
THE STATE AGRICULTURAL COLLEGE

THE AGRICULTURAL EXPERIMENT STATION,

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COLORADO WEEDS.

Approved by the Station Council.

ALSTON ELLIS, President.

FORT COLLINS, COLORADO.

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Colorado Weeds.

BY CHARLES S. CRANDALL.

It is not our present purpose to attempt an exhaustive treatment of the weeds of the State, but by a few brief general considerations, and the mention of a limited number of well-known offenders, to bring the subject to the attention of the farmers, in the hope that they will aid us in the collection of data from which to compile a complete report. Our own observations have thus far been confined to a limited territory. We need detailed information from all portions of the State before we can properly classify our weeds, or draw correct conclusions regarding their distribution, and relative noxious qualities. Hence, for the State as a whole, our statements can only be general.

Every cultivated district has its weeds, and in most districts they are present in great variety; but the prevalent forms of one district may be widely different from those of another. The region adjacent to the eastern foothills is infested with one series of weeds north of the Divide, and by a greatly different series south of the Divide. The weeds of the plains of the eastern counties are mostly different from those near the foothills, and west of the range we find a class of weeds different from those prevailing on this side.

A plant may be present in two or more districts, but attract notice as a weed only in one; it may even be a very bad weed in one district and harmless in another. Thus our common *Thermopsis* (*Thermopsis montana*) is reported as a persistent weed in the San Luis valley, taking possession of moist pasture lands, and gradually extending its area to the detriment of the grasses; while here we would class it as one of the most indifferent weeds—existing, but not spreading to any injurious extent. A few kinds are everywhere present, and are universally classed as injurious. Owing to this diversity in the weeds of different regions, and to the various ratings that may be given particular species in the different districts, it is difficult to form a classification based upon relative badness. Adopting the commonly used division into worst, bad and indifferent, it is plain that conflict would arise in any attempt to adjust a list to all districts; even in a particular district there would be differences of opinion as to the class in which

certain weeds should be placed, and as to the position in the class; there may even be differences of opinion as to whether a plant should appear in a list of weeds at all or not, and this would demand an answer to the question, What is a weed? The dictionary defines the word weed as "Any plant growing in cultivated ground to the injury of the crop or desired vegetation, or to the disfigurement of the place; an unsightly, useless, or injurious plant." Then we have the old definition, "A plant out of place," which is broad enough, and at the same time has the virtue of brevity. There is evident propriety in including in a weed list, not only the decidedly injurious ones, that cause so much trouble in gardens and fields, but also the unsightly and useless plants that disfigure our road-sides, ditch-banks, pastures, and waste places. We must include, also, some of our most useful plants, because they frequently give trouble by appearing out of place. Alfalfa is invaluable to this Western country as a forage crop, but when it springs up in your strawberry bed you regard it as a weed, and treat it accordingly. A field of alfalfa is broken up and sown to wheat; the roots are imperfectly cut, and we have two crops in competition on the same ground—neither is profitable. It was wheat that was wanted, but the yield was cut short by the alfalfa; in this case the alfalfa is in effect a bad weed. Many other plants may possess this two-faced character—useful or ornamental when in their proper places, but becoming noxious when appearing where they are not wanted.

From observations thus far made, we have included in our list of weeds 228 species of plants. Regarding most of them there is no question—they are plainly weeds; a few, however, are placed in the list provisionally, and our estimate of their position may be changed by further observation. A considerable addition will undoubtedly be made when our study has been extended to include the southern and western portions of the State.

A very natural inquiry concerning weeds is, Where do they come from? Ours are in great part native; they are plants indigenous to the foothills and plains, which, by reason of the favorable conditions afforded them in the irrigated districts, are enabled to develop strongly and multiply rapidly. They are aggressive in the struggle for possession of the land, and thus become pestiferous to our cultivated crops. Sixty-five per cent. of our 228 species of weeds belong to this class; the balance, or 35 per cent., are introduced. These foreigners are mostly European plants, which first secured a foothold on the Atlantic coast, and then, following civilization, gradually migrated westward. A few have come to us from the Southern States and Mexico.

The proportion of native weeds is greater here in the West than it is East. In some of the New England States a majority

are foreign. In New Jersey, as appears from Dr. Halstead's weed list, the foreign and native species are almost equally divided.

That the Eastern States should have a larger proportion of European weeds than the Western, is perfectly reasonable; they have a much older agricultural development, are nearer the ports of entry, and the advantages for the growth and dissemination of plants have been greater. Considering the comparatively short period since cultivation of the soil began in Colorado, we have a remarkably large representation of European weeds, and we are yearly receiving additions. Our large percentage of native weeds may also be accounted for by the nature of the country. Dr. Gray, in an article on weeds, explained that the herbaceous plants native in the forest-covered East, were placed at a disadvantage by the removal of the forests, and could not successfully compete in the struggle for existence with the introduced European weeds. In our Western treeless region the native plants are subject to full exposure, and have become inured to the most adverse conditions. Cultivation and irrigation have given them new vigor; they no longer merely exist—they assert themselves, and find place among the most aggressive of our weeds.

Arranging our weeds according to their duration, we find that 128, or more than one-half, are perennials. Of these, 98 are native, and 30 are foreign. The biennials are represented by only 11 species, 7 of which are foreign. The 89 annuals are quite evenly divided, 43 being foreign, and 46 native.

