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## A Contribution To The Knowledge Of The Minnesota Flora

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tin") seems to exert a rather similar control over the same group of substances but the action is much slower than seen with insulin or adrenaline. Muscular exercise calls the hormonal controls into action and, apart from this, sets up diffusion gradients involving these substances by burning glucose, by releasing potassium from the inside of the cells and by breaking down the important fuel complex phosphocreatine.

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### A NEW SPECIES OF TREMATODE FROM THE BLADDER OF THE SPOTTED SALAMANDER

FRANK G. MESERVE  
*Macalester College*

*See* Some Monogenetic Trematodes from the Galapagos Islands and the Neighboring Pacific.

Allan Hancock Pacific Expeditions. Vol. 2, No. 5. Univ. of Southern California Press. 1938.

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### A CONTRIBUTION TO THE KNOWLEDGE OF THE MINNESOTA FLORA<sup>1</sup>

JOHN W. MOORE  
*University of Minnesota*

During the period from June until late September field studies were made with the definite purpose of obtaining more information on the occurrence and distribution especially of higher plants in Minnesota.

Two extended field excursions were made. One was into St. Louis County, where plants were collected in the region of the Mesabi Iron Range, thence along the northern border from International Falls to Warroad on Lake of the Woods with stops at intervals for the purpose of collecting plant specimens. The second was through the western part of the state from Breckenridge, in Wilkin County, south to Luverne, in Rock County, and east through the southernmost counties to Fillmore. Several shorter excursions were made north, east, and south from the Twin City area.

A total of 415 collections was secured with an aggregate total

<sup>1</sup>The report which is here presented is the outcome of field work during the past summer and fall, (1938), under the auspices of the Minnesota Academy of Science and the American Association for the Advancement of Science.

of about 2,500 specimens. Some twenty species collected have but a scanty representation in the University of Minnesota Herbarium. Two hundred and fifty new county records were secured. Nine species and seven varieties of plants are here added for the first time to the present published records of Minnesota plants. A formal list of new county records and previously unreported plants is appended. In addition to these, several collections do not answer well any published plant descriptions and require additional study. It is perhaps best to record the technicalities concerning them at a later date.

Conclusions are based upon a study of the ample collections available in the University of Minnesota Herbarium as well as much relevant botanical literature.

Let us now consider the additions to the known Minnesota flora. We have in the neighborhood of seventy ferns and fern allies in our flora. They are perhaps better known than the large assemblage of some 2,000 flowering plants. To add a fern to the known list is, at this late date, a rare privilege. Last summer while collecting on the Sioux Quartzite at Pipestone the clover fern, *Marsilea vestita*, was discovered. It is interesting to note that Upham,<sup>2</sup> in his Catalogue of the Flora of Minnesota, after noting its occurrence near Devil's Lake (North Dakota) and in Iowa puts in the notation "probably also in Minnesota." However, so far as can be determined from published reports and a lack of any collection in the Minnesota Herbarium, we have now the first definite evidence of its presence in the state. In association with *Marsilea* at Pipestone two unreported sedges, *Cyperus acuminatus* and *Eleocharis Engelmanni*, were also collected. All of these little plants are inconspicuous and possibly have been overlooked on that account.

One of the pepper grasses, a mustard, *Lepidium densiflorum*, was encountered on the morainic hills a short distance southwest of South St. Paul. It is probable that the plant has in the past been called *Lepidium apetalum* Willd., a close relative. Also in the same area a very pretty blue flowered species of Venus's Looking Glass, *Specularia leptocarpa*, was found growing on a south facing hillside. This species has been reported from the adjoining states of Iowa, Nebraska and South Dakota.

A robust frost aster, *Aster Batesii*, was found in three western Minnesota counties. This aster has been known previously only from Nebraska and was described from there by the late Per Axel Rydberg. The ray flowers are tinted with pink or pale purple.

Several varieties of well known Minnesota plant species were secured, which are not, as far as the writer knows found in the published records. Briefly these are: a smart weed, *Polygonum punctatum* var. *leptostachyum*; a sedge, *Cyperus filiculmis* var. *macilentus*; one of the milkworts, *Polygala verticillata* var. *isocycla*; a hairy

<sup>2</sup> Upham, Warren. Catalogue of the Flora of Minnesota. Geol. and Nat. Hist. Surv. of Minn. Ann. Rept. for 1883, p. 180, 1884.

leaved plantain, *Plantago major* var. *pachyphylla*; a thin stalked variety of swamp beggar-ticks, *Bidens connata* var. *gracilipes*; two varieties of the hair bell, the eastern one, *Campanula rotundifolia* var. *intercedens* and a western representative *Campanula rotundifolia* var. *petiolata*.

As Minnesota becomes older, plants from other parts of the world make their appearance. Some of these new arrivals have an ability to thrive in their new abode and crowd out the native vegetation, others are casual and very local and seem to be unable to travel far from the point of introduction. The first are weeds, the latter usually not.

One weedy brome grass, *Bromus subsquarrosus* Borbas, was collected on the University campus. This plant seems to have been present in the United States for some time but has been included in reports as *Bromus japonicus* which is a distinct species. Another grass, also from the campus, the crested wheat grass *Agropyron cristatum* has been recommended for planting as a forage plant in dry areas in other parts of the country.

The garden hyssop has been recorded as a garden plant in Minnesota. Last summer this mint, *Hyssopus officinalis*, was found well established about a mile north of the town of Taylors Falls where it grows in association with the showy, yellow-flowered five finger, *Potentilla recta*, another European plant.

A few notable extensions of ranges of flowering plants in Minnesota were secured. *Aristida Curtissii* is represented in the Minnesota herbarium by specimens from Dakota and Hennepin counties on the eastern border of the state. This grass was found growing in Rock and Big Stone counties in western Minnesota.

*Panicum albemarlense*, another grass apparently common in counties of the east central part of the state, was also secured in Big Stone County.

One of the smart weeds, *Polygonum buxiforme*, previously known from Winona was obtained in Lake of the Woods County.

*Euphorbia missouriensis*, a spurge, is represented by specimens in the University of Minnesota Herbarium from Chippewa, Pipestone, Yellow Medicine and Cottonwood counties. All of these are from the western part of the state. Specimens of this plant were found in Dakota County.

And finally, *Solanum rostratum*, the original buffalo bur, a member of the potato family, is represented in the herbarium by specimens from Anoka, Hennepin and Winona counties. A nice burry collection was made down in Rock County in the extreme southwestern corner of Minnesota.

The following catalogue of plants includes only those species of the collection which apparently represent new county records or plants previously unrecorded for Minnesota. In each case the scientific name is given followed by the collection number and the county.

All the collections were made by the writer and Mrs. Moore during the season of 1938.

The determinations are those of the writer, with one exception. The moss, *Entodon sedutrix*, was identified by Prof. N. L. Huff of the Department of Botany at the University of Minnesota.

A specimen representing each number of the collection will be deposited in the University Herbarium.

## BRYOPHYTA

## MUSCI

- Barbula unguiculata* (Huds.) Hedw. 10583, Fillmore County.  
*Entodon sedutrix* (Hedw.) C. Muell. 10591, Chisago County.  
*Funaria hygrometrica* (L.) Sibth. 10585, Fillmore County.  
*Leskea arenicola* Best 10516, Lac Qui Parle County.

## PTERIDOPHYTA

## POLYPODIACEAE

- Cystopteris bulbifera* (L.) Bernh. 10586, Fillmore County.  
*Pellaea glabella* Mett. ex Kuhn 10617, Washington County.  
*Woodsia ilvensis* (L.) R. Br. 10361, 10362, 10374, 10375, Lake of the Woods County;  
 10499, Big Stone County.

## MARSILIACEAE

- Marsilea vestita* Hook. and Grev. 10550, Pipestone County. Not previously collected in the state.

## EQUISETACEAE

- Equisetum laevigatum* A. Br. 10257, Dakota County.

## SELAGINELLACEAE

- Selaginella rupestris* (L.) Spring 10496, Big Stone County.

## SPERMATOPHYTA

## ANGIOSPERMAE

## MONOCOTYLEDONEAE

## ALISMACEAE

- Alisma subcordatum* Raf. 10384, Roseau County.

## GRAMINEAE

- Agropyron cristatum* Gaertn. 10243, Hennepin County. Not previously reported from Minnesota.

*Agropyron Smithii* Rydb. 10260, Dakota County.

*Agrostis scabra* Willd. 10179, Dakota County.

*Alopecurus aequalis* Sobol 10410, Ramsey County.

*Andropogon furcatus* Muhl. 10479, Traverse County.

*Aristida basiramea* Engelm. 10440, 10447, Washington County.

*Aristida Curtissii* (A. Gray) Nash 10507, Big Stone County; 10557, Rock County.

*Avena sativa* L. 10224, Dakota County.

*Bouteloua curtipendula* (Michx.) Torr. 10268, Anoka County.

*Bouteloua gracilis* (H. B. K.) Lag. 10184, Dakota County.

*Bouteloua hirsuta* Lag. 10267, Anoka County; 10441, Washington County.

*Bromus latiglumis* (Shear) Hitchcock 10451, Wilkin County.

*Bromus subsquarrosus* Borbás

Syn. *Bromus japonicus* Thumb.  $\beta$ . *porrectus* Hackel. 10244, Hennepin County.

Not previously reported from Minnesota.

*Digitaria ischaemum* (Schreb.) Muhl. 10448, Washington County.

*Digitaria sanguinalis* (L.) Scop. 10264, Dakota County.

*Eragrostis pectinacea* (Michx.) Nees 10316, Dakota County.

*Hordeum jubatum* L. 10178, Dakota County.

*Leersia oryzoides* (L.) Swartz 10417, Ramsey County.

*Muhlenbergia cuspidata* (Torr.) Rydb. 10439, Washington County; 10504, 10506, Big Stone County.

- Muhlenbergia racemosa* (Michx.) B. S. P. 10503, Big Stone County; 10517, Lac Qui Parle County.  
*Panicum albemarlene* Ashe 10497, Big Stone County; 10596, Chisago County.  
*Panicum barbipulvinatum* Nash 10482, Traverse County.  
*Panicum capillare* L. 10626, Ramsey County.  
*Panicum huachucae* Ashe 10426, Washington County.  
*Panicum Lindheimeri* Nash var. *implicatum* (Scribn.) Fernald 10255, Hennepin County; 10513, Lac Qui Parle County.  
*Panicum meridionale* Ashe 10322, Scott County.  
*Panicum praecocius* Hitchc. and Chase 10555, Rock County.  
*Panicum Scribnerianum* Nash 10510, Lac Qui Parle County; 10624, Washington County.  
*Panicum Wilcoxianum* Vasey 10186, Dakota County; 10623, Washington County.  
*Phleum pratense* L. 10209, Dakota County.  
*Poa compressa* L. 10182, Dakota County.  
*Setaria lutescens* (Weigel) F. T. Hubbard 10620, Washington County.  
*Setaria verticillata* (L.) Beauv. 10289, Rice County; 10568, Jackson County.  
*Setaria viridis* (L.) Beauv. 10225, Dakota County.  
*Sporobolus neglectus* Nash 10527, Lincoln County.  
*Sporobolus vaginiflorus* (Torr.) Wood 10505, Big Stone County; 10602, Washington County.  
*Stipa spartea* Trin. 10188, Dakota County.

## CYPERACEAE

- Carex cristatella* Britton 10261, Dakota County.  
*Carex oligosperma* Michx. 10355, St. Louis County.  
*Carex retrorsa* Schwein. 10262, Dakota County.  
*Cyperus acuminatus* Torr. and Hook. 10549, Pipestone County. Not previously reported from Minnesota.  
*Cyperus filiculmis* Vahl. var. *macilentus* Fernald 10185, Dakota County. Not previously reported from Minnesota.  
*Cyperus inflexus* Muhl. 10501, Big Stone County; 10526, Lincoln County.  
*Cyperus strigosus* L. 10431, Washington County.  
*Dulichium arundinaceum* (L.) Britton 10354, St. Louis County.  
*Eleocharis calva* Torr. 10391, 10392, 10397, Roseau County.  
*Eleocharis Engelmanni* Steud. 10551, Pipestone County. Not previously reported for Minnesota.  
*Eleocharis palustris* (L.) R. and S. var. *major* Sonder 10393, Roseau County.  
*Eriophorum virginicum* L. 10353, St. Louis County.

## LEMNACEAE

- Lemna minor* L. 10450, Wilkin County; 10491, Big Stone County; 10404, Ramsey County.  
*Lemna trisulca* L. 10449, Wilkin County.  
*Spirodela polyrhiza* (L.) Schleid. 10404, Ramsey County.

## COMMELINACEAE

- Tradescantia bracteata* Small 10199, 10200, Dakota County.

## JUNCACEAE

- Juncus alpinus* Vill. var. *insignis* Fries 10396, Roseau County.  
*Juncus nodosus* L. 10395, Roseau County.

## ORCHIDACEAE

- Calopogon tuberosus* (L.) B. S. P. 10349, St. Louis County.

## DICOTYLEDONEAE

## URTICACEAE

- Cannabis sativa* L. 10314, Dakota County; 10635, Ramsey County.  
*Pilea pumila* (L.) Gray 10582, Fillmore County.  
*Urtica gracilis* Ait. 10567, Jackson County.  
*Urtica procerca* Muhl. 10459, Traverse County.

## POLYGONACEAE

- Polygonum buxiforme* Small 10363, Lake of the Woods County.

- Polygonum Convolvulus* L. 10194, Dakota County.  
*Polygonum Hydropiper* L. 10292, Rice County.  
*Polygonum Persicaria* L. 10318, Dakota County; 10529, Lincoln County.  
*Polygonum punctatum* Ell. var. *leptostachyum* (Meisn.) Small 10293, Rice County.  
 Not previously reported for Minnesota.  
*Polygonum ramosissimum* Michx. 10465, Traverse County.  
*Polygonum tenue* Michx. 10498, Big Stone County; 10438, Washington County.

## CHENOPODIACEAE

- Chenopodium album* L. 10319, Dakota County.  
*Chenopodium glaucum* L. 10485, Traverse County.  
*Cyclocoma atriplicifolium* (Spreng.) Coult. 10600, Chisago County.  
*Kochia Scoparia* (L.) Schrad. 10539, Lincoln County.

## AMARANTHACEAE

- Acnida tamariscina* (Nutt.) Wood 10434, Washington County.  
*Acnida tuberculata* Moq. 10630, Washington County.  
*Amaranthus blitoides* Wats. 10223, Dakota County.

## PORTULACACEAE

- Portulaca oleracea* L. 10315, Dakota County; 10502, Big Stone County.  
*Talinum parviflorum* Nutt. 10500, Big Stone County.

## CARYOPHYLLACEAE

- Saponaria officinalis* L. 10259, Dakota County.  
*Silene stellata* (L.) Ait. f. 10574, Freeborne County.

## RANUNCULACEAE

- Anemone canadensis* L. 10208, Dakota County.  
*Delphinium virescens* Nutt. 10190, Dakota County.  
*Ranunculus sceleratus* L. 10385, Roseau County.

## MENISPERMACEAE

- Menispermum canadense* L. 10509, Lac Qui Parle County.

## CRUCIFERAE

- Berteroa incana* (L.) 10196, Dakota County.  
*Lepidium densiflorum* Schrad. 10189, Dakota County. Not previously reported from Minnesota.  
*Sisymbrium altissimum* L. 10180, Dakota County.  
*Thlaspi arvense* L. 10207, Dakota County.

## CAPPARIDACEAE

- Polanisia graveolens* Raf. 10445, Washington County.

## SAXIFRAGACEAE

- Heuchera Richardsonii* R. Br. var. *hispidioides* R. B. L. 10370, Lake of the Woods County.

## ROSACEAE

- Physocarpus opulifolius* (L.) Maxim. var. *intermedius* (Rydb.) Robinson 10614, Washington County.  
*Potentilla argentea* L. 10216, Dakota County.  
*Potentilla arguta* Pursh 10193, Dakota County.  
*Potentilla monspeliensis* L. 10197, Dakota County.  
*Potentilla paradoxa* Nutt. 10530, Lincoln County.

## LEGUMINOSAE

- Amorpha canescens* Pursh 10452, Wilkin County.  
*Amorpha fruticosa* L. var. *angustifolia* Pursh 10489, Big Stone County.  
*Amphicarpa Pitcheri* T. and G. 10416, Ramsey County.  
*Astragalus canadensis* L. 10477, Traverse County.  
*Lathyrus palustris* L. 10399, Roseau County.  
*Melilotus officinalis* (L.) Lam. 10211, Dakota County.  
*Psoralea argophylla* Pursh 10542, Lincoln County.  
*Strophostyles leiosperma* (T. and G.) Piper 10466, Washington County.  
*Trifolium pratense* L. 10210, Dakota County.  
*Trifolium repens* L. 10206, Dakota County.

## OXALIDACEAE

- Oxalis stricta* L. 10237, Dakota County; 10622, Washington County.  
*Oxalis violacea* L. 10471, Traverse County.

## LINACEAE

- Linum sulcatum* Riddell 10300, Goodhue County.

## POLYGALACEAE

- Polygala verticillata* L. var. *isocycla* Fernald 10302, Goodhue County. Not previously reported for Minnesota.

## EUPHORBIACEAE

- Acalypha virginica* L. 10566, Jackson County; 10433, 10618, Washington County.  
*Euphorbia corollata* L. 10609, Washington County.  
*Euphorbia Geyeri* Engelm. 10444, Washington County.  
*Euphorbia glyptosperma* Engelm. 10475, Traverse County; 10511, Lac Qui Parle County.  
*Euphorbia missouriensis* (Norton) Small 10205, Dakota County.  
*Euphorbia serpyllifolia* Pers. 10508, Lac Qui Parle County.

## ACERACEAE

- Acer Negundo* L. 10214, Dakota County.

## BALSAMINACEAE

- Impatiens biflora* Walt. 10287, Rice County.

## MALVACEAE

- Hibiscus Trionum* L. 10533, Lincoln County.

## HYPERICACEAE

- Hypericum boreale* (Britton) Bicknell 10634, Ramsey County.

## ELATINACEAE

- Elatine minima* (Nutt.) Fisch. and Meyer 10356, St. Louis County.

## CISTACEAE

- Helianthemum Bicknellii* Fernald 10578, Freeborne County.

## LYTHRACEAE

- Lythrum alatum* Pursh 10323, Scott County; 10432, Washington County.

## ONAGRACEAE

- Epilobium adenocaulon* Haussk. 10535, Lincoln County.  
*Merolix serrulata* (Nutt.) Walp. 10469, Traverse County.

## UMBELLIFERAE

- Eryngium yuccaefolium* Michx. 10579, Freeborn County.  
*Sium cicutaefolium* Schrank 10383, Roseau County.

## GENTIANACEAE

- Gentiana puberula* Michx. 10553, Rock County.

## APOCYNACEAE

- Apocynum album* Greene 10247, Hennepin County.

## CONVOLVULACEAE

- Convolvulus sepium* L. var. *americanus* Sims 10569, Faribault County.

## BORAGINACEAE

- Lithospermum linearifolium* Goldie 10466, Traverse County.

## VERBENACEAE

- Verbena stricta* Vent. 10478, Traverse County.

## LABIATAE

- Dracocephalum parviflorum* Nutt. 10203, Dakota County.  
*Hedeoma hispida* Pursh 10177, Dakota County.  
*Hyssopus officinalis* L. 10598, Chisago County.  
*Isanthus brachiatus* (L.) B. S. P. 10495, Big Stone County.  
*Lycopus asper* Greene 10461, Traverse County.  
*Mentha canadensis* L. var. *glabrior* Hooker 10295, Rice County; 10421, Washington County; 10466, Traverse County.  
*Physostegia virginiana* (L.) Bentham 10286, Rice County; 10418, Washington County.



*Pycnanthemum virginianum* (L.) Durand and Jackson 10571, Freeborn County.  
*Salvia lanceolata* Willd. 10481, Traverse County.

## SOLANACEAE

*Physalis virginiana* Mill. 10188, Dakota County; 10560, Rock County.  
*Solanum nigrum* L. 10235, Dakota County.  
*Solanum rostratum* Dunal 10564, Rock County.

## SCROPHULARIACEAE

*Thysanthes dubia* (L.) Barnhart 10633, Ramsey County.  
*Veronica virginica* L. 10573, Freeborn County.

## PLANTAGINACEAE

*Plantago aristata* Michx. 10299, Goodhue County.  
*Plantago major* L. 10428, Washington County.  
*Plantago major* L. var. *pachyphylla* Pilger 10360, Lake of the Woods County; 10398, Roseau County. Not previously reported for Minnesota.  
*Plantago Rugelii* Decne. 10590, Chisago County.

## RUBIACEAE

*Galium Aparine* L. 10204, Dakota County.  
*Galium boreale* L. 10369, Lake of the Woods County; 10572, Freeborn County.  
*Galium tectorium* L. 10258, Dakota County.  
*Houstonia canadensis* Willd. 10365, Lake of the Woods County.

## CUCURBITACEAE

*Echinocystis lobata* (Michx.) T. and G. 10414, Ramsey County.  
*Sicyos angulatus* L. 10563, Rock County.

## CAMPANULACEAE

*Campanula rotundifolia* L. var. *intercedens* (Witasek) Farwell 10213, Dakota County; 10366, Lake of the Woods County. Not previously reported for Minnesota.  
*Campanula rotundifolia* L. var. *petiolata* (A. DC.) Henry 10367, Lake of the Woods County. Not previously reported for Minnesota.  
*Specularia leptocarpa* (Nutt.) A. Gray 10201, Dakota County. Not previously reported for Minnesota.

## LOBELIACEAE

*Lobelia siphilitica* L. var. *ludoviciana* A. DC. 10415, Ramsey County.  
*Lobelia spicata* Lam. var. *hirtella* Gray 10324, Scott County.

## COMPOSITAE

*Achillea lanulosa* Nutt. 10191, Dakota County.  
*Ambrosia elatior* L. 10317, Dakota County.  
*Artemisia Herriotii* Rydb. 10480, Traverse County.  
*Artemisia pabularis* (A. Nels.) Rydb. 10454, Wilkin County.  
*Aster angustus* (Lindl.) T. and G. 10492, Big Stone County.  
*Aster azureus* Lindl. 10570, Freeborn County.  
*Aster Batesii* Rydb. 10464, Traverse County; 10515, Lac Qui Parle County; 10532, Lincoln County. Not previously reported for Minnesota.  
*Aster ericoides* L. 10514, Lac Qui Parle County; 10603, Washington County.  
*Aster laevis* L. 10518, Lac Qui Parle County; 10453, Wilkin County.  
*Aster lateriflorus* (L.) Britton 10611, Washington County.  
*Aster paniculatus* Lam. 10429, Washington County.  
*Aster sagittifolius* Wedemeyer 10604, Washington County.  
*Aster salicifolius* Lam. 10358, St. Louis County; 10456, Traverse County.  
*Aster sericeus* Vent. 10522, Lac Qui Parle County; 10580, Freeborn County.  
*Bidens cernua* L. 10490, Big Stone County; 10386, Roseau County.  
*Bidens comosa* (A. Gray) Wiegand 10494, Big Stone County; 10631, Washington County.  
*Bidens connata* Muhl. var. *gracilipes* Fernald 10420, Washington County. Not previously reported for Minnesota.  
*Bidens connata* Muhl. var. *petiolata* (Nutt.) Farwell 10632, Washington County.  
*Bidens frondosa* L. 10483, Traverse County; 10422, Washington County.  
*Boltonia asteroides* (L.) L'Her 10430, Washington County.  
*Chrysopsis foliosa* Nutt. 10476, Traverse County.

- Coreopsis palmata* Nutt. 10576, Freeborn County.  
*Erigeron canadensis* L. 10320, Dakota County.  
*Erigeron ramosus* (Walt.) B. S. P. 10187, Dakota County.  
*Eupatorium altissimum* L. 10326, Scott County.  
*Gnaphalium obtusifolium* L. 10612, Washington County.  
*Helianthus rigidus* (Cass.) Desf. 10523, Lac Qui Parle County.  
*Helianthus autumnale* L. 10427, Washington County.  
*Helianthus tuberosus* L. 10457, Traverse County.  
*Lactuca spicata* (Lam.) Hitchc. 10565, Jackson County.  
*Rudbeckia hirta* L. 10192, Dakota County.  
*Solidago altissima* L. 10455, Wilkin County.  
*Solidago graminifolia* (L.) Salisb. var. *Nuttallii* (Greene) Fernald 10540, Lincoln County; 10575, Freeborn County.  
*Solidago gymnospermoides* (Greene) Fernald 10561, Rock County.  
*Solidago hispida* Muhl. 10592, Chisago County.  
*Solidago rigidiuscula* (T. and G.) Porter 10577, Freeborn County; 10607, Washington County.  
*Solidago serotina* Ait. 10458, Traverse County.  
*Solidago ulmifolia* Muhl. 10588, Chisago County; 10615, Washington County.  
*Vernonia fasciculata* Michx. 10610, Washington County.  
*Xanthium echinatum* Murr. 10488, Big Stone County.

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## GROWTH SUBSTANCES AND NUTRITION OF PROTOZOA \*

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For many years investigators have concerned themselves with the isolation, synthesis, and subsequent influence on plants and animals of many divers substances referred to by the non-committal term of "growth substances." The major portion of this research has been confined to the higher plants and animals; however, some attention has been given to bacteria, yeasts, and molds. Very little work has been reported on the role of growth substances in the nutrition of protozoa. This was due primarily to the fact that protozoa have usually been studied in culture media contaminated with microorganisms other than the one in question, a situation which made any results obtained difficult to interpret. Although certain protozoa, namely the plant-like chlorophyll-bearing forms, have been successively cultured bacteria-free for some time, it is only recently that the animal-like ciliates have been grown in artificial media free from other living microorganisms. Facts concerning the nutrition of protozoa are somewhat obscured by the presence of chlorophyll; hence in order to obtain a true picture of the nutrition of both green and colorless protozoa it is essential to study both types in bacteria-free media. Until this was accomplished it was impossible to determine with any degree of accuracy the nutritional

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