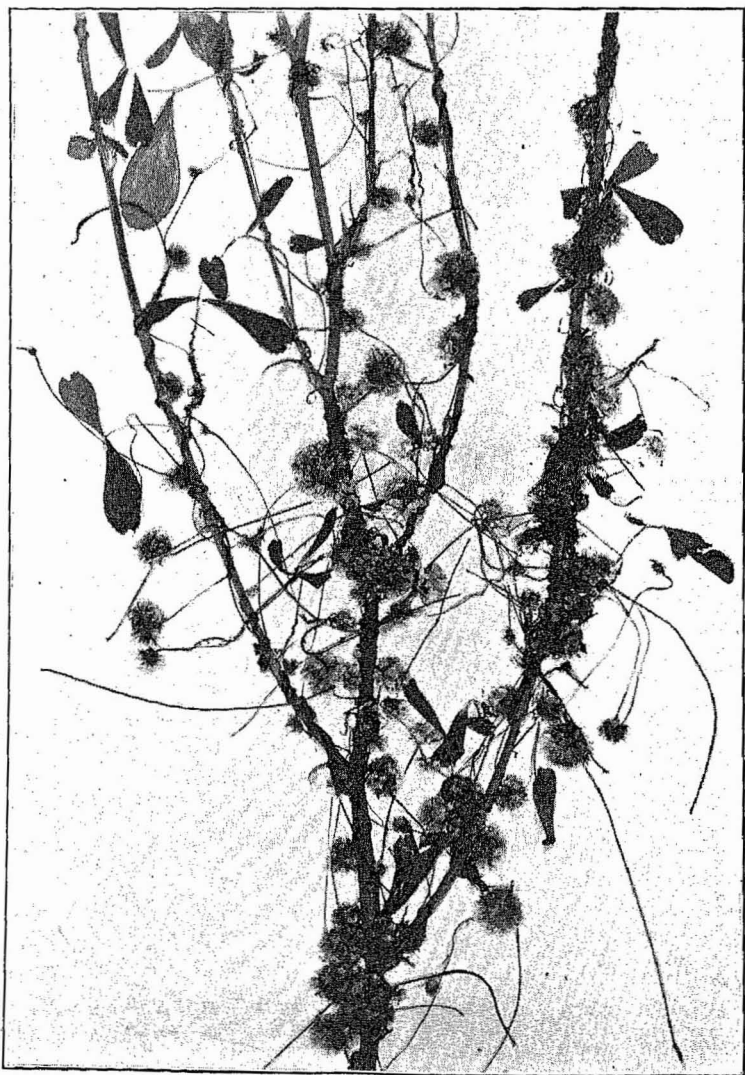


FIG. 13. Dodder on alfalfa plant. Natural size. Original.

suckers into them for nourishment. As soon as this parasitic habit is well established the lower part of the stem withers and breaks away from the root, and from that time on the host plant supplies all the food. The leaves are small, scale-like, and almost function-

less. The flowers are small, dull yellow, with 5 petals, and grow in custers along the thin, wiry stems. (Fig. 13.)

Time of flowering.—June to August.

Description of seed.—The seeds are borne in tiny, round capsules, 2 to 4 in each. They are about 1/30 to 1/20 inch in diameter, oval to irregular spherical, usually angled on the scar-bearing surface, color yellowish to dark brown, light green to purple, surface dull and pitted. (Pl. V, fig. 92.)

Propagation.—Chiefly by seeds, though pieces of the vine scattered among alfalfa plants readily twine about and attack them.

Occurrence.—This dodder is a species introduced from Europe. It is now found more or less in alfalfa and clover fields throughout the country. In Montana it is often reported troublesome in alfalfa but seldom in clover.

Source.—As an impurity in alfalfa and clover seed, also baled hay and manure. If introduced with the seeds of other crops, the young dodder plants die for want of a suitable host, but some of the seed may be delayed in germination for several years.

Importance.—Dodder is a serious pest of alfalfa fields. Some damage is done the crop by the parasite's extracting nourishment from it, but the most objectionable feature is its habit of binding large masses of the plants together, making them difficult to cut and handle. It is particularly exasperating in alfalfa to be cut for seed, and no seed should be harvested from such fields.

Control.—These seeds can easily be detected in those of alfalfa and clover, which are the only crops troubled by this species of dodder. As these crops are maintained in the land for two or more years it is of special importance that they be grown only from inspected seed, lest it become necessary to plow them up before they reach their prime. When dodder is found only in patches in a field of growing alfalfa, it is worth while to search the field carefully before the alfalfa comes into bloom and mow and burn on the ground all the infested areas. If it is all through the field, it is usually best to plow it up and grow grain or timothy on the land for four or five years at least. Great care should be used to prevent the seed from being scattered with manure or by farm machinery on land that is to be seeded to alfalfa or clover. The seeds are said to live in the soil for several years.

DOGBANE, *Apocynum androsaemifolium* L.

Other names.—Spreading dogbane; wandering milkweed; Indian hemp; honeybloom.

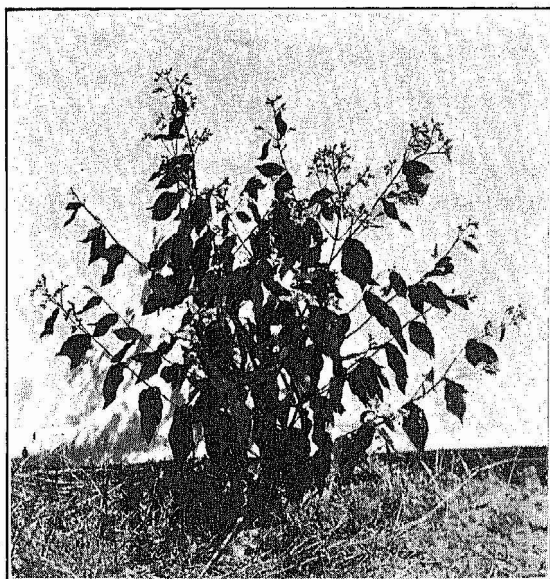


FIG. 14. Dogbane. One-sixth natural size. Original.

Description of plant.—A perennial milkweed with smooth, hard, wiry stems. The plants grow 1 to 2 feet tall and branch freely. (Fig. 14.) Leaves opposite, 2 to 3 inches long and one-third as wide, with short reddish stalks. Flowers pink, $\frac{1}{4}$ inch in diameter, bell-shaped with 5 petal lobes, and borne in loose clusters. The seeds are produced in rounded, pod-like structures about 4 inches in length, with long, slender tips. They usually grow in pairs. (Fig. 15.) The plants produce long, tough rootstocks rather deep in the ground which continually send up new shoots, causing the weeds to appear in patches which, however, are not very dense.

Time of flowering.—June to August.

Description of seed.—The seeds are closely packed in the pod-like follicles described above. They are $\frac{1}{4}$ inch long, reddish brown, narrow, tapering at either end, apex nearly pointed, finely granular with faint longitudinal lines, crowned with a silky pappus. (Pl. IV, fig. 84.)

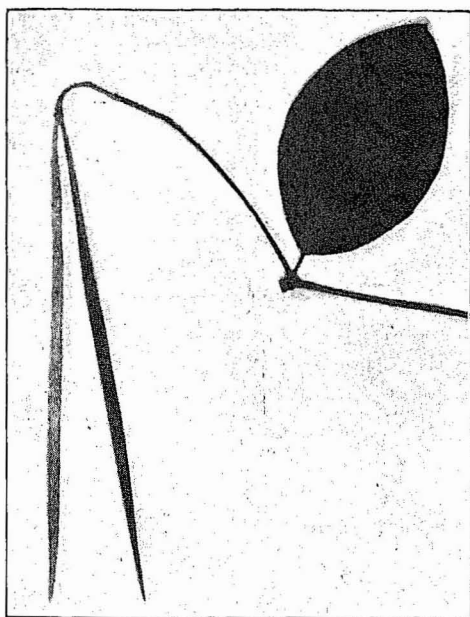


FIG. 15. Dogbane. Seed follicles. Two-thirds natural size. Original.

Propagation.—By wind-blown seeds and by underground root-stocks.

Occurrence.—Dogbane is a native of this country where it is widely distributed. In Montana it is particularly prevalent west of the continental divide.

Source.—There seems little tendency for this weed to get into land free from it except by wind-blown seeds.

Importance.—It is most objectionable as a persistent weed of cultivated land, especially orchards. It does not, however, grow so densely as to entirely crowd out other plants. It is reputed to be poisonous but we know of no animals eating it, though many have an opportunity. As a redeeming feature bees visit it eagerly and gather nectar which makes honey of excellent quality.

Control.—It is seldom worth while to attempt complete eradication as the cultivation which the crop requires is generally sufficient to keep the plants so reduced in number as to do little harm. In gardens, however, dogbane should be destroyed by very frequent tillage, never letting the plants get a start above ground.

FALSE FLAX, *Camelina sativa* Crantz.

Other names.—Balloon mustard; gold-of-pleasure.

Description of plant.—A smooth, slender, straight, slightly branched annual and winter annual, about 2 feet high. (Fig. 16.)

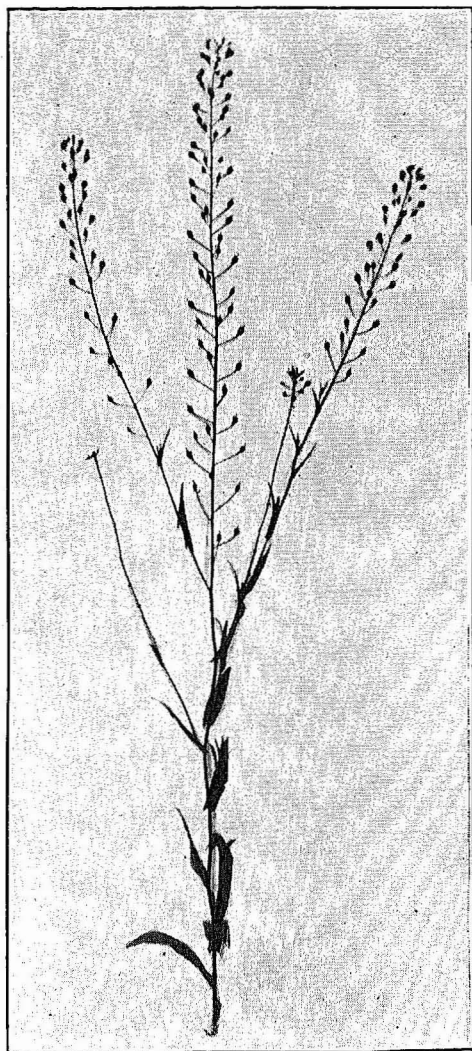


FIG. 16. False flax. One-third natural size. Original.

The leaves are 2 to 3 inches long, without stalks, and arrow-shaped, the basal lobes clasping the stem. The flowers are small, greenish yellow, with 4 petals. New ones continue to appear at the tips while the seed capsules develop below them. These capsules are a flattened ovoid with a stout bristle at the extremity. A partition runs lengthwise through the middle. (Fig. 26d.)

Time of flowering.—June to September.

Description of seed.—Each capsule produces 8 to 12 seeds. These are about 1/16 inch long, usually oval, reddish yellow, granular, one side rounded while the other has a prominent ridge. (Pl. IV, fig. 86.) The seeds become covered with a mucilaginous coat when wet.

Propagation.—By seeds.

Occurrence.—Introduced from Europe and now widely distributed through the United States, including the grain and flax fields of Montana. Not as abundant, however, as some other members of the mustard family.

Source.—Impure seed of flax grain and sometimes timothy and alfalfa.

Importance.—In grain fields false flax is of much less importance than field mustard and fanweed, which belong to the same family, though occasionally it is so abundant that it greatly reduces the yield, especially of winter wheat. In flax, however, it is the most important weed. Of ninety-three samples of flax seed examined, twenty-five contained false flax. Newly seeded alfalfa also is often badly choked by it.

Control.—The method for controlling false flax is the same as that recommended for common wild mustard (page 62). Especial care should be taken to keep it out of flax as the seeds of the two are very difficult to separate.

FANWEED, *Thlaspi arvense* L.

Other names.—French weed; penny-cress; stinkweed.

Description of plant.—A smooth annual and winter annual belonging to the mustard family. The stems are 1 to 2 feet high and branch considerably if not crowded. (Fig. 17.) The leaves are 1½ to 2½ inches long and one-fourth as wide. The upper ones are without stalks and have 2 basal lobes clasping the stem. The flowers are about ⅛ inch in diameter with 4 white petals. As new flowers appear at the tips of the growing branches, seed capsules

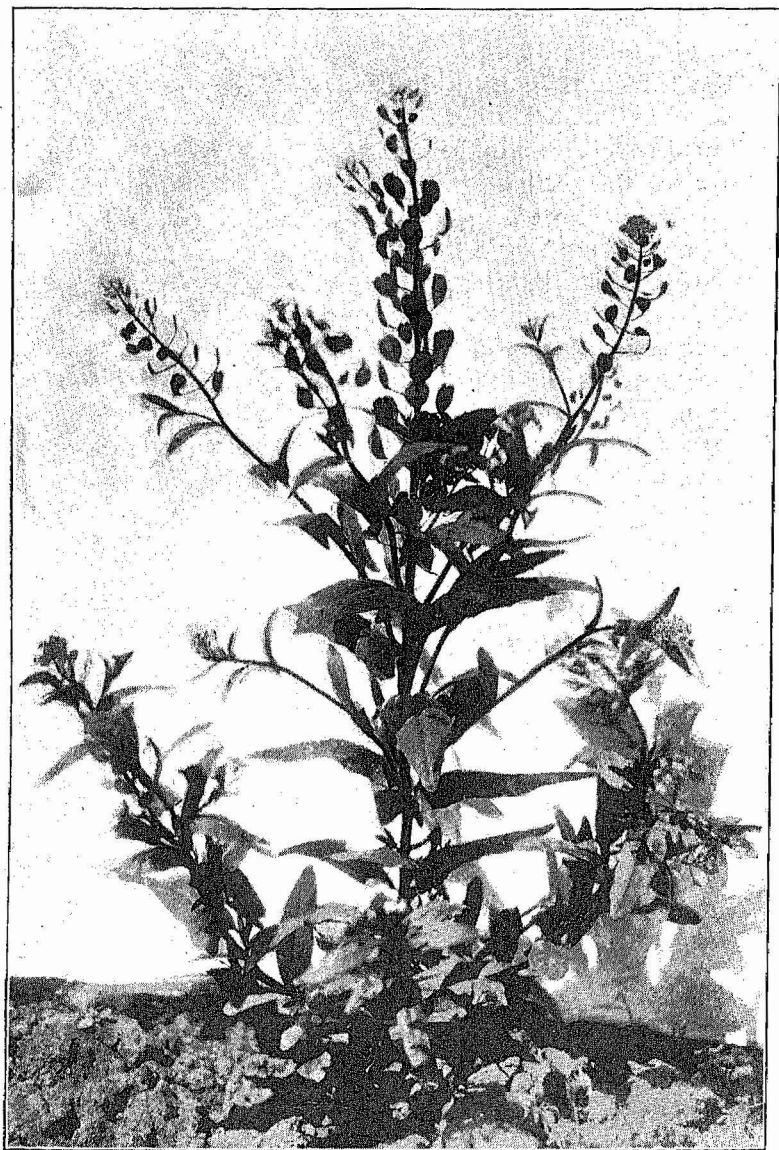


FIG. 17. Fanweed. One-third natural size. Original.

form below them. Often full-sized capsules and flowers will be found on the same plant. These capsules are flat and round like a palm-leaf fan with a notch in the tip. (Fig. 26f.) They are about $\frac{1}{2}$ inch in diameter.

Time of flowering.—Throughout the season, but mostly in June and July.

Description of seed.—Each capsule produces 10 to 14 seeds. They are about $\frac{1}{10}$ inch long and $\frac{1}{12}$ inch broad, deep reddish brown, ovoid, flattened, roughened with 5 or 6 curved ridges which run concentrically around the central groove. (Pl. I, fig. 61.)

Propagation.—Fanweed is an enormous seeder. We have calculated that very large plants growing alone produce 15,000 to 20,000 seeds each. They are capable of germinating as soon as ripe and one may find plants of all ages throughout the summer, and they rarely winter-kill.

Occurrence.—Introduced from Europe and now found throughout this country, but especially prevalent in northern United States and southern Canada. It grows to perfection in the cool climate of Montana where the soil is supplied with sufficient moisture but it does not make much headway against hot weather and drought.

Source.—Planted with impure seed of grain, clover, alfalfa, etc. Carried over short distances on farm machinery, wagons, and threshers. Perhaps distributed with irrigation water.

Importance.—A few years ago fanweed was unknown in most parts of Montana but now many parts of the state are overrun with it. This is due to its wonderful seeding powers, its vigorous growth and early seeding, and the carelessness of farmers in the selection of grain and other seeds for planting.

It is stated on good authority that in certain parts of Canada this pest has practically taken possession of the land and some fields in Montana are fast reaching that condition. Many grain fields are more than half fanweed and scarcely worth harvesting. It is at its worst in winter wheat on the more moist of the unirrigated lands but causes much reduction in yield of grain, hay, and flax wherever it has made its appearance. Where it thrives it is undoubtedly the worst annual weed in Montana.

Control.—No easy method of controlling fanweed in localities where it thrives has yet been discovered. The difficulties are so great that some farmers are almost ready to give up the fight.

Nevertheless we have for our encouragement the fact that some farmers raise fairly good crops in the worst fanweed sections; and we believe that under proper management profitable farming can be carried on in spite of this pest in any part of the state where conditions otherwise are suitable.

It is probable that where this weed has become established it will never become eradicated and the problem is to keep it down to such an extent that it will not seriously reduce crop yields. The plants, especially when small, are very easily killed but new ones appear constantly. This is due to the fact that the seeds germinate very unevenly. Some will start immediately while others will lie dormant in the soil for months or possibly years until stimulated by cultivation.

Summer fallow is the most important means of keeping down the weed in grain fields. It is absolutely essential to plow or thoroughly cultivate the land in the spring before the plants become too large to be easily destroyed. It must then be harrowed at very frequent intervals through the summer and just before seeding. A peg or spike-tooth harrow is not good for this purpose and an Acme or duck-foot type of cultivator must be used or many plants will escape. This work must be more thorough than is usually done, for a few plants left here and there will set seed and largely undo what has been accomplished. The land should not be plowed after the fallow before seeding.

Spring-seeded grain crops where conditions are favorable should be raised in preference to winter wheat if fanweed is very abundant. The weeds living over as winter annuals start more quickly than winter wheat and choke it out, whereas if a spring crop is sown the fanweed may be destroyed by cultivation just before the seeding and the crop will only have to compete with those plants that start from the seed in the spring. These will come on and produce seed in abundance but if the work has been properly done and the crop is not sown too early while the ground is cold they are not likely to get ahead of it.

Cutting is very injurious to fanweed. Plants that have been cut off may produce some seed close to the ground but they do not get tall enough to choke out a vigorously growing crop. When fanweed appears in newly seeded alfalfa it is a common and successful practice to mow the field when the plants are only a few inches high,

and if necessary a few weeks later. The same method is worth trying with winter wheat under some conditions, but the mowing must be done before the stems of the wheat have made much growth or they will not head out. If the stem growth has started it will be necessary to set the cutter bar rather high.

Seeding to a hay crop is effective where practicable, for after plowing the meadow a few years later the soil is generally fairly free from living fanweed seed.

Chemical sprays have been tried but offer little promise of success in this state.

Many farmers are making more or less of a failure of fanweed control, and the chief causes of failure may be summed up as follows:

1. By assuming that seed is free from fanweed because they can not easily see it there.
2. By not making a vigorous attack on the first plants that appear in new territory.
3. By careless summer fallowing. In practically every infested section in Montana there are fields that mature some seed before the weeds are destroyed in early summer and fields that have plants here and there that escaped destruction by tillage. If ten plants are left to the acre and each produces only 4,000 seeds, there will be an average of about one seed for every square foot. After producing one crop of mixed grain and fanweed, such a field will be as bad as before the fallow.
4. By attempting to fight fanweed without good surface tillage implements, such as the Acme type of harrow, etc.
5. By allowing some fanweed to mature in the rows of an intertilled crop.
6. By seeding to grain, grass, or other crop without first thoroughly destroying the weeds growing on the ground.
7. By not taking advantage of the fact that alfalfa, clover, or timothy will stand clipping and fanweed will not.

FOXTAIL (GREEN), *Chaetochloa viridis* (L.) Scrib.

Other names.—Wild millet; bottle grass; pigeon grass.

Description of plant.—An annual grass 1 to 2 feet tall, growing in tufts with heads 2 or 3 inches long, somewhat resembling those of millet, to which it is very closely related. (Fig. 18.) It must

not be confused with squirrel-tail (fig. 47) which is also called fox-tail by many.