Division according to relative badness is of necessity entirely arbitrary; an attempt has been made to base the position of each species upon the sum of its bad qualities. There is with many species a single quality which predominates over all others, and determines its position; one species, by reason of its prolificacy, may be ranked as one of the worst; another, much less abundant, may take the same rank because it is very persistent and difficult to eradicate. Our present estimate places in the list of worst weeds 56 species; 29 of these are foreign and 27 native. The species falling under the head of bad weeds number 81, 55 of which are native, and 26 foreign. In the list of indifferent weeds, the predominance of native species is still further increased, there being 66 native and 25 foreign, a total of 91.

Classified botanically, our weeds have a wide distribution. The 228 species and varieties represent 141 genera, belonging to 42 orders. Compositæ has much the largest representation; 55 species and varieties, or very nearly one-quarter of the whole, belong to this order; next come Leguminosæ and Gramineæ, represented by 12 genera and 21 species each; then follows Polygonaceæ, with 16 species; the balance are distributed in numbers varying from 1 to 8.

In any given locality additions to the number of weeds frequently appear; it may be a plant whose presence in the neighborhood has been noticed, but which has been passed by as inoffensive; suddenly we find it taking possession of our cultivated ground, and possibly the next year it develops into a formidable pest; another plant, an entire stranger, may from its first appearance be so aggressive as to leave no doubt of its having descended from ancestors that somewhere, by struggles through many generations, had developed those qualities, enabling successful competition with other plants for possession of good ground. The questions, Where did these plants come from? How did they get into our soil? are often difficult to answer. Most of our herbaceous weeds are great travellers; they migrate from one place to another in a variety of ways. Some are provided with structural features which aid dissemination, as the pappus of the fruits of many Compositæ, the coma of the seed of milkweed, or the hooked prickles of the fruits of our clot-bur and wild licorice; some are carried by animals or birds, or on the surface of streams, but the most effective agent in distribution is man himself. Weed seeds are sent across the country baled up in hay, in the packing about merchandise, with the grain and grass seed raised for market, and in a hundred other ways. This broadcast distribution of weed seeds is all unintentional, and in many cases it could be avoided by the exercise of a little care. There is no doubt that many of the weeds that are so troublesome are sown with the grain or grass seed. Seeds which from casual observation appear clean, may upon critical examination disclose an astonishing percentage of seeds of noxious weeds. Two years ago we ordered from the East seeds of twenty species of grasses and forage plants for trial and comparison with native species; only the species ordered appeared on the bill, but when the plants came in flower we found a number of species for which we had not bargained. As an example, two species of brome grass (*Bromus inermis*, Leyss., and *Bromus unioloides*, Kunth.) were ordered, but we did not order the four poor relations from Europe which accompanied them, namely: *Bromus secalinus*, L., *Bromus racemosus*, L., *Bromus sterilis*, L., and *Bromus maximus*, Desf. I may here mention another species of chess which appeared for the first time last season, and whose presence seems to trace directly to hay used as packing about some goods that came from the East, *Bromus Tectorum*, L., a useless importation from Europe, which has been reported from only a few Eastern stations.

The number of plants that make their first appearance on railroad embankments, or about station buildings, confirms the statement that railroads are active agents in disseminating weeds. The Eastern weeds that have found lodgment in our soil have mostly come by rail, and we may confidently expect the arrival of other species that are every year being reported from stations nearer to us.

But the travel of weeds is by no means in one direction; the West is sending some of its worst species in exchange for those contributed from the East; we hear of them in Illinois and Ohio, and even as far East as New York. A few recent introductions that have not yet spread to any extent are mullein (*Verbascum Thapsus*, L.), seen only along the railroad at Boulder; jimson-weed or thorn-apple (*Datura Stramonium*, L.), near Boulder and at Golden along the railroad; Canada thistle (*Cnicus arvensis*, Hoffm.), seen in one locality only; ox-eye daisy (*Chrysanthemum Leucanthemum*, L.), reported from the south and near Denver.

CAPSELLA BURSA-PASTERIS, (L.) Moench. (Plate I.)

(SHEPHERD'S PURSE.)

Annual; root leaves clustered, pinnatifid or toothed, stem leaves sagittate clasping; flowers white; racemes elongated; pod obcordate-triangular. This weed has a very wide distribution; it has followed civilization all over the world. With us it is an annoyance in gardens and a pest in fields, doing the greatest injury in fields of alfalfa; it has been sent us from several localities with the report that it was running out alfalfa. That it is capable of doing this I have seen demonstrated in a road-side piece of alfalfa, which in three years has entirely succumbed to the encroachment of the shepherd's purse. The plant is an annual; it may be found in flower and fruit from earliest spring until winter, and even all winter when the cold is not too severe. In size it varies greatly—from 2 inches to 2 feet; in irrigated fields it makes a rank growth and produces an enormous amount of seed. In order to estimate approximately the seed-producing possibilities, a count has been made of two average plants; 60 fruits from one plant gave an average of 30.1 seeds; for the other, 25 seeds; the average for both plants being $27\frac{1}{2}$ seeds to each fruit. On one plant were 951 fruits, on the other 952; this would give over 26,000 seeds to each plant. But this would not fairly represent the possibilities; the plants were not mature; on one 1,444 buds and flowers were counted, on the other 1,499; assuming that all of these reach full development, and we would have an average of over 66,000 seeds to the plant. Allow for accidents and assume 50,000 as the average number of seeds produced; surely this is enough to account for the rapid spread of the plant. Multiplication is by seed only; it follows that the way to subdue the plant is by preventing the formation and scattering of seed; the hoe and the cultivator judiciously used will accomplish this. We rate the plant as one of our worst weeds.

SAPONARIA VACCARIA, L. (Plate II.)

(COW HERB ; COCKLE.)

