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U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN No. 10.

THE
RUSSIAN THISTLE

AND

OTHER TROUBLESOME WEEDS

IN

THE WHEAT REGION OF MINNESOTA AND
NORTH AND SOUTH DAKOTA.

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Farmers' Bulletin No. 1. The What and Why of Agricultural Experiment Stations. (A brief explanation of the object, origin, and development of the stations, their work in Europe and in the United States, and the operations of the Office of Experiment Stations of the Department of Agriculture.) Prepared by the Office of Experiment Stations. Pp. 16. Issued June, 1889.

Farmers' Bulletin No. 2. The Work of the Agricultural Experiment Stations. (Illustrations of station work in the following lines: Better cows for the dairy; fibrin in milk; bacteria in milk, cream, and butter; silos and silage; alfalfa; and field experiments with fertilizers.) Prepared by the Office of Experiment Stations. Pp. 16. Issued June, 1889.

Farmers' Bulletin No. 3. The Culture of the Sugar Beet. (Traits of the climatic conditions, soil, fertilizers, and cultivation required by the sugar beet, cost of growing, time to harvest, and method of soiling; describes briefly the process of beet-sugar manufacture, and gives statistics of sugar production and consumption.) By H. W. Wiley, chemist of the Department of Agriculture. Pp. 24. Issued March, 1891.

Farmers' Bulletin No. 4. Fungous Diseases of the Grape and their Treatment. (Describes downy mildew, powdery mildew, black rot, and anthracnose of grapes, and gives instructions for their treatment and estimated cost of remedies.) By B. T. Galloway, chief of the Division of Vegetable Pathology. Pp. 12. Issued March, 1891.

Farmers' Bulletin No. 5. Treatment of Smuts of Oats and Wheat. (Describes the smuts of wheat, oats, and barley, the damage they cause, and the various methods of treatment which have been found useful for their prevention.) Prepared by the Division of Vegetable Pathology. Pp. 8. Issued February, 1892.

Farmers' Bulletin No. 6. Tobacco: Instructions for its cultivation and curing. Prepared by John M. Estes, special agent. Pp. 8. Issued February, 1892.

Farmers' Bulletin No. 7. Spraying Fruits for Insect Pests and Fungous Diseases, with a Special Consideration of the Subject in its Relation to the Public Health. Prepared by the Division of Entomology and Vegetable Pathology. Pp. 20. Issued April, 1892.

Farmers' Bulletin No. 8. Results of Experiments with Inoculation for the Prevention of Hog Cholera. By Dr. D. E. Salmon, chief of the Bureau of Animal Industry. Pp. 40. Issued May, 1892.

Farmers' Bulletin No. 9. Milk Fermentations and their Relations to Dairying. Prepared in the Office of Experiment Stations. Pp. 24. Issued July, 1892.

THE RUSSIAN THISTLE.

BY L. H. DEWEY.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF BOTANY,
Washington, D. C., January 12, 1893.

SIR: I have the honor of transmitting herewith a report on certain pernicious and troublesome weeds prevailing in Minnesota and North and South Dakota. Mr. L. H. Dewey, Assistant Botanist, was sent out last autumn to make observations and collect information relative to the nature and increase of these weeds, and to ascertain as far as possible the best means for their destruction. It is hoped that the information which he has embodied in this bulletin will prove to be of value to farmers in the section invaded by this pest.

Respectfully,

GEO. VASEY,
Chief of Division.

Hon. J. M. RUSK,
Secretary.

NAME.

The Russian thistle or Russian cactus is really neither a thistle nor a cactus. It is a saltwort, closely related to the tumbleweed, goosefoot, lamb's-quarters, and pigweed. Under any name, however, it is one of the worst weeds ever introduced into the wheat fields of America. To the botanist it is known as *Salsola Kali* L. var. *Tragus* D. C. In some parts of Russia it is known as Tartar weed and Hector weed. Saltwort is its true English name, but to the farmers of the Northwest, who are best acquainted with the troublesome plant, it will probably continue to be known as the Russian thistle until finally exterminated.

DESCRIPTION.

The Russian thistle is an annual, coming each year from the seed. It grows from a single small light-colored root less than half an inch in diameter and 6 to 12 inches long to a height of 6 inches to 3 feet, branching profusely, and when not crowded forms a dense bush-like plant 2 to 6 feet in diameter and one-half to two-thirds as high. When young it is a very innocent-looking plant, tender and juicy throughout, with small, narrow, downy, green leaves. When the dry weather

comes in August this innocent disguise disappears, the tender downy leaves wither and fall, and the plant increases rapidly in size, sending out hard, stiff branches. Instead of leaves these branches bear at intervals of half an inch or less three sharp spines, which harden but do not grow dull as the plant increases in age and ugliness. The spines are one-fourth to one-half inch long. At the base of each cluster of spines is a papery flower about one-eighth of an inch in diameter. If this be taken out and carefully pulled to pieces a small, pulpy, green body, coiled up and appearing like a minute green snail shell will be found. This is the seed. As it ripens it becomes hard and of a rather dull gray color. At the earliest frosts the plants change in color from dark green to crimson or almost magenta, especially on the more exposed parts. When the ground becomes frozen and the November winds blow across the prairie the small root is broken or loosened and pulled out. The dense yet light growth and circular or hemispherical form of the plant fits it most perfectly to be carried by the wind. It goes rolling across the country at racing speed, scattering seeds at every bound, and stopping only when the wind goes down or when torn to pieces, for there are few fences or forests to stop its course in the Dakotas.

