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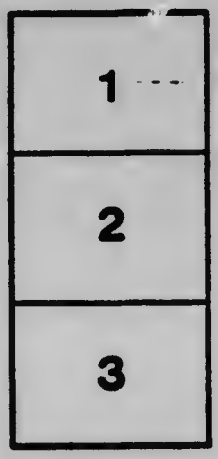

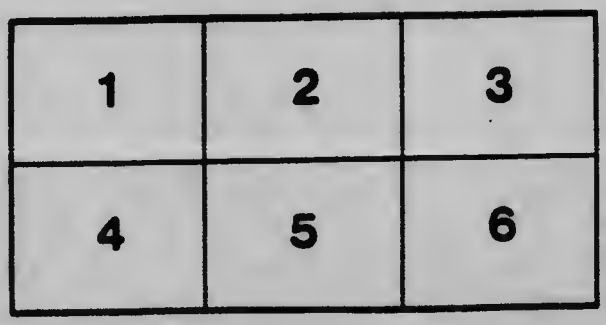

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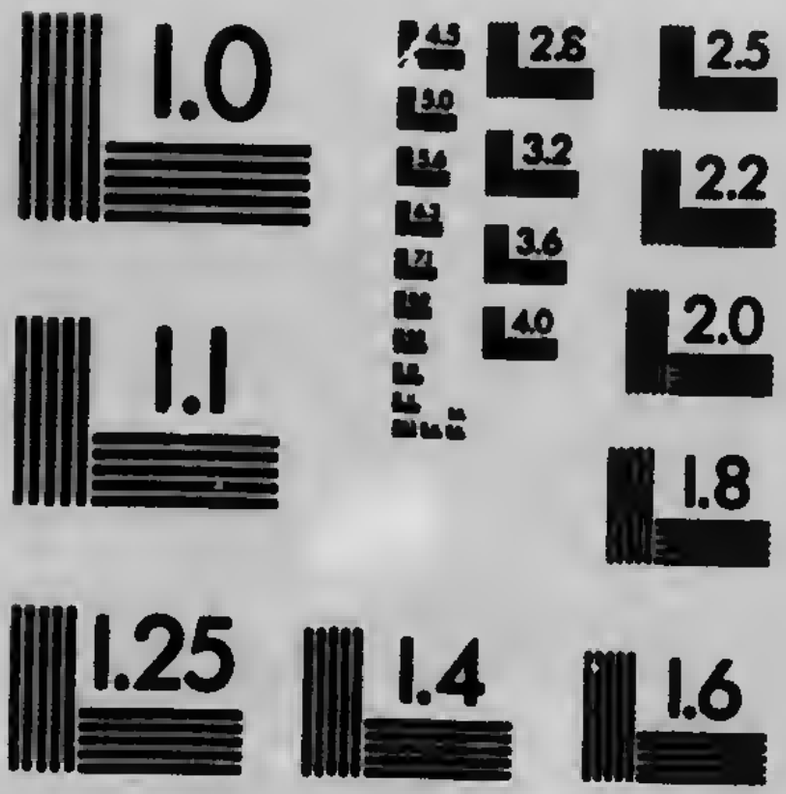

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Ontario Department of Agriculture

ONTARIO AGRICULTURAL COLLEGE

BULLETIN 159

WEEDS OF ONTARIO

by

A. H. MOSELEY, B.S.A.

Assistant in Botany

Reprinted from bulletins on weeds and noxious plants prepared by F. C. Harrison, B.S.A., in 1901 and revised by W. [illegible], B.S.A., M.S., in 1907 and 1908, and from Bulletin 165, "The Perennial Sow Thistle and Some Other Weed Pests" prepared by L. S. Hewitt, B.S.A., in 1908.

Issued by L. R. Taylor, Editor, in the Printing Department, Ontario Agricultural College, Guelph.

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Ontario Department of Agriculture

ONTARIO AGRICULTURAL COLLEGE

The Weeds of Ontario

By J. Eaton Howitt, M.S.A., Lecturer in Botany

FOREWORD.

A review of the history of the Weed Bulletins issued from the Ontario Agricultural College reflects the growth of the seriousness of the weed problem throughout the Province during the past twenty years, the consequent gradual increase of an interest in the practical study of weed plants, and the never-ending necessity for education in the matter.

The first bulletin sent out were prepared by the late J. Hoyes Panton, M.A., F.G.S., Professor of Natural History and Geology. No. X., which appeared in 1887 [illegible] small three-paged circular. It called attention to the rapid incr[illegible] weeds in Ontario, and warned farmers particularly against th[illegible] of the *Perennial Sow Thistle*, which had made its appearance i[illegible] nborhood of Stratford, and *Pennycress*, which had been reporte[illegible] vicinity of Almonte. Bulletin LXXXV., appearing in 1892, dealt with methods of destroying eleven of the worst common weeds of the time, viz., *Canada Thistle, Sow Thistle, Wild Flax, Pigeonweed, Ragweed, Couch Grass, Ox-eye Daisy, Burdock, Blueweed, Mustard* and *Wild Oat*. Bulletin XCI., "Weeds of Ontario," issued in 1893, besides listing 92 common weeds known in Ontario, drew special attention to *Pennycress, Tumbling Weed, Wild Carrot, Clot Bur* and *Dodder*. This was a small seven-page circular. In 1900, Bulletin 128, "The Weeds of Ontario," by F. C. Harrison, B.S.A., was issued. In 1903 a second edition, revised by Mr. Harrison and Wm. Lochhead, M.A., M.S., Professor of Botany, was issued, and in 1906 a large third edition, revised again by Mr. Lochhead, was published. From the small three pages of the first bulletin prepared by Prof. Panton, this had grown to a full-sized ninety-six-page bulletin.

Owing to the rapid increase in the spread of *Perennial Sow Thistle* and other newly-introduced weeds, Bulletin 168, "The Perennial Sow Thistle and Some Other Weed Pests," by J. E. Howitt, M.S.Agr., of the Department of Botany, was issued in 1908.

With the exhaustion of the supply of these two former bulletins, it has been deemed advisable to incorporate them now into one publication. This work has been carried out by Mr. Howitt, who has given special attention to this branch of botanical study during the past four years. With the exhaustive revision and many additions made this bulletin is practically a new work. The drawings for the new cuts used in this edition were made by A. C. Baker, a fourth year student in biology.

It is hoped that its distribution amongst those who are actively engaged in farming, the teachers and pupils in the schools, and others who are interested in our weed problems, may have beneficial results.

S. B. McCready.

ACKNOWLEDGMENT.

The writer wishes to state that in the revision of this bulletin much of the information about the weeds recently introduced into Ontario has been obtained from "Farm Weeds of Canada," by G. H. Clark, B.S.A., and Dr. James Fletcher, of the Dominion Department of Agriculture.

WHAT IS A WEED?

There are several definitions of a weed, viz.: "A plant out of place"; "Any injurious, troublesome or unsightly plant that is at the same time useless, or comparatively so"; "A plant which interferes with the growth of the crop to which the field is temporarily devoted."

INJURIOUS EFFECTS OF WEEDS.

1. They absorb soil moisture and thus lessen the supply of water available to the crop plants. "An average Mustard plant pumps from the soil about fourteen ounces, or seven-tenths of a pint, per day."

2. They use up the plant food in the soil, and thus rob the crop plants. Furthermore, they often mature their seeds before the crop plants, and during the time they are ripening their seeds draw heavily upon the plant food in the soil, and thus leave little available for the crop plants when they require it to mature their seeds.

3. They shade, crowd and choke out useful plants. Weeds frequently grow more vigorously than the crop plants, and thus often stand above them, preventing the light and air required for healthy growth from reaching them.

4. Weeds are a constant source of expense. They increase the cost of every operation, in the preparing of the land, and in the seeding, cultivating, harvesting and marketing of the crop.

5. They may interfere with the regular rotation of crops. It is sometimes necessary, on account of some particular weed, to drop some crop from the rotation entirely.

6. Some weeds, as Water Hemlock and Horsetail, are poisonous to stock. Quite frequently reports are received of stock being poisoned by eating such weeds.

7. Milk is often tainted by the cows eating such weeds as Wild Garlic and Stinkweed.

8. The market value of seed grain, clover and grass seeds is much decreased by the presence of weed seeds in any quantity.

9. Weeds often harbor or favor the development of injurious insects and fungus diseases.

10. Weeds are unsightly, and their presence detracts very materially from the value of a farm. No man cares to buy a weedy place if he can secure a clean one.

INTRODUCTION AND SPREAD OF WEEDS.

Most of the injurious weeds found in this Province have come directly or indirectly from other countries. They are brought in and conveyed from field to field and farm to farm in various ways:

By the wind. Seeds which are carried by the wind usually have tufts of fine, silky hair attached to them. Such are the seeds of the Dandelion, Canada Thistle, Sow Thistle (annual and perennial), Willow Herb, and Cotton Grass. These and similar seeds are wafted to and fro, till they become attached to the soil and commence to grow. In some cases, as in the Dock and Wild Parsnip, the seeds are winged; in others the pod containing the seed has flat and extended edges, exposing much surface to the wind. The Pennycress is an example of the latter.

Some weeds are rolled along the ground by the wind. To this class belong the Russian Thistle and the Tumbling weed of the North-West. When these weeds ripen, they break off close to the ground; and, being light, they are easily carried by the wind, especially on an open prairie, and the seeds drop out as the weed rolls from place to place.

An examination of snow drifts in Dakota, a few years ago, showed the presence of many weed seeds. Thirty-two seeds of nine species were found in two square feet of a drift. In the same place it was observed that a twenty-five mile wind carried wheat seed a distance of thirty rods in a minute.

Seeds which become sticky when wet often adhere to leaves, and go wherever the leaves are carried by the wind. This is true of the Plantain.

2. *By water.* Some seeds, especially those of aquatic plants, are distributed by water. Darwin maintained that many seeds, dropping into the sea, or being washed in from the shore, might be carried nearly a thousand miles by the movements of the water without injuring their vitality. Seeds which float on the surface of water are carried to and fro by the wind till they find a lodgment and begin to grow; and many, of various kinds, are carried from high to low ground and distributed far and near by the rills and streams which flow from mountain, hill, and upland after heavy rains and spring thaws. The common Speedwell and Ragweed are often distributed in this way.

3. *By birds and other animals.* Seeds are distributed by animals in a variety of ways. "It is estimated that about 10 per cent. of all flowering plants possess seeds which are dispersed by means of barbed or curved processes." By these barbs or processes the seeds cling to the feathers of birds and the hairy coats of animals, and in this way are carried from place to place. To this class belong the Bur, Burdock, Hound's Tongue, Bedstraw, Cockle, and such like. And the seeds of some plants, such as Mistletoe and the Meadow Saffron, exude sticky substances which cause them to adhere to birds and other animals.

In the hardened earth taken from the feet of birds Darwin found a large number of seeds, many of which germinated; and it is, undoubtedly, true that seeds are often conveyed from one place to another in the dirt that clings to the feet of animals.

Seeds often pass through the stomachs of animals without being digested; and, during their passage, they are conveyed hither and thither by the animal, and finally deposited, to grow and reproduce their kind, whether of weeds or useful plants. Every farmer knows the truth of this statement as regards cattle, horses and swine; and it may be mentioned that Darwin picked from the excrement of small birds twelve kinds of seeds which were perfect in form and germinated in nearly every instance.

Ants, locusts, and other insects also do something in the way of distributing the seeds of certain plants, including noxious weeds.

4. *By man.* Man himself, however, has most to do with the spread of troublesome weeds, chiefly through the agency of railroads, implements, farm yard manure, feed-stuffs, and impure seed.

Many weeds are carried from one province or country to another in the fodder and litter used by animals in transit on railways and in grain carried by rail. More or less of the grain, litter and fodder are scattered at places along the track, and at stations where grain and animals are unloaded and cars cleaned out. Weeds thus get a start and spread to neighboring farms. The Russian Thistle was introduced in this way.

When implements are transferred from one field to another pieces of

dry earth or sod are frequently dislodged, and new weed seeds are introduced. This is a common method of spreading weed seeds all over farms and throughout whole neighborhoods. Threshing machines from dirty farms are well known sources of trouble under this head.

Fresh barnyard manure from city stables is very often full of weed seeds, and should be rotted or piled and allowed to heat thoroughly before it is applied to clean land. Wild lettuce, for example, was brought from Toronto to the neighborhood of Burlington in manure; and in this way many other pests have been distributed from towns and cities to the farms of the Province.

COLLECTION AND IDENTIFICATION.

Not only every seedsman, but every farmer, and every teacher in a rural school, should have a collection of weed seeds for reference and comparison, in order that he may be able to detect and identify such seeds when they are in grass seed, clover seed, rape seed, or any other kind of seed which is sold or offered for sale. A good collection can be easily made in the summer months. All that is necessary is a number of small bottles and a little attention at the right time. The so-called homeopathic vials of one drachm capacity are suitable for the purpose, but they should be carefully and plainly labelled. If they are not so labelled, the collection will be valueless.

Fig. A. Tripod magnifier.

Fig. B. Linen tester.

A small magnifying glass is very useful in identifying seeds. Perhaps the most convenient glass for the purpose is the *tripod magnifier* (Fig. A), costing about fifty cents. The *linen-tester* (Fig. B), is cheaper, but yet quite serviceable.

CLASSIFICATION OF WEEDS.

Weeds may be classified according to the length of time they live, as follows:

Annuals, or weeds which germinate, bloom, fruit, and die in one year or season. Corn Cockle is an example.

Winter Annuals, which germinate late in summer or autumn, pass the winter as seedlings or immature plants, and complete the cycle of their existence by blooming, fruiting, and dying during the following summer. Such are Chess and Shepherd's Purse.

Biennials, which produce leaves and roots the first year, and flowers and seeds the second year, after which they die. The Wild Carrot and Evening Primrose are familiar examples.

Perennials, which last from year to year, blooming and seeding annually. These are divided into two classes:

(1) Those with underground creeping stems, such as the Canada Thistle.

(2) Those with roots which do not spread underground, such as Chicory, Plantain, and Dock.

It is important to know the class to which a weed belongs, as the method of eradicating an annual is often very different from that required to destroy a perennial.

GENERAL PRINCIPLES IN THE CONTROL OF WEEDS.

1. Never allow weeds to mature seeds. Cut those on the roadsides, headlands, in waste places and in the fence corners, as well as those in the fields.

2. Be constantly on the watch for the appearance of new weeds. Do not wait until a weed has become established before finding out what it is. It is a comparatively easy task to get rid of a few plants of Perennial Sow Thistle, but a long, tedious and costly operation to clean a field which has become overrun by it.

3. Sow only pure seed. Impure seed is dear at any price. Pure seed is the purchaser's right by law, and he should insist on having it.

4. In dealing with perennial weeds with creeping underground roots, be careful not to harrow or cultivate through patches and drag the "roots" all over the field.

5. See that the separator is cleaned before being brought upon the farm. Burn the refuse from the separator, and do not throw it on the manure heap.

6. Avoid feeding stock upon chop containing weed seeds in any quantity. Such food should be boiled before being fed.

GENERAL METHODS FOR THE ERADICATION OF WEEDS.

1. Crop Rotation.

Crop rotation is of utmost importance in dealing with weeds. Some sharp, short rotation of crops should be adopted which will allow of the frequent use of the cultivator, the cutting of the flowers before seeding, and the introduction of a smother or hoed crop. One cannot recommend a system of cropping which will be suitable to all kinds of farming. Each farmer must select the rotation most suitable to his conditions, keeping in mind those features of rotation which will best enable him to fight the particular weed or weeds with which he has to contend.

The following short rotation is recommended for the eastern provinces by J. H. Grisdale, Agriculturist of the Central Experimental Farm:

"To destroy weeds, probably the best rotation possible is one of three years' duration, including clover and mixed hay, followed by roots or corn, the land shallow-plowed in fall and sown to grain the next spring with ten pounds of red clover and twelve pounds of timothy per acre. (When the land is heavy or clayey, the ten pounds of red clover may be replaced by six pounds of red clover and two of alsike.) If a portion of the arable land must be used for pasture, then the land might be allowed to remain under grass or hay for two years instead of one year, the second being used for pasture, thus extending the three-year into a four-year rotation. The pasture land in the four-year rotation, or the hay land in the three-year rotation, should be broken up early in August and cultivated at intervals to destroy the successive growths of weeds as they appear. The land should be again plowed, or preferably ridged, in the fall."

2. Hoed Crops.

The growing of such crops as potatoes, corn and roots provides a means by which many weeds may be effectively fought. Hoed crops alone do not give entire satisfaction in fighting creeping perennial weeds. This is due to the fact that in cultivating and hoeing the rootstocks are cut but not all destroyed and in a short time some begin to grow again. Hoed crops, therefore, should not be depended upon alone to eradicate creeping perennials but should be used in connection with other methods as outlined further on.

3. Summer Fallowing.

This method is extremely efficacious with all sorts of weeds, including the Perennial Sow Thistle. By fallowing for weeds a bare fallow is understood, or at least one which is given sufficient cultivation to prevent weeds from reproducing themselves by seeds or "roots." A neglected fallow is nothing more or less than a weed bed, and is useless and a source of contamination for every field on the farm. The chief objection to

fallowing is the lying idle of the field for a season, but this is probably offset by the effectiveness of the method in dealing with such weeds as the Perennial Sow Thistle as compared with other methods which require a great deal more labor, time and attention.

4. Early After-harvest Cultivation.

This is one of the best ways to destroy annual and winter annual weeds, such as False Flax, Corn Cockle and Wormseed Mustard. Plow shallow immediately after harvest and harrow and cultivate frequently. By the shallow plowing the weed seeds are kept near the surface, and by the frequent stirring of the soil they are made to sprout, and having sprouted they are easily destroyed by further cultivation.

5. Seeding Down.

Fields overrun with some kinds of weeds, particularly annuals, may be cleaned by seeding to grass for hay or pasture. This method has the advantage of requiring little labor, which is expensive at the present time. Cutting the hay crop early will prevent most weeds from maturing any quantity of seed. Close pasturing, especially with sheep, will in time destroy most weeds, even perennials.

6. Sheep Destroy Weeds.

A flock of sheep will do much to keep a farm free from weeds, and it is to be deplored that sheep are not more generally kept upon Ontario farms. *"When an abundance of succulent pasture of the finer grasses is provided, weeds can scarcely be said to be favored by sheep as a staple part of their diet. Sheep will, however, even when good pasture is provided them, vary their diet by nipping off seedling plants or the fresh growing parts, and the bloom with its contents of sweets from older plants of many of our common weeds. When their pasture is depleted, sheep feed readily on Wild Mustard, Ox-eye Daisy, Yarrow, Plantain, Perennial and Annual Sow Thistle, Wild Vetch or Tare, Docks, Sorrel, Lamb's Quarters, Milkweed, Ragwort, Burdock and Shepherd's Purse. In fact, there are few weeds that sheep will not eat, to the extent of preventing them from seeding, if there is not enough of their favorite grasses to satisfy them. It is only when the supply of food is unusually short that sheep will feed on plants having leaves and stems covered with bristly hairs or spines, or with a flavor that is obnoxious to them. When the plants are young and tender, however, sheep have been observed to eat such weeds as Ragweed, Blue-weed, Cockle, Orange Hawkweed, Hound's Tongue, Stickseed, Mullein, Canada Thistle, Stinkweed, Toadflax, and

* Farm Weeds of Canada.

others that are bristly or have a pungent flavor. Thorough cultivation with a systematic rotation of crops, combined with the maintenance of as many sheep as can be kept to advantage, is a certain and profitable means of keeping weeds under control."

7. Smothering.

The aim of this method is to kill the weeds by depriving them of light and air. This is accomplished by getting some quick growing crop, such as rape or buckwheat, established on the land while the weeds are in a weakened condition. The result is that the smother crop soon occupies every available foot of the land and forms a dense shade in which the weeds in their weakened state cannot continue to grow.

8. Hand Pulling.

Hand pulling and the total removal of weeds is the most effective means of destruction, but of course is only practicable with shallow-rooted weeds not very abundant in a field. Small patches of perennial weeds can be destroyed by digging out the plants with a fork, roots and all, and burning them. Great care must be taken to get every bit of the "root," and the patch should be watched, and if new shoots appear, they should be taken out at once. In an ordinary season several diggings will be required in order to completely exterminate a creeping perennial.

A FEW FACTS REGARDING WEED SEEDS IN CLOVER AND GRASS SEEDS.

Alfalfa Seed.

Out of 147 samples of alfalfa seed submitted for test by farmers and seedsmen, 15 were found to be absolutely free from weed seeds of any kind, 98 to be free from the weeds covered by the Seed Control Act, though containing other weed seeds in various amounts; 34 were found to contain sufficient weed seeds to disqualify them from being offered for sale in Ontario. Out of the 147 samples tested 7 were noticeably dark and discolored, indicating lack of germinative capacity, and 4 were found to contain very large quantities of grit and other inert matter.

The following weed seeds were found to be the most common impurities in alfalfa seed: Green Foxtail (*Setaria viridis*), present in 56 samples; Lamb's Quarters (*Chenopodium album*), present in 42 samples; Russian Thistle (*Salsoli kali*, var. *tenuifolia*), present in 35 samples; Buckhorn or Ribgrass (*Plantago lanceolata*), present in 32 samples; Curled Dock

(*Rumex crispus*), present in 21 samples; Pigweed (*Amaranthus retroflexus*), present in 20 samples; Ragweed (*Ambrosia artemisaefolia*), present in 11 samples; Yellow Foxtail (*Setaria glauca*), present in 10 samples; Chicory (*Cichorium intylbus*), Wild Carrot (*Daucus carota*), Bull Thistle (*Cirsium lanceolatum*) and *Centaurea picris* present in 9 samples.