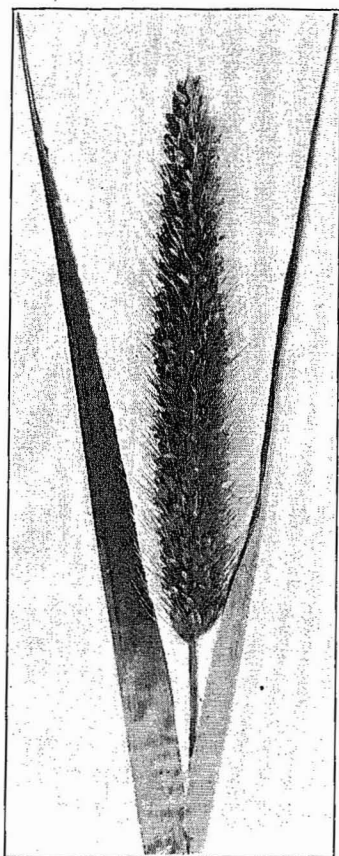


FIG. 18. Green foxtail. Head. Natural size. Original.

Time of flowering.—Late June to August.

Description of seed.—The seeds are about $1/12$ inch long, oval, enclosed by two firm husks, the outer husk or scale being rounded and folded over the flattened inner scale. (Pl. V, fig. 91.) Both scales are ridged crosswise and faintly striate lengthwise; color variable, very light yellow to deep brown, depending upon the degree of ripeness.

Propagation.—By seeds.

Occurrence.—Introduced from Europe, now found in all parts of the United States and southern Canada. It is common in all cultivated crops and in meadows and lawns if a good stand of grass is not secured.

Source.—Impure seed of farm crops, especially clover, alfalfa, and millet.

Importance.—Green foxtail is fast becoming one of the most serious of our annual grass weeds. It is prevalent in many "clean cultivated" orchards, gardens, grain fields, and meadows. It seeds late, after grain and hay are cut, and if this land is cultivated the following year foxtail is likely to appear in great abundance.

Control.—The seeds of foxtail are extremely common as an impurity in those of alfalfa, clover, millet, flax, and even grains, and strict attention should be paid to seed inspection. However, as this grass is now widely distributed throughout many portions of the state, the principal problem is to grow crops in land already infested. The most important means of combating it is to thoroughly cultivate the land just before seeding to destroy all weeds that have begun growth. If this is done, good crops are usually secured in spite of the foxtail.

GUMWEED, *Grindelia squarrosa* (Pursh) Dunal

Other names.—Rosin weed; tar-weed.

Description of plant.—A stiff branching biennial (sometimes perennial) 1 to 1½ feet high. The flowers are about an inch in diameter, daisy-like, with short orange-yellow rays. The buds and bases of the flowers are covered with blunt green hooks (fig. 19), which are coated with a sticky substance—hence the name.

Time of flowering.—July and August.

Description of seed.—Numerous seeds are produced in the flower heads. They are about ⅓ inch long, creamy white, light brown, or yellow; more or less flattened, straight to much curved, 4-angled, narrowed at the base; apex truncate, often concave with distinct marginal rim, some smooth and others grooved lengthwise. (Pl. III, fig. 81.)

Propagation.—By seeds.

Occurrence.—Native to the prairies from Minnesota to Mexico, from which region it has spread eastward and westward over the



FIG. 19. Gumweed. Tip of stem. Natural size. Original.

entire country. In Montana it is much more common east than west of the divide.

Source.—As an impurity in seeds.

Importance.—With us it is principally a roadside weed, but it frequently intrudes in meadows if the stand is poor. It can not compete with a vigorously growing crop.

Control.—Gumweed is rarely so troublesome that it requires special attention. If no plants are growing on the land at seeding time and if the seed planted is free from impurities, it will give no trouble.

KINGHEAD, *Ambrosia trifida* L.

Other names.—Giant ragweed; horseweed.



FIG. 20. Kinghead. Mass of plants in fence row. Original.

Description of plant.—One of the largest of annuals, generally 6 to 8 feet high and sometimes more. The entire plant is very rough from the presence of stiff hairs. Not branching except slightly at the top. The lower leaves are 6 to 8 inches in length and about the same in width, and deeply cleft into 3 and sometimes 5 lobes. The upper leaves are smaller and entire. They have an opposite arrangement on the stem. (Fig. 20.) The flowers are of two kinds, the male in loose, flexible spikes at the top and the female at the union of the upper leaves with the stem. Neither produces showy petals.

Time of flowering.—July and August.

Description of seed.—The seeds are about $\frac{1}{4}$ inch long, hard, brown; a stout beak on the top, around the base of which are 6 to 8 blunt spines, which are the ends of more or less stout ridges starting from the base of the seed. (Pl. V, fig. 97.)

Propagation.—By seeds which are rather difficult to separate from grain and which are carried readily by water.

Occurrence.—Native throughout most of the United States. Montana, especially the western portion, is rather free from it,

though it is increasing. It thrives best in low, moist land along watercourses.

Source.—The seeds are sown with impure grain and are distributed locally by streams and irrigation water.

Importance.—Where many seeds have dropped in favorable soil the rank growth takes possession of the land to the exclusion of everything else. In this state it is mostly confined to scattering plants in grain fields and to waste places.

Control.—As kinghead is still very scarce in Montana, special attention should be given to seed inspection to prevent its introduction. Where already present, a thorough summer fallow or seeding down to a hay crop will free the land from it if it is not allowed to seed along fences and in waste places.

KNAPWEED (RUSSIAN), *Centaurea pieris*, Pallas; Willdenow

Our interest in this knapweed lies in the fact that it is not native to America and it is just being introduced with imported Turkestan alfalfa seed. We do not know how it will thrive here but see no reason why it could not become a serious pest, though up to the present time we have no record of its having become established in any part of the United States. We are aware also that many of our most important weeds have come from Europe and this should teach us a lesson. It is of great importance to keep this weed from becoming established, and this can be done only by rigid inspection of all Turkestan alfalfa seed from abroad.

Description of seed.—The seeds are about $\frac{1}{8}$ inch long, approximately twice as long as broad, chalky white, sometimes having a tinge of yellow, slightly wedge-shaped, marked with fine, longitudinal lines. (Pl. III, fig. 79.)

LAMB'S-QUARTERS, *Chenopodium album* L.

Other names.—Smooth pigweed.

Description of plant.—A smooth, pale, succulent annual, 2 or 3 feet tall. (Fig. 21.) The leaves are pale green and covered with a whitish, mealy coating. The stem is often splashed with red. Flowers small, green, without petals.

Time of flowering.—Middle of June to September.

Description of seed.—The seeds are small, circular in outline, about $\frac{1}{20}$ inch in diameter, lens-shaped, dark brown or black, shiny, sometimes found within the chaffy covering of 5 scales, the

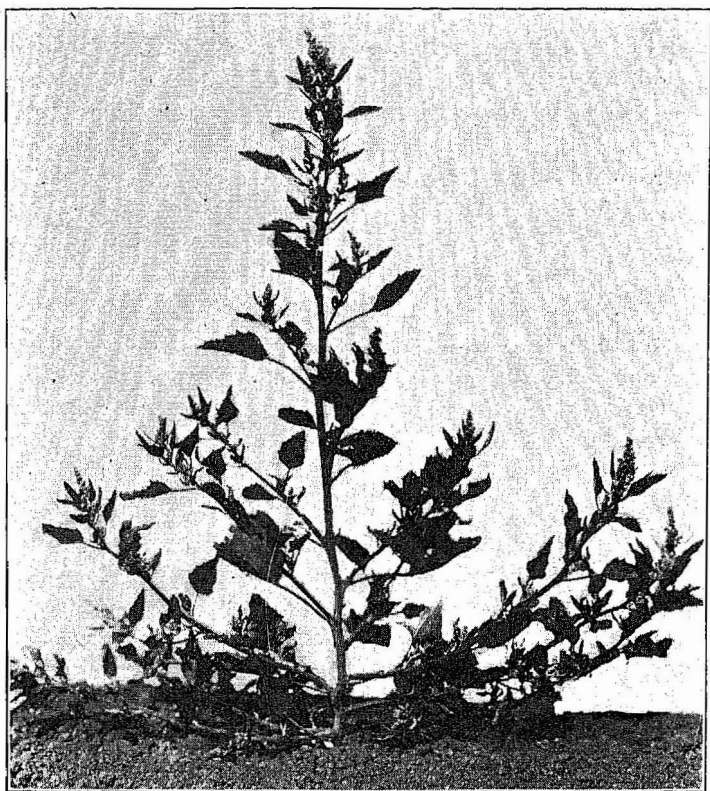


FIG. 21. Lamb's-quarters. One-sixth natural size. Original.

more convex side bearing a curved groove leading from the center to the edge of the seed. (Pl. I, fig. 62.)

Propagation.—By seeds.

Occurrence.—Introduced from Europe and now one of the commonest of all weeds throughout the United States. Especially prevalent in gardens and waste places but also found in grain fields and meadows.

Source.—Over short distances the seed is carried by birds, in mud on the feet of animals and man, and on farm machinery. It is frequently carried to city gardens with manure. Over long distances it is carried with many kinds of crop seeds, where it is one of the most frequent intruders.

Importance.—As an impurity in farm seeds, especially those of

alfalfa, clovers, timothy, and oats, this weed is of first importance and greatly reduces their market value. It is particularly troublesome in gardens and intertilled crops and will usually be found in grain fields if the stand is poor. Being a vigorous grower, it reduces the yield very considerably besides being very unsightly.

Control.—It is not difficult to remove the seed from grain, but it is not so easy to separate it from alfalfa seed and others of small size. In gardens and potato fields it is easily destroyed by cultivation.

MARSH ELDER, *Iva xanthifolia* Nutt.

Other names.—Careless weed; false ragweed; high-water shrub.

Description of plant.—A coarse annual 3 to 6 feet high, branching at the top. The leaves are much like those of the common wild sunflower but more toothed at the margins. They still more resemble those of the cocklebur. The flowers are dull green, not showy, and borne in loose, branching clusters at the top of the plant. (Fig. 22.)

Time of flowering.—Principally August.

Description of seed.—The seeds are about 1/10 inch long, color variable, olive green, brown to almost black, surface mealy and dull, pear-shaped, slightly flattened, finely striated lengthwise, often keeled on the side and a little curved towards the base. (Pl. V, fig. 95.)

Propagation.—By seed.

Occurrence.—Native throughout the central and western United States. In waste places, roadsides, and cultivated land in most parts of Montana.

Source.—A common intruder in many kinds of seed. Carried locally on feet of animals, farm machinery, etc.

Importance.—An objectionable roadside weed but most important in grain fields where it crowds out the grain, takes much moisture from the soil, and because of its large size and woody texture interferes more or less with harvesting, besides being most unsightly.

Control.—In grain fields all that is necessary under ordinary circumstances is to have the land well prepared at seeding time and sow clean seed. Sometimes, however, the land is so infested with the weed seed that a summer fallow or seeding down to a hay crop may be required.

As a weed of roadsides and waste places it will require mowing

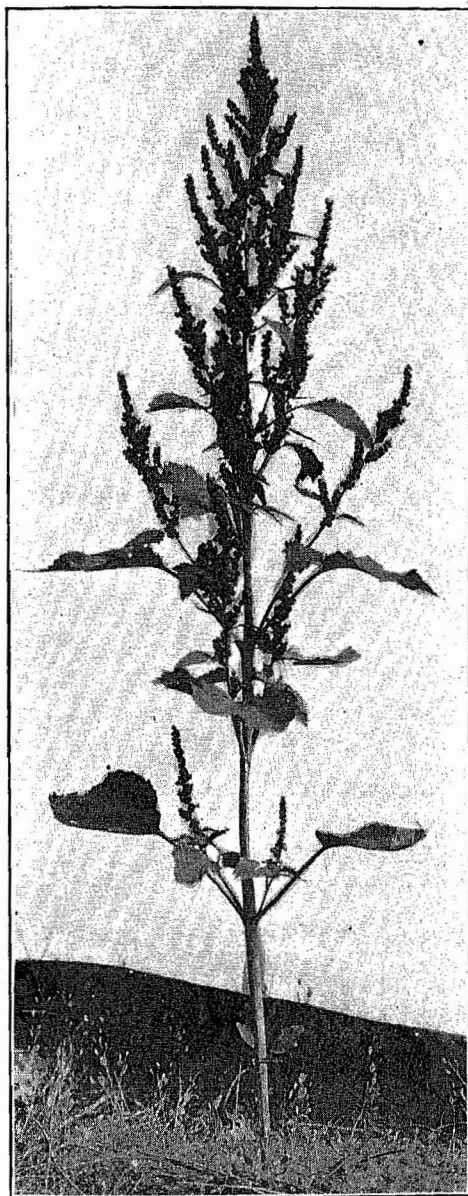


FIG. 22. Marsh elder. One-sixth natural size. Original.

when the plants are about a foot high if its unsightliness is to be avoided.

MILITARY GRASS, *Bromus tectorum* L.

Other names.—Slender chess; downy brome grass; June grass.

Description of plant.—An annual and winter annual 1 to 2 feet high. This grass grows in tufts, and while the plants are green they are soft and flexible but when mature, sharp and wiry. The character of the heads is shown in figure 23.

Time of flowering.—May and June.

Description of seed.—The seeds are about $\frac{1}{4}$ inch long, enclosed in scales of about the same length; outer scale very finely pubescent and bearing an awn $\frac{5}{8}$ inch long, inner scale thin and papery-like, grain adhering to the glumes. (Pl. I, fig. 64.)

Propagation.—By seeds.

Occurrence.—Introduced from Europe and rapidly spreading through the United States. It seems to thrive especially well in the agricultural sections of the Rocky Mountain region where it is rapidly becoming a serious pest.

Source.—Impure grass and grain seed.

Importance.—The very rapid spread of this grass during the last few years shows its adaptability to this section. It seeds early and heavily and grows so thickly on the land that it holds its own



FIG. 23. Military grass. Head. Two-thirds natural size. Original.

against most field crops. It has been found next to impossible to grow winter wheat continuously where this grass has become established. It has practically no value for hay as it ripens early and is hard and wiry.

Control.—It is of prime importance to keep the seed of military grass out of uninfested land. Where it has become established, its eradication is made especially difficult by the uneven germination of the seed. In summer fallow a new crop of seedlings appears after each cultivation throughout the summer.

When military grass appears in winter wheat it is best to change to a spring crop if possible. Disking is not sufficient to destroy a well-established sod of this grass. The best success has been had by plowing as soon as the crop is removed, summer fallowing with frequent cultivation the next summer, plowing again the next fall or the following spring, and then seeding to Marquis wheat.

Where it gives serious trouble in alfalfa fields, it can be much reduced by harrowing the field two ways with a spring-tooth harrow as early in the spring as the condition of the land will permit.

MORNING-GLORY (WILD), *Convolvulus arvensis* L.

Other names.—Small-flowered morning-glory; field bindweed; European bindweed.

Description of plant.—A perennial, somewhat resembling the cultivated morning-glory but growing in clumps or patches. The flowers are pink or nearly white and relatively small, about an inch in diameter. (Fig. 24.) Long, cord-like roots grow out in all directions and form buds which send up new shoots, thus forming a mass of vines that chokes out other vegetation.

Time of flowering.—Late June until frost.

Description of seed.—The seeds are produced in round capsules, 2 to 4 in each. They are about $1/5$ inch long, dull black to dark brown, oval, one face convex, the other angled with flat sides, surface coarsely roughened. (Pl. I, fig. 65.)

Propagation.—By seeds and by spreading roots. The latter enlarge the patches and when torn to pieces and scattered about by cultivation start new patches.

Occurrence.—Introduced from Europe, now found in most of our northern states and Canada. There are a few patches in most of the older settled valleys of this state.

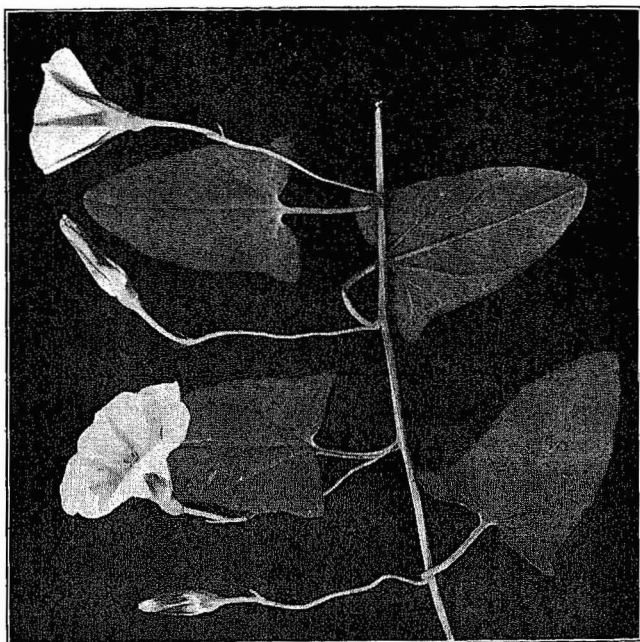


FIG. 24. Morning-glory. Portion of vine. Natural size. Original.

Source.—Seeds, as an impurity in those of various crops. Fortunately they are rare, but they have doubtless been responsible for the introduction of this serious pest into every locality where it now occurs.

Importance.—Where this morning-glory is found it is one of the worst of all pests. Only rank-growing crops like alfalfa can develop along with it, and it is troublesome also in binding together other plants that come within its grasp.

Control.—Clean cultivation methods similar to those recommended for either quack grass or Canada thistle will control this troublesome weed.

Planting the land to alfalfa is very often practiced, as the alfalfa will gradually crowd out the morning-glory and the frequent cuttings have somewhat the same effect as clean cultivation. The weed is greatly hindered in growth on account of shading by the alfalfa and usually in two or three years eradication will be complete.

Pasturing infested land with sheep, cattle, or hogs is very effec-

tive. If other feed is not too abundant, the sheep or cattle will keep the morning-glory cropped off very closely and will gradually starve the plants. Hogs are very fond of the roots as well as the stems and they will root up an infested field in a short time. The planting of an intertilled crop after pasturing the land is advisable in order that any plants may be destroyed if they appear.

MUSTARD (COMMON, FIELD), *Brassica arvensis* (L.) Ktze.

Other names.—Charlock; field kale.

Description of plant.—A rough, hairy annual, 1 to 3 feet high, branching freely, unless closely crowded. The flowers are rather large for a mustard, about $\frac{3}{8}$ inch in diameter, with 4 bright yellow petals. There are several mustards that are weeds, but the shape of the leaves and the seed capsules as shown in figures 25 and 26b will serve to distinguish this one in most cases.

Time of flowering.—June until frost.

Description of seed.—The seed capsules are only 1 to 2 inches long and contain 8 to 16 seeds. The seeds are almost spherical, somewhat variable in size, usually about $\frac{1}{16}$ inch in diameter, black to reddish or light brown, surface comparatively smooth to the naked eye, finely pitted when seen under a lens. (Pl. IV, fig. 88.)

Propagation.—By seeds produced in enormous quantities. As a rule some remain ungerminated in the soil until the second year unless the land is cultivated several times.

Occurrence.—Introduced from Europe, now very prevalent in cultivated fields throughout the United States and Canada. Very common in grain fields, in this state often so abundant as to give them a bright yellow color in early summer.

Source.—Impure seed of grain, flax, millet, alfalfa, and clover.

Importance.—Common wild mustard is one of the commonest weeds of grain fields, often growing so thickly that the field is a solid golden yellow at blooming time. It rarely chokes out the grain completely but it reduces the yield more than most farmers will admit. It requires special effort to separate mustard seed from the grain and there is often considerable dockage in consequence. It is even more difficult to separate from the smaller seeds such as clover, alfalfa, and millet, and its importance there is even more serious. As a redeeming quality this mustard furnishes considerable nectar at a time when in many sections it is much needed for building

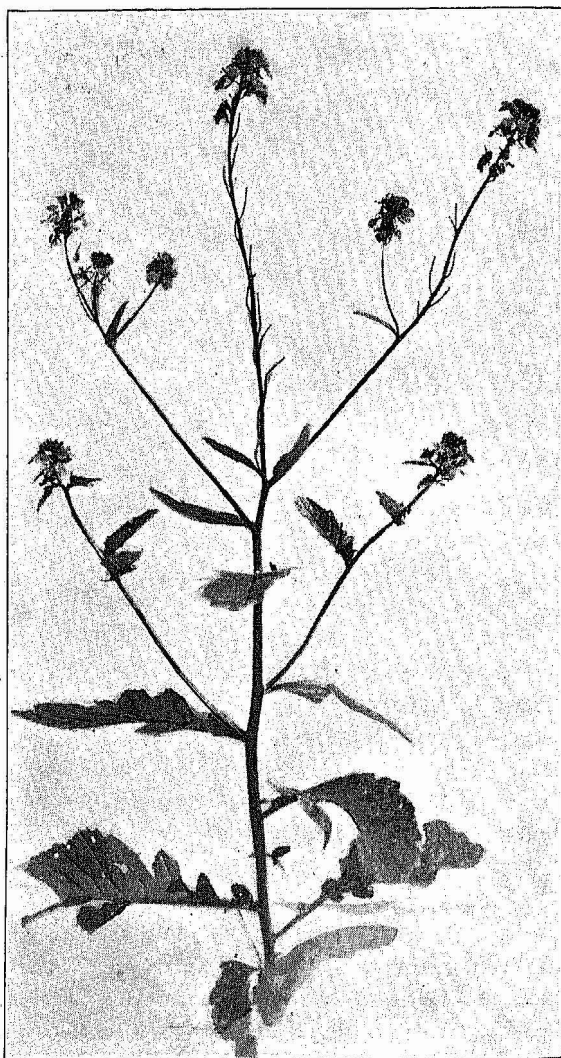


FIG. 25. Common, field mustard. One-third natural size. Original.

up strong colonies of bees.