The saltwort or Russian thistle appears more like the common "tumbleweed" (*Amarantus albus* L.) than any other plant in the Northwest. It may be readily distinguished from the tumbleweed by the sharp spines in clusters of three each, the absence of flat leaves, denser growth, darker color, and by the red color in the fall.

TRoublesomeness.

A weed is only a plant out of place or a useless plant taking the place of something useful. The Russian thistle, although rather pretty when reddened in the fall, and useful for forage when young, is always a weed. It will take possession of a field to the exclusion of everything else, and it draws from the land a large amount of nourishment that might otherwise go to make useful plants. In these respects it merely partakes of the properties of all weeds except that it spreads and multiplies more rapidly and hence takes more space and more nourishment.

Some of its special characteristics render this thistle much more troublesome than other weeds. It is armed with spines quite as sharp and much stronger than those of common thistles. Because of these it is difficult to drive horses through a field where the plants are abundant. In some sections the farmers find it necessary to bind leathers about the horses' legs while at work. Horses running in the pasture are often injured by having the skin on their legs badly lacerated. The spines breaking off under the skin cause festering sores. These sores are caused by the irritation, however, not by any poisonous property as is frequently supposed. Hunters find difficulty in getting their dogs to work well for prairie chickens in the stubble, and the dogs are

sometimes injured by the sharp spines. Thrashers find it almost impossible to get gloves thick enough to keep the spines out of their fingers, yet thin enough to work with.

The Russian thistle is the worst rolling tumbleweed on the prairie, and in time of prairie fires is easily blown across a fire-break of any width, carrying fire to stacks and buildings. The weeds bank up against wire fences, causing them to be blown over by the force of the wind, and are sometimes carried into the groves on tree claims, making it impossible to cultivate. In this way, by forming a mulch, often several feet deep, they may do some good. When large and well developed they are bulky and stiff, making it very difficult to run harvesting machinery or even a plow. On railroad grades they prevent the growth of grass and other plants that would keep the banks from washing.

ORIGIN.

The Russian thistle originated in eastern Europe or western Asia. It has been known in Russia many years and has quite as bad a reputation in the wheat regions there as it has in the Dakotas. It was introduced in Bonhomme County, S. Dak., about fifteen years ago. Reports differ as to the method of its introduction. There is little doubt, however, that it was first brought there in very small quantities in flaxseed which was imported from Europe. There is evidently no foundation whatever for the theory, which is too often related as a fact, that it was first sown in South Dakota by immigrants either for forage or to inflict an injury on an enemy. The few plants grown from the foreign seed grew, produced seed, and increased slowly and almost unnoticed until about six years ago (1886). They were then thoroughly acclimated and naturalized and seem to have partaken of the conquering spirit of the West.

MODES OF DISTRIBUTION.

The Russian thistles are most wonderfully adapted for spreading and covering new territory. As tumbleweeds they are carried for miles by the wind, scattering seeds as they go. By this means alone they often advance 5 or 10 miles in a single season. Single stray weeds may doubtless be blown much farther. The general advance is in the direction of the prevailing winds or the most frequent high winds, but the shifting breezes beat the plants about and seed all the area occupied. In many localities where a few plants were first seen four or five years ago every spot of land where the sod has been broken is now occupied. On every badger burrow and overfed spot in the prairie; on every roadside, railroad embankment, fire-break, and neglected garden; on every field of early-plowed land or stubble may be seen a patch of thistles. The seeds are not here and there, as with Eastern weeds, but they are everywhere. The few plants introduced four or five years ago have seeded the land for miles in every direction.

Plants are carried long distances on the railroads by stealing rides on the brake-rods and on the engine. They are also carried in the bedding or earth in stock cars. The seed is carried in flaxseed to considerable extent, but in none of the other grains raised in the West.

Wherever the plants or seeds thus carried by man are dropped they make new centers of growth, from which they may be scattered to the surrounding country by the wind. They grow larger and more abundant some years than others, but even during their off years they keep on spreading over new territory.

AREA COVERED.

The Russian thistles are now (1892) more or less abundant over all the region between the Missouri and "Jim" rivers in South Dakota and extending into North Dakota as far as the second tier of counties. They are found east of the "Jim" River along nearly every railroad, but have not yet become thick enough to be really troublesome in many places east of the "Jim" River Valley. About 30,000 square miles are infested with the weed, and it is abundant and really troublesome over about two-thirds of this area.