Other weed seeds found in alfalfa were Black Medick (*Medicago lupulina*), Sweet Clover (*Melilotus alba*), Lady's Thumb (*Polygonum persecaria*), Knob Grass (*Polygonum aviculare*), Sheep Sorrel (*Rumex acetosella*), Dodder (*Cuscuta* sp.), Old Witch Grass (*Panicum capillare*), Mayweed (*Anthemis cotula*), Yellow Cress (*Radicula paulstris*), Field Mustard (*Brassica arvensis*), Night-flowering Catchfly (*Silene noctiflora*), Scotch Thistle (*Onopordum acanthium*), Corn Flower (*Centaurea nigra*), Black Bindweed (*Polygonum convolvulus*), Mint (*Mentha* sp.), Water Hemlock (*Cicuta maculata*), Musk Thistle (*Carduus nutans*), Stick Seed (*Lappula exhinata*), White Cockle (*Lycnhis alba*), Bedstraw (*Galium aperine*), Canada Thistle (*Circium arvense*), Barnyard Grass (*Echinochloa crus-galli*), Cow Cress (*Lepidium campestre*), Corn Gromwell (*Lithospernum arvense*), Mallow (*Malva rotundifolia*).

Alsike Seed.

Out of 45 samples of alsike seed tested none were found to be absolutely free from weed seeds; 4 only were free from the weed seeds covered by the Seed Control Act; 41 contained weed seeds covered by the Act.

The following were found to be the most common impurities in alsike seed: Night-flowering Catchfly present in 37 samples, Curled Dock present in 17 samples, Sheep Sorrel present in 16 samples, Lamb's Quarters present in 11 samples, Green Foxtail present in 7 samples.

Other weed seeds found in alsike were: Bladder Campion, Bugle Weed (*Lycoups virginicus*), Rib-grass or Buckhorn, Rough Cinquefoil (*Potentilla monspeliensis*), Wormseed Mustard, False Flax, Chickweed (*Stellaria media*), Canada Thistle, Black Bindweed, Lady's Thumb, Black Medick, Common Plantain, Old Witch Grass, Pigweed, Ragweed, Yellow Cress, Yellow Foxtail, Evening Primrose, Pepper Grass (*Lepidium* sp.), Mayweed, Mouse-ear Chickweed (*Cerastium vulgatum*), Shepherd's Purse (*Capsella bursa-pastoris.*)

Red Clover Seed.

Out of 78 samples tested 1 was absolutely free from weed seeds; 21 were free from the weed seeds covered by the Seed Control Act; 56 contained weed seeds covered by the Seed Control Act; 5 samples contained large amounts of grit and other inert matter.

The following were found to be the most common impurities in red clover seed: Green Foxtail present in 50 samples, Buckhorn or Ribgrass present in 35 samples, Curled Dock present in 26 samples, Lady's Thumb present in 21, Ragweed in 20, Lamb's Quarters present in 17 samples, Pale Plantain (*Plantago rugelii*), Night-flowering Catchfly, and Sheep Sorrel present in 12 samples.

Other weed seeds found in red clover were Mayweed, Wild Oats (*Avena fatua*), Black Medick, Canada Thistle, Yellow Foxtail, Common Plantain (*Plantago Major*), Bladder Campion (*Silene latifolia*), Heal-all (*Prunella vulgaris*), Pigweed, False Flax (*Camelina sativa*), Bracted Plantain (*Plantago aristata*), Catnip (*Nepeta cataria*), Wormseed Mustard (*Erysimum cheiranthoides*), Stickseed, Evening Primrose (*Onagra biennis*), Old Witch Grass, Barnyard Grass, Cow Cress, Knot Grass, Black Bindweed, Wild Carrot, Wild Vetch (*Vicia cracca*), Dodder.

Timothy Seed.

Out of 33 samples tested 3 were entirely free from weed seeds, 17 contained no weed seeds covered by the Seed Control Act, 13 contained weed seeds covered by the Act.

The following were the commonest impurities found in timothy seed: Pale Plantain present in 16 samples, Lamb's Quarters present in 11 samples, Evening Primrose present in 8 samples, Ribgrass or Buckhorn present in 7 samples, Pepper Grass and Cone Flower (*Rudbeckia hirta*) present in 6 samples.

Other weed seeds found in timothy were: Mint, Ergot (*Claviceps purpurea*), Blue Vervain (*Verbena hastata*), Night-flowering Catchfly, Spiny Annual Sow Thistle, Old Witch Grass, Finger Grass (*Digitaria sanguinale*), Wormseed Mustard, Common Plantain, Rough Cinquefoil, Green Foxtail, Bugle Weed, Curled Dock, Mayweed, False Flax, Lady's Thumb, Sheep Sorrel, Catnip and Mouse-ear Chickweed.

SECTIONS OF THE SEED CONTROL ACT.

[Reprinted from The Revised Statutes of Canada, 1906, Vol. III Chap. 128, embodying the amendments passed January 28, 1910.]

Prohibitory Clauses.

Section 6.—No person shall sell, or offer, expose or have in his possession for sale, for the purpose of seeding, any seeds of cereals, grasses, clovers or forage plants, unless they are free from any seeds of the following weeds: Wild Mustard or Charlock (*Brassica sinapistrum*, Boiss.);

Wild Radish (*Raphanus raphanistrum*, L.); Tumbling Mustard (*Sisymbrium sinaspistrum*, Crantz.); Hare's Ear Mustard (*Coringia orientalis* (L.) Dumort); Ball Mustard (*Neslia paniculata*, Desv.); Field Pennycress or Stinkweed (*Thlaspi arvense*, L.); Wild Oats (*Avena fatua*, L., and *Avena strigosa*, Schreb.); Bindweed (*Convolvulus arvensis*, L.); Perennial Sow Thistle (*Sonchus arvensis*, L.); Ragweed (*Ambrosia artemisiaefolia*, L.); Great Ragweed (*Ambrosia trifida*, L.); Purple Cockle (*Lychnis Githago*, Lam.); Cow Cockle (*Vaccaria vaccaria* (L.), Britton); Orange Hawkweed or Paint Brush (*Hieracium aurantiacum*, L.); and *Hieracium praealtum*, Vill.); and from the Sclerotia known as Ergot of Rye (*Claviceps purpurea*, Tul.); unless each and every receptacle, package, sack or bag containing such seeds, or a label securely attached thereto, is marked in a plain and indelible manner,—

(a) With the full name and address of the seller;

(b) With the name of the kind or kinds of seed;

(c) With the common name or names of the weeds hereinbefore named, the seeds of which are present in the seed sold or offered, exposed or had in possession for sale. 4-5 E. VII., c. 41, s. 3.

Section 7.—No person shall sell, or offer, expose or have in his possession for sale, any seeds of timothy, red clover, alsike, alfalfa, or any mixture containing the said seeds, in or from any receptacle, package, sack or bag upon which is marked "No. 1," or any other designation which represents such seeds as of first quality, unless they are free from the seeds of weeds named in the last preceding section, and are also free from the seeds of White Cockle (*Lychnis vespertina*, Sibth.); Night-flowering Catchfly (*Silene noctiflora*, L.); Bladder Campion (*Silene latifolia*, Mill.); False Flax (*Camelina sativa*, Crantz., and *microcarpa*, Andrz.); Canada Thistle (*Cnicus arvensis*, Hoffm.); Ox-eye Daisy (*Chrysanthemum Leucanthemum*, L.); Curled Dock (*Rumex crispus*, L.); Blue Weed (*Echium vulgare*, L.); Ribgrass (*Plantago lanceolata*, L.); Chicory (*Cichorium Intybus*, L.): Alfalfa Dodder (*Cuscuta* species); and contain out of every one hundred seeds not less than ninety-nine seeds of the kind or kinds represented, or seeds of other useful and harmless grasses and clovers, of which ninety-nine seeds, ninety seeds must be germinable. 4-5 E. VII., c. 41, s. 4.

Section 8.—No person shall sell, or offer, expose or have in his possession for sale, for the purpose of seeding in Canada, any seeds of timothy, alsike, red clover or alfalfa, or any mixture containing the said seeds, if the seeds of the weeds named in this Act are present in a greater proportion than five to one thousand of the seed sold, or offered, exposed or held in possession for sale. 4-5 E. VII., c. 41, s. 6.

Section 8a.—No person shall sell, or offer, expose or have in his possession for sale, for seeding, any seeds of cereals, grasses, clovers, forage plants, field roots or garden vegetable crops which are not capable of germinating in the proportion of two-thirds of the percentage standard of vitality for good seed of the kind, unless every receptacle, package, sack,

or bag containing such seed, or a label securely attached thereto, is marked in a plain and indelible manner with the name of the kind of seed and the percentage of the seeds that are capable of germination.

Regulations of the Governor in Council.

Sections 6, 7 and 8a are modified by subsections 2 (a) and 2 (aa). The regulations made by the Governor in Council, under section 2 of the Act, are subject to change. On April 18, 1910, an order in council was passed ordering that the regulations that were approved on August 26, 1905, be rescinded from and after the first day of July, 1910, and the following regulations made in lieu thereof:—

The number of seeds of the weeds named in sections 6 and 7 of the Seed Control Act that may be tolerated in any seeds, without affecting their character as being within the meaning of the said sections free from the seeds of the said weeds, shall be as follows:—

(a) For seed of oats, barley, wheat or other seeds that are similar in size to these grains, one weed seed in one pound avoirdupois.

(b) For seed of timothy, red clover and alfalfa, five weed seeds in one ounce avoirdupois.

(c) For seed of alsike, ten weed seeds in one ounce avoirdupois.

Standards of Purity for Timothy, Alsike, Red Clover and Alfalfa Seed.

The following table combines the standards of purity for timothy, alsike, red clover and alfalfa seed defined by the Act and fixed by order

Kind of seed.	Section 6. Weeds named in sec. 6 allowed without labelling.	No. 1 Quality, Section 7. Weed seeds named in Sec.'s 6 and 7 allowed.	No. 1 Quality, Section 7. Other weed seeds allowed. (1-100).	Section 8. (5 weed seeds per 1,000 of the good seeds).
	Maximum number per ounce.	Maximum number per ounce.	Maximum number per ounce.	Maximum number per ounce.
Timothy	5	5	822	410
Alsike	10	10	425	212
Red Clover ...	5	5	184	92
Alfalfa	5	5	145	72

EXPLANATION OF REPORT ON PURITY TEST.

*Timothy, alsike, red clover and alfalfa seed to be first quality or No. 1 must not contain weed seeds named in Sections 6 and 7 of the Seed Control Act in greater numbers than 5 per ounce of timothy, 10 per ounce of alsike, and 5 per ounce of red clover and alfalfa. The total number of all kinds of weed seeds, including those named in the Seed Control Act, must not exceed 13,142 per pound of timothy, 6,800 per pound of alsike, 2,944 per pound of red clover, or 2,320 per pound of alsike. Any seed containing weed seeds named in the Seed Control Act in greater numbers than 410 per ounce of timothy, 212 per ounce of alsike, 92 per ounce of red clover, or 72 per ounce alfalfa, is prohibited from sale for seeding purposes, under Section 8 of the Seed Control Act. Grades of the above mentioned seeds coming between these two standards fixed by the Act may be sold for seeding in Canada, under the conditions defined by Section 6 of the Seed Control Act; but they may not be graded No. 1 or given any designation or brand implying that the seed is of first quality.

The quantities of seed generally used for purity test are half an ounce of timothy, half an ounce of alsike, one ounce of red clover and of alfalfa. The report states the fraction of an ounce that was used in making the test and the number of the weed seeds named in the Seed Control Act that were found in the amount used. From this the number per ounce of the weed seeds named in the Act can be readily determined; and, as the total number of all kinds of weed seeds per pound is given in the report, the rating or grade of the seed can be arrived at. Thus, if a sample of red clover contains not more than 5 per ounce of the weed seeds named in the Seed Control Act, and does not contain a total of more than 2,944 per pound of all kinds of weed seeds, it will grade No. 1. If it contains more than 92 per ounce of the weed seed. named in the Act, it is prohibited from sale for seeding purposes. If it contains over 5 per ounce of the weed seeds named in the Seed Control Act but not more than 92, it can be legally sold, but it cannot be rated as first-class seed.

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*Seed Testing, Revised 1910, by Geo. H. Clark, Seed Commissioner.

A NUMBER OF COMMON WEEDS, WITH POPULAR DESCRIPTIONS AND NOTES ON ERADICATION

DESCRIPTIONS OF THE WEED-SEEDS ILLUSTRATED ON OPPOSITE PAGE

1. *Green Fox-Tail.* About one-twelfth of an inch long; oval w blunt ends; uneq ly bi-convex; brown and often mottled; surf granular and striate. Yellow Fox-Tail seed is about one-eighth of inch long, plano-convex, with fine, distinct cross ridges.

2. *Chess.* About one-third of an inch long; back rounded; glu 7-nerved; middle nerve projecting as an awn; the palet bears a r of spine-like hairs along each nerve.

3. *Wild Oat.* About three-fourths of an inch long; spindle-shap glume 9-nerved, middle nerve forming a twisted and bent awn; a t of brownish hairs arise from scar at base.

4. *Couch Grass.* Seeds about one-half inch in length; rather sl der; oval; and tipped with a short awn.

5. *Curl Dock.* One-eighth to one-twelfth of an inch long; poin elliptical, with three faces; surface smooth; reddish brown.

6. *Sheep Sorrel.* Seeds about one-twentieth of an inch in leng usually greyish or reddish brown, and finely roughened; provided w three equal faces, egg-sl ped, each face of the cover of the seed be central ridges with branches.

7. *Lamb's Quarters.* Circular, lens-shaped, and black; grooved one face; often partially covered with the seed covering.

8. *Purslane.* One-twenty-fourth to one-twenty-fifth of an inch diameter; jet black; flattened egg-shaped; notches at smaller end; s face finely roughened.

9. *Corn Cockle.* Seeds from one-twelfth to one-eighth of an i long; angular in outline; color jet black, occasionally dark brown; e surface is crowded with ridges or spines arranged in circular rows le ing from the scar.

The small drawings beside the enlarged drawings represent the natural size of the seeds.

Descriptions of the Weed-seeds Illustrated on Opposite Page

10. *Bladder Campion.* About one-sixteenth of an inch in leng kidney-shaped; surface roughened by many little projections arrang more or less in concentric rows; light brown in color.

11. *White Cockle.* Resembling Bladder Campion, but lighter color; roundish and not so angular; depression about scar not so w marked.

12. *Night-Flowering Catchfly.* Resembles white cockle, but dark

13. *Pepper-Grass.* About one-sixteenth of an inch in length; eg shaped but much flattened; the groove is curved and quite evident; t scar is white; reddish yellow to reddish brown.

14. *Penny Cress.* Seeds one-twelfth of an inch long; somewh egg-shaped and flattened; surfaces have 12-14 curved ridges, whi start and end at the pointed end of the seed; color dark reddish brow

15. *Wild Mustard.* One-sixteenth of an inch in diameter; da brown to reddish brown in color; almost spherical in outline.

16. *Worm Seed Mustard.* About one-twenty-fourth of an inch length; most are pointed at the end opposite the scar; the groove quite evident; surfaces smooth and dull; reddish yellow in color.

17. *Shepherd's Purse.* About one-twentieth of an inch in lengt somewhat flattened; oval; each face has two grooves; color reddi yellow.

18. *Small Seeded False Flax.* Reddish brown; more or less ov and slightly flattened; about one-twentieth of an inch long; the groo more evident on one face than on the other; a whitish scar at one end.

19. *Field Bindweed.* About one-sixth of an inch long; oval; colo dark brown; surface is somewhat roughened; outer face convex; inne face divided by a ridge into two plane faces.

20. *Dodder.* Ranging from one-sixteenth to one-twenty-fourth o an inch in length; slightly egg-shaped and flattened; notch near on end; resembles red clover seed, but is smaller, with a dull, roughene surface; color is yellow to brown and reddish, or often yellowish gree

21. *Hound's Tongue.* Seeds are spiny nutlets, one-eighth of an inc long; upper side flat, oblique and roughened with hooked prickles.

The small drawings beside the large drawings represent the natural size of the seed.

DESCRIPTIONS OF THE WEED-SEEDS ILLUSTRATED ON OPPOSITE PAG

22. *Blue Weed.* Stone-like in hardness; about one-tenth of an in length; surface roughened and of a gray color; the scar is large triangular at flat end; the ridge along the outer face is convex.

23. *Mullein.* About one-twenty-fifth of an inch in length; thim shaped; base flat with scar at centre; thimble slightly six-sided, side deeply pitted; pits of adjacent rows alternate; light to dark bro The seeds of Moth Mullein and Common Mullein are much alike.

24. *Rib-Grass.* From one-eighth to one-twelfth of an inch in leng oval in shape with one face rounded, the other deeply grooved bea a central scar; dark brown or amber colored.

25. *Ragweed.* Ranging from one-fifth to one-twelfth of an incl length; top-shaped; apex-pointed, and bearing a crown of four to e spines; light to brown in color.

26. *Yarrow.* Seeds about one-twelfth of an inch long; small thin; slightly egg-shaped; color varying from yellowish-white to g

27. *Ox-Eye Daisy.* About one-twelfth of an inch long; ten slen white ribs running from end to end; a knob at the broad end; slightly club-shaped.

28. *Burdock.* One-fifth to one-fourth of an inch in length; p matic and mottled; four or five faces; apex broader than base; a star in centre of a distinct brown ring.

29. *Canada Thistle.* From one-eighth to one-twelfth of an inch length; brown in color; somewhat spindle-shaped, but often flatten top end cup-shaped with a rim and a small central knob.

30. *Chicory.* From one-eighth to one-twelfth of an inch in leng usually light brown; usually cylindrical; top flat and crowned w scales.

The small drawings beside the enlarged drawings represent the natural size of the seeds.

DESCRIPTIONS OF THE WEED-SEEDS ILLUSTRATED ON OPPOSITE PAGE.

31. *Prickly Lettuce.* Seeds one-eighth to one-sixth of an inch in length; broadly lance-shaped; each face has 5-7 ribs; color dark brown somewhat mottled with black; apex is tipped with a beak which is almost as long as the seed.

32. *Spiny Sow Thistle.* One-eighth of an inch in length; varying from oval to lance-shaped; flat; each face bearing three narrow ridges which meet at the ends; surfaces smooth; color straw-colored to reddish brown.

33. *Perennial Sow Thistle.* Slightly spindle-shaped with blunt ends and often much flattened; five coarse, finely wrinkled ridges running lengthwise on each face; dark reddish-brown; about one-eighth of an inch long.

34. *Fleabane.* Seeds one-twentieth of an inch long; oval; remnants of pappus bristles remaining often at the apex.

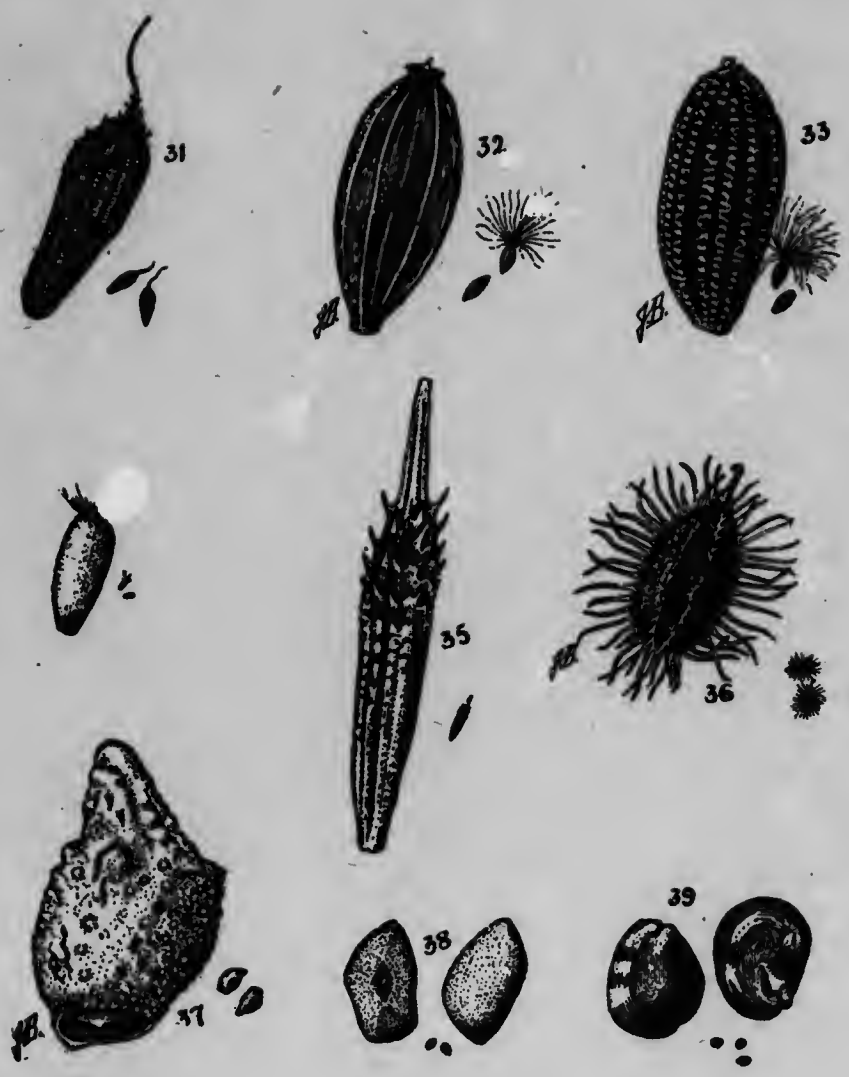
35. *Dandelion.* Seeds one-eighth of an inch long; exclusive of short beak; lance-shaped in outline; ten ridges running lengthwise; provided with barb-like teeth towards the apex; color varies from light to dark brown.