Control.—Control aims at a reduction in the prevalence of the mustard rather than total extermination. It is not practicable to insist on seed absolutely free from mustard if it is to be sown on

land more or less infested, but to plant the quantities that some do is the highest folly.

In new lands where mustard is just appearing, hand-pulling when the yellow blossoms appear in grain fields is worth while. The eradication in a badly infested field depends on getting the seed in the ground to start and then destroying the young plants. This requires a thorough summer fallowing. After the crop is removed, a thorough harrowing or disking, if done immediately, will

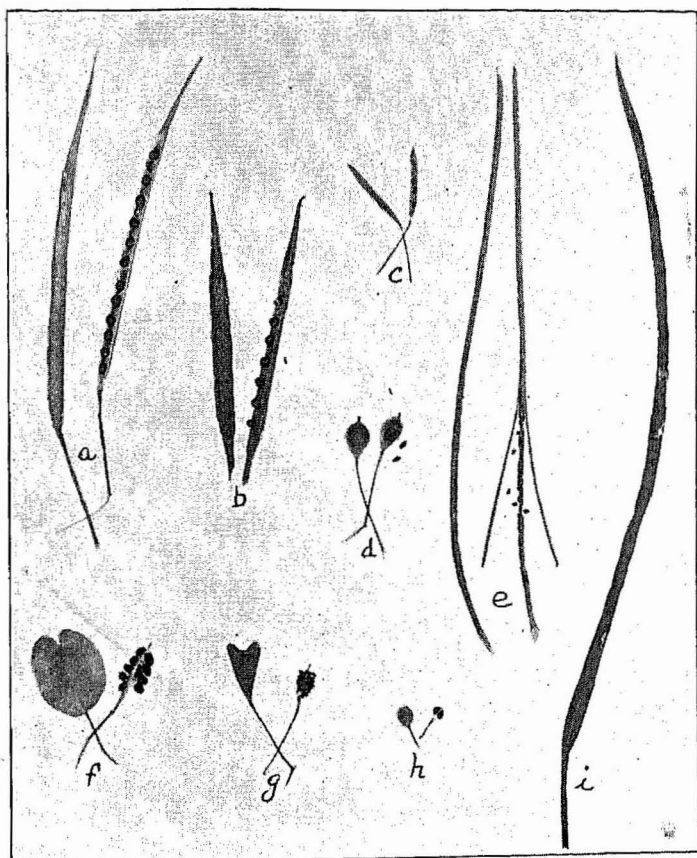


FIG. 26. Members of mustard family. Seed capsules. Natural size. a, Wild turnip; b, common, field mustard; c, tansy mustard; d, false flax; e, tumbling mustard; f, fanweed; g, shepherd's purse; h, peppergrass; i, hare's ear mustard. Original.

often start a large number of plants in the fall. Then plow the land about four inches deep and work down with a harrow. In the spring clean off the land with an Acme or other surface-working harrow and repeat this operation frequently enough to destroy all the small plants as they appear. As the soil dries in our climate with this frequent cultivation, it is advisable to irrigate if water is available and then as soon as new plants get a good start plow about five inches deep. Work this land down so as to make good conditions for the mustard seed to grow and continue the cleaning process as often as the weeds appear. In August irrigate again, and when the weeds again start plow as deep as the land has ever been previously plowed—perhaps seven or eight inches. Again work down and for the rest of the season clean off the young weeds as often as they appear. This method will bring nearly all the seeds in the soil as deep as the furrow slice to the air and cause their germination. This treatment is sufficient to reduce the mustard to a point where it will interfere but little for two or three years. For a thorough job put this land into a hoed crop, such as corn, potatoes, etc., for the next year. It is possible to seed infested land to a hay crop, but the mustard seed will lie dormant in the soil for years and start a thick growth when the sod is plowed. New seedlings of alfalfa, clover, or timothy are not likely to be choked out by mustard; but if there seems to be danger of this, mowing will give the weeds such a setback that the crop will gain the advantage, provided a good stand was secured. Spraying with iron sulphate or other chemicals has not proven generally successful so far as tried in this state.

MUSTARD (HARE'S EAR), *Conringia orientalis* (L.) Dumort.

Description of plant.—Annual and winter annual 2 to 4 feet high and but slightly branched. The plant is hairless and covered with a whitish bloom like that of a cabbage. The leaves are 2 to 5 inches long, one-third as wide, without stalks, the upper ones having 2 basal lobes that clasp the stem. (Fig. 27.) The flowers are a little smaller and paler than those of the common wild mustard. The seed capsules are the longest of the mustards, being as a rule 3 to 5 inches. (Fig. 26i.)

Time of flowering.—July until frost.

Description of seed.—Each long capsule contains from 2 to 3

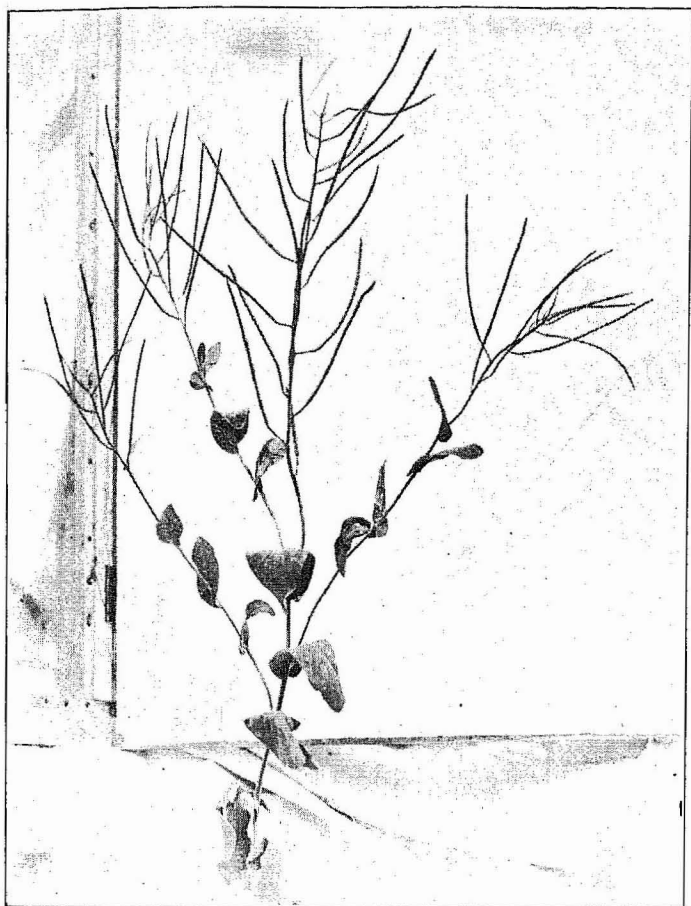


FIG. 27. Hare's car mustard. One-fourth natural size. Original.

dozen seeds, which are about $1/12$ inch long, dark brown, surface covered with very irregular pitted patches, rounded oblong, with one side furnished with a prominent vertical ridge, more or less pointed at the scar end. (Pl. IV, fig. 89.)

Propagation.—By seeds.

Occurrence.—Introduced from Europe, now common in the northwestern United States and southwestern Canada. Almost unknown in Montana until about 1910. Now quite frequent in grain fields.

Source.—Originally brought to the United States in flax seed. Now distributed mostly with seed grain, alfalfa, flax, and millet.

Importance.—Hare's ear mustard is a large, vigorous plant capable of doing quite as serious damage to grain fields as common field mustard. Also the plants when mature interfere considerably with the binder.

Control.—The same as recommended for common field mustard (see page 62).

MUSTARD (TANSY), *Sophia incisa* (Engelm.) Greene

Other names.—Green tansy mustard; cut-leaved tansy mustard.

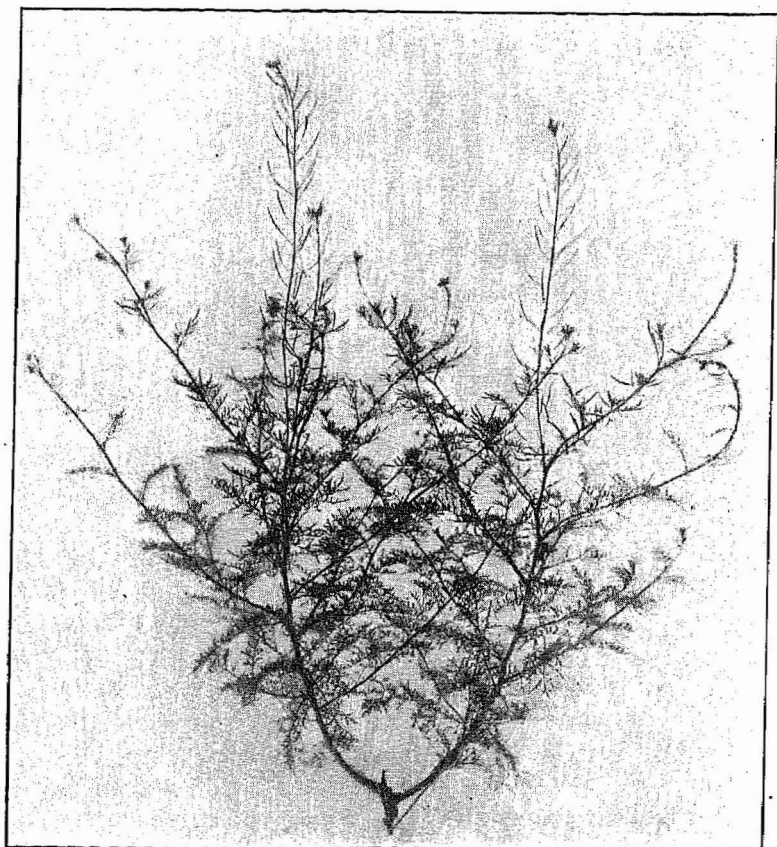


FIG: 28. Tansy mustard. One-third natural size. Original.

Description of plant.—A biennial, forming the first season only a tuft or rosette of leaves, the next year sending up a stem 2 to 3 feet tall with few branches. The leaves are several inches long and very much divided. (Fig. 28.) The flowers are only $\frac{1}{8}$ inch in diameter and bright yellow. The seed capsules are about $\frac{3}{4}$ inch long. (Fig. 26c.)

Time of flowering.—July and August.

Description of seed.—The seed capsules contain 8 to 12 seeds. The seeds are small, about $\frac{1}{25}$ inch long, flattened oblong, usually compressed at the scar end, reddish brown to yellow, surface very finely roughened. (Pl. V, fig. 98.)

Propagation.—By seeds which are sticky when wet to aid in their distribution.

Occurrence.—Native in the western United States and Canada. It appears to have come into Montana from the Pacific coast. It is rapidly increasing in cultivated fields. We had few complaints about it before 1911.

Source.—Carried from place to place with impure seed, and apparently by irrigation water.

Importance.—Tansy mustard is sometimes very prevalent in grain fields, especially winter wheat sown on stubble without plowing, but on the whole it is less serious than most other mustards.

Control.—This weed is a biennial and does not produce seed the first season. If the land is thoroughly cultivated to free it from weeds just before seeding, not much loss will come from this mustard.

. **MUSTARD (TUMBLING),** *Sisymbrium altissimum* L.

Other names.—Jim Hill mustard.

Description of plant.—Annual and winter annual, 2 to 4 feet high. When young the plants form on the ground a rosette of hairy leaves from which a succulent stem grows. This soon hardens and the mature plant is nearly smooth and wiry and, if not crowded, very much branched, forming a loose ball. (Fig. 29.) On poor, dry ground the top may be only a foot in diameter, but in very rich soil with abundant moisture and the plants well separated we have seen them fully 6 feet in diameter and very compact. The leaves are several inches in length and divided to the midrib. The flowers are about $\frac{1}{4}$ inch in diameter and pale yellow. The seed capsules are

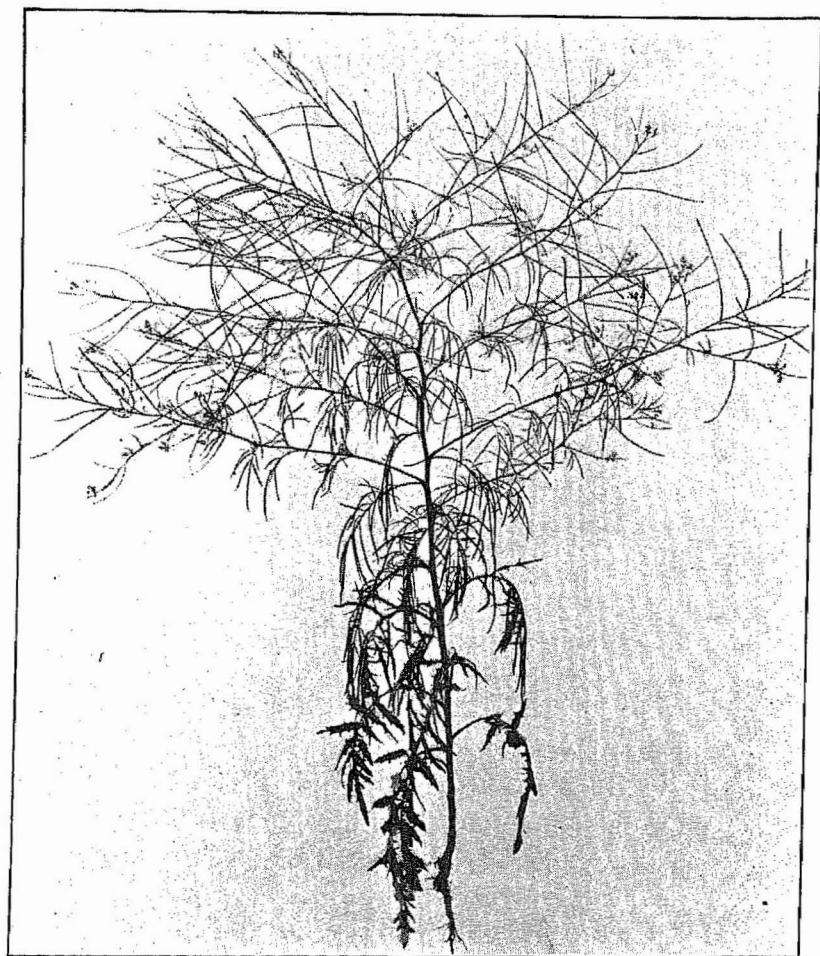


FIG. 29. Tumbling mustard. One-fourth natural size. Original.

hard and wiry, about $1/16$ inch in diameter and 2 to 3 inches long (Figs. 26e and 29.)

Time of flowering.—Middle of June to August.

Description of seed.—The slender capsules bear 100 to 130 seeds each. The seeds are very small, about $1/25$ inch long, flattened, oblong, olive brown to greenish or reddish yellow, groove usually darkened a deep green, surface very finely roughened. (Pl. V, fig. 96.)

Propagation.—There are few plants that produce so many seeds as tumbling mustard. It has been estimated that single large plants may produce 1,500,000. Our own estimate on very large specimens like those described above would indicate that this is no exaggeration.

Occurrence.—Introduced from Europe and now widely distributed in America. It first appeared in Montana along railroad tracks, hence the name "Jim Hill" mustard used by many farmers in this state and Washington. It is now extremely common, especially in the western half of the state.

Source.—These seeds are distributed with those of various field and forage crops, by irrigation water, and by wind. When mature and dry the plants readily break off at the ground and form "tumble weeds" that roll for miles, dropping seeds as they go. They sometimes cling to passing trains and are thus carried very long distances.

Importance.—Tumbling weed is not only a pest of grain fields like other mustards, crowding out the crop with its vigorous, branching growth, but it intrudes itself wherever it can find raw ground to get a start. It takes possession of waste places, and in young orchards where "clean cultivation" is practiced half-heartedly it makes a solid mat waist-high to the great detriment of the trees. When dry, fire runs through this growth furiously if it gets a start. The tumbling weeds piling against fences and other obstructions are a great nuisance. All things considered, this must be regarded as one of our worst annual weeds.

Control.—Tumbling mustard seems to yield to cultivation even more readily than other mustards. This is perhaps because the seeds germinate more promptly and evenly. As a result it rarely gives much trouble where clean seed is sown on land thoroughly cultivated before seeding. Its great reproductive powers and its tumbling habit make it impossible to keep it entirely out of cultivated fields, however. If it shows up badly in newly seeded grain fields, harrowing will greatly reduce it without seriously injuring the crop. It is important to keep the plants cut in waste places.

PEPPERGRASS, *Lepidium apetalum* Willd.

Other names.—Green-flowered peppergrass; bird seed.

Description of plant.—An annual and winter annual of the mustard family. The plants are only 6 inches to a foot high and branch

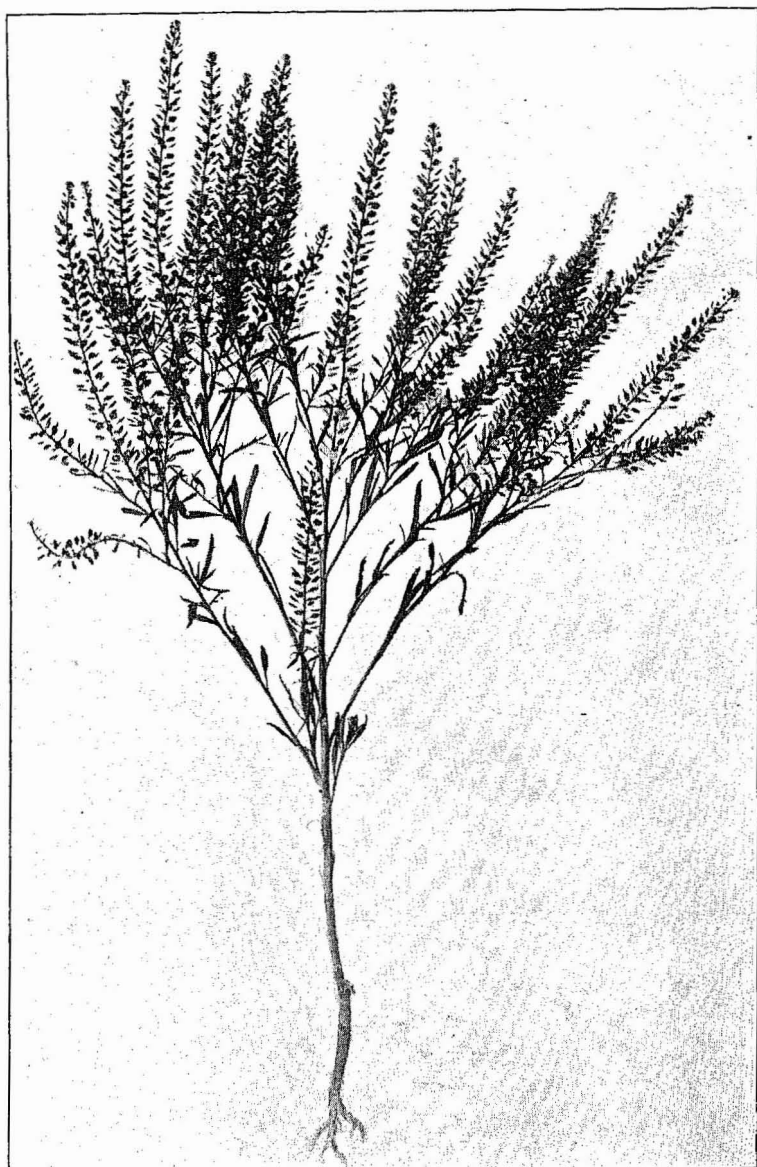


FIG. 30. Peppergrass. One-half natural size. Original.

freely. (Fig. 30.) The flowers are very small and inconspicuous, without petals. The seed capsules are very numerous, less than $\frac{1}{8}$ inch in diameter, round in outline with a notched apex, and relatively flat and thin. (Fig. 26h.) Except for their small size they are similar to those of fanweed.

