

OREGON AGRICULTURAL EXPERIMENT STATION.

Bulletin No. 32. November, 1894.

BOTANICAL DEPARTMENT.



Five Farmers' Foes.

Canada Thistle.

Sow Thistle

Bull Thistle.

Chinese Thistle.

Russian Thistle.

MOSES CRAIG, Botanist.

The Bulletins of this Station are sent free to all residents of Oregon who request them.



AGRICULTURAL COLLEGE PRINTING OFFICE.

H. R. CLARK, Manager,

CORVALLIS, OREGON:

1894.

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FIVE FARMERS' FOES.

CANADA THISTLE.--(*Cnicus arvensis*, Hoffm.)

BULL THISTLE.--(*Cnicus lanceolatus*, Hoffm.)

SOW THISTLE.--*Sonchus arvensis*, L.)

CHINESE THISTLE.--(*Xanthium spinosum*, L.)

RUSSIAN THISTLE.--(*Salsola kali*, L. var. *tragus*, DC.)

Every farmer wishes to increase the quantity of his crops and the Experiment Station wishes to aid him in so doing. This result may be gained in two ways: By increasing the acreage, or by giving the plants more food and better care. Large farms are apt to be neglected, so increase of land under cultivation frequently fails to give a proportionately increased crop. One cause of this is the weeds which creep stealthily in crowding out the crops from which they take moisture and food. We believe that if people really understood how much is annually lost in this way they would immediately take bold steps to free themselves from these pests.

PURPOSE OF THE BULLETIN.

The object of this bulletin is to call the attention of Oregon agriculturists, and others interested, to the large crops of weeds annually grown on their farms and to describe some methods of preventing this injury. There is a great difference in weeds, some are easily eradicated while others defy the best efforts of careful cultivators to destroy them.

Prominent among the latter class are the Thistles, and with them we group some plants which though not true thistles are frequently mistaken for them. The more thorough our knowledge of these plants, their nature and habits, the more effective will be the means of destruction.

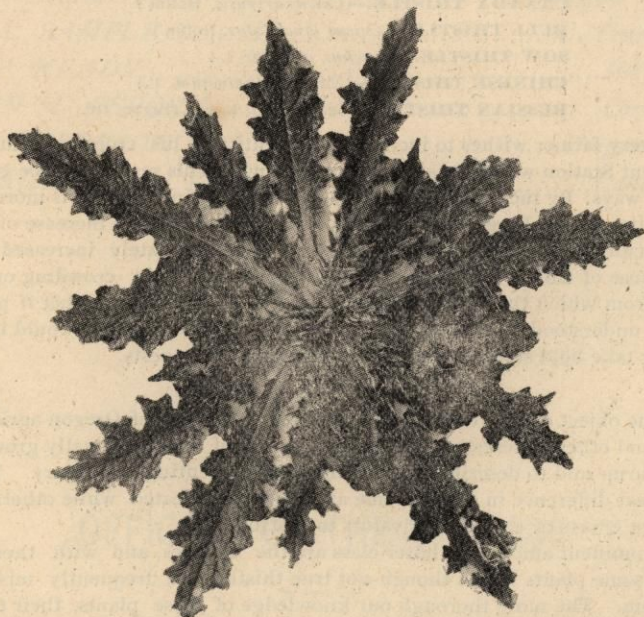
Every farmer should know three things about weeds, namely: How weeds get on a farm, the character and amount of injury they are likely to cause, and how to best destroy them. So before studying the thistles in detail it may be well to consider briefly weedy plants in general and try to answer the above questions.

HOW WEEDS GET ON THE FARM.

Most weeds are propagated by seed which is produced in great abundance and modified in various ways to aid in their distribution. The roots

or seeds of some seem ever in the soil ready to sprout and grow whenever a favorable opportunity offers.

The interesting subject of plant distribution may be considered under three heads, first the provisions made by nature in the plant itself which may be either structural or physiological, second the natural forces that act as aids in distributing the plants and last though not least the agency of man. Under structural provisions come modifications of the fruit, such as pappus of which the thistle down carried by the wind is a familiar example, hooks as in the cockle-bur by which the burs fasten themselves to the hair of animals and are thus carried from place to place, or modifications of the seed as the hair of Milkweed (*Asclepias*) or the winged seed of Catalpa. Under physiological provisions we may have prolonged vitality of the plant, a seed covering attractive to birds, or a sticky exudation as in the Tarweed (*Madia*). Among the natural forces aiding in the distribution of plants are winds, streams, fish, birds and cattle.