36. *Wild Carrot.* Seeds each one-eighth of an inch in length; and flattened on the back: primary ribs slender, bristly, and five in number; secondary ribs, 4 in number, each bearing a row of barbed prickles.

37. *Pigeon Weed.* Nutlets one-twelfth of an inch long; egg-shaped and curved; scar is conspicuous; surface roughened; gray in color.

38. *Broad-Leafed Plantain.* Seeds about one-twentieth inch long; flattened; outline variable from oval to rhomboidal; wavy lines on surface; color, brown.

39. *Pig-Weed.* About one-twenty-fourth of an inch in length; flattened, egg-shaped, or lens-shaped; polished and jet black; a slight notch on sharp edge is the scar; near the scar-notch is a small projecting point.



The small drawings beside the enlarged drawings represent the natural size of the seeds.

DESCRIPTIONS OF THE WEED-SEEDS ILLUSTRATED ON OPPOSITE PAGE.

40. *Barnyard Grass.* One-tenth of an inch long, plano-convex mandolin-shaped. It is a smooth, glossy seed, and the color is usual greenish or grayish yellow.

41. *Witch Grass.* A small, shiny gray seed, about one-sixteen of an inch long, oval and somewhat flattened bi-convex.

42. *Black Medick.* Often found in the black, ribbed pod or legun which is somewhat coiled up. The seed is egg-shaped, but otherwi resembles Alfalfa seed.

43. *Common Chickweed.* Very small seed, one-twenty-fourth an inch in diameter, somewhat wedge-shaped, with a notch at the poi The surface is finely tubercled, in four or five looped rows on each the parallel faces, and the color varies from reddish to gray.

44. *Cinquefoil.* Minute, yellowish-gray seeds, somewhat kidne shaped, and covered with curved ridges.

45. *Orange Hawkweed.* Small torpedo-shaped seeds, about on twelfth of an inch long, and grooved. Ripe seeds are dull jet blac immature seeds reddish.

46. *Cone Flower, Yellow Daisy, Black-Eyed Susan.* A small du black seed, curved and somewhat angular, with fine longtiudinal stri tions on the four faces.

47. *Wild Lettuce.* A thin, , oval seed, with a slender beak tip. It has a dull black color and faint cross-ridges, and is about on sixth of an inch in length.

48. *Wild Buckwheat, Black Bindweed.* A jet black, shiny thr sided seed, about one-eighth of an inch long. It is broadest near t abruptly pointed apex, and the sides are slightly concave, but the angl are rounded.

49. *Heal All, Self-Heal.* A brownish seed, about one-twelfth of inch long, oblong-oval, tapering to a small white triangular scar-appe dage at the base. Dark lines follow the margins and centres of t faces. These pretty double lines are characteristic.

50. *Evening Primrose.* An angular, reddish-brown seed, usual with a narrow wing along the edges. The four faces are finely roug ened, and faintly ridged. Some seeds are pyramidal, some prismat others wedge-shaped, but commonly four-sided with one face round

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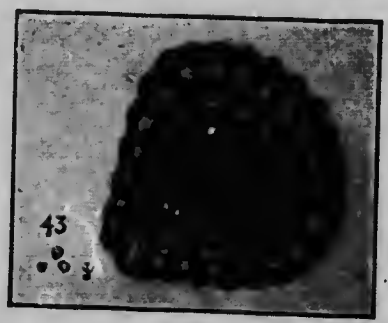

HORSETAIL FAMILY (*EQUISETACEAE*).

Horsetail or Scouring Rush.

Equisetum arvense (L).

This plant is found in damp grass lands, in low places in cultiva fields, and on apparently dry sandy land which has a poorly drained s soil. If fed in quantity in hay it is poisonous to horses.

The Horsetails appear in early spring as small pale stalks with yello ish or brownish heads. Later in the season feathery, tail-like leafy gr shoots appear. These are frequently described by correspondents being like little pine trees. It is this form of the plant which is usua noticed in cultivated fields.

Eradication. The appearance of this weed in any quantity alwa indicates lack of proper underdrainage. This lack supplied, the we soon disappears from cultivated fields.

THE GRASS FAMILY (*GRAMINEAE.*)

Fig 1.

Fox-tail, Yellow Fox-tail or Pigeon Grass.

Setaria glauca (L).

A common weed in stubble, fallow or root fields. It has a annual root, with stems about two feet high, of erect habit of growt At the summit of that part of the leaf which sheaths the stem (the ligule there is a fringe of hairs. The leaves are flat, rough above, and smoot beneath. The dense, close spike, which resembles millet, is bristly an tawny yellow in color.

The seeds are 1/8 in. long, of various shades of brown in color, an with transverse wrinkles. They frequently retain their green color, an are quite commonly found as an impurity in clover and grass seed. (Se Fig. 1, a.) An average plant produces about 15,000 seeds.

Time of flowering, July-September.

Time of seeding, August-October.

Eradication. Gangplow stubble ground about three inches deep earl in the fall; as soon as the seeds have had time to sprout, cultivat thoroughly; repeat cultivation and rib the land with a double moul board plow the last thing before the frost. Put in a hoed crop (pota toes, roots or corn) next spring, and cultivate thoroughly throughou the growing season. Follow with a grain crop seeded with clover without plowing after the roots, for if the land is plowed it is liabl to bring more seed to the surface. When the sod is broken up, plow shallow in the latter part of harvest, cultivate with harrow and culti-vator throughout the fall, and rib up as above.

FIG 1.

YELLOW FOX-TAIL.

(*Setaria glauca.*)

In the early after-harvest cultivation of stubble ground, some harrow the stubble as the first step; and when the weed seeds have sprouted under their light covering, then gang-plow and harrow, and stir afterwards with the cultivator as time permits throughout the fall.

Green Fox-tail.

Seteria viridis (L.).

A grass very similar to Yellow Fox-tail and found in similar situations. It can, however, be distinguished from Yellow Fox-tail by the denser spike with green or golden bristles, and by the seeds which are smaller and with the cross ridges less distinct. The seeds are very frequently found in clover and grass seed. The method of eradication is the same as for Yellow Fox-tail.

Fig. 2.

Chess, Cheat or Wheat Thief.

Bromus secalinus (*L.*).

A weed naturalized from Europe. It is a winter annual, with fibrous roots and rough, coarse leaves. It has large spikelets, dark green in color, of characteristic shape, and grows from three to four feet high.

Many look upon Chess as degenerated wheat, because it appears among fall wheat that has been winter-killed. This idea is erroneous and without foundation. The fact is that Chess will mature seed under adverse conditions, even though the plant be only a few inches high. The seed possesses great vitality, and is often found in wheat and rye.

Chess is most commonly found among wheat and rye.

The flour made from it is dark-colored, and has narcotic principles. Care in the selection of seed grain and careful cultivation, tending to prevent the maturing of the seeds, are the chief remedies. The planting of a crop that can be harvested before the Chess matures is a good plan in badly infested localities. An average plant produces about 1,000 seeds.

Time of flowering, June. Time of seeding, July.

"Chess is a typical plant belonging to the genus *Bromus*. Wheat belongs to the genus *Triticum*. Chess will produce Chess and only Chess, and a seed of wheat cannot be sown to produce Chess, and Chess cannot produce wheat under the most favorable conditions of growth.

"In instances where parts of a plant, apparently a combination of Chess and wheat, were so united as to seem but one plant, close examination proved them to be parts of separate plants, and that the apparent union was not real."

Eradication. Avoid sowing Chess in seed grain. The seed is comparatively short-lived and a four-years' rotation exclusive of winter grain will clean it out of the soil. Patches in grain fields should be cut before

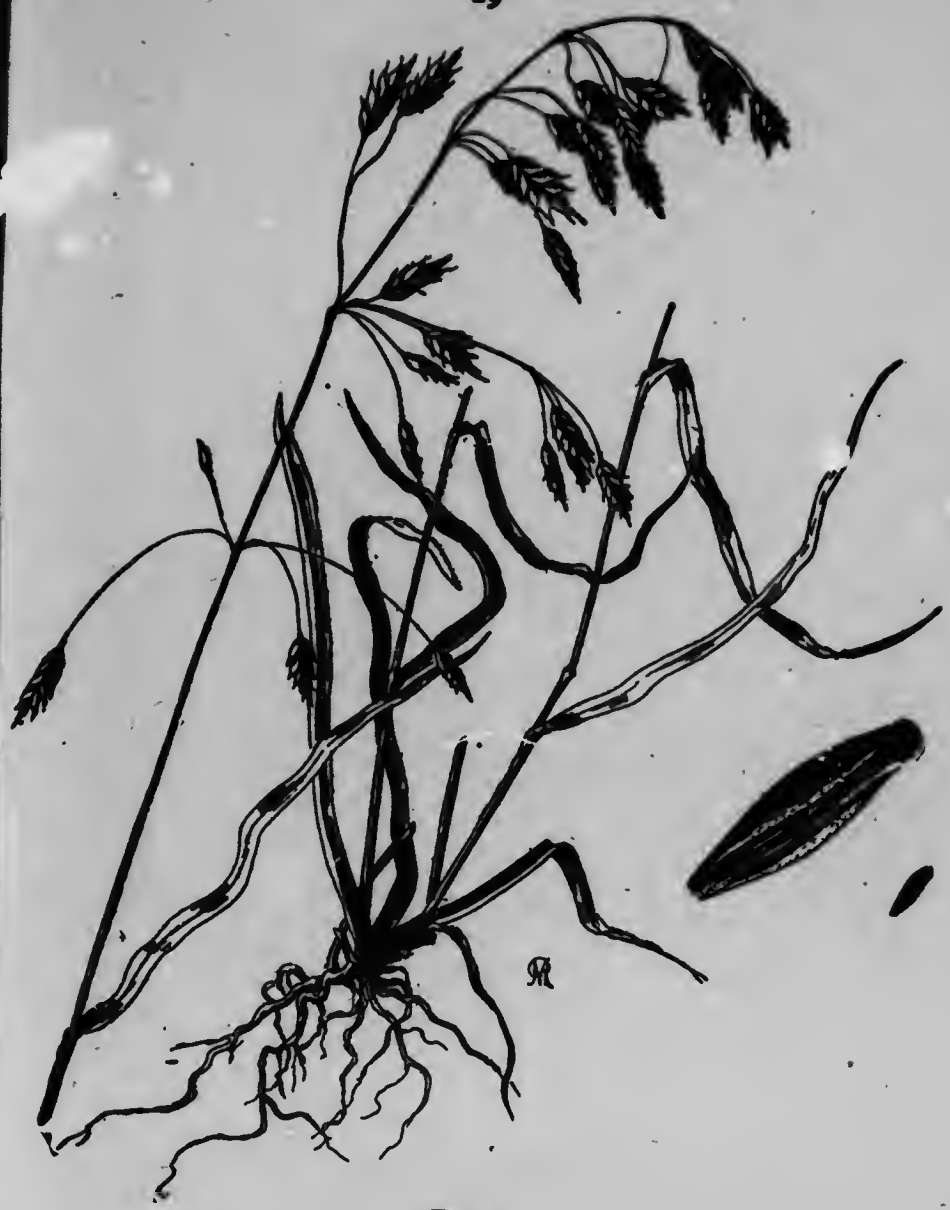

FIG. 2.

CHESS.

(*Bromus secalinus.*)

the plants mature their seeds. Thick seeding with early red clover is recommended for badly infested fields. The first crop of hay should be cut before the Chess has had an opportunity to produce seeds. Shallow, after-harvest cultivation will do much to keep this pest in check.

FIG. 3.

WILD OAT.

Avena fatua (L.).

An annual weed with erect and smooth stems. The leaves and stems are covered with white bloom, which give a peculiar white-green color to the whole plant. The head forms a loose panicle, with nodding and spreading branchlets. The awn is long and bent, and covered with brown hairs. It is bent most when dry; but if moistened, it uncoils and wriggles around, thus causing the seed to move appreciable distances.

The principal points of difference between the wild and cultivated oats are (1) In the former the chaff is thick and hairy, while in the latter it is thin and hairless; and (2) The wild oat has a long, stiff awn which is bent and twisted when dry, while the cultivated oat either has a much smaller and less stiff awn or none at all. An average plant produces about 800 seeds.

Time of flowering, July. Time of seeding, July-August.

Dispersal—Conveyed from place to place by threshing machines, and as an impurity in seed-grain.

Wild oats are at home in any soil that will grow cereals, and they ripen their seeds among almost any cereal crop. The seeds possess wonderful vitality, some of them remaining buried in the soil for years and germinating as soon as they are brought under favorable conditions.

Eradication. On a field infested with wild oats, cereal crops should be dropped out of the rotation as far as possible; and hoed crops, soiling crops, hay, and pasture should take their place. To get the land under grass, it should be fallowed during part of the season, the cultivation being frequent and shallow, to destroy all seeds that may have germinated in the upper layer of the soil. The land can then be sown with winter wheat and seeded, or with an early variety of barley, which should be cut on the green side. The treatment mentioned is suitable for pasture land, or land which has produced a hay or soiling crop during the forepart of the season. Two hoed crops in succession will do much to exterminate this pest.

FIG. 3.
WILD OAT.
(*Avena fatua.*)

FIG 4.

COUCH-GRASS, TWITCH-GRASS, QUACK-GRASS, QUITCH-GRASS, OR QUICK-GRASS; ALSO WHEAT-GRASS.

Agropyron repens (L.).

Couch-grass is a creeping perennial which grows from 1 to 3 fe high. It has a jointed root-stock which penetrates deeply into t ground and possesses great vitality. The plant produces spikes fro 3 to 8 inches long. The small spikelets alternate at each notch of t flower stalk, with the side of the spikelet turned towards the stalk.

The seeds are about ½ in. long, and rather slender (Fig. 4). A average plant produces 400 seeds.

Time of flowering, June-July.

Time of seeding, July-August.

Dispersal—The root-stocks are carried around by implements, a the seeds are occasionally found in seed-grain.

Whatever value Couch-grass may have for pasture, its habit taking and keeping possession of the soil renders it extremely objectio able. It flourishes best in loamy or humus soils, from which it is e pecially difficult to eradicate.

Eradication. As soon as the crop is harvested plow lightly, the harrow with the ordinary harrow, and, if necessary, cultivate with t spring-tooth cultivator. This shakes the roots free from the soil a makes it possible to gather them up with the horse rake. Burn soon as they have dried sufficiently. Repeat this process two or thr times. If the weather at this time should happen to be dry and h so much the better. Late in the fall rib up the land into drills, a allow to stand over winter. The frost, in all probability, will rend material assistance in the eradication. The following spring plow abo the end of May, cultivate well, and put in some hoed crop, or summ fallow, sowing buckwheat, the crop to be plowed in. A carefully cu tivated crop of rape is recommended as being particularly effective destroying this pest.

FIG. 4.

Couch Grass on right of figure and part of a stalk of perennial *rye-grass* (*Lolium perenne*) on left. Note the arrangement of spikelets in rye-grass.

FIG. 5.

SKUNK-TAIL GRASS, WILD BARLEY, OR SQUIRREL-TAIL GRASS.

Hordeum jubatum (L.).

This grass is very troublesome in the West, and is now quite fr quently found in many parts of Ontario, especially along railways.

A native perennial grass forming tufts from 8 to 12 inches hig Leaves are pale green in color, from 3 to 4 inches long with rough ma gins. Flowers are in a silky, bristly spike, from 3 to 4 inches long, pa yellowish green in color. The seed is slender, sharp-pointed, somewh resembling a small barley seed, and has a long upwardly barbed awn.

Eradication. Cut the plants whenever they appear in waste place and thus prevent them from going to seed and spreading. This weed not troublesome in cultivated crops. If it becomes abundant in pasture mow as soon as the heads come out. This will not injure the oth grasses in the meadow.

OLD WITCH GRASS OR TUMBLE GRASS.

Panicum capillare (L.).

An annual grass, very common in neglected hoed crops, gardens an waste places. Plants stout, with hairy leaves and large, finely branchin loosely spreading tops (panicles) which are often seen rolling over th ground on windy days in the fall of the year.

BARNYARD GRASS OR COCKSPUR GRASS.

Echinochloa crusgalli (L.).

This grass is often abundant in hoe crops, headlands and waste place The seed occurs occasionally in commercial seeds. A coarse annual gras from one to three feet high with broad leaves. Inflorescence 1 to 3 inche long, consisting of several one-sided branches crowded together and bea ing numerous short awned spikelets. Seeds dark green to brown, flat o one side, rounded on the other, ⅛ inch long, very smooth and shining.

Eradication. Proper cultivation of hoe crops and taking care to cu in waste places before it seeds will cause it to disappear.

FINGER GRASS OR CRAB GRASS.

Digitaria sanguinalis (L.) (Scop.).

A troublesome grass in lawns and sometimes in low fields. A muc branched, leafy annual, from ten inches to two feet high, spreading on th

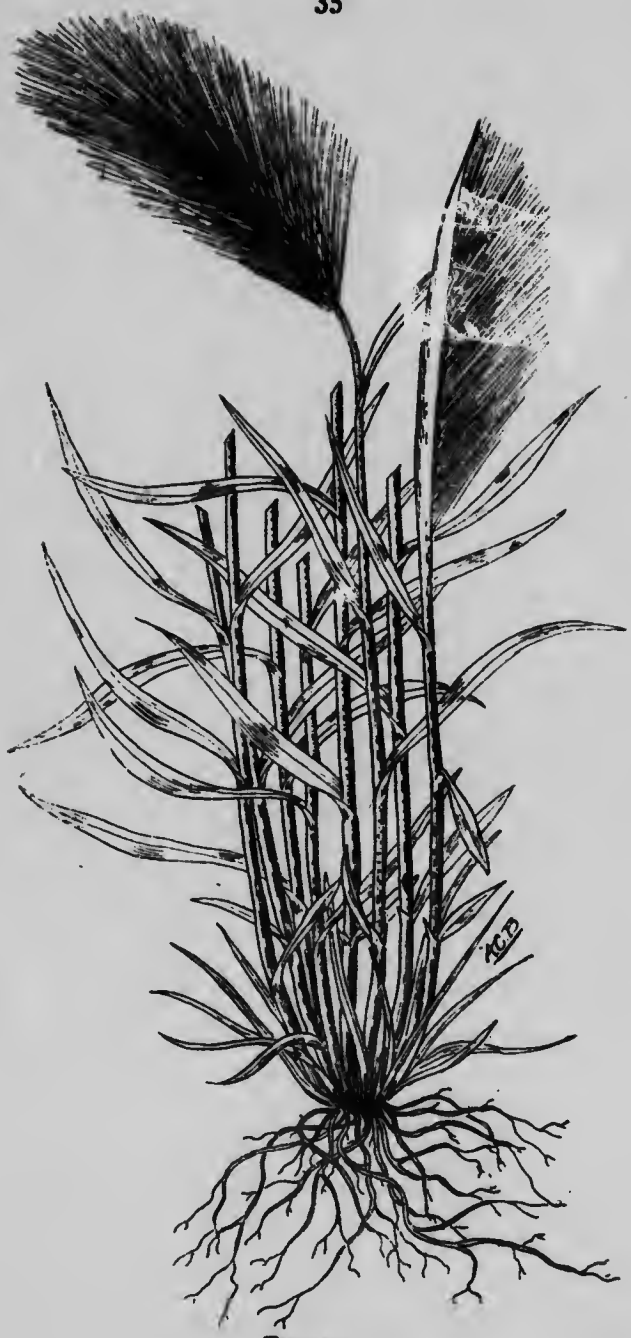

FIG. 5.
SKUNK-TAIL GRASS.
(*Hordeum jubatum.*)

ground and frequently rooting at the lower joints of the stem. The leave are from two to four inches long with rough margins. Flowers are pr duced in spikes which come off from the stem like the fingers on the han hence the common name, Finger Grass.

Eradication. A much harder grass to eradicate than the Fox-tai because it roots so readily at the joints. Repeated cultivation after ha vest will do much to destroy it. Spud out patches in lawns and stir th soil with a rake and sow heavily with lawn grass seed when the groun is moist.

THE BUCKWHEAT FAMILY (*POLYGONACEAE*).

Fig. 6.

Dock, Curled Dock, Sour Dock, or Yellow Dock.

Rumex crispus (L.).

A deep-rooted perennial weed introduced from Europe.

It occurs around buildings, in neglected lanes, along waysides an in pastures. The stem is quite slender, and the leaves are from six t twelve inches long, with wavy margins; hence the common name "curled dock." The flowers are in racemes, green in color.

The seed is winged, and is carried considerable distances by th wind. The manner of attachment of the seed to the wing is show in illustration (Fig. 6). The seeds are light brown in color, tri angular, with sharp edges and tapering point. They are smooth an shiny.

The wind acts as an agency in scattering the seed, and it is a ver common impurity in clover and other seeds used on the farm.

An average plant produces about 17,000 seeds.

Time of flowering and seeding, July-August.

Eradication. In most cases this weed can be kept in check b the frequent introduction of well-cared-for hoed crops into the rotation The shorter the rotation, the better. The later sown hoed crops, especially rape, are more effective than those sown earlier in the season Before the hoed crop is sown, this weed may be kept from breathing above ground by going frequently over the field with a broad-shared cultivator, which will cut the plants an inch or two below the surface but, as the roots are tough and strong, it may sometimes be necessary to use the gang-plow, or even the single plow. About the 1st of July, the land may be sown with rape in drills, say 26 inches apart, and kept clean, or nearly so, by the horse-hoe and more or less hand-hoeing. The rape can be pastured off in the usual way during the fall; and, occasionally, it may be necessary to put another hoed crop on the same ground the following spring, say a crop of corn; but much depends upon the timeliness, regularity, and thoroughness with which the hoeing is done.