Very smooth throughout; 1 to 2 feet high, branched above. Leaves opposite, connate, lower oblong, upper ovate-lanceolate. Flowers in open cymes, pink. Calyx 5-angled, enlarged in fruit. Stamens, 10; styles, 2. Annual.

This is an introduction from Europe. At one time it was grown in gardens as an ornamental; its seeds were scattered, it became spontaneous, and is now well naturalized in many localities. It found its way to Colorado certainly as early as 1874, for on the authority of two collectors it is recorded as "introduced" in the flora published by Porter and Coulter in that year. The plant is now so abundant in grain fields as to rank among our worst pests; in many places it springs up abundantly in gardens and among hoed crops, but where the ground is cultivated it is easily mastered. When once started among grain, there is no remedy except to destroy when in flower. Seed is no doubt often sown with the grain, but this can be avoided with a little care; the seed is easier to separate than that of the corn cockle (*Agrostemma Githago*, L.), so troublesome in the Eastern States; it is smaller, nearly globular, very minutely roughened, and can be screened out easily. Plants should not be allowed to mature in waste places; they are not strongly rooted, and in the fall they break off or blow out and go rolling like a tumble weed, carrying their seed with them to considerable distances.

GAURA PARVIFLORA, Dougl. (Plate III.)

(SMALL FLOWERED GAURA.)

Annual; 2 to 7 feet high, from a long, slender tap-root. Stem at first simple, at length branching from the axils of the leaves. Leaves sessile, ovate-lanceolate, denticulate, sparsely covered with long villous hairs, and also with short hairs which are somewhat glandular. As the plant matures the leaves fall away, so that in the fall only a few below the spikes remain. The small flowers in long virgate spikes. Calyx tube prolonged beyond the ovary, 4-lobed. Petals, 4; stamens, 8; stigma 4-lobed.

This weed is a native; it ranges from Washington to Texas, east to the Missouri and westward to Utah. In some localities it is so abundant in grain fields and meadows as to give it rank among the worst weeds. It propagates only by seed, which it produces freely. Preventing seed formation by destruction before or at the time of flowering, is the remedy.

GRINDELIA SQUARROSA, Dunal. (Plate IV.)

(GUM PLANT ; ROSIN WEED.)

Annual; branching from the base; 1 to 2 feet high. Leaves sessile, rigid, spatulate to linear-oblong, narrowed at the base below, broadened and half-clasping above, acutely serrate or denticulate. Heads of yellow flowers rather large, terminating the branches. Involucre strongly squarrose with the spreading and recurving short filiform tips of the bracts; very viscid, especially at time of flowering. Rays narrow, very numerous.

This species is very common in all territory west of the Mississippi; it is extending eastward, and has been reported from Minnesota, Iowa, Missouri, and Illinois. Here it is most conspicuous along road-sides and on plains that have been broken up and then neglected; it invades cultivated land, and locally is very troublesome in corn-fields. The sum of its pestiferous and undesirable qualities warrants giving it a place among our worst weeds.

IVA AXILLARIS, Pursh. (Plates V. and VI.)

(POVERTY WEED.)

Herbaceous, perennial, from woody creeping root-stocks; branching, 6 inches to 1 foot high, equably leafy to the top. Leaves sessile, obovate or oblong, tapering to a narrow base, entire, obtuse, about 1 inch long, minutely appressed pubescent. The small, greenish heads on short recurved pedicels, solitary in the axils of the leaves. Common from the Missouri River to the Pacific, and from New Mexico to British Columbia. The natural home of the plant appears to be in sandy or saline soils, but it adapts itself to all soils, and is everywhere very troublesome. Once established on the farm or in the garden, it spreads rapidly and is difficult to eradicate. Plants produce a moderate quantity of seed, but multiplication is mainly by the extension of the running root-stocks. Like the "quack grass," the breaking up of these root-stocks only increases the number of plants; pieces may be transported across a field on the tools used, and there take root, thus assisting the distribution. Constant cultivation, and the removal of the root-stocks from the soil, is the only remedy.

IVA XANTHIIFOLIA, Nutt. (Plate VII.)

Annual; tall and coarse, 3 to 7 feet high; pubescent, at least when young; leaves mostly opposite, large, broadly ovate, incisedly serrate, acuminate, 3-ribbed at base, scabrous above. The small heads nearly sessile in crowded, spike-like paniced clusters from the axils of the leaves, and terminal.

A Western plant, ranging from New Mexico to Idaho. It has been reported from Iowa, and from northern Michigan, and is undoubtedly extending eastward. The plant produces seed in considerably quantity, and propagates only by seed. It is in many places a serious pest in cultivated fields, because of its abundance and rapid growth; being an annual, it is not difficult to destroy, and can be kept down by a little care; the trouble usually comes from delay in cultivation, which allows the weed such a start that it works injury to the crop, and requires much additional labor to eradicate. A mistake is often made in allowing it to grow and produce seed on waste land, or along road-sides. It is a too common sight to see such places covered with a tall, forest-like growth of this plant. From these places seeds are scattered upon our fields, and each year the trouble is repeated. Stop the formation of seed, and the plant will soon cease to be a pest.

SOLANUM ROSTRATUM, Dunal. (Plate VIII.)

(BEAKED HORSE-NETTLE; BUFFALO-BUR.)

Annual; yellowish, with copious stellate pubescence, much branched, 6 inches to 2 feet high. Stems, petioles, and veins of the leaves armed with straight prickles. Leaves 2 to 4 inches long, pinnatifid or sometimes bipinnatifid, the lobes rounded. Peduncles about an inch long, later 3 to 4 inches, bearing several flowers on short pedicels. Flowers yellow, an inch in diameter. Fruit enclosed by the close-fitting calyx, which is thickly beset with prickles.