There are many scattered localities in States farther east where the thistles have been introduced but have not yet become abundant enough to cause much alarm. There are a few plants around the elevators and stock yards between Minneapolis and St. Paul, and an occasional one may be found along the Northern Pacific Railroad northwest of Minneapolis. Where this road crosses Gull River, in Todd County, Minn., quite a number of the thistles are growing. There are a few plants along the Chicago, Milwaukee and St. Paul Railroad just east of Sioux City, Iowa.

The real Russian thistle is not known west of the Missouri River. In the Black Hills, in South Dakota, and in many parts of Nebraska there is a saltwort (*Salsola kali* L.) which looks very much like the Russian thistle, but it is confined almost exclusively to saline localities and, so far, it has shown but little tendency to spread and become troublesome. This plant is also found in the tidewater region of the Atlantic coast, and it is probably this comparatively harmless form that is found in some parts of Wisconsin.

DAMAGE DUE TO THE RUSSIAN THISTLE.

In the badly infested area more than 640,000 acres are devoted to wheat-raising. The average loss on this land that may be attributed to the Russian thistle alone can not be less than 5 bushels per acre, and 3,200,000 bushels of wheat at the minimum price of 50 cents per bushel (which is considerably less than the average price) indicates a loss to the farmers in the two Dakotas of \$1,600,000. The loss in other crops, the injuries caused by the spines and the fires caused by the plants jumping fire-breaks will bring the total loss to something more than \$2,000,000 for the year 1892.

These figures may seem alarming, but they are based on conservative estimates. If they are alarming to the farmers it is well, for it is only when alarmed that most men will take effective measures to avoid danger.

CONDITIONS FAVORABLE OR UNFAVORABLE TO GROWTH.

Russian thistles grow best on high and dry land, where they are not too much crowded by other plants. They are seldom seen in sloughs or low land and make no progress in the native prairie except where the sod has been broken by badger burrows, or by overfeeding and tramping of cattle on some of the ranges. They are less numerous and robust in wet seasons than in dry ones, not so much because they can not stand wet weather, but because they are more crowded by other plants. Some Russian thistles growing on the bank of an irrigating ditch, with their roots almost in the water, made a larger and more vigorous growth in the dry season of 1891 than others about them in dry soil. At Minneapolis this year (1892) the rainfall was 45 inches before the end of September, yet the few thistles there were growing well.

The thistles appear to grow equally well in alkaline soil and in soil that is not alkaline at all. So far as the amount of rainfall or alkaline quality of the soil is concerned the Russian thistle may grow anywhere in the temperate zone.

The absence of trees and fences, the strong winds, and the methods of farming are particularly favorable to its distribution and growth in the Northwest. Wheat after wheat, with an occasional barren (or weedy) fallow, but no cultivated or hoed crops, gives but little opportunity to clear the land of troublesome plants. A few very profitable crops have induced the farmers to break up more land than they can work well. Wheat is sown over a large number of acres, sometimes merely drilled in on the furrow, or even in unplowed stubble land, and very frequently sown with insufficient cultivation of the soil. Where whole sections or even townships are one continuous wheat field, an acre here and there grown up to weeds, so as to be not worth the harvesting, does not seem to cut much figure in the total amount, and the weeds are allowed to grow and ripen seed to cover a larger area the next year. The thistles begin to grow large and coarse and to ripen seed soon after harvest; but at this time, when they most need attention, the farmer finds it difficult to get help enough to secure his wheat crop, and the weeds are left to take care of themselves, which they do to perfection.

Plowing in the spring or early summer is especially favorable to the growth of the Russian thistles, since they can get a good start in July, and, being able to stand dry weather better than other plants, they take complete possession of the soil. Land broken up in spring or early summer is liable to be covered with the plants in August, for the

seed is everywhere in the prairie grass and only waits for the sod to be broken that it may grow.

A hard frost early in the fall kills many Russian thistles before the seeds are ripened and therefore reduces the number of plants the following season. The comparative decrease in the number of plants during the present season is doubtless due to an early frost in the fall of 1891. The small size and less vigorous growth is due to the excessive rains early in the season.

WILL NOT RUSSIAN THISTLES DIE OUT OF THEMSELVES?

This question is frequently asked, and there really seems to be some grounds for the hope. In every locality the plant is less troublesome this year (1892) than it was last year. Causes for this have just been given. In many instances it has been noticed that in small patches, where the ground has become thoroughly seeded with the pests, they come up too thick to grow in their ordinary spreading habit, and, becoming slender and spindling, are quite unfit to roll about as tumbleweeds. There is no record, however, of their becoming so thick over any large area that some plants did not find room to develop into very good tumbleweeds. What is true of small patches is only partially true of large areas.