Fig. 6.

Curled Dock.

(*Rumex crispus.*)

FIG. 7.

SORREL, OR SHEEP SORREL.

Rumex acetosella (L.).

A perennial with running root-stocks. The stem is slender ar erect with branches. The leaves are spear-shaped and quite characte istic. The flowers occur in racemes, and are green in color. The foliag has a pronounced acid taste.

The seed is 1-16 in. long, triangular, smooth, and shining whe naked, but dull brown when invested by its covering. An averag plant produces about 10,000 seeds.

Time of flowering, June-September.

Time of seeding, July-October.

Propagation—By its running root-stocks, and as an impurity i clover seed, especially Alsike.

Eradication. Sorrel is usually an indication of a poor, sandy, o gravelly soil. It prefers acid soils, hence liming and manuring ar effective remedies when the land is well tilled. The remedies given fo the Dock (Fig. 5) are applicable to Sorrel, only it requires more fre quent use of the broad-shared cultivator, which should be used so as t cut the roots just below the surface of the soil, without bringing up an of the creeping roots.

Lady's Thumb, or Smartweed (*Polygonum Persicaria*). This plan grows to a height of 12 to 18 inches. Its leaves are lance-shaped usually with a blotch near the centre. It is an annual and is ofte abundant.

Treatment. Prevent from seeding, and sow clean seeds.

FIG. 7.
SHEEP SORREL.
(*Rumex acetosella.*)

FIG. 8.

WILD BUCKWHEAT OR BLACK BINDWEED.

Polygonum convolvulus (L.).

An introduced annual found commonly in cereal crops through Ontario. It is a twining herb with branching stems and thin, smo arrow-shaped leaves. Flowers small, greenish, in clusters in the axil the leaves and at the end of the stems. Seed, black, buckwheat-shap ⅛ of an inch long, but when found in grain the outer black coat is o missing and the seed is then white and waxy in appearance.

Time of flowering, from June to September; seeds ripe about middle of July.

Dispersal—By seeds.

Eradication. Sow pure seed grain. Cultivate lightly after harv and cause the seeds to germinate, then harrow out the young plants

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Fig. 8.
Wild Buckwheat.
(*Polygonum convolvulus.*)

THE SPINACH OR GOOSEFOOT FAMILY (*CHENOPODIACEAE*).

FIG. 9.

LAMB'S QUARTERS, OR GOOSEFOOT.

Chenopodium album (L.).

An annual weed widely distributed in cultivated land. It grows to a height of from 2 to 6 feet. The stem is grooved and much branched. The leaves are whitish green below and dark green above. The flowers are inconspicuous and greenish in color.

The seed (Fig. 9) is black and shining, lens-shaped and round, about 1-16 in. in diameter.

Time of flowering, June-October.

Time of seeding, August-October.

Distribution—By seeds, especially as an impurity in clover and grass seeds.

Eradication. Late cultivation is especially necessary in combating this weed, as it flowers and seeds till very late in the season. The land should be gang-plowed shallow and harrowed immediately after harvest, and cultivated at intervals until late in the fall, when it may be plowed or ribbed up for a hoed crop the following spring. Subsequent treatment the same as for Foxtail (Fig. 1).

Oak-leaved Goosefoot. Usually spreads on the ground. Its leaves are like minute white oak leaves.

Maple-leaved Goosefoot. Grows erect, with large, thin, triangular leaves.

Strawberry Blite. Resembles the last, but has red seed clusters.

Spreading Orache. Somewhat resembles Lamb's Quarters, but has larger and thicker leaves, goosefoot shape. It is much branched or spreading and the seed covers are warty.

FIG. 9.
LAMB'S QUARTERS.
(*Chenopodium album.*)

FIG. 10.

RUSSIAN THISTLE.

Salsola Kali, var. *tenuifolia* (G. F. W. Mey).

This is a new weed which has appeared on many farms in Ontario during the past season. It has been introduced as an impurity in Alfalfa seed. A large percentage of the samples of Alfalfa seed examined at the Department of Botany this spring, 1907, contained the seeds of this weed, and already this fall several specimens of the weed, found in Alfalfa fields, have been sent in for identification. The Russian Thistle is a very serious pest in several of the Western States, and is found in the Prairie Provinces, but has not yet been reported as being very troublesome there. The plants, when ripe, break off at the surface of the ground and are rolled long distances by the wind, scattering their numerous seeds on their journey. It is this tumbling habit that makes this weed particularly adapted to the prairie lands of the West, and it probably will never be a serious pest in Ontario where fences, trees and other obstructions will prevent its being spread far and wide by the wind.

Description. The Russian Thistle is a native of Europe and Western Asia. It is a nearly smooth, bushy branched annual, from 1 to 3 feet high. Mature plants are more or less spherical in form. The stems and branches are red in color. The leaves are awl-shaped, 1 to 2 inches long, soft and fleshy when young, very prickly pointed when mature. The flowers are inconspicuous, being small, without petals, and solitary in the axils of the leaves. The seeds are about 1-12 of an inch long, obconical in general outline, with a cup-shaped depression at the upper end in the centre of which is a pointed projection; color dull grey or green, embryo spirally coiled.

Eradication. The Russian Thistle being an annual weed is not hard to exterminate. If once cut off at the surface of the ground it never grows again, and hence in well cultivated fields it is not likely to prove a pest. The chief danger lies in neglect. A single plant produces an enormous number of seeds, and if a few specimens are allowed to mature they will seed down a whole field and cause serious trouble the following year, especially in a crop which does not allow of the frequent use of the culti-

vator. Farmers in Ontario should, therefore, be on the lookout for this weed and destroy any specimens they may find in their fields, fence corners, or along the road sides. If a field is neglected until it becomes seeded, repeated plowing will be required in order to clean it. *" When

FIG. 10.

RUSSIAN THISTLE.

the plant is not more than six inches high careful plowing with a drag chain from the end of the doubletrees to the plow beam, dragging back so as to have every plant dragged under the furrow, with harrowing to fill every crevice between the furrows, will destroy every plant that cannot get its leaves to the surface."

*" Farm Weeds of Canada," by George H. Clark and Dr. James Fletcher.

THE PIGWEED FAMILY (*AMARANTHACEAE*).

Fig. 11.

Pigweed, or Redroot.

Amaranthus retroflexus (L.).

An annual, with pink root, stout, erect stem, and many branches, it grows from 1 to 6 feet high. The leaves are light green in color, and ovate in shape. The flowers are in spikes, which terminate branches, or are from the axils of the leaves, and are green in color.

The seeds (Fig. 11) are round and lens-shaped, smooth, and shiny black in color, resembling the seed of Lamb's Quarters, but slightly smaller and thinner. An average plant produces 15,000 seeds.

Time of flowering, July-September.

Time of seeding, August-October.

Dispersal—The seed is distributed by the wind and as an impurity in grass seed.

Eradication. Special attention must be given to fall cultivation of the soil, so as to prevent plants from ripening, and to sprout and destroy the seeds which have fallen upon the ground. The land should be gang-plowed shallow and harrowed immediately after harvest, and cultivated at intervals until late in the fall, when it may be plowed or ribbed up for a hoed crop the following spring. Subsequent treatment the same as for Foxtail (Fig. 1).

Tumble Weed, or White Pigweed (*Amaranthus graecizans*). This plant resembles Russian Thistle quite closely, but can be distinguished from it by its round, shiny, jet-black seeds, and by its leaves, which, although small, have a definite blade. It is a low branched annual when growing in sandy, open fields and roadsides.

Treatment. Prevent the maturing of the seeds which ripen in August. The plants, as a rule, are conspicuous, and may be readily collected and *burned*. The seeds are often found in grass-seed mixtures.

Spreading Amaranth (*Amaranthus blitoides*), forms large mats on waste ground, along roadsides and walks.

Fig. 11.

Pig-weed.

(*Amaranthus retroflexus.*)

THE PINK FAMILY (*CARYOPHYLLACEAE*).

FIG. 12.

CORN SPURREY.

Spergula arvensis.

This is an annual weed introduced from Europe. It is found chiefly on sandy soil. It grows from 18 to 15 inches high. The flowers are small, white and in loose, terminal clusters. The leaves are needle-like in whorls at the joints of the stem. The seeds are dull black mottled with brown, round and flattened with the margin extended into a narrow rim.

Time of flowering, July; seeds ripe July to August.

Dispersal.—By seeds.

Eradication. Frequent stirring of the soil to make the seeds sprout and frequent harrowing to destroy the seedlings.

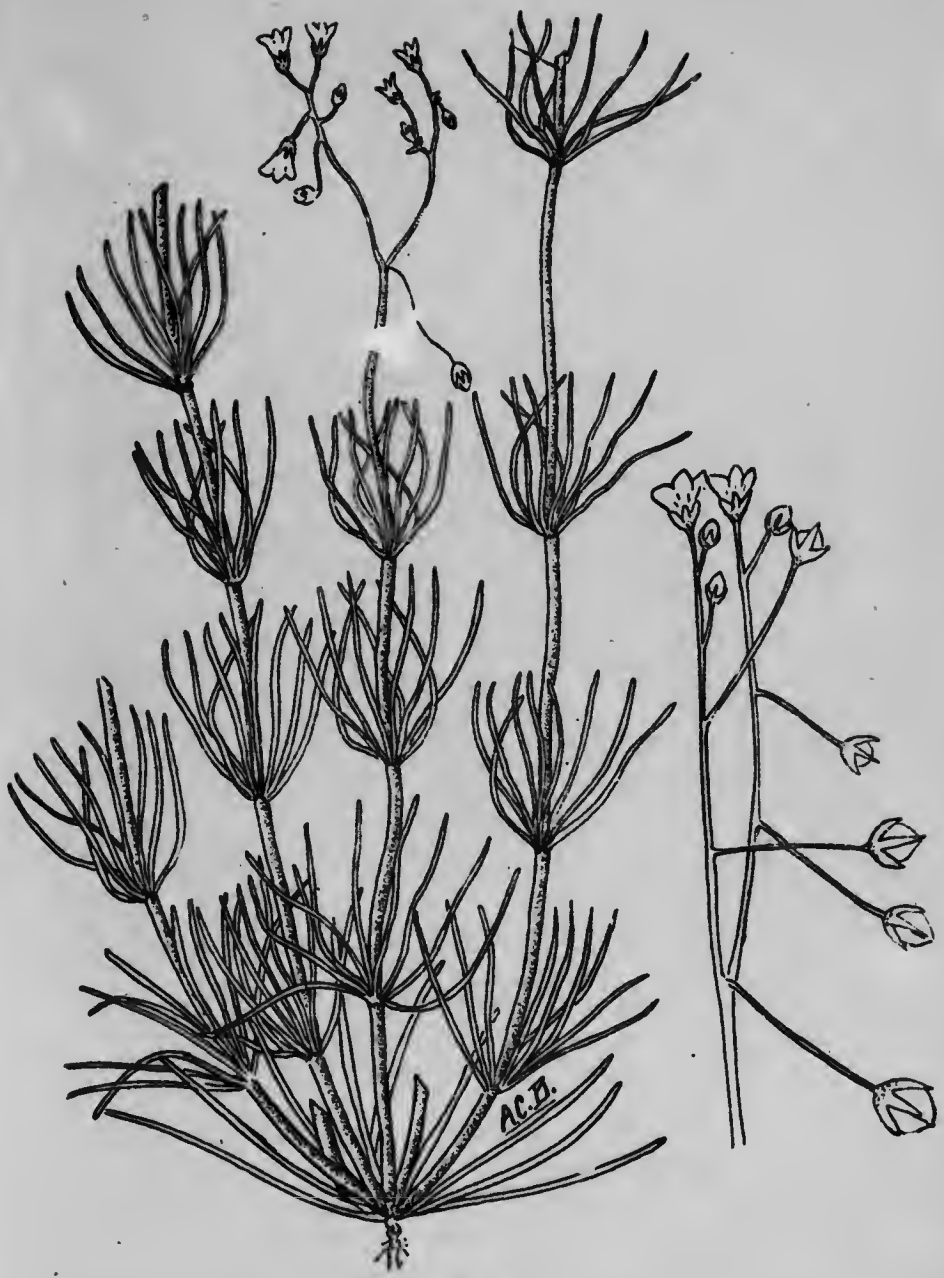

FIG. 12.

CORN SPURREY.

(*Spergula arvensis.*)

FIG. 13.

CORN COCKLE, OR CORN CAMPION.

Agrostemma githago (L.).

An annual adventive from Europe, about 1 to 3 feet high, with erect habit of growth. It has but few branches, and the stems are all very hairy, with whitish-green hairs. The leaves are rather long and narrow, with pointed ends. The flowers are red to purple, and the flower cup (calyx) has long lobes, three or four times the length of the petals.

The seed capsules are generally well filled with seed which is black in color and kidney-shaped, with tubercles (small conical projections) arranged in rows around the sides of the seed. (See Fig. 13.) The seed is about 1-8 in. across. An average plant produces about [illegible] seeds.

Time of flowering, July.

Time of seeding, August.

Dispersal—By birds, in manure, and as an impurity in seed.

It may be noted, in passing, that the seed is injurious to young chickens, and the husks of the seed often elude the miller and appear as black specks in flour, which is seriously damaged thereby. An old writer, Gerarde, says:

"What hurt it doth among corn (wheat) the spoyle unto bread, as well in colour, taste, and unwholesomeness, is better known than desired."

Eradication. Sow clean seed; and when the weed is not very thick pull it by hand. Otherwise use the same treatment as for mustard.

Fig. 13.
Corn Cockle.
(*Agrostemma githoga.*)

FIG. 14.

BLADDER CAMPION, COW BELL OR BLADDER WEED.

Silene latifolia (Mill).

This is another bad weed which is becoming a serious pest on many farms in Ontario and about which a great many enquiries have been made during the past two years. It is spread chiefly as an impurity in clover seed. A large number of the samples of clover seed, especially those of red and alsike clover, sent to the Department of Botany this past season for examination as to purity, have been found to contain the seeds of this weed. As it is a free seeder, and very difficult to exterminate once it becomes established, too much care cannot be taken to secure clover seed free from this impurity, and to dig up by the roots and burn any stray specimens that by any means may find their way on to the farm.

Description. The Bladder Campion is a naturalized, deep rooted, freely branching, perennial weed belonging to the Pink Family (*Caryophyllaceae*). It grows from six inches to two feet high. The leaves are ovate lanceolate, smooth, in pairs with their bases meeting around the stem. The flowers are white, nearly an inch in diameter and borne in loose clusters which are often drooping. The petals are two-cleft and the calyx much inflated and bell-shaped, with distinct purplish veins. It is from the inflated calyx that the plant derives its common names, Bladder Campion, Bladder Weed and Cow Bell. The capsule or "seed pod" is enclosed by the inflated calyx and opens at the top by 5 short recurved teeth. This weed flowers from June to August and matures seed from July to September. Large quantities of seed are produced. They are about 1-16 of an inch in length, irregularly kidney-shaped, light brown to dark grey in color, the surface covered with regularly arranged rows of tubercles. Typical seeds show a marked depression at the scar. This character, and the more conical shape of the tubercles, make it possible for a careful observer to distinguish them form the seeds of the Night-flowering Catchfly and White Cockle, which they resemble very closely.

Eradication. The roots of this pest are very long, thick, and much branched. A good-sized plant will have a root over two feet long with numerous deep rootstocks. A weed with such an underground root system is necessarily hard to combat. Some means must be taken by which the deep roots and rootstocks can be destroyed. Small patches should be carefully dug out early enough in the season to prevent seeding, taking pains to get every piece of the root and rootstocks. Badly infested fields should be plowed deeply immediately after harvest; and then thoroughly cultivated and cross-cultivated with the broad-shared cultivator in order to cut up and weaken the underground root system. The following spring continue this deep cultivation at intervals of about two weeks until it is time to put in a hoed crop, which must be kept thoroughly clean in order to be effective.

FIG. 14.

BLADDER CAMPION.

(*Silene latifolia.*)

FIG 15.

WHITE CAMPION, OR WHITE COCKLE.

Lychnis alba (L.).

A biennial weed introduced from Europe, with hairy and branchin stems from 1 to 3 feet high. Like the Night-flowering Catchfly, it ha a viscid secretion, which attracts many insects. The leaves are oblon with acute tips. The flowers are in loose panicles, white or pink i color, and nearly ¾ in. broad. As a rule, they open at night, and remai so until the morning of the following day. The pod has short teet around the top, which curl back when dry, and the seeds are distribute by the winds swaying the stem, when the seeds drop out. In wet weathe these teeth straighten out and completely close the opening at the top.

The seed (Fig. 15) is grey in color and kidney-shaped, wit tubercles regularly disposed over the surface. An average pistillate plan produces 10,000 seeds.

Time of flowering, June-August.

Time of seeding, July-August.

Dispersal—By wind and as an impurity in seeds.

Eradication. Exercise great care in cleaning seed grain, and examin all purchased grain with a sharp lookout for this seed. If the weed b on the farm, follow the method outlined for Fox-tail (Fig. 1).

COW COCKLE OR COW HERB.

Saponaria Vaccaria (L.).

A weed common in grain fields in the West. The seed is often foun in grain from the West. During the past few years it has been found i many parts of Ontario, but has not yet become a serious pest in thi Province. It is a smooth, glaucous, annual plant, from 1 to 2 feet high The leaves are oval lance-shaped, opposite and clasp the stem at the base Flowers are bright pink, about ½ inch in diameter. Seed pod is enclose in the inflated, 5-angled calyx and contains about 20 black, spherical seed about 1-12 inch in diameter, with the surface minutely pitted.

Time of flowering, July; seeds ripe in August.

Dispersal—by seeds only.

Eradication. The plant being conspicuous is easily hand pulled. Fal and spring cultivation will do much to clean badly infested fields.

The Night-flowering Catchfly (*Silene noctiflora*, L.), resembles the Bladder Campion; but it is an annual, tall and very leafy, with a viscid secretion all over its stem, often so profuse that the stems and leaves are covered with small insects entangled in it. It opens at night and possesses a fragrant smell. It is not so bad a weed as its relative, the Bladder Campion. In Fig. 14 are shown the seeds of these two plants, natural size and enlarged. That on the left is Bladder Campion, that on the right is the Night-flowering Catchfly.

FIG. 15.
WHITE COCKLE.
(*Lychnis alba.*)

PURSLANE FAMILY (*PORTULACACEAE*).

FIG. 16.

PURSLANE, OR PURSLEY.

Portulaca oleracea (L.).

Purslane is pre-eminently a garden weed and is readily recognized by its fleshy leaves and stem, which lie prostrate on the ground. It is an annual.

The stems are red, and the leaves wedge-shaped and clustered at the ends of branches. The flowers are bright yellow, about ¼ in. across and open only during full sunlight for a few hours in the morning. The seeds (Fig. 16), in small capsules, are black, kidney-shaped, and extremely small. An average plant produces 60,000 seeds.

Time of flowering, July, until frost.

Time of seeding, August, until frost.

Dispersal—By seeds.

Purslane has been used as hog feed in very dry seasons, but the cost of gathering it is too great.

Eradication. Careful hoeing and constant cultivation. The latter should be as early as possible. The same treatment should be followed as that outlined for Foxtail (Fig. 1).

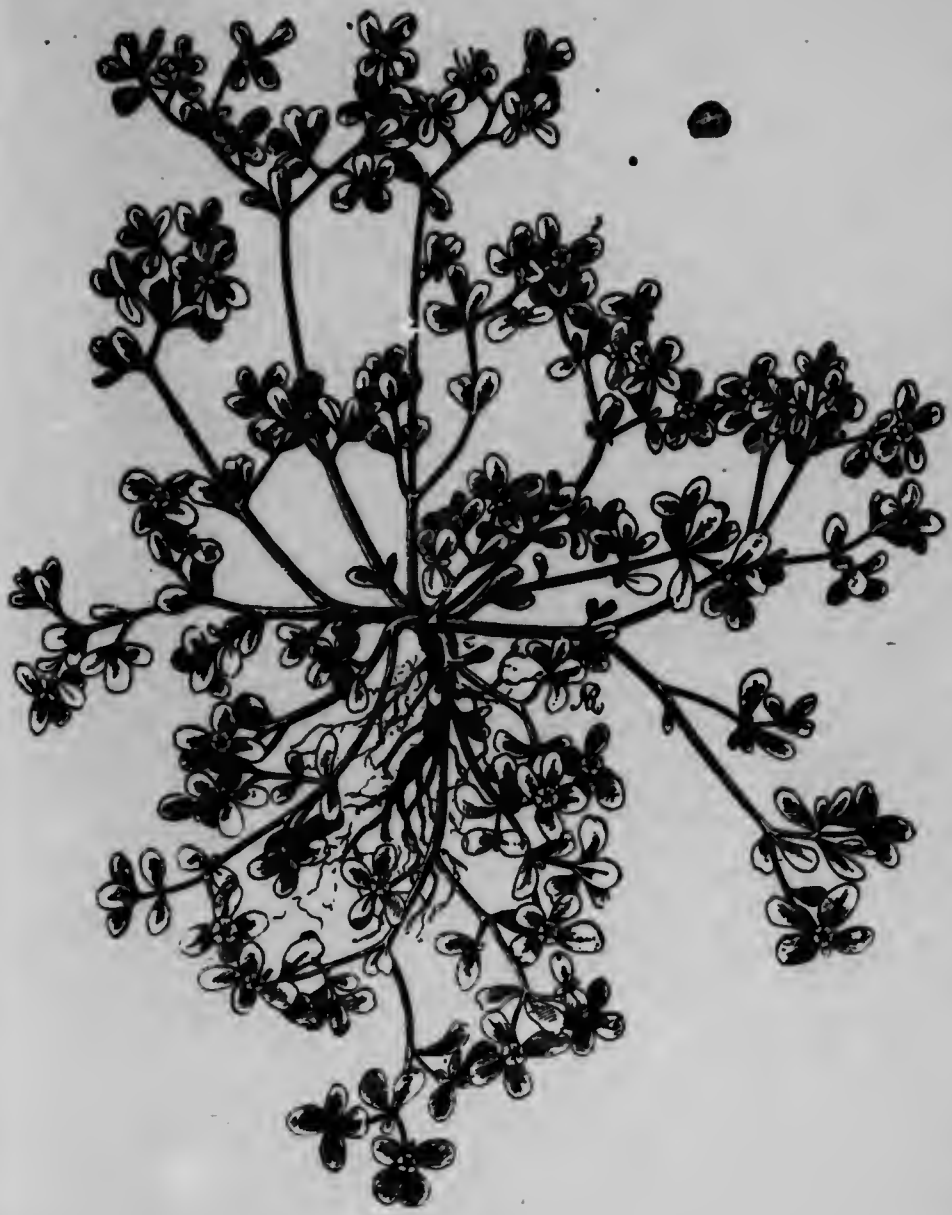

FIG. 16.