LEAVES OF BULL THISTLE.

That roads and railroads are great factors in weed distribution is apparent to all who have noticed the number and variety of Eastern plants growing along these lines of traffic. The seeds of many plants are annually emptied upon our shores in the ballast left about sea-ports by vessels from foreign countries, or travel westward over the mountains in the straw and chaff used for packing goods. Some of the worst weeds are thus brought from a distance but many come from neighboring fields or roadsides occupying valuable space and if allowed to ripen seed will reappear in greater numbers the next season.



CANADA THISTLE.

COÖPERATION IN THE DESTRUCTION OF WEEDS.

Sometimes they spread so rapidly as to require concerted action to destroy them; to this class belongs the Canada thistle which spreads both by seeds and by underground stems rendering its destruction very difficult where it is once established. The diligent farmer may free his farm from weeds one year, only to find that a shiftless neighbor has raised a crop of thistles to re-seed his farm and necessitate a yearly repetition of this labor. No wonder the farmer becomes discouraged after a few years experience of this sort and soon his fields are as bad or worse than his neighbors.

Thoroughness is the secret of success and weeds cannot be successfully combatted without the earnest coöperation of all land-owners in the county, since one farm overrun with weeds which are permitted to ripen seed is sufficient to seed a township. If all the farmers in a given territory would unite in keeping down all bad weeds and not let one escape for three years they would be surprised to see how few of these pests would remain.

The most perfect co-operation however is that enforced by law. An effective weed law vigorously enforced is a blessing to any state. Let us enforce our present laws and try to have others enacted including more of our worst weeds.

OREGON LAWS FOR EXTIRPATING WEEDS.

As far as we are able to ascertain there is no law in this state requiring the destruction of any weed except the Canada Thistle and the Dagger Cockle-bur. There are however several plants that are becoming so troublesome in different parts of the state as to require united efforts for their destruction. We desire to call especial attention to the following weeds, in addition to the five described in this bulletin, and urge that they be included in the weed law before they become thoroughly established:

French Pink (*Centaurea cyanus*, L.)

Dog's Fennel (*Anthemis cotula*, DC.)

Tarweed, (*Madia* species.)

Wild Mustard (*Brassica campestris*, L.)

Ox eye or White Daisy, (*Chrysanthemum leucanthemum*, L.)

Moth Mullein (*Verbascum blattaria*, L.)

It will be noticed by some that in the plants mentioned above the common or English name is followed by another printed in *italics*. This is the scientific or Latin name used by botanists the world over, while the common name changes even in different parts of the same county. The letter following the Latin name is the initial of the botanist who first described the species.

Our present law is insufficient because it does not tell exactly what plant is meant, thus one might be uncertain whether "Dagger Cockle-bur" means *Xanthium spinosum*, L., *Gilia squarrosa*, H. & A., or some other plant. All uncertainty would be removed by the use of the Latin name.

On account of the difficulty, experienced by some, in distinguishing between the Canada and Bull Thistles would it not be well to put them both under the ban? They are both bad weeds.



ROOT OF CANADA THISTLE.



FLOWER OF BULL THISTLE.

CANADA THISTLES MUST BE DESTROYED !

An act for the Extirpation of the Canada Thistle:

SECTION 1. It shall be the duty of the Supervisors of the several counties in this State, in addition to the duties hitherto prescribed by law, to cause the destruction, in the manner which to the said supervisor shall seem the most effective, of the weed known as the Canada thistle, where such weed shall be found growing upon the public highways and county roads of this State.

SEC. 2. The road supervisor of each road district in this State shall immediately after this Act takes effect, and from time to time thereafter, ascertain whether or not there is any weed known as the Canada thistle in his road district, and shall as soon as he ascertains that there is any of said weed, notify the county court of his county in writing at a regular session thereof of the existence of said weed, and upon whose land the said weed is growing. As soon as the county court has received said information said court shall appoint a householder in said road district as a commissioner, to hold office for the term of one year, whose duty it shall be to cause the said weed to be extirpated wherever found within said district.

SEC. 3. When the commissioner aforesaid is appointed it shall be his duty to ascertain from the road supervisor of his district the exact location of said weed, and he shall then notify the owner of the land upon which it is growing of its presence thereon, and request said owner to effectually remove said weed from his land; and in case the residence of the owner is unknown or is so far away that he cannot be notified, or, if notified, can not attend to the extirpation of said weed within a reasonable time, then it shall be the duty of the commissioner to notify the occupant of said land and request him to extirpate said weed from said land.