There are a few examples known where foreign weeds have been introduced into this country and have spread so rapidly as to cause considerable alarm for a few years, and afterwards have died out of themselves, or, at least, have ceased to cause trouble. There are numerous instances where weeds have been troublesome for many years and are still causing trouble in all infested regions except where the farmers, by combined action and determined effort, have exterminated them. There is indeed a possibility that the Russian thistle may die out of itself, but there is a greater probability that it will not only continue to grow, if allowed to do so, and to cause much damage in its present area, but that it will spread elsewhere. There is a certainty that if thorough measures be taken to stamp it out of existence it may be killed and will cease to be troublesome anywhere.

REMEDIES.

Plow in August or early September, before the Russian thistles have grown large and stiff and before they have gone to seed, using care that all weeds are well turned under. If the season be long and weeds come through the furrow it may be necessary to harrow the land before winter. Burn over stubble fields as soon as possible after harvest. Cut the stubble with a mowing machine if the fire does not burn everything clean without cutting.

Cutting the stubble and thistles before the latter have gone to seed will help, but is not thoroughly effective without fire, as the thistles will send out branches below where the mowing machine cuts them.

If the weeds have been neglected and have grown large and rigid, as they do by the middle of September, especially on neglected barren fallow or spring-plowed breaking, they may be raked into windrows and burned. The old-fashioned revolving hayrake or any rake made especially strong so as to pull the weeds, and especially good at clearing itself in dumping, will answer the purpose. An ordinary wheel hayrake with a set of strong teeth has been used successfully. This method is to be recommended only as a last resort, for by the last of September some of the seeds will be ripe enough to shell out and will escape being burned with the plants. If left until October, when many of the plants are certain to be fully ripe and dry, the land where they are growing will be well seeded any way; but raking together and burning the weeds will prevent their being blown across neighboring fields during the winter. Of course care should be taken to do this work when there is little wind, for a burning Russian thistle before the wind will jump any fire-break and carry both seeds and fire.

Barren fallowing does very well if kept barren by thorough cultivation. It gives but little benefit to the land, however. A much better method is to sow clover, millet, or rye, pasture it and plow it under green. This will be beneficial to the land, especially if a comparatively large proportion of clover is used, and the weeds will be choked out. Millet and oats combined may be grown and cut for hay. This crop will choke out nearly all the weeds, and the few that do grow will be too slender to cut any figure as tumbleweeds.

Corn, potatoes, beets, or any cultivated crop, *well taken care of*, will in two years rid the land of not only the Russian thistles, but nearly all other weeds.

Sheep are very fond of the Russian thistle until it becomes too coarse and woody. By pasturing the sheep on the young plants they may be kept down and the only valuable quality the plant has may be utilized.

In fields where the weeds are thick drag with an iron harrow, hitching the team on by a long chain. As soon as the harrow is full of weeds set fire to them and keep dragging and burning. This scheme, although apparently somewhat chimerical, has actually been tried with success.

If the Russia thistle is to be kept out of the cultivated fields it must be exterminated along roadsides, railroad grades, fire-breaks, waste land where the sod has been broken, and, in fact, in all accidental places where it may have obtained a foothold.

The ordinary road machines may be used to advantage along the roadsides, the scraper being set so as to take as thin a layer of earth as possible and throw weeds and all to the middle of the track. A single trip each way with the road machine would be sufficient in nearly all places to take the weeds between the beaten track and the prairie grass, so that 15 to 20 miles a day could be easily cleaned. If this work be done in August, before the Russian thistles become too large and stiff,

the work of the road scraper will be sufficient. Going over with a heavy roller, however, would not only improve the road, but would crush the weeds so that no occasional mature plant would be blown away. If the work is put off until September the weeds should be raked together and buried.

On fire-breaks, railroad grades, and odd places these and other noxious weeds may be killed by a judicious use of the mowing machine, scythe, hoe, rake, and fire.

RECOMMENDATIONS.

Place a Russian thistle in each school-house, so that the pupils may become familiar with it, and teach them to kill it wherever they find it as they would kill a rattlesnake.