PURSLANE.

(*Portulaca oleracea.*)

THE BUTTERCUP FAMILY (*Ranunculaceae*).

FIG. 17.

TALL BUTTERCUP, TALL CROWFOOT, MEADOW BUTTERCUP.

Ranunculus acris (L.).

A noxious weed in low meadows and pasture lands. It crowds out the grass and cattle will not eat it on account of its hot tasting, blistering juice. It is seldom troublesome on well drained land under a short rotation of crops.

An introduced perennial weed with fibrous roots and an erect, somewhat hairy stem. The leaves are three-parted with the divisions again three-cleft with deeply lobed segments. Flowers are produced from early in June until frost. They are bright yellow in color and conspicuous. The dry seed-like fruits are in globose heads.

Time of flowering, June to September; seed ripe by July.

Dispersal—By seeds.

Eradication. When possible the land should be well drained and brought under cultivation, and not seeded down again until the weed has disappeared. On pasture lands which cannot be cultivated the weed should be cut closely two or three times each year; once early in June and again in July or August. This treatment to be successful must be repeated for two or three years.

FIG. 17.
TALL BUTTERCUP.
(*Ranunculus acris.*)

THE MUSTARD FAMILY (*CRUCIFERAE*).

Fig. 18.

Penny-cress, Bastard-cress, French Weed, Wild Garlic, or Stink-weed.

Thlaspi arvense (L.).

A winter annual, introduced from Europe, and a very bad we It is very abundant in Manitoba, and is becoming rather common Ontario. It grows as an erect plant, with a number of branches fr the upper part. The leaves are numerous during the first of the seas and clasp the stem by ear-line lobes. The flowers are white and sm with spreading flower stalks. The pods which succeed the flower very characteristic. They are nearly orbicular, about half an i broad, quite flat, with a broad wing all around, and notched at the t Fig. 18 shows this peculiarity. Each pod produces about twelve see which are dark brown to black and oval in shape, with curved lines. average plant produces about 20,000 seeds.

The plant has a peculiar odor, resembling that of garlic, hence so of the common names. The seed also has a very pungent taste. Wh eaten by milch cows, it imparts a disagreeable flavor to the milk.

Time of flowering, May-September.

Time of seeding, June-September.

Dispersal—Chiefly by the wind.

Eradication. Continuous growing of hoed crops with thorou cultivation thereof, followed by heavy seeding with rye. In places wh the weed is very thick, mowing and burning is a good remedy. T method outlined for eradicating Mustard is applicable to this weed.

Fig. 18.
Penny-cress.
(*Thlaspi arvense.*)

FIG. 19.

PEPPER GRASS, OR TONGUE GRASS.

Lepidium apetalum (Willd.).

A native annual which grows from six inches to a foot and a ha high. The stem usually has many branches, and the lower leaves te minate in a large lobe (with small lateral ones), with edges slightly cu in along the margin. The upper leaves are tapering. The flowers ar small and white, with slender spreading flower stalks. The seed poc are round, with a very small wing at the top and a notch at the extremity The end of a branch with seed pods is shown nearly natural size i Fig. 19.

The seeds are reddish brown, flat and oval in shape, and 1-16 in long. The average plant produces about 18,000 seeds.

Time of flowering, June-August.

Time of seeding, July-September.

Dispersal—By birds and as an impurity in clover seed.

Eradication. Be careful to prevent the plants from seeding, and do not plow them under when half ripe, as many of the seeds will germinate even though partially matured. Pull and burn where only a few plants exist, and when they are numerous use the method employed for the eradication of Mustard.

FIG. 19.
PEPPER GRASS.
(*Lepidium apetalum.*)

FIG. 20.

FIELD PEPPER GRASS OR COW CRESS.

Lepidium campestre (Br.).

This is a comparatively new weed in Ontario, about which many enquiries have been received during the past few years. From information gathered from correspondents it seems certain that it has been spread as an impurity in clover seed.

Field Pepper Grass or Cow Cress is an introduced annual or biennial weed belonging to the Mustard family (*Cruciferae*). It grows from 1 to 2 feet high and branches freely above. The basal leaves are petioled, oblong and entire; stem leaves spear-shaped, entire or slightly toothed and clasping the stem by their arrow-shaped bases. Flowers are small, white or yellowish in color. The seed pods are broadly ovate, boat-shaped, being rounded below and hollowed out above. They stand out stiffly from the stem on pedicels of about their own length. The seeds are reddish brown in color, about 1-12 of an inch long, sharply egg-shaped, rounded or somewhat flattened, and the surface is granular and slightly scurfy.

Eradication. Hand pull small patches. Cut clover early enough to prevent seeding. Plow up badly infested fields, and put in a hoed crop for one season.

Fig. 20.

Field Pepper Grass or Cow Cress.

(*Lepidium campestre.*)

FIG. 21.

SHEPHERD'S PURSE.

Capsella bursa-pastoris (L.).

A winter annual, naturalized from Europe, with a long, deep, tap root. The root leaves are lobed and form a large rosette which lies close to the ground, and in this state it passes the winter. The following spring a more or less branched stem arises, with arrow-shaped leaves thereon. The flowers are very small and white in color, and are much less conspicuous than the seed vessels, which are triangular in shape, and are attached to the stalk or pedicel at the lower apex of the triangle. From the character of these pods, the plant obtains its scientific and common name. The triangular pod is divided down the centre by a partition, forming two cells, each of which contains from 10 to 12 seeds (Fig. 21). In size the plant varies greatly from a few inches to two feet, depending on the soil and locality. But even a very diminutive plant produces many seeds. The seed is very small, light brown in color and oblong in shape (Fig. 21). An average plant produces over 50,000 seeds. Fig. 21 shows shape of seed, also the arrangement of seeds in the pod.

Time of flowering, early spring till the beginning of winter.

Time of seeding, early spring till the beginning of winter.

Dispersal—As an impurity in grass seed; also by birds, as the pods when ripe open and drop the seeds, which are eaten by birds, and often evacuated without digestion or injury.

Eradication. It easily succumbs to cultivation; and as the plant spreads only by seed, persistent effort should be made to prevent seeding.

FIG. 21.
SHEPHERD'S PURSE.
(*Capsella bursa-pastoris.*)

FIG. 22.

FALSE FLAX, OR GOLD OF PLEASURE.

Camelina sativa (L.).

This weed probably came to this country in imported flax seed. I Europe it is cultivated for the fine oil extracted from the seed, which i used in feeding cattle. Its common name arose from its suppose resemblance to flax.

An annual and winter annual, with simple or branching stems; th lower leaves are long, with a stem, or petiole; and the upper ones clas the stem with arrow-shaped bases. The flowers are numerous, yellow and somewhat inconspicuous. The seed vessel, or pod, is pear-shape or globular, with a small projection from the upper end. The little stalk holding the pods are slender and spreading or ascending. The seed i brown and larger than that of Shepherd's Purse. (Fig. 22.) An averag plant produces about 40,000 seeds.

Time of flowering, June-August.

Time of seeding, July-August.

Dispersal—As an impurity in flax and clover seed, and occasionall in grain.

Eradication. Plow lightly as soon as the crop is harvested. Harrow and then cultivate frequently throughout the autumn, to destroy th young seedlings. It is important that this autumn cultivation should b thorough. Grow a hoed crop the following year. The rotation of crop should be modified in the infested fields by dropping winter wheat ou for a time. Grass seed should be sown along with the spring wheat o barley.

FIG. 22.

FALSE FLAX.

(*Camelina sativa.*)

FIG. 23.

BALL MUSTARD.

Neslia paniculata (Desv.).

A weed of European origin, common in grain fields in the western provinces and now becoming frequent along railway lines and in waste places in Ontario.

A slender annual or winter annual from 2 to 3 feet high. Leaves oblong, pointed and clasping the stem at the base. Flowers small, orange yellow in color, in long, slender terminal clusters (racemes). Pods round, veiny, ridged and containing a single yellow seed. They do not split open and are commonly taken for the seeds. They are frequently found in seed grain and screenings from the West.

Eradication. Avoid sowing seed grain containing the "seeds" of this weed. Hand pull and burn when in small quantities. Badly infested fields should be given thorough early after-harvest cultivation, followed by spring cultivation and a hoed crop next season.

FIG. 23.
BALL MUSTARD.
(*Neslia paniculata.*)

FIG. 24.

WILD RADISH.

Raphanus raphanistrum (L.).

This is a weed of European origin which is a serious pest in th Maritime Provinces and which has recently been introduced into Ontari It is an annual and winter annual from 1 to 2 feet high. In genera appearance it is like the Wild Mustard, but its yellow flowers hav purplish veins on the petals and the pods are much more jointed in appear ance. The seeds are 1-10 of an inch long, light reddish brown, oval i outline, and with the surface finely roughened.

Time of flowering, June to September; seeds ripe by August.

Dispersal—By seeds.

Eradication. Hand pull when it first appears to prevent it fron spreading. If it becomes very plentiful, follow the method of croppin outlined for Wild Mustard.

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FIG. 24.
WILD RADISH.
(*Raphanus raphanistrum.*)

FIG. 25.

WILD MUSTARD, CHARLOCK, OR HERRICK.

Brassica arvensis (L. Ktze.).

Among the worst weeds in Ontario is the Wild Mustard, an annu naturalized from Europe, with fibrous roots and erect habit of growt The stem is rough, with stiff hairs somewhat scattered over the surfac The branches arise from the upper part of the stem and bear oblo leaves and the lower leaves have one terminal large lobe and sever smaller lateral ones (lyre shaped). The flowers are yellow, showy, a about ⅔ in. broad, with stout flower stalks, which are more noticeab when the plant is in fruit. The pods, which appear on the lower pa of the stem whilst the top is still in flower, are from 1 to 2 inches lon and are either spreading or ascending.

The shape of the pod is characteristic; it is constricted between t seeds, thus giving the appearance of a rounded enlargement where ea seed is borne. This appearance is termed "knotted." The pod te minates in a two-edged beak, and the two valves of the pod are strong veined or ribbed.

The seed (see Fig. 25) is black, 1-10 in. in diameter, perfectly spher cal, and very much like rape or turnip seed, and it retains its vitali for a long time when buried in the soil. An average plant produc 15,000 seeds.

Time of flowering, June-September.

Time of seeding, July-September.

Dispersal—By birds and implements, but chiefly as an impurity i seed.

Eradication. Owing to the great vitality of the seed, Mustard a very hard weed to eradicate. The seeds, once in the ground, live fo years, and continue to germinate as they are brought near the surfac Hence it takes patience, a great deal of labor, and a long time to get ri of the weed, when it once gets possession of the land. When present onl in small amounts, hand-pulling is the best method, provided the pullin is done before seeds have formed; and as persons pulling in a hurr cannot wait to examine for seed, it is best to put the weeds, as they a pulled, in bundles where they can be burned when dry.

When fields are overrun with the weed, it is best to proceed as fo lows: Harrow stubble-ground early after harvest, or gang-plow an harrow. As soon as the seeds have had time to sprout, cultivate tho oughly; repeat cultivation at intervals; and rib up with a double mould board plow the last thing in the fall. Put in a hoed crop, either roo or corn, the following spring, and cultivate it thoroughly throughou the growing season. Cultivate and harrow well two or three times aft roots or corn, having first run the plow along each row of corn roo to cut the roots and turn them up; and rib up before the frost. (If th

FIG. 25.
MUSTARD.
(*Brassica arvensis.*)

plow is used after roots or corn, it is likely to bring more seed to the surface.) Sow a crop of grain the following spring and seed with clover. Pull weeds by hand out of the grain crop; take a crop or two of hay, or pasture; and break up the clover sod, treating it as outlined in the note to Mr. Rennie's method of cleaning land. (See page 138.) When necessary at any stage in this method, use a grubber or subsoil plow to stir the soil to a greater depth than is reached by the surface cultivation.

Spraying with Chemicals.

Repeated tests have proved that solutions of blue stone (blue vitriol, or copper sulphate) or of green stone (copperas or iron sulphate) can be used successfully to destroy Mustard in cereal crops without injury to the standing grain.

The experiments conducted by the Botanical Department would indicate that iron sulphate is on the whole more satisfactory for this purpose than copper sulphate. A 20 per cent. solution of iron sulphate should be used (80 lbs. to 40 gallons of water) and the field should be sprayed on a bright, sunny day when the young Mustard plants are well up and just about to come into bloom. If the solution is applied too late some of the older plants will not be destroyed and may produce seeds, and the results, therefore, will not be entirely satisfactory. If copper sulphate is used a 2 per cent. solution (1 lb. in 5 gals. of water) is sufficiently strong. Stronger solutions would be apt to injure the crop.

An ordinary barrel sprayer with a hand pump or a potato sprayer with a broad-cast attachment can be used to apply these solutions. Further information on spraying to kill Mustard may be had by applying to the Botanical Department, O. A. C.

Fig. 26.

Hare's-ear Mustard.

Conringia orientalis (L.) (Dumort).

A weed which is quite general throughout the West, in grain fields, on stubble and by roadsides; spreading rapidly. It has been found in one or two places in Ontario. An annual and winter annual with a straight, slightly branched stem from 1 to 3 feet high. Whole plant smooth and when young covered with a bloom like that of a cabbage. Leaves somewhat fleshy, oblong oval, entire and clasping the stem by two rounded lobes. They resemble in shape a hare's or rabbit's ear, hence the common name, Hare's ear Mustard. Flowers are creamy white, about ¼ inch across. Pods are four-sided and 3 to 4 inches long. Seeds are dark reddish brown, 1-12 of an inch long, somewhat wheat-shaped, with the surface granular roughened.

FIG. 26.
HARE'S-EAR MUSTARD.
(*Conringia orientalis.*)

Time of flowering, July; seeds ripe in August and September.

Dispersal—By seeds.

Eradication. Hand pull small patches when the weed first makes its appearance. If a field becomes badly infested, try thorough, early, after-harvest cultivation.

Tumbling Mustard.

Sisymbrium altissimum (L.).

This Mustard, which is troublesome in the West, is now found in many parts of Ontario, though it has not yet become a pest in cultivated fields in this Province. The fact, however, that it produces great quantities of seed indicates that if neglected it may become a serious nuisance. It is therefore advisable that a watch be kept for it in order that any plants which appear in cultivated fields may be destroyed before they mature their seeds.

Tumbling Mustard is a bushy-branched annual or winter annual, from 2 to 5 feet high. The lower leaves are pinnatifid with the segments pointing backward (runcinate); the upper leaves are very variable in size and outline but are all deeply pinnatifid with narrow segments. The flowers are numerous at the end of the branches, pale yellow, and about ⅓ of an inch in diameter. They are succeeded by long, slender pods, each of which contains numerous seeds. The plants, when mature, break off near the surface of the ground and are rolled about by the wind, scattering their seeds as they go. It is from this tumbling habit that the plant gets its name, Tumbling Mustard. The seeds are very small, less than 1-24 of an inch in length. They are greenish yellow to olive brown in color and somewhat U-shaped. Being so very small they are not readily crushed by grinding and thus frequently find their way unharmed into chop. It has been estimated that a single plant may produce a million and a half seeds, but fortunately they do not appear to have the vitality of the seeds of Field Mustard.

Time of flowering, June to September; seed ripe in August.

Dispersal—By seeds.

Eradication. Pull stray plants along the roadsides and in waste places before they mature. Hand pull in fields unless very abundant. Badly infested fields may be cleaned by fall cultivation and harrowing over spring grain to destroy the seedlings.

Fig. 27.

Green Tansy Mustard.

(*Sisymbrium incisum* (Engelm.), var. *filipes* (Gray).

A common weed in grain fields in the West. In Ontario it is found chiefly along railways and in waste places. During the past year (1910) it was reported as growing as a weed in cultivated fields from one county

FIG. 27.
GREEN TANSY MUSTARD.
(*Sisybrium incisum.*)

in Ontario. It is a biennial weed and produces the first season a rosett of finely divided leaves which lie on the ground; the second season i produces a much branched stem from 2 to 4 feet high. Leaves brigh green, much divided into fine segments. Flowers bright yellow, ⅛ o an inch across, borne in elongated clusters (racemes) and succeeded b narrow, smooth, slightly curved pods from ½ to ¾ inch long, on slender spreading stems. Seed is brownish red, about 1-25 of an inch long, somewhat oblong in shape.

Time of flowering, July; seeds ripe in August.

Dispersal—By seeds.

Eradication. Hand pull. Thorough fall and spring cultivation wil clean badly infested fields.

FIG. 28.

WORMSEED MUSTARD, OR TREACLE MUSTARD.

Erysimum cheiranthoides (L.).

A native weed, which seems to be spreading rapidly through the Province. Many specimens have been sent here for examination during the past year.

An annual or winter annual with erect and branching stems from 8 in to 2 ft. high. The foliage is bright green and abundant. The leaves are long, tapering at the base into a short petiole, and they are covered with T-shaped hairs. The flowers are yellow and about ¼ in. across. The little stalks (pedicels) holding the pods, come out from the stem obliquely, but the pod stands erect on the pedicel, parallel with the stem. The pod is about an inch long and four-angled, with one row of seeds in each cell. The seeds are 1-16 in. long and light brown in color, with a furrow on one side. An average plant produces 25,000 seeds.

Seeds give a bitter taste to feed containing them.

Time of flowering, June-July.

Time of seeding, July-August.

Dispersal—Frequently as an impurity in clover seed.

Eradication. Hand pulling and burning is the best remedy when the weed occurs in small quantities; but where there is much of it, the following procedure is advised: Harrow stubble-ground early after harvest, or gang-plow and harrow. As soon as the seeds have had time to sprout, cultivate; repeat the cultivation, and rib up the land with a double mould-board plow the last thing in the fall. Put in a hoed crop, either roots or corn, the following spring, and cultivate thoroughly throughout the growing season. Cultivate after the roots or corn, sow a crop of grain, and seed with clover. If not too much, pull weeds by hand out of the growing crop.

FIG. 28.
WORMSEED MUSTARD.
(*Erysimum chieranthoides.*)

Rocket, or Salad Rocket.

Eruca sativa (Lam.).

This is a weed recently introduced into Ontario. It is a native of Europe, and has been recently brought here in alfalfa seed. At a little distance it would easily be mistaken for Wild Mustard or Charlock, which it resembles closely in size, habit of growth, foliage and flowers. It requires, however, only a glance to distinguish it. The leaves are more or less deeply pinnately lobed. The flowers are light yellow and the petals are distinctly veined with purple. When the pods are present the plant can be known with certainty, for the upper third of these is a flat empty beak. As the plant has been introduced so recently we have little indication as to whether it is likely to prove a bad weed or not. It is not considered a bad weed in its native country, but that is not very safe ground for us to go upon, since some of our worst weeds are of little importance in the country of their origin. So far we have no information as to the persistence of the weed after the breaking up of the alfalfa and the putting in of a hoed crop. We should be glad if those whose attention is called to the matter would make observations to this end and so extend our exact knowledge of the habits of the plant.

Since it is a close relation to the Wild Mustard and is evidently a free seeder we think it advisable that farmers should take due precautions against it. We would recommend hand pulling before it goes to seed if it is present only in small quantity in grain. When in the hay crop and more numerous we would recommend cutting the alfalfa before the seeds of the Rocket can mature. The plant is an annual and if kept from seeding must rapidly die out. Too great care cannot be exercised in selecting seed free from the seeds of the weed.

THE ROSE FAMILY (*ROSACEAE*).

Fig. 29.

Rough Cinquefoil.

(*Potentilla monspeliensis* (L.).

A native annual weed found frequently in meadows and hay fields in some parts of Ontario. Stem erect, branching, rough-hairy. Leaves compound, with 3 somewhat oblong, oval, toothed leaflets. Flowers bright yellow, in terminal clusters (cymes). The seeds are light brown, about 1-30 of an inch long, blunt and slightly curved, with branching longitudinal veins on the surface.

Time of flowering, June to July; seeds ripe July to September.

Dispersal—By seeds, which are frequently found in timothy seed.

Eradication. This weed will not persist in cultivated crops. Repeated close cutting in hay fields, meadows and waste places will destroy it.

Fig. 29.

Rough Cinquefoil.

Rough-fruited Cinquefoil.

Potentilla recta (L.).