SEC. 4. If such owner or occupant shall fail or refuse to destroy such weed after being notified by the commissioner of the existence of such weed upon his land, then it shall be the duty of said commissioner, and he shall have authority to go upon said land and cause said weed to be extirpated from said land in the manner which to him seems the most effective. The expense of destroying said weed on said land shall be paid upon proper showing made by the commissioner out of the county funds, and shall be and remain a charge upon said lands, to be assessed to said land and collected the same as taxes:



BULL THISTLE.

provided, that the same may be remitted by the county court at any regular session thereof upon the petition of ten resident householders of the precinct where said petitioner resides.

Sec. 5. The commissioner shall receive from the county for his services, specified in sections 3 and 4 of this Act, the sum of two dollars per day actually employed.

Sec. 6. If the road supervisor or commissioner mentioned in this act willfully violates any of the provisions thereof, he shall be deemed guilty of a misdemeanor, and upon conviction thereof in any justice's court having competent jurisdiction, shall be fined not less than fifty nor more than one hundred dollars for each offence.

Sec. 7. It shall be the duty of all municipal corporations and county authorities in this State to provide for the extermination of said Canada thistle within the limits of such corporation or on the vacant lands within such county, and any city or town corporation within this State neglecting or refusing to comply with the provisions of this section shall be liable to a forfeiture to the State of a sum not less than fifty nor more than five hundred dollars, to be recovered by suit in the name of the State in any court of competent jurisdiction.

Sec. 8. It shall be the duty of the several district attorneys of this State to prosecute all suits brought under the provisions of section 7 within their respective counties, and such attorneys shall be entitled to a fee of twenty-five dollars for every judgment rendered in favor of the State in such suits, and shall be entitled to a fee of ten dollars for every suit brought under the provisions of this Act when judgment is rendered against the State.

Sec. 9. Inasmuch as there is urgent need for the immediate extirpation of this weed, this Act shall take effect upon its approval by the Governor.

Session Laws of Oregon 1889, pp. 70-72.

LAW AGAINST DAGGER COCKLE-BUR.

An act for the Destruction of the Dagger Cockle-bur:

Sec. 4208. It shall be the duty of the supervisors of the several counties in this state in addition to the duties hitherto prescribed by law, to cause the destruction of in the manner which to said supervisors shall seem most effective, of the weed known as the dagger cockle-bur, where such weed shall be found growing upon the public highways and county roads of this state.

Sec. 4209. The road supervisor shall have the power to warn out laborers upon the public highways for the extirpation of said weed, as in cases of repairs of such highways.

Sec. 4210. Any road supervisor neglecting to perform his duty under the provisions of this chapter shall be liable to a fine of not more than twenty-five nor less than five dollars, to be recovered to the use of the county before any justice of the peace by suit in the name of the county.

Sec. 4211. The owners or occupants of lands shall carefully extirpate such weed when the same is found growing upon the land of such owner or occupant; and if such owner or occupant shall fail or refuse to destroy such weed after being notified by the road supervisor or any other person of the existence of such weed upon his land, then it shall be the duty of the road supervisor to cause said weed to be destroyed upon said land, and at the expense of the owner thereof, the expense of such labor in destroying such weed to be recovered by suit in the name of the county before any court of competent jurisdiction.

Sec. 4212. It shall be the duty of municipal corporations and county authorities in this state to provide for the extermination of the said dagger cockle-bur within the limits of such corporation, or on the vacant lands within such county, and any city or town corporation within this state neglecting or refusing to comply with the provisions of this section shall be liable to a forfeiture to the state of a sum not less than fifty nor more than five hundred dollars, to be recovered by suit in the name of the state in any court of competent jurisdiction.