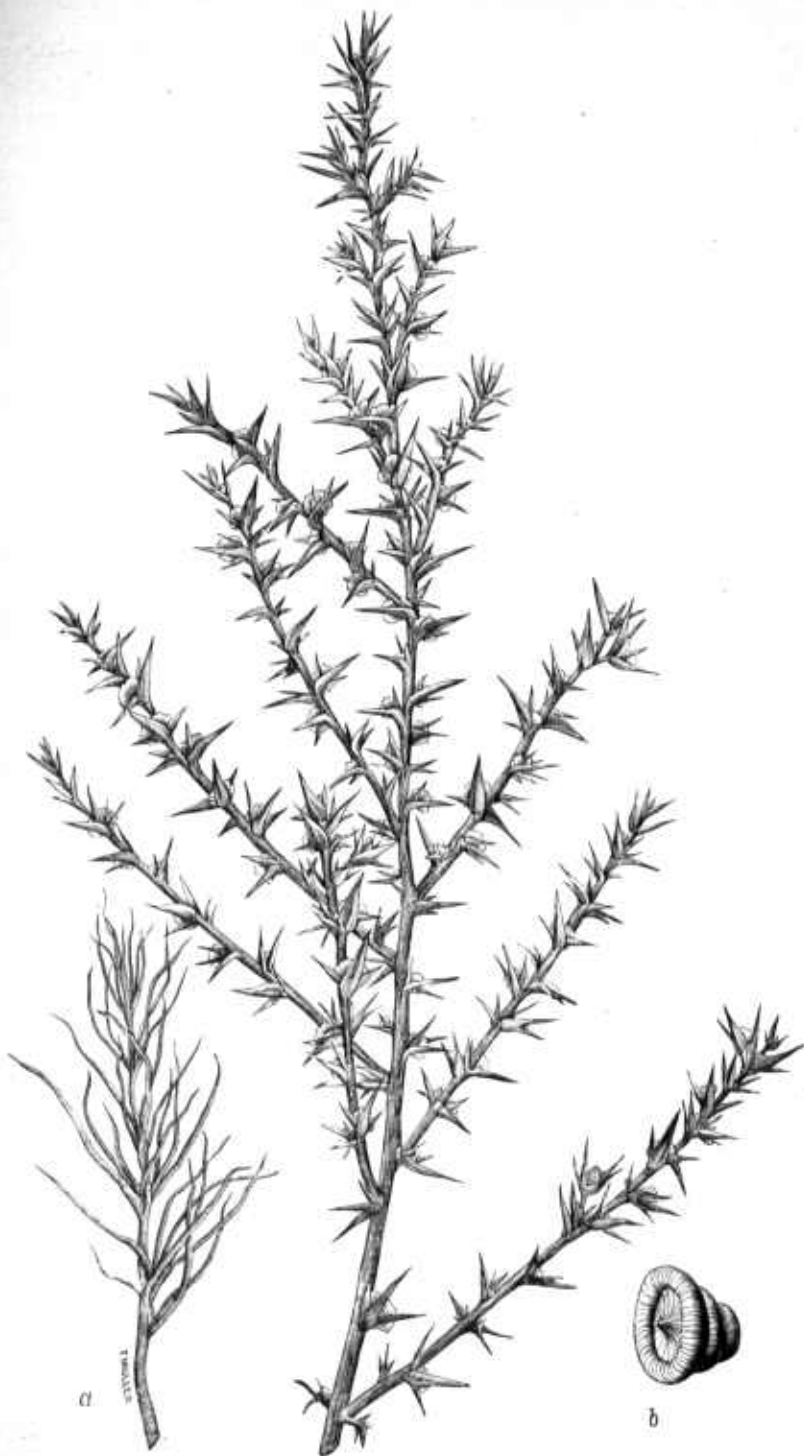
Permit no Russian thistle to go to seed. The plant is an annual; the seeds are evidently short-lived; hence if no plants are permitted to go to seed for two years the weed will in all probability be exterminated.

Let no one break up more land than he can take care of or more than he can properly cultivate.