A perennial weed with larger, paler, yellow flowers than the last and 5 to 7 leaflets in each leaf. It is reported as being troublesome in meadows and hayfields in some parts of Ontario. Breaking up the field and putting it under a cultivated crop should clean out this weed.

THE PEA FAMILY (*LEGUMINOSAE*).

White Sweet Clover.

Melilotus alba (Desr.).

This and the yellow species (*Melilotus officinalis*) are found commonly in vacant grounds and neglected fields about cities and along roadsides. They are tall, rank growing plants, and thrive best on heavy clay soils. They are biennials and produce the second year tall, tough, much branched stems which bear the sweet scented flowers so attractive to honey bees. These plants have the redeeming features of being nitrogen gatherers and good soil formers.

Eradication. Keep closely cut for two years in succession. Plants which are cut off early in the season may grow again and produce seeds before frost comes. Two or three cuttings are therefore often required in a single season.

Wild Tares or Perennial Vetch.

Vicia cracca (L.).

This is a perennial plant with a deep system of root-stocks. It is often reported difficult of eradication. The flowers are blue, and there are 10 to 12 pairs of leaflets to each compound leaf. This plant appears to persist most tenaciously in damp soil. The same cultivation which is used in controlling the Canada and Perennial Sow Thistles will subdue the Perennial Vetch.

THE EVENING PRIMROSE FAMILY (*ONAGRACEAE*).

Fig. 30.

Common Evening Primrose.

Oenothera biennis (L.).

A tall, stout, native biennial weed found frequently in Ontario in hay fields and on the edges of cultivated fields. The leaves are from 1 to 6 inches long, oblong to lance-shaped with wavy, slightly toothed margins.

FIG. 30.
COMMON EVENING PRIMROSE.
(*Oenothera biennis.*)

Flowers open in the evening and are large and bright yellow in color. Seed pods lie close to the stem and are about an inch in length. Seeds are reddish brown and irregular in outline, 4 to 5 sided.

Time of flowering, June to September; seeds ripe by August.

Dispersal—By seeds.

Eradication. Spud out plants on the headlands and in the fence corners. Never troublesome when a field is brought under cultivation.

THE PARSLEY FAMILY (*UMBELLIFERAE*).

FIG. 31.

SPOTTED COWBANE, OR WATER HEMLOCK.

Cicuta maculata (L.).

A weed of wet, marshy places. Cattle are frequently poisoned by eating the roots of this plant, especially early in the spring when pasture is scarce.

A smooth perennial from 2 to 5 feet high. Leaves compound, of 2 or 3 divisions, the stalks with expanding bases which clasp the stem, the leaflets lance-shaped and sharp-toothed. The flowers are small, white. and in flat topped clusters (umbels). The root consists of a number of spindle-shaped "tubers."

Eradication. Watch marshes and low places for this weed and hand pull any plants that are found. This is easily done if the roots are first loosened with a spud or other implement. Be sure to destroy the plants after pulling them.

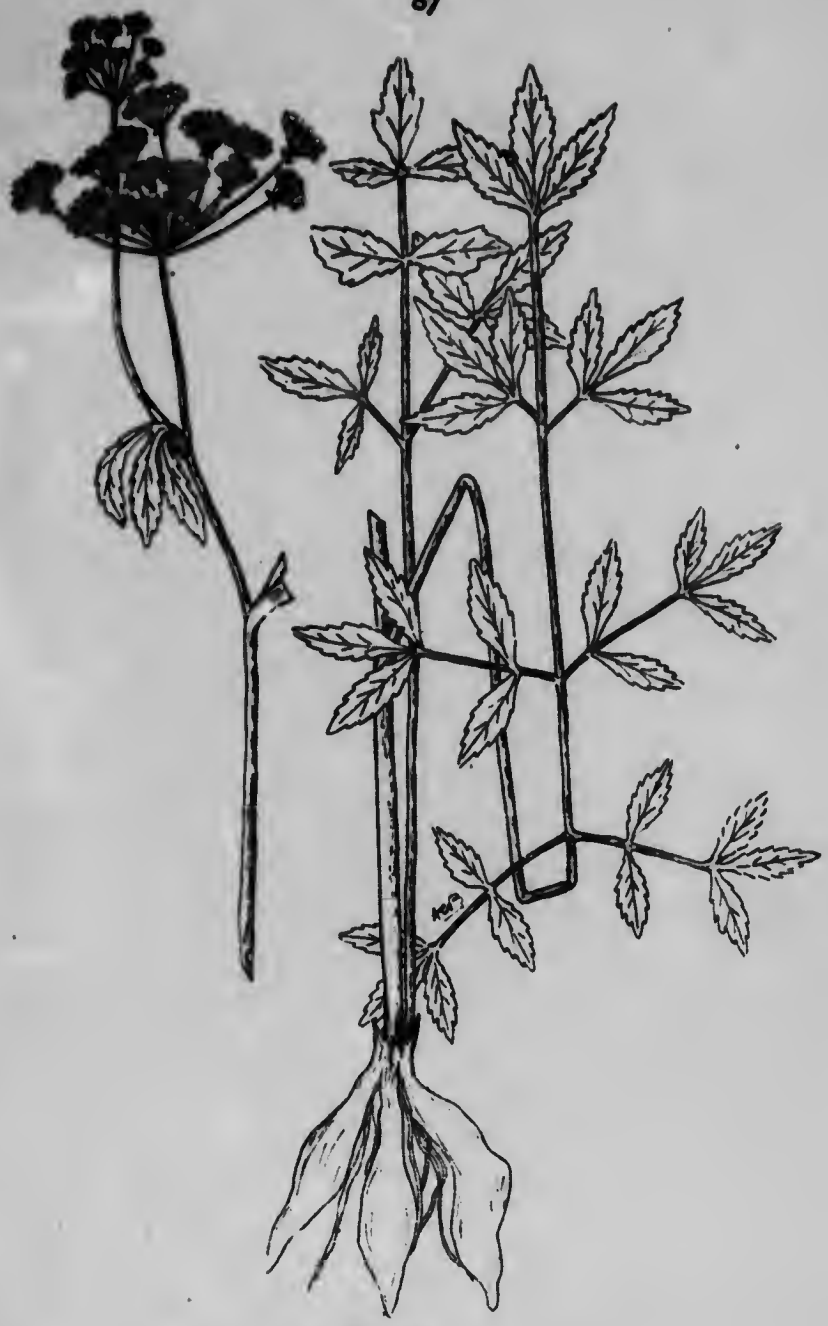

FIG. 31.

SPOTTED COWBANE OR WATER HEMLOCK.

(*Cicuta maculata.*)

MICROCOPY RESOLUTION TEST CHART

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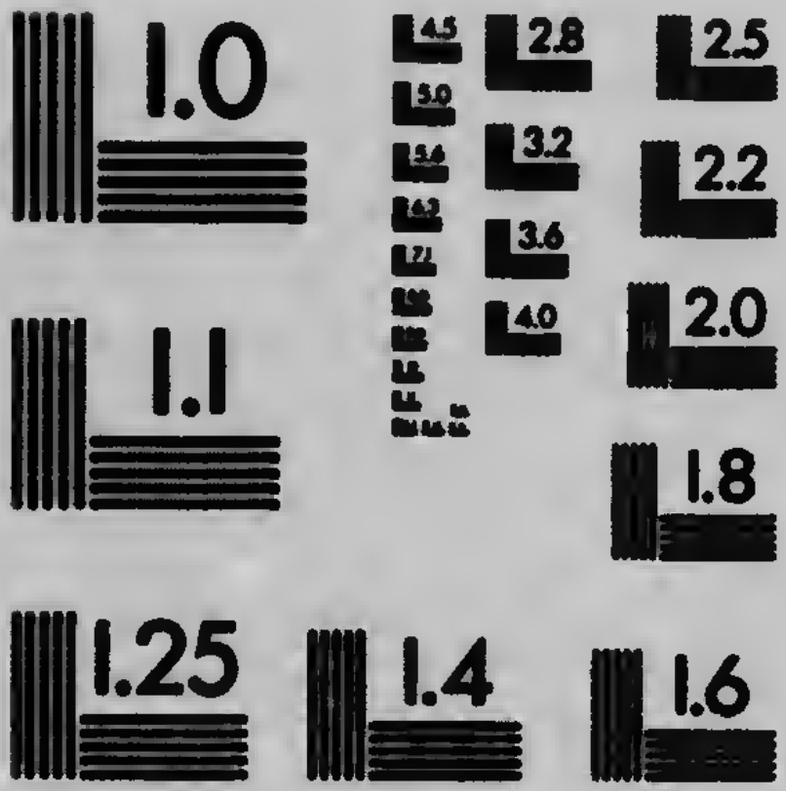

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FIG. 32.

WILD CARROT, BIRD'S NEST, OR DEVIL'S PLAGUE.

Daucus carota (L.).

This is a biennial, naturalized from Europe, with a deep, strong tap root, a bristly stem, and much divided leaves like the cultivated carrot. The clusters of flowers are in compound umbels which resemble bird-nest cavities.

Time of flowering, July-September.

Time of seeding, August-December.

Dispersal—By seeds carried by wind and animals.

Eradication. Spudding is quite effective when the roots are cut before blossoming the first season. When the field becomes badly infested it should be plowed and cultivated and treated to a hoed crop, as described for the treatment of Blue-weed (page 94).

MILKWEED FAMILY (*ASCLEPIADACEAE*).

MILKWEED, OR SILKWEED.

Asclepias syriaca (L.).

This plant quite frequently appears in cultivated crops in Ontario, and once it becomes established its extermination is a difficult task.

It is a deep-rooted perennial weed, with a stout stalk from 2 to 5 feet high covered with soft hairs. Leaves large, lance-oblong to broadly oval with fine down on the under surface. Flowers dull purple to white in color and borne in compact clusters (umbels). Fruit, a large pod which opens down one side (follicle) to allow the white plumed seeds to escape.

Eradication. Cut early to prevent from seeding. Spud out scatt[illegible] plants in meadows and grain fields. If a field is very badly infes[illegible] break it up and follow one of the methods suggested for Perennial Sow Thistle.

FIG. 32.
WILD CARROT.
(*Daucus Carota L.*)

THE MORNING GLORY FAMILY (*CONVOLVULACEAE*).

Fig. 33.

Bindweed.

Convolvulus arvensis (L.).

A very troublesome weed which winds its tough and curling stems around the stalks of various plants, partially chokes them, and thereby hinders their growth. It is a perennial with a very extensive creeping root which penetrates far into the soil, and any piece of the root possessing one or more buds is capable of starting new plants; hence it is necessary to clean implements very thoroughly after they have been used in a field containing this weed. The stems are branched and either trail on the ground or climb by twisting around some other plant. The leaves are rather small, with 2 to 4 lobes at the base, giving them an arrow-headed shape. The flowers are white or rose-colored and 1 inch across. The seeds, three in number, are large, black, and angular, and are held in a spherical capsule (Fig. 33). An average plant produces about 160 seeds.

Time of flowering, June-September.

Time of seeding, August-October. Often no seed is produced.

Dispersal—Chiefly by means of its creeping roots; sometimes as an impurity in seed grain.

Eradication. This is a very difficult weed to eradicate, and careless cultivation only increases the trouble by carrying the roots from place to place. Salting is recommended by some practical farmers who have succeded in eradicating this very troublesome pest; but we cannot speak from experience as to the value of this method of treatment.

The weed may be kept in check by the frequent introduction of well-cared-for hoed crops into the rotation, and the shorter the rotation the better. The later sown hoed crops, especially rape, are more effectual than those sown earlier in the season. Before the hoed crop is sown, the weed may be kept in check by going frequently over the field with a broad-share cultivator, so as to cut all the plants an inch or two below the surface without bringing up any of the creeping rootstocks. About the 1st July the land may be sown with rape in drills, say 26 inches apart, and during the early growth of the crop the weeds may be kept in check by means of the horse-hoe, with more or less hand-hoeing. If the land has been well manured or is naturally rich in vegetable matter, the rape will make a rank growth and smother some of the weeds. The rape may be pastured in the fall, and in extreme cases may be followed by another hoed crop, such as corn. If the corn is well cultivated and hoed, most, perhaps all, of the plants will be destroyed.

FIG. 33.

BINDWEED.

(*Convolvulus arvensis.*)

In some cases it may be advisable to summer-fallow, and in such cases it is best not to plow more than is absolutely necessary, but to depend mainly on the broad-share cultivator. Buckwheat sown on summer-fallow and plowed under when coming into blossom, followed by surface cultivation with broad-share cultivator, will assist very much in killing the weed. If necessary, the summer-fallow may be followed by a hoed crop.

FIG 34.

DODDER, DEVIL'S GUT, OR STRANGLE WEED.

Cuscuta epithymum (Murr.).

This weed is spreading very rapidly as an impurity in alfalfa and clover seed. It is by no means a new weed in Ontario, but during the past year has been especially abundant. Judging by the numerous samples sent in for identification, and by the host of questions asked concerning it more information is required as to its appearance, habit of growth and method of control. It is therefore discussed rather fully here.

Dodder differs from ordinary weeds in possessing no leaves. The yellow thread-like stems of the plant twine around the clover plants and send into their tissues small short rootlets, which are called suckers or haustoria. By means of these suckers the Dodder draws from the clover the food necessary for its growth and reproduction. It thus kills the clover by robbing the plant of its food and causing it to starve. The yellow thread-like stems of the Dodder first appear quite early in the season. They soon spread from plant to plant until a tangled mass of yellow threads covers a whole patch of clover. Badly infested fields may become entirely covered with this pest in a short time. On these yellow threads are produced dense clusters of small white flowers, which are succeeded by rounded, brown seed pods. Each plant produces a large number of seeds. The seeds vary in size from 1-24 to 1-15 of an inch; are grey or yellowish brown in color, vary greatly in shape, but are generally somewhat oval in outline, and the surface is dull and roughened.

Great care should be taken to secure clover seed free from Dodder seed. Alfalfa seed containing this impurity is dear at any price. Small patches should be mowed, raked and burnt early enough to prevent seeding. If by any chance some of the seeds are scattered before the patches are mowed, several thorough hoeings should be given in order to prevent any young plants from getting established. Badly infested fields should be plowed and put under a hoed crop for a season. Clover or alfalfa should not be sown in the field again for two or three years.

FIG. 34.
FIELD DODDER ON RED CLOVER.
a Flowering Cluster; *b* Cluster of Dry Seed V ssels. From a photograph. Natural size.
(Reproduced by the courtesy of the U. S. Dept. of Agriculture, from Farmers' Bulletin 306 "Dodder in Relation to Farm Seeds," by F. H. Hillman.)

THE BORAGE FAMILY (*BORAGINACEAE*).

Blue Bur, Stickseed, or Sheep Bur.

Lappula echinata (Gilbert).

A disagreeable weed on roadsides, in waste places and in pastures. The burs become matted in the wool of sheep.

An introduced annual and winter annual. Erect and branching, covered with rough hairs. Leaves linear oblong, stem-leaves without stalks. Flowers small, ⅛ inch across, pale blue in long, slender one-sided clusters. Seeds greyish brown in color, pear-shaped, about ⅛ inch long, with hooked spines around the margin.

Time of flowering, from June; seeds ripe in July.

Dispersal—By seeds.

Eradication. In pastures and waste places continued close cutting for a number of years will prevent its seeding and finally cause it to disappear. If a field becomes very badly infested, break it up and put it under a cultivated crop for a year or two. Hand pull stray specimens.

Fig. 35.

Blue Weed, Viper's Bugloss, Blue Thistle, or Blue Devil.

Echium vulgare (L.).

A biennial weed naturalized from Europe, with deep tap root, which penetrates to a great depth. During the first year, the portion above ground is a rosette of leaves; and from the centre of this, next season, bristly, hairy, and erect stems arise 1 to 2½ feet high. The leaves are oblong, 2 to 6 inches in length, with both upper and lower surface hairy. The flowers are numerous, arranged in a rich spire, and are azure blue in color. The seeds are hard and brown in color, with a broad base and angular body 1 to 8 inches long (Fig. 35). An average plant produces 3,500 seeds. The seeds are probably dispersed in winter by the wind, as they remain for a long time on the plant.

Its names, both Latin and English, are significant of the notion that it was an effectual remedy against the bite of a viper.

The weed prefers gravelly and lime soils.

Time of flowering, July-October.

Time of seeding, August-October.

Dispersal—By seeds, especially in winter, when they are blown over the snow.

Eradication. This weed gives very little trouble in arable land, if the cultivation is at all thorough. In fence corners, on roadsides, and in waste places, cutting below the crown with a spud is practically the only effective method of destroying the weed. Sometimes, however, this is impracticable, because of the number; and in such cases some special treatment, similar to that recommended for the Dock may be resorted to.

FIG. 35.
BLUE WEED.
(*Echium Vulgare.*)

FIG. 36.

HOUND'S TONGUE, DOG BUR, OR BURS.

Cynoglossum officinale (L.).

A biennial weed, with erect hairy stem, of rank growth, and much branched, 1 to 3 feet high. The lower leaves have petioles; the upper ones clasp the stem. They are 6 to 12 inches long and coverd with downy hair, and have a disagreeable odour resembling that of mice. The flowers are small and lurid purple-red in color. The fruit consists of a broad rounded bur, ¼ inch long, with one flat side and coyered with short spines which enable it to adhere to clothing or to animals (Fig. 36). An average plant produces about 600 seeds.

Time of flowering, June-August.

Time of seeding, July-September.

Dispersal—Chiefly by animals carrying the burs.

Eradication. Spud or cut deep in fall and early spring; the former to destroy the plant in its first year, and the latter to complete the destruction by removing those that escape the first cutting.

Pigeon Weed, Wheat Thief, Red Root, or Corn Gromwell (*Lithospermum arvense*, L.). A winter annual naturalized from Europe, with reddish roots. It is usually branched, and grows to a height of 12 in. The leaves are sessile, narrow, and harsh to feel. The flowers are small and white; at maturity, four small smooth seeds are produced, which have considerable vitality.

Time of flowering, from April to July.

Time of seeding, from June to August.

Dispersal—Mainly through seed grain, such as wheat, rye, timothy, and alsike clover; often spread by birds and distributed in the manure.

Eradication. Drop fall wheat from the rotation. Cultivate lightly after harvest and cause the seeds to germinate. When three or four inches high, harrow or plow them under. If this treatment is repeated each fall, wheat can again be grown.

FIG. 36.

HOUND'S TONGUE.

(*Cynoglossum officinale.*)

THE FIGWORT FAMILY (*SCROPHULARIACEAE*).

FIG. 37.

MULLEIN, OR VELVET DOCK.

Verbascum thapsus (L.).

The mullein is a weed introduced from Europe; very common in waste places, roadsides, and gravelly or sandy pastures. It is a biennial, with large, long roots, from which spring a tall and unusually unbranched stem, 2 to 6 feet high. Both stem and leaves are densely woolly all over, with branched hairs. The leaves are whitish, thick, and velvety to the touch. The flowers are yellow and arranged on densely crowded elongated spikes. The capsule containing the seeds is about ⅛ in. long, and the seeds are small, about 1-20 in. long, six-sided, with irregular ridges running lengthwise between the sides. The color of the seed is dark brown. An average plant produces 6,000 seeds.

Time of flowering, July-September.

Time of seeding, August-November.

Dispersal—As an impurity in clover and grass seed.

Eradication. Spud or cut below the crown; or dig up the roots when young; or break up the soil and grow hoed crops. It easily succumbs to cultivation.

The Moth Mullein (*Verbascum blattaria*) is a worse weed than common mullein, as it infests meadows and bears far more seed. The seed is often found as an impurity in clover and timothy. The plant itself is smooth and tender, from 2 to 6 feet high, with dentate leaves. The flower is yellow, with brown marks on the back of the petals; and the stamens have violet filaments. The seed is brown, very small, and six-sided. Treat it the same as common mullein.

In Fig. 37 are shown the seeds of the mulleins—the upper seed is the common mullein, the lower is the moth mullein.

FIG. 37.
MULLEIN.
(*Verbascum Thapsus.*)

FIG. 38.

TOAD FLAX, OR BUTTER AND EGGS.

Linaria vulgaris (Hill).

This weed has become very plentiful in Ontario, and is now found in many pastures, on roadsides and in waste places.

It is a deep-rooted, persistent, perennial weed. The stem is slender and erect, somewhat wiry, and from 12 to 18 in. high. The leaves are narrow, stalkless and scattered along the stem at very short intervals. The flowers are showy, distinctly two-lipped, about 1 in. long, bright yellow in color with orange lips and borne in a long terminal cluster (raceme). The seeds are dark brown or black in color, about 1-10 in. in diameter, flat and disc-like, with a distinct wing around a thicker central portion which is roughened with little projections.

Time of flowering, June to September; seeds ripe by August.

Dispersal—By seeds and rootstocks.

Eradication. Adopt a short rotation of crops and give thorough deep cultivation in spring and fall. Hand pull when the soil is wet in pasture lands which cannot be broken up. Break up badly infested pastures in July, keep under clean summer fallow until fall and put on a hoed crop the following season.

Fig. 38.
Toad Flax, or Butter and Eggs.
(*Linaria vulgaris.*)

THE PLANTAIN FAMILY (*PLANTAGINACEAE*).

Fig 39.

Common Plantain.

Plantago major (L.).

A weed of meadows and lawns, the seeds of which are too often found in grass and clover seed.

A perennial with a short, thick rootstock bearing numerous large, dark green, oval, long-stalked leaves close to the ground. Flowers inconspicuous, borne in long dense spikes. Seed pods oval, dividing about the middle and containing from 8 to 16 small, flat, irregularly-shaped brown seeds.