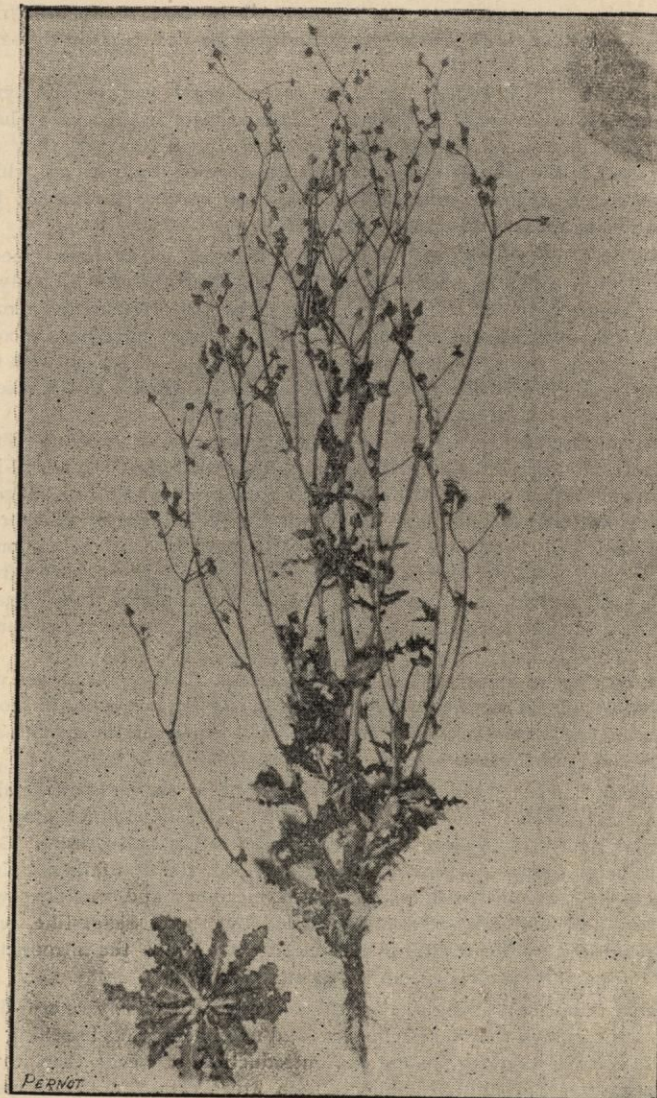
Sec. 4213. It shall be the duty of the several district attorneys of this state to prosecute all suits brought under the provisions of section 4212 within their respective counties, and such attorneys shall be entitled to a fee of twenty-five dollars for every judgment rendered in favor of the state in such suits, and shall be entitled to a fee of ten dollars for every suit brought under the provisions of this chapter when judgment is rendered against the state.

Chapter 82 Hill's Annotated laws of the State of Oregon.

HOW TO DESTROY WEEDS.

It is difficult to give methods of weed destruction that will prove applicable to the whole state as what would be effective here might not be practicable elsewhere. The treatment varies with the soil, climate and nature of the plant but some general rules may be given.

Annuals, that is plants living only one year, have herbaceous fibrous roots and can easily be destroyed by keeping them mown down or by plowing them under thus enriching the soil. Sometimes seeds already in the



SOW THISTLE. (*S. oleracea*, L.)

ground remain there for a long time without germinating, if the conditions are unfavorable, but a little care for a few years in removing all plants before any of the seeds ripen will gradually rid a farm of them.

Biennials, live two years storing up food the first season and fruiting the next, have thick fleshy roots and may be destroyed in the same way as annuals.

Perennials, that is plants living for several years fruiting and dying down each fall to come up again with renewed vigor in the spring, have woody roots and are more difficult to dispose of. If however they are kept cut close to the ground and not allowed to develop their leaves, which have been compared to the lungs of animals, they become weakened, the other plants get a start and choke them out.

Weeds in places where they are not too numerous, as in lawns, meadows etc., may be killed by placing a handful of salt on the crown, early in the season, preferably just after the grass has been cut. Kerosene, strong brine, gas lime, naphtha, and sulphuric acid used similarly have been recommended. Pulling weeds up root and branch or digging them out with the trowel and spade is very effective and well worth the trouble in the case of bad weeds.

In attempting to rid a field of weeds do not forget those growing in the fence corners, on the banks of ditches, and along roadsides. This will improve the appearance of your fields, increase their value, and prevent seed from being scattered over the farm by the wind. Begin the work of destruction early as it will then prove much easier. It must be done early enough to kill the weeds before the seeds begin to ripen. Keep the fields free from all weeds. Mark well where weed patches are and examine those parts of the field from time to time and if any weeds are found remove them immediately.

Cutting when in flower will kill many weeds. Thistles, Tarweed and other members of the Sunflower family, (*Compositæ*) if cut while in bloom *should be burned immediately* else the seed will ripen on the ground and be distributed by the wind.

Cultivation in a dry time is most injurious to weeds and beneficial to growing crops if their roots are not injured. After a summer crop has ripened sow some crop to cover the ground and keep weeds down. Give clean cultivation every few years either with a hoed crop or a fallow. Keep the ground well occupied with crops. Keep meadows and roadsides well sodded and plow-land cultivated unless shaded by crops. Sedge-like weeds may be destroyed by tile draining wet meadows. Avoid the introduction of weeds in manure, litter, or from weedy surroundings.