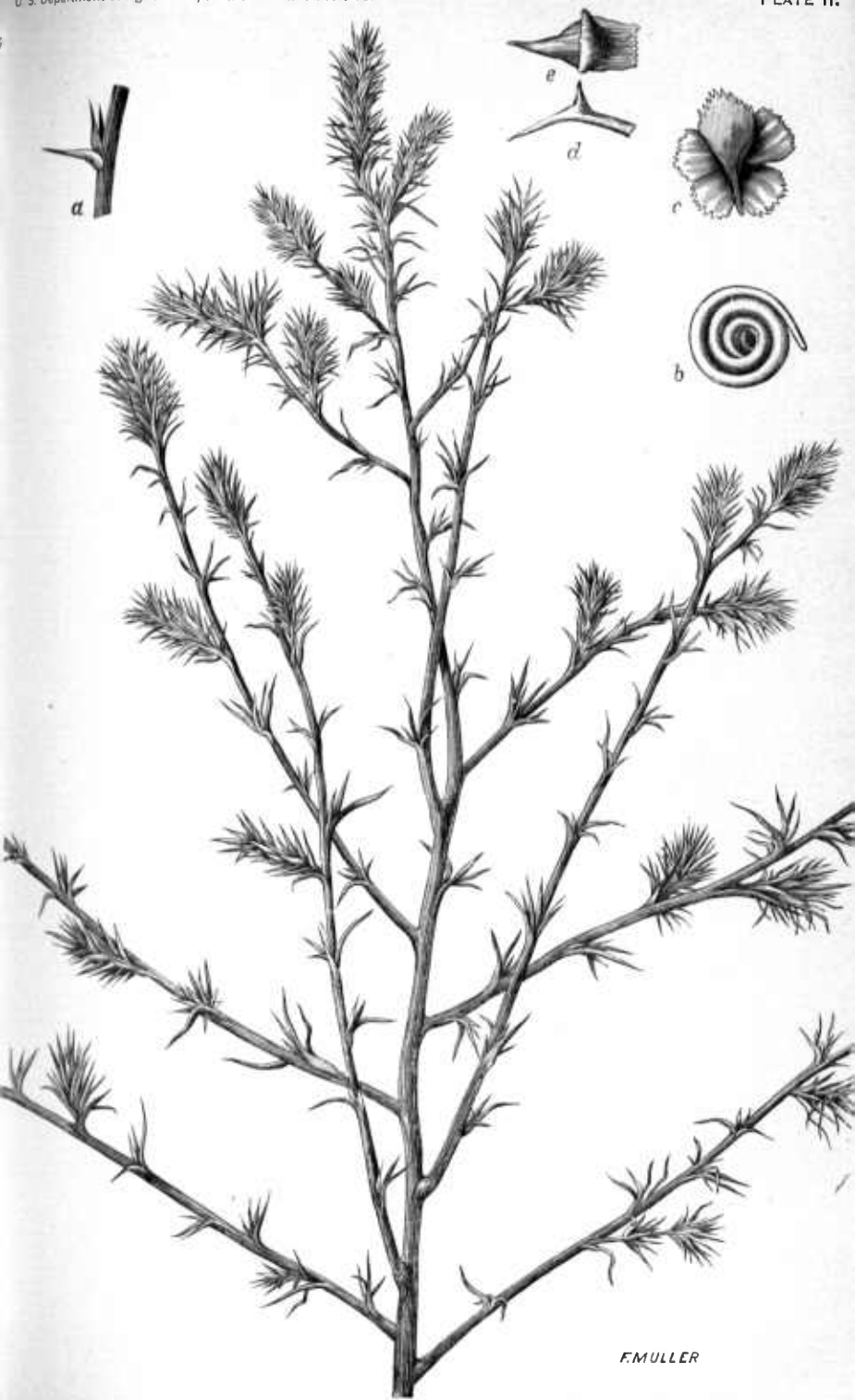
Let each farmer first keep down all the weeds on his own farm and then insist that his neighbor do likewise.

A little careful legislation that will touch up the careless farmer, the nonresident landowner, and the railroad companies would aid considerably in the solution of the question.

Be careful that all seed sown be as pure and clean as the modern fanning-mill can make it. Use especial care in regard to flaxseed and millet or any of the smaller and lighter seeds.



MATURE RUSSIAN THISTLE.



F. MULLER

RUSSIAN THISTLE BEFORE FLOWERING.

NOTES ON OTHER TROUBLESOME WEEDS.

MUSTARD FAMILY.

Many species of the mustard family are very troublesome in the wheat-growing region. The plants themselves are very hardy, starting early in the spring and withstanding the cold until late in the fall. Many of them produce seed during the greater part of the season. The seeds are abundant and small, but have wonderful vitality, sometimes remaining dormant in the ground several years and then growing when brought near the surface by the plow.

The most troublesome species belonging to this family are the wild mustard (*Brassica Sinapistrum* Boiss), treacle mustard or Western wall-flower (*Erysimum asperum* D. C.), wormseed mustard (*Erysimum cheiranthoides* L.), false flax (*Camelina sativa* Crantz), Shepherd's purse (*Capsella Bursapastoris* Moench.), penny-cress or French-weed (*Thlaspi arvense* L.), and peppergrass (*Lepidium intermedium* Gray). These are all annuals, and grow only in cultivated land or where the sod has been broken. Wild mustard, penny-cress, and peppergrass are more troublesome than the others in Minnesota and the Dakotas.

Remedies.—For the larger mustards in grain crops hand-pulling is the most practical remedy. If the land has become pretty thoroughly seeded, plow rather shallow and put in corn, beans, potatoes, or beets, or some cultivated crop. Cultivate the land as deep as it was plowed, so that all the seeds in the soil may be brought near the surface and have an opportunity to germinate some time during the season. Of course, care should be taken to prevent plants from ripening seed in the fall when the crops have been removed and the land is usually neglected. One season, if the work is well done, may be sufficient to clear the land of weed seeds; but cultivation for two years in succession is certain to be effectual.

PULSE FAMILY.

WILD LICORICE. (*Glycyrrhiza lepidota* Nutt.).—This is probably one of the most troublesome members of this family in the Northwest. The plant grows 2 to 3 feet high from a perennial root, which is sweet to the taste. The leaves are compound, like those of the locust, with fifteen to nineteen leaflets. The pods are nearly an inch long, of a dark-brown color at maturity, and are beset with hooked prickles.

This plant grows mostly in the native prairie sod, but is nowhere very abundant. It is classed as a noxious weed because the prickly pods stick in sheep's wool and in the manes and tails of horses. Cutting or pulling the plants are perhaps the best remedies. Salt or coal oil on the roots may aid in killing them.

ROSE FAMILY.