Time of flowering.—June to August.

Description of seed.—Each capsule contains 2 seeds as a rule. They are about $\frac{1}{16}$ inch long, light reddish yellow, obovoid in outline, thin, with a deep curved groove on each face. (Pl. II, fig. 70.)

Propagation.—By seeds.

Occurrence.—Found all over the United States. Doubtfully native. Almost everywhere that raw ground remains untilled for a few weeks this little weed will appear.

Source.—From the many places where it grows the seeds are readily carried short distances by animals, birds, and man. They are frequent intruders in grass and other small seeds.

Importance.—Peppergrass is usually thought of as a weed of roadsides, waste places, and poorly kept gardens. Compared with other members of the mustard family it has small power of competing with field and forage crops. However, if land is poorly prepared for seeding or a poor stand is secured and this weed has already a start, it makes a good growth in alfalfa, flax, clover, and grain fields.

Control.—Clean seed and thorough cultivation before seeding will keep this weed from doing serious damage.

PIGWEEED, *Amaranthus retroflexus* L.

Other names.—Rough pigweed; redroot pigweed; Chinaman's greens.

Description of plant.—A coarse, rough, succulent annual, 2 to 4 feet high. (Fig. 31.) Both stems and leaves show tinges of deep red. The flowers are not showy and are covered with pointed green scales.

Time of flowering.—July until frost.

Description of seed.—The seeds are about $\frac{1}{20}$ inch long, oval in outline and lens-shaped, a slight notch near the narrow end, reddish to jet black, smooth and highly polished. (Pl. I, fig. 60.)

Propagation.—By seeds.

Occurrence.—Native to Central America and Mexico. From

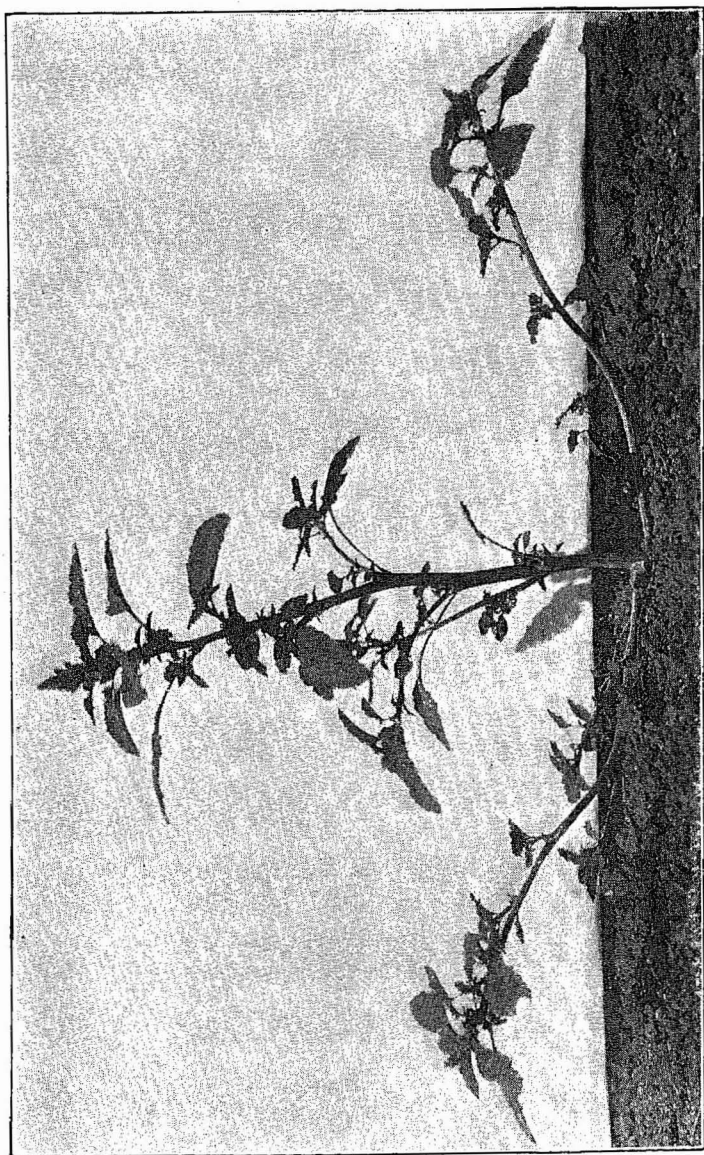


FIG. 31. Pigweed. One-sixth natural size. Original.

those countries it has spread throughout the United States and Canada, finding its way everywhere that land is taken up.

Source.—Over long distances the seeds are carried with those of many field, forage, and garden crops.

Importance.—Pigweed is most important as a garden weed and it also gives trouble in fields of potatoes, beets, and other intertilled crops. If cultivation is infrequent or poorly done, these weeds get the better of the crop.

Control.—Good cultivation kept up until fairly late in the season is necessary to keep pigweed out of gardens and intertilled crops. For control in field crops, clean seed and a well-prepared seed-bed will insure success.

PLANTAIN (COMMON), *Plantago major* L.

Other names.—Broad-leaved plantain; dooryard plantain; bird seed plantain.

Description of plant.—Low-growing perennials with several leaves and flower stems growing in a tuft from the crown. The leaves are broadly oval with heavy ribs on the under side. The flowers are not showy and are borne in long spikes. (Fig. 32.)

Time of flowering.—June to September.

Description of seed.—The seeds are borne in several long spikes. They are about 1/20 inch long, varying greatly in shape according to the number in the capsule, flattened, rounded, on the outside, angular on the inner scar-bearing surface, light brown to black, surface very finely netted. (Pl. V, fig. 94.)

Propagation.—By seeds.

Occurrence.—Native to the United States and Europe. Found near habitations almost everywhere, especially in rather wet soil.

Source.—A common intruder in grass, clover, and small seeds.

Importance.—This weed is most troublesome in lawns where its broad, spreading leaves crowd out the grass and the strong perennial roots are difficult to exterminate.

Control.—Plantain is usually troublesome in lawns, because of the long vitality of its seeds. It is important, therefore, to demand clean seed when starting a lawn. It is sometimes found in the field or garden in low, rich soils, but it is soon eradicated by proper cultivation of intertilled crops. Salt or carbolic acid applied to the cut crown is very effective in treating scattered plants in lawns.

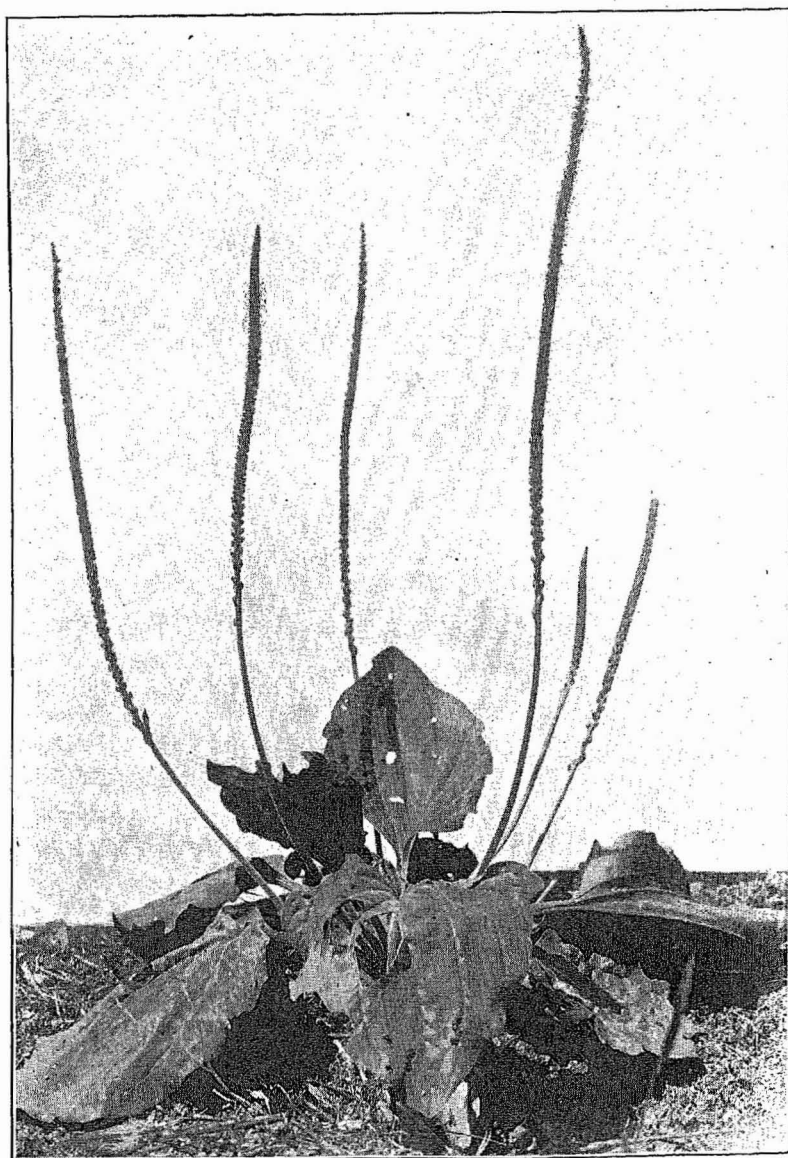


FIG. 32. Plantain. Two-thirds natural size. Original.

POVERTY WEED, *Iva axillaris* Pursh

Other names.—Salt sage; small-flowered marsh elder.

Description of plant.—A pale green perennial growing in dense clumps or patches. The stems are 8 to 18 inches high and branch very little. (Fig. 33.) The entire plant is made rough by short, stiff hairs. The leaves extend to the top of the plant and the small flower heads are borne in the axils of the upper ones. It has an extensive system of underground rootstocks by which it spreads. The odor of this weed is rather strong and disagreeable.

Time of flowering.—July and August.

Description of seed.—The seeds are about $\frac{1}{8}$ inch long; color variable, olive green, brown to almost black; surface mealy and dull, pear-shaped, slightly flattened, striated lengthwise, often keeled on the sides and slightly curved towards the base. (Pl. V, fig. 93.)

Propagation.—By seeds, which fortunately do not spread the plant very rapidly, and by underground rootstocks.

Occurrence.—Native throughout the western third of this continent. The infested areas are widely scattered, though some may be found in nearly every county of the state. It seems to have a slight preference for alkali land, though it occurs also in the best of soil.

Source.—The natural spread of poverty weed is slow, for it has been growing in this region for centuries and yet the patches are very scattered. It rarely is found as an impurity in seeds though its increase since farming began here would indicate that it is sometimes spread in this way.

Importance.—This pest is well named poverty weed. The damage done is directly in proportion to the area and value of the land it covers, for where it grows nothing else can. Furthermore, it is so tenacious of life that few farmers will give the time and effort necessary to eradicate it.

Control.—This is a very difficult weed to control when well established on rich soils. Prevent all seed production by repeated close cuttings throughout the growing season. The rootstocks must be starved to death by permitting no leaf growth. This may be accomplished by summer fallow, the growing of cultivated crops, or the adoption of the methods recommended for Canada thistle. This weed is such a pest that it is worth while to do the work thoroughly

enough to totally eradicate it, merely thinning it out being poor economy.

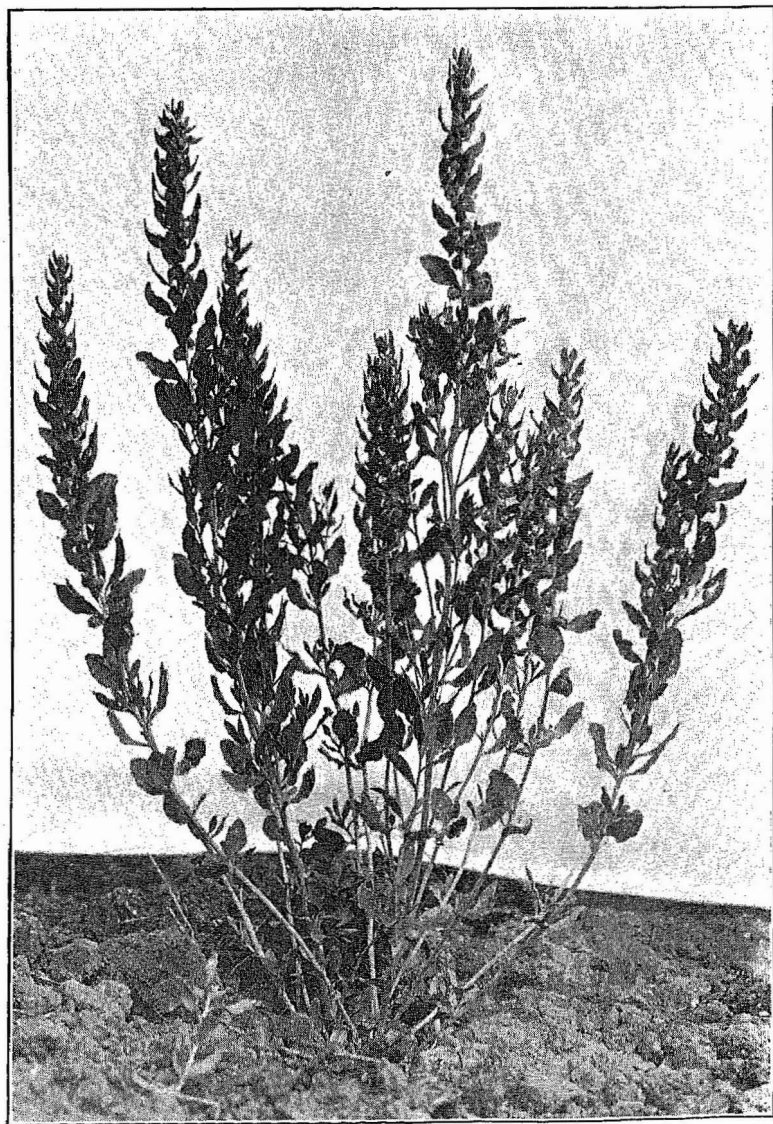


FIG. 33. Poverty weed. One-third natural size. Original.

PRICKLY LETTUCE, *Lactuca Scariola* L.

Other names.—Chinese lettuce; milkweed.

Description of plant.—Annual, winter annual, or biennial, depending upon conditions. Stem 3 to 6 feet high with many side branches. (Fig. 34.) The leaves are free from hairs, but the lower ones especially have numerous soft prickles on the margins and the under side of the midrib. (Fig. 35.) The plants are filled with a milky juice and when young seem quite succulent, but as they grow older the lower part of the stem becomes quite hard and woody. The flowers are $\frac{3}{8}$ to $\frac{1}{2}$ inch in diameter, light yellow, and shaped like those of a dandelion. (Fig. 46d.)

Time of flowering.—July until frost.

Description of seed.—The seeds are about $\frac{1}{8}$ inch long, grayish, broadly lance-shaped, flattened with 5 to 7 ridges on each face, at the apex a long, slender beak which bears the white pappus. (Pl. VII, fig. 106.)

Propagation.—By seeds.

Occurrence.—Introduced from Europe but a few years ago and now distributed throughout the country. In Montana it gives most trouble in the western half of the state.

Source.—It gets its start in new territory as an impurity in seeds and when a new crop of seeds has formed these are carried every where by the wind.

Importance.—Prickly lettuce appears in raw ground almost everywhere. It is conspicuous in waste places and neglected gardens but also is a serious pest of grain fields, meadows where the stand is poor, poorly kept fallows, and "clean cultivated" orchards. It has become the practice of some orchardists to let the weeds grow on the land during the first part of the season and then destroy them by cultivation to add organic matter to the soil. Under these conditions the stems of this weed become so large and hard that an ordinary cultivator or harrow will not cut or break them off. It is, therefore, rated as one of the worst of orchard weeds.

Control.—Owing to the production of many seeds that blow about, it is necessary to cut prickly lettuce in waste places if it is to be controlled easily in nearby cultivated fields. In fallows and cultivated fields and orchards where the seeds have fallen, it is very necessary to start cultivation early for then the plants are succulent and easily destroyed. After they become large, hard, and

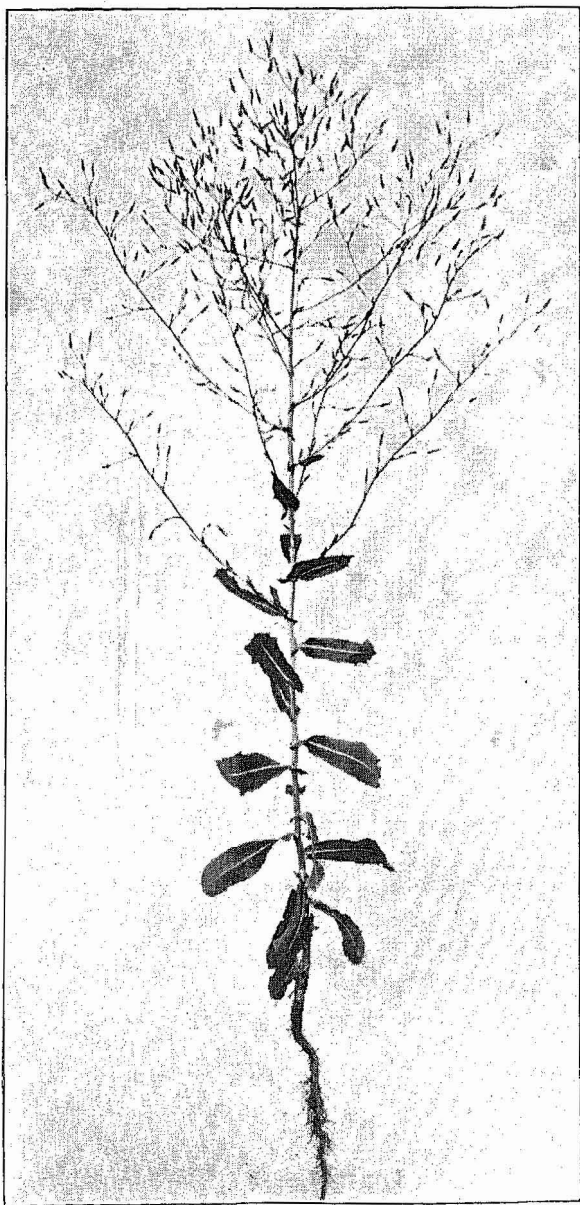


FIG. 34. Prickly lettuce. One-eighth natural size. Original.

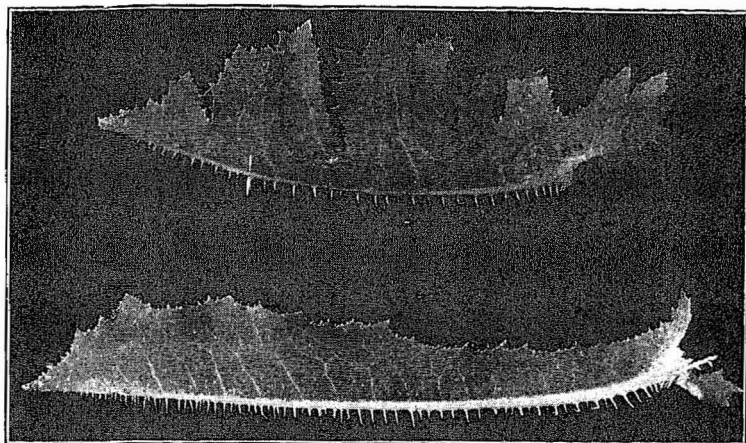


FIG. 35. Prickly lettuce. Upper and lower leaves. Natural size. Original.

woody, a plow or very heavy cultivator is required to kill them. Occasionally land becomes so badly infested that it is advisable to seed down to a hay crop and start mowing it when it is a few inches high.

QUACK GRASS, *Agropyron repens* (L.) Beauv.

Other names.—Couch grass; quitch grass.

Description of plant.—A dark bluish green perennial grass 2 or 3 feet tall. The character of the heads is shown in figure 36. It produces a perfect mat of underground rootstocks (fig. 37) that run close under the surface of the ground and send up innumerable new stems. The result is an unusually dense growth and a very compact sod. Montana farmers who are unfamiliar with quack grass may confuse it with common blue-joint or blue-stem, also called Colorado blue-stem and western wheat grass (*Agropyron Smithii* Rybd.). The two may be distinguished in the following ways: (1) Quack grass makes a very close, dense growth while blue-stem is more scattered, especially on dry bench lands. (2) The rootstocks of quack grass are longer, much more abundant, and of a dull yellow color, while those of blue-stem are bright yellow. (3) The spikelets on the heads of quack grass have 3 to 7 flowers each, while those of blue-stem have 7 to 13 flowers (Fig. 38.) This discussion has no reference to *Calamagrostis canadensis*, sometimes called

blue-joint grass, nor to *Andropogon* sp., as neither of these is likely to be confused with quack grass.