Ranges from New Mexico to Wyoming, and across the plains. It has migrated eastward, being common in Iowa and Missouri, and is reported from Illinois, Indiana, Ohio, and New York. It is everywhere recognized as a bad weed; here, from its abundance, it ranks as one of the worst. Destroying early enough to prevent the scattering of seed, is an effectual remedy.

FRANSERIA DISCOLOR, Nutt. (Plates IX. and X.)

Perennial; the erect, slender stems from very slender running root-stocks, 6 inches to 1 foot high, usually somewhat branched. Leaves 2 to 5 inches long, oblong in outline, interruptedly bipinnatifid, the lobes short and broad, silvery white below, green above. Sterile racemes usually solitary, terminating the stem, occasionally small racemes on the lateral branches, fertile flowers few, the involucre ovoid, 2-flowered, armed with few short conical spines.

Ranges from New Mexico to Wyoming, and east to Nebraska. An aboriginal species that does not appear to have migrated very far eastward. We have no weed so persistent as this; its thread-

like root-stocks grow very rapidly, and extend through the soil in all directions, forming a close network. By washing out, I have traced them four and five feet beyond the last plant appearing above ground. When plants are hoed up they are very soon replaced by others, which spring from these root-stocks; plowing, which breaks the root-stocks in pieces, only helps to multiply the plant. The only way to eradicate it is to so persistently cut it down that the plants are given no chance to carry on the processes of nutrition; if no leaves are allowed, the plant must soon die for want of them. The species does not spread rapidly from seed, as only a comparatively small number are produced; ten plants counted gave an average of 73. As the plants multiply mainly by root-stocks, it is important that they be dug out completely as soon as discovered, and before they become well established.

HORDEUM JUBATUM, L. (Plates XI. and XII.)

(SQUIRREL-TAIL GRASS; FOX-TAIL; WILD BARLEY.)

Annual; 6 inches to 2 feet high. Leaves flat, 2 to 4 inches long, margins scabrous. Flowers in a dense spike about 4 inches long, pale green, often purplish. Three florets at each joint of the rhachis, only the central one perfect, lateral florets short awned, central floret with awn 2 inches long, outer glumes 2 inches long, 6 at each joint, rough, upwardly barbed.

This is a Western species, that has become widely distributed over the northern United States. It is one of our worst weeds, spreading rapidly in lands wet from seepage, and also troublesome in cultivated ground. It is especially bad in meadows; its presence greatly lessens the value of hay on account of the injurious effect upon stock of the long, rough awns. When in bloom the grass is ornamental, but its beauty is short-lived; the rhachis soon breaks up, and the parts are scattered by the wind. It should be cut early to prevent seeding.

Plates I., II., VI., VII., VIII., IX. and XI. are from drawings made by Miss C. M. Southworth; plates III. and IV. from drawings made by Miss Alice Bell. Plates V., X. and XII. are from photographs.

We ask of farmers and others interested that they co-operate with us in the endeavor to designate and classify the weed pests from every agricultural region of the State.

Send us lists of the worst weeds that infest your region, with information as to the general habits of the plants, the kind of soil in which they are most abundant, and the crops most infested.

Where possible, it would be still better to send specimens of the plants; in some cases it will be necessary to have specimens, in order to accurately determine the species, for the reason that there is some confusion in local names. The same plant is frequently known by different names in different sections.

Small plants should be sent entire, roots and all; they should show blossoms, and, if possible, fruit also. Large plants may be sent in part—a portion of the stem showing leaves, flowers, and fruit. Plants may be dried under pressure, between sheets of blotting-paper, or newspaper; when sent dry, they should be protected from injury in the mails by pieces of heavy paste-board. If sent fresh, they should be slightly moistened, and wrapped in heavy paper.

Always write the name of the sender on the outside of the package. Address,

DEPARTMENT OF BOTANY AND HORTICULTURE,
STATE AGRICULTURAL COLLEGE,
FORT COLLINS, COLORADO.