Weeds are not only unsightly but they occupy valuable space crowding out crops from which they take moisture and nutriment, thus lessening the yield. It is much easier to prevent the introduction of weeds than to destroy them when thoroughly established,—so great care should always be taken to sow clean seed, as the extra expense will be more than repaid by the increased value of the crop. Unless one can readily distinguish good pure seed from bad mixed seed he should purchase only from reliable firms.



CHINESE THISTLE.

DESCRIPTION OF THE CANADA THISTLE.

This plant differs from the common Bull Thistle, for which it is often mistaken, in its slenderer wingless stem and branches, in the thin narrow ($\frac{1}{2}$ to $\frac{3}{4}$ inch), curled and more deeply cut leaves, less rigid prickles, and smaller flower heads which are about half an inch in diameter.

It is more difficult to destroy than the common thistle as it is a perennial spreading by long underground stems, which penetrate deeply into the soil, often below the reach of the plow. These rhizomes extend horizontally in all directions and being furnished with buds send branches to the surface where a tuft of leaves is first produced followed later by aerial stems which bear flowers and seed. These die down to the ground every fall, but in the spring the rhizomes again send up numerous branches which soon cover the ground, the plants spreading with surprising rapidity from year to year.

This "Cursed Thistle" is also propagated by seeds which supported by the downy pappus are often carried long distances by the wind. Like most of our troublesome weeds it was introduced from Europe and has now become permanently established in this country. It has been reported from nine counties in Oregon where fortunately it is not abundant.

Cnicus arvensis, Hoffm. Fl. Germ. IV. 180—Perennial and spreading by creeping root-stalks a foot or two high, corymbosely branching, usually glabrate and green: stem and branches wingless: leaves lanceolate, pinnatifid and toothed, furnished with abundant weak prickles: heads loosely cymose, less than an inch high, dioecious; in male plant ovate-globular, and flowers (rose-purple) well exserted; in female oblong-campanulate and flowers less projecting: bracts of involucre all appressed, short, and with very small weak prickly points: only abortive anthers to the female flowers. Meadows, pastures, and waste grounds, from Newfoundland through the Northern and Middle Atlantic States: a too common weed. (Nat. from Eu.)

HOW TO DESTROY CANADA THISTLES.

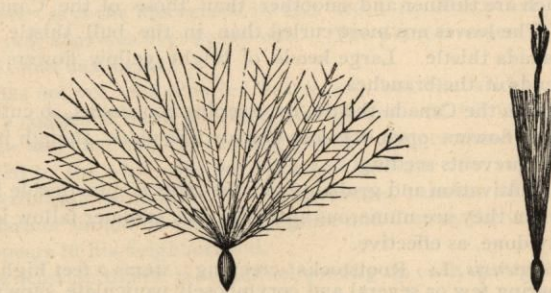
Frequent deep plowing will in shallow, dry soils nearly always destroy the thistle, but in light, rich, moist soils this usually fails. Wherever a dense sod can be formed seeding will be found the easiest means of destruction, though not so rapid as plowing, hoeing, salting, or burning where these means are available. On rich bottom lands or in ground filled with stumps, a grass sod will be found the best destroyer. If the land is not rich enough to form a good sod manure it.

Mowing when the thistle is coming into bloom does not destroy the plant though it checks its growth. The application of kerosene or strong brine to the roots, after cutting off the tops three or four inches below the crown with a spade, is effective and practicable in small patches. In stony ground the scythe, salt, and sheep will be found good destroying agents. If the thistles are in fence rows move the fence and plow.

One object of thorough cultivation is that all weed seeds may germinate and be destroyed at once and not lie dormant in the ground coming up a few at a time to reseed the field. Plowing and stirring the soil when infested with Canada thistles unless thoroughly done, only multiplies them, so do not permit any leaves or underground stems to remain, but burn the plants immediately after cutting. The cultivation need not be deep. If all the thistles are kept cut off three inches below the surface the underground portions will soon die of exhaustion.

DESCRIPTION OF THE BULL THISTLE.

This common weed is very abundant in pastures and along roadsides throughout the state, flourishing in rich moist soil. It is a biennial producing the first year simply a tuft of large spiny leaves spread out flat upon the ground; the second year it sends up a stout, erect, branched stalk, two to four feet high, blooms, bears seed and dies. The plant is propagated by seeds which supported by the spreading pappus are carried long distances by the wind and scattered far and wide.