Time of flowering.—July.

Description of seed.—The seeds, including the scales, are about $\frac{3}{8}$ inch long, the outer scales smooth and strongly nerved, pointed, and terminating in an awn $\frac{3}{16}$ inch long. The face of the inner scale is glabrous except near the tip where it is puberulent; hairs on the edge are short, stout, and somewhat blunt. The kernel is about $\frac{3}{16}$ inch long with a wide open groove resembling a small grain. (Pl. VI, fig. 104.)

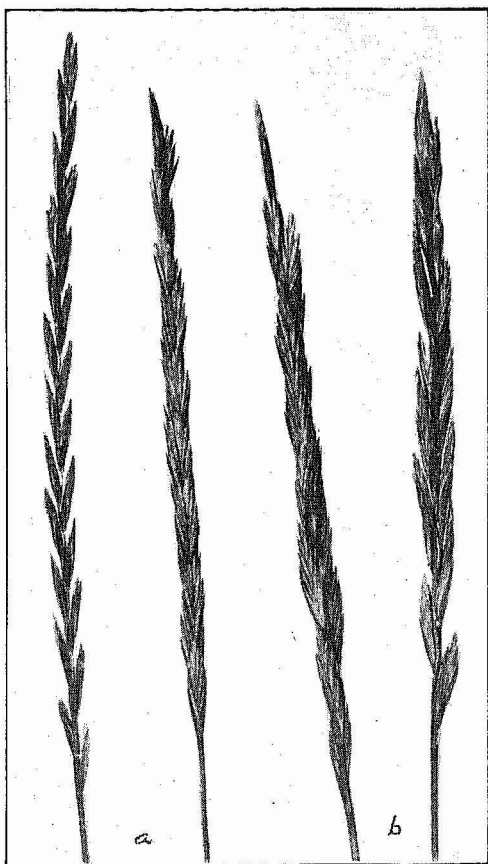


FIG. 36. a, Quack-grass; b, blue-stem. Two views of heads. One-half natural size. Original.

Propagation.—By seeds and by rootstocks. Pieces of the latter grow very readily when carried about the field by cultivators.

Occurrence.—Introduced from Europe, now quite prevalent throughout this country. This pest is frequently found in the older agricultural sections of this state and is steadily increasing. It thrives in most soils and competes successfully with all crops but requires considerable moisture for vigorous growth.

Source.—The seeds are often found with those of timothy, clover, alfalfa, and other crops, even grain. Quack grass makes hay of fair quality which is often sold and shipped and is an important source of infestation.

Importance.—Quack grass is not generally distributed over the state but it is a very bad weed where it does occur and where moisture is sufficient. Introduced commonly in grass seed, it becomes established in meadows, along ditch banks, and in waste places, and is extremely hard to eradicate. It forms a very tough sod and crowds out all other plants.

Quack grass has very little agricultural value. While it makes fair hay and has some value for pasture, its objectionable features offset its advantages.

Control.—A young quack grass plant, two to three months old, is just as easily killed as a wheat plant of the same age. When the plants become about four months old the rootstocks develop, and as they increase in number eradication becomes difficult. The rootstocks seldom appear more than six inches below the surface of the ground.

All successful methods of eradicating this troublesome weed from large areas have as a fundamental principle thorough cultivation. Eradication may be accomplished by dragging the rootstocks to the surface where they are killed by exposure; or by turning the plants under completely and by repeated cultivation preventing any surface growth, thus starving the plants; or by somewhat modifying both methods so that the two principles may be used in combination.

The ordinary implements found upon any well-equipped farm are sufficient, provided the work accomplished is well done. Plowing is the principal operation and the use of a jointer is advised, as it is very important that all the land be cut and turned. The best results will follow when the land is comparatively dry and after the

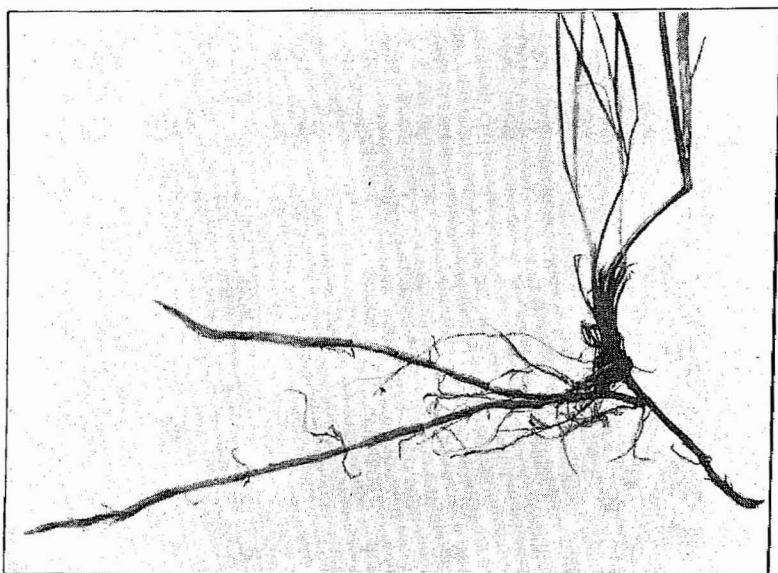


FIG. 37. Quack-grass. Underground rootstocks. One-half natural size. Original.

root systems have been more or less exhausted by the growth of the plants.

If land is summer fallowed to eradicate this weed, always withhold irrigation from the infested area as the plants are very susceptible to drying while the ground is being worked. The land should be disked within a few days, with the disks set nearly straight to avoid inverting the sod. This tends to pack the ground while forming a dust mulch. The disking should be repeated at short intervals throughout the season in order to prevent any surface growth of the quack grass. A cultivator or weeder is not to be recommended as the quack grass is tough and instead of being cut off by the cultivator is usually dragged under the surface of the ground and revives in a short time. The succeeding crop should be an intertilled one and any quack grass plants which appear should be destroyed by cultivation or hand-hoeing. Where small patches occur, it is desirable to follow a method of eradication which allows the working of each patch separately. A plan of this sort confines the rootstocks to the infested areas and prevents the spreading of the weed by the farming operations.

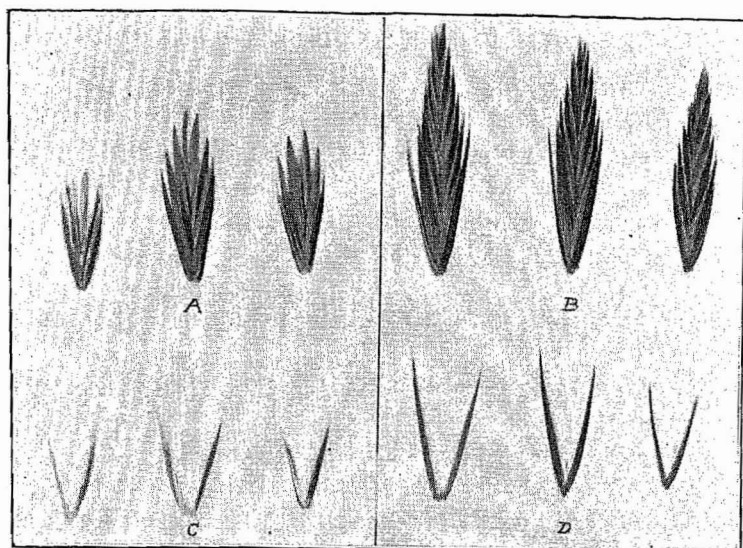


FIG. 38. Quack grass and blue-stem. A, spikelets of quack grass; B, spikelets of blue-stem; C, spikelet glumes of quack grass; D, spikelet glumes of blue-stem. Natural size. Original.

Smothering the plants by the use of hay, straw, etc., is effective for small patches. The method is similar to that recommended for Canada thistle.

The application of chemicals or the use of chemical sprays has not proved successful.

Quack grass can not be successfully choked out by seeding to meadow as the quack grass is so vigorous that it gains a foothold in spite of the grass.

Great care should be taken in selecting seed to be used in seeding down hay or pasture land. A few quack grass seeds mixed with good grass seeds mean a loss in the crop and much labor in the near future. Samples of grass seed intended for use should be tested at the State Laboratory for impurities.

RAGWEED (COMMON), *Ambrosia artemisiaefolia* L.

Other names.—Smaller ragweed; hogweed; Roman wormwood.

Description of plant.—A coarse, hairy, branching annual, 2 to 4 feet high. The stems are tinged with dark red. The leaves are 4 to 6 inches long and deeply cleft. (Fig. 39.) The male flowers

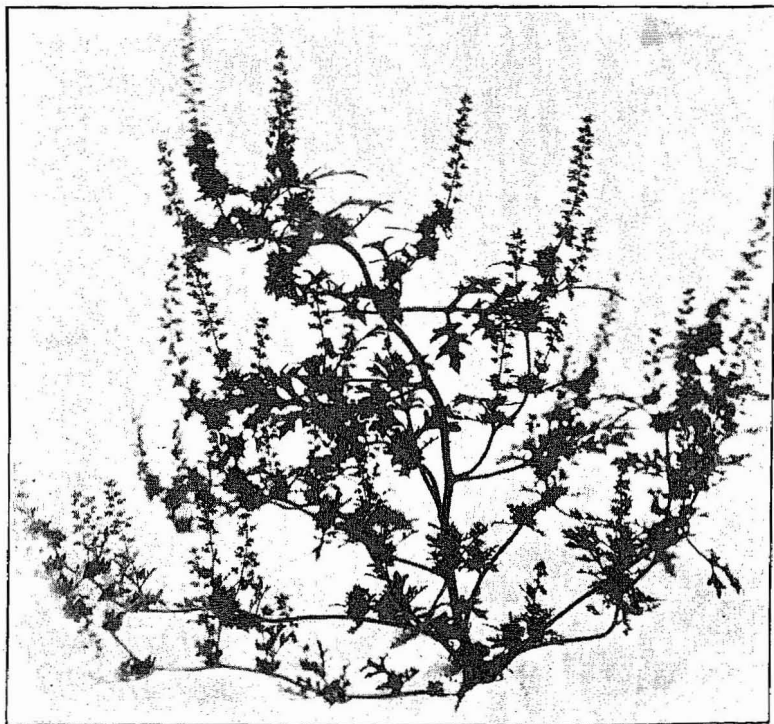


FIG. 39. Ragweed. One-fourth natural size. Original.

are in small heads or flexible spikes at the ends of the upper branches. The most noticeable thing about them is the yellow pollen sacs.

Time of flowering.—July and August.

Description of seed.—The seeds are borne in the axils of the upper leaves. They are about $\frac{3}{16}$ inch long, dark brown, a stout beak on the top, around the base of which are 5 to 10 blunt spines which are the ends of more or less stout ridges starting from the base of the seed. (Pl. IV, fig. 83.)

Propagation.—By seeds.

Occurrence.—Native in the eastern and central United States, it has spread westward to the Pacific coast. As yet it is not very common in Montana.

Source.—Impure seeds of grass, clover, alfalfa, millet, and other crops.

Importance.—In some localities a common weed of roadsides and waste places. It is also troublesome in meadows and cultivated fields where there is a poor stand of the crop. The weed has a taste and odor objectionable to stock and if milk cows are forced to eat it a bitter taste is imparted to the milk. It produces vast quantities of pollen which cause hay fever in some people.

Control.—There is little indication at present that this weed will ever become so bad in Montana that it will require more for its control than clean seed, a well-prepared seed-bed, and the mowing of roadsides and waste places. It has been found most often as an impurity in alfalfa seed.

RUSSIAN THISTLE, *Salsola pestifer* A. Nels.

Other names.—Russian tumble weed; tumbling thistle.

Description of plant.—This annual is not a true thistle but a prickly relative of lamb's-quarters. It is a low-branching, bushy plant 2 or 3 feet high and fully as broad if not crowded. (Fig. 40.) Most of its leaves are small, sharp, pointed scales. The stems show many longitudinal ribs and are usually splashed with deep red. The flowers are very inconspicuous and borne in the axils of the upper leaf scales.

Time of flowering.—July until frost.

Description of seed.—The seeds are borne in the axils of the upper leaves. They are about 1/16 inch in diameter, conical, apex flattened, both sides showing the coiled germ, grayish brown, usually covered with a thin, gray husk. (Pl. VI, fig. 99.)

Propagation.—By seeds. When the plants are mature and dry they break off at the root and become perfect tumble weeds, rolling before the wind, shedding their seeds, and gradually breaking into pieces.

Occurrence.—Introduced from Asia and now found extensively in the United States, especially the northern and western portions. It is probably in every county in Montana but is most abundant east of the continental divide. It thrives on many different kinds of soil, even where there is much alkali. It is quite resistant to drought. It is not, however, a very serious pest in rich irrigated valleys for it has little ability to compete with other plants.

Source.—Locally distributed by winds. Over long distances it is very often carried with the seeds of field and forage crops of all kinds where it is one of the most frequent of intruders.

Importance.—The Russian thistle not only exhausts the soil of food and water but crowds the crop, especially grain that has made a poor stand. It also seriously interferes with the binder, badly pricks the legs of horses, and makes the sheaves very disagreeable to handle.

When mature and dry the plants become broken off or pulled up and their rounded form makes them ideal tumbling weeds, blowing about and scattering their seeds until they lodge in unsightly heaps along fences and in dooryards and groves of trees. Over the unfenced prairie they roll before high winds with astonishing speed until worn out.

It is essentially a weed of partially cultivated ground. It is easily destroyed by good cultivation and, on the other hand, it is easily choked out by a vigorously growing crop. It can not ordinarily

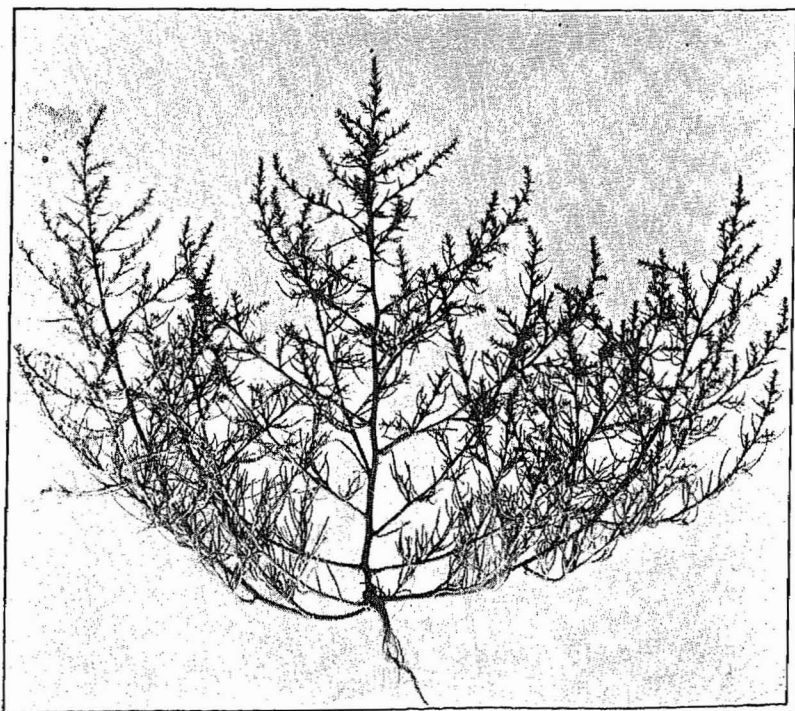


FIG. 40. Russian thistle. One-sixth natural size. Original.

get a start in unbroken sod. It is seldom troublesome in this state on irrigated lands or in the higher, cooler valleys but is a real pest on dry lands in the hotter and drier sections. This is not because it dislikes water for it thrives well on the raw ground along irrigation ditches, even close to the water where it has earned the name of "ditch whiskers." The reason for its greater prevalence on dry land appears to be that here the crops and other vegetation are not so rank as to choke it out and rotation is not much practiced.

Control.—In badly infested fields the weeds should be mowed and burned in late summer before the seed is ripe. Some branches, however, come out so low that the mower will pass over them and there will be plenty of seed formed unless the field is at once plowed and harrowed. Another method sometimes practiced with success is to pasture the infested land with sheep which are rather fond of the young plants.

Following either of these preliminary treatments the farmer may choose between two lines of procedure as he thinks best.

(1) The field may be kept in summer fallow or a cultivate crop for two years, provided all the weeds are kept down and not too many blow in from the surrounding country. If corn is planted it should be in check rows and cultivated both ways, otherwise so many Russian thistles will grow in the rows that they will seriously interfere with harvesting.

(2) The field may be seeded to a rank-growing crop such as millet, brome grass, peas, alfalfa, clover, or timothy. On irrigated ground grain will serve nearly as well if sown at the right time on properly prepared soil.

It has been suggested that close pasturing, cutting early for feed, or careful cultivation to prevent this plant from going to seed for two years would practically clean an infested field. The seeds do not persist in ground that is moist as they will either grow or rot.

SHEEP SORREL, *Rumex acetosella* L.

Other names.—Field sorrel; horse sorrel.

Description of plant.—A small perennial 6 inches to a foot tall and very slender. The leaves are mostly clustered at the base of the stem and have long stalks and arrow-shaped blades. (Fig. 41.) They are smooth and rather fleshy and have a sour taste. The stem is much branched at the top where it bears numerous flowers. The

male and female flowers are borne on separate plants and are not showy, from lack of petals. The whole flowering portion is a rusty red. This sorrel—really a small dock—has an elaborate system of rootstocks which run rather near to the surface of the ground. The



FIG. 41. Sheep sorrel. Two-thirds natural size. Bul. 30, Mont. Exp. S'a.

plants are therefore in patches, sometimes covering an entire field.

Time of flowering.—June to August.

Description of seed.—The seeds are about 1/16 inch long, shiny, reddish brown, broadly oval, having 3 equal convex sides, usually covered with a dull reddish brown, roughened calyx. (Pl. II, fig. 68.)

Propagation.—By seeds borne on female plants only. However, the two kinds are usually found more or less mixed so that seeding is abundant. Rootstocks are also important in the local spread.

Occurrence.—Introduced from Europe but now all over this country. In Montana is it getting quite common. It is reputed to thrive best on poor land lacking in lime, but it certainly grows well in good soil also, except that it is likely to be crowded out by other vegetation.

Source.—Impure seeds, especially those of grass and clover. The seed-bearing plants are often shipped with hay also.

Importance.—Sheep sorrel is important only upon land which is in a poor state of fertility or acid in reaction, probably because of its adaptability and the scarcity of other plants. Sometimes it occurs abundantly in orchards which have been clean-cultivated for a period of years. It is seldom seen on rich land where a system of crop rotation is practiced.

Control.—Sheep sorrel persists mostly upon soils which are gravelly or in a poor state of fertility. It is claimed that its presence indicates acidity of the soil. The application of lime corrects the acidity and it is claimed by some that the weed can be controlled in this manner. By the use of intertilled crops for a few years, thus preventing the weeds from maturing seeds, and practicing a system for building up the fertility of the land, the weed will be easily controlled.

SHEPHERD'S PURSE, *Capsella bursa-pastoris* (L.) Med.

Description of plant.—A slender, branching annual and winter annual 6 to 30 inches high. (Fig. 42.) It belongs to the mustard family and is distinguished from the others by the seed capsules, which are heart-shaped (fig. 26g) and a little less than ¼ inch long. The flowers are very small with 4 white petals.

Time of flowering.—Throughout the season.