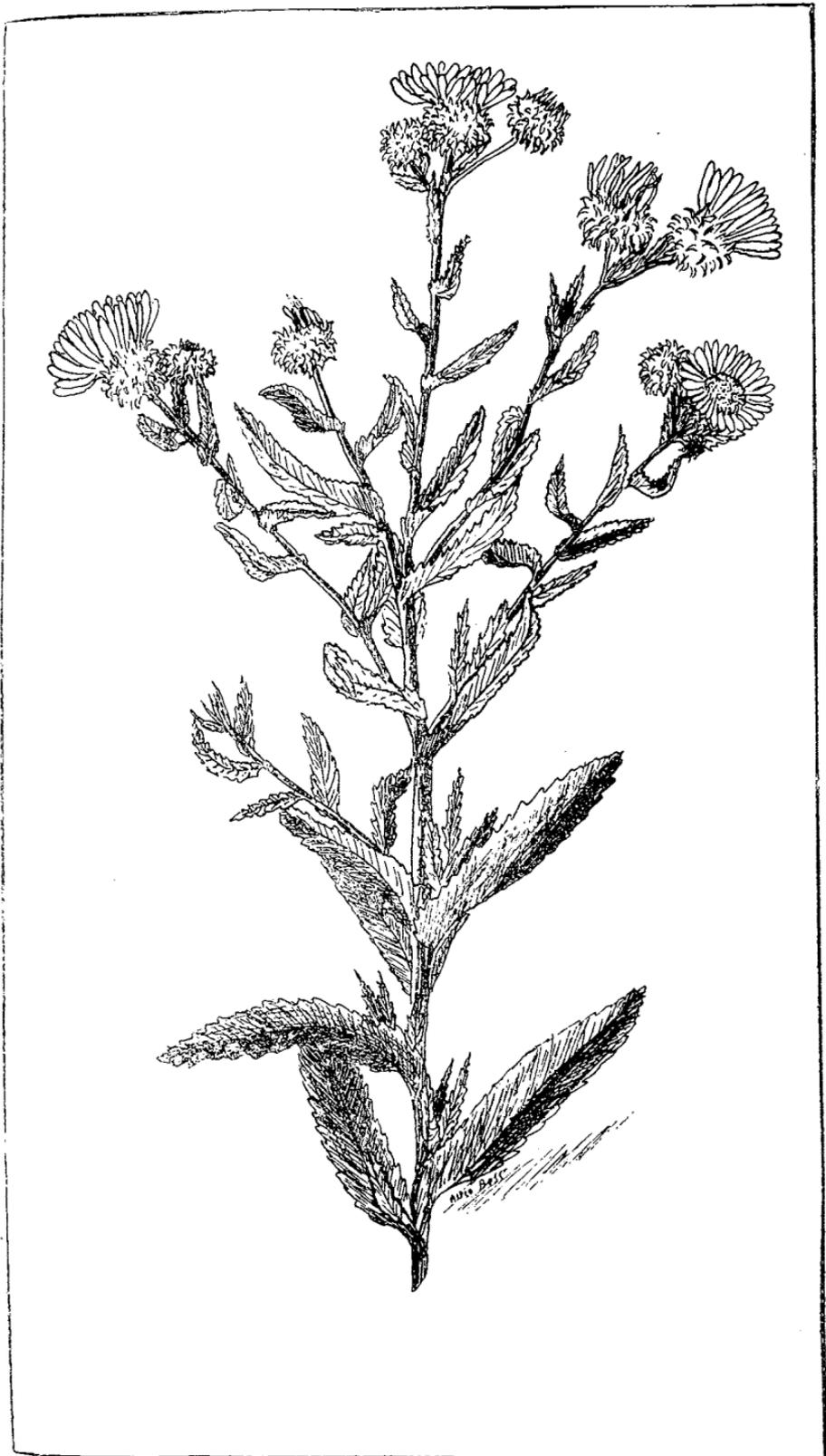
(PLATE I.)—CAPSELLA BURSA-PASTORIS, Mench.



(PLATE II.)—SAPONARIA VACCARIA, L.

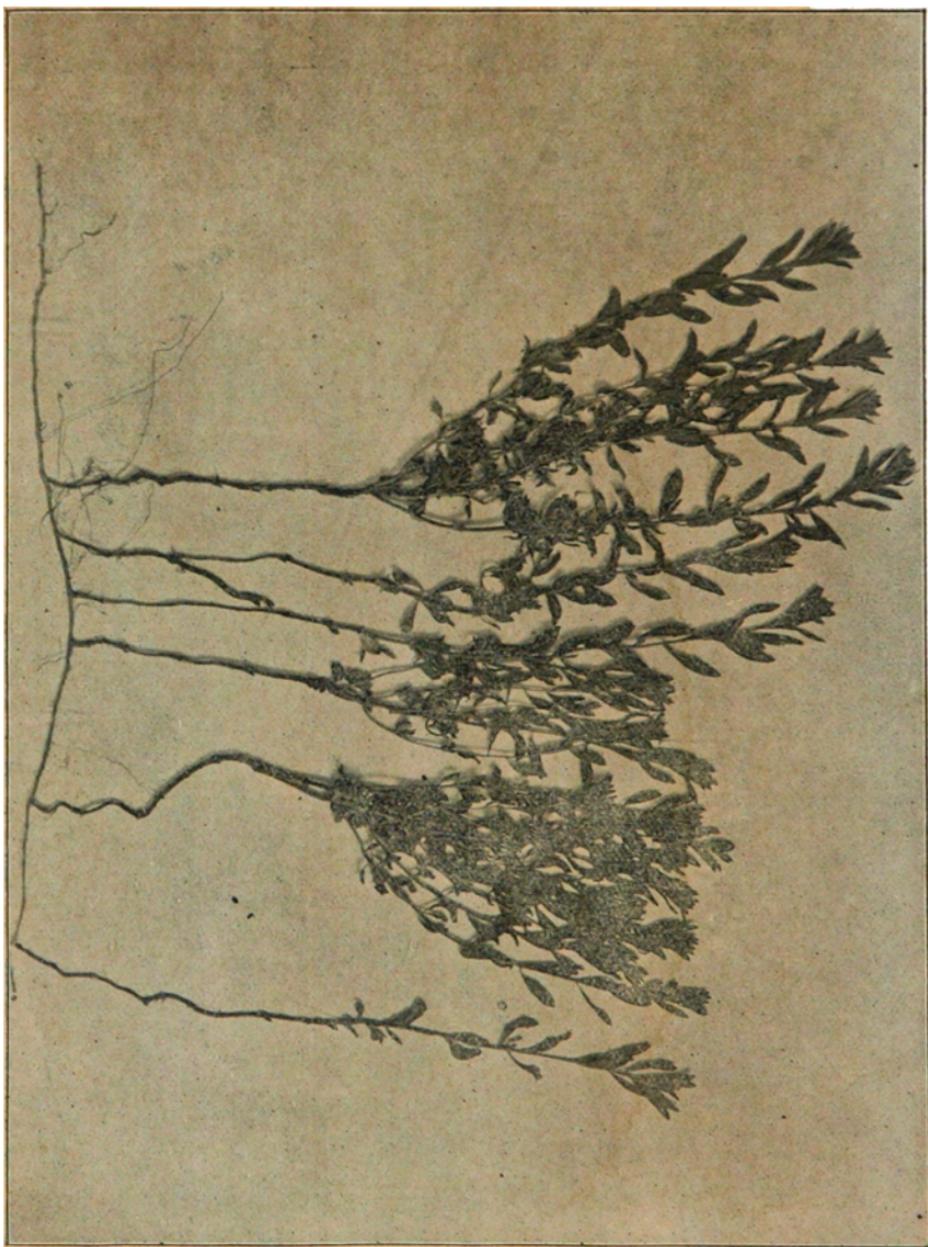


(PLATE III.)—GAURA PARVIFLORA, Dougl.