SEED OF BULL THISTLE.

It may be distinguished from the Canada thistle by the larger flower heads (1 to $1\frac{1}{2}$ inches in diameter) and the wider ($1\frac{1}{2}$ to 2 inches) stemless leaves cobwebby beneath with margins running down the stem as ragged wings which make the stalk very prickly.

The bull thistle is easily killed by keeping it cut just below the surface of the ground. Mowing the thistles three or four times a year will kill many of them but enough plants are always left to reseed the patch. Thorough work for two years followed by watchful care will rid a farm of this pest.

Cnicus lanceolatus, Hoffm. Spec. III. 1666. Biennial, 3 or 4 feet high, with large heads (almost 2 inches high) terminating somewhat leafy branchlets, cottony tomentose when young becoming green, more or less villous or hirsute: leaves lanceolate, deeply pinnatifid and with lanceolate lobes, rigidly prickly; upper face strigose-setulose; base decurrent on the stem into interrupted prickly wings; bracts of involucre arachnoid-woolly, lanceolate and mostly attenuate into slender and rigid prickly-pointed spreading tips: flowers rose-purple, hermaphrodite. Pastures and waste grounds, Newfoundland and Canada to Georgia (very common northward); also in Oregon. (Nat. from Eu.)

THE SOW THISTLE.

There are two species of this so called thistle in the state; one an easily killed annual, the other an aggressive weed difficult to destroy when once established but fortunately rare.

The first species (known to botanists as *Sonchus oleraceus*, L.) is abundant in many parts of the state. When growing in gardens and small

patches it may be extirpated by clean culture or by pulling the plants up when the ground is wet and soft as it frequently is in western Oregon. Large patches may be treated as follows: Cut the plants just before blooming with a scythe or mowing machine, carefully cleaning out all fence corners, ditches, etc., then rake into heaps and burn as soon as possible to prevent seed ripening and becoming scattered.

The other species (*S. arvensis*, L.) is a perennial distinguished from the above, which it resembles, by its creeping rootstalks. The hollow, angular stems, which grow about two feet high, are softer and less rigid than those of the true thistles. Prickles are borne only on the margins of the deeply cut leaves which are thinner and smoother than those of the Canada and bull thistles. The leaves are more curled than in the bull thistle but less than in the Canada thistle. Large heads of bright yellow flowers are produced at the ends of the branches.

It spreads like the Canada thistle, by creeping rootstocks, so cutting the plant before the flowers open does not destroy this plant though it checks the growth and prevents seeding.

Thorough cultivation and grubbing out the roots is practicable in small patches but when they are numerous and large the summer fallow is easier, and if properly done, as effective.

Sonchus arvensis, L. Rootstocks creeping; stems 2 feet high, naked at summit, bearing few or several and corymbosely paniculate showy heads: leaves runcinate-pinnatifid or some undivided, denticulate-spinulose, cauline partly clasping at base; peduncles and involucre more or less glandular-bristly; head almost an inch high; akenes oblong, about 10-costate, rugulose on the ribs.—On shores and banks of streams, in several places in N. Atlantic States, and Salt Lake City, Utah. (Nat. from Eu.)

THE CHINESE THISTLE.

This is a coarse annual, from South America, abundant in fields and waste places along railroads in Eastern and Southern Oregon. It grows from one to three feet high with a much branched stem which bears numerous slender triple-spines at the base of the alternate leaves. These spines are a pale yellow color, about an inch long and very sharp. The leaves are white-downy beneath and taper toward both ends with a short petiole. The fertile flowers are enclosed in a bur-like, two celled involucre, armed all over with hook-tipped prickles. These burs cause great annoyance in the fleeces of sheep.

It differs from the Canada thistle, bull thistle, and sow thistle in having the spines borne on the stems instead of on the leaves; and from the Russian thistle in the long, round, needle-like spines which are never flat as in the saltwort.

This plant, which is probably the one meant in the weed law by Dagger Cockle-bur, is not likely to become very troublesome as it lives but one year and is easily killed by cutting off the top. Keep the plants from maturing seed by frequent mowing, or clean cultivation with a hoed crop, and you will soon be rid of it.