Description of seed.—Each capsule contains from 10 to 20 seeds, each about 1/24 inch long, reddish yellow to reddish brown, oblong,

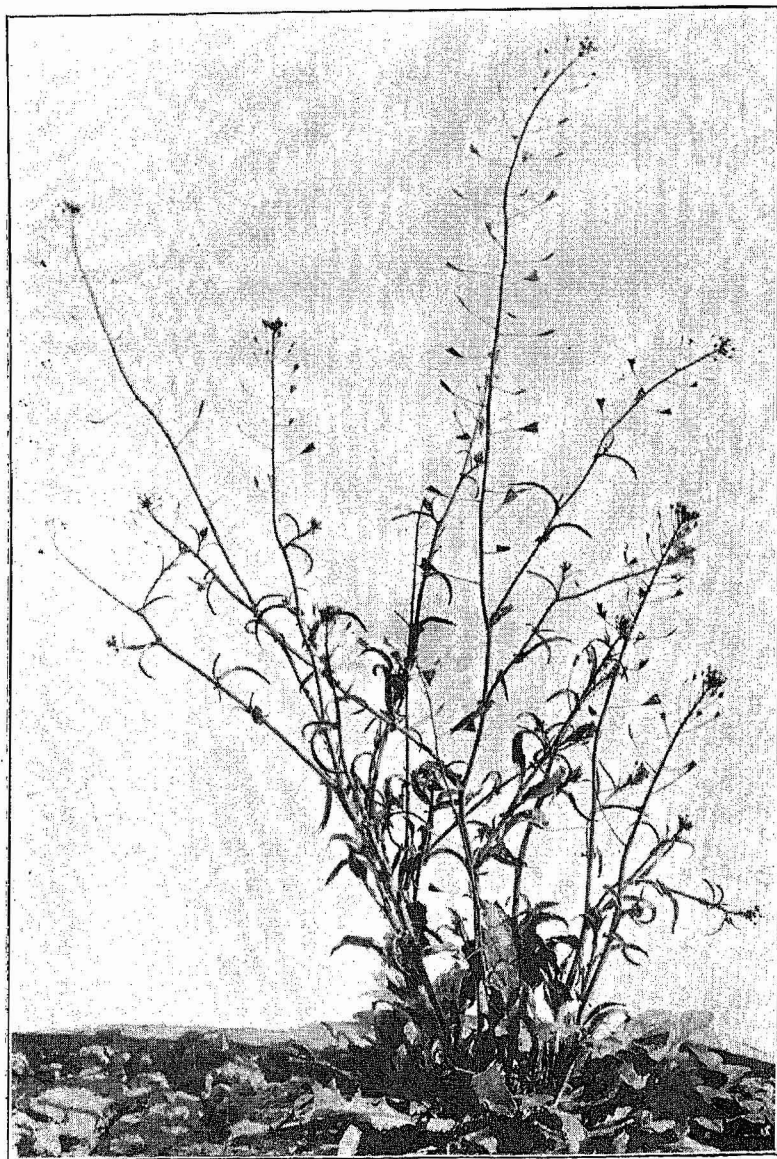


FIG. 42. Shepherd's purse. One-third natural size. Original.

slightly flattened, two longitudinal grooves on each side. (Pl. II, fig. 67.)

Propagation.—By seeds.

Occurrence.—Introduced into the United States from Europe but it can be found now almost everywhere that civilization has extended.

Source.—Distributed locally by various agricultural operations and carried more or less as an impurity in many kinds of seeds.

Importance.—Shepherd's purse is very common in waste places, poorly kept gardens, etc., but has only small power of crowding out field and forage crops, especially if a good stand is secured.

Control.—Usually the only means of control required is good cultivation of gardens and potato fields and good preparation of the soil for field crops. Mowing practically destroys all plants in waste places.

SKELETON WEED, *Lygodesmia juncea* Don

Other names.—Wild asparagus; devil's shoestring.

Description of plant.—A perennial milkweed with apparently leafless stems, the leaves being very small and scale-like. The stems are 1 to 2 feet high, much branched, slender, hard, rough, and wiry. (Fig. 43.) The flowers are about $\frac{3}{4}$ inch in diameter, light purple with few rays. (Fig. 44.) This plant is usually found in rather sparse, irregular patches.

Time of flowering.—July and August.

Description of seed.—The seeds are about $\frac{1}{5}$ inch long, very slender, sides almost parallel excepting near the apex where they taper slightly, ribbed, pappus light brown. (Pl. III, fig. 80.)

Propagation.—Principally by wind-borne seeds, though the plants sprout up somewhat from the strong perennial roots.

Occurrence.—Native throughout the northwestern United States and western Canada. Gradually extending eastward. It is fairly common on the ranges of Montana and when the land is brought under cultivation the weed persists for a considerable time.

Source.—Skeleton weed spreads locally by wind-blown seeds. It is infrequent as an impurity in seeds. It is spread somewhat with hay containing it.

Importance.—This weed in pastures where it is often found is of little importance, as the plants do not grow so thickly that they

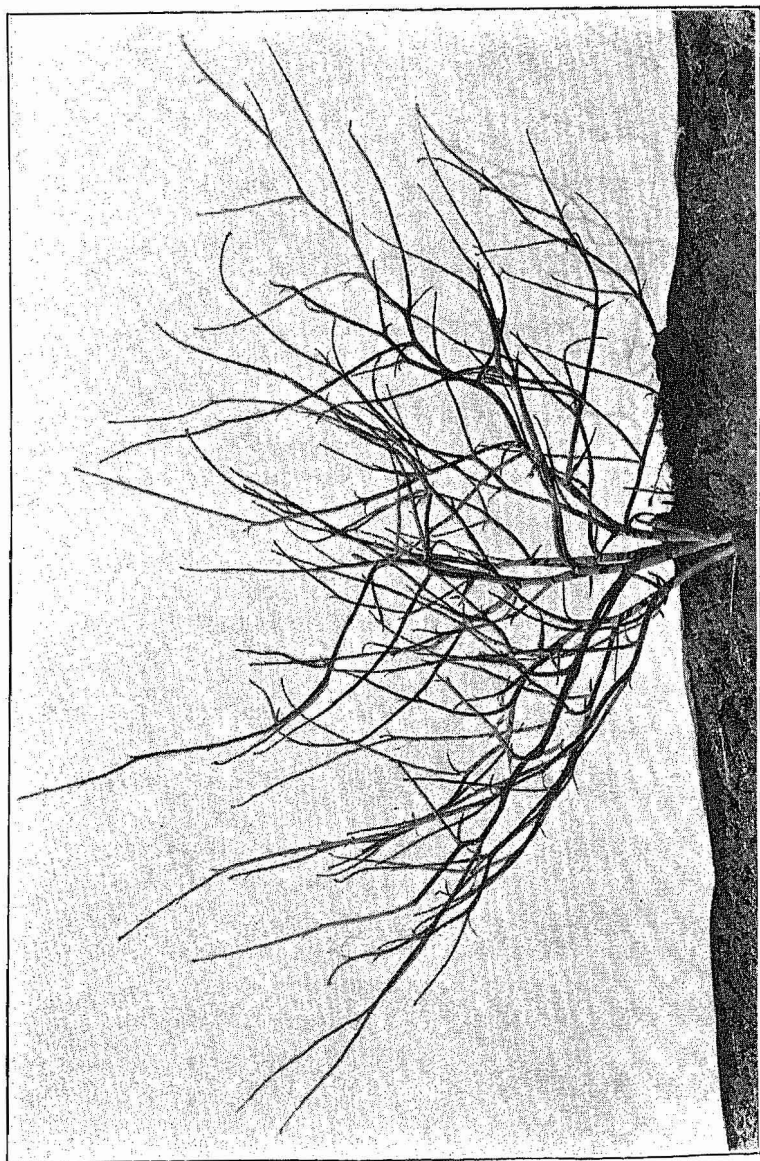


FIG. 43. Skeleton weed. One-third natural size. Original.

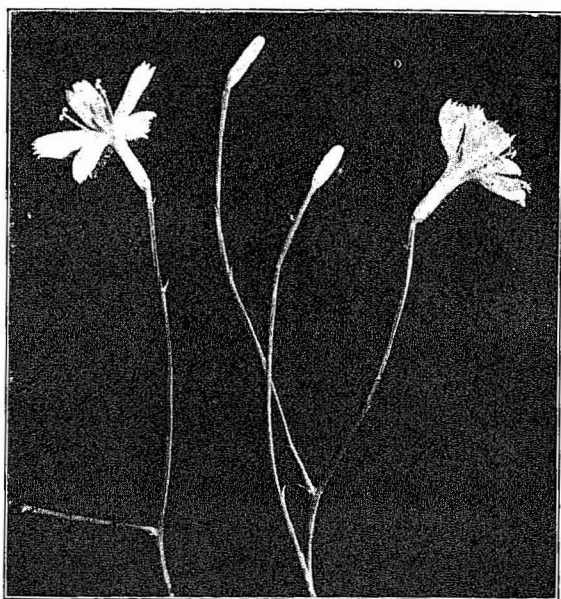


FIG. 44. Skeleton weed. Tips of stems. Natural size. Original.

crowd out all the grass and stock graze between them. When cut with hay, stock simply reject these weeds. When the land is brought under cultivation, however, this pest persists and may even grow more thickly than when in sod, interfering considerably with the crop.

Control.—This weed is very similar in habit to blue lettuce, but it is more easily controlled. On badly infested land a three-year rotation of crops including an intertilled crop should be adopted, or in very severe cases the fallow method recommended for Canada thistle should be practiced. Complete eradication is not usually insisted upon, for after the thick patches found native in the sod have been reduced to scattering plants they are not especially troublesome.

SOW THISTLE (ANNUAL), *Sonchus oleraceus* L.

Other names.—Common sow thistle; hare's lettuce.

Description of plant.—An annual milkweed, 2 to 3 feet high, with dark, shining, toothed leaves. At the base of each leaf is a pair of lobes clasping the stem. The flowers are light yellow, about $\frac{3}{4}$

inch in diameter, and resemble those of the dandelion. (Fig. 46C.)

Time of flowering.—July until frost.

Description of seed.—The seeds are reddish brown in color, about 1/10 inch long and half as wide, with prominent longitudinal ridges broken by cross bars. (Pl. VII, fig. 108.) The bristly pappus is easily broken off.

Propagation.—By seeds.

Occurrence.—Introduced from Europe and now prevalent throughout much of the United States and Canada. Though comparatively new in Montana, it is rapidly increasing in the irrigated sections.

Importance.—This sow thistle thrives under much the same conditions as the dandelion. It is of little importance in dry sections, but in rich irrigated land under cultivation and in newly seeded meadows and lawns it may become quite troublesome.

Control.—At the present time annual sow thistle is pretty much confined to definite patches in waste places and poorly cultivated fields. Much can be accomplished by preventing seeding in these places, as the seeds are spread freely by the wind. The weed is easily controlled by thorough tillage, and in newly seeded meadows early mowing will give the crop the upper hand.

SOW THISTLE (PERENNIAL), *Sonchus arvensis* L.

Other names.—Field sow thistle; creeping sow thistle; milk thistle.

Description of plant.—A perennial milkweed 2 to 5 feet high, growing in dense clumps or patches. The leaves are more or less toothed and often the teeth look sharp and spiny but they are rather soft and, compared with Canada and prairie thistles, they are relatively harmless. The flowers resemble those of a dandelion in shape and color (figs. 45 and 46B) and are about 1½ inches in diameter. This perennial has a strong root system and many long rootstocks that run deep below the surface of the ground and send up new stems freely.

There are two related weeds, common or annual sow thistle (*Sonchus oleraceus* L.) and prickly sow thistle (*Sonchus asper* (L.) Hill), but these may be distinguished from the perennial form by the fact that they are annuals, without rootstocks, and not often



FIG. 45. Perennial sow thistle. One-third natural size. Original.

growing in patches, and by their smaller flowers, about $\frac{3}{4}$ to 1 inch in diameter. (Fig. 46C.)

Time of flowering.—July and August.

Description of seed.—The seeds are borne in heads like those of the dandelion. They are about $\frac{1}{8}$ inch long, dull, dark reddish brown, oblong, slightly flattened, ridged lengthwise and wrinkled transversely. (Pl. IV, fig. 87.)

Propagation.—By underground rootstocks and by seeds. Its

greater seed production makes it in many places an even worse pest than the Canada thistle.

Occurrence.—Introduced from Europe into eastern Canada and now prevalent in that region and in the northeastern United States. It is spreading westward and may now be found in a few places in most of the northern states. It is as yet rare in Montana.

Source.—Where this weed is found it is spread freely by wind-borne seed. Doubtless most of the introductions into territory previously free from it were through seed contamination; for while it is uncommon to find it in crop seeds in this part of the country, a few seeds are sufficient to give it a start.

Importance.—In Canada the sow thistle is reputed to be the worst weed and many acres of land have been abandoned on account of this pest. In Montana, at the present time, it is not considered serious. However, with its characteristic seeding and spreading habit it may become very serious if allowed to become established.



FIG. 46. A, dandelion; B, perennial sow thistle; C, annual sow thistle; D, prickly lettuce. Flowers two-thirds natural size. Original.

Wherever it occurs methods of eradication should be adopted without delay.

Control.—The perennial sow thistle has all the characteristics of Canada thistle and in addition it produces seeds in abundance, and these are carried long distances by the wind. In some districts of the Northwest, especially in Canada, many fields are so badly infested that farmers have abandoned them entirely. However, under our climatic conditions the Canada thistle is more hardy and is perhaps the worst weed. The recommended method of control is similar to that for the Canada thistle.

SQUIRREL-TAIL, *Hordeum jubatum* L.

Other names.—Wild barley; skunk-tail grass; often called fox-tail, which may confuse it with *Chaetochloa*. (page 49).

Description of plant.—A biennial or perennial (under some conditions annual) grass with slender stems 1 to 2 feet high, growing in thick bunches or tufts. (Fig. 47.) The heads are 3 to 4 inches long and characterized by very numerous, slender, flexible awns or beards about 2 inches long. When green or half ripe it is one of the handsomest of grasses.

Time of flowering.—July and August.

Description of seed.—The seeds are about $\frac{3}{16}$ inch long, slender; very sharply pointed, grain adheres to the glumes; awn $1\frac{1}{2}$ to 2 inches long, barbed upwards, resembling a miniature seed of barley. (Pl. VI, fig. 103.)

Propagation.—By seeds.

Occurrence.—Native throughout the western half of the United States, spreading eastward and increasing on its native range as the land is brought under cultivation. Very common as a weed of roadsides, waste places, neglected gardens, and vacant spots in cultivated fields.

Source.—It has sometimes been planted as an ornamental grass but the seeds are mostly carried by clinging to passing animals and in hay. The presence of the long awn causes most of the seeds to be thrown out when threshing the crop in which it intrudes, but a few of them get broken off and the separation is, therefore, not perfect.

Importance.—This grass gives most trouble in pastures, especially in rather wet alkali land where other vegetation grows but

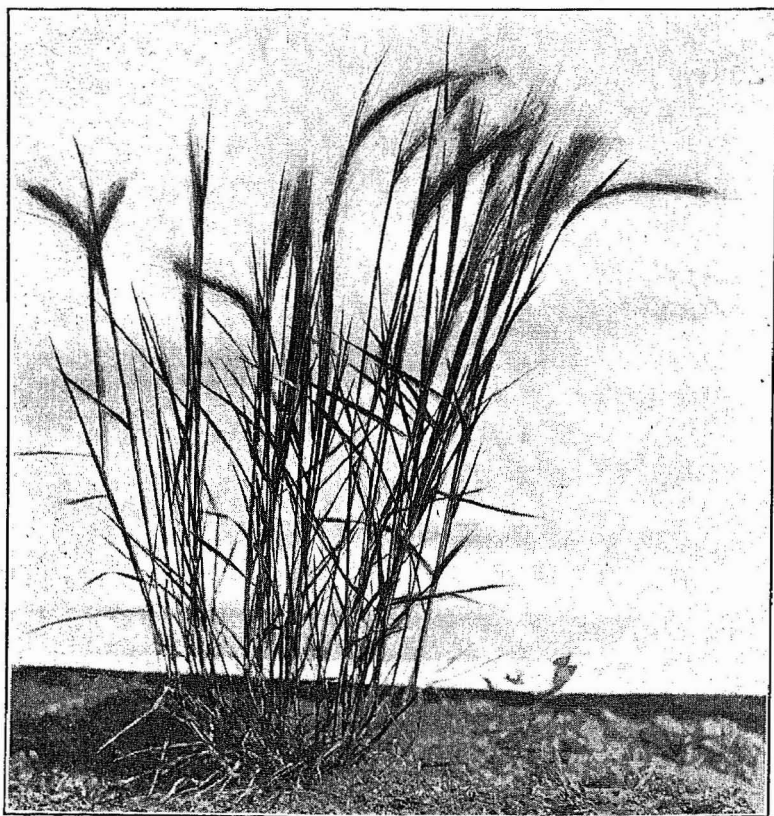


FIG. 47. Squirrel-tail. One-fourth natural size. Original.

sparsely. As it matures it becomes hard and brittle and the awns pierce the mouths of stock attempting to eat it, often causing ulcerations of the gums and lips. Hay containing ripe squirrel-tail sometimes causes the same trouble. It is common along roadsides and waste places but it is so handsome that it can hardly be objected to as unsightly, at least until it matures and the heads break up.

Control.—Squirrel-tail is readily destroyed by cultivation and will not give trouble on land cropped with grain or hay if a good seed-bed is prepared and the seed sown is free from it. No method has yet been devised for keeping it out of pastures on low alkali ground; but as it has been found that white clover, when it thrives,

readily crowds out the squirrel-tail, raking the seed of this plant into the soil is worth a trial.

SUNFLOWER (COMMON, WILD), *Helianthus annuus* L.

Description of plant.—Coarse annuals, very rough from a covering of stiff hairs. The stems here are 3 to 5 feet high, though farther south they sometimes grow 10 to 12 feet. The leaves of this species are broadly heart-shaped, which distinguishes it from some others. (Fig. 48.) The showy flowers, 3 to 4 inches in diameter, with bright yellow rays are familiar to almost everyone.

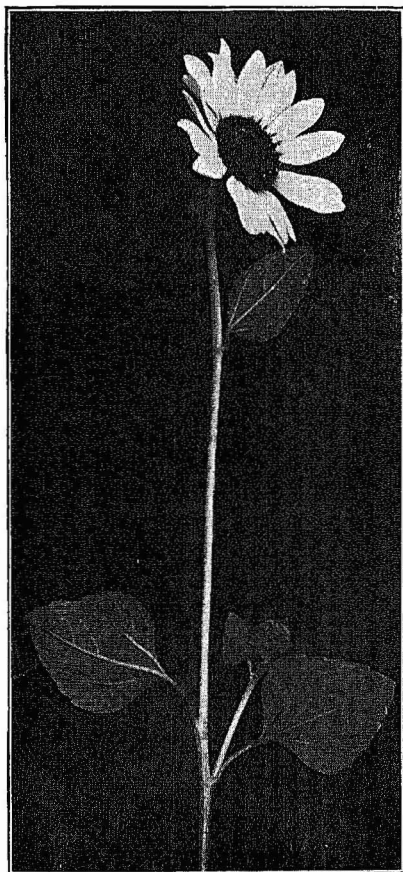


FIG. 48. Sunflower. Tip of stem. One-fourth natural size. Original.

Time of flowering.—July and August.

Description of seed.—The seeds are borne in large heads and are about 1/6 inch long, brown, egg-shaped in outline, flattened, mottled, grooved lengthwise. (Pl. I, fig. 66.)

Propagation.—By seeds.

Occurrence.—A native of the central and western United States and spreading eastward. It was rare in Montana until settlers came here, but now it is common in cultivated land east of the continental divide and becoming so to the west.

Source.—The seeds are carried locally by irrigation water and by various agricultural operations. They are common impurities in seed of grain, millet, and other crops.

Importance.—Sunflowers spring up in abundance in gardens and intertilled crops and are often found in grain fields. They are among the most conspicuous weeds of roadsides and waste places. The seeds are found with great frequency in oats, wheat, flax, and alfalfa. We have seen oats coming from the thresher fully 10 per cent sunflower seeds. These seeds, unlike those of the mustard family, have some food value but it is small compared with the loss in yield of grain. The stems are objectionable in harvesting.

Control.—The methods recommended for the control of marsh elder (page 56) apply equally to sunflowers.

THISTLE (PRAIRIE), *Carduus undulatus* Nutt.

Other names.—Field thistle; wavy-leaved thistle.

Description of plant.—Biennial, (some forms perennial), with stiff, hairy stems 1 to 3 feet high. (Fig. 49.) The leaves are deeply toothed, with very sharp, stiff spines on the margins. They are covered with white, cottony hairs which are especially abundant on the under side. The flower heads are 1½ to 2 inches in diameter and light purple in color.

Bull thistle (*Carduus lanceolatus* L.) is very similar to prairie thistle but may be distinguished by the presence of stiff bristles instead of white, cottony hairs on the upper side of the younger leaves. It has been introduced from Europe but is now quite common here.

Time of flowering.—July to September.