Eradication. A short rotation including a hoed crop will keep this weed in check. *"Plantain in lawns may be weeded out when the soil is firm by forcing a small implement like a chisel, with a half-rounded blade having a point like the tip of a spoon, between the soil and the fleshy crown of the weed to a depth sufficient to break the plant away from its fibrous roots without disfiguring the turf."

Pale Plantain, or Rugel's Plantain.

Plantago rugelii (Dene).

This Plantain is found as frequently as Common Plantain, from which it can be distinguished by the paler green leaves with the stalks dark purple at the base, the longer and more tapering spikes with the flowers less crowded, and the seed pods, which open below the middle and contain from 4 to 9 flat, irregularly-shaped black seeds, which are larger than the seeds of the Common Plantain.

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*"Farm Weeds of Canada," by G. H. Clark, B.S.A.

FIG. 39.
COMMON PLANTAIN.
(*Plantago major.*)

FIG 40.

PLANTAIN, BLACK PLANTAIN, RIB-GRASS, OR RIB-WORT.

Plantago lanceolata (L.).

This plant was once very generally believed to be a favorite food of cattle, yet the opinion of most agriculturists is against it. It is considered a bad weed, especially when it appears in lawns. Numerous inquirers ask what it is, and how to get rid of it. It is a perennial or biennial, with a short thick root-stock, of erect growth, or more generally lying on the ground as a rosette of leaves. At the base of the leaves there are tufts of brown hair; and the leaves themselves are long, narrow and tapering, with prominent veins, or ribs running lengthwise; hence some of the popular names. The flower-stock is slender and channelled, is without leaves and terminates in a dense spike. The stamens project from the inconspicuous flowers, giving a whitish appearance to the whole head. The seeds are enclosed in small pods, each containing two seeds. The seeds are about 1-12 of an inch long, brown and shiny, with a groove on one side, in the centre of which there is a black spot. The opposite side is rounded, as are also the ends. An average plant produces 1,200 seeds.

Time of flowering, June-September.

Time of seeding, July-September.

Eradication. If the plants are not numerous, cut below the crown with a spud. If they are, break up the field and put in a hoed crop.

FIG. 40.

PLANTAIN.

(*Plantago lanceolata.*)

THE SUNFLOWER FAMILY (*COMPOSITAE*).

FIG 41.

CANADA FLEABANE, HORSE WEED, OR BUTTER WEED.

Erigeron canadensis (L.).

A tall, hairy plant, very common in meadows. It is a winter annual. The stem is much branched, hairy, and may vary from 3 inches to 10 feet in height. The leaves are downy, from 1 to 4 inches long. The flower heads are numerous, about ¼ in. broad, with white flower rays. The seeds are small, light in color, and 1-16 in. long, with a pappus of short tufty hairs. An average plant produces 120,000 seeds (Kerner).

Time of flowering, June-September.

Time of seeding, June-September.

Dispersal—Chiefly by the wind.

Eradication. Having a small root, this weed can be easily pulled. Hence, where there is not very much of it, hand-pulling is a satisfactory means of eradication. As a rule, the weed is troublesome only in meadows, and the frequent breaking up of meadow land tends to keep it under control.

Daisy Fleabane (*Erigeron annuus*, L.) has larger and fewer flowers, ½ inch across. It is common in meadows and along roadsides from May to November.

FIG. 41.

FLEABANE.

(*Erigeron canadensis.*)

FIG. 42.

GREAT RAGWEED, OR KINGWEED.

Ambrosia trifida (L.).

A weed in Western grain fields and in waste places in Ontario. A rough, coarse-growing annual weed from 3 to 6 feet high, with large opposite leaves which are mostly three-lobed. The flowers are of two kinds, the sterile borne on tapering spikes about 4 inches in length; the seed-producing flowers grow close to the stem in clusters in the axils of the leaves at the base of the spikes; sterile flowers ¼ inch across, cup-shaped, nodding; stamens yellow and conspicuous. Seed-producing flowers inconspicuous with slender purplish pistils.

Time of flowering, July; seeds ripe by August.

Dispersal—By seeds. Wheat from districts of the West often contains Great Ragweed seed.

Eradication. Hand pulling and mowing.

FIG. 42.
GREAT RAGWEED.
(*Ambrosia trifida.*)

FIG. 43.

RAGWEED, HOGWEED, BITTERWEED, OR ROMAN WORMWEED.

Ambrosia artemisiifolia (L.).

Ragweed is an annual. The stem is much branched and slightly hairy, from 1 to 3 feet high. The leaves are very finely divided, the lower surface being of a lighter color than the upper. The flower heads are very numerous, from 1 to 6 inches long, green and inconspicuous. The flowers are yellow, 1-6 inch across, infertile in the terminal spikes, and fertile only at the base of the spikes. The seed is dark brown, with a sharp tip, around which are arranged 4 to 6 spines, 3-16 inches long. They have great vitality and remain in the soil a long time without injury. An average plant produces about 5,000 seeds. The seed has a bad taste and gives a peculiar odor to the milk of cows which eat it.

Time of flowering, July-September.

Time of seeding, August-November.

Dispersal—As an impurity in seed grain; and by wind and water, being borne long distances by freshets.

Eradication. For the eradication of this weed, special attention must be given to the fall cultivation of the soil, to prevent seeds from ripening. Gang-plow or cultivate, and harrow stubble ground immediately after harvest, and repeat cultivation at intervals until late in the fall; then plow or rib up, and follow with a hoed crop. Care should be taken with the hoed crops that no specimens of Ragweed go to seed. When in grass, go over with a mower in September or October, if any plants are likely to mature seed. Do not sow late maturing crops. Ragweed when eaten by cows causes bitterness in milk.

FIG. 43.
RAG WEED.
(*Ambrosia artemisiæ*)

FIG. 44.

YELLOW DAISY, CONE-FLOWER, BLACK-EYED SUSAN, OR NIGGERHEAD.

Rudbeckia hirta (L.).

A biennial and sometimes annual weed found in pastures and meadows. It grows about 1 to 3 feet high. The stems are sparingly branched and very bristly. The leaves are thick, hairy, oblong and tapering towards the point. The flower is about 1 in. across, with orange yellow rays or petals (10 to 20 in number) and dark purple brown discs almost spherical or cone-shaped. The seeds are dark brown, almost black, four angled, and about ⅛ in. long, with no pappus, or tuft of hair. (Fig. 44). An average plant produces about 2,000 seeds.

Time of flowering, June-August.
Time of seeding, July-September.
Dispersal—As an impurity in seed grain.

Eradication. It can generally be killed by mowing, but it is sometimes necessary to break up meadow or pasture land, as suggested in note to Mr. Rennie's method of cleaning land, and follow with a hoed crop. If this is well cared for, it will destroy all Cone-flowers.

FIG. 44.
CONE FLOWER.
(*Rudbekia hirta.*)

FIG. 45.

OXEYE DAISY, WHITE DAISY, WHITE WEED, OR POVERTY WEED.

Chrysanthemum Leucanthemum (L.).

The Oxeye Daisy is a weed naturalized from Europe, and is very closely related to the Chrysanthemum or national flower of Japan.

It is a perennial with short, thick root-stocks, possessed of much vitality. Very many stems spring from one root. It grows from 6 inches to 3 feet high. The leaves slightly clasp the stem, the lower ones, narrow, long, and toothed along the edges, the upper ones, small and without teeth. They are slightly aromatic, more perceptibly so if bruised. The flowers are 1 to 2 inches broad, on long stalks, with from 20 to 30 white rays and bright yellow disc. The seed is about 1-12 in. long and angled, with alternate white and black longitudinal ribs. It has a short point but no pappus (Fig. 45). An average plant produces 7,500 seeds.

Time of flowering, June-August.

Time of seeding, June-September.

Dispersal—Chiefly in grass seeds and by birds.

Eradication. The Daisy is most troublesome in pastures, and can be got rid of only by breaking up the sod. It can be eradicated by the method outlined for Canada Thistle, or by seeding down to clover and plow up after one crop has been cut and taken off. The clover should always be cut before the Oxeye Daisy has had a chance to mature seed.

FIG. 45.

OXEYE DAISY.

(*Chrysanthemum Leucanthemum.*)

FIG. 46.

COMMON RAGWORT, TANSY RAGWORT, OR STAGGERWORT.

Senecio Jacobaea (L.).

This plant has been sent to the Department on one or two occasions from the neighborhood of Guelph. It has probably been reported before as occurring in Ontario, since it is mentioned in the official list of the Toronto Educational Department Herbarium, but as it is not recorded, to our knowledge, in any other list, it is for all practical purposes a plant new to the Province.

This is the weed which has caused so much trouble in the Eastern Provinces. It is a very dangerous weed because, when eaten by cattle, it causes a curious and fatal disease of the liver (Hepatica cirrhosa). For this reason farmers should keep a sharp lookout for it, and destroy it whenever it appears. It is easily recognized, being a large, conspicuous, strong growing plant, about 2 to 3 feet high. The flowers are in numerous heads in corymbose clusters, bright yellow in color and very showy. The root leaves are 6 to 8 inches long, petioled. Stem leaves sessile and clasping, all leaves dark green, deeply twice pinnatified, the segments crowded and overlapping, crisped and waved. This being a short-lived, shallow-rooted perennial it is not difficult to eradicate, all that is necessary being to cut it in time to prevent it from seeding for several successive years.

FIG. 46.

RAGWORT, TANSY RAGWORT OR STAGGERWORT.

(*Senecio Jacobaea* L.)

FIG. 47.

LESSER BURDOCK, BUR, CLOT-BUR, OR BEGGAR'S BUTTON.

Arctium minus (Bernh.).

A biennial weed with tremendous roots, probably the largest of all weed roots. This root is uniform in size for a foot below the surface; further down it is much branched and has a great hold on the ground. The stem is much branched (from 4 to 6 feet high) and rough, with broad rounded leaves, the lower surface of a lighter green than the upper. The flower heads occur in clusters and are purple in color. The flower receptacle, or involucre, as it is called, is composed of hooked spines, which are very adhesive and do much injury to the wool of sheep. The seeds are brown, $\frac{1}{4}$ in. long and spotted with darker brown (Fig. 47).

Time of flowering, July-September.

Time of seeding, August-October.

Dispersal—Chiefly by animals carrying the seed from place to place.

The plant when burned yields a good quality of alkaline ash, equal to the best potash; and a decoction from the roots is said to be equal to the juice of Sarsaparilla as a blood purifier, etc.

Eradication. Cut below the crown with a spud and burn the tops.

FIG. 47.
BURDOCK.
(*Arctium minus.*)

Fig. 48.

Canada Thistle, or Creeping Thistle.

Cirsium arvense (L.) (Scop.).

This weed was originally introduced from Europe, and hence incorrectly named Canada Thistle. It is a hardy perennial, with numerous underground stems which bear a large number of shoots. (See Fig. 48, illustrating two of these shoots.) It grows to a height of 1 to 3 feet. The leaves are narrow and long, deeply indented into very prickly, lobed segments. The leaf has a crimped appearance, and at the base slightly clasps the stem. The under surface of the leaf is woolly, the upper surface less so. It produces numreous heads containing flowers, which are ½ to ¾ inches across and of a lilac-purple color. The flower is smaller than that of other thistles. The seed is grey, oblong, and about ⅛ in. long, with slight longitudinal markings. Attached to the top is a conspicuous tuft of long hairs (the pappus) (Fig. 48). The seed is carried long distances by the wind. An average plant produces 3,500 seeds.

Time of flowering, June-August.

Time of seeding, July-September. Many plants produce no seed.

Dispersal—Chiefly by the wind.

Great care should be taken to prevent Canada Thistle from seeding.

Eradication. The Canada Thistle can be eradicated in several ways, if thorough work is done at the right time:

1st. By careful and persistent spudding, done in such a way as to prevent the plant from developing top above the ground.

2nd. By early after-harvest cultivation of stubble ground.

3rd. By the frequent introduction of hoed crops into the rotation.

4th. By the seeding much with clover, taking one or two crops of hay, plowing the clover sod shallow early after harvest, and cultivating frequently throughout the fall.

5th. By summer-fallowing.

Assuming that all land should be plowed in the fall, we may outline briefly one or two methods of destroying thistles:

(1) *In stubble ground for spring crop.* Gang-plow shallow and harrow early after harvest (immediately after the crop is off); and as soon as seeds have had time to sprout or thistles begin to appear, cultivate thoroughly with a broad-share cultivator, the points or shares overlapping far enough to cut all plants; and harrow again, to pull up and expose the plants that have been cut. Repeat the cultivation at intervals throughout the fall, and plow in the usual way, or, if possible, rib up with a double mould-board plow just before the frost. This systematic cultivation from harvest till winter will check thistles and other weeds very much, and when followed by a hoed crop (mangels, corn, turnips, carrots, beans or rape), properly cultivated, it will not only clean the land, but put it into good shape for a crop of grain (oats, barley, etc.), the next spring, which crop should be seeded with red clover.

FIG. 48.
CANADA THISTLE.
(*Cirsium arvense.*)

(2) *In sod (meadow or pasture) for spring crop.* After one or two, but not more than two, crops of hay or pasture, plow shallow (not more than four inches) early after harvest, say the 1st to the 15th of Au[illegible] and harrow at once. Let it stand a couple of weeks, and then c[illegible] the same way it was plowed, two or three inches deep, with a [illegible]g-tooth cultivator. After a while cross-cultivate a little deeper. If possible, cultivate a third, or even a fourth time, going a little deeper each time. Then, if you can manage to do so, rib it up with a double mould-board plow the last thing in the fall. This will make a good foundation for any crop the following spring—grain, roots, corn or rape—and if the portion in hoed crop is thoroughly cultivated with horse and hand hoes, very few, if any, thistles will be left. The portion intended for rape must be kept clean by surface cultivation till the time for putting in the crop, say the last half of June or the 1st of July, after which it should be treated like other hoed crops.

Some recommend a crop of fall rye on land which is intended for rape the following summer, but the rye takes so much moisture from the soil in the spring that the rape after it is apt to be a poor crop, unless in favorable seasons.

If summer-fallowing is resorted to, it will be well not to plow any more than is necessary, but to rely on surface cultivation with the broad-share cultivator and the harrow, done in such a way as to cut the plants two or three inches below the surface, without bringing up any of the numerous rootstocks which run along a little lower down. It will also be well to keep the fallow covered part of the summer by growing some kind of green crop, say a crop of buckwheat, sowed rather thick and plowed under when coming into bloom. This will help to prevent the loss of nitrates which bare land suffers from washing, and will improve the soil by increasing the supply of vegetable matter in it.

When necessary at any stage in the above method of cultivating either stubble-ground or sod, say for mangels, use a grubber or subsoil plow to stir the soil to a greater depth than is reached by the surface cultivation.

FIG 49.

CHICORY, OR WILD SUCCORY.

Cichorium intybus (L.).

A perennial weed introduced from Europe, with long, deep tap-root, which when dried and ground up is used in adulterating coffee and as a substitute for it. The stems are almost leafless, from 1 to 3 feet high, much branched, slightly hairy and whitish in color. The leaves, spread out on the ground, are long, with irregular edges. The flower heads are numerous, occurring in clusters, without flower stalks, on the naked branches. The flowers are about 1½ inches across, bright blue in color,

FIG. 49.
CHICORY.
(*Chicorium intybus.*)

and are usually closed by noon. The seed is about ⅛ inch long, tapering to a blunt point, the opposite end having a fringe of minute hairs around the crown. The body of the seed is corrugated. An average plant produces about 3,000 seeds.

Time of flowering, July to October.

Time of seeding, August to October.

Dispersal—Frequently as an impurity in clover and grass seed.

Eradication. Seldom troublesome in well cultivated fields. A short rotation of crops will soon cause it to disappear. Badly infested fields may be cleaned by deep, thorough, fall cultivation, followed by a hoed crop the next season.

Barnaby's Thistle.

Centaurea solsitialis (L.).

This plant is comparatively new to Ontario. Its home is in the Mediterranean region, but it has been introduced into most temperate climates with alfalfa, clover and other seeds. It has become scattered pretty well over Ontario as an impurity in alfalfa. It is a bushy-branched, annual weed from 1 to 2 feet high. The flowers are yellow and surrounded by conspicuous, stout, yellow spines about three-fourths of an inch long. The lower leaves are divided, the upper linear entire and run along the stem at the base (decurrent). This plant being an annual and very conspicuous is not likely to become a bad weed.

Fig. 50.

Fall Dandelion.

Leontodon autumnalis (L.).

An introduced perennial weed reported recently from several places in Ontario as occurring in hayfields. Leaves mostly basal, springing from a short, thick rootstock and resembling somewhat the leaves of the Common Dandelion. Stems branched, scaly and few flowered. "Flowers" about 1 inch across, bright yellow. Seed is ¼ inch long, brown, linear, ribbed lengthwise and bears a row of feathery bristles about its own length.

Time of flowering, July till frost; seeds ripe by August.

Dispersal—By seeds and by division of the crown.

Eradication. *"Badly infested fields should be brought under cultivation. Pasture lands that cannot be cultivated may be improved by severely raking the surface with a spring-tooth harrow and sowing the most vigorous grasses."

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*"Farm Weeds," by G. H. Clark.

FIG. 50.

FALL DANDELION.

(*Leontodon autumnalis.*)

FIG. 51.

PERENNIAL SOW THISTLE.

Sonchus arvensis (L.).

This is by all means the worst weed in the Province of Ontario at the present time. It is found in almost every county, and upon almost every farm. So rapidly and so persistently is it spreading that in some parts of the Province it threatens to entirely over-run the fields and drive out the farmer. In spite, however, of its wide dispersal there are many who are not able to recognize this pest and who mistake it for its two comparatively harmless cousins, the Common Annual Sow Thistle and the Spiny Annual Sow Thistle. This should not be the case, as it is a very conspicuous weed, and differs markedly from the other two species. The Perennial Sow Thistle grows freely on a great variety of soils, but is especially troublesome on rich, low, damp land. It appears the first year in a field in scattered patches consisting of young plants, each plant made up of a rosette of leaves lying close to the ground, and thus, when numerous, they completely cover it. These young plants have but short underground root stocks, and are comparatively easy to destroy. The second year a large stem bearing numerous leaves and flowers is produced and the rootstocks grow long and send up quantities of new shoots. Once established in this manner, it is no easy task to destroy this pest.

Description—The Perennial Sow Thistle (*Sonchus arvensis*) is a tall, coarse growing perennial weed with deep roots and numerous thick, underground stems or rootstocks, commonly spoken of as "roots." Upon these at intervals of a few inches are borne buds which develop into new plants. The stem is smooth and hollow and the whole plant is filled with a bitter milky juice. The leaves are pointed, 4 to 12 inches long, deeply cut with the segments pointed backwards (runcinate), slightly prickly. The flowers, or more correctly speaking, the heads of flowers, are about 1 to 1½ inches across, and bright orange in color. The involucre, or, as it is commonly called, the flower cup, and the peduncles or flower stems are covered with distinct, yellow glandular bristles. The seeds are dark reddish-brown in color, about ⅛ of an inch long, somewhat spindle shaped with blunt ends, and each surface bears a number of very deeply wrinkled, longitudinal ribs. Each seed bears at the top a tuft of white silky hairs (pappus) which, when dry, acts as a parachute and enables the seed to be borne long distances by the wind.

POINTS OF DISTINCTION BETWEEN THE PERENNIAL SOW THISTLE AND THE ANNUAL SOW THISTLES.

1. The Perennial Sow Thistle is a taller, coarser growing plant than either of the other two Sow Thistles.

2. The Perennial Sow Thistle has numerous underground rootstocks while the annual species have only fibrous roots. (See illustrations.)

FIG. 51.
PERENNIAL SOW THISTLE.
(*Sonchus arvensis.*)

3. The leaves of the Common Annual Sow Thistle are deeply cut and lobed and scarcely spiny. The leaves of the Spiny Annual Sow Thistle are almost entire, very prickly and often decidedly waxy. The leaves of the Perennial Sow Thistle are deeply cut, but not lobed, and slightly prickly. (See illustrations.)

4. The "flowers" of the Perennial are bright orange in color and about 1½ inches across, while the flowers of the Annuals are pale yellow and less than ½ inch in diameter.

5. The "flower-cups" (involucres) and "flower stems" (peduncles) of the Perennial Sow Thistle are conspicuously covered with yellow glandular bristles, while those of the annual species are nearly smooth.

6. The seeds of the three species also differ as to shape and markings.

How the Perennial Sow Thistle is Spread.

The Perennial Sow Thistle is being rapidly and widely spread by means of its numerous seeds, which are blown far and wide by the wind, and to some extent by its abundant underground rootstocks which with remarkable rapidity spread through a field, sending up new shoots which soon entirely cover the ground and choke out all other vegetation. The rootstocks when broken up are often carried from field to field by harrow or cultivator. It has been estimated that an average plant produces 2,000 seeds. There are thousands of these plants going to seed on neglected farms, on road sides and in fence corners. Many more mature plants are harvested with the grain and their millions of seeds scattered at threshing times. Is it to be wondered that the Perennial Sow Thistle is becoming such a serious pest in Ontario?

Methods of Eradication.

These are discussed under the headings of General Suggestions and Detailed Methods.

General Suggestions.

1. Bear in mind that a few patches of Perennial Sow Thistle, if allowed to mature, may seed down a whole neighborhood. Therefore, take every precaution to prevent the seeding of patches in meadows, grain fields, fence corners, and on the road side.

2. Watch for the first two or three patches in the field and destroy them before the pest becomes established.

3. Be careful not to harrow or cultivate through patches and drag the underground rootstocks all over the field.

4. The Perennial Sow Thistle thrives most luxuriantly on rather low, damp land. Underdraining therefore will help to control it.