Xanthium spinosum, L. A foot or two high, much branched: leaves ovate-lanceolate with cuneate base, the larger 3-lobed or incisedly pinnatifid, glabrate and green above, white-tomentose beneath: axils bearing long and

slender 3-parted yellow spines: fertile involucre solitary or few in upper axils, cylindraceous, half-inch long, obtuse, armed with short weak prickles, inconspicuously 1—2 beaked or pointless. A weed of S. Atlantic States and Pacific coasts, occasionally about sea-ports northward to Mass. (Nat. from Trop. Am.)

THE RUSSIAN THISTLE.

The Russian thistle, or Saltwort, is now awakening wide-spread interest through the country because of the damage it may cause if once established, and the ease with which it may be destroyed if proper measures are taken in time.

Prof. Dewey (to whose excellent monograph we are indebted for much here given) says the loss caused by this weed in North and South Dakota for the year 1892 was over \$2,000,000. The plant is especially troublesome in wheat and flax fields.

It has not yet been reported in Oregon, but the arid parts of the state will be a congenial home to which the plants will be brought ere long in the straw and chaff used in packing goods. Thence these tumble weeds will be carried by the wind over the fields and through the valleys of our state, this distribution being aided by the immense number of seeds produced. Every farmer should be able to recognize and destroy the very first specimen that appears in his neighborhood.

The Russian thistle is an annual coming up each spring from seed sown the previous fall. When young it is a tender, innocent-looking plant with small, downy, green leaves. At first it is said to resemble a young pine in color and appearance. Later, in August, the tender leaves drop off and the plant increases rapidly in size sending out hard stiff branches which bear at intervals of half an inch clusters of three sharp spines instead of leaves. The spines are about half an inch long and borne at their base is a very small papery flower.

The stem, comes from a small root, is much branched and if not crowded forms a dense bush 2 to 6 feet in diameter and half as high. The mature plants are of a purplish color and may be distinguished from other tumble weeds by the denser growth, darker color and the clusters of sharp spines instead of flat leaves.

It may be well to give the technical description as drawn up by Prof. L. H. DEWEY, since the botanics in common use do not describe this variety.

Salsola kali tragus (L.) Moq. in DC. Prod., XIII, 2, 187 (1849).—A herbaceous, annual, diffusely branching from the base, 0.5 to 1 m. (1½ to 3 feet) high and twice as broad, smooth or slightly puberulent; tap root dull white, slightly twisted near the crown; leaves alternate, sessile; those of the young plant deciduous, succulent, linear or subterete, 3 to 6 cm. (1 to 2 inches) long, spine-pointed and with narrow, denticulate, membranaceous margins near the base; leaves of the mature plant persistent, each subtending two leaf-like bracts and a flower at intervals of 2 to 10 mm. (about one-twelfth to five twelfths of an inch), rigid, narrowly ovate, often denticulate near the base, spine-pointed, usually striped with red like the branches, 6 to 10 mm. (3-12 to 5-12 of an inch) long; bracts divergent, like the leaves of the mature plant in size and form; flowers solitary and sessile, perfect, apetalous, about 10 mm. (five-twelfths of an inch) in diameter; calyx membranaceous persistent, inclosing the depressed fruit, usually rose-colored, gamosepalous, cleft nearly to the base into five unequal divisions about 4 mm. (one-sixth of an inch) long, the upper one broadest, bearing on each margin near the base a minute tuft of very slender coiled hairs, the two nearest the subtending leaf next in size, and the lateral ones narrow each with a beak-like connivent apex, and bearing midway on the back a membranaceous, striate, erose-margined horizontal wing about 2 mm. (one-twelfth of an inch) long, the upper and two lower wings much broader than the lateral ones; stamens 5, about equaling the calyx lobes; pistil simple; styles 2, slender, about 1 mm. (one twenty-fifth of an inch) long; seed 1, obconical, depressed, nearly 2 mm. one-sixteenth of an inch in di-

ameter, dull gray or green, exalbuminous, the thin seed-coat closely covering the spirally-coiled embryo; embryo, green, slender, about 12 mm. one-half inch long, when uncoiled, with two linear subterete cotyledons. The plant flowers in July or August and the seeds mature in September and October. At maturity the action of the wind causes the root to break with a somewhat spiral fracture at the surface of the frozen ground and the plant is blown about as a tumbleweed. The mature flower with the enclosed seed is held in place in the axils of the bracts by the two minute tufts of coiled hairs, preventing the seeds from falling all at once when the plant begins to roll.