WILD ROSE (*Rosa blanda* Ait.).—A perennial, woody plant 1 to 3 feet high, too well known to need description. It gives great beauty to the landscape in June, and, although it must injure the wheat to some extent both in yield and grade, the farmers do not complain much about it. They seem to prefer to lose a little wheat rather than call a rose a noxious weed.

The rose is abundant in wheat-fields and also in the native prairie. It is very hardy and deep-rooted, and withstands cultivation well; but deep plowing and thorough cultivation with corn, beans, or some cultivated crop will subdue it.

COMPOSITE FAMILY.

ROSINWEED (*Grindelia squarrosa* Dunal.).—A sticky, branching, perennial or biennial herb 2 to 3 feet high, with spherical heads and yellow blossoms. It grows in the native prairie, often so thick as to check the growth of grass.

GOLDENROD (*Solidago rugosa* Mill.; *S. nemoralis* Ait., and *S. Canadensis* L.).—The Goldenrods are too well known to need description. They are seldom regarded as troublesome weeds, but these three species often grow so thickly in the native prairie as to materially injure the pasture.

MARSH-ELDER (*Iva xanthiifolia* Nutt.).—This is an annual herbaceous plant, growing 5 to 10 feet high, and appearing very much like the great ragweed (*Ambrosia trifida*). It takes complete possession of the land if allowed to do so, even contending successfully against the native prairie grass. In the wheat-fields it does considerable damage unless the growth of wheat is vigorous enough to choke it down early in the season.

RAGWEED (*Ambrosia artemisiifolia* L.; *A. trifida* L., and *A. psilostachya* D. C.).—These are well-known plants. The first two are annuals and more abundant in the North than the third, which has slender running rootstocks. They grow mostly in cultivated land, or at least where they do not have to contend against the prairie grasses, and often cause considerable loss in the wheat-fields, especially where the wheat is slow in starting in the spring.

COCKLEBUR (*Xanthium Canadense* Mill.).—This is one of the worst weeds from Kansas and Nebraska to southern Minnesota and South Dakota. It grows in cultivated land and makes good headway even

in the native prairie. The prickly burs are very troublesome in regions where sheep are grazing.

WORMWOOD (*Artemisia biennis* Wild.).—Three or four species of wormwood are very common in Minnesota and the Dakotas, but the tall, slender, dark-green biennial wormwood seems to be the most troublesome. It takes possession of the land in wheat fields where the wheat is partly killed out or is slow in starting.

Remedies.—For those members of the composite family that are troublesome in pasture land, mowing before they go to seed, usually in July or August, will subdue them, and if kept down two or three years in succession the grass will become thick enough to choke out the few remaining plants.

For cultivated lands a little more thorough cultivation and less neglect during the last of the season will be found effectual.

AMARANTH FAMILY.

TUMBLEWEED (*Amarantus albus*, L.).—This weed is too well known to need description. In habit and general appearance it is like the Russian thistle, but is less dense, ripens seed earlier, has smaller and less rigid spines, and bleaches to a lighter color when it dries. The seeds are flattened, black, and shining, and not more than one-twentieth of an inch in diameter. Most of the remedies given for the Russian thistle may be applied to this weed, but it must be remembered that this is mature and off before the wind, and seeding the land a month earlier than the saltwort.

GOOSEFOOT FAMILY.

LAMB'S-QUARTERS, PIGWEED (*Chenopodium album* L.).—An erect, branching, herbaceous plant 2 to 4 feet high, from an annual root. The flowers are small, green, and densely clustered in spikes. The leaves are more or less toothed on the margins, and the whole plant is mealy. It grows mostly in uncultivated or waste land. Hand pulling or thorough cultivation will readily subdue it.

WINGED PIGWEED (*Cycloloma platyphyllum* Moquin.).—A coarse, much-branched, annual, herbaceous plant, blown about in the fall as a tumbleweed. The leaves are narrow and sinuate-toothed, like those of the dandelion. The fruits have a continuous, membranaceous ring about them, so that they may be carried by the wind to some extent independently of the plant. It grows only in cultivated land or waste places where the sod has been broken. Preventing the plants going to seed will soon subdue them.

RUSSIAN THISTLE, SALTWORT (*Salsola Kali* L. var. *Tragus* D. C.).—This troublesome weed is mentioned here only as a member of the goosefoot family.

DOCK (*Rumex salicifolius* Weinmann, *R. obtusifolius* L. and *R. crispus* L.).—Coarse perennial herbs, too common in cultivated fields. The

seed ripens at about the same time as spring wheat and usually comes from the thrashing machine with the grain. It is doubtless often sown with wheat unless the seed wheat is carefully cleaned.

Remedies.—Clean seed, hand pulling or grubbing with a mattock, and thorough cultivation. In small patches salt or kerosene on the roots may have the desired effect.

BLACK BINDWEED (*Polygonum convolvulus* L.).—This is a slender, climbing, herbaceous vine common throughout the wheat-growing regions all through the West. It injures the yield and the grade of wheat and often binds the grain together, making it impossible for the harvesting machines to do good work. The black triangular seeds are ripened about the same time as the spring wheat, and being but little smaller than the wheat kernel, often appear in the grain as it comes from the thrashing machine.