(PLATE IV.)—GRINDELIA SQUARROSA, Dunal.

(PLATE V.)—*Iva axillaris*, Pursh.

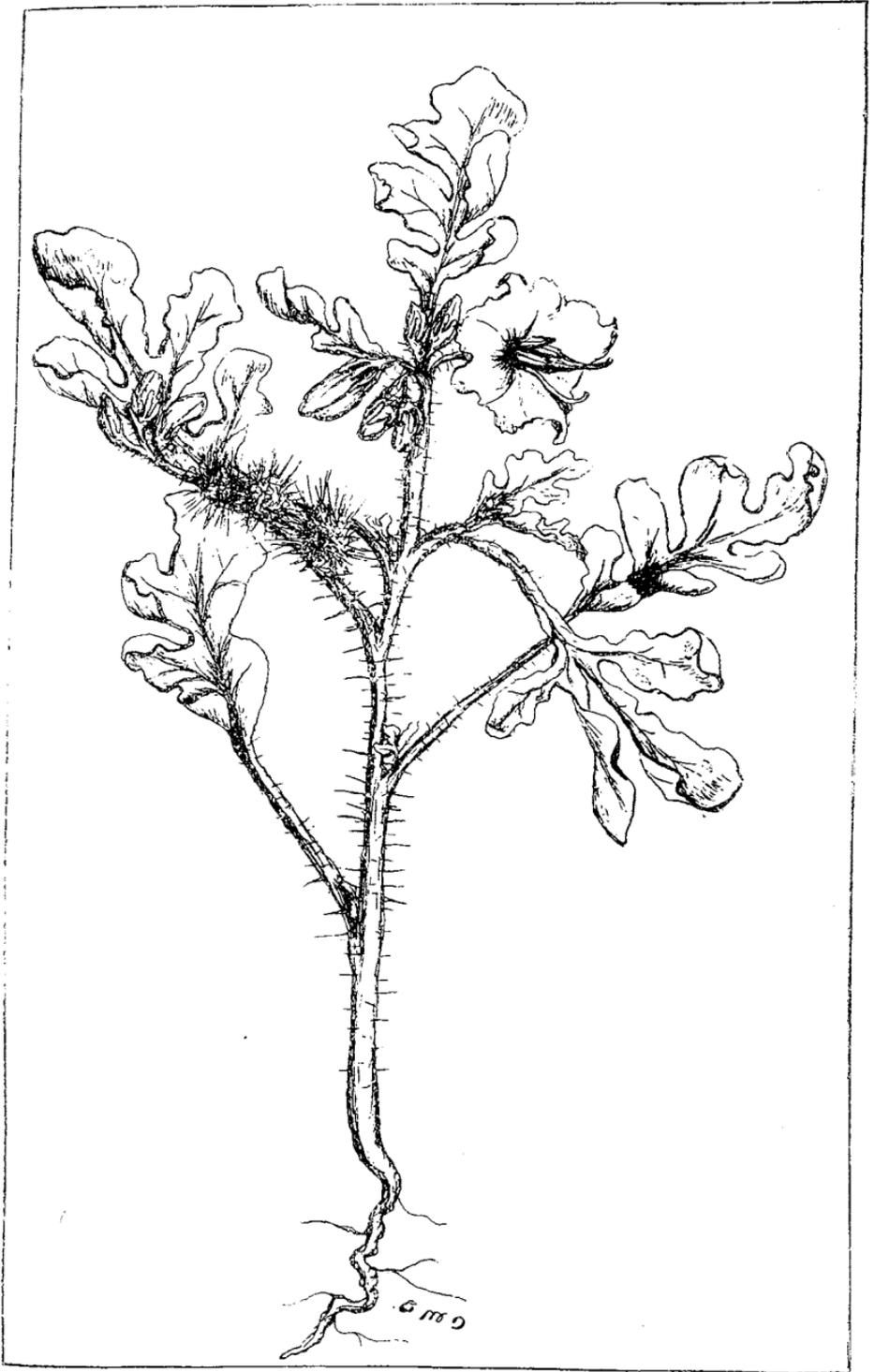