Description of seed.—The seeds are similar to those of Canada thistle but larger, about 1/3 inch long, light brown, shiny, curved

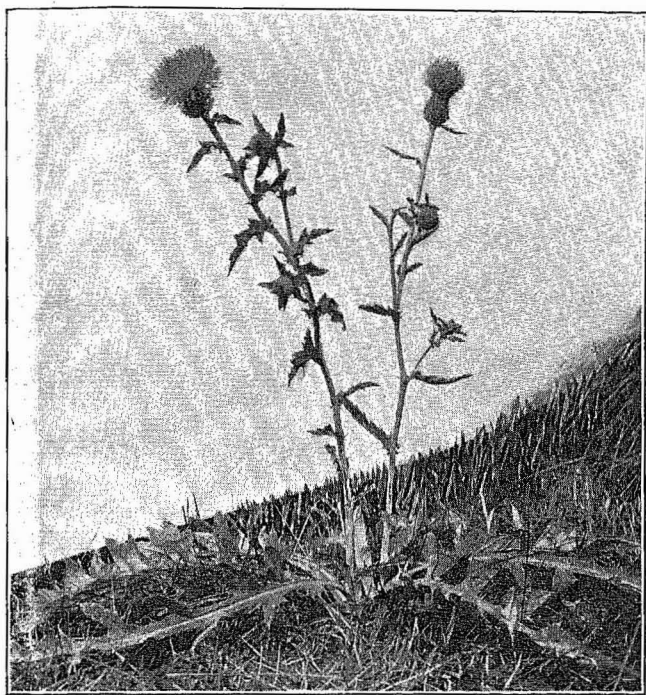


FIG. 49. Prairie thistle. One-eighth natural size. Original.

or straight, elongated oblong, smooth, somewhat flattened, marked with faint longitudinal lines; the top is cup-shaped, having a light-colored rim with a small, cone-shaped point in the center. (Pl. II, fig. 73.)

Propagation.—By seeds which are scattered by the wind.

Occurrence.—Native throughout the western half of the United States. Found on the virgin prairie and hillsides, also along roadsides and in waste places.

Source.—Distributed locally by the wind. The seeds are sometimes found mixed with those of farm crops.

Importance.—Prairie thistle (and also bull thistle) is readily destroyed by tillage and is, therefore, of little importance in cultivated fields. It is largely because of their prickly nature that these plants are objectionable.

Control.—The only control measures necessary are thorough

tillage of fields where it is abundant in the virgin soil and cutting the weeds in waste places and roadsides.

TOAD FLAX, *Linaria Linaria* (L.) Karst.

Other names.—Butter-and-eggs; flaxweed; wild snapdragon.

Description of plant.—Smooth, hairless, unbranched perennials, 2 or 3 feet high, with long, narrow leaves. The orange yellow flowers have a long spur at the base and are borne in a spike-like cluster at the top of the stem. (Fig. 50.) The plant is provided with rather deep underground rootstocks and grows in dense patches.

Time of flowering.—July until frost.

Description of seed.—The seeds are produced in nearly spherical, 2-celled capsules. They are about 1/12 inch in diameter including the broad, wing-like margin, dark brown to black, flat disk-like, the wing notched and curved with 5 radiating ridges. (Pl. IV, fig. 85.)

Propagation.—By seeds and by underground rootstocks that enlarge the patches.

Occurrence.—Introduced from Europe and planted in dooryards and flower gardens as an ornamental plant. From these places it has escaped cultivation and now may be found in waste places, roadsides, gardens, and cultivated fields. It is not very common in the newer agricultural districts of the state.

Source.—Planted in dooryards and flower gardens. The seeds sometimes are found in those of grains, forage crops, and flax.

Importance.—Were it more abundant this would be a very important weed, for it grows in thick patches, crowding out most other plants, and it is difficult to exterminate. Fortunately it has but little tendency to spread.

Control.—This weed is very difficult to eradicate because of its deep rootstocks. It usually becomes well established in pastures and as stock dislike its taste and odor it is unmolested and allowed to spread without hindrance.

Small patches should be worked separately, keeping the rootstocks within the infested area. Clean cultivation should be practiced for at least one season, and ordinarily this will destroy most of the plants.

The use of a salt brine or caustic soda is very effective for small areas. These solutions will kill all vegetation as well as the weeds and will leave the ground clean when the chemical is leached away.

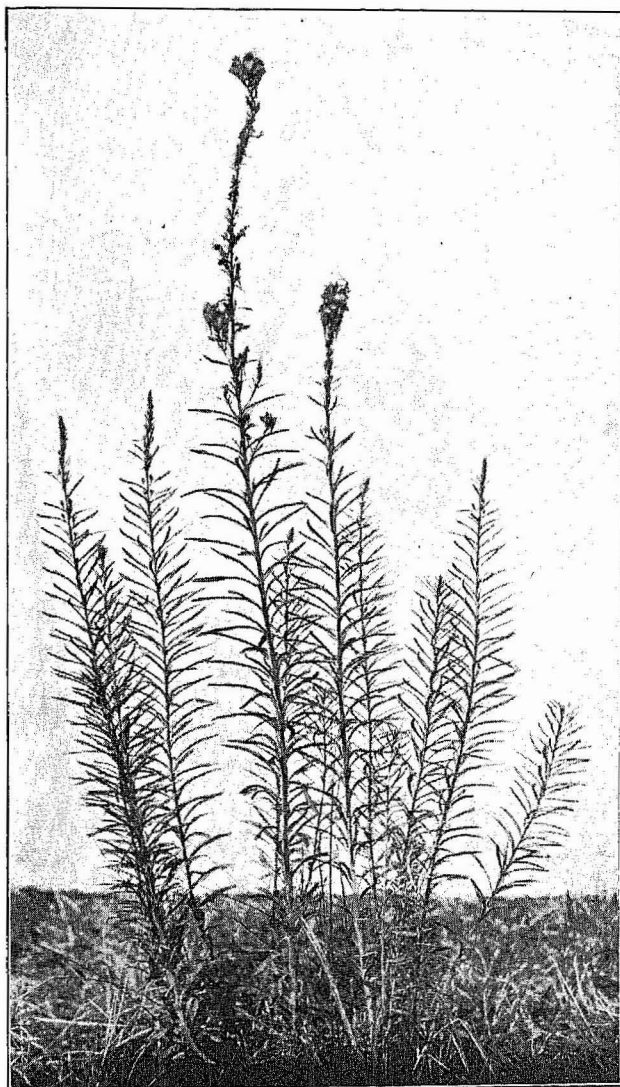


FIG. 50. Toad flax. One-sixth natural size. Original.

WILD BEGONIA, *Rumex venosus* Pursh

Other names.—Veined dock.

Description of plant.—Perennial plants of the dock family. The stems are smooth, rather stout, and about a foot high. Like the other docks they are tinged with dark red. The leaves are 3 to 5 inches long, about a third as wide, oval and entire, with prominent veins. The flowers are borne on slender stalks in a cluster at the top of the plant. (Fig. 51.) They are mixed green and red in color and have no petals, the most conspicuous portion being that which forms the wing on the seed. The plant is provided with moderately

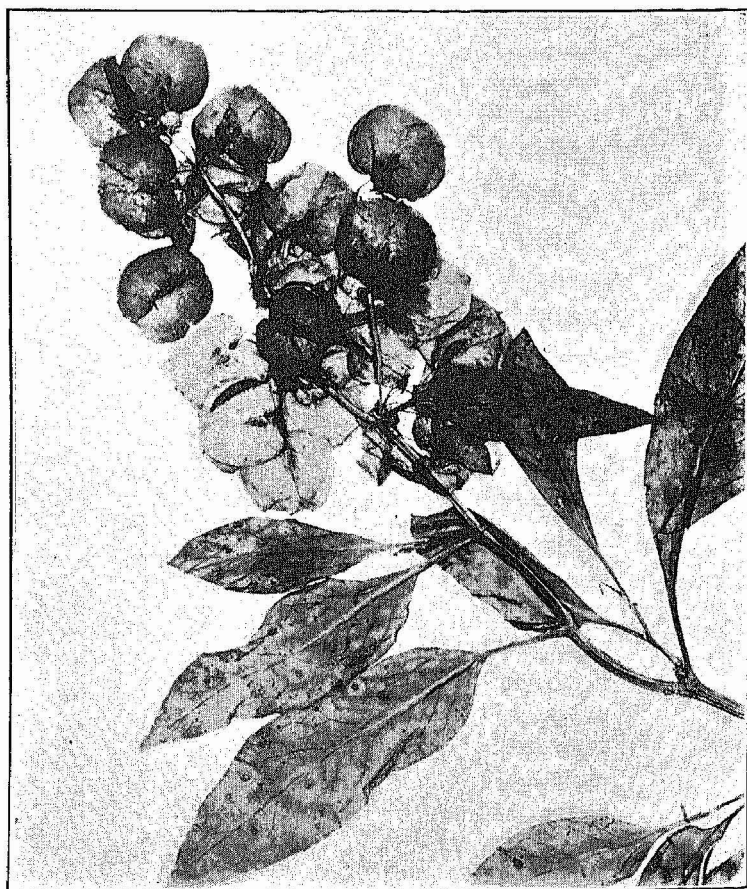


FIG. 51. Wild begonia. Winged seeds and tip of stem. Original.

deep rootstocks which, sending up new shoots, cause the plant to grow in patches.

Time of flowering.—July and August.

Description of seed.—The seed is enclosed in a broad, papery wing, dull red in color, with prominent veins. (Fig. 51.) The seeds are $\frac{1}{4}$ inch long, shiny brown, smooth, ovoid, 3-angled, ridges slightly margined, base abruptly rounded, apex acute. (Pl. II, fig. 74.)

Propagation.—By seeds which, though provided with a large wing, are not carried far by the wind. The rootstocks aid in enlarging the patches.

Occurrence.—Native to the western United States but confined to widely separated patches. In this state it is usually found in brushy ravines and river bottoms.

Source.—This weed shows little tendency to spread about.

Importance.—Wild begonia is of little importance in its native haunts, but when the land is cleared and broken it persists with considerable tenacity, choking out the crops that are planted and requiring much labor for its extermination.

Control.—This weed is a native and is usually found on sandy soil and is rarely troublesome on heavy land or where different crops have been growing in rotation. The most satisfactory method of eradication is deep plowing when the plant is coming into bloom. It may be necessary to repeat the plowing once or twice during the season. Wild begonia is not easily eradicated but may be so reduced in abundance that it will do little damage.

WILD BUCKWHEAT, *Polygonum Convolvulus* L.

Other names.—Bindweed; black bindweed; knot bindweed.

Description of plant.—A tough, slender, branching, annual vine. The leaves are broad arrow shaped, 1 to 2 inches long. (Fig. 52.) The flowers are small, without petals, and greenish, tinged with red or pink.

Time of flowering.—Late June to September.

Description of seed.—The seeds are about $\frac{1}{8}$ inch long, dull black, triangular, equally 3-sided, and bluntly pointed. It often appears in commercial grain with parts of the calyx attached or as a small, white, triangular seed without its black seed coat. (Pl. III, fig. 75.)

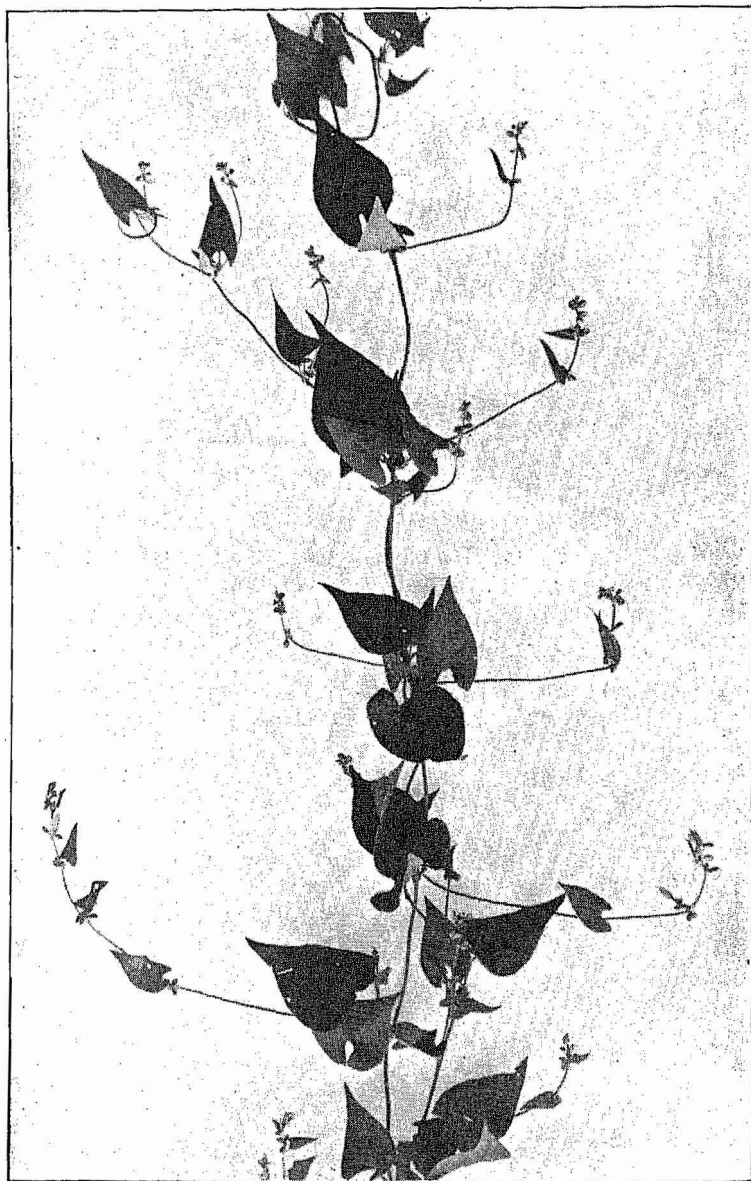


FIG. 52. Wild buckwheat. Portion of vine. One-third natural size. Original.

Propagation.—By seeds.

Occurrence.—Introduced from Europe and now found all over this country. It is quite common in the grain-growing sections of Montana.

Source.—Impure seeds of nearly all field and forage crops, especially wheat and oats.

Importance.—Probably this bindweed does not reduce much the yield of farm crops, but in grain fields it mats the stalks together, increasing the loss from lodging, and it is a real nuisance at harvest time, sometimes making binding next to impossible.

Control.—The most important measure for its control is the sowing of clean seed. The seeds of wild buckwheat are slow in germination and where the land is badly infested fallowing until late in the fall and sowing to spring grain is often desirable. Seeding down to a hay crop is the best remedy where practicable.

WILD LICORICE, *Glycyrrhiza lepidota* Pursh

Description of plant.—A perennial with tough, slightly branched stems, 1 to 3 feet high. The leaves are compound, with an odd number of leaflets, usually 13 to 17. (Fig. 53.) The flowers are yellowish white, pea-like, and borne in spike-like clusters on long stems in the axils of the upper leaves. The seeds are borne in true pods about an inch long and covered with sharp hooks. (Fig. 54a.) When ripe they are brown in color. The plant produces a few long underground rootstocks that send up new shoots, making rather sparse patches.

This plant is not likely to be confused with any other. The bur-like pods suggest burs of cocklebur, but they are smaller, thinner, lack the 2 thick-set hooks at the tip, and contain 3 to 6 rounded seeds in one chamber instead of 2 elongated seeds in separate chambers. (Fig. 54a.) Also, cocklebur has rounded, simple leaves, no showy flowers, and no rootstocks.

Time of flowering.—July until frost.

Description of seed.—Each bur-like pod contains several seeds. The burs (fig. 54a) are $\frac{1}{2}$ inch long, light reddish brown, oblong, slightly flattened, beaks weak and small, covered with small, hooked prickles. The seeds are olive green to brownish in color, with a dull smooth surface, $\frac{1}{8}$ inch long, stout, kidney-shaped. (Pl. VII, fig. 105.)



FIG. 53. Wild licorice. Tip of stem, showing bur-like pods. One-fourth natural size. Original.

Propagation.—By seeds and by rootstocks.

Occurrence.—Native throughout the western United States and Canada. Frequently found in the unbroken sod on the prairies and foothills of this state and especially along the watercourses.

Source.—From the patches where it occurs the seeds are carried in their burs in the hair of passing animals, wild and domestic, especially long-haired dogs. The burs float readily on the water and are distributed along the banks of streams for miles. The seeds are not easily removed from the burs and for this reason they do not get into farm seeds to any extent.

Importance.—Wild licorice is one of the worst of our native

weeds. It is very hard to eradicate and keeps appearing year after year in spite of ordinary cultivation. Fortunately the plants do not stand so close as to prevent entirely the growth of crops between them. The burs are a serious nuisance in the tails and manes of horses, the hair of dogs, and the clothing of man.

Control.—This weed is a member of the pea family and its burs resemble the cocklebur and are distributed in a similar manner. Prevent seed from maturing by cutting off the plants at the surface of the ground. This cutting, if done at short intervals, will gradually kill the perennial rootstocks. Ordinary plowing, followed by harrowing to expose the roots to the sun, will kill many of the weeds, as they are very susceptible to drying. Keeping them reduced rather than total eradication is the usual practice.

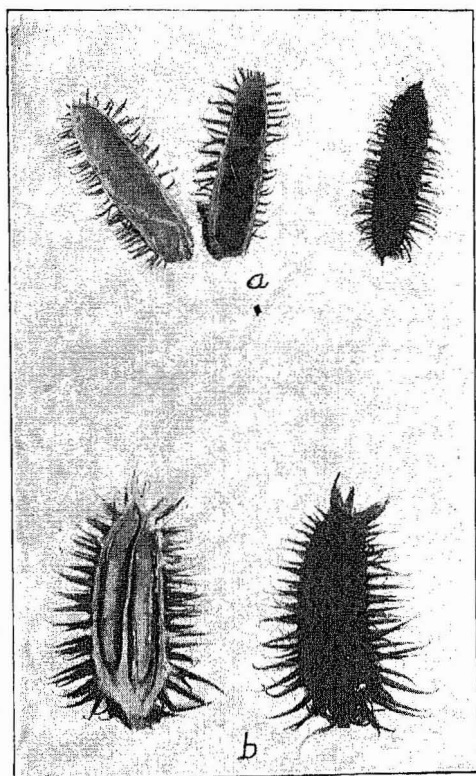


FIG. 54. a, Wild licorice; b, cocklebur. Hooked burs. Natural size. Original.

WILD OAT, *Avena fatua* L.

Description of plant.—This annual is so much like common cultivated oat as to need little description. The principal difference lies in the seed, which in the wild oat matures a little earlier and has the special characteristics described below. (Fig. 55.)

Time of flowering.—Late June and July.

Description of seed.—The seeds vary greatly in size as do those of the tame oat; color yellowish white to dark brown and black. Distinguished from the tame oat in that they have a strongly twisted right-angled awn, a slanting horse-shoe-shaped scar at the base of



FIG. 55. Wild' oat. Head. Two-thirds natural size. Bul. 30, Mont. Exp. Sta.

the seed, and stiff hairs surrounding the base of the scar. (Pl I, fig. 63.)

Propagation.—By seeds.

Occurrence.—Introduced into this country from Europe. Now found almost everywhere that oats are grown.

Source.—The twisted awns clinging to the wool of the sheep and the hair of other animals are carried about to some extent, but most of the wild oats that trouble us are planted by ourselves with the seeds of common oats, wheat, and barley.

Importance.—As an intruder in grain fields wild oat is "one of the most common of the annual grass weeds." Sometimes 10 to 20 per cent of barley and wheat as the grain comes from the thresher is made up of wild oats. This does not represent the entire loss, however, for wild oats mature early and a large proportion shell out and are lost in harvesting. The food value per bushel of wild oats is very low, owing to the large proportion of hull to kernel.

Control.—The first requisite is to sow clean seed. Where practicable this should be secured from fields free from this pest, but sometimes such can not be found. Wild oat separators in different sizes are now on the market that are very successful in removing oats from wheat and will take the most of them out of barley.

It is quite difficult to grow oats or even other grains continuously on the same land and keep it free from wild oats. If this must be done it is desirable always to cultivate the land as soon as the crop is removed to germinate as many of the seeds as possible, the young seedlings being killed by freezing the following winter. If the land is too badly infested it must be summer fallowed the next year, or oats and peas may be grown and cut early for hay, a procedure extensively followed in some sections. The practice of stacking grain for threshing instead of leaving it in shocks in the field greatly facilitates weed control.

On irrigated land it is best to seed down to a hay crop when wild oats become abundant. They must be kept from growing along irrigation ditches.

WILD TOMATO, *Solanum triflorum* Nutt.

Other names.—Wild potato; cut-leaved nightshade.

Description of plant.—An annual with a weak, branching stem that spreads over the ground, becoming a so-called "carpet-weed."

These mats are roughly circular in outline and are from 8 to 15 inches in diameter. The leaves are 1 to 2 inches long and deeply cut. The flowers are bluish white, $\frac{1}{4}$ to $\frac{3}{8}$ inch in diameter and shaped like those of the potato. There are usually 3 in a cluster, and these are followed by 1 to 3 round, smooth, green berries (fig. 56) which, when mature, are a little less than $\frac{1}{2}$ inch in diameter.

Time of flowering.—July and August.