Remedies.—Clean seed, fall plowing, and thorough fitting of the ground. If the bindweed is very abundant put in a cultivated crop or a crop of millet and clover, to be turned under for green manuring.

GRASS FAMILY.

BARN-GRASS (*Panicum crusgalli* L.).—This is a coarse, annual grass 2 to 3 feet high, with a panicle of three to eight dense spikes and 1 to 2 inches long. In the western form the panicle is almost always dark colored or nearly black at maturity, and the spikelets are short-awned or awnless.

In wet seasons it takes possession of the land where the wheat is slow in starting and either chokes it out entirely in low places or greatly reduces the yield and the grade. The seed, although less than one-half as large as the wheat kernel, often comes from the thrashing machine with the grain. A little more careful screening would readily take it out and save the farmer considerable in the price of thrashing.

Remedies.—Where it is thick, mow before it goes to seed. Tile-drain low places where the value of the land will warrant it.

SAND-BUR, BUR-GRASS (*Cenchrus tribuloides* L.).—This little grass, with its sharp, spiny burs, is well known. It is found in all parts of the United States except the high mountain regions, but is especially abundant and troublesome from Ohio to Kansas and Nebraska, extending into South Dakota and Minnesota. Its character as a noxious weed is due to the spiny burs which render it exceedingly troublesome in sheep's wool. It is an annual, and may be subdued in fields by cultivation or burning. To exterminate it, however, it must be prevented from going to seed in waste places.

PORCUPINE-GRASS, NEEDLE-GRASS (*Stipa spartea* Trin.).—A rather stout, erect grass 2 to 3 feet high, with strong, twisted awns 3 to 6 inches long, growing in tufts or small bunches, usually on rather dry knolls.

The sharp beak to the fruit and the retrorsely barbed awn cause it to work into sheep's wool and even pierce the skin, producing bad sores and not infrequently causing death. In hay the awned spikelets are very troublesome to horses, working into the nostrils, where the moisture causes the awns to untwist, producing a very disagreeable irritation.

The spikelets ripen and fall in June, so that the grass must be mowed early to prevent its going to seed. Where this grass is thick it would be advisable to plow up the land and, after subduing it with one or two cultivated crops, seed it with something more valuable than porepine grass.

COUCH-GRASS, QUICK-GRASS, QUACK-GRASS (*Agropyrum repens*, Beauv.).—This grass is very similar in appearance to the wheat grass of the prairies, forming heads like the wheat grass, but seldom producing mature seed. It may be distinguished by its long, white rootstocks, by which it is usually propagated. These rootstocks are very tenacious of life, and if broken to pieces every piece is likely to grow if left in the ground. Ordinary plowing and cultivation in the early part of the season helps to disseminate it and improve its growth rather than subdue it.

Throw the plow or cultivator out of the ground in crossing a patch of quack-grass in the field or small pieces of the rootstocks will be carried to scatter the grass to other places. Salt and sheep will subdue it. Fall plowing to turn the roots to the frost will check it. Plow deep, drag out the roots and burn them. Follow any method by absolutely clean cultivation for the entire season.

SQUIRREL-TAIL, WILD BARLEY (*Hordeum jubatum* L.).—This grass is common throughout the region west of the Mississippi River. It is a bad pest in pasture and grass land, as it is worthless itself and it takes possession of the land best adapted to the production of the most nutritious grasses.

Mowing before it goes to seed may check its growth and will at least prevent its spreading. Cultivation and reseeding is the only sure method of getting rid of it.

GENERAL REMEDIES.

Do all that is possible to prevent weeds from going to seed.

Be sure that all seed, especially flax, oats, and grass seed, be thoroughly cleaned before it is sown on the land.

Fit the land thoroughly, so that wheat, oats, or rye may have as good a chance to grow as the weeds that are already in the soil.

When cultivated or hoed crops are raised, cultivate them well and do not allow a crop of weeds to grow after the corn or potatoes have been taken off. If the fertility of the soil and the length of the season will warrant two crops in a single year, let both crops be useful.

A crop of weeds turned under green enriches the soil and decreases the store of weed seeds by at least so many as the number of plants turned under, while a crop of weeds grown to maturity drains the soil of fertility and adds many times the number of plants to the store of seeds for future weeds.

DESCRIPTION OF PLATES.

PLATE I. Branch from Russian thistle, showing the appearance of the plant when the seeds are mature: *a*, Branch from a young plant, showing the appearance before the dry season; *b*, Mature seed enlarged five times.

PLATE II. Branch of Russian thistle, showing the appearance before flowering and before the spiny branchlets have elongated: *a*, Spines enlarged; *b*, Young grain with the covering removed, enlarged about seven times; *c*, Blossom removed from the axil and viewed from below, enlarged about four times; *d*, Section of fruiting calyx, side view; *e*, Same, seen from above.