5. Sheep are fond of this weed, and, if turned on a field after harvest, will prevent its seeding and by their close cropping weaken the underground rootstocks.

FIG. 52.
SPINY ANNUAL SOW THISTLE.
(*Sonchus asper.*)

Detailed Methods.

Several methods of exterminating the Perennial Sow Thistle are here outlined in detail. They have all been suggested by practical farmers. It is hoped that those who are looking for information on this subjcte will find among them a method suited to their own conditions.

Method No. 1. This method is suggested by Professor Zavitz, who found it effective in the eradication of Quack Grass. Cultivate the field until about the middle of June, running over it frequently with the cultivator so as to keep the tops down and thus weaken the "roots." Then apply manure at the rate of about 20 tons per acre (12 good loads). Cultivate the manure in thoroughly and with a double mould board plow slightly ridge up the land, making the ridges about 26 inches apart. On the ridges sow pasture rape at the rate of 1½ lbs. per acre. It is important that the right amount of rape should be sown, for if too little is sown the stand will not be thick enough to smother the weeds, and if on the other hand too much is sown the plants will be too crowded and not grow vigorously enough to keep ahead of the thistle. Sow the rape when the land is sufficiently moist to insure quick germination of the seed. If the rape is slow in starting the Sow Thistle may get a start in the rows and thus necessitate hand cultivation there. Cultivate the rape every week or ten days until it occupies all the ground and makes further cultivation impossible. If, when the rape is cut or pastured, any Sow Thistles remain, the field should be ridged up the last thing in the fall and put in with a hoed crop the following year. This should not be necessary if a good stand of rape is secured.

Method No. 2. This is a system of intensive cropping suggested by Professor Zavitz. As soon as a cereal crop is harvested, plow the land and give frequent cultivation to the first or middle of September. Then sow winter rye at the rate of about two bushels per acre. This can be pastured the following spring, or cut for hay or grain. As soon as the crop is off the land, put in rape, turnips or buckwheat. The advantage of this system is that three crops are harvested in two years and the Sow Thistle fought at the same time.

Method No. 3. This method is recommended by Professor Day. Immediately after harvest gang-plow shallow and run over the field several times with the broad shared cultivator. Later in the fall plow a little deeper, and continue cultivating every week or ten days as long as the season permits. Last thing before the ground freezes rib up the land with a double mould board plow. The following spring give frequent cultivation up to the first of July, then sow pasture rape.

Method No. 4. This is a short rotation which has been recommended by several Farmers' Institute workers. Clover is followed by a crop of grain, then clover again. The clover is cut in June, and the land plowed about four inches deep and given frequent and thorough cultivation during the rest of the summer. The following spring a grain crop is sown, seeding down with clover. For best results the grain crop should be one which can be cut early enough to prevent the thistle from seeding.

FIG 53.
ANNUAL SOW THISTLE.
(*Sonchus oleraceus.*)

Method No. 5. Directly after harvest plow the land lightly, and then give frequent cultivation as long as the season permits. The following spring gang-plow, and leave in summer fallow until it is time to sow fall wheat. The summer fallow to be effective must be a *bare fallow.* The field must be cultivated thoroughly and frequently, with the object of keeping the tops down and breaking up and bringing to the surface of the ground as many of the "roots" as possible. The gang-plow should occasionally be run over the field in order to insure the cutting of the roots. Bare summer fallow has given excellent results on the College farm in seasons when other methods were at best only partially effective.

FIG 53.

ANNUAL SOW THISTLE, COMMON SOW THISTLE, OR MILK THISTLE.

Sonchus oleraceus (L.).

An annual weed introduced from Europe. It grows 2 to 3 feet high, has fibrous roots and leafy stem, and is not quite so large or coarse as the Perennial Sow Thistle. The leaves are much lobed, and have short, soft spines. Each head is many-flowered; but the flowers are small, about 1½ in. across, and of a pale yellow color. The seeds are brown, dull or roughened, and about ⅛ in. long, with 5 longitudinal ridges finely wrinkled crosswise, and attached to the top is a large tuft of fine hairs united at the base.

Time of flowering, June-August.
Time of seeding, July-August.
Dispersal—Chiefly by the wind.

Eradication. Cultivate stubble-ground and sod early after harvest and throughout the fall as for Canada Thistle (see Fig. 53). Follow with hoed crop, preferably corn or roots, and cultivate thoroughly throughout the growing season. Use the cultivator, instead of the plow, after roots or corn; sow a crop of grain and seed with clover; if practicable, pull the weeds by hand out of the grain crop; take one or two crops of hay or pasuure, and again break up the sod, plowing, harrowing and cultivating as for Thistle.

FIG. 54.

PRICKLY LETTUCE.

Lactuca Scariola (L.).

Prickly Lettuce is a native of the old world, and has invaded this Province both from New York and Michigan. It is a winter annual; it springs from seeds in the fall, and survives the winter. The plant grows to a height of 3½ feet; the stem is leafy and usually smooth; the leaves

FIG. 54.
PRICKLY LETTUCE.
(*Lactuca scariola.*)

are oblong and slightly pointed, often clasping at the base; the under surface of the midrib of the leaf is spiny: Heads are numerous and yellow.

Time of flowering, July-September.

Time of seeding, August-October.

Dispersal—By means of its seeds, which are provided with a pappus or tuft. An ordinary plant may produce 8,000 seeds.

Eradication. The best methods of destroying the weeds are: 1. To mow repeatedly as it comes into bloom, or earlier. 2. To cultivate thoroughly with a hoed crop. By this method the weeds in the soil will be induced to germinate. They should not be covered deeply in plowing. Mature plants should be cut down and burned lest the seeds be blown about and scattered by the wind.

Farmers should be careful to buy only clean clover, millet and grass seeds, and the weed inspector should insist on the fulfilment of the law, and have all fence-corners, roadsides, and waste lands cleared of the pest.

FIG. 55.

WILD LETTUCE, SOUTHERN THISTLE, OR TRUMPET-MILKWEED.
(Erroneously called Prickly Lettuce.)

Lactuca Canadensis (L.).

An annual or biennial plant with a leafy stem, which may attain a height of seven feet. The leaves are deeply lobed, terminating in an acute point, and have stalks or petioles, the lower ones being smaller than those near the top of the stem. The stem branches at its summit into a compound flower-cluster. The flowers are small, yellow in color, and open only a few at a time. The seed is dark brown in color, flat and oval, with longitudinal ribs and a threadlike beak at the apex, and possesses a small white tuft of hair.

Time of flowering, June-October.

Time of seeding, July-October.

Dispersal—Chiefly by the wind.

Eradication. Where there is not much of it, pull and burn before ripening. Where this cannot be done, use the same method as for Mustard.

FIG. 55.
WILD LETTUCE.
(*Lactua Canadensis.*)

FIG. 56.

PAINT BRUSH, DEVIL'S PAINT BRUSH, OR ORANGE HAWK WEED.

Hieracium aurantiacum (L.).

This is another weed which is gaining ground in Ontario. It has been common for some time in the eastern part of the Province, but is now reported as being found as far west as Oxford County. It has been found in the vicinity of Guelph for many years. It is being dispersed as an impurity in clover seed, and by means of its tufted seeds, which are blown about by the wind. It is a serious pest when it gets into meadows and pastures, as it spreads rapidly by runners and soon crowds out the grass. Careful watch should therefore be kept to prevent its establishment upon the farms of Ontario.

It is a perennial weed of European origin, and produces slender runners, which lie near the surface of the soil. The leaves are all basal, and lie close to the ground, forming a rosette. They are broadly lance-shaped, from 2 to 6 inches in length, the "flower" is orange red in color, about ⅔ of an inch in diameter, and borne in clusters on the top of a simple, nearly leafless stem from 12 to 18 inches high. The seeds are provided with tufts of down. When found in clover seed, however, the down is usually absent. They are torpedo shaped, about 1-12 of an inch long, and ribbed lengthwise. Ripe seeds are dull jet black in color, unripe seeds deep red.

Eradication. Paint Brush is but a shallow-rooted perennial, and readily succumbs to cultivation. Infested meadows and pastures should be broken up and put under a short rotation of crops. Salt at the rate of 1½ tons per acre is recommended for the destruction of this weed. It should be scattered over the patches so as to fall on the leaves. It is claimed that it destroys the Paint Brush and improves the grass.

FIG. 56.
PAINT BRUSH.
(*Hieracium aurantiacum*, L.).

KNOW THE WEEDS.

It is very important that those engaged in farming should get to know the worst weeds and the weed seeds most frequently found in commercial seeds. This they can do with a little trouble. Strange weeds should be sent to the Botanical Department here for identification, and a collection of the most common weed seeds should be secured for reference and comparison.

WEED IDENTIFICATION AND SEED TESTING.

The Department of Botany is at the service of farmers, gardeners, seed merchants and others in the identification of weeds, weed seeds, plant diseases, grasses and economic plants. Clover and other farm seeds are tested and reported upon as to purity absolutely free of charge. Plant specimens and samples of seeds should be carefully packed and addressed with postage prepaid to the Botanical Department, Ontario Agricultural College, Guelph, Ontario.

ERADICATION OF WEEDS.

The most important points under this head are:

First, a determination to get rid of weeds and to keep the land clean.

Second, the method or methods of tillage and cropping.

As regards the latter point, the writer feels that he cannot do better than submit the method outlined by the late Wm. Rennie, whose experience of over thirty years warranted him in speaking with some confidence on the subject. Mr. Rennie's method not only cleans the land, but increases its fertility, and those who wish fuller information should consult the college reports for 1895, 1896 and 1897.

For various reasons very few farms in the older sections of the Province of Ontario are free from weeds, and the question how to clean our lands without incurring too much expense is one of the most important which can engage the attention of Canadian farmers.

In the first place, I would say that all obstructions to cultivation, such as piles of stone, must be removed—hauled away to the woods or an out-of-the-way corner in the winter or some other slack time. Secondly, places for harboring weeds, such, for example, as snake fences,

should be got rid of as soon as possible. On the Ontario Experimental Farm nearly all field fences have been removed. The outside and lane fences are almost the only ones left. Portable fences are used when required for pasturing live stock.

Annuals and Biennials. Wild oats, wild mustard seed, and some other seeds belonging to these classes, have great vitality. If down pretty well beyond the reach of the air, they will live for twenty years, and will germinate as soon as they are brought near the surface.

The best way to destroy annuals and biennials is by thorough and frequent shallow cultivation early after harvest in stubble ground and in sod plowed for the following year, and at the proper season (spring and summer) among what are called "hoed crops," that is, potatoes, carrots, turnips, mangels, Indian corn, etc. By shallow cultivation the seeds are kept near the surface, and by frequent stirring of the soil they are made to sprout; and, having sprouted, they can be killed by further cultivation. Those which sprout late in the fall are destroyed by the winter frost. It is impossible to get rid of such weeds by plowing the ordinary depth, say seven or eight inches, once in the fall or at any other time. Plow shallow (not more than four inches in sod and three inches in stubble ground), and harrow and cultivate frequently, as by each stirring of the soil fresh seed is made to sprout, and what has already sprouted is destroyed. When necessary to loosen the soil to a greater depth, use a grubber or a subsoil plow.

Perennials. It is necessary to study the habits of perennial weeds to see how they grow and propagate themselves from year to year, in order to keep them in check; and a close examination of almost any of them will show that the buds from which the young plants start are near the surface of the soil. Hence shallow cultivation, similar to that mentioned above, is the effective method of destroying them. Disc harrows cut the shallow, creeping roots into fragments, which bud and greatly increase the difficulty of eradication. Deep plowing only transplants the buds to a greater depth, and increases the trouble. Plow shallow (see preceding paragraph), and harrow and cultivate frequently, using a grubber or subsoil plow when it is necessary to stir the soil to a greater depth. As above, the cultivation must be early after harvest and throughout the fall in stubble ground and sod, and in spring and summer among corn, potatoes and root crops. Ill-timed, irregular or partial cultivation only makes all weeds grow more vigorously.

Canada thistle, perennial sow thistle, couch-grass, bindweed, etc., can be destroyed by the following method: Middle of May gang plow the land about three inches deep and harrow thoroughly. In two weeks, when the weeds are nicely up, cultivate with a common or spring-tooth cultivator provided with wide points that overlap so as to cut off every plant two or three inches below the surface. Then harrow to pull up the plants and leave them to die. In the middle of June there

will be another crop, and possibly a greater number of plants, but not so vigorous as the first crop. Repeat the operations with the wide point cultivator and the harrow. In July a few delicate plants will make their appearance and will have to be destroyed in the same way. This will be sufficient for most weeds; but bindweed may need one or two extra cuttings with the wide points, and a corresponding number of harrowings.

The preceding method will clean the land, but it involves the loss of a year's crop; so it is well to add that land may be kept comparatively free from weeds without the loss of a crop, by after-harvest cultivation of all fields not in grass, begun with each field *just as soon as the crop is off* and continued throughout the fall, first by shallow gang-plowing and harrowing, and afterwards at intervals, as above, by the wide-point cultivator and the harrow. This treatment followed by a hoed crop *properly attended to* will destroy most perennial weeds and all annual and biennial seeds that are near the surface.

Note. To Mr. Rennie's method, or methods, as above given, we would venture to add one which we have seen carried out with the most satisfactory results by Mr. Rennie on the College farm, and with marked success by farmers in other parts of the Province. It may be put in the imperative form, as follows: Sow much with red clover, in order to have a rich clover sod to plow down for all or nearly all spring crops, taking as far as possible only one crop of hay or pasture before plowing, occasionally two, but not more than two. Plow the clover sod shallow, not more than four inches, early after harvest, say the 1st to the 15th of August, and harrow at once. Let it stand a couple of weeks; then cultivate, the same way as it was plowed, two or three inches deep, with a spring-tooth cultivator. After a while, cross cultivate a little deeper. If possible, cultivate a third, or even a fourth time, going a little deeper each time. Then, if you manage to do so, rib it up with a double mouldboard plow, as you would for a crop of turnips. When this is done the available plant food (clover roots, etc.) is preserved in the centre of the drills, the water runs off early in the spring, and the drills can be levelled with the cultivator and harrow, either for spring grain or for hoed crops.

This method will not only clean land, but will greatly enrich it.

AN ACT TO PREVENT THE SPREAD OF NOXIOUS WEEDS.

Province of Ontario

1. Where used in this Act the term "non-resident land" shall apply to all lands which are unoccupied, and the owner of which is not resident within the municipality, and the term "resident lands" shall apply to all lands which are occupied or which are owned by persons resident within the municipality.

2. It shall be the duty of every occupant of land, or, if the land be unoccupied, it shall be the duty of the owner, to cut down and destroy all Canada thistles, ox-eye daisy, wild oats, ragweed and burdock growing on his land, and all other noxious weeds growing on his land to which this Act may be extended by by-law of the municipality, so often each and every year as is sufficient to prevent the ripening of their seed, provided that such cutting or destruction does not involve the destruction of the growing grain.

3.—(1) The council of any city, town, township or incorporated village may, by by-law, extend the operation of this Act to any other weed or weeds, or to any other disease of grain or fruit trees or fruit (other than the diseases known as "yellows" and "black knot" in fruit trees), which they declare to be noxious to husbandry or gardening in the municipality; and all the provisions of this Act shall apply to such noxious weeds and diseases as if the same were herein enumerated.

(2) Such council may and, upon a petition of fifty or more ratepayers, shall appoint at least one inspector to enforce the provisions of this Act in the Municipality, and fix the amount of remuneration, fees or charges he is to receive for the performance of his duties and in case a vacancy occurs in the office of inspector, it shall be the duty of the council to fill the same forthwith.

(3) The council of any township in which there are any large tracts or blocks of waste or unoccupied land, may, upon the petition of not less than thirty ratepayers, by by-law, suspend the operation of this Act, in respect of such waste or unoccupied lands; such by-law shall define with sufficient clearness the tracts or blocks of land so exempted, and shall remain in force until repealed by such council; and until repealed the lands therein described shall be exempt from the operation of this Act.

(4) The council may pass a by-law dividing the municipality into such sections or divisions as may be necessary for the carrying out of this Act, and may appoint inspectors for such divisions whose duties and powers shall in all respects be the same as that of the township inspector.

4.—(1) It shall be the duty of the inspector to give or cause to be given notice in writing to the owner or occupant of any land within the municipality where the said noxious weeds are growing and in danger of going to seed (and in the case of property of a railway company, the notice shall be given to any station master of the company resident in or nearest to the municipality) requiring him to cause the same to be cut down or destroyed within ten days from the service of the notice; and it shall be the duty of the inspector to give or cause to be given such notice for the first time not later than such date or dates in each year as may be fixed by by-law of the municipality.

(2) In case such owner or occupant of land (or, if it be railway property, then the station master upon whom notice has been served) refuses or neglects to cut down or destroy all or any of the said noxious weeds within the period aforesaid, the inspector shall enter upon the land and cause such weeds to be cut down or destroyed with as little damage to growing crops as may be, and he shall not be liable to be sued therefor; or the inspector, instead of entering upon the land and causing such weeds to be cut down or destroyed, may lay information before any justice of the peace as to such refusal or neglect, and such owner or occupant shall, upon conviction, be liable to the penalties imposed by section 9 of this Act; but no inspector shall have the power to cut down or destroy noxious weeds on any land sown with grain.

(3) Where such noxious weeds are grown upon non-resident lands it shall not be necessary to give notice before proceeding to cut down or destroy the same.

5.—(1) The inspector shall keep an accurate account of the expense incurred by him in carrying out the provisions of the preceding sections of this Act with respect to each parcel of land entered upon, and shall deliver a statement of such expenses, describing the land entered upon, and verified by oath, to the owner or occupant of resident lands, requiring him to pay the amount.

(2) If any owner or occupant of land liable under the provisions of this Act deems such expense excessive, an appeal may be had to the said council (if made within thirty days after the delivery of such statement) and the said council shall determine the matter in dispute.

(3) In case the owner or occupant of resident lands refuses or neglects to pay the same within thirty days after such request for payment, the said claim shall be presented to the council of the municipality in which such expense was incurred, and the said council is hereby authorized and required to audit and allow such claim, and order the same to be paid from the fund for general purposes of the said municipality.

6. The inspector shall also present to the said council a similar statement, verified by oath, of the expenses incurred by him in carrying out the provisions of this Act upon any non-resident lands; and the council is hereby authorized and required to audit and allow the same, or so much thereof as to the council may seem just, and to pay so much thereof as has been so allowed.

7. The council of the municipality shall cause all such sums as have been so allowed and paid by the council under the provisions of this Act, to be by the clerk severally placed on the collector's roll for the municipality against the lands described in the statement of the inspector, and to be collected in the same manner as other taxes imposd by by-laws of the municipality.

8.—(1) It shall be the duty of the overseers of highways in any municipality to see that the provisions of this Act relating to noxious weeds are carried out within their respective highway divisions, by cutting down or destroying, or causing to be cut down or destroyed at the proper time to prevent the ripening of their seed, all the noxious weeds growing on the highways or road allowances within their respective divisions; such work to be performed as part of the ordinary statute labor, or to be paid for at a reasonable rate by the treasurer of the municipality, as the council of the municipality may direct.

(2) In unorganized townships where road commissioners have been appointed under the provisions of the Assessment Act, or under any Act relating to statute labor in unorganized townships, it shall be the duty of every owner or occupant to cut down and destroy or cause to be cut down and destroyed, at the proper time to prevent the ripening of their seed, all the noxious weeds growing in any highway adjoining such land, not being a toll road, from the boundary of such land to the centre line of such road, and in case of default, after notice from the road commissioners requiring such work to be done on or before a day named in the notice, such owner or occupant shall incur a penalty of $5 for each lot or parcel in respect of which default is made, and upon conviction thereof before a Justice of the Peace having jurisdiction in the township such Justice shall order the penalty, together with the costs of prosecution and distress, to be levied by distress of the offender's goods and chattels, and every penalty so recovered shall be paid the road commissioners, and be expended in improving the roads in such township.

(3) In case of such default as mentioned in the preceding sub-section the road commissioners may perform the work in place of such owner or occupant, and the cost thereof to the extent of $1.25 for each day's labor involved shall be recoverable as a debt due by such owner or occupant to the road commissioners in any court of competent jurisdiction.

9.—(1) Any owner or occupant of land who refuses or neglects to cut down or destroy any of the said noxious weeds, after notice given by the inspector, as provided by section 4, or who knowingly suffers any of the said noxious weeds to grow thereon, and the seed to ripen so as to cause or endanger the spread thereof, shall upon conviction, be liable to a fine of not less than $5 nor more than $20 for every such offence.

(2) Any person who knowingly sells or offers to sell any grass, clover or other seed, or any seed grain among which there is seed of Canada thistles,

ox-eye daisy, wild oats, ragweed, burdock, or wild mustard, shall, for every such offence, upon conviction, be liable to a fine of not less than $5 nor more than $20.

(3) Every inspector, overseer of highways or other officer who refuses or neglects to discharge the duties imposed on him by this Act shall, upon conviction, be liable to a fine of not less than $10 nor more than $20.

(4) Any person who sows any wheat or other grain knowing it to be infected by the disease known as smut, without first using some proper and available remedy to destroy the germs of such disease, shall, upon conviction, be liable to a fine of not more than $20.

10. Every offence against the provisions of this Act shall be punished, and the penalty imposed for each offence shall be recovered and levied, on summary conviction before any justice of the peace; and all fines imposed shall be paid to the treasurer of the municipality in which the offence is committed, for the use of the municipality.

11. The council of every municipality in Ontario shall require its inspector, overseer of highways and other officers to faithfully discharge all their duties under this Act.

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