Description of seed.—In the soft pulp of the berries numerous

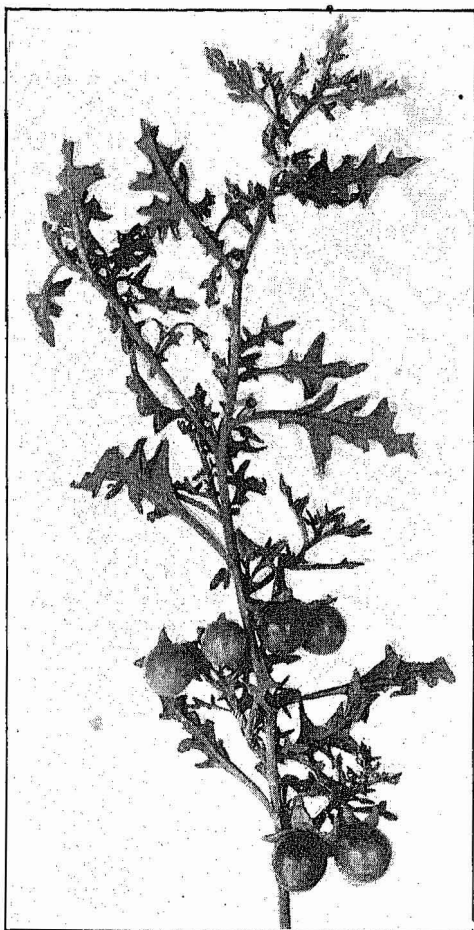


FIG. 56. Wild tomato. Tip of stem with berries. One-half natural size. Original.

seeds may be found. They do not readily escape from this pulp and hence are not often found as an impurity in seeds. The seeds are $\frac{1}{3}$ inch in diameter, lemon yellow to light brown, flattened, ovate, dull, finely granular. (Pl. III, fig. 82.)

Propagation.—By seeds.

Occurrence.—Native throughout the western United States and Canada. Very scarce in Montana until the land was brought under cultivation. Now common in all the older settled sections.

Source.—It is difficult to account for the spread of this weed which so quickly gets a start around habitations in the Northwest. Birds and animals may carry the seed to some extent but various farm operations seem to have the greater responsibility. The berries growing close to the ground are trodden upon and crushed and stick to the feet, dropping off where chance may dictate. The seeds may sometimes become mixed with small garden seeds but this is not a common occurrence.

Importance.—Wild tomato is chiefly a weed of gardens, waste places, and poorly cultivated ground. It is quite tender and easily destroyed but if left alone the dense mats will cover much ground.

Probably the greatest interest concerning this plant lies in the berries. New settlers especially, seeing them for the first time, are curious to know if they have any value or if, on the other hand, they are poisonous. We have received dozens of inquiries along this line. In answer we may say that chemical examination shows that they contain a very small quantity of the poisonous principle "solanin," but so do various other members of this family, including the tomato and potato. On the other hand, we have knowledge of people who have eaten them with no harmful effects and have never heard of anyone's being injured by them. They are so unpalatable, however, that no one would be likely to eat very freely of them unless they were mixed with a large proportion of other substances. They seem not to have much culinary value.

Control.—As this weed gives trouble only in gardens and inter-tilled crops, good cultivation is the only remedial measure required.

YELLOW TREFOIL, *Medicago lupulina* L.

Other names.—Black medick; hop medick; nonesuch.

Description of plant.—A weak-stemmed annual, 8 inches to a foot high, with leaves very much like those of alfalfa, to which it is

closely related (Fig. 57). The flowers also are similar but bright yellow and held in a compact cluster. The seed pod is short, kidney-shaped, and black. (Fig. 58.)

Time of flowering.—June until frost.

Description of seed.—Each pod holds a single seed. The seeds are about 1/10 inch long, dull yellow to green, smooth, egg-shaped, flattened, with a short protuberance near the middle of the inner edge. Often found in commercial seed within a black, oval, much flattened and spirally coiled pod. (Pl. III, fig. 76.)

Propagation.—By seeds.

Occurrence.—Introduced from Europe, now found throughout the country. It adapts itself readily to different soils.

Source.—Impure seeds, especially those of clover and alfalfa.

Importance.—Yellow trefoil is not a serious pest, its principal harm being an an intruder or adulterant in other seeds. On the other hand, it has redeeming qualities. It is a good forage plant,

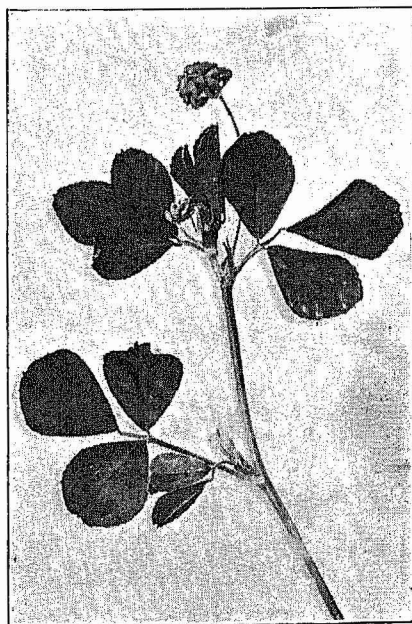


FIG. 57. Yellow trefoil. Tip of stem with flowers. Two-thirds natural size. Original.

except that it is so small and only an annual and can rarely be cut profitably for hay. It is also a fair honey-producing plant.

Control—As the only objectionable feature of this plant is as an intruder in alfalfa seed, the only method required for its control is to plant only seed free from it, and to cut for hay rather than save for seed alfalfa fields containing it.

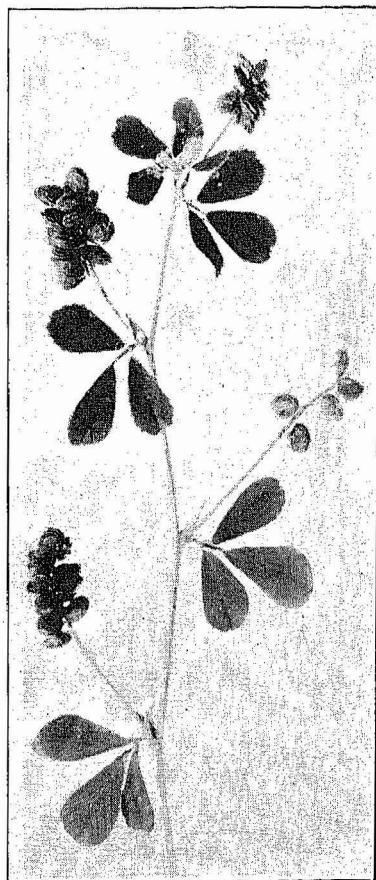


FIG. 58. Yellow trefoil. Tip of stem with seed pods. Two-thirds natural size. Original.

PLATE I

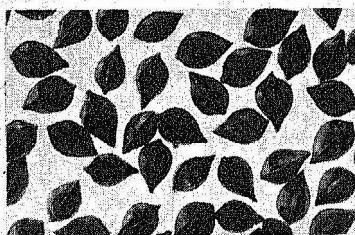
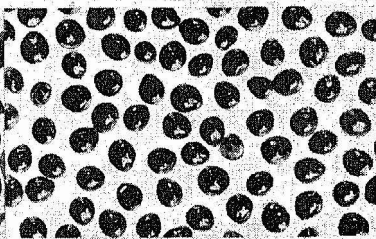
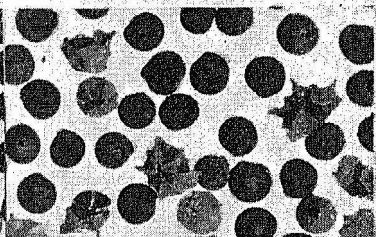
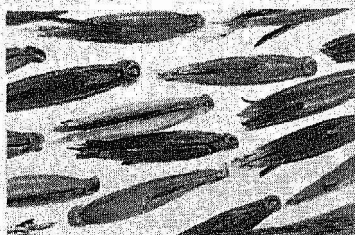
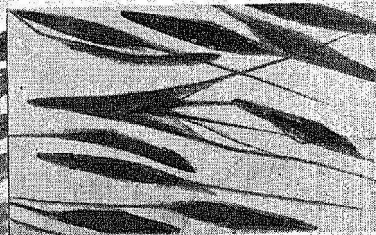
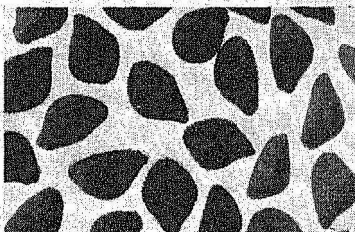
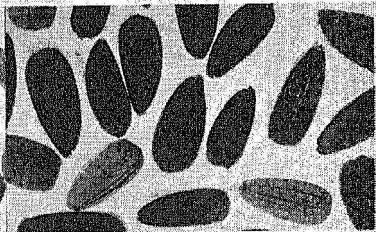
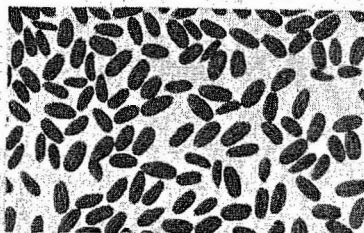
59. CURLED DOCK $\times 4$ 60. PIGWEED $\times 4$ 61. FANWEED $\times 4$ 62. LAMBSQUARTER $\times 4$ 63. WILD OATS $\times 2$ 64. MILITARY GRASS $\times 2$ 65. MORNING GLORY $\times 3$ 66. SUNFLOWER $\times 3$

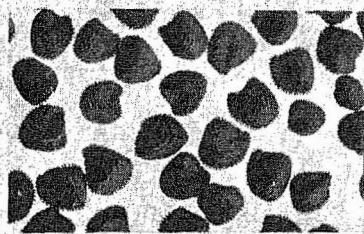
PLATE 11



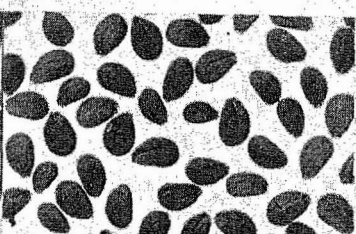
67. SHEPHERD'S PURSE x4



68. SHEEP SORREL x4



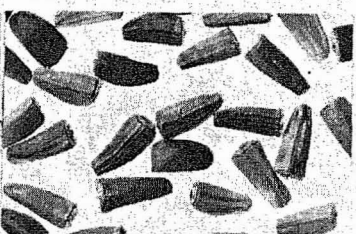
69. CORN COCKLE x2



70. PEPPER GRASS x4



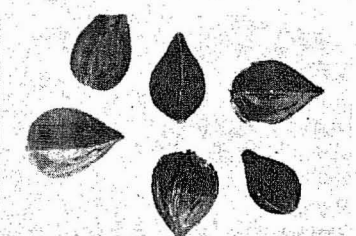
71. DANDELION x4



72. CHICORY x4



73. PRAIRIE THISTLE x3



74. WILD BEGONIA x3

PLATE III

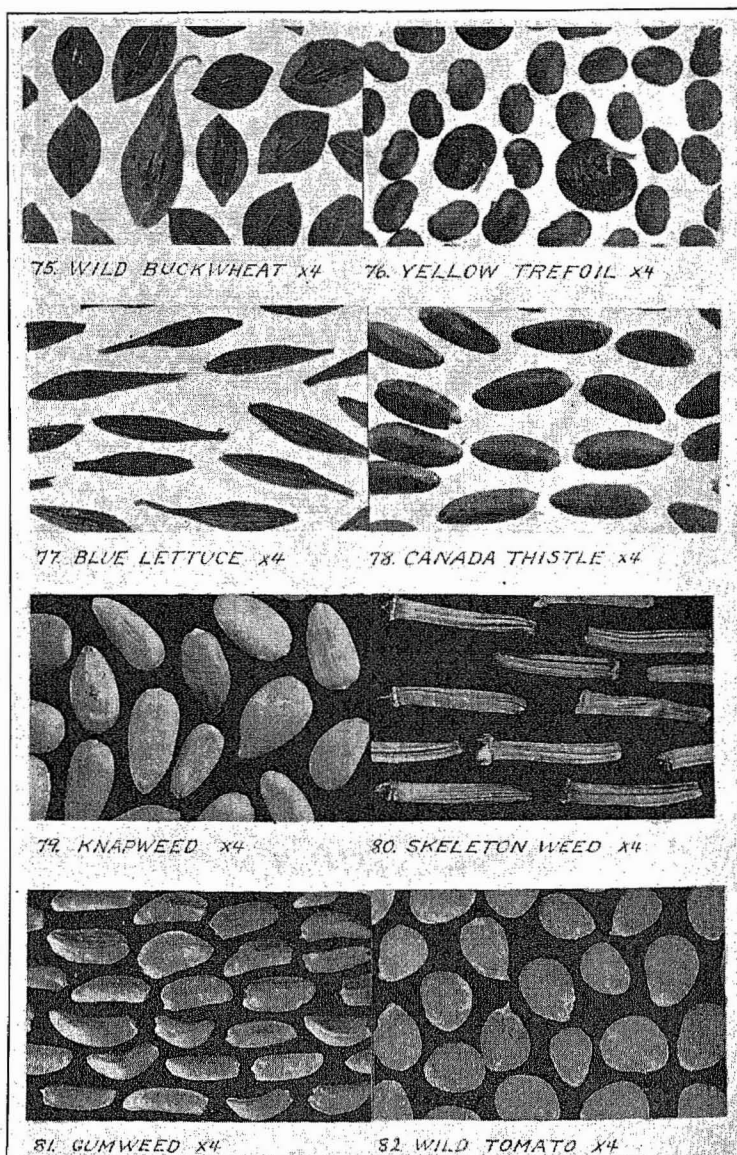
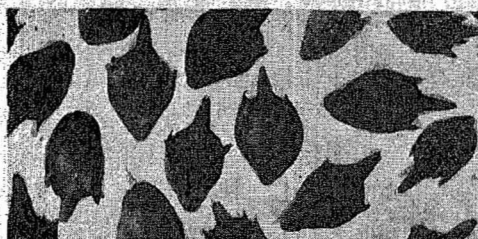
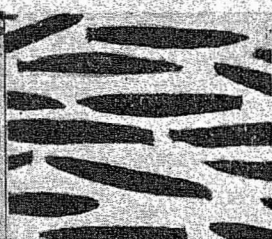


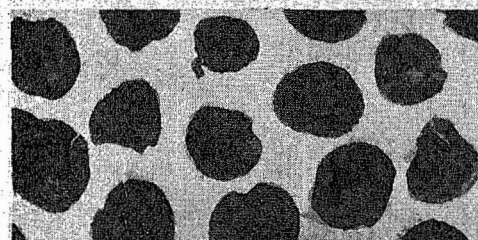
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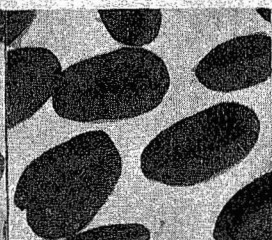
83. RAGWEED X3



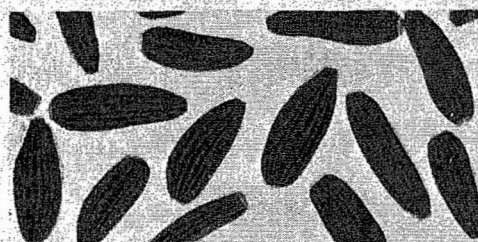
84. DOGBANE X4



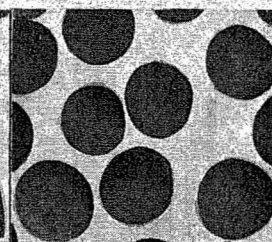
85. TOAD FLAX X6



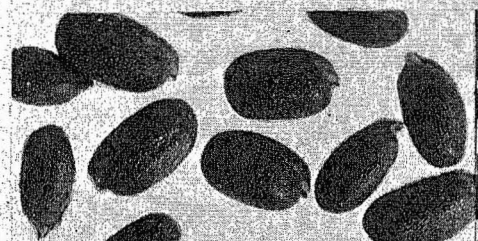
86. FALSE FLAX X6



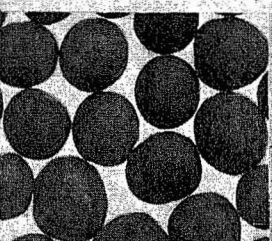
87. PERENNIAL SOW THISTLE X6



88. WILD MUSTARD X6

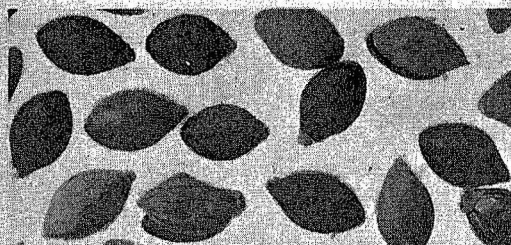


89. HARE'S-EAR MUSTARD X6

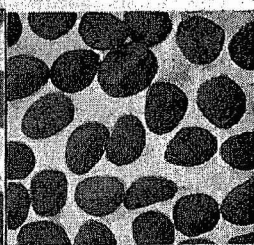


90. COW COCKLE X5

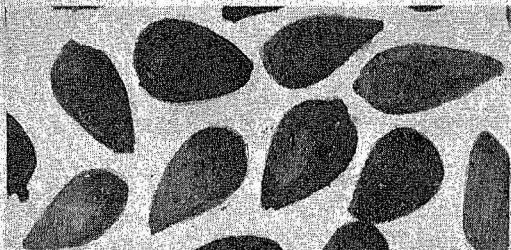
PLATE V



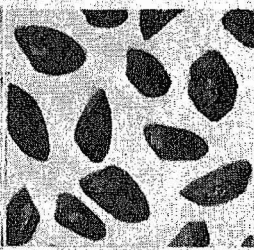
91. GREEN FOXTAIL X6



92. DODDER X8



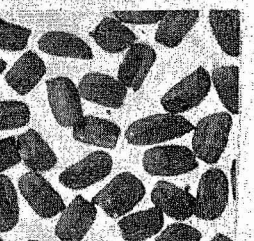
93. POVERTY WEED X8



94. PLANTAIN X8



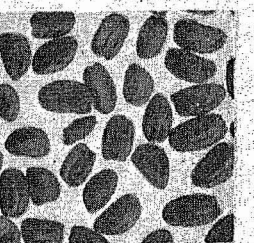
95. MARSH ELDER X6



96. TUMBLING MUSTARD X7



97. KING HEAD X3



98. TANSY MUSTARD X7

PLATE VI



99. RUSSIAN THISTLE x8

100. COMMON CHICKWEED x8

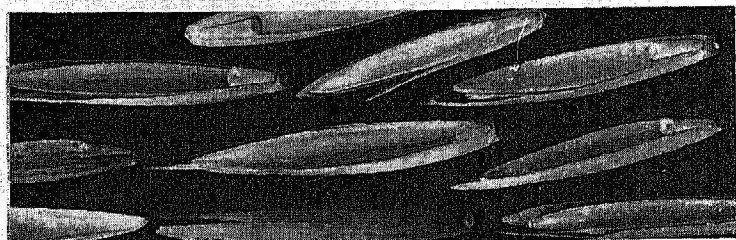


101. CHESS x7

102. MOUSE-EARED CHICKWEED
x8

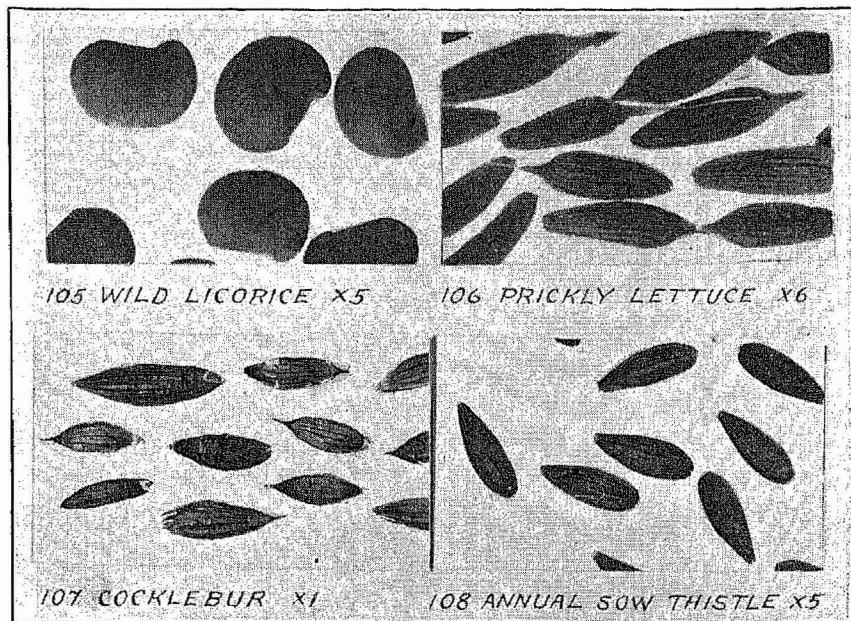


103. SQUIRREL TAIL x5



104. QUACK GRASS x5

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