The variety *ragus* differs from the typical form of *Salsola kali*, which is common along the Atlantic coast, in the following characters: The leaves of the mature plant are very little longer than the leaf-like bracts which they subtend, while in the typical form of the species they are generally two or four times as long. The calyx is membranaceous and nearly always bright rose-colored, and wings on the back of the calyx lobes are much larger than the ascending lobes, while in the typical form the calyx is coriaceous and usually dull white or only slightly rose-colored, and the wings are thick, comparatively narrow, and less prominent than the ascending lobes. The species itself is less bushy in habit and less rigid at maturity. It has been known along the Atlantic coast from Massachusetts to Georgia for nearly a century and has never developed into a troublesome weed.

The Russian thistle is easily killed by cutting it off at the surface of the ground with a hoe, in June or July, as the single tap root will not sprout again. When a field has become seeded it may be cleaned by repeated plowing in July or August, carefully covering all weeds with the harrow. Infested grain fields should be harvested early to avoid trouble in handling the crop. Plowing immediately after harvest will destroy many plants. Burning over stubble fields soon after harvest is good. Care should be taken to prevent threshing machines from carrying the seed to new localities. For spring grain the ground should be prepared and sown as early as possible.

Every weed destroyed will lessen the work of another season. The plants should be destroyed before they begin to roll and tumble about scattering seed, piling up against shrubs and fences breaking them and increasing the danger from fire. Mowing them is not always effective as the thistles often send out branches below where the machine cuts them. Pasturing sheep on the young plants will keep them down or they may be choked out by forming a dense sod. The seeds ripen about the 1st of September, and all plants pulled later should be burned immediately. Fortunately the seeds will not remain long in the soil without germinating. Clean culture should be given hoed crops until after the middle of August, as thistles starting so late will not have time to mature seed.

We can not help quoting the words of Director W. H. Hays, of the Minn. Station: "An individual can not deal with this foe. * * * The power of the government * * * must be brought into use before the pest has spread from the present comparatively small infested areas to the entire country. And if the state * * * compels one man to prevent this weed from spreading from his lands, it assumes the responsibility of compelling every other land owner to likewise keep it in check, that he who complies with the law may accomplish his purpose, and not merely spend labor and money and have the weed again come on his fields from surrounding lands."

ACKNOWLEDGMENTS.

In preparing this bulletin we have consulted many sources of information for descriptions and methods of destroying the above plants, which owing to limited space cannot be mentioned here. Among the most impor-

tant were the reports and bulletins of the U. S. Dept. of Agriculture and of the Experiment Stations, Darlington's "American Weeds," and Gray's "Synoptical Flora."

All the half-tone engravings, were made in our Department of Photo-engraving by Prof. E. F. Pernot, to whom I desire to express my obligations for the excellent manner in which he has shown the characteristics of each plant. The electrotypes of the Bull thistle are from the Dept. of Agriculture at Washington. Our thanks are also due to Prof. L. H. Pammel of the Iowa Station for a cut of the Russian thistle, specimens of which we were unable to secure in this state.

HOW TO SEND PLANTS FOR IDENTIFICATION.

Remember that the Station was established for your benefit and if at any time you desire information concerning weeds growing on your farm or along the roadsides, or if a plant disease attacks your crops write to the Station about it and we will help you all we can.

All questions regarding plants should when possible be accompanied by specimens. These should be complete, as fragmentary or imperfect ones cause delay and errors in determination. Good specimens include flowers, fruit, leaves, and if herbaceous a portion of the root. Send plenty of material.

Plants may be preserved by drying them under pressure between folds of absorbent paper changing the dryers daily for four or five days. Protect from breakage by enclosing them between pieces of pasteboard. When sent fresh they should be moistened slightly and well wrapped in heavy paper. Number the specimens, wrapping each species separately and send in an unsealed package, with your name and address, preceded by the word *from*, plainly written on the outside. Postage one cent an ounce. In the accompanying letter refer to the specimens by number, stating the time and place of collection with such other information as you consider of interest.

We have endeavored to select and place in a brief, accessible, and it is hoped not too technical a form what is now known about the above plants. The plates will enable readers to readily recognize the species described.

Constant vigilance with intelligent action on the part of cultivators and husbandmen is necessary to keep their farms free from weeds but if the thorough work of destruction here recommended is persisted in for several years the labor will then become slight.

Let us keep out the Canada and Russian thistle that now threaten us and which if not excluded will cost the state much more in the next decade than the comparatively slight cost of destroying them on their first appearance.

Address all communications relating to plants to
MOSES CRAIG, Botanist,
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RUSSIAN THISTLE.