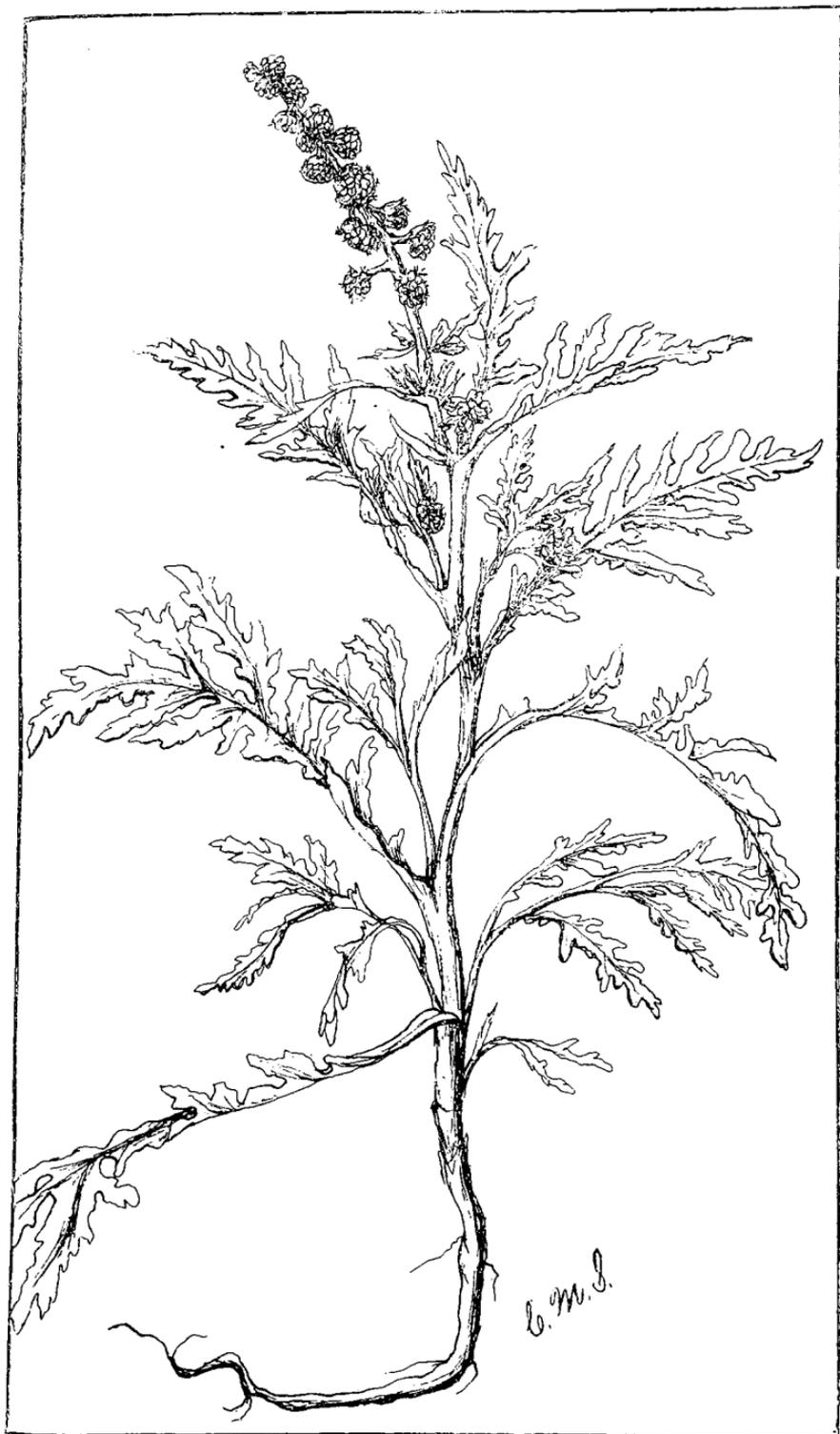
(PLATE VI.)—*IVA AXILLARIS*, Pursh.



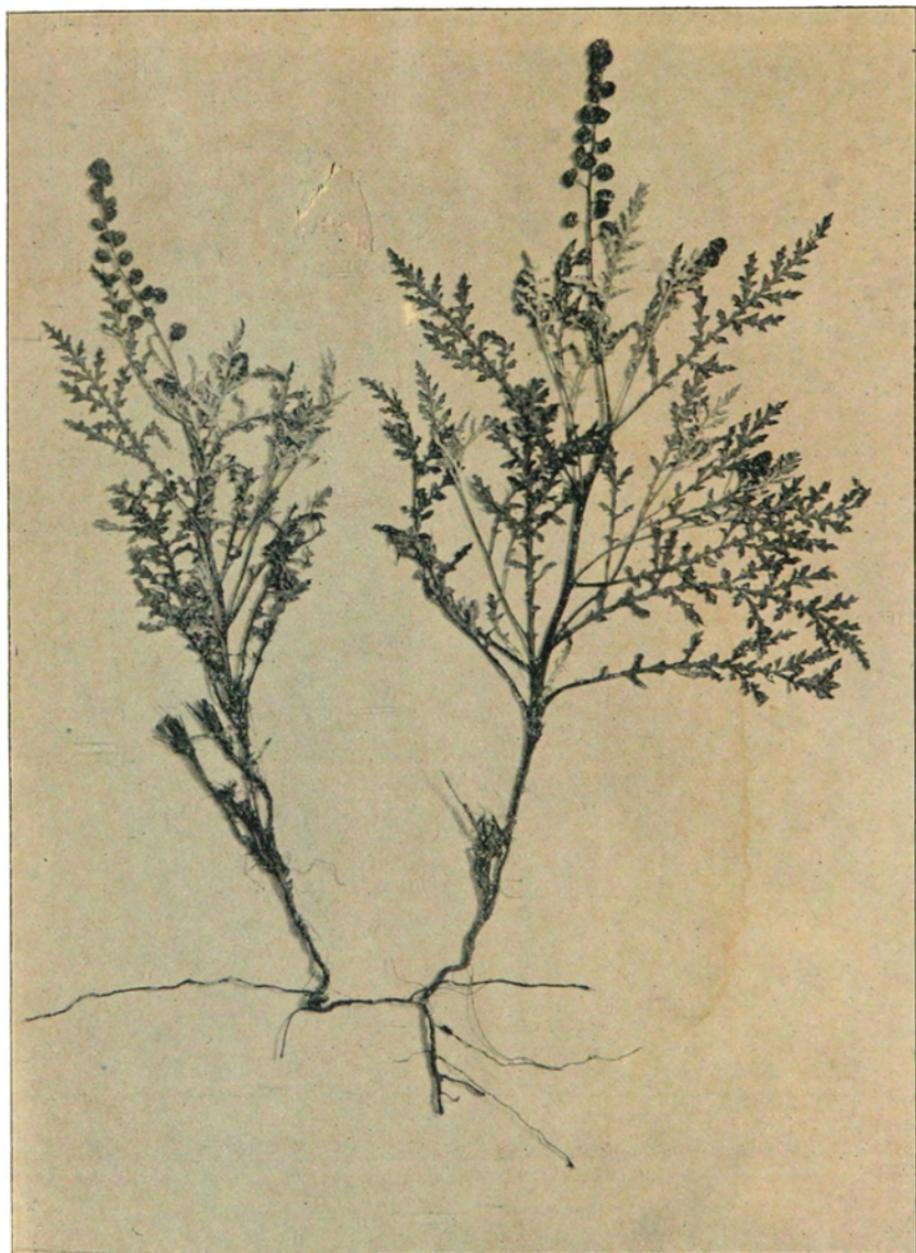
(PLATE VII.)—*IVA XANTHIFOLIA*, Nutt.



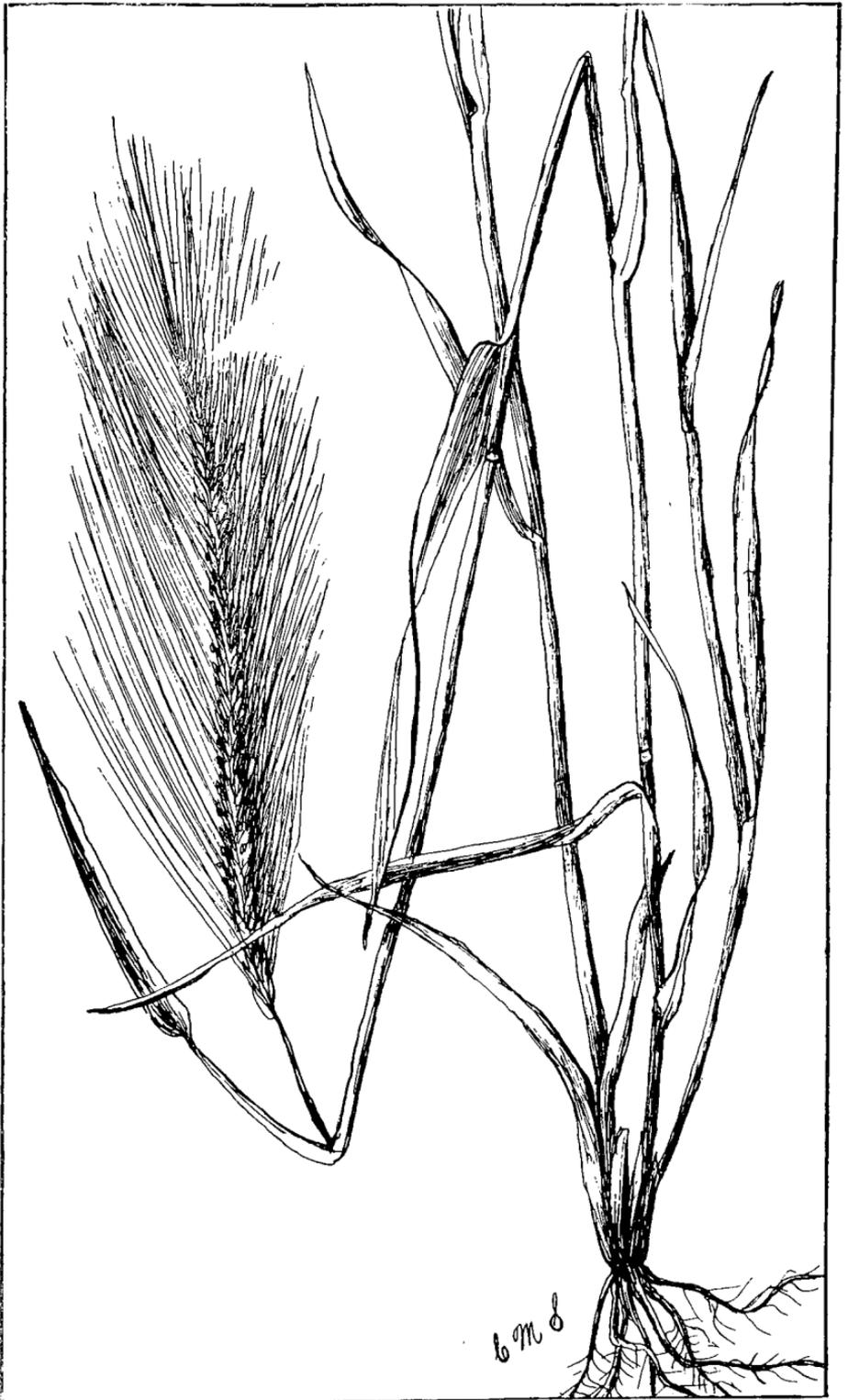
(PLATE VIII.)—*SOLANUM ROSTRATUM*, Dunal.



(PLATE IX.)—FRANSERIA DISCOLOR, Nutt.



(PLATE X.)—FRANSERIA DISCOLOR, Nutt.



(PLATE XI.)—HORDEUM JUBATUM, L.



(PLATE XII.)—HORDEUM JUBATUM